

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

DRAFT WORK PROGRAMME 2016-17

DRAFT - CONFIDENTIAL

Table of contents

CALL FOR FACTORIES OF THE FUTURE (FOF)

FoF 01-2016:	Novel hybrid approaches for additive and subtractive manufacturing machines	7
FoF 02-2016:	Machinery and robot systems in dynamic shop floor environments using novel embedded cognitive functions	9
FoF 03-2016:	Zero-defect strategies at system level for multi-stage manufacturing in production lines	11
FOF 04-2016:	Continuous adaptation of work environments with changing levels of automation in evolving production systems	13
FoF 05-2016:	Support for the further development of Additive Manufacturing technologies in Europe	18
FoF 06-2017:	New product functionalities through advanced surface manufacturing processes for mass production	17
FOF 07-2017:	Integration of unconventional technologies for multi-material processing into manufacturing systems	19
FOF 08-2017:	In-line measurement and control for micro-/nano-enabled high-volume manufacturing for enhanced reliability	21
FoF 09-2017:	Novel design and predictive maintenance technologies for increased operating life of production systems	22
FoF 10-2017:	New technologies and life cycle management for reconfigurable and reusable customised products	24

CALL FOR SUSTAINABLE PROCESS INDUSTRIES (SPIRE)

SPIRE 01-2016:	Systematic approaches for resource-efficient water management systems in process industries	27
SPIRE 02-2016:	Plant-wide monitoring and control of data-intensive processes	29
SPIRE 03-2016:	Industrial technologies for the valorisation of European bio-resources into high added value process streams	30
SPIRE 04-2016:	Industrial furnace design addressing energy efficiency in new and existing furnaces	33
SPIRE 05-2016:	Potential use of CO ₂ and non-conventional fossil natural resources in Europe as feedstock for the process industry	34
SPIRE 06-2016:	Business models for flexible and delocalised approaches for intensified processing	36
SPIRE 07-2017:	Integrated approach to process optimisation for raw material resources efficiency, excluding recovery technologies of waste streams	38

SPIRE 08-2017:	CO2 Utilisation to produce high added value chemicals	40
SPIRE 09-2017:	Pilot lines based on more flexible and down-scaled high performance processing	42
SPIRE 10-2017:	New electrochemical solutions for industrial processing, which contribute to a reduction of CO2 emissions	44
SPIRE 11-2017:	Support for the enhancement of the impact of SPIRE PPP projects	46
SPIRE 12 -2017:	Assessment of standardisation needs and ways to overcome regulatory bottlenecks in the process industry	48

CALL FOR ENERGY-EFFICIENT BUILDINGS (EEB)

EeB 01-2016	Smart insulation materials with improved properties	50
EeB 02-2016:	Performance indicators and monitoring techniques for energy-efficiency and environmental quality at building and district level	52
EeB 03-2016 :	Integration of advanced technologies for heating and cooling at building and district level	53
EeB 04-2016:	New technologies and strategies for the development of pre-fabricated elements through the reuse and recycling of construction materials and structures	55
EeB 05-2017:	Development of near zero energy building renovation	57
EeB 06-2017:	Highly efficient hybrid storage solutions for power and heat in residential buildings and district areas, balancing the supply and demand conditions.	59
EeB 07-2017:	Integration of energy harvesting at building and district level	61
EeB 08-2017:	New business models for energy-efficient buildings through adaptable refurbishment solutions	63

CALL FOR NANOTECHNOLOGIES, ADVANCED MATERIALS BIOTECHNOLOGY AND PRODUCTION

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

NMBP 01-2016:	Novel hybrid materials for heterogeneous catalysis	65
NMBP 02-2016:	Advanced Materials for Power Electronics based on wide bandgap semiconductor devices technology	66
NMBP 03-2016:	Innovative and sustainable materials solutions for the substitution of critical raw materials in the electric power system	68
NMBP 04-2017:	Architected/Advanced material concepts for intelligent bulk material structures	69

NMBP 05-2017:	Design-driven advanced materials for high added value innovative products	71
NMBP 06-2017:	Improved material durability in buildings and infrastructures, including offshore	73
NMBP 07-2017:	Systems of materials characterisation for model, product and process optimisation	75
NMBP 08-2016/17	Accelerating the uptake of nanotechnologies, advanced materials or advanced manufacturing and processing technologies by SMEs	77

Green vehicle topic

NMBP 09-2016:	Affordable weight reduction of high-volume vehicles and components taking into account the entire life-cycle	79
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Key enabling technologies for societal challenges - Advanced materials and nanotechnologies for healthcare

NMBP 10-2016:	Biomaterials for treatment and prevention of multiple sclerosis	81
NMBP 11-2016	Nanoformulation of biologicals	83
NMBP 12-2017:	Reference methods for managing the risk of engineered Biomaterials	84
NMBP 13-2017:	Cross-KET for Health	86
NMBP 14-2017:	Regulatory Science Framework for assessment of risk-benefit ratio of Nanomedicines and Biomaterials	88
NMBP 15-2017	Upscaling of the production of nanopharmaceuticals	89
NMBP 16-2017:	Nanotechnologies for imaging cellular transplants and regenerative processes in vivo	91
NMBP 17-2017:	Mobilising the European nano-biomedical ecosystem	92
NMBP 18-2017:	ERA-NET on Nanomedicine	93

Key enabling technologies for societal challenges - Advanced materials and nanotechnologies for energy applications

NMBP 19-2016:	Advanced materials solutions and architectures for high efficiency solar energy harvesting	94
NMBP 20-2016:	Advanced materials enabling the integration of storage technologies in the electricity grid	95
NMBP 21-2017:	Cost-effective materials for “power-to-chemical” technologies	97
NMBP 22-2017:	High-performance materials for optimizing CO2 capture	99

Key enabling technologies for societal challenges - Eco-design and new sustainable business models

NMBP 23- 2016:	ERA-Net on manufacturing technologies supporting industry and particularly SMEs in the global competition	100
NMBP 24-2017	Business models and industrial strategies supporting novel supply chains for innovative product-services	102

Knowledge-based nanotechnologies and advanced materials for industrial value chains

NMBP 25-2016	Pilot lines for manufacturing of materials with customized thermal/electrical conductivity properties	104
NMBP 26-2016:	Pilot Lines for Reactive/In Situ /In process generation of nano-features	106
NMBP 27-2016:	Pilot Line Manufacturing of Nanostructured Antimicrobial Surfaces using Advanced Nanosurface Functionalization Technologies	108
NMBP 28-2017:	Pilot Lines for Manufacturing of Nanotextured surfaces with enhanced mechanical properties	110
NMBP 29-2017:	Open access Pilot Lines for 3D printed and/or injection moulded polymeric or ceramic microfluidic MEMS and/including biological applications	113
NMBP 30-2017:	Paper-based electronic paper	115

Biotechnology

NMBP 31-2016:	ERA-NET Cofund on Biotechnologies	117
NMBP 32-2016:	Bioconversion of non-agricultural waste into biomolecules for industrial applications	118
NMBP 33-2016:	Microbial chassis platforms with optimized metabolic pathways for industrial innovations through systems biology	119
NMBP 34-2016:	KET Biotechnology foresight identifying high-value opportunities for the EU industry	121
NMBP 35-2016/17:	Dedicated support to biotechnology SMEs closing the gap from lab to market	122
NMBP 36-2017:	Microbial platforms for CO ₂ -reuse processes in the low-carbon economy	124
NMBP 37-2017:	Optimisation of biocatalysis and downstream processing for the sustainable production of high added-value platform chemicals	125
NMBP 38-2017:	New Plant Breeding Techniques (NPBT) in molecular farming: Multipurpose crops for industrial bioproducts	127
NMBP 39-2017:	Support for enhancing and demonstrating the impact of KET Biotechnology projects	128

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

NMBP 40-2016:	Advancing the integration of Materials Modeling in Business Processes to enhance effective industrial decision making and increase competitiveness	130
NMBP 41-2016:	Network to capitalise on strong European position in materials modelling and to allow industry to reap the benefits	132
NMBP 42-2017:	Next generation system integrating tangible and intangible materials model components to support innovation in industry	134

Actions to support developments in, and acceptance of, nanotechnologies, advanced materials and biotechnology - Science-based risk assessment and management of nanotechnologies, advanced materials and biotechnologies

NMBP 43-2016:	Analytical techniques and tools in support of nanomaterial risk assessment	136
NMBP 44-2016:	Promoting safe innovation through global consolidation and networking of nanosafety centres and strengthening the European nanosafety cooperation	137
NMBP 45-2017:	Framework and strategies for nanomaterial characterisation, classification, grouping and read-across for risk analysis	139
NMBP 46-2017:	Advanced and realistic models and assays for nanomaterial hazard assessment	141

Innovative and responsible governance of new and converging enabling technologies

NMBP 47-2016:	Improving nanotechnology (KETs) skills by involving multiple stakeholders	143
NMBP 48-2016/17:	Presidency events	144
NMBP 49-2016:	Support for National Contact Points	146
NMBP 50-2016:	Networking and sharing best experiences in using regional clusters strategies with a focus on supporting innovation in the NMBP thematic area.	148
NMBP 51-2017:	Governing innovation of nanotechnology through enhanced societal engagement	148
NMBP 52-2017:	Enhancing public awareness on nanotechnology	150
NMBP 53-2017:	(Multi-scale modelling based development of) innovative solutions for the conservation and preservation of post-war cultural heritage	151

The FoF cPPP 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.

FoF 01-2016: Novel hybrid approaches for additive and subtractive manufacturing machines

SPECIFIC CHALLENGE:

Manufacturing has been using for the production of goods and wares many different processes that can be classified as subtractive or additive processes. Traditional machines have been normally focused on only a single type of these processes but there is a new generation of machines that combines the features of individual manufacturing processes into a single platform.

These hybrid manufacturing processes can enable a high-value and sustainable manufacturing by keeping the advantages of the single processes in a single machine whilst reducing their disadvantages. Nevertheless, the enhanced features of the hybrid machines bring as well an increasing process complexity and higher costs of production that impact the final price in the market of the produced items. High added value products with complex structures can balance out those production costs.

New hybrid machines, equipped with both subtractive and additive manufacturing technologies, can be a game changer to create new opportunities and applications for Additive Manufacturing (AM). The great potential of AM is in most of the cases limited by the subtractive post-processing steps needed to ensure optimal tolerances and surface finish. These hybrid combinations can also enable the production of larger items than in AM single machines and have a large potential for repair applications.

SCOPE:

Proposals should address the development of advanced All-in-one machines that enable the production of a part/product directly from a CAD model in a short time and without the need of post-processing steps. A variety of Additive Manufacturing technologies and different materials can address this challenge by means of new and/or innovative processes. The role of

SMEs and their potential as end-users for the developed machines needs to be considered in order to ensure the access to existing and new markets.

Research activities should address all of the following areas:

- Single-setup processing
- Connection between subtractive and additive processes in the machine
- Increased build rate of the machine in comparison to the separate processes
- Production of parts/products that are functional and with the final desired accuracy, surface-finish and tolerances
- Properties of the new hybrid components after the manufacturing process

The proposal must include at least one demonstrator in real industrial settings in order to show the industrial viability of the solution.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- Social Sciences and Humanities (SSH) elements: creativity in the development of services and product design

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further during the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed novel hybrid approaches should lead to a remarkable impact in the following terms:

- 20% reduction in time and cost with respect to current AM machines
- 15% increase in productivity for high-volume AM production
- More flexibility and robustness of the machines to adapt with customisation and changing market needs
- Reduction of inventory because of the making of products on-demand
- Reduction of work floor space
- Create localised manufacturing environments and reduce supply chains length

- Strengthen global position of European AM industrial base and related AM sectors
- Contributions to standardisation and certification for new hybrid procedures.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FoF 02-2016: Machinery and robot systems in dynamic shop floor environments using novel embedded cognitive functions

SPECIFIC CHALLENGE:

Current production and logistic shop floors are organised in a fixed combination of sequential automated and manual tasks. Each station, in which one or more tasks are performed, is designed for optimal productivity, and the whole linear sequence of operations is as well optimised for productivity. This paradigm is efficient when production is set to the maximum capacity and the same tasks are repeated in the same way in each cycle. However, this does not scale well to other situations. The complexity and cost of this organisation increases dramatically when it comes to flexible production or logistics, as for example when mixing different models, and the cost for introducing a new product reference is also very high. Moreover, this model lacks the capacity to react to unexpected technical problems that may arise.

Future shop floors have to endorse flexibility and define networks in which a tight collaboration between humans, machines and robots is possible. Therefore the shop floors must be supported by enhanced perception capabilities including the ability to reason over the perceived environment. By using novel embedded cognitive functions, machinery and robots shall be able to collaborate as network agents in a realistic semi-structured environment, being able to adapt their behaviour in order to give a response to unforeseen changes or situations. Furthermore, the cognitive capabilities will allow the machinery and robots to evolve from being programmed for a dedicated task to the handling of a multitude of different tasks.

SCOPE:

Research activities should address at least three of the following areas:

- Perception as an integrated cognitive capability, considering collaborative perception (counting not only with on-board sensors, but also with the sensing capabilities available in the whole shop floor), scene understanding, reasoning and acting (active perception).

- Perception as a way to create intelligent, dexterous "universal" devices for handling or manipulation of products or tools (e.g. handling of soft or shape changing objects, non-task dedicated devices)
- Mobility as a key factor for flexibility: machinery and robot systems should not only be able to autonomously navigate in realistic changing scenarios, but also develop the competences to switch from environment level navigation to the accurate positioning required to complete the operations.
- Methods and technologies to eliminate physical barriers such as safety guarding or enclosures have already been developed, but lack in inherent safety of the overall system. Cognitive capabilities in order to guarantee safety at all times, including when the system is down (e.g. maintenance, failure) should be researched so that it is possible to open the way to certification.
- Adaptation through context awareness and reasoning, aiming at making machinery and robots aware of their surroundings, so that they can perceive and obtain information on the non-programmed and non-expected situations, and adapt their behaviour in order to better handle them.
- Life-long learning and knowledge sharing tools, reducing to the minimum the initial programming efforts, and reusing the acquired abilities and competences over the existing machines.

Robots and machines should not be considered as individual agents, but will have to be part of an overall interactive network which should be defined and possibly standardised.

Proof of concept in terms of at least one demonstrator should be delivered before the end of the project, excluding commercially usable prototypes, but convincingly demonstrating scalability towards industrial needs, involving as appropriate disciplines of Social Sciences and Humanities, and making a clear case for the safety of the worker under all circumstances.

In order to ensure a high impact, both standardisation and certification activities have to be addressed in the proposal.

Possible horizontal aspects addressed by topic:

- Social Sciences and Humanities (SSH) elements: human and social acceptance of close human-robot collaboration.
- Gender relevance

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed machinery and robot systems should lead to a remarkable impact in the following terms:

- Automation of previously manual production in order to bring European production plants in cheap labour countries back to Europe
- Strengthen global position of European manufacturing industry through the introduction of the new technologies related to machinery and robots with enhanced capabilities
- Strengthen the innovation potential of European manufacturing industry through the creation of new products made possible with the new developed technologies
- Reduction of 20% of set-up and new product adaptation costs, increasing efficiency

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FoF 03-2016: Zero-defect strategies at system level for multi-stage manufacturing in production lines

SPECIFIC CHALLENGE:

The current trend in multi-stage manufacturing is towards more complex, distributed and faster evolving manufacturing facilities. To develop a zero-defect strategy to cope with increasing competition and sustainability related issues, plants should be designed and managed using best practices from emerging key enabling technologies. Manufacturing processes have to be environmental friendly and safe and deliver high quality products adapted to customer requirements, whilst minimising costs.

Within a context of market globalisation, the quality of products has become a key factor for success in manufacturing industry. The growing unpredictability of demand necessitates continuous adjustments in production targets. The increasing interest in sustainable production places a premium on reducing material waste, re-works, rejects and stocks and has led to a demand for the development of zero-defect strategies at system level.

SCOPE:

Proposals should develop tools and methods for multi-stage manufacturing production with the aim of preventing defect generation and propagation as part of a system-level zero-defect strategy. In this context, integrated production and quality control strategies able to achieve the desired production rate for high quality products need to be developed. They should include both tools to prevent the generation of defects at single stage level and tools to prevent the propagation of defects to downstream stages.

Quality control tools should be supported by distributed on-line data gathering systems, on-line defect management policies (i.e. on-line re-work or workpiece repair), inter-stage information and part flow control strategies and selective inspection policies to achieve higher control of the most critical stages in the system. The final aim is to achieve production system configurations that profitably exploit the quality/productivity trade-off at system level whilst reducing complexity.

Research activities should cover several of the following fields in a multidisciplinary approach:

- Methodologies and strategies for integrating production and quality systems into the multi-stage manufacturing process.
- Knowledge management tools to facilitate problem resolution, alarm triggering, and early detection based on lessons learnt, previous alarm activations, trends, etc.
- Tools for understanding, monitoring and real-time fault diagnosis of industrial process operation.
- Development of system-level zero-defect strategies to prevent the generation of defects at single stage level and propagation of defects to downstream stages.
- Distributed on-line data gathering systems and on-line defect management policies.
- Inter-stage information and part flow control strategies and selective inspection policies.

Possible horizontal aspects addressed by topic:

- n/a

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed zero-defect strategies at system level should lead to a remarkable impact in the following terms:

- Achievement of zero defects in a multi-stage production line
- Overall 10% improvement of product quality
- Reduction of production costs by 15%
- Increased production flexibility. Higher production rates by 15%
- Reduction of waste and scrap by 10%

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FOF 04-2016: Continuous adaptation of work environments with changing levels of automation in evolving production systems

SPECIFIC CHALLENGE:

Despite high automation levels in factories today, humans remain central to manufacturing operations.

In the past, and due to human flexibility, workers were expected to adapt to machine requirements. However, today's machines increasingly allow these roles to be reversed with automation systems becoming ever more adaptable to the capabilities of workers, and work organisation becomes more flexible in terms of time and place. Furthermore, higher levels of customisation and variable requirements, call for new human-centred automation approaches, complementing the cognitive capabilities of humans by advanced sensing and the higher precision of machines.

Modern manufacturing system design builds on an optimal distribution of tasks between humans and machines for higher performance, agility and quality.

SCOPE:

Research activities should address all of the following areas:

- Determination of adequate levels of automation for optimal flexibility, agility and competitiveness of highly customised production. Adaptive automation systems should accommodate to the worker's skills and flexibility needs, be it by compensating limitations (e.g. due to age or inexperience) or by taking full advantage of the worker's experience;

- Methods and tools for a continuous adaptation of workplaces to the physical, sensorial and cognitive capabilities of workers (especially of older and disabled people in those workplaces) and their socio-economic needs, by taking into consideration "safety and health at work" requirements. An adequate methodology to measure "worker satisfaction" should be developed and tested. The underlying theoretical framework should in particular involve knowledge from a socio-organisational perspective, including the engagement of workers in the design and adaptation of their workplace to ensure attractiveness;
- Exploit technologies such as virtual (and/or augmented) reality to support process and workplace simulations and industrial social networking with rich user experience for knowledge capture and decision support with a strong focus on usability, user acceptance and training.

Possible horizontal aspects addressed by topic:

- Social Sciences and Humanities (SSH) elements.

This topic requires a collaborative effort between the SSH and engineering to (a) come to an adequate understanding of "worker satisfaction" and the relevant quantitative indicators, and to (b) introduce the concept of "usability" of machines by the worker on the shop floor (particularly concerning elderly, disabled or other target groups with special needs) thus contributing to improving worker safety and health.

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed new technologies should lead to a remarkable impact in the following terms:

- 20% increase in customisation capability;
- 10% increase in manufacturing quality;
- Increased worker satisfaction and strengthened global position of industry in Europe through higher social acceptance levels.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

Additive Manufacturing (AM), including 3D-Printing, is one of the potential game changers that, for some applications, has already reached a tipping point of maturity. European companies are still strong in some areas but this position requires high levels of continuous innovation, especially where competitors are fast approaching. There are also other areas that are comparatively less developed and where the technology transfer and adoption is not functional, leading to a slow uptake of the results.

Despite the EC support, in the global picture the competitiveness of the European companies is threatened by the recent developments and the important investments at international level. Moreover, some of the more fundamental aspects in order to take advantage of this promising technology still need to be addressed.

It is necessary to identify current bottlenecks and barriers to further development of AM technologies in Europe. Furthermore the stakeholders also need to be mobilised in order to exploit the business opportunities that AM provides, facilitating the take-up of this technology in Europe, with a focussed promotion and support strategy for Additive Manufacturing technologies.

SCOPE:

The proposals should address at least several of the following aspects:

- Review of recent technological developments, key publications, and international research and innovation programmes on AM.
- Identification of gaps and opportunities for further research and innovation, as well as non-technological gaps in order to develop policy framework recommendations (e.g. regulation, standardisation, public procurement).
- Community building activities (think-and-do-tank) and actions to foster dialogue and collaboration across levels (stakeholders and governance) and with key strategic partners, the Member States and the European Commission. This broad multi-stakeholder community (science, policy, business, society) at local, regional, national and EU level will enable the launching of innovation partnerships for developing and testing of AM.
- Assessment of the current regulatory and IPR frameworks, micro- and macro-economic assessment of opportunities and risks and its impact on social aspects and labour market benefits.
- Productivity and resource efficiency gains through AM and its impact on European competitiveness through localised manufacturing, where more goods will be manufactured close to their point of consumption.
- Identification of current bottlenecks for the transferability of new technologies across sectors.
- Development of best practices to help stakeholders to achieve large scale deployment.

- Identification of bottlenecks that prevent the stimulation of investments in new AM technologies and promote successful innovative AM solutions.
- Support information exchange between EU funded projects which address the same AM areas to exploit synergies.
- Building skills capacity for innovation and competitiveness, engaging with academia for the development of learning resources adaptable to different learning approaches and curricula at undergraduate, master, and life-long learning levels.

Proposals should include the organisation of workshops with top-ranked international experts and EC services from the various disciplines aiming at the elaboration of a future AM roadmap, as well as an International Conference on AM at the end of the project.

In order to ensure the industrial relevance and impact of the research effort, the active participation of industrial partners represents an added value to the activities and this will be reflected in the evaluation, under the criteria Implementation and Impact.

Possible horizontal aspects addressed by topic:

- n/a

The Commission considers that proposals requesting a contribution from the EU between EUR 750,000 and 1,000,000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. No more than one proposal will be funded.

EXPECTED IMPACT:

- The proposals are expected to have an impact on the European AM community in the following ways:
 - Create a network of research and industry partners for further RTD and industrial innovation and contribute to the sharing of European best practices.
 - Create links and foster collaboration with relevant European initiatives and activities.
 - Speeding up industrial exploitation and take up of results of AM and facilitate cross-sectorial technology transfer.
 - Early awareness of key innovation developments and anticipation of business trends and market prospects.
 - Training and educational skills capacity in the AM community, both at academic and professional level.
 - Enabling regulatory authorities to address better the relevant issues based on a thorough assessment of the current legal framework, IPR management and standardisation needs.
 - Rationalising the process to deliver standardisation mandates to the European Standards Organisations.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FoF 06-2017: New product functionalities through advanced surface manufacturing processes for mass production

SPECIFIC CHALLENGE:

As a response to increasing competition in global markets, many industrial sectors (e.g. automotive, aerospace, machine-tool) aim at improving their product performances through surface functionalization. As the products are increasingly complex in terms of scale (from nano to macro) and shape, processes need to deliver efficiently, ensuring an uncompromised quality together with high versatility and controlled costs. One way to reach this goal is to differentiate between a product body and its surface, where specific properties can be tailored. Furthermore, the required functionalities may be achieved with little or no addition of new raw material. For example, modifications in the surface geometry or even microstructure induced by texturing processes enable to improve the performance of those products by providing them with dedicated functionalities such as tailored friction, antibacterial properties or self-cleaning capabilities among others.

In this context, substantial research is needed for exploring innovative approaches aimed at producing high added-value functional surfaces by a superficial modification of the substrate. Special attention should be paid to the cost efficiency of the novel surface manufacturing processes and to the development of technologies that are flexible, up-scalable to real scale conditions and their implementation into mass production conditions. Finally, environmental aspects of the processes should also be addressed.

SCOPE:

The proposal should address surface-modifying methods which do not alter the chemical composition of the surface or add an extra layer of a different material, for example: micro-machining, texturing, photon-based technologies, laser, mechanical treatments, etc. These methods should be used to create new manufacturing processes that can be applied on mass production lines. Due to the need for cost-effective technologies, these processes should be easy to integrate within the existing manufacturing plants. The research activities should be multi-disciplinary and address all of the following issues:

- Development of cost-efficient, up-scalable and flexible surface processing techniques that introduce micro- or nano-scale modifications at the surface level of the part providing it with specific properties or capabilities.
- Design and implementation of specific methods and systems that enable highly efficient up-scaling of the developed processing techniques from laboratory scale to real scale, with a specific objective to apply the processes for mass production.

- Implementation of modelling tools to support selection of the processing parameters that lead to the targeted surface modifications.
- Solutions which are economically viable and easy to transfer to other fields than the demonstrated fields of application.
- In-process inspection and monitoring possibilities to ensure that the final results remain within the quality requirements.

In order to ensure the industrial relevance and impact of the research effort, the active participation of industrial partners represents an added value to the activities and this will be reflected in the evaluation, under the criteria Implementation and Impact. The projects are expected to cover applied research but also demonstration activities, such as a testing a prototype in a simulated operational environment. The ability of the demonstration activities to validate a technology's high level of readiness will be reflected in the evaluation.

Possible horizontal aspects addressed by topic:

- - Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed innovative production functionalities should lead to a remarkable impact for both producers and users, in the following terms:

- Cost increase pertaining to those functionalities integrated into products should be below 10% with respect to the cost of conventional products
- The improvement in the product performance should be above 20% in the targeted functionalities such as: surface friction (increase or decrease), wear resistance, surface energy, corrosion and thermal resistance, hardness, self-cleaning properties, conductivity, anti-fouling, catalytic properties, etc. Besides, the improvement can also consist in obtaining tailored optical properties including for aesthetical purposes.
- Strengthened global position of European manufacturing industry through the intensive implementation of innovative and unconventional technologies along the European manufacturing value chain

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FOF 07-2017: Integration of unconventional technologies for multi-material processing into manufacturing systems

SPECIFIC CHALLENGE:

The competitiveness of European manufacturing depends on producing differentiated and high added value products in an efficient and sustainable manner, with reduced production costs, increased product quality and minimised time to market. Multi-material products have the advantage of putting the right material in the right place to satisfy all the expected requirements, which is particularly relevant when high cost or critical materials are involved. The aim of this topic is to integrate unconventional manufacturing technologies within a specific set (laser, water jet, ultrasonic, electro beam welding and/or electro discharge machining) into a manufacturing system to make multi-material products composed of such high cost or critical materials. These innovative manufacturing concepts and technologies can help European industry to face the challenge of improving resource efficiency and sustainability.

The integration of the above-mentioned unconventional manufacturing technologies into the process chain may be complemented with processes such as thermal treatment, in-process inspection, stress-relieving, micro-structural improvements, machining and joining. Successful integration will help to achieve a breakthrough in innovative manufacturing approaches for multi-material products. The major challenge lies in reinforcing the integration of these unconventional processes into manufacturing systems for multi-material products and subsequently implementing them throughout the European manufacturing sector.

SCOPE:

The proposal should use unconventional manufacturing technologies within a specific set (laser, water jet, ultrasonic, electro beam welding and/or electro discharge machining) to create new manufacturing systems for multi-material products. To tackle this major challenge successfully, research will need to cover all of the following areas:

- innovative process chains for multi-material products based on unconventional technologies, integrated if appropriate with more conventional manufacturing techniques such as machining and joining;
- manufacturing processes capable of generating the features and geometries required for multi-material products as well as integrating additional improvements such as thermal treatment, stress relieving, surface hardening, micro-structural improvements;

- new flexible machinery concepts and components to allow the integration of unconventional technologies and processes into industrial manufacturing systems able to handle a range of material combinations and products;
- in-process inspection and monitoring to ensure quality requirements within the innovative process chains.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed new technologies should lead to a remarkable impact in the following terms:

- Reduction of at least 10% in the production time through the integration of operations and the reduction of idling time between manufacturing steps.
- Reduction of at least 15% in the production cost through process integration and improved manufacturing quality
- Resource efficiency improved by reducing the use of raw materials and energy consumption by at least 10%.
- Strengthened global position of European manufacturing industry through the intensive implementation of innovative and unconventional technologies along the European manufacturing value chain
-

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

Rapid developments in micro-/nano-technologies require complex business models that respond to volatile markets in demand for faster product delivery with an unprecedented yield and quality. High-volume manufacturing is not spared from these requirements, and will in fact need to demonstrate a productivity improvement compared to lab-scale process development and low-volume manufacturing in order to remain commercially competitive.

The process scaling needs to include system-level architectures for metrology and control. This includes data acquisition and control at the levels of the process, the physical handling and the component validation. The in-line metrology and inspection for micro-/nano-production plays an important role, together with a common reference system and approach across process chain. The evolution of the control system on the factory floor will also need to show various levels of distributed control in order to cover both batch-to-batch and run-to-run variations with real-time parameter prediction and feedback.

Practical industry solutions for reference metrology at these small dimensions are not readily available. However, whilst efforts are made towards producing reference materials, reliable and fast measurements that allow for control both at the process level and at the higher level of product vehicle or line, are needed. This will enable predictive management of batches, improved quality and speed control, and fully autonomous control with machine learning.

SCOPE:

Proposals should include a systems-level strategy for integrating measurement and control throughout the production line for micro-/(nano-)enabled high volume manufacturing. To address this challenge the proposal will need to cover all of the following areas:

- Measurement techniques that target highly integrated and functional three-dimensional products at the micro-(and nano-)scale.
- Measurement and data acquisition which are non-destructive, i.e. no waste material at the measurement steps, and allow for high throughput scenarios in their respective industrial settings.
- Traceability in the measurements back to reference samples. Direct contributions to related standards may be a part of the proposal.
- Approaches to control at the different levels of factory integration, including process variation, product/component reliability, waste optimisation, yield/output improvements and predictive/preventive corrections to the entire line.

Possible horizontal aspects addressed by topic:

- not applicable

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed new technologies should lead to a remarkable impact in the following terms:

- Improvement in existing manufacturing processes through implementation of system-wide control systems, demonstrating better resource efficiency, yield and productivity of a wide variety of components and final products.
- Improvement in technical knowledge on the in-line metrology for micro-/(nano-)sized components in a high-volume manufacturing setting.
- Accelerated uptake by industry of in-line measurements and related control systems that allow for traceability in terms of physical dimensions, functionality and reliability of micro-/nano-sized components.
- Contribution to standardisation in the field of reference materials targeting micro-/(nano-) technology and factory integration.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FoF 09-2017: Novel design and predictive maintenance technologies for increased operating life of production systems

SPECIFIC CHALLENGE:

The elevated complexity and costs of production assets combined with the requirements for high-quality manufactured products necessitate novel design and reliability-based maintenance approaches that are able to provide the required levels of availability, maintainability, quality, safety while considering the system as a whole and throughout the production lifecycle.

Analysis of operational parameters and in-service behaviour, self-learning features and condition prediction mechanisms could contribute to improve smart maintenance systems capable to integrate information from many different sources and of various types, in order to more accurately estimate the process performances and the remaining useful life. That will lead to a more efficient management, reconfiguration and re-use of assets and resources, avoiding false alarms and unforeseen failures which lower operators' confidence in such systems.

SCOPE:

The aim would be to design optimal maintainability solutions into production systems to improve operating life at maximised performance and reduce costs by carrying out maintenance activities at the most optimised time before failure occurs, thus minimising the degree of intervention required and maximising the system availability.

More trustworthy predictive maintenance and cause-and-effect analysis techniques should be developed to aggregate and interpret data captured from production systems and effectively share the massive amount of information between users. Measurements of a range of parameters at the level of components, machines and production systems should be carried out to provide data for building trend reference models for prediction of equipment condition and to synchronise maintenance with production planning. The dependability of the techniques would be demonstrated for a range of components and machines.

While the focus will be on demonstrating the design approaches and maintenance technologies, R&D activities supporting the integration and scale-up are expected as well.

Demonstration activities should address all of the following areas:

- Methodologies and tools for improved maintainability and increased operating life of production systems.
- Methodologies and tools to schedule maintenance activities together with production activities.
- Predictive maintenance solutions, combined with integrated quality-maintenance methods and tools, as well as failure modes, effects, and criticality analysis (FMECA) techniques, that effectively share information among different data sources in a secure way.
- Versatility, in order to make solutions transferable to different industrial sectors.
- The project must include two complex demonstrators in real industrial settings to represent a clear added value.

In order to ensure the industrial relevance and impact of the demonstration effort, the active participation of industrial partners, including SMEs, represents an added value to the activities.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

- International cooperation

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed new technologies should lead to a remarkable impact in the following terms:

- 10% increased in-service efficiency through reduced failure rates, unplanned plant/production system outages and extension of component life.
- More widespread adoption of predictive maintenance as a result of the demonstration of more accurate, secure and trustworthy techniques at component, machine and system level
- Increased accident mitigation capability

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

FoF 10-2017: New technologies and life cycle management for reconfigurable and reusable customised products

SPECIFIC CHALLENGE:

New customised products will be increasingly incorporating, in a seamless fashion, intelligence and smart functionalities through advanced materials and embedded components. The integration of highly differentiated materials and components is a key requisite for flexible manufacturing of individualised consumer/customised products. On the other hand, enhanced integration of sophisticated ICT-based components and of advanced materials implies a rapid product obsolescence rate, and can thus introduce further pollution risks if reuse of products and/or components is not improved. Therefore, reconfiguration and reuse of products, and related services, need to be developed.

SCOPE:

To face sustainability and flexibility challenges customised products need to be conceived, designed and manufactured in a modular way, and their single components have to be developed so as to be interoperable with one another during the product/service lifetime, so as to be exchangeable and updateable whenever necessary. This influences both the hard and soft requirements and calls for new production technologies that enable the fast manufacturing, assembly and configuration of complex products, as well as the products updatability and disassembly for re-use and end of life management.

In particular, consumer goods manufacturers should be able easily and effectively to integrate products and components which can be independently designed, produced and used in order to make diverse final personalised products in different production systems.

All involved actors in the product life cycle, from manufacturers of basic products components to retailers and vendors up to the final customers, should be provided with the needed hard and soft tools to reassemble and/or reconfigure the product or its components.

Research activities should address all of the following areas:

- Methodologies, engineering and tools for the fast reconfiguration and re-use of personalised products and their components
- New production techniques allowing for a fast manufacturing, assembly and configuration of complex personalised products
- Innovative methods and technologies for personalised products updatability, disassembly for reuse and end of life management of the products as well as their different components
- Methodologies and tools for the development of assembly, configuration, disassembly and reconfiguration services along the whole consumer/customised products value chain and along its overall life cycle also including the aftersale stage.

The proposals are expected to include use-case demonstrations aiming at the rapid deployment of the new modularity, reconfiguration and re-use of personalised consumer/customised products and life cycle management. All relevant value-chain stakeholders are expected to participate.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- International cooperation

This topic is particularly suitable for collaboration at international level, especially regarding the involvement of multiple actors in complex value chains on a global scale for consumer/customised goods.

- Social Sciences and Humanities (SSH) elements

The resulting personalised products are expected to satisfy the final consumer needs at an individual level and consequently to facilitate daily life (particularly concerning elderly, disabled or other target groups with special needs) or improve workers and sportsmen safety and health.

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The developed new technologies should lead to a significant impact in terms of:

- Reduction of time to market of new personalised products/services by 30% through a modular product/service design and manufacturing approach
- Cost reduction of the manufacturing of personalised products by 25% by decreasing lead times in product-services development and configuration
- Reduction of environmental impact by more than 50% due to modular reusable components and final products
- Savings of overall products/services life cycle costs by 30% as a consequence of the reusability and re-adaptability of the components of the personalised products

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

H2020-SPIRE-2016/2017

The SPIRE cPPP will address the challenges raised by the rejuvenation of the European industrial processes: more efficient use of resources (raw materials, water, etc.) and energy (including renewables), high-tech and eco-efficient production facilities and materials, and minimising and re-using waste.

SPIRE 01-2016: Systematic approaches for resource-efficient water management systems in process industries

SPECIFIC CHALLENGE:

Nowadays, 12% of water utilisation in the EU is devoted to industrial use. Since water is a scarce resource, it is crucial for the European industry to change the current paradigm and develop more sustainable and efficient water technologies, which is also an important element for increasing its competitiveness, because a significant amount of energy is consumed for industrial water treatment. In the sustainable development context, efficient water use is closely linked to the efficient use and re-use of other resources, such as energy, chemicals, raw materials and soils. As such, these aspects need to be considered holistically in order to develop sustainable solutions.

SCOPE:

The main objective is the optimisation of the use of water in industry. Research activities should focus on several of the following areas:

- Combining existing technologies in order to achieve an increased energy and resource efficiency in water treatment processes leading to increased sustainability by reducing water use, energy and raw materials consumption and minimizing waste.
- Selective separation processes in order to be able to treat specific industrial fluxes, also leading to the recovery of valuable substances.
- Adaptation of current processes or equipment to use alternative water sources. e.g. rainwater, salt or brackish water, cooling water, or Waste Water Treatment Plant (WWTP) effluent.
- Alternative cooling/heating methods. Reducing the energy levels that are needed for water and steam related production processes; dry cooling technologies; water and energy recovery processes from water vapour.
- Use of renewable energy, in order to reach low energy water treatment processes.
- Development of closed loop recycling and reuse, involving cascading of processes and industrial water symbiosis.

The proposals should also include a Life cycle analysis, since it offers the framework to deliver meaningful information on the "water footprint" of manufactured goods, delivered services, business operations and consumer behaviour. The total footprint of the process regarding water, energy and resources should be considered.

In order to properly monitor the Resource Efficiency Impact, Key Performance Indicators should be implemented.

The proposals should allocate an important part of the budget to demonstration activities. The active participation of industrial partners from the relevant sectors in multidisciplinary consortia will represent an added value to the activities.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Reduction of at least 20% in water use compared to the current practice in the sector.
- Reduction of at least 30% in wastewater production compared to the current practice in the sector.
- Reduction of at least 15% in energy use compared to the current practice in the sector.
- Minimising the Water Footprint, employing less water intensive or waterless technologies and increasing recycling.
- Foster new technology developments in water treatment.
- Decouple the industrial production from the utilisation of fresh water reserves

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

All current plants in process industries have control systems managing their production processes. Distributed Control Systems (DCS) and Programmable Logic Controls (PLC) are present all across production sites with continuous semi-continuous or batch processes. However, there is still a lack of integration of local control systems dedicated to unit processes into an overarching real-time optimisation and scheduling system controlling and monitoring the operations of the whole plant. This plant or even site-wide integration is especially challenging for production processes where monitoring involves the collection and evaluation of large amounts of data.

Future plant monitoring and control systems will have to integrate lower scale model based control frameworks into plant scale scheduling, or even geographic and logistic optimisation tools. The generalisation of model based predictive control techniques to plant-wide and possibly site-wide monitoring and control should be developed using overall plant models, and optimised solutions should be demonstrated.

SCOPE:

Research activities should address the following areas:

- Extension of the model based control techniques to the level of plant or site-wide control and scheduling by the use of dynamic overall plant models, ensuring a robust real-time optimisation of the plant's operations.
- Integration of local control systems into an overarching real-time plant and/or site optimisation and scheduling system, taking into account geographic and logistic constraints and potential malfunctions.
- Cross-sectorial transfer of the technologies developed.
- Model Based Predictive Control frameworks taking into account the Operators Training Systems in their design.
- Plant level LC management tools (integrated or possibly as a plug-in to the control system) and robustness of the real-time optimisation tools

Solutions should consider the “data-intensive” nature of the process chains (data reliability, handling of huge amounts of data in real-time, extraction of decisions from large data-sets. Proof of concept in terms of at least one demonstrator should be delivered before the end of the project, excluding commercially usable prototypes, but convincingly demonstrating scalability towards industrial needs and making a clear case for the safety of the worker under all circumstances.

The project can make use of pre-existing commercially available plant optimisation and scheduling solutions, making all the required adaptations. In order to ensure the impact of the project, standardisation is to be addressed.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- Gender relevance

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Compared to the current practice in the sector:

- Decrease of on-site material handling time by 10%
- Decrease of resource consumption by 10%
- Decrease by 10% the global use of energy on-site.
- Decrease by 10% of the Green House Gases emissions.
- Strengthen the global position of European process industry through the introduction of the new technologies related to plant-wide and/or, if possible, site-wide process control.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 03-2016: Industrial technologies for the valorisation of European bio-resources into high added value process streams

SPECIFIC CHALLENGE:

Bio-based resources constitute a valuable source of sustainable raw materials for Europe, but currently they are not utilised in an optimal way. For example, residues from agriculture and forestry, as well as waste streams from aquaculture, farms, and food and feed industry (including skins, feathers, fats, shells, materials from slaughter-houses, fish mills, etc.) are often not fully exploited. Considering that such bio-resources contain valuable substances for the production of high added value chemicals and bio-materials (e.g. sugars, fatty acids,

amino acids, alcohols, resins, fibres, aromatic substances), which could provide sustainable alternatives to analogues currently manufactured from fossil feedstock, their efficient utilisation is needed in order to support the establishment of a more sustainable and efficient industry in Europe. Furthermore, these bio-based streams could provide access to new building blocks and products with added functionalities, which are currently not commercially available, thus opening new market opportunities for industry.

For a wider utilisation of such bio-resources, the development of technologies for the efficient processing, isolation, fractionation and purification of these waste and side streams, will be essential to efficiently recover valuable bio-components, while maintaining key chemical functionalities present in bio-based molecules. The industrial deployment of such technologies will allow improving the competitiveness of the European chemical and process industry and will ensure a better utilisation of available European bio-resources. These technologies will also support a decrease in waste generation and contribute to making Europe self-sufficient in terms of raw materials, leading to increased long term sustainability for the European process industry.

SCOPE:

Proposals should address the efficient utilisation of biomass waste streams of organic nature from industrial processes (e.g. food and feed industry, aquaculture) and/or side streams from harvesting activities (e.g. agricultural and forestry harvesting residues) ensuring non-competition with higher value chains (e.g. food production). The proposals should aim to provide novel concepts to fully valorise these bio-resources, providing high added-value products and bio-based streams (bio-chemicals, monomers, fibres, polymers etc.) for further utilisation in industry. The concepts taken into account should yield novel products and process streams with a quality that is equal or better than the one of the available fossil analogues already on the market and where possible, provide opportunities to open new markets (e.g. development of novel products).

Proposals should target technologies (e.g. chemo-, thermo and bio-catalytic, fermentative), which can include recovery, and primary (e.g. sugars, lignin, tannins, resins, proteins) and/or secondary (e.g. furans, sugar acids, carboxylic acids, fatty acids and aromatics) processing of bio-resources, leading to bio-products and streams with high added value. The concepts are expected to provide significant added value creation in the process. Proposals are expected to address R&I activities covering the following areas:

- Chemo/biocatalytic/fermentative route development for conversion processes as well as purification processes where needed, including mastering of the technology in order to yield (new) bio-based building blocks, polymers and chemicals and derived product portfolios in a relevant industrial environment.
- Market analysis and techno-economical evaluation of the concepts proposed to assess the economic viability of the approaches and a business plan for the deployment of the technology.

The concepts should demonstrate improved resource efficiency, including a significant reduction of fossil resources and energy utilisation, as well as water and other utilities. The

concepts should also bring a reduction in CO2 emissions compared to the commercially utilised process (or similar for new processes that do not have commercial analogues).

Proposals should envisage the demonstration of the concepts in an industrially relevant environment and show the potential for their integration into the relevant industrial sectors. Demonstration of the integration in existing industrial scenarios would be a major added-value. The demonstration activities are expected to address the scalability and replicability of the proposed concepts.

Possible horizontal aspects addressed by topic:

A significant participation of SMEs with R&D capacities is encouraged.

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- The concepts proposed should provide a decreased utilisation of fossil resources in the process industry of at least 30 % compared to similar commercially available processes.
- The concepts proposed should provide an improvement in energy utilisation in the process industry of at least 30 % compared to similar commercially available processes.
- The concepts proposed should provide a decrease in CO2 emissions of at least 30% compared to similar commercially available processes.
- The economic viability of the concepts should be demonstrated, as well as the contribution to the long term sustainability of the industrial sectors targeted.
- The proposal should provide a clear business case for the deployment of the solutions in industry.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

Industrial furnaces with higher performances, optimised resource and energy efficiencies and less pollutant emissions are a major goal for combustion researchers, furnace producers and the process industries. Relatively few new furnaces are installed in Europe these days due to the capital intensive nature of the industrial furnaces, which makes this challenge more urgent to overcome.

In addition, most of the industrial furnaces in Europe are currently fed with natural gas. Another challenge in the coming years will be the use of alternative energy sources or hybrid heating systems for such applications. Novel designs based on new technical concepts, materials and different combustion routes and processes are key for new advanced furnaces and the retrofitting of existing ones.

The development of a clear understanding of the process function, the reliability of the process information and how the furnace interacts with the rest of the manufacturing process will be paramount for the new generation of technologies for new and retrofitted industrial furnaces. To develop and to scale up new systems and equipment based on new high temperature materials and advance protective coatings is a real challenge and could contribute to great savings in energy.

SCOPE:

Proposals need to consider all aspects for the construction of new furnaces or the retrofitting of existing furnaces with more efficient and effective technologies. They need to also consider the effects on upstream and downstream processes linked to those heating systems.

The design methods and criteria need to take into account technical aspects, constraints found in legislation, compliance with codes and standards and all the related economic aspects, including how the cost of design changes can escalate.

Research activities for new industrial furnace design should address all of the following areas:

- Use of at least two different energy sources, e.g. electricity, gas, oil, biogas, biomass, coal. Hybrid heating systems can also be considered. Design has to take into consideration the type of feed and an optimised fuel consumption.
- Prediction tools and computer simulation development applied to the design process and performance prediction.
- Interaction of the furnace with the rest of the manufacturing process, including the effect on upstream and downstream processes. Heat transfer and recovery need to be also considered.
- Improved equipment efficiency by using new and improved high temperature/corrosion/wear resistance materials e.g. new steels, super alloys, high resistance composite metallic alloys, innovative refractories, high temperature

insulation materials systems, hybrid metallic/ceramic solutions for high temperature applications.

- Monitoring and control systems for the SO_x, NO_x and CO emission of industrial furnaces

The proposals must include at least one demonstrator in an industry-relevant environment, for either new or existing furnaces.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Compared to the current practice in the sector:

- Reduce the energy consumption by at least 15%.
- Reduce the operating costs by at least 15%.
- Reduce NO_x, SO_x and CO emission by at least 25%.
- Reduce Capex and Opex costs of the furnaces by at least 15%.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 05-2016: Potential use of CO₂ and non-conventional fossil natural resources in Europe as feedstock for the process industry

SPECIFIC CHALLENGE:

Europe is facing a large emission of CO₂-containing gases and at the same time a scarcity of carbon-based resources. Whereas today the carbon flow of the process industries is organised in a linear way from feedstock input to output of product plus emission (among other residues), the objective is to facilitate a cyclic flow in which CO₂-containing gases from one industry becomes the feedstock of another.

Due to greenhouse gas emissions (GHG), the process industry is increasingly looking into the potential use of non-conventional fossil natural resources (e.g. shale gas, gas hydrates, tar sands, coal bed methane, gas to liquid and coal to liquid technologies) as alternative feedstock. Moreover, some organic solid wastes (both from domestic and from industrial applications) can be used to obtain carbon based gas (e.g. biogas, syngas).

The challenge is to understand how to turn these different carbon sources into chemicals that can be used as sustainable building blocks or fuels, while at the same time the process is economically feasible depending on the different energy price scenarios. The aim is to perform a forecast study for the use of CO₂ containing process gases as feedstock for process industries, by means of the conversion of CO₂ and CO to carbon-derived products. Converting these gases into chemicals and products could lead to a major reduction of emissions and dependency on fossil fuels.

Presently the prices for the emission of CO₂ are dropping significantly compared to the initial prediction (e.g. in the ETS scheme) and at the same time both fossil based and renewable feedstock are highly volatile on the world market. Therefore, there is an urgent need to forecast different possible scenarios for a sustainable use of carbon resources and how this can be organised in a cyclic flow in the process industry.

SCOPE:

There is a strong need to evaluate the novel technologies and solutions for the use of CO₂/CO containing process gas as well as non-conventional fossil natural resources at production site level together with the economic feasibility. Furthermore, it is required to compile information on and create awareness on the relative maturity and adaptability of technologies to the local situations, with the aim to accelerate market adoption and replication of these solutions.

Some of the targeted chemicals offer dual use as an intermediate in chemical production as well as an energy carrier such as chemical energy storage. Therefore, the proposed technology not only links CO₂-producing and intensive carbon sectors but addresses various high-volume applications and significant markets.

The focus of the forecast study should be on the use of CO₂ containing process gases to produce high value added products (e.g. fine chemicals).

The study should address an integrated approach including the following aspects:

- To lay the foundation of the design of future facilities to demonstrate conversion of CO₂-containing gas into chemicals on site.
- The design of scenarios for the proper and most valuable uses of different gas resources.

- To analyse the need for pre and post-conversion separation and conditioning processes
- To evaluate the potential impacts of the use of non-conventional fossil natural resources on the CO₂ use and identify best solutions
- The scenarios should include evaluation of LCA, acceptance and recognition of new “clean” products, business models, proof of sustainability and skill sets.

All above mentioned should take into consideration the following issues: i) the most carbon efficient process, ii) the technical challenges that hamper the deployment of technical solutions at demonstration scale iii) the challenge of building a new model for integrating different industrial sectors.

Possible horizontal aspects addressed by topic:

- n/a

The Commission considers that proposals requesting a contribution from the EU between EUR 250.000 and 500.000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one project will be funded.**

EXPECTED IMPACT:

- New scenarios for increased use of CO₂/CO containing process gases and non-conventional fossil natural resources as new feedstock depending on future fossil fuel and energy prices.
- Strategies to facilitate the use of primary fossil feedstock displacement (downstream consuming industry).
- Future scenarios that enable new business models improving competitiveness of participating industries based on the use of CO₂/CO containing process gases and non-conventional natural resources as feedstock for the process industry.
- Synergies by linking production sites of emitting and downstream consuming industries.
- New areas for SME development and growth

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 06-2016: Business models for flexible and delocalised approaches for intensified processing

SPECIFIC CHALLENGE:

The competitiveness of European manufacturing depends on producing differentiated and high added value products in an efficient and sustainable manner, with reduced production costs, increased product quality and minimised time to market. To create a long-lasting competitive advantage for the European process industry it is also needed to properly inter-relate the production with modern and innovative ways of doing business.

Therefore, technological innovation in sustainable manufacturing in the process industry needs to be matched with new business models, which may support industry and cross-sector clusters as well as industrial parks, while also allowing more flexible and delocalised operations. These new business models should be designed to address the barriers which have so far prevented regionally or locally adapted solutions, with an emphasis on technical but also non-technological barriers, such as like legal, regulatory or cultural ones.

On the other hand, these new business models should allow the positive interactions between the different actors (firms, neighbouring municipalities, infrastructure administrations), which can allow positive outcomes in terms of accrued economic value associated with perceived level of attractiveness to inward investors, leading to jobs creation, and sustainable development promotion by local authorities, industries and policy makers. In addition, these business models should consider the influence of industrial consumer trends on future energy and resource systems to achieve ambitious sustainability paths, which will be very relevant for the whole market.

SCOPE:

New business solutions should enable higher throughput operations and allowing industry to produce in a distributed and small scale manner; these new business models are expected to be more flexible and demand-driven. Site re-optimization studies will help identifying barriers towards good practice solutions and integrating several industries or processes.

Activities should focus on all of the following areas:

- To determine the spatial flexibility parameters which allow to optimise activities interdependence and to define the resource flexibility parameters which allow optimising yearly fluxes between companies
- Integrated business model solutions for customer-driven supply chain management based on intensified processing.
- To deliver design constraints for new decentralised locations, which would position them, if applied, in the industrial symbiosis category,
- To pinpoint the routes which allow the reduction of carbon footprint at affordable interdependence investments
- Scenarios for novel distributed and intensified processing, sourcing and design solutions linking individual "home-based" designers and manufacturers to the supply-chain, promoting social inclusion and deploying skills locally available.
- Scenarios for local sourcing and supply, thus reducing the environmental footprint, taking into account both raw material and energy sources

The projects are expected to include an evaluation of best use and practical cases for intensified processing, while also providing an understanding on the research needs to achieve rapid deployment of the novel business solutions in particular consumer-targeted domains and a roadmap for their implementation. All relevant supply-chain stakeholders should be considered and it is expected that SMEs will play an important role in the deployment and application of future business models.

Possible horizontal aspects addressed by topic:

- The needs of SMEs as part of the supply-chain should be addressed

The Commission considers that proposals requesting a contribution from the EU between EUR 250.000 and 500.000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded.**

EXPECTED IMPACT:

A study on the research needs to develop new business model solutions that can support the return of delocalised manufacturing to Europe, in the order of at least 5% of the total manufacturing capacity, in the process industry sectors, within 5 years after the end of the study.

The overall aim is to obtain an understanding of how to achieve in the medium term new business model solutions which should provide:

- Reduction in the environmental footprint compared to products produced in the traditional value chains by 10% through less stock, less waste, and less transportation;
- Reduction of raw material by 15% through the creation of strong networks with related sources of raw material coming from different sources (primary and secondary) locally
- Development of scenarios in order to identify the proper locations and opportunities associated to delocalised facilitates taking into account legal and social hampering factors

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 07-2017: Integrated approach to process optimisation for raw material resources efficiency, excluding recovery technologies of waste streams

SPECIFIC CHALLENGE:

Process industries are currently facing the challenge of an increase in the energy and raw materials cost, a few of them facing a relative scarcity. Raw materials resources are blended, mixed and transformed into finished products by means of different manufacturing processes. Material losses and variable yields in the different processes can mean a considerable increase in the total cost breakdown.

Input from end-of-life recycling is an important goal covered in previous Horizon 2020 Calls including the SPIRE-7-2015 topic. However, yield losses in the different production steps in process industries are still important and this leaves room for improvement (e.g. real losses in pipelines, the storage containers extraction operations, raw materials residues left in ovens, mixing bowls and mixer blades, altogether with inefficient or ineffective chemical reactions).

Improving the utilisation of raw materials resources (fluids, solids or gases) is essential to increase yields throughout the supply chain. The reduction in losses will also ensure a decrease of the environmental footprint and therefore contribute to a more sustainable industry.

The challenge of a more efficient use of raw materials resources in order to deliver high performance and sustainable production must be accompanied by optimising material efficiency all along the process route and throughout the value chain.

SCOPE:

Proposals should address the technological improvements for both continuous and batch processes to improve material and energy efficiency in the entire production route . They should also identify key bottlenecks and resource efficiency improvement opportunities that will increase yields while optimising the energy consumption of the original processes. The process review and the implementation of improvements should also significantly increase the current production rates.

Research and Innovation activities should address all of the following areas:

- Reduction of material losses during the upstream beneficiation, the intermediate processing, the final process stages. Improvement of both the yield and the energy efficiency of the production process routes.
- Quality and process control that ensures process stability and robustness while allowing some flexibility at the inlet conditions and the development of tools to assess the optimal combination of material input and yield control.
- Identification and use of KPIs based on energy, water and raw material resources consumption, carbon dioxide emissions that can ensure the sustainability of the processes.
- Mapping of the material and energy flows across the entire production system to allow for a cross-sectorial integration and optimisation.
- Evaluation and quantification of the emissions reduction by improving yield.

The proposals must include at least one demonstrator per process in a real industrial setting.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Identify bottlenecks and resource efficiency improvement opportunities
- Identify knowledge gaps in the supply chain
- At least 25% reduction in yield losses when compared to the current practice in the sector, by optimising/minimising production losses and an increased material consumption on interconnected cycles
- At least 10% improvement in energy efficiency when compared to the current practice in the sector.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 08-2017: CO₂ Utilisation to produce high added value chemicals**SPECIFIC CHALLENGE:**

CO₂ represents an alternative, abundant and valuable source of carbon which could be a suitable raw material, and its utilization has the potential to contribute significantly to reducing greenhouse gas emissions and thereby unwanted climate change effects. In addition, the utilisation of CO₂ (and CO) as a feedstock by the European process industry to produce materials, chemicals and fuels could be a key solution to reduce the dependence on imports of fossil resources while providing a secure of supply of carbon feedstock.

The chemical industry is still largely based on the use of fossil fuels and feedstock as source of carbon, but a decrease is necessary in order to reduce carbon dioxide emissions. The utilisation of CO₂ (and CO) to produce added value chemicals may represent a viable

opportunity. While there are still significant scientific technological challenges to be solved in order to exploit the CO₂ (and CO) as a carbon source in a more systematic manner, there have already been concepts demonstrated at lab scale, which could provide possible solutions if properly scaled up. Therefore, it is necessary to demonstrate the feasibility of such CO₂ (and CO) utilisation technologies to produce added value products at larger scale, in an operational environment, to be able to assess the industrial potential of such technologies.

SCOPE:

Proposals should address innovative processes to produce added value chemicals from CO₂ (and CO) and demonstrate the technical and economic feasibility in an industrially relevant environment through demonstration of a system prototype. Technologies targeting conversion of CO₂ (and CO) to short chain alcohols, dimethyl ether and fuels are considered outside the scope of this topic.

The topic focuses on the conversion of CO₂ (and CO) to chemicals, possibly including chemicals with other components beyond C, H and O (such as N), in an integrated approach and therefore, the proposals need to consider the following elements:

- CO₂ (and CO) should come preferably from industrial flue and process gases from the process industries e.g., cement, steel and other energy intensive industries
- CO₂ (and CO) purification and conditioning methods to bring the gas to a sufficient quality for efficient conversion into chemicals.
- The testing of a system prototype should be integrated with process modelling and life cycle assessment in order to quantify the processes in terms of resource intensity reduction as well as reduction of emissions.
- The quality of the products obtained should relate to the specifications requested by the market.
- The project should contain an analysis of the economic feasibility and impact, and the evaluation of the market potential, and benefit on the European competitiveness deriving from the introduction of the new process.

Proposals should involve industries in a clear leadership role. The impact on greenhouse emissions will be an important element of the evaluation.

Possible horizontal aspects addressed by topic:

- n/a

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Demonstrate technical and economic feasibility of novel processes for CO₂ and CO conversion to added-value chemicals.
- Reduction of at least 20%, on Life-Cycle-Assessment basis, of the emissions of greenhouse gases and energy/resource intensity with respect to commercial manufacturing of the same product.
- Significant increase of the industrial competitiveness deriving from the novel processes of conversion of CO₂ and CO to added-value chemicals.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 09-2017: Pilot lines based on more flexible and down-scaled high performance processing

SPECIFIC CHALLENGE:

Although the European process industry holds a globally strong position, it is losing competitiveness in the face of world regions which are richer in raw materials and/or have lower energy, labour and environmental costs. Consequently, in order to maintain its competitiveness on the global stage, it will be important to substantially improve its performance, as well as the energy and resource efficiency of its operations. In addition, the existing industrial processes often do not provide sufficient flexibility (e.g. ability to easily change production rates) making them unable to meet the demand for fluctuating production volumes and seasonal production campaigns requiring in situ processing (e.g. bio-mass, limited batches), which would benefit from flexible and/or mobile production systems that do not require extensive infrastructure (e.g. containerised approach).

During the last decade, several concepts have been developed and reported to enable more flexible, compact and cost effective processes proposing a variety of process intensification methodologies, which have the potential to achieve the very significant improvements in performances, energy usage and material efficiency sought by the industry. However, these concepts have mostly been demonstrated/validated at laboratory/small scale and further work is needed to fully assess their industrial potential in terms of performances, techno-economic feasibility and scalability

SCOPE:

Proposals are expected to identify and demonstrate innovative, compact, high performance production lines for existing and novel products with significantly lower operational and investment costs (compared to their existing analogues). This may be achieved by adaptation, redesign of existing process units or by completely new concepts, provided that a significant improvement in cost, flexibility and performance can be achieved, compared to the commercially available processes. The approach proposed should allow short time-to-market and integration in currently existing plants, while ensuring a high flexibility (e.g. production lines with a broad turn-down ratio or by using parallel modular units for adapting capacity).

Proposals should address all of the following activities:

- The proposed solutions should encompass the elimination, combination or replacement of one or more process steps/units aiming to achieve significant efficiency improvement and higher productivity and flexibility, while ensuring lower capital and operation costs.
- Significant demonstration activities in a relevant industrial environment are expected, which will allow validating the productivity and flexibility improvements and provide clear indications on the scalability, replicability and potential for its integration in existing industrial plants.
- Techno-economic analysis providing a proof of economic and industrial feasibility for the innovative, high performance, flexible/scalable production lines that will be demonstrated, as well as a business plan for the deployment of the technology.

Demonstration of the integration in existing industrial scenarios would be a major added-value.

The proposal should include clear steps for the deployment of the concepts in industry (e.g. including clear business scenarios and a work package on business plans)

The proposal should provide evidence on the concept potential for job creation.

Possible horizontal aspects addressed by topic:

A significant participation of SMEs with R&D capacities is encouraged.

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- The equipment size/production-capacity ratio, energy and resource consumption, or waste production will be significantly improved by more than 30% compared to existing approaches. The targets should be quantified in the proposal and validated during the execution of the demonstration.
- The novel processes/production lines should contribute to lowering the investment and/or operating costs by at least 20% compared to existing approaches. The targets should be quantified in the proposal and validated during the execution of the demonstration.
- Concepts should demonstrate a positive environmental impact, by reducing by-products and/or waste generation, as well as reducing CO₂ emissions and energy consumption.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 10-2017: New electrochemical solutions for industrial processing, which contribute to a reduction of CO₂ emissions

SPECIFIC CHALLENGE:

Electrochemical processes have the potential to be highly efficient and thereby create less by-product waste compared to conventional chemical processes. Important reasons for the industrial interest include the use of less expensive starting materials, less aggressive process conditions (e.g. lower temperatures with less degradation of feed and/or product), fewer processing steps (for example electrochemical synthesis and product separation may be combined in one reactor), precise control of oxidation or reduction level by control of electrode potential and discovery of unique processing routes to establish new markets for products. In addition, electrochemical processes have the potential to replace polluting chemical reactions with more environmentally friendly electrochemical reactions.

Despite the large number of chemicals available in the market, electrochemical synthesis of chemicals has until now been limited to a narrow spectrum. However, advances in electrochemical synthesis and methods are now possible and facilitated by recent developments in materials science, nanotechnology, and by the development of new in-situ analytical techniques or the progress in multi-scale modelling. This provides opportunities for new approaches for the electrochemical manufacturing of products.

Intensive research into organic and inorganic electrochemical processing promises major developments in different applications, specifically with the prospect of greatly reduced electricity consumption and the use of electrical power generated from environmentally friendly production processes like wind and solar energy, thereby contributing to the reduction of greenhouse gas emissions.

SCOPE:

Proposals should provide a proof of the economic and industrial feasibility of the new technologies. The proposed solutions should also have the potential for integration into existing industrial operations. A prospect for a wider impact of the proposed solutions on the chemical industry is also needed.

Important aspects that should be taken into account are:

- Easy integration with renewable energy (electricity from renewable production sources).
- Electrochemical synthesis and/or electrolysis which allows the direct creation of products (e.g. fuels, chemicals, metals).
- Ease of operation at low temperature and pressure conditions.
- Integration of product produced into existing storage and supply infrastructures.
- Significant improvements in energy and resource efficiency compared to the commercially available analogue (or similar process) with reduction of direct and/or indirect greenhouse gas emissions.
- Improvement in safety and the work environment.

Projects will carry out demonstration activities in industrial environments aimed at confirming the industrial relevance and feasibility of the proposed technologies, showing the potential for integration in existing operations.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implementation as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million € would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Decrease by 25% of energy use compared to related non-electrochemical processes
- Decrease by 30% of Green House Gases emissions compared to related non-electrochemical processes
- Strengthen the global position of European process industry through the introduction of new technologies related to electrochemical processing of materials

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPIRE 11–2017: Support for the enhancement of the impact of SPIRE PPP projects

SPECIFIC CHALLENGE:

Dissemination, exploitation and transfer of projects results are important activities during project life-time and beyond in order to make sure that projects fully achieve the expected impacts. Clustering of project activities, according to specific objectives and addressed themes, and their inter-linking with existing technology transfer activities, are effective ways to stimulate the take-up of project results and to exploit synergies. Further, there is a need to focus on knowledge transfer and training issues regarding present and future industrial workers, for which a strong link between industry and academia is needed.

An adequate exploitation of such activities together with a joint analysis of the results obtained and the training needs during the project lifetime and beyond is also needed, to ensure an effective implementation at the PPP level.

SCOPE:

The coordination actions shall aim in particular to actively cluster existing activities under the SPIRE PPP that go beyond the exploitation and dissemination activities of each project. The initiative, which is expected to last 2 years, will require close collaboration with relevant industrial associations, technology and knowledge transfer programmes as well as the training community.

The project should aim at looking for new ways of engaging with the broader process community, and encouraging engagement with other networks in the process industry (e.g. regional networks).

Activities may include:

- Moving beyond traditional dissemination activities and favour the development of tailored innovative dissemination actions and initiatives inspired by project outcomes and targeted at specific stakeholders (incl. SMEs, learning community).
- Sharing insights on innovative business model concepts for implementing resource and energy efficient solutions, including cradle to cradle and industrial symbiosis approaches.
- Identification of gaps and opportunities for further research and innovation, as well as non-technological gaps in order to develop policy framework recommendations (e.g. regulation, standardization, public procurement).

- Workshops with top-ranked international experts from the various disciplines aiming at the elaboration of future SPIRE priorities and training needs within the technological area of the cluster.
- Building skills capacity for innovation and competitiveness in the process industry (e.g. engaging with the academia for the development of learning resources adaptable to different learning approaches and curricula at undergraduate, master, and life-long learning levels, based in particular on the innovation outcome of projects).
- Reviews of recent technological developments, publications, international RTD and innovation programmes within the technological area of the cluster.

Possible horizontal aspects addressed by topic:

- n/a

The Commission considers that proposals requesting a contribution from the EU between EUR 250.000 and 500.000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The impact on the areas of application of the projects is expected to be:

- Speeding up industrial exploitation and take up of results of SPIRE PPP projects and facilitate cross-sectorial technology transfer.
- Stimulation of networks and alliances for further RTD and industrial innovation in the addressed technology and application areas.
- Added value beyond the original scope of the SPIRE PPP projects by exploiting synergies and sharing best practice, including on innovative business models. Increased public presence and awareness of SPIRE PPP activities.
- More effective execution of activities of common interest, such as training & education, IPR management and standardisation.
- Anticipation of business trends and market prospects.
- Early awareness of key innovation developments.
- Dissemination of project results beyond traditional dissemination models and timeframe of the projects.
- Development of training and innovation skills capacity in the process industry.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

It is essential to take advantage of the potential important benefits from new technologies and materials while ensuring that there are mechanisms in place to prevent, identify and manage any potential risks that come about associated with certain use of such technologies. The European regulatory process should also instil consumer confidence in the approved marketed products and encourage the reduction of production costs and the increase of efficiency, improving of the quality of products and services, ensuring worker health and safety, and protecting the environment in order to keep jobs and a competitive economy.

The EU Regulation 1025/2012 defines the procedures to be applied when harmonised standards are used to provide a presumption of conformity with legal requirements.

SCOPE:

Regulation should be simple and stable but, above all, should be reliable. Before any changes are considered, a very careful and well-thought analysis should be undertaken in order to minimise the risk of potential negative impact on innovation and on the uptake of technology. Furthermore, standards should be non-restrictive, reflecting a balance between a need for harmonisation and innovation.

A clear, consistent and predictable regulatory framework which avoids unnecessary administrative and financial burden is needed. Proposed support actions should cover the needs of the different industrial sectors representing big and small companies within the SPIRE community. Their objective should be to identify and to propose solutions along the value chain, required to reach long term sustainability for Europe in terms of global competitiveness, ecology and employment.

Evaluation of standardisation and/or regulation needs could include recommendations within the following issues:

- Re-use of different grades of wastewater for industrial purposes.
- Re-use of different types of waste (e.g. through re-classification) as feed for industrial production and/or energy sources.
- Recovery of valuable materials, metals and minerals from waste.
- Lifecycle Assessment methodologies to allow a harmonised comparison between industries and sectors.
- Production of advanced renewable fuels from the use of CO₂ as feedstock.
- General harmonisation of the European Waste, Water and Energy policies.
- Eliminating bottlenecks for the transferability of new technologies across European borders.
- Eliminating bottlenecks that prevent the stimulation of investments in new technologies, e.g. within clean and low carbon technologies.

- New standardisation methodologies that facilitate continuous production.

While in some cases it is necessary to recommend harmonisation on a European scale through regulation and European Standards, in other cases it may only be necessary to enable transferability of technology across sectorial boundaries.

Examples for this could be (but not restricted to) the following:

- IT control systems and plant monitoring systems facilitating industrial symbiosis.
- Equipment for Process Intensification.
- Equipment for small scale localised production.

Possible horizontal aspects addressed by topic:

- International cooperation

The Commission considers that proposals requesting a contribution from the EU between EUR 500.000 and 1 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded.**

EXPECTED IMPACT:

- Enabling regulatory authorities to better address the different relevant issues based on a better assessment and taking into consideration the different stakeholders in SPIRE.
- Rationalising the process to deliver standardisation mandates to the European Standards Organisations.
- Successful implementation of different policies, regulations and standards within the SPIRE sectors.
- Enabling of industrial symbiosis and better use of industrial resources.
- Reducing cost of operation for the process industry.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

H2020-EeB-2016/2017

The EeB cPPP 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.

EeB 01-2016 Smart insulation materials with improved properties**SPECIFIC CHALLENGE:**

The role of insulation is essential to achieve energy efficiency in renovated buildings and in nearly zero energy buildings following the requirements of the recast of the Energy Performance of Building Directive (2010/31/EU). An improved insulation in buildings will have a large impact on the reduction of energy consumption and CO₂ emissions at European level. It can also bring significant environmental, economic and social benefits both for the Member States and for the citizens.

Although currently many materials are available on the market, there is a strong need to develop affordable advanced insulation materials which exceed the performance of presently used materials, and also respect strict sustainability principles

SCOPE:

Proposals should address the development of new insulation materials and solutions based on nanotechnologies and/or advanced materials and offering enhanced insulation properties and environmental performance.

The proposed solutions should go well beyond the state of the art and take into account the final performance properties of the new materials and of the respective building components.

The following factors should also be considered: enhanced durability for increased use duration, reduced maintenance and reduced costs; respect of sustainability principles (the sustainability of each developed solution should be evaluated via life cycle assessment studies carried out according to the International Reference Life Cycle Data System - ILCD Handbook); applicability to both new build and renovation; lightweight construction and ease of installation; realistic solutions at a competitive price; limited impact on living space; increased comfort and noise reduction; fit for deconstruction; recycling/reuse of materials at end of life. Resistance to damaging agents such as fire, moisture, rodents etc should also be considered when relevant for the application. Standardisation aspects should be included particularly in relation with the work carried out in CEN/TC 350. Additional properties such as multi-functionality, load bearing, improvement of indoor air quality, and use of wastes may also be considered.

Proof of concept in terms of one (or more) component(s) containing the new materials developed should be delivered within the project, excluding commercially usable prototypes (2006/C323/01), but convincingly demonstrating scalability towards industrial needs duly justifying availability of the proposed materials for potential further massive use and wide replication across Europe. Information guides for applications, installation and training on the new solutions should be provided before the end of the project.

In addition to the industrial, academic and construction stakeholders, the participation of public authorities would also be an asset for the proposals, as public authorities own a large part of the building stock at European level.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

To maximise their impact, the funded projects are expected to cluster with each other in order to facilitate research cohesion, integration, and advancement of the EeB-PPP agenda.

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Compared to state of the art materials and components, the newly developed materials should bring:

- Improvement by at least 25% of the insulation properties at component level;
- Reduction by at least 20% of the total costs compared to existing solutions
- Improvement by at least 20 % of durability at component level;
- Proof of high replication potential both in new built and renovation in Europe;
- Easier implementation;
- At least a 15% reduction of the energy spent during the whole life cycle of a building;
- Strengthening of the competitiveness of the European construction sector in the field of “green” construction technologies.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

The construction sector is a key player in the efforts to decarbonise the European economy with the goal to drastically reduce energy consumption and decrease CO2 emissions. Key Performance Indicators, along with appropriate methodologies and tools are crucial in order to quantify and benchmark the energy-efficiency and the environmental quality at building and district level. Adequate monitoring and management techniques are also needed, mixing results and practices from the building sector together with other relevant sectors like energy grid to ensure an effective performance improvement both at building and district level.

SCOPE:

Proposals should focus on solutions beyond the state of the art, which will improve and provide a feedback on the experiences on energy efficiency and environmental quality from the latest generation of new and renovated buildings and their interactions in districts.

Proposals should focus on the following main objectives:

- To establish a consolidated structured and geo-clustered analysis and compilation of the latest generation buildings and their interaction with district resources in order to develop the return of experience associated with them,
- To identify and analyse relevant sectorial indicators, data models and supporting ICTs enabling and supporting decision making for energy efficiency and environmental quality, from design to operational phases,
- To elaborate and develop operational and harmonised protocols supporting tools and systems to characterize the performances in real operational conditions,
- To develop benchmarks on the impact of the non-qualities on the overall energy performance, which protect privacy while allowing deep analysis,
- To understand the specific causes of non-performance or sub-optimal performance throughout the entire life cycle (from design to construction and operation) and promoting best practices to the industry.

Possible horizontal aspects addressed by topic:

- n/a

The Commission considers that proposals requesting a contribution from the EU between EUR 250.000 and 500.000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting other amounts. **No more than one proposal will be funded.**

EXPECTED IMPACT:

Impacts are expected on:

- Setting up more accurate guidance for all types of building that can be used by design teams. These accurate guidance shall match actual building operation more closely;
- Collecting data and knowledge on the effective performance of new and renovated buildings of the latest generation;
- Developing scientific and technical databases which shall be robust and shared to objectify and characterize performance in situ. These database shall also allow the confrontation between forecasts and reality, and detail the need to change practices;
- Enabling statistical and knowledge analyses enabling to reach consensus on how to bridge the gap between performances expected at the design level and performances really obtained.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

EeB 03-2016: Integration of advanced technologies for heating and cooling at building and district level

SPECIFIC CHALLENGE:

- The energy used for space heating, cooling and hot water generation represents most of the overall energy consumption in buildings (70-90% of total energy). In order to reduce this consumption, state-of-the-art or new technologies need to be deployed, developed and integrated with high efficiency equipment, both for residential buildings and districts. The share of renewable energies in the energy supply for heating and cooling needs to be increased.
- Cost effective, practical and affordable solutions need to be demonstrated and validated to ensure the success of the retrofitting business. The current potential of energy saving in the EU through renovation activities is very high. In Europe there are two main categories and segments to cover: residential buildings and district network buildings.
- Regarding the existing residential buildings which represent the largest part of the energy consumption, there is an urgent need to develop integrated solutions that would fit with the current natural gas boilers dominance in the EU market.
- For the district network buildings, systems should be improved with the support of high efficient control systems that manage better the demand/supply for heating and cooling, and that could fit with a better exploitation of the waste heat available from various industrial or commercial sources.

SCOPE:

Buildings retrofitting potential in the EU is huge and existing heating/cooling technologies do not sufficiently enable the integration of new advanced efficient systems. Proposals should embrace two types of buildings: residential buildings and district heating/ cooling connected buildings. For both types, the integration of new reliable systems should be based on new or existing reliable design tools which would facilitate taking the decision on the installation of the best solutions. The research activities should at least address the following areas:

- Integration of advanced heating and cooling technologies such as hybrid systems combining fossil based equipment with renewables systems (cost competitive heat pump kits, solar thermal or biomass systems are attractive combinations).
- Energy waste heat/cool sources that may be exploited in the system.
- Easy installation and integration of such equipment with concern to minimise the maintenance needed and to simplify the logistic.
- Control and monitoring of the entire system, to ensure an efficient match between the supply and demand of energy, including ICT and algorithms embedded in the equipment.

Concerning the district systems, advanced District Heat and Cooling (DHC) systems, i.e. systems operating at low temperatures, must be able to deal with both centralised and de-centralised hybrid sources (e.g. solar thermal, biomass, geothermal, heat pumps, waste heat, excess renewable electricity storage).

Proposals should provide detailed information on the energy data of the buildings (current energy use and proposed reduction with new equipment, the gross floor area of the building together with the targeted annual energy use per m², broken down by space heating, cooling, domestic hot water heating, and lighting). The energy use should achieve at least the national limit values for new buildings according to the applicable legislation based on the Energy Performance of Buildings Directive.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. A significant participation of SMEs with R&D capacities is encouraged.

The Commission considers that proposals requesting a contribution from the EU between 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requiring other amounts.

EXPECTED IMPACT:

- Demonstrate a high potential of replication contributing to large scale market deployment before 2025 with in particular the support of dedicated tool kits, which would be easy to install and would require a limited workforce.
- Cost-effective highly energy-efficient equipment with target reduction of energy consumption of 20 -30 % (including renewables).
- Payback period of below 10 years.
- Best practice examples for the construction sector based on innovation and competitiveness, with benefits for the citizens and the environment.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

EeB 04-2016: New technologies and strategies for the development of pre-fabricated elements through the reuse and recycling of construction materials and structures

SPECIFIC CHALLENGE:

As a consequence of economic development, construction and demolition waste (CDW) has become a serious problem, creating serious environmental pollution in certain areas of the world. In the EU, CDW accounts for approximately 25% - 30% of all waste generated and consists of numerous materials, many of which can be recycled.

Advanced research actions and technical solutions are required for large-scale reuse and recycling of construction materials in building refurbishment, contributing to overall CO2 and energy reduction. At the same time pre-fabricated components are now commonly used in the construction sector not just to reduce costs but also to facilitate installation/dismantling and re-use of components.

The development of pre-fabricated elements containing a high share of recycled materials and of building concepts considering a high fraction of material replacement is needed. The main focus would be on the recovery/ recycling of materials that have the highest technical and economic interest and which are associated to refurbishment processes.

At the same time, the possibility to reuse different materials to be reused in buildings should be further investigated through a proper characterisation of their properties. Also the development of processes for easy disassembly needs to be considered as well as the need to address strict regulations and standards (i.e. anti-seismic) in several European regions.

The EC Waste Directive mentions under Art 11- 2b that: " by 2020, the preparing for re-use, recycling and other material recovery, including backfilling operations using waste to

substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a minimum of 70 % by weight."

SCOPE:

Building concepts using new or adapted prefabricated components need to be developed, in order to implement construction processes allowing the reuse and recycling of different materials and structures.

In the case of building retrofitting with traditional construction methods poor results are frequently obtained. This is especially true when recycled materials are used. There is a need to harmonize the way to acquire and use all the information related to the building and its stakeholders (procurers, builders, owners, users, operators, etc.) in order to radically modify the construction processes (e.g. lean construction and higher degree of industrial building prefabrication), and the off-site production of components (e.g. prefabricated components).

Proposals should cover the following areas:

- Optimisation of recyclability properties of the materials and development of solutions to recycle and reuse construction materials and existing building structures in particular through the uptake by the manufacturing chain.
- Innovative solutions integrating the last developments in construction and installation processes which show clear evidence of technical and economic viability.

The project should also address the demonstration of the recycling technologies in the construction or refurbishment of buildings representative of three different climatic zones across Europe, allowing for a high replication potential.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- CO2 savings (by min. 30 %), energy savings (by min 20%), and higher resource efficiency (minimum share of recycled materials in final product of 10-15 %) will ultimately contribute to a resource-efficient and climate change resilient economy.

- Creation of new value chains by expanding the size and attractiveness of additional sectors.
- High replication potential of the solutions obtained.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

EeB 05-2017: Development of near zero energy building renovation

SPECIFIC CHALLENGE:

Buildings and more specifically the housing sector represent about 40% of EU energy consumption. Ambitious renovation of the ageing building stock offers huge potential to reduce that energy consumption. Lowering the energy costs for households while increasing in-house comfort will not only help to achieve EU environmental objectives, but will also benefit EU economy and contribute to social well-being.

A large-scale deep rehabilitation of the residential building stock to match the net-zero energy standards at affordable price must be achieved. Breakthrough solutions are required to reduce energy consumption in building (e.g. in space heating/cooling and domestic hot water production, maximising the envelope performances, heat recovery and local use of renewables) with the support of advanced BEM (Building Energy Management) systems. Proposals should go beyond the state of the art and previous project results of the EeB PPP.

SCOPE:

Research should address in-depth analysis and subsequent improvement of the renovation process, including innovative technical elements/products/processes aiming to improve the decision-making, and should be based on a collaborative multi-value multi-stakeholder exercise. Methodology, guidelines and effective operational tools are needed to ease the selection between renovation scenarios. The analysis should take into account life cycle assessment, life cycle costing, indoor environment quality, as well as user behaviour and acceptance. Research should lead to innovative concepts for a systemic approach to retrofitting which integrates the most promising cost-effective technologies and materials, in order to reduce heat losses through the building envelope and also the energy consumption by ventilation and other energy distribution systems, while increasing the share of renewable energy in buildings.

The new tools will help revalorisation of existing buildings in the long term, including the energy performance of the building as a factor of the total property value. This should be

reflected in the definition of innovative business models where all relevant actors are involved, including public authorities and investors.

Proposals should aim at maximizing the capacity of replication of the developed concepts and methods for integrated sustainable renovation. Large-scale market uptake should be addressed, for example by targeting buildings with similar use conditions and/or comparable blocks of buildings or districts in need for renovation.

Proposals should show clear evidence of technical and financial viability of the solution through their application on real case demonstrations.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

Significant participation of SMEs is encouraged.

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Reduction of at least 60% in energy consumption in order to reach the target of near zero energy compared to the values before renovation, while enhancing indoor environmental quality.
- Decrease of installation time by at least 30% compared to typical renovation process for the building type.
- Demonstration of a high replicability potential and of large market uptake capacity.
- Affordability considering all values at stake, with a payback period of below 15 years.
- New generation of skilled workers and SME contractors in the construction sector capable to apply a systemic approach to renovation.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

EeB 06-2017: Highly efficient hybrid storage solutions for power and heat in residential buildings and district areas, balancing the supply and demand conditions.

SPECIFIC CHALLENGE:

- The storage of thermal or electric energy needs optimised operational technical solutions in order to better manage and synchronise the overall supply and demand (at residential, district and urban level). Good management of the peak loads, especially stemming from an increase of renewable energy production, would reduce the overall energy consumption and the cost of operation of the installations.
- Hybrid solutions are needed, inherently addressing the seamless conversion and integration of renewable electricity and heat, as to anticipate the future energy grid that will fully allow an exchange of different energy carriers. Such hybrid solutions form a next step in the electrification of the heat supply market.
- To go beyond current state of the art on thermal storage (i.e. compact systems) for residential buildings, it is necessary to bring research activities in this field closer to pre-commercial stage, to demonstrate their technical and economic viability, and to optimise the operation of such hybrid solutions in view of combining them with the surplus of renewable electricity with low temperature heat and cooling demand.
- In the EU, there are nowadays just a few examples of operationally integrated solutions for the optimal interaction in district networks, combining both electricity and heat/cooling energy supply and storage.
- Efficient use of renewable energy in hybrid systems for the storage and generation of energy needs to be achieved.

SCOPE:

Proposals should develop advanced innovative high-density hybrid energy storage devices, targeting the efficient use and further increase of renewable energy in the built environment, and demonstrating its value in terms of flexibility in the energy systems. They should address both electrical and thermal applications and able to reach a rapid release.

Such hybrid approaches encompass different aspects, which may be addressed separately or coherently:

- high efficiency conversion and storage of surplus renewable electricity into heat;
- multifunctional use in both heating and cooling applications at different temperature grades;
- different time scales, e.g. in seasonal storage of high temperature solar heat and peak-shaving in lower temperature heat-pump applications.

Research and innovation activities should address:

- electricity applications, where the technologies covered may include batteries, flywheels and capacitors suitable for applications in the power range of several tens of KW to 1 MW as well as other technologies related to storage of large-scale power needed for district areas.

- thermal applications, where these hybrid solutions should develop the high efficiency conversion and storage of surplus renewable electricity into heat. The hybrid system should take into account the optimal integration of various potential heat storage media. Therefore, preference will be given to systems that exploit sorption technologies (solid/ liquid) and/or latent heat (PCM). The innovation part of the project should include the possibility that energy systems may be connected, and of merging energy from different sources, e.g. renewable electricity combined preferably with electric storage and heat, industrial waste heat, heat grids, ground systems.

Proposals are expected to cover the various aspects of the overall system, such as design, storage materials, interfaces with various components and auxiliaries (heat exchangers, reactor etc) and include monitoring and control of the overall technologies/ components (BEMS).

Proposals should preferably include demonstration pilots for both residential and district connected buildings in three different climatic regions. They also need to integrate strategies for optimal interaction with the energy grid, and assess the value of this integration in view of flexibility in the energy system.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. A significant participation of SMEs with R&D capacities is encouraged.

The Commission considers that proposals requesting a contribution from the EU between EUR 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requiring other amounts.

EXPECTED IMPACT:

For residential buildings which are not connected to District Heating and Cooling

- Demonstration of the economic viability of the overall storage systems when operating in real conditions in residential buildings with a return of investment period of 9-10 years
- Technologies which are reliable and should ensure a minimum of 20 years life time
- Solution which fits in existing building configurations – with compact systems using limited spaces in existing building (volume of storage limited to 3 m³).
- Demonstration of an overall net energy reduction by 20 %
- Validated contribution to energy system flexibility

Residential buildings connected to District Heating and Cooling

- Demonstration of the economic viability of the overall storage systems with return of investment of less than 20 years
- Technologies which are reliable and operating for a minimum of 30 years
- Provide compact systems (volume of storage limited to 1 m³)
- - Overall net energy gain of minimum 30%

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

EeB 07-2017: Integration of energy harvesting at building and district level

SPECIFIC CHALLENGE:

Integration of energy harvesting approaches is a major challenge, in particular the development and integration of different renewable energy sources at building and district scale.

The envelope should be considered as an active and/or adaptive skin that interacts with the external environment and strongly influences the building energy performance and indoor comfort. Indeed, in view of a large-scale deployment of nearly-zero energy solutions in existing buildings, besides reducing energy demand through highly insulating materials and reduction measures, the possibility to harvest energy in the building envelope is of great importance.

The district dimension should be taken into account, both because of a higher potential for integration and optimisation of renewable energy sources, and because of the potential of additional energy harvesting approaches

SCOPE:

Proposals should aim at maximising the harvesting of renewable energy (for heating, cooling, electricity, domestic hot water, etc.) at building and district scale (e.g. exploiting large renewable energy source installations and heating and cooling networks). Research results shall contribute to drastic energy saving and CO₂ emission reduction while enabling massive replication in low zero energy buildings and energy self-sufficient districts. the focus is on a cost-effective and easy installation in a wide variety of buildings and surroundings.

Buildings are connected with various entities like suppliers and distribution system operators through different networks (internet, smart meter linked to the grid, energy storage systems, electric vehicles, etc.). Therefore, proposals should take into account an appropriate

integration of monitoring and control systems for the developed solutions, combining, where relevant, additional functionalities such as safety and security.

Proposals shall be flexible to cope with different designs and architectural concepts, with components being especially shaped and integrating different material combinations (such as glass, pre-casted elements, membranes).

The modular dimension is important to allow a cost-effective and easy installation in a wide variety of buildings and processing practices.

Proposals shall enable a reduction of maintenance and operation costs, in particular when many sensors and actuators are cost-effectively distributed throughout the envelope.

Applicability in different geographical areas is important.

Clear evidence of technical and economic viability should be provided by validating and demonstrating the proposed adaptable envelope in real case retrofitting projects.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7. A significant participation of SMEs with R&D capacities is encouraged.

The Commission considers that proposals requesting a contribution from the EU between 4 and 6 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requiring other amounts.

EXPECTED IMPACT:

- The additional cost related to new technologies should not be higher than 20% of conventional standard building costs.
- Demonstration of the replicability potential in a real case-study.
- Solutions with a payback period of below 10 years.
- The integrated harvesting systems will cover at least 30-40 % of the overall energy demand for new buildings and 20% for renovated buildings

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

The most important benefit associated with the refurbishment of an existing building comes from improving the energy performance, which gives an essential contribution to reach the EU 2020 consumption goals, taking into account that buildings represent 40% of the energy use in the EU. A key challenge for its large-scale implementation is the necessity to manage a broader involvement of stakeholders representing different interests and different responsibilities influencing the potential solutions and actions. This regards not only the choice of technologies, but also the design and renovation methods, as well as a number of socio-economic issues.

Nowadays, decentralised energy generation technologies have been demonstrated in a number of building applications in Europe and beyond but large scale uptake and business deployment of these technologies is still in its early stage. Currently, the renovation level is about 1.2% of the building stock in Europe per year and it should increase, according to the European Performance Building Directive (EPBD), to 2 - 3 % per year until 2030. Innovative business models which allow consumers and the market to invest with confidence in long term operation, maintenance, reliability and service levels need to be developed.

SCOPE:

Activities should focus on the benchmark and the assessment of innovative business models, evaluating different refurbishment packages enabling the selection of the most attractive and efficient ones for different building types (residential/District Heating Cooling connected) and climatic conditions, taking the maximum advantage of user behaviour and geo-clustering.

Adequate assessment tools and the methodological challenges facing analyses addressing the issue of comprehensive analytical approaches in order to inform business decisions in this respect need to be discussed. Life cycle models as input to the decision making process in the feasibility phase of the renovation project also need to be considered.

Proposals need to assess different highly resource-efficient business models for refurbishing buildings including the possibilities provided by public procurement options, appropriate combinations of public and private, or only private funding. These concepts need to be developed taking into account the building owners, the socio-economic impacts, and the current EU crisis.

Proposals should also develop effective methods for steering and governance especially paying attention to the local scale, including the variety of actions by cities and municipalities that can define obligations or encourage voluntary actions. In particular the business models developed should support the preparation of innovation-related public building procurements by local/regional/national authorities or at European level.

The business models should cover the complete cycle as from the design phase of the building: decentralised energy generation technologies, integration, installation,

commissioning, operation, servicing and maintenance, etc. In this framework, activities should cover business model design and optimisation, market and customer segmentation approaches for decentralised energy generation, consumer behaviour and decision driver research for optimising business model structures, supply chain and concept delivery optimisation, new earning models and financing mechanisms. In addition, proposers should also seek solutions to increase participation of stakeholders, considering methods to engage end users living in the buildings/neighbourhood and methods to increase the interest and commitment of building owners and market partners.

Socio-economic impacts of refurbishment should be taken into account considering the possibly drastic effects of high renovation costs on house owners and tenants, and seeking possible solutions to reduce costs, as well as addressing the needed commitment by users to energy efficiency after renovation.

Clear evidence of technical, environmental and economic viability should be provided. The possibility to engage municipalities planning to integrate renewable energy sources in the built environment could be an added value.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- Social Sciences and Humanities
- Gender relevance

The Commission considers that proposals requesting a contribution from the EU between EUR 500.000 and 1 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Cost-effectiveness and reduction of the current price of the renovation.
- Adaptive renovation packages with low environmental impact.
- Increased awareness and commitment of citizens on improved energy-efficiency of the building stock.
- Increased ability of municipalities for organising the renovation of building stocks, in particular through the use of public procurement tools.
- Better quality standards and performance guarantees while improving indoor environment and remaining cost-effective.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

**Advanced materials and nanotechnologies for high added value products
and process industries**

This part 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.

NMBP 01-2016: Novel hybrid materials for heterogeneous catalysis

SPECIFIC CHALLENGE:

In many currently explored applications of organic-inorganic hybrid materials, the achievement of superior properties is often hampered by the weak chemical (i.e. van der Waals, hydrogen bonding) interactions existing between the inorganic building blocks, leading, *inter alia*, to leaching of the inorganic components, agglomeration, phase separation, low mechanical stability. This is particularly critical for heterogeneous catalysis applications, where a robust linkage between the components would afford better performances also in terms of recovery and re-use of the catalyst. Even in the case of phase-boundary catalysis, where strong chemical bonds prevent the leaching of the active species, covalent bonds are a preferred option.

A further factor affecting the actual effectiveness of heterogeneous catalysts is the accessibility of the active component, being facilitated by either i) a porous microstructure or by ii) a loosely cross-linked structure enabling swelling of the hybrid catalyst in the reaction medium, where the substrate is dispersed.

In the latter case, an important role is played by the polarity of the medium in which the catalysis is carried out, being the interaction between the heterogeneous catalyst scaffold and the species affected by their polarities.

SCOPE:

Explore novel concepts in hybrid materials design for heterogeneous catalysis, also resorting on templating-effects and based on one-step synthesis, accomplishing i) the formation of a robust structure based on covalent bonds between organic and inorganic components and ii) accessibility of the catalysis-active moiety by tailoring the morphology and the polarity of the resulting materials, according to the targeted conditions and application such as condensations and asymmetric reactions.

A further aspect to be taken into account is the possibility to tune the cross-linking degree of the obtained hybrid materials by changing the synthetic parameters and synthesis route, to achieve different microstructures. The novel routes should be based on easy synthetic step(s) being scalable and adjustable for industrial scale.

Possible horizontal aspects addressed by topic:

Any?

Activities are expected to focus on Technology Readiness Levels 3 to 5.

The European Commission considers that proposals requesting a contribution from the EU in the range of EUR 5 to 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than 2 proposals will be funded.**

EXPECTED IMPACT:

- Scientific and technological breakthroughs in the development of novel concepts in hybrid materials design for industrial heterogeneous catalysis.
- Proposals addressing novel C-C bond forming and recyclable hybrid catalysts are expected to produce valuable chemicals of biological and pharmaceutical importance.
- The activity of the novel solid hybrid catalysts are expected be higher than the counterpart homogenous catalyst, improving process efficiency providing economic and environmental benefits
- Considering the leading-edge character of the proposed field, the impact for the European industry is expected to be in the medium to long term.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 02-2016: Advanced Materials for Power Electronics based on wide bandgap semiconductor devices technology

SPECIFIC CHALLENGE:

Power electronic components, modules and systems including wide bandgap devices technology are of large strategic importance in Europe. Part of the value chain is still possible

in Europe; the related application areas are based on the deep knowledge and market position in automotive industry, industrial electronics, energy transmission, renewable power generation (wind power, PV), healthcare, smart factory and prominent know-how for reliable materials for electronic assemblies. Contribution to the objectives of the SET-Plan in term of energy saving, efficiency, CO2 reduction are therefore part of this challenge.

The proposal should address the development of advanced, cost-effective, sustainable materials, architectures and processes for power electronics suitable for use in energy technology.

SCOPE:

The action should focus on advanced materials for innovative power components, new product development and application which will increase the reliability and operational lifespan of components under realistic conditions.

Considerable improvement of the operation of power-electronics devices based on the improved properties of the materials, architectures, and/or processes should be addressed. Realistic solution should be provided in term of operational characteristics like voltage, current level and sensitivity or switching frequencies as well as in long term maintenance-free operation with respect to the particular and stringent demand of the envisaged energy application.

Improvement in the cost and use effectiveness, including maintenance intensity should (or maybe?) be quantified. The proposal may develop manufacturing concepts for the construction of components and modules with less production defects;

International cooperation (with Japan?) is encouraged to tackle societal challenges, which are global by nature;

Possible horizontal aspects addressed by topic:

Implemented as cross-KET activities.

The implementation of this topic is intended to **start at TRL 4** (small scale prototype built in a laboratory environment) and **target TRL 6** (prototype system tested in intended environment close to expected performance).

The Commission considers that proposals requesting a contribution from the EU between **EUR x and y million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Substantial improvement of the wide bandgap semiconductors materials performance;
- Time to the market intake will be hence optimised (shortened);
- Global innovation for strategies for Key Enabling Technologies will be reinforced;
- Additional development for the leadership of Europe sector of power electronics, industries;
- Preliminary tailored business plan will be defined in the proposal to support the scientific, technological and/or socio-economic impact and specific action will be addressed in the proposal.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 03-2016: Innovative and sustainable materials solutions for the substitution of critical raw materials in the electric power system

SPECIFIC CHALLENGE:

The ambition of the European Union to achieve a secure, competitive and sustainable energy system by 2050 has become a priority. The electric power system will play a pivotal role in the overall energy mix, with particular challenges to achieve a balance between electricity supply, conversion, transport and use of energy. Critical raw materials (CRM) can become a bottleneck to the supply-chain of the different technologies used in the electric power system with implications for materials demand under different scenarios described in the EU Energy Roadmap 2050.

Even if recycling rates for some of these materials could be optimised to the highest possible extent, the overall increasing demand for CRM urges to roll-out substitution-based solutions within the next decade.

This specific challenge is covered by the Priority Area “Substitution of raw materials” of the European Innovation Partnership (EIP) on Raw Materials.

SCOPE:

Proposals should deliver innovative, sustainable and cost effective materials solutions for the substitution of (i) heavy rare earth elements used in permanent magnets and/or (ii) CRM used in energy storage applications and/or (iii) CRM used in catalysts for applications to generate electricity and/or (iv) CRM in materials used in photovoltaic cells. Substitution of CRM in electronics including lighting applications is out of scope of this call topic.

In order to ensure the industrial relevance and impact of the research efforts, the cost effectiveness and commercial exploitation potential of the proposed solutions compared to state-of-the-art solutions currently available on the market should be convincingly assessed in the proposal.

Possible horizontal aspects addressed by topic:

In line with the objectives of the Union's strategy for international cooperation in research and innovation (COM(2012) 497), international cooperation according to the current rules of participation is encouraged, in particular with Japan and the United States of America. The quality of the international cooperation will be rewarded in the evaluation of the proposal.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- A strongly reduced or completely eliminated CRM content in the proposed solution(s) while keeping up or improving the materials performance levels as specified in the relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <http://setis.ec.europa.eu/set-plan-implementation/towards-integrated-roadmap-and-action-plan>
- The risk mitigation from future bottlenecks in the material supply-chain of energy technologies used in the electric power system;
- Contribute to achieving the EU policy COM(2011)25: Tackling the challenges in commodity markets and on raw materials;
- Contribute to achieving the objectives of the EIP on Raw Materials.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 04-2017: Architected/Advanced material concepts for intelligent bulk material structures

SPECIFIC CHALLENGE:

The development of smart materials has been gathering pace over the past few years to develop novel concepts for intelligent components and structures with integrated functionalities that are able to communicate and interact with their environment, store data about their condition and react accordingly to external stimuli. Research in the areas of biomimetics and nanomaterials can provide several examples of the development of smart materials and has seen a significant expansion. Examples include materials that can alter their physical properties, (e.g. viscosity, shape, colour and more) in response to temperature, stress or electrical fields, convert sunlight into electricity, store energy, etc. Smart materials have also been used extensively in sensor developments in aerospace and automotive applications with the aim of producing intelligent structures and components that provide information of their in-service condition. However, there are several concepts that have not yet been implemented in large scale industrial. Such technologies include self-repair or self-healing materials, materials for vibration suppression, lightweight composites that can inform the user of any internal damage without the need of time consuming and expensive Non Destructive Examination (NDE), Functionally Graded composite Materials (FGMs), energy storing components, etc.

SCOPE:

Proposals are sought to address specific industrial needs and facilitate the implementation of smart materials for applications in transport, consumer goods and ICT. The technical challenges to be addressed relate to the development, processing and integration of smart materials with new functionalities, as e.g. for advanced sensors (nanosensor technologies), damage detection, self-repair, self-actuation, morphing, magnetic functionality (for non-magnetic materials), sound and vibration damping, for ICT applications. Material concepts based on biomimetics should also be considered. Although the materials most suited to such development are lightweight advanced composites from different material classes, (like multiferoics, polymeric or metal matrix composites, organic fibrous materials), the scope does not exclude metallic materials with tailored unique properties. It is expected that such smart materials may make use of the unique properties possessed by nanoparticles and therefore the development of nanomaterial based intelligent components will be within the scope of the call. The development of such material structures has to be accompanied by high resolution analytical tools that are able to characterise the materials on all scales and, moreover, to track and reveal their function –structure relations in situ. For this topic proposals should also be able to demonstrate in addition to the development concept, the feasibility of such technologies in terms of cost, production methodologies and reliability. Proposals should also include an outline of the initial exploitation and business plans. More detailed exploitation plans, outline financial arrangements and any follow-up should be developed during the project.

Possible horizontal aspects addressed by topic:

Any?

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR **x and y** million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Applications are envisaged in transport and consumer goods. The implementation of novel smart material technologies is expected to pave the way for innovative environmentally friendly smart products enhancing the market opportunities for European industries, improve consumer safety, reduce maintenance costs, and improve resource efficiency. In addition, the knowledge base in the EU will be greatly enhanced not only at the R&D level but also at the manufacturing and production level, creating a highly skilled workforce with improved levels of job satisfaction. It is inevitable that the functionalities of smart materials will require the identification of gaps in standards and future pre-normative activities will have to be addressed.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 05-2017: Design-driven advanced materials for high added value innovative products

SPECIFIC CHALLENGE:

Creative industries have been defined as one of the most active, significant and relevant new emerging industrial sectors in the European economy (Report on Emergency Industries, PwC, 2012). The creative industries linked to manufacturing (e.g. architecture, automotive, art, crafts, supports for cultural items, decoration, fashion, furniture, lighting, interior design materials and products, jewels, luxury, media supports, publishing, sport and toys) are generators of competitive advantages that cannot be reproduced elsewhere, promoters of local development and drivers of industrial change (COM(2012)537 ‘Promoting cultural and creative sectors for growth and jobs in the EU’).

Creative SMEs in particular can make use of design as a strategic tool to create innovative products and services addressing new consumers' standards and societal challenges while assuring competitive and sustainable development.

However, the future European exploitation of this rich sector depend on the EU ability to

support fast-paced creative SMEs and start-ups in exploiting highly innovative technological advances in materials for commercial and societal applications.

To promote design-driven innovation, a number of action lines have been endorsed by the Commission, including integrating design into research and development and promoting new collaborative innovation strategies ('Implementing an Action Plan for Design-Driven Innovation', SWD(2013)380).

SCOPE:

Proposals should address the development of innovative advanced material solutions (e.g. superhydrophobic nanomaterials and nanoscale systems, self-cleaning and self-healing systems, smart textile fabrics and papers, biomimetic, shape change materials, self-assembling systems, energy harvesters) for use in the creative industry sectors defined above to address key consumer and societal challenges. Creativity, cultural and societal values, alongside specialist knowledge, should be driving the material innovation to add value to products through the use of new material functionalities (also "intangible", e.g. creative design, trend translation, enhanced sensations, values) or conceive radically new products with strong competitive advantages based on material innovations.

Proof of concept in terms of product and/or process must be delivered within the project, excluding commercially usable prototypes (in compliance with European Commission Communication 2006/C323/01), but convincingly demonstrating scalability towards industrial needs.

In order to ensure the industrial relevance and impact of the research efforts, the properties improvement and commercial potential of the innovative technologies compared to state-of-the-art solutions currently available on the market should be convincingly assessed in the proposal. The active participation of designers, societal stakeholders, materials suppliers, manufacturers and end users of the resulting products represents an added value and this will be reflected in the second stage of the evaluation.

Possible horizontal aspects addressed by topic:

A significant participation of SMEs with R&D capacities is encouraged.

For this topic, proposals should include an outline of the initial exploitation and business plans, which will be developed further in the proposed project.

Activities expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR x and y million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Novel, higher added-value, better performing, sustainable, appealing designs and creative solutions for societal and/or commercial applications based on innovative advanced materials.
- Promoting new collaborative innovation strategies and practices along the value chain to better support commercial and societal applications benefiting from a strong user orientation.
- Enhancing innovation capability and competitiveness of European SMEs by effectively combining and transferring new and existing knowledge with 'intangible' factors (e.g. creative design, trend translation, enhanced sensations, values).
- New business opportunities for the European industry.
- Contribute to achieving the relevant EU policy objectives in COM(2012)537, 'Promoting cultural and creative sectors for growth and jobs in the EU'.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 06-2017: Improved material durability in buildings and infrastructures, including offshore

SPECIFIC CHALLENGE:

Durability is a key criterion for materials in many applications and environments. Longer performing materials can strongly reduce overall life time costs, such as lower usage costs through reduced maintenance and shorter service interruptions. Costs may also be reduced in the production phase (raw materials, energy, transport, formability) and the materials may be more appropriate for end of life reuse/recycling. Typical applications requiring excellent long term durability and high reliability are buildings, marine applications and infrastructures including off shore.

In many applications, operational durability needs to be better understood, particularly for innovative products which have no demonstrated long term performance. Durability has to be evaluated both theoretically and in real installation conditions (including within challenging environments when relevant) as these may influence final product performance.

SCOPE:

Research proposals should address all of the following aspects: theoretical understanding of the factors which affect durability of materials including reliable, fast and robust environment

and ageing models; experimental methods to measure and reliably test durability, non-destructive inspection procedures and monitoring tools; development of new and more durable materials (possibly multifunctional); and “fit for purpose” validation of new materials through life testing by demonstrating in the planned application and environment.

The proposed solutions should go well beyond the state of the art and it should be demonstrated that materials with improved durability also fulfil all other properties necessary for the application proposed.

The following factors should also be all considered: principles of sustainability (the sustainability of each developed solution should be evaluated via life cycle assessment studies carried out according to the International Reference Life Cycle Data System - ILCDC Handbook); ease of installation; realistic solutions at a reasonable price and appropriateness for the operational environment. When relevant, design considerations (optimal combination of new materials) should also be considered. Recycling/reuse of materials should also be addressed. Standardisation aspects should be considered when relevant. Proof of concept in terms of one (or more) component(s) containing the new materials developed should be delivered within the project, excluding commercially usable prototypes (2006/C323/01), but convincingly demonstrating scalability towards industrial needs. Information guides for applications, installation and any appropriate training on the new solutions should be provided before the end of the project.

To ensure the industrial relevance and impact of the research effort, the active participation of industrial partners, including SMEs will provide significant added value to the activities, and will be reflected within the evaluation of the criteria 'Implementation and Impact'.

Possible horizontal aspects addressed by topic:

Any?

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR x and y million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Compared to the applications and impacts of presently available materials with similar functionalities, the newly developed materials should bring:

- At least 30% improvement in durability on the most relevant properties for the application
- At least equivalent level for all other properties;
- At least 30% lower cost;

- Positive LCA balance over the whole life cycle;
- Proposals will have a higher impact if they are relevant to several applications;
- Contribution to strengthening competitiveness of the European industry, including in the field of “green” technologies;
- Contribution to implementing EU policies.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 07-2017: Systems of materials characterisation for model, product and process optimisation

SPECIFIC CHALLENGE:

As material systems and device structures become nanosized and nanostructured, significant challenges exist with respect to their design and the tailoring of their functions in a controlled way. The use of discrete materials models, as a bridge for linking and coupling nanostructure features to macroscopic device functionality is gaining increasing importance in the fast and reliable development of new materials, devices, and the control of the related production processes. Characterisation techniques and experimental data for process optimisation and model validation are key in such developments.

Europe has a large number of first-class laboratories for characterisation in the field of advanced materials and nanotechnologies. In some cases, regional hubs of laboratories addressing characterisation for specific industrial or application sectors have already been successfully established. Nevertheless, there is an ever increasing need for a strong transnational and trans-sectorial coordination and optimisation of existing characterisation technologies and their utilisation for the benefit of widespread process optimisation and model validation. This includes the need for widely agreed experiment protocols, multi-technique and multi-scale characterisation approaches, metadata descriptions of interpretation tools and accessible, relevant and reliable data bases for raw and interpreted data.

SCOPE:

In the triangle of "manufacturing", "modelling", and "experimentation" the projects should develop an open innovation environment for the optimisation of materials and/or nano-device manufacturing processes and for the validation of materials models¹ based on experimental characterisation.

¹ http://ec.europa.eu/research/industrial_technologies/modelling-materials_en.html

An open innovation environment should be created linking characterisation laboratories with capacities adapted to process optimisation and model validation needs. Also information on characterisation tools and expertise should be included.

Commonly agreed validation and measurement protocols should be developed which address the most relevant issues related to experiments, process optimisation and model validation. Projects should also document their protocols for the interpretation of raw experimental data and document reliable models for data interpretation where needed. The project may seek to agree standards for interpretation protocols. Meta data to describe all protocols should be agreed.

The same metadata should be used for interfacing existing characterisation databases to make search and linking between different, distributed databases effective and easy. The metadata should allow future extension to other sectors. Strategies and test rules pertaining to data integrity and quality mechanisms should be established. A concept to make raw and interpreted data citable should be developed and implemented for this system. The project should ensure wide spread participation.

Projects should bring together a representative number of players from public and industrial nanoscale characterisation laboratories, from manufacturers, and from the academic and industrial materials modelling communities. To ensure a wide coverage, these players should cover several industrial or application sectors. Existing regional/national hubs may also participate, but they need to connect in the project to players in other countries, possibly also other regional/national hubs.

The proposal should present a credible business plan for the maintenance of the open environment after the project duration.

The project is strongly encouraged to consult the stakeholders outside the consortium through existing groups such as the European Materials Modelling Council or the Characterisation cluster. Appropriate resources should be foreseen for clustering activities.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- International cooperation with ISO?
- This topic is part of the open data pilot.

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project. The outline should also address the socio-economic benefit of the proposed solutions, supported by quantifications. Furthermore, the outline should also include the maintenance aspect of the developed databases beyond the lifetime of the project.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 4 million would allow this specific challenge to be addressed appropriately.

Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded.**

EXPECTED IMPACT:

- Increased speed of material and/or nano-device development through development of an open innovation environment
- Wide acceptance of the proposed solutions beyond the consortium.
- Use of the protocols and systems in other KET relevant areas or sectors beyond the ones covered by the project.
- Use of the protocols in the development of new standards.
- Clear, prospects for quantified, socio-economic gains from the results

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 08-2016/17 Accelerating the uptake of nanotechnologies, advanced materials or advanced manufacturing and processing technologies by SMEs

SPECIFIC CHALLENGE:

Research results should be taken up by industry, harvesting the hitherto untapped potential of nanotechnologies, advanced materials and advanced manufacturing and processing technologies. The goal is to create added value by creatively combining existing research results with other necessary elements,²² to transfer results across sectors where applicable, to accelerate innovation and eventually create profit or other benefits. The research should bring the technology and production to industrial readiness and maturity for commercialisation after the project.

SCOPE:

The SME instrument consists of three separate phases and a coaching and mentoring service for beneficiaries. Participants can apply to phase 1 with a view to applying to phase 2 at a later date, or directly to phase 2.

In phase 1, a feasibility study shall be developed verifying the technological/practical as well as economic viability of an innovation idea/concept with considerable novelty to the industry sector in which it is presented (new products, processes, design, services and technologies or new market applications of existing technologies). The activities could, for example, comprise risk assessment, market study, user involvement, Intellectual Property (IP) management, innovation strategy development, partner search, feasibility of concept and the like to establish a solid high-potential innovation project aligned to the enterprise strategy and with a

European dimension. Bottlenecks in the ability to increase profitability of the enterprise through innovation shall be detected and analysed during phase 1 and addressed during phase 2 to increase the return in investment in innovation activities. The proposal should contain an initial business plan based on the proposed idea/concept.

The proposal should give the specifications of the elaborated business plan, which is to be the outcome of the project and the criteria for success.

Funding will be provided in the form of a lump sum of EUR 50 000. Projects should last around 6 months.

In phase 2, innovation projects will be supported that address the specific challenge and that demonstrate high potential in terms of company competitiveness and growth underpinned by a strategic business plan. Activities should focus on innovation activities such as demonstration, testing, prototyping, piloting, scaling-up, miniaturisation, design, market replication and the like aiming to bring an innovation idea (product, process, service etc) to industrial readiness and maturity for market introduction, but may also include some research. For technological innovation a Technology Readiness Levels of 6 or above (or similar for non-technological innovations) are envisaged; please see part G of the General Annexes.

Proposals shall be based on an elaborated business plan either developed through phase 1 or another means. Particular attention must be paid to IP protection and ownership; applicants will have to present convincing measures to ensure the possibility of commercial exploitation ('freedom to operate').

Proposals shall contain a specification for the outcome of the project, including a first commercialisation plan, and criteria for success.

The Commission considers that proposals requesting a contribution from the EU between EUR 0.5 and 2.5 million would allow phase 2 to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Projects should last between 12 and 24 months.

In addition, in phase 3, SMEs can benefit from indirect support measures and services as well as access to the financial facilities supported under Access to Risk Finance of this work programme.

Successful beneficiaries will be offered coaching and mentoring support during phase 1 and phase 2. This service will be accessible via the Enterprise Europe Network and delivered by a dedicated coach through consultation and signposting to the beneficiaries. The coaches will be recruited from a central database managed by the Commission and have all fulfilled stringent criteria with regards to business experience and competencies. Throughout the three phases of the instrument, the Network will complement the coaching support by providing access to its innovation and internationalisation service offering. This could include, for example, depending on the need of the SME, support in identifying growth potential, developing a growth plan and maximising it through internationalisation; strengthening the leadership and management skills of individuals in the senior management team and developing in-house coaching capacity; developing a marketing strategy or raising external finance.

EXPECTED IMPACT:

- Enhancing profitability and growth performance of SMEs by combining and transferring new and existing knowledge into innovative, disruptive and competitive solutions seizing European and global business opportunities.
- Market uptake and distribution of innovations tackling the commercial uptake of nanotechnologies, advanced materials and advanced production technologies in a sustainable way.
- Increase of private investment in innovation, notably leverage of private co-investor and/or follow-up investments.
- The expected impact should be clearly described in qualitative and quantitative terms (e.g. on turnover, employment, market seize, IP management, sales, return on investment and profit).

TYPE OF ACTION: SME Instrument (70% funding)

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Green vehicle topic

NMBP 09-2016: Affordable weight reduction of high-volume vehicles and components taking into account the entire life-cycle

SPECIFIC CHALLENGE:

One of the principal levers to improve the energy efficiency, performance and range of vehicles, and reduce their impact on the environment, is to decrease their weight. This is particularly important for conventionally-powered vehicles to reduce CO₂ emissions but also for EVs in which the relatively limited range and high costs, linked to the still comparatively low production volumes, remain critical factors that determine their competitiveness.

Previously-conducted EU research projects have already demonstrated the fact that the adoption of advanced grades of steel, metal alloys, novel plastics and composites can lead to a drastic reduction in the weight of a wide range of vehicle components. However the outcome of these activities is also that the additional cost for each kilogram saved is still too high to represent a revolutionary approach enabling intensive use of such lightweight materials particularly in vehicles intended for mass-production.

Correspondingly it is necessary to address this issue directly and urgently in order to identify solutions for the significant weight reduction of vehicles, and in particular electrified cars, which are cost-effective and viable with respect to the intended production volumes and from the entire life-cycle perspective, improving performance without compromising

crashworthiness and durability. Specifically the principal focus should be on large production volumes exploiting economies of scale, targeting production volumes of at least 50000 units per annum, while investigating also the opportunity for developing common solutions across different types of vehicle.

SCOPE:

A holistic, integrated and cost-driven approach should be pursued in order to optimize the use of lightweight materials solutions in all vehicle structures, subsystems and components with the exception of the powertrain.

Materials engineering should address the development of new low density/high strength and highly formable materials (e.g. steels, alloys, polymers, reinforcements) and their combination (e.g. composites, sandwiches, high strength foams) at affordable prices starting from less expensive sources, also via recycling and/or processes which are less energy-demanding. Furthermore, materials engineering should address corrosion, thermal expansion, joining (e.g. bonding, riveting, etc.) and recycling issues of multi-material designs, one essential prerequisite being the widespread availability and minimal CO2 footprint of the candidate materials.

Manufacturing engineering should address the speeding-up and efficiency-improvement of lightweight part production also through the combination of different manufacture steps, moving towards new approaches specific for new materials, including cost-effective multi-material joining technologies as well as the formability of tailored blanks material hybrid parts.

Design should pursue approaches based on both “right material for the right application” and “multi-functional optimization” in order to exploit the lightweight materials properties, optimizing their use through functional integration of multi-material solutions, including design for recycling.

Virtual engineering should support the multi-functional design for the optimization of performance (including crashworthiness, durability, etc), developing and applying methods and tools to enable the efficient and effective simulation of multi-functional, multi-material solutions as well as of sustainable manufacturing technologies in order to minimize material use and energy consumption.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- Gender relevance

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Identifying viable solutions which are sustainable from the life-cycle perspective:

- Reduced energy consumption of vehicle due to weight reduction: -10%
- Cost-effective weight savings depending on intended production volumes, eg.:
 - For 50,000 units per annum: < 6 €/kg-saved
 - For 100,000+ units per annum: < 3 €/kg-saved
 - Improved LCA environmental impact (from cradle to grave): > +10% in terms of GWP (Global Warming Potential)

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Key enabling technologies for societal challenges - Advanced materials and nanotechnologies for healthcare

NMBP 10-2016: Biomaterials for treatment and prevention of multiple sclerosis

SPECIFIC CHALLENGE:

The aim of this topic is to develop innovative approaches for biomaterials for health that are easily transferable from industry to the clinic and based on new methodologies directed to the improvement of the treatment and prognosis of multiple sclerosis, where regrowth and regeneration of affected areas of the nervous system is the key to successful therapy. Multiple Sclerosis is often of chronic duration and associated with increasing levels of disability. In the European Union, at least 700 000 people are affected with Multiple Sclerosis (MS) and between 1 000 000 and 2 500 000 people world-wide. It is diagnosed between the ages of 20 and 40 when families and careers are developing and is the most common cause of disability affecting young adults, thereby having a strong economic impact for society in terms of healthcare costs.

SCOPE:

Proposals should focus on the development of new multifunctional biomaterials, as part of eventual Medical Devices¹ or Advanced Therapies², so that they can function as effective eventual therapeutic interventions in multiple sclerosis. They can include biocompatible and biodegradable biomaterials as part of minimally invasive treatments and theragnostic materials. Funding for the development of new drug candidates for these conditions or for any form of clinical trial will not be considered.

The development of new integrated experimental and computational approaches aimed to describe interface processes and their determinants should be considered as key step for the design of safe and performing biomaterials. Experimental protocols should be planned taking due account of current good laboratory practice (GLP) and ISO guidelines. Manufacturing processes will need to be addressed, including up scaling, good manufacturing practice (GMP), process analytical technology (PAT), technology transfer and regulatory work in respect of relevant regulations as appropriate^{1,2}. At least one type of tissue engineering construct should be delivered at the end of the research project together with a proof of concept of its therapeutic potential and preclinical validation.

In order to ensure relevance and impacts of the research efforts, the active participation of industrial partners and clinicians represents an added value to the proposals and this will be reflected in the evaluation under the criterion “Impact”. A multidisciplinary approach is preferred, taking into account both surgical, minimally invasive and pharmacological approaches, as well as prevention and rehabilitation strategies. The expected results should improve the quality of life of the affected population and their careers. They should be measurable even for optimising research costs of the enterprises and for reducing time-to-market of new products. The project should include training and dissemination activities.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a **contribution from the EU between EUR x and y million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

¹ As defined by Council Directive of 20 June 1990 on the approximation of the laws of the Member States relating to Active Implantable Medical Devices (90/385/EEC) (OJ L 189, 20.7.1990, p. 17) (as amended), Council Directive 93/42/EEC of 14 June 1993 concerning Medical Devices (OJ L 169, 12.7.1993, p. 1) (as amended) and Directive 98/79/EC of the European Parliament and of the Council of 27 October 1998 on In Vitro Diagnostic Medical Devices (OJ L 331, 7.12.1998, p. 1) (as amended) and with the relevant Implementing Measures and all succeeding measures.

² As defined by Regulation (EC) No 1394/2007 on advanced therapy medicinal products (gene therapy, stem cell therapy and tissue engineering)

EXPECTED IMPACT:

- Innovative bio/nano-materials for the treatment of multiple sclerosis;
- improved quality of life of MS patients due to minimally invasive action and/or longer duration of implants and devices;
- enhance competitiveness of the biomaterials and biomedical industries in the EU;
- Impact assessment should take into account technology transfer effects on biotechnology companies, with particular regard to SMEs and – namely – to new forms of cooperation between academia, research centres and the private sectors. Such effects should be balanced to match sustainability principles and values - supporting the EU 2020 Strategy³ - and to enforce competitiveness in terms of reducing time-to-market and trial costs for European industries. Dissemination results should contribute to increase social awareness about more efficient and less costly therapies – based upon innovative approaches and broader accessibility – with improved patient compliance.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 11-2016 Nanoformulation of biologicals

Proposed to be replaced with the NMBP/ICT coordinated call topic in 2017

SPECIFIC CHALLENGE:

Many biomolecules (e.g. proteins, peptides, nucleic acid), in opposition to classical small molecules, have demonstrated interesting activities in vitro. However, they are too often not drugable because once in pre-clinical in vivo development, they show disappointing loss of efficacy and/or unacceptable toxicity. For example, a high in vitro efficacy of a biomolecule can disappointingly become low in vivo, because said biomolecule is processed by the immune system or enzymes of the host before reaching its targeted tissue. Nanotechnology represents a promising opportunity to overcome these drawbacks. Indeed, the formulation of nanocarriers containing biomolecules can greatly improve their in vivo efficacy and/or decrease their toxicity.

SCOPE:

This call addresses nanoformulation of biologicals (like proteins, peptides and nucleic acids – in opposition to classical small molecules). Projects related to siRNA or peptide nanodelivery should be preferred but those connected with macromolecules (protein, gene) should be evaluated as well.

Formulation of nanomedicines has in general been empirical and often produced and amorphous or undefined structure which produces regulatory and manufacturing issues. The

aim here is the control of the assembly by using self-assembling systems, or the structure is forced by the manufacturing system or by controlled nano assembly processes. The resulting structures should have a degree of control over their shape and size incorporating non-Lipinski molecules such as nucleic acids, proteins or peptides. The benefit apart from easier manufacturing process control additionally would be transport through biological barriers.

Partners will develop a nanoformulation of biomolecules to provide a solid pre-clinical proof of concept. Partners will also have to describe how the various barriers for advancing their new therapy to clinical application will be overcome; they will especially take into account the medical regulatory requirements and the scale-up production for clinical study.

The clinical focus should be notably on age related diseases or inflammatory diseases, but excluding cancer and infectious diseases.

Possible horizontal aspects addressed by topic:

-?

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Developments of new solutions for the particularly needed delivery of siRNA and peptide.
- Foster the translation of nanoformulation of biomolecules towards clinical development / application.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 12-2017: Reference methods for managing the risk of engineered Biomaterials

SPECIFIC CHALLENGE:

The development of new biotechnology-based products needs to be complemented with a scientifically valid identification of the potential hazards from these biomaterials to human

health and to the environment, together with the monitoring and reduction of the risk that these new technologies pose. Current knowledge is still incomplete and the established methods may be inappropriate for specific materials. Hence, future production system engineering requires validated methodologies as basis for an appropriate integrated risk management.

SCOPE:

The development of new biotechnology-based products needs to be complemented with a scientifically valid identification of the potential hazards from these biomaterials to human health and to the environment, together with the monitoring and reduction of the risk that these new technologies pose. Current knowledge is still incomplete and the established methods may be inappropriate for specific materials. Hence, future production system engineering requires validated methodologies as basis for an appropriate integrated risk management. The expected projects should be related to validating, adapting and/or developing a reliable methodology for risk assessment and thorough overarching hazard identification for engineered biomaterials and should address the following areas:

- Comparison and validation of current (and/or development including validation of new) test methods and test schemes, including in vitro and in silico methods, to detect adverse effects from biomaterials to
 - human health including acute and chronic toxicity (oral, inhalation, dermal);
 - the environment; eco-toxicity tests, bioaccumulation, persistence, bioavailability and life cycle impacts onto all forms of biota.
- Relevant reference and/or certified reference materials
- Management of accidental risk including explosion and massive release
- Methods for performance assessment of hazard and exposure monitoring systems and on the field detection systems
- Methods for evaluation of risk reduction strategies and systems

Projects are expected to initiate and support standardisation of the proposed biomaterials and methods, including methods that will reflect their eventual deployment as part of Advanced Therapy Medicinal Products or Medical Devices.

In order to ensure industrial relevance and impact of the research effort, the active participation of industrial partners as well as third countries represents an added value to the activities and this will be reflected in the evaluation.

Possible horizontal aspects addressed by topic:

- In order to ensure industrial relevance and impact of the research effort, the active participation of industrial partners as well as third countries represents an added value to the activities and this will be reflected in the evaluation.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR x and y million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Development of comprehensive understanding of the properties, interaction and fate of engineered biomaterials in relation to human health and environment;
- Support to policy and decision making concerning biomaterials research in respect to various stakeholders: public authorities, industry, researchers and citizens;
- Support to good governance in biomaterials research;
- Contribution to the future definition of appropriate measures, where needed;
- Support to pre and co-normative activities, such as with reference to the implementation of the REACH regulation³;
- Support to the safe, integrated and responsible approach as laid down in "Nanosciences and Nanotechnologies: An action plan for Europe".

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 13-2017: Cross-KET for Health

This is the first draft description for a coordinated call with DG CNECT. The text will be developed further in conjunction with DG CNECT.

SPECIFIC CHALLENGE:

Research and development at the interface of micro-nano–bio integrated systems and advanced materials science has the potential to provide novel technological platforms to enhance the ability to sense, detect, analyse, monitor and act on phenomena from macro (e.g. body, tissues) to nano scale (e.g. molecules, genes) thereby facilitating personalised and preventive health taking into account relevant health policies..

SCOPE:

The work should address novel platforms, techniques or systems validated at the lab, integrating advanced multiple KET's for diagnosis, treatment, monitoring and drug delivery e.g. nano-devices and micro-nano robots for drug delivery; nano-diagnostic devices for neurodegenerative diseases; organ on chip; nano-based system for assessing and monitoring therapy and rehabilitation effectiveness in chronic and degenerative diseases. Proposals should enter at TRL 4 and demonstrate clear case for manufacturability and transfer into pre-clinical and clinical validation including pilot manufacturing where appropriate..

Possible horizontal aspects addressed by topic:

- ?

Activities are expected to focus on Technology Readiness Levels 4 to 6 (?)

The Commission considers that proposals requesting a contribution from the EU between EUR x and y million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Advanced integrated KET based health platforms, techniques or systems ready for manufacturing and clinical validation.
- World-class competitive industrial R&D in micro-nano-bio integration with the use of nano-materials.
- Affordable systems with unique features (in terms of e.g. precision, efficiency and capability) that address specific well identified requirements in healthcare and well-being

TYPE OF ACTION: Innovation Actions

This cross-KET topic will be co-funded by DG CONNECT (4-6 M€) and DG RTD (4-6 M€) within the framework of a Cross-KET initiative for Health.

The conditions related to this topic are provided at the end of this call and in the General Annexes.

New topic ! (budget availability is created by the fact that the NMCP/ICT call has a smaller budget than the Nanoformulation of biologicals topic, which is proposed to be dropped)

SPECIFIC CHALLENGE:

The application of nanotechnology and nanobiomaterials has great potential to advance medicine for the benefit of citizens. However, for medical regulation the use of these new technologies poses considerable challenges for assessing the quality, safety and efficacy of the novel nanomedicines and medical devices and to avoid delays in approval for Market Authorisation.

SCOPE:

The project is to advance the field of medical regulatory science and practice through the development and validation of science based regulatory knowledge and standardisation of technical tools and methods. Priority will be given to development of new regulatory standards and tools that are based on scientific principles that already have a Proof-of-Concept at the laboratory scale.

The intention is to lead to a new and better methodology for pre-clinical and clinical evaluation and help to take appropriate stock of and to apply innovative scientific advances as and when they occur.

International cooperation and participation of Member States funding programmes with complementary funding is encouraged to facilitate adoption of newly developed regulatory science on the global scale.

Possible horizontal aspects addressed by topic:

- INCO encouraged

Activities are expected to focus on Technology Readiness Levels 3-7

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one project will be funded.**

EXPECTED IMPACT:

- To reduce the cost of pre-clinical and clinical regulatory assessment for new medical products and therapies that are based on the application of nanotechnology and nanobiomaterials
- To reduce the overall time to Marketing Approval for the new products

- To improve standardisation of regulatory practice at the European and international level
- To provide legislators with a set of tools for more informed risk assessment and decision making instruments for the short to medium term, by gathering data from a basic level and performing
- To establish a close collaboration among regulators, industry, science and patients with regard to the knowledge required for appropriate risk management, and create the basis for common approaches, mutually acceptable datasets and risk management practices.
- To establish a European Consortium for Regulatory Science in Biomaterials and Nanomedicines involving industrial, academic, regulatory and patient representative stakeholders,
- To identify within the consortium critical issues for innovative products (update needed within existing legislation and/or need for new legislation) and establishment of an action plan for future updates,
- To establish links with existing European Infrastructures active in the field, along with relevant European Research Networks
- To elaborate an action plan for a better integration of the European Union with other areas of the world (USA, China, Japan, etc.)

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 15-2017 Upscaling of the production of nanopharmaceuticals

SPECIFIC CHALLENGE:

In nanomedicine the scale-up of nanopharmaceuticals production from pre-clinical laboratory scale to the quantity and GMP quality needed for clinical testing is severely hindered by a lack of pilot manufacturing capacity and supply infrastructure. The quantities required for clinical testing studies are modest (e.g. in the order of ten to hundred grams), but such pilot processes do not fit easily into existing manufacturing plants. The lack of a pilot manufacturing supply chain is especially problematic for SMEs and other organisations that do not have the necessary resources to develop the processes in-house.

SCOPE:

Projects shall develop one or more pilot lines and processes for the scaling-up of the production of innovative nanopharmaceuticals to the quantities needed for clinical testing, taking into account the medical regulatory requirements. The pilot lines shall be developed

with the appropriate characterisation and quality control processes. Relevant medical regulatory requirements must be taken into account. Projects shall address industrial sustainability from an economic, environmental and social point of view. The nanopharmaceuticals selected for scaling-up shall be translatable and in an advanced stage of pre-clinical development, with positive perspectives to proceed to clinical testing. Clinical testing itself is not part of the project. Scaling-up of nanopharmaceuticals production intended primarily for the therapy of XXXXX (reference to what was selected in the 2014 call) is excluded from the scope of this topic.

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities.

For this topic, proposals should include an outline of the initial exploitation and business plans, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Improve GMP nanopharmaceuticals supply for enabling clinical trials, further validating and demonstrating the effectiveness of nanopharmaceuticals for medical therapies;
- Leveraging of existing investments in successful pre-clinical nanomedicine research;
- Increase of the attractiveness of Europe as a location-of-choice to carry out advanced medical research and product development, due to improved nanopharmaceuticals supply capacity.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NOTE: This topic may move to 2016 as the coordinated call with CNECT is planned for 2017 and the Nanoformulation of biologicals topic, which is proposed to be dropped, was planned for 2016.

SPECIFIC CHALLENGE:

Detection and monitoring of stem cell transplants in vivo is of utmost importance for development of clinical cell therapy. Suitable nanotechnology-based imaging approaches with high sensitivity should allow for monitoring of cell viability, engraftment and distribution. Appropriate imaging techniques have been developed for application in small animals, but are not available yet for use in preclinical large animal models and patients. In particular, such technologies will represent an important safety measure enabling early detection of stem cell based therapy.

SCOPE:

Proposals should focus on the following:

- Development of highly sensitive imaging approaches enabling discrimination of living cell transplants
- Monitoring should be highly sensitive, in best case allowing for detection of single cells
- Possibility of non-invasive whole body monitoring in large animals
- Development of clinically applicable imaging approaches

Possible horizontal aspects addressed by topic:

- Any?

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between **EUR x and y million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Development of novel highly sensitive nanotechnology-base imaging approaches allowing for monitoring of survival, engraftment, proliferation, function and whole body distribution of cellular transplants in preclinical large animal models and patients.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 17-2017: Mobilising the European nano-biomedical ecosystem

Note: This CSA may need to be brought forward to 2016 and the content and duration tailored to support the objectives of the emerging IDI

SPECIFIC CHALLENGE:

Developing innovative Nanomedical products for a more personalized, predictive and efficient medicine requires further integration of nanotechnologies aiming at applications in human health notably with further Key Enabling Technologies. It also needs a functioning ecosystem of actors, in which the research, translation, regulation, standardization and take-up of innovative nanomedicines by the different European Healthcare Systems is stimulated. End-of-life/disposal and recyclability issues should also be addressed as appropriate.

SCOPE:

Supporting the development of an ecosystem for Nanomedicine in Europe, including activities such as coordinating national platforms and regional clusters; developing common training material and services; international cooperation related to community building, road-mapping, regulation, manufacturing, reimbursement and pricing, standardization and recyclability; and reaching out to attract the interest of citizens, young talents and young entrepreneurs. Collaborations with relevant Technology Platform or similar initiatives in Europe or worldwide will allow deeper and more effective cross-KETs activities for innovative integrated solution and well as a consolidated international strategy for the sector.

Possible horizontal aspects addressed by topic:

- Any?

The Commission considers that proposals requesting a contribution from the EU between EUR x and y million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Increased take-up of innovative Nanomedicines by end-users incl. regulatory and public authorities, healthcare insurances doctors and patients
- Improvement of cross-KETs activities to provide better integrated healthcare solutions

- Increased international networking with new potential market opportunities

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 18-2017: ERA-NET on Nanomedicine

SPECIFIC CHALLENGE:

Strengthening Europe's position in nanomedicine research requires concentrated action on common European research priorities in view of implementing joint initiatives. The Nanomedicine Strategic Research and Innovation Agenda gives a strategic and perspective frame for increasing uptake of nanomedical research and innovation through joint undertakings notably with large pharma or diagnostics companies, thereby contributing to the emergence of a nanomedicine industrial sector.

SCOPE:

The proposed ERA-NET aims at coordinating the research efforts of the participating Member States, Associated States and Regions in the field of nanomedicine, continuing the activities started by EuroNanoMed and fostering the competitiveness of European nanomedicine actors, and to implement a joint transnational call for proposals (resulting in grants to third parties) with EU co-funding to fund multinational innovative research initiatives in this domain.

The action will link with existing PPP or Joint programming initiatives such as IMI to leverage public funding and increase joint projects with Industries and to create a positive environment for the uptake of innovation nanomedicine.

The Commission considers that proposals requesting a contribution from the EU between **EUR x and y million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Synergies and coherence in key fields of nanomedicine research at national and regional level
- Implementation of relevant parts of the Nanomedicine Strategic Research and Innovation Agenda

- Favourable conditions for an increased uptake of nanomedical technologies into industrial medical products

TYPE OF ACTION: ERANET Cofund

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Key enabling technologies for societal challenges - Advanced materials and nanotechnologies for energy applications

NMBP 19-2016: Advanced materials solutions and architectures for high efficiency solar energy harvesting

SPECIFIC CHALLENGE:

High efficiency solar energy harvesting (very high-efficiency photo-voltaics (PV) or concentrated solar power (CSP)) is an important building block in installing a secure, competitive and sustainable energy system. Increased efforts have to be made to make these technologies cost competitive under suitable electricity market conditions. Novel functional materials and material combinations throughout the solar system manufacturing chain enhance the efficiency of solar energy harvesting beyond that of the current state-of-the-art technologies. These new materials and processes allow the European materials supply sector to expand its industrial leadership towards the next generation of solar energy harvesting which is expected to reach the markets beyond 2020.

SCOPE:

Proposals should develop materials solutions for novel very high efficiency solar (PV or CSP) technologies, to enhance system conversion efficiencies, while preserving lifetime and ensuring materials resource efficiency. Research efforts must focus on delivering advanced materials (including but not limited to particles, thin films, nanostructure, heat transfer fluids, phase change materials and receptors), and/or their combinations into innovative device architectures (such as tandem structures or multi-junctions amongst others). The proposed solutions need to demonstrate their added value in terms performance or unique application options and their viability in terms of manufacturability, yield and stability. Finally, the high efficiency concepts should be assessed for technical and economic viability and developed towards readiness for pilot manufacturing.

Possible horizontal aspects addressed by topic:

This topic calls for proposals with focus on advanced materials solutions and architectures. A complementary topic “Support to emerging PV technologies” is published in the “Secure, clean and efficient energy” work programme 2016 – 2017 (LCEXX - 201X: Support to emerging PV technologies) calling for proposals on solutions with a technology-approach.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <http://setis.ec.europa.eu/set-plan-implementation/towards-integrated-roadmap-and-action-plan>
- A deeper understanding of the material and interface characteristics and their long-term behaviour;
- The demonstration of device designs and fabrication processes for high efficiency technologies of at least 25% efficiency at cell level and above 21 % efficiency at module level;
- The demonstration of pilot manufacturing readiness of emerging and/or novel high efficiency technologies with a potential levelized cost of electricity of 0.07 – 0.12 €/kWh (PV) and 0.10 – 0.15 €/kWh (CSP) in 2020 for an irradiation range of 2000 – 1450 kWh/(m²a). (figures to be checked)

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 20-2016: Advanced materials enabling the integration of storage technologies in the electricity grid

SPECIFIC CHALLENGE:

Reliable access to cost-effective electricity is the backbone of the EU economy, and electrical energy storage is an integral element in this system. Without significant investments in stationary electrical energy storage, the current electric grid infrastructure will increasingly

struggle to provide reliable, affordable electricity, jeopardizing the transformational changes envisioned for a modernized grid. Investment in integrating energy storage refurbishing the grid is essential for keeping pace with the increasing demands for electricity arising from continued growth in productivity and the projected increase in distributed energy sources. The technical aspects that will be posed by an improved grid include inventing new technologies requiring new advanced materials. Some materials will improve present technology, while some will enable emerging technology and some will anticipate emerging new storage technologies.

SCOPE:

By the development of advanced functional particles, filaments, layers, coatings and new functionalities, proposals should contribute to the integration of storage devices in the electrical grid. Targeted applications could include but are not limited to high capacity cables and superconductors, high voltage cables and accessories to 1000 kV, materials for medium voltage and smart electrical accessories, new materials for extreme conditions and surface treatment of existing materials to protect and improve performances within the context of the electricity grid.

Activities addressing the development of materials specifically for energy storage technologies and for power electronics are outside the scope of this call. A dedicated topic on materials research for power electronics is included in this Work Programme under topic NMBP XX – 2016 "Advanced Materials for Power Electronics based on wide bandgap semiconductor devices technology".

Possible horizontal aspects addressed by topic:

This topic calls for proposals with focus on advanced materials solutions for electricity grid related technologies. A complementary topic “Next generation innovative technologies enabling smart grids, storage and energy system integration with increasing share of renewables: distribution network” is published in the “Secure, clean and efficient energy” work programme 2016 – 2017 (LCEXX - 201X: Next generation innovative technologies enabling smart grids, storage and energy system integration with increasing share of renewables: distribution network) calling for proposals on the development of innovative solutions starting from the technology part of the value chain.

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <http://setis.ec.europa.eu/set-plan-implementation/towards-integrated-roadmap-and-action-plan>
- Significant enhancement of power supply reliability, managing volatility of the grid considering the connection of renewable energy sources, increased grid efficiency.
- Alleviation of geographical constraints for low carbon energy production with increased efficiencies at a reduced cost;
- Reduction of the barriers to increase the penetration rate of distributed and/or intermittent renewable energy sources;
- Implementation of relevant parts of the SET-Plan Integrated Roadmap, available at <http://setis.ec.europa.eu/set-plan-implementation/towards-integrated-roadmap-and-action-plan>

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 21-2017: Cost-effective materials for “power-to-chemical” technologies

SPECIFIC CHALLENGE:

Energy storage will play a key role in enabling the EU to develop a low-carbon electricity system. Energy storage can supply more flexibility and balancing to the grid, providing a back up to intermittent renewable energy. Chemical energy storage is the transformation of electrical energy into chemical energy carriers. It consequently involves exchange of energy between different vectors of the energy system. Once the energy is transformed to chemicals the concept opens for many ways to use the primary electric energy e.g. for re-electrification, heating and mobility. For such chemical energy storage, hydrogen or chemicals (which include directly or indirectly a process step including hydrogen) are considered.

SCOPE:

Proposals should deliver advanced materials, materials solutions or new chemistries, to up-scale the chemical storage of energy in hydrogen or chemicals to economically viable levels. The proposals should select one or more of the following **topics**:

- The development of high capacity durable proton exchange membranes (PEM) and Solid Oxide Electrolysis Cell electrolyzers for the production of pressurized hydrogen;
- The development of novel low cost advanced materials for solid state storage of hydrogen at low pressure, targeting at the same time improved storage density and cycling durability;
- The development of direct synthesis of hydrocarbons from CO₂-H₂O co-electrolysis based on sustainable, non-toxic and non-critical raw materials;
- The development of low cost photochemical water splitting reactors with optimized flow behaviour, as well as new catalysts presenting longer lifetimes based on advanced materials and new chemistries.

Possible horizontal aspects addressed by topic:

This topic calls for proposals with focus on cost effective materials solutions for “power-to-gas technologies”. A complementary topic “Diversification of sustainable fuel production through new conversion routes and new fuels” is published in the “Secure, clean and efficient energy” work programme 2016 – 2017 (LCEXX - 201X: Diversification of sustainable fuel production through new conversion routes and new fuels) calling for proposals on the development of alternative fuels from CO₂ in industrial waste flue gases through chemical catalytic conversion or from H₂O, CO₂ and sunlight through micro-organisms or chemical synthesis.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <http://setis.ec.europa.eu/set-plan-implementation/towards-integrated-roadmap-and-action-plan>
- Total hydrogen production and delivery cost, including energy, investment & operating cost, significantly below 5€/kg;
- Significant increase of the durability under current and temperature cycling of co-electrolysis technology based on sustainable, non-toxic and non-critical raw materials;

- Alleviation of geographical constraints for low carbon energy production with increased efficiencies at a reduced cost;
- Reduction of the barriers to increase the penetration rate of distributed and/or intermittent renewable energy sources;

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 22-2017: High-performance materials for optimizing CO₂ capture

SPECIFIC CHALLENGE:

Carbon capture and storage (CCS) is a key element in the EU low-carbon policy. Presently, the roll-out has been hampered by costs and techno-economic uncertainties of the CCS, where CO₂ capture is a major part. While there is a need to demonstrate capture technologies in real market conditions, promising new material solutions have been under development for the next generation CCS technologies that are expected to reach the markets beyond 2020. These solutions could dramatically improve the efficiency of CO₂ capture but the manufacturing processes should be further developed towards higher yields while conserving functionality at a lower cost.

SCOPE:

Proposals should capitalise on promising material solutions for the next generation CO₂ capture technologies (such as pre-combustion or post-combustion capture, oxygen combustion or other novel technologies or concepts). Recent work on such materials and capture techniques, based on, inter alia, nanostructured hybrid materials, membranes, solid and liquid-based adsorbents has made progress to the extent that their cost and performance competitiveness with respect to the state-of-the-art technologies (at least at demonstration level) should now be tested. The proposed solutions need to prove their added value in terms of performance or their ability to address unique applications, and their viability in terms of manufacturability, yield and stability. Finally, the high efficiency concepts should be assessed for technical and economic viability and developed to readiness for pilot manufacturing.

Possible horizontal aspects addressed by topic:

This topic calls for proposals with focus on the manufacturability high performance materials for CO₂ capture. A complementary topic “New generation high-efficiency capture processes” is published in the “Secure, clean and efficient energy” work programme 2016 – 2017

(LCEXX - 201X: New generation high-efficiency capture processes) calling for proposals on the development of new generation CO₂ capture processes.

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- The performance levels of the proposed materials solution(s) should be in line with those specified in relevant parts of the SET-Plan Integrated Roadmap and its Annexes, available at <http://setis.ec.europa.eu/set-plan-implementation/towards-integrated-roadmap-and-action-plan>
- Improved security of supply by reducing the need for extra fuel to produce goods and power, increased use of indigenous resources;
- Increased competitiveness by low carbon footprint, preparing for carbon labelling;
- A strengthened European vendor industry in a highly competitive market.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Key enabling technologies for societal challenges - Eco-design and new sustainable business models

NMBP 23- 2016: ERA-NET on manufacturing technologies supporting industry and particularly SMEs in the global competition

SPECIFIC CHALLENGE:

Pooling resources can foster the competitiveness of Europe's advanced manufacturing industry, by the co-funding of manufacturing research projects performed by transnational consortia involving enterprises and their strategic partners. A strategic and industry relevant approach is needed in order to address key manufacturing priorities, covering the entire value chains and gathering national and regional research and innovation capacities, thereby mobilising all relevant European stakeholders and in particular SMEs.

SCOPE:

The proposed ERA-NET aims to coordinate the research and innovation efforts of the participating Member States, Associated States and Regions in the field of advanced manufacturing, continuing the activities started by MANUNET and followed by MANUNET II, supporting in particular SMEs and with a special focus on the key areas of new production processes, adaptive manufacturing systems and technologies for the factory of the future, and to implement a joint transnational call for proposals (resulting in grants to third parties) with EU co-funding to support multi-national innovative research initiatives in this domain.

Coordination with the relevant players at European level such as those in the Factories of the Future cPPP and relevant European Technology Platforms is expected and the strong involvement in the transnational projects of SMEs with innovation potential is encouraged.

International cooperation on R&I issues on manufacturing at global level should be properly addressed and the potential participation in the proposed ERA-NET of regions from third countries with local funding programs on manufacturing is encouraged.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- International cooperation
- Social Sciences and Humanities (SSH) elements
- Gender relevance

The Commission considers that proposals requesting a contribution from the EU between EUR 10 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded.**

Prospective participant organisations should note that the impact of this ERA-NET could be enhanced by using resources coming through the European Structural and Investment Funds (provided that the appropriate policy measures together with the corresponding national contribution for them have been foreseen in the relevant Operational Programme). In such a case, participants should understand that ESI Funds cannot replace partly or wholly the expected national contribution(s) for matching the expected Horizon 2020 grant. However ESI Funds (together with national funds) can be used for enhancing the impact of the ERA-NET mobilising additional national funds for this purpose.

EXPECTED IMPACT:

- Synergies and coherence in key fields of advanced manufacturing research at national and regional level;
- Input to strategy and policy in the domain of advanced manufacturing
- Creation of a sustainable cooperation structures at regional, national and transnational level supporting research and innovation in key priority areas of the manufacturing sector in Europe.

TYPE OF ACTION: ERA-NET Co-fund

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 24-2017 Business models and industrial strategies supporting novel supply chains for innovative product-services

SPECIFIC CHALLENGE:

Purchasing is a traditional method of obtaining machinery or equipment, but it is not always the most suitable way for innovative product-services. Although other methods are becoming increasingly attractive, for example a lease contract for the use of equipment, a rent or custom hire, they are often not ideal solutions for B2B supply chains for innovative product-services. The business owners for pioneering product-services need to upgrade their equipment faster than in other sectors. Additionally, the lack of stability of the markets in the current economic situation in Europe does not create strong incentives to the industrial sector for long term investments in tangible fixed assets. At the same time, a quick response to market demand is crucial to market success.

It is important to develop value systems that take in to account the new extended supply chain from the early stage of the design process till the end-of-life activities management. In addition, nowadays the real production could take place anywhere in the world and leave Europe with free production capacities or not renewed. The overall process does not necessarily take into account economic, social and environmental aspects for Europe.

SCOPE:

The internet, digital technologies and social media have the potential to support new supply chain models that are focused on business-to-business (B2B) as well as business-to-consumer (B2C) relationships, on improving the capacity utilisation in Europe (around 80% now).

The research activities should focus on all of the following areas:

- New business solutions for extended supply chains and the integrated sustainable European framework that would take into account the needs of design, production, utilisation and end-of-life and would overcome the risk of under-utilised capacity.
- Digital technologies that would enable supply chain members to increase connectivity and inter-operability to rapidly coordinate and to react to market demand as a whole system.
- Solutions for local cooperation and supply, thus reducing the environmental footprint.

Business models supporting the novel supply chains for innovative product-services would need to facilitate the flow of information on free utilisation capacity among service providers,

which could be dedicated business set-ups for that kind of product-services, or just existing manufacturers with free production capacity at certain moments in time and business companies seeking short term solutions for their capacity shortages.

Project activities will focus on new concepts and methodologies for knowledge-based, specialized product-service, which can fulfil the requirements of fast changing markets for innovative product-services. The service could be also supplemented by after sale services and extended guarantees provided by any entity from the supply chain base on common agreement.

The new concepts developed would implement the idea that what business wants from suppliers/service providers is not necessarily ownership, but rather the function that the product or the service can provide, if the business organisation for instance does not want to invest money in the product. It is desirable, in this perspective, to create sustainable networks and clusters, by integrating the various actors (from suppliers devoted to the collection, disposal, recycling and reuse of critical materials and components) into a perspective of sustainability and corporate social responsibility.

Possible horizontal aspects addressed by topic:

- Suitable for SMEs
- International cooperation
- economics and business administration
- Social Sciences and Humanities (SSH) elements

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6. Implemented as cross-KET activities.

The implementation of this proposal is intended to start at TRL 4, target TRL 6 (?).

The Commission considers that proposals requesting a contribution from the EU between EUR 3 and 5 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Decrease of the production costs in Europe, through a better use of the total manufacturing capacity;
- Increase in the investment in the manufacturing industry in Europe;
- Reduction in the environmental footprint compared to products produced in the traditional value chains, through less transportation by the use of local, regional product-services capacity;

- Development of novel supply networks for sectoral organisations and of sectoral solutions that could be also applied by other industrial sectors;
- Creation of new embedded services supporting the business-to-business supply chain;
- Possibility for further development of the new supply chains for other business scenarios;
- New Extended Supply Chain business models based on a sustainability-driven small series production;
- Creation of novel models of work organisation and sustainability-driven networks/clusters able to integrate the product-service life-cycle stages in the same industry, as well as across industries.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Knowledge-based nanotechnologies and advanced materials for industrial value chains

NMBP 25-2016 Pilot lines for manufacturing of materials with customized thermal/electrical conductivity properties

SPECIFIC CHALLENGE:

Advanced functional materials with customized thermal/electrical conductivity properties provide new opportunities in manufacturing.

The improved properties of advanced functional material with customized thermal/electrical conductivity properties will benefit end user industries such as automotive, aerospace, consumer durables, electrical and electronics, healthcare, and energy. Applications are wide ranging, including areas like electrical and electronics applications, energy and power, consumer goods, automotive and aerospace and healthcare (e.g. capacitors, skins of aircrafts for lighting protection, thermal layers, insulation panels for energy efficient buildings, etc.) and include new manufacturing processes such as additive and 2D/3D printing processes.

The need for such materials, affordable and industrially robust, calls for the upscaling of these widely researched materials and their manufacturing processes. This should ensure the further integration of the nano-enabled multifunctional materials into practical large-scale applications, and drastically exceed the current limited uses in niche-markets.

SCOPE:

Pilot line development and demonstration in operational environments, using an existing pilot line as a basis;

Eventually including new methods and/or instrumentation with real time characterization for measurement, analysis and control at the nanoscale to characterise relevant materials and process properties;

Increasing the level of robustness and repeatability of such industrial processes;

Optimize and evaluate the increased performances of the production lines in terms of productivity and cost-effectiveness; and finally

Assess the functionality and performance of the produced new material.

Proposals should address the complete the research-development-innovation cycle and obstacles remaining for industrial applications, involve a number of relevant materials producers and users, also considering the needs of SMEs.

Plans for operating the individual and/or networked pilot line facilities following the project completion should be included.

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities.

For this topic, proposals should include an outline of the initial exploitation and business plans, including plans for operating the individual and/or networked pilot line facilities following the project completion

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts

EXPECTED IMPACT:

The improved properties of advanced functional material with customized thermal/electrical conductivity properties can benefit end user industries such as automotive, aerospace, consumer durables, electrical and electronics, healthcare, and energy.

Compatibility with existing production lines should facilitate the fast and easy integration of the new production technology with producers.

Direct benefit to the involved industries should be demonstrated in the form of reduced costs and full consideration of environmental and safety legislation

In-line process control technologies should reach industrial maturity and robustness.

Characterization methods also need to be established in support of recognised quality standards.

Overall the action is expected to help driving the demand for advanced and smart materials in Europe as well as support the penetration of new markets worldwide. This should include clear benefits to SME manufacturers, facilitated by the feasibility to be reached for the new materials and their manufacturing.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 26-2016: Pilot Lines for Reactive/In Situ /In process generation of nano-features

SPECIFIC CHALLENGE:

Successful adaptation of nanotechnology in the end-products requires in many cases to utilize material that are able to develop their nano-functionalities during the standard process of product and semi-finished product manufacturing. As an examples plastics additives that crystallize in nanoparticle during injection moulding, metal phases that are formed during forging, or hieratic structures that spontaneously form during application of a coating. The possibility to obtain the nano features directly during the manufacturing process strongly reduces the safety issues related to the use of free nanoparticles contributing to a safe utilization of nanomaterials.

This manufacturing principle requires a strong connection between all the actors in the production line and in particular between material producer and end-product manufacturer. The main objective of this action is offering custom fabricated semi-finished components from advanced materials, including nanofoams and nanocomposites obtained from the Reactive/In Situ /In process generation of the nano-features.

SCOPE:

Pilot line development and demonstration in operational environments, using existing facilities as a basis for an efficient, continuous large-scale, low-cost synthesis of reactive/in situ/in process generated nanomaterials.

Eventually including new methods and/or instrumentation with real time characterization for measurement, analysis and control at the nanoscale to characterise relevant materials and process properties;

Increasing the level of robustness and repeatability of such industrial processes;

Optimize and evaluate the increased performances of the production lines in terms of productivity and cost-effectiveness; and finally

Assess the functionality and performance of the produced new material.

Also non-technological aspects key for the marketing of such products (e.g. standardization, regulatory issues, user acceptance, HSE aspects, LCA) need considering. This may include ensuring cooperation between material producer and end-product manufacturer, for example the mining industry to ensure the supply of the most critical materials.

Proposals should address the complete research-development-innovation cycle and obstacles remaining for industrial applications, involve a number of relevant materials producers and users, also considering the needs of SMEs.

Plans for operating the individual and/or networked pilot line facilities following the project completion should be included.

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities.

For this topic, proposals should include an outline of the initial exploitation and business plans, including plans for operating the individual and/or networked pilot line facilities following the project completion

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

The action is in particular expected to demonstrate the successful upscaling of the manufacturing of advanced reactive materials within existing production lines, leading to higher production volumes, improved reliability and repeatability of the produced nano enhanced materials and products and improved productivity and cost-effectiveness.

Compatibility with existing production lines should facilitate the fast and easy integration of the new production technology with producers. Measurement and characterization methods must be established in support of recognised quality standards. In-line process control technologies should reach industrial maturity and robustness. Added benefits also outside the installations involved in the project may be expected from this as well.

Definition of guidelines and reference cases will contribute to development of business plans that encourage private sector investment for future business growth

New entrants into the market are expected, including new SME materials manufacturers, facilitated by the feasibility to be reached for the new materials and their manufacturing.

Promoting safe-by-design approaches from the reactive/in situ/in process generation of nano-features should contribute to the accelerated market uptake of the new nanomaterials and nano-enabled products .

Overall the action is expected to help driving the demand for advanced and smart materials in Europe as well as support the penetration of new markets worldwide. This should include clear benefits to SME manufacturers, facilitated by the feasibility to be reached for the new materials and their manufacturing.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 27-2016: Pilot Line Manufacturing of Nanostructured Antimicrobial Surfaces using Advanced Nanosurface Functionalization Technologies

New?

SPECIFIC CHALLENGE:

Infections by pathogenic microorganisms adhering on various surfaces kill worldwide more people than any other single cause.

These diseases are of particular significance in hospitals (surfaces/furniture, medical devices/implants, surgery equipment, health care products and hygienic applications) as well as in water purification systems, textiles, food packaging and storage, domestic appliances, etc..

Alternatives to antibiotics to control infectious biofilms is required, due to the increasing prevalence of antibiotic resistant bacterial strains. The increasing demand for superior quality medical devices and improved sanitation call for the development of nano-enabled surfaces with antimicrobial functionality.

Nanotechnologies for water treatment units in industrial environments is another example where innovation is required in addressing environmental factors, decisive for industrial competitiveness.

Addressing these challenges calls for the industrial upscaling of manufacturing processed for generation of nanostructured antimicrobial surfaces. Technologies that are affordable and industrially robust are required.

SCOPE:

The proposed pilot lines should address the development, upscaling and demonstration in relevant industrial environments of reliable manufacturing processes to obtain nanostructured surfaces with antimicrobial, biocompatible, anti-adhesive properties. They should use an existing pilot line basis; incorporating new methods and/or instrumentation with real time characterization for measurement, analysis and operations at the nanoscale to characterise relevant materials process properties; increasing the level of robustness and repeatability of such industrial processes; optimize and evaluate the increased performances of the production lines in terms of productivity and cost-effectiveness; and finally assess the functionality and performance of the produced new material.

Specific aims of the proposed actions could be

- The fabrication of new antimicrobial surfaces, or the improvement of existing ones via the application of surface coatings, or the modification of the surface architecture, in order to eliminate or substantially reduce the extent of bacterial attachment on these surfaces are foreseen. A multi-functional approach should be followed for the development/modification of the nanostructured surfaces ((i.e. prevention of adhesion combined with killing of microorganisms)
- Creating a network of specialized labs which may offer a wide variety of technology services at affordable costs to end-users across Europe, and improve the collaborating with EU and/or International end users (for example industries or municipalities located in deserted zones or islands etc.).
- Considering also non-technological aspects key for the marketing of such products (e.g. standardization, regulatory issues, user acceptance, HSE aspects, LCA).

Proposals should demonstrate the effectiveness of the developed technologies through the pilot-scale manufacturing of nanostructured antimicrobial surfaces. They should address the complete research-development-innovation cycle and all obstacles remaining for industrial applications, and involve a number of relevant materials producers and users, also considering the needs of SMEs.

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities.

For this topic, proposals should include an outline of the initial exploitation and business plans, including plans for operating the individual and/or networked pilot line facilities following the project completion

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT

Societal challenges in the healthcare are addressed. Medical and healthcare are obvious markets, but it is also expected to see contributions to solving other social challenges such as sustainable solutions for availability of clean water.

Improved hygiene in hospital environments and prevention of cross-infections will show economic and social benefits of scale, resulting from such reduced needs for treatment of infectious diseases acquired during hospitalization.

Adding anti-microbial, anti-adhesion functionalities to water treatment equipment is another potential area where benefits can be derived from reduced operational costs and increased water quality.

The aim is to reduce the cost of these surfaces and their production, and establish process control and characterization approaches for an industrial production. Direct benefit to the involved industries should be demonstrated in the form of reduced costs and full consideration of environmental and safety legislation.

Added benefits also outside the installations involved in the project may be expected from this as well. New entrants into the market are expected, including new SME materials manufacturers, facilitated by the feasibility to be reached for the new materials and their manufacturing.

Overall the action is expected to help driving the demand. This should include clear benefits to SME manufacturers, facilitated by the feasibility to be reached for the new coatings and surfaces and their manufacturing.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 28-2017: Pilot Lines for Manufacturing of Nanotextured surfaces with enhanced mechanical properties

SPECIFIC CHALLENGE:

Nanostructured coatings or nanotextured surfaces provide improved scratch and abrasion resistance, super hardness that rivals diamond in performance, improved wear resistance and corrosion inhibition., self-cleaning surfaces for buildings, highly mechanical resistant coatings for technical textiles, structural elements for machinery, construction, transportation or even colour and gloss retention, etc.

Nano-enhanced functional surfaces have huge potential in different sectors, including packaging, marine, water treatment, electronics, building & construction, automotive, energy and other applications including textile, leather and industrial engineering.

The involved technologies to manufacture these surfaces or coatings are currently at a lower TRL level, and call for up-scaling, demonstration and validation in large scale pilot installations, before industrial manufacturing can take place.

SCOPE:

Pilot line development and demonstration in operational environments, using an existing pilot line as a basis;

Eventually including new methods and/or instrumentation with real time characterization for measurement, analysis and control at the nanoscale to characterise relevant materials and process properties;

Increasing the level of robustness and repeatability of such industrial processes;

Optimize and evaluate the increased performances of the production lines in terms of productivity and cost-effectiveness; and finally

Assess the functionality and performance of the produced new material. Examples of possible developments include:

- Upgrade existing production methods, such as extending current production capabilities of mass production injection moulding, or current Roll-2-Roll- and sheet-2-sheet printing, into the sub-100 nm regime.
- Enhancing key properties of promising lab scale nano-enabled surfaces and upscale their production up to pilot level. Different technologies for nano-enabled surface production may be considered.
- Applying such surfaces in sectors (more than one is preferred) where they may have strong social and economic impact.
- Considering also non-technological aspects key for the marketing of such products (e.g. standardization, regulatory issues, user acceptance, HSE aspects, LCA).

Proposals should address the complete research-development-innovation cycle and obstacles remaining for industrial applications, involve a number of relevant materials producers and users. SME needs should be catered for, e.g. through a coordinated network of pilot line, test and validation services, in order to prepare for management decisions to progress to the next step of new technology deployment, i.e. installation of industrial pilot lines and enter the commercialisation stage.

Plans for operating the individual and/or networked pilot line facilities following the project completion should be included.

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities.

For this topic, proposals should include an outline of the initial exploitation and business plans, including plans for operating the individual and/or networked pilot line facilities following the project completion

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts

EXPECTED IMPACT:

A direct economic impact on the economy of the manufacturing industry as well as society, resulting from issues such as increased performance and durability of wear-intensive industrial components, reduction of infrastructure maintenance costs, and reduction of operational costs due to energy savings.

Functional nanocoatings have a huge potential for many sectors, and embedded nanostructured functionalities in coatings and surfaces can alleviate problems from ice, pollutant, UV, fire, heat, marine life and corrosion. These factors cost global industry billions in maintenance, loss and downtime each year. For example, direct corrosion costs account for 3-4% of a country's GDP worldwide. More sustainable production as well as products can also be expected, including an environmental impact, from using eco-friendly nanocoatings instead of traditional lubricants for example.

Integration of state-of-the-art nanotechnology in the traditional production of coatings or surfaces will give a market advantage and enhance the competitiveness of European industry.

The new functionalities achieved will have important impact on many sectors, including packaging, marine, water treatment, electronics, building and construction, automotive, energy, textile, leather and industrial engineering.

Compatibility with existing production lines should facilitate the fast and easy integration of the new production technology with producers. Measurement and characterization methods must be established in support of recognised quality standards. In-line process control technologies should reach industrial maturity and robustness. Added benefits also outside the installations involved in the project may be expected from this as well.

New entrants into the market are expected, including new SME materials manufacturers, facilitated by the feasibility to be reached for the new materials and their manufacturing.

Overall the action is expected to help driving the demand for advanced and smart materials in Europe as well as support the penetration of new markets worldwide. This should include clear benefits to SME manufacturers, facilitated by the feasibility to be reached for the new materials and their manufacturing.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 29-2017: Open access Pilot Lines for 3D printed and/or injection moulded polymeric or ceramic microfluidic MEMS and/including biological applications

SPECIFIC CHALLENGE:

Microfluidics devices were initially based on non-polymeric materials like silicon or glass, manufactured in facilities developed for the semiconductor industry. New fabrication techniques that are completely based on polymer /plastic materials can lead to reducing fabrication costs and optimise time, including rapid prototyping methods for a new range of products.

A new generation of 3D printed and/or injection moulded polymeric or ceramic microfluidic MEMS products are targeted. Applications may include MEMS for nozzles or filters, sensor applications, lab-on-chip systems (including microfluidics e.g. electro-kinetic pumping/electro-osmosis and sensing capabilities), printed biochemical materials, soft substrates etc., and open for new applications, including disposables where production cost need to be kept to a minimum.

While typical features for the mentioned applications may be larger than leading edge semiconductor processes, the required feature sizes are nonetheless significantly smaller than what is available with current standard printing and injection molding techniques i.e. micro- and nano-fabrication capabilities are required.

SCOPE:

The pilot line development and demonstration must be done in an operational environments, using an existing pilot line as a basis; eventually including new methods and/or instrumentation with real time characterization for measurement, analysis and operations to characterise relevant materials, process properties and product features; increasing the level of robustness and repeatability;

Applications may fall within areas such as:

- Micro- & nano-printed biological applications (including instrument on a chip, bio-medical/bio-physical sensors, Lab-on-chip, organ-on-a-chip, bio-compatible or toxic scaffolds, active influence of cell growth & differentiation).
- Micro- & nano-printed Polymeric or ceramic microfluidic MEMS for nozzles or filters, sensor applications, and multi-use chip (including also injection molded nanostructures in plastics).
- In-line process control technologies as well as characterization methods needs to be included in order to meet recognised quality standards.
- Full consideration of environmental and safety legislations is required

- Considering also non-technological aspects key for the marketing of such products (e.g. standardization, regulatory issues, user acceptance, HSE aspects, LCA).

The increased performances of the production lines in terms of productivity and cost-effectiveness should be demonstrated together with the relative improved functionality and performance of the resulting products.

Proposals should address the complete research-development-innovation cycle and obstacles remaining for industrial applications, involve a number of relevant materials producers and MEMS manufacturers. SME needs should be catered for, e.g. through a coordinated network of pilot line, test and validation services, in order to prepare for management decisions to progress to the next step of new technology deployment, i.e. installation of industrial pilot lines and enter the commercialization stage.

Plans for operating the individual and/or networked pilot line facilities following the project completion should be included.

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities.

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT

The action should allow for a new generation of MEMS products.

The scaled up production lines for 3D printing and/or injection moulding in combination with the use of polymers and new micro- and nano-fabrication capabilities is expected to increase cost-effectiveness and robustness of the process and resulting products.

Direct benefit to the involved industries should be demonstrated in the form of reduced costs and full consideration of environmental and safety legislation.

Compatibility with existing production lines should facilitate the fast and easy integration of the new production technology with producers. Measurement and characterization methods must be established in support of recognised quality standards. In-line process control technologies should reach industrial maturity and robustness. Added benefits also outside the installations involved in the project may be expected from this as well.

New entrants into the market are expected, including new SME manufacturers, facilitated by the feasibility to be reached for the new manufacturing processes.

Expansion into new markets should be considered, including contributions to an improved quality of life from the resulting products (e.g. lab-on-chip, filters and sensors for medical or other applications), ultimately contributing to a significant growth of quality jobs.

Contribution to training and knowledge dissemination for building an educated workforce and helping creating entrepreneurs may also be expected.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 30-2017: Paper-based electronic paper

SPECIFIC CHALLENGE:

On one hand the lifetime of electronics is becoming shorter, now approaching an average in the range of months; this evolution generates technological challenges and poses a growing ecological problem. On the other hand, paper is ubiquitous in everyday life and it is one of the cheapest materials in our society. It is renewable, portable, flexible and in addition cellulose, its main component, is the Earth's major biopolymer and has an essential economic importance in Europe, which is responsible for 30% of the world's total production. Paper Electronics represents a new concept which combines the use of paper as a functional part of electronic components or devices. Typical applications include packaging, graphics and hygiene products for indicating product safety or freshness, support logistics and safety for example.

Paper-based electronics shows promising technical, economic, and environmental advantages which will allow new recyclable electronics devices, like paper displays, smart labels, smart packaging, bio-applications, RFID tags, among others. Paper-based electronics represents a promising source of innovation and growth for sectors such as packaging industry which develops smart solutions able to interact with the end users or classic paper publishing industry which are facing challenges from electronic books and journals, healthcare industry which intensify the development of specified of lab-on-chip devices.

SCOPE:

The proposal should address the engineering challenges linked with the use of paper as substrate as well as active components of the electronic devices: it includes the development on new technologies for paper manufacturing (fiber enhancement, porosity, fillers, etc) and converting, new paper coatings (organic, inorganic or hybrid), paper surface characteristics and functionalization (nanocellulose, plasma or gas treatments, for instance) but also introduction of new materials (conductors, semiconductor insulators, electrochromic, batteries

electrodes) and high-precision and cost efficient printing or other manufacturing technologies on large area (inkjet and roll-to-roll processes).

Possible horizontal aspects addressed by topic:

- Implemented as cross-KET activities

Activities are expected to focus on Technology Readiness Levels 3 to 5.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- To develop a new disruptive and sustainable paper-based platforms for electronics that not only integrate discrete devices but also use the cellulose as an electronic material for insulators, electrolytes, conductors, and semiconductors;
- To use the same paper substrate that supports the electronics to also drive a bioplatfrom or a display, process source video data, or provide the power source through an embedded chemical battery.
- In long term, the developed technologies should pave the way for active, full color, video-rate reflective displays that perform well in high-light conditions, achieving performance equivalent to classical electronics (i.e. for display devices, a contrast ratio from 10:1, reflectivity of over 80%, full color, ...)
- Reduce the environmental impact of electronics
- Consolidate paper making industries and wood-harvesting industries
- Creation of new markets and new business opportunities for the European industry fulfilling or anticipating consumer needs in this area.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Biotechnology

SPECIFIC CHALLENGE:

During the last two decades major progress was made in terms of industrial applications of biotechnology. Relevant national and FP7 research programmes and projects in the Biotechnology area have significantly contributed to improve European economic and environmental protection. Innovation in biotechnology also provides opportunities to transform the global economy from an extensive dependence on fossil raw material to a sustainable “bio-economy”.

However, economic indicators suggest a need for urgent action to maintain Europe’s global lead in biotechnology. In order to increase the competitiveness of EU industries, broader and deeper collaboration across relevant sectors and Member States is necessary. It will also be necessary to better use research advances in areas such as systems and synthetic biology for applications and demonstration in industrial biotechnology.

SCOPE:

Proposals should gather a critical number of relevant programme managers and funders in the field and aim at implementing a co-funded call focusing on Technology Readiness Levels in the range of 3 to 6 with the possibility to implement additional activities. They shall build on the previous success of ERA-IB-2, ERASysAPP, ERASynBio under FP7, allowing for the seamless integration of the areas covered, together with the bioinformatics area and be complementary to related health initiatives. The ultimate aim is to speed-up research and innovation in industrial biotechnology, establishing systems biology and synthetic biology as technology drivers while focusing on downstream applications. The significant involvement of industry in the activities developed up to the exploitation of results will be an important element to achieve this goal. Extensive communication activities shall foster the European leadership role in advanced biotechnological research and innovation.

Possible horizontal aspects addressed by topic:

The proposals will address Social Sciences and Humanities (SSH) elements, in particular for outreach activities and in terms of the public perception of biotechnologies for industrial uses.

The Commission considers that proposals requesting a contribution from the EU between EUR 10 and 15 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Better align current EU and national biotechnology initiatives with the goals of the KET Biotechnology area under Horizon 2020, in particular by focusing on application-oriented research and demonstration activities and by developing a European Biotechnology hub, acting as a facilitator and multiplier in this regard.

- Launch at least one call for proposals, seeking improved use of synergies and coherence of current research funding activities and existing research infrastructures (e.g. bioinformatics).
- Increase the financial commitment of participating countries and additional private sector resources by at least 20% compared to previous ERA-NET projects.
- Increase the visibility of the potential benefits of a bio-based economy for the society.

TYPE OF ACTION: ERA-NET Cofund Action

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 32-2016: Bioconversion of non-agricultural waste into biomolecules for industrial applications

SPECIFIC CHALLENGE:

Following the principle of a circular economy, industrial by-products, municipal solid bio-waste fractions and sludgy bio-waste from other industries, like the food industry, as well as from water treatment facilities, could be considered feed stock for bio-conversion into value-added industrial products.

However, most of these bio-waste fractions are used nowadays for low-value applications only, such as for energy generation in incineration facilities, as fodder in livestock industries and as fertilisers in agriculture. Therefore, responding to the need to improve industrial resource efficiency, the current main challenges are to identify economically viable links between waste generation and waste utilization, and to develop the necessary technologies (including biotechnologies) for bioconversion of waste into higher added-value products.

SCOPE:

The objective of this topic is to develop biotechnology approaches for the conversion of bio-waste from the above mentioned sectors into higher added-value bio-based products, such as chemicals and chemical building blocks, biopolymers, materials and bioactive compounds. This includes sustainable downstream steps for product separation and purification. Physico-chemical technologies concomitant to the enzymatic/microbial processes are also needed. Proposals should address the current technical state-of-the-art regarding waste utilisation for bioproducts taking into account the current market and legislative barriers in the EU. The feasibility of integrating the newly developed approach into existing value chains should be assessed and demonstrated.

Proposals should have a strong industry drive and prove the techno-economic viability of the proposed value chain. They need to also take into account the optimisation of the final product's "end of life" through, for example, biodegradation or recycling. A life cycle assessment of the entire value chain should be included.

Possible horizontal aspects addressed by topic:

Proposals should specifically target collaboration with SMEs and should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 3 to 5.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Develop at least 2 new bio-based value chains, utilising either industrial by-products and/or relevant bio-waste fractions for bio-product generation.
- Demonstrate the economic and environmental feasibility of the proposed value chains and conduct relevant outreach activities.
- Propose relevant business plans which include the assessment of the potential impact of the proposed value chains in terms of EU jobs and growths in the short and medium term. The expected impact of the value chains should be clearly described in qualitative and quantitative terms (e.g. in terms of turnover, employment, market seize, IP management, sales, return on investment and profit).

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 33-2016: Microbial chassis platforms with optimized metabolic pathways for industrial innovations through systems biology**SPECIFIC CHALLENGE:**

Systems biology deals with the understanding and controlling the complexity of living beings as opposed to studying their constituent parts. As such, systems biology can be considered as a cross-discipline, i.e. the integration of varied types of biological information and the development of models and networks, which together provide greater understanding of the biological system under study. Systems biology relies on cutting-edge technologies, including those in the fields of "omics" (genomics, transcriptomics, proteomics, metabolomics) and bioinformatics, all offering massive amounts of data, most of which remain stored and

underexploited. Therefore, it is a growing area of science that builds information from the translation of biological data and strives to transfer knowledge to society in the form of valuable products and processes.

On the other hand, microbes are attractive candidates to serve as cell factories for the production of many valuable compounds useful for the food, feed, fuel, cosmetics and pharmaceutical industries. The current availability of genome sequences and metabolic models offers the adequate resources for the full exploitation of systems biology in industrial biotechnology, which can boost the design of novel and more efficient microbial platforms for the production of industrial compounds through the sound knowledge of their molecular constituents.

SCOPE:

Proposals should use systems biology approaches integrating "omics" data analysis, mathematical modelling and knowledge of interactions between cellular components under different environmental conditions, to enable useful applications for a broader set of microorganisms, while also achieving some of the following:

- More efficient metabolic pathways of current microbial platforms, adapting them to high performing manufacturing processes
- Improving existing cell factories or developing new ones with enhanced properties for harsh process conditions in industrial applications
- Development of efficient cell factories for the industrial production of novel high-value products.

Possible horizontal aspects addressed by topic:

Proposals will involve SME collaboration (indicatively around 30% of the budget) and international cooperation.

For this topic, proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 3 to 5. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Development of at least two new high added-value products

- Boosting technological innovation for European industries to keep the leadership in biotechnology
- An offer of substantial opportunities for an increasing number of SME to uptake innovative research.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 34-2016: KET Biotechnology foresight identifying high-value opportunities for the EU industry

SPECIFIC CHALLENGE:

Although Europe enjoys a lead position in science and technology, including biotechnology, in comparison with other world regions European technology base is often scattered and very diverse in terms of regional and national capacities. If Europe is to keep its leadership in Biotechnology, its R&D&I funding agencies, in particular the European Commission, need to stay abreast of progress in the areas they fund to ensure utmost relevance of their activities. In the Biotechnology areas stakeholder roadmaps and scientific publications are often outpaced by rapid progress made in research. The cross-cutting nature of biotechnology also requires targeting the limited funds available in the most efficient way. It is thus essential to forecast the future of R&D&I needs closely, in order to identify major opportunities that are not only readily feasible but also of high value, while achieving a positive public perception of biotechnologies and the potential they hold.

SCOPE:

Proposals should use a multidisciplinary approach, including modelling and simulation, to provide comprehensive and dependable information about the future industrial biotechnology scenario (including pharmaceuticals) in the EU in the short and medium-term. Proposals should consider the potential of industrial biotechnology innovation for enabling the European industry to deliver high-value products satisfying evolving consumer needs, the creation of new commercial opportunities and the possible risks for people's health and the environment. European capacities in terms of human resources, infrastructures, research and development and public and private stakeholders should be taken into account. Proposals should also identify links with policy development, and the preparation of the future programmes beyond Horizon 2020.

Possible horizontal aspects addressed by topic:

To a reasonable extent, the proposal will address Social Sciences and Humanities (SSH) elements, for example changing consumers' needs and the public perception of biotechnologies for industrial uses.

The Commission considers that proposals requesting a contribution from the EU between EUR 700.000 and 1 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded.**

EXPECTED IMPACT:

- A reliable priority-setting scenario for funding relevant industrial biotechnology in the EU in the short to medium-term
- An instrument to enhance collaboration between all Member States, building on the strengths of each of the countries and allowing weaknesses to be overcome
- A general vision of European industrial biotechnology capacity and needs that will serve to target and strengthen R&D&I cooperation across EU Member States, in particular boosting the participation of smaller countries.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 35-2016/17: Dedicated support to biotechnology SMEs closing the gap from lab to market

SPECIFIC CHALLENGE:

The large numbers of SMEs characterising the EU industrial biotechnology sector are playing a crucial role in the move to competitive and sustainable biotechnology-based processes. These SMEs are characterised by their research intensity and long lead times between early technological development and market introduction. They therefore need to be supported to overcome the so-called “valley of death”. SMEs working in the field of industrial biotechnology and ideas/concepts involving the use of systems and/or synthetic biology are particularly invited to apply for funding.

SCOPE:

The SME instrument consists of three separate phases and a coaching and mentoring service for beneficiaries. Participants can apply to phase 1 with a view to applying to phase 2 at a later date, or directly to phase 2.

In phase 1, a feasibility study shall be developed verifying the technological/practical and economic viability of an innovation idea with considerable novelty in the industrial sector in which it is presented (new products, processes, designs, services and technologies or new market applications of existing technologies). The activities could, for example, comprise risk

assessment, market study, user involvement, Intellectual Property (IP) management, innovation strategy development, partner search, feasibility of concept, to establish a solid high-potential innovation project with a European dimension. Bottlenecks to increase profitability of the enterprise through innovation shall be detected and analysed during phase 1 and addressed during phase 2 to increase the return on investment of the innovation activities. The proposal should contain an initial business plan based on the idea/concept.

Funding will be provided in the form of a lump sum of EUR 50 000. Projects should not last longer than 6 months.

In phase 2, innovation projects will be supported addressing the specific challenge and demonstrating high potential in terms of competitiveness and growth, underpinned by a strategic business plan. Activities should focus on innovation activities such as demonstration, testing, prototyping, piloting, scaling-up, miniaturisation, design or market replication. The aim is to bring innovative ideas (product, process, service etc.) to industrial readiness and maturity for market introduction. Proposals could also include some research activities. A Technology Readiness Level of 6 or above (or similar for non-technological innovations) is envisaged -see part G of the General Annexes.

Business plans, either developed through phase 1 or other means, should be the foundation of the proposals. Particular attention must be paid to IP protection and ownership; applicants must present convincing measures to ensure the possibility of commercial exploitation ('freedom to operate').

Proposals shall include a first commercialisation plan and criteria for assessing the success of the proposed activities.

In addition, in phase 3, SMEs can benefit from indirect support measures and services as well as access to the financial facilities supported under 'Access to Risk Finance' of this work programme.

Successful beneficiaries will be offered coaching and mentoring support during phase 1 and phase 2. This service will be accessible via the Enterprise Europe Network and delivered by a dedicated coach through consultation and signposting to the beneficiaries. The coaches will be recruited from a central database managed by the Commission and have all fulfilled stringent criteria with regards to business experience and competencies. Throughout the three phases of the instrument, the Network will complement the coaching support by providing access to its innovation and internationalisation service offering. This could include, for example, depending on the need of the SME, support in identifying growth potential, developing a growth plan and maximising it through internationalisation; strengthening the leadership and management skills of individuals in the senior management team and developing in-house coaching capacity; developing a marketing strategy or raising external finance.

The Commission considers that proposals requesting a contribution from the EU of up to EUR 50 000 for phase 1 and between EUR 0.5 and 2.5 million for phase 2 would address the challenges appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. Projects should last between 12 and 24 months.

EXPECTED IMPACT:

- Enhancing profitability and growth performance of SMEs by combining and transferring new and existing knowledge into innovative, disruptive and competitive solutions seizing European and global business opportunities.
- Market uptake and distribution of innovations tackling the specific challenge of boosting biotechnology-based industrial processes driving competitiveness and sustainability.
- Increase of private investment in innovation, notably leveraging private co-investor and/or follow-up investments.
- The expected impact should be clearly described in qualitative and quantitative terms (e.g. on turnover, employment, market seize, IP management, sales, return on investment and profit).

TYPE OF ACTION: SME Instrument (70% funding)

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 36-2017: Microbial platforms for CO₂-reuse processes in the low-carbon economy**SPECIFIC CHALLENGE:**

Nowadays CO₂ re-use is one of several technological ways to reduce otherwise harmful CO₂ emissions, thus making CO₂ a valuable commodity rather than a pollutant. However, the research behind full development of CO₂ reuse technologies is in its early stages. Some of these technologies use CO₂ as a feedstock for chemicals and plastics, thus increasing the industrial biotechnology potential for enhancing European economic competitiveness. In this way, tackling the CO₂ challenge includes interesting possibilities for encouraging innovation and sustainability.

An industrial biotechnology route for CO₂ re-use is fermentation, where CO₂ is fermented into a desired molecule using hydrogen as a source of energy. However, there are technical issues that need to be resolved, because the biochemical reactions involved are not yet self-supporting in terms of energy for the industrial scale conversion of CO₂ into chemicals. Moreover, the final yield of the products is low and the process needs optimisation. In the end, the success of CO₂ reuse technologies will depend on developing processes which are less energy and material intensive than the processes they aim to replace. Therefore, substantial research is required to achieve the goal of a CO₂ economy.

SCOPE:

Proposals should address current limitations of CO₂ reuse technologies based on microbial platforms, by developing their full potential, and need to cover one or more of the following issues:

- Microbes with an improved ability to convert CO₂ as a feedstock into chemicals and plastics
- Discovery of new, more active and robust enzymes for improved bio-catalysis
- Design of new synthetic systems to produce useful enzymes
- Improved microbes with resistance to by-products and target products

Possible horizontal aspects addressed by topic:

As much as possible, proposals will involve SMEs and international cooperation, and they will address elements of Social Sciences and Humanities (SSH) exploring the public perception and acceptance of the technology of CO₂ reuse.

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 3 to 5. Implemented as cross-KET activities.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Development and validation of at least 2 microbial cell factories
- Contributing to the reduction in CO₂ emissions
- Supporting the EU in becoming a global leader in CO₂ re-use technologies

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 37-2017: Optimisation of biocatalysis and downstream processing for the sustainable production of high added-value platform chemicals

SPECIFIC CHALLENGE:

The bio-based production of chemical building blocks from renewable resources has become an interesting alternative to inherently non-sustainable petrochemical-based processes, which are neither low-carbon nor resource-efficient. However, despite the discovery and development of numerous platform cell factories, bio-based production is not (or not fully) competitive in terms of economics and remains, therefore, a niche market application dedicated to high-value specialty products.

To overcome current limitations, it is necessary to further improve the efficiency of bio-based production processes by creating better performing platform cell factories and relevant downstream processes.

SCOPE:

The objective is to optimise already existing or newly developed platform cell factories for the production of platform chemicals and biofuels (excluding pharmaceuticals), following the cascading use of resources. Proposals should include areas such as bioinformatics, systems biology and synthetic biology where appropriate. Furthermore, applicants should take into account integrated approaches from sourcing of renewable biomass to bioconversion and downstream processing, including the final consumers of the bio-based product.

Proposals will have a strong industry drive and include demonstration activities to prove the techno-economic viability of the proposed value chain on the basis of a full Life-Cycle-Assessment, including the preparation of a model business plan. The optimisation of the final product's "end of life" through, for example, biodegradation or recycling should also be considered. Promotional activities, beyond the usual web-based approaches, targeted at all groups of participants should be included.

Possible horizontal aspects addressed by topic:

- n/a

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 5 to 7.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Reduction of the production costs of the proposed bio-based products by at least 30%.

- Demonstration of the economic and environmental feasibility of the proposed value chains.
- Full set of promotional and outreach activities, targeted at specific stakeholder groups, and based on the full Life-Cycle-Assessment and business plan prepared.

TYPE OF ACTION: Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 38-2017: New Plant Breeding Techniques (NPBT) in molecular farming: Multipurpose crops for industrial bioproducts

SPECIFIC CHALLENGE:

Molecular farming involves the production of pharmaceutical and industrial compounds in plants through advanced technologies and it offers a competitive platform for the manufacturing of high-end products. Examples are plant-derived vaccines and the production of other commercially valuable proteins or small molecules. Indeed, plants are highly amenable to the production of a wide range of proteins, some of which are specific. In addition, the scalability allowed by plants exceeds that of other production systems. Molecular farming represents a development opportunity for a set of new high-value crops, for the health, chemical and agricultural industries and their related technology sectors. However, the expansion of molecular farming has been dawdling, due to its reliance on standard genetic modification and the hurdles it poses for commercialisation.

In the past ten years, complementary and more sophisticated new plant breeding techniques (NPBT) have been developed to produce new plants with the desired traits circumventing the main drawbacks of standard genetic modification (i.e. no foreign DNA is contained in the resulting end product). The use of NPBT for molecular farming could provide opportunities for new crops for the production of bioproducts, while maintaining the position of leadership of the European plant breeding sector in research and innovation.

SCOPE:

Proposals should use the technologies comprised in the NPBT set¹, in particular those that avoid final genetic modification products, with plants amenable to be used as green factories in order to yield industrial high-value products. Proposals should address at least one of the following areas:

- Minor, underutilized and non-food crops suitable for the extraction of bioactive compounds

¹ SANCO, http://ec.europa.eu/food/plant/gmo/new_breeding_techniques/index_en.htm
and JRC <http://ftp.jrc.es/EURdoc/JRC63971.pdf>

- Crops that grow more efficiently and have higher yields of the target bioproduct, while being more tolerant to adverse environmental conditions
- Improved plant-based low-cost platforms for commercial production of bioproducts

Possible horizontal aspects addressed by topic:

Proposals will include participation of SMEs.

When appropriate, proposals will be based on international cooperation.

They will include Social Sciences and Humanities (SSH) elements contributing to a better understanding of plant breeding and related biotechnologies by the general public.

Proposals should include an outline of the initial exploitation and business scenarios, which will be developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 3 to 5.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- At least, 25 % contribution to the EU goals of increased sustainability of agriculture and the bio-based economy
- Development of new data for the assessment of innovative NBPT as tools for future plant breeding and their potential for a speedy uptake in general breeding practice
- Innovation in the way plant breeding technologies is presented to the public for an improved understanding of biotechnology and informed decision making

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 39-2017: Support for enhancing and demonstrating the impact of KET Biotechnology projects

SPECIFIC CHALLENGE:

Dissemination, exploitation and transfer of project results are crucial activities during project life-time and beyond in order to make sure that projects have the expected impacts. Clustering of project activities, according to objectives and addressed themes, and linking them with

corresponding existing technology transfer activities are effective ways to stimulate the uptake of project results and the exploitation of synergies. An adequate monitoring of such activities during the project lifetime and beyond is also needed to ensure an effective implementation at programme level.

SCOPE:

The coordination action should aim in particular to actively cluster existing activities under the KET Biotechnology programme of Horizon 2020 and might also include related prior activities launched under FP7.

Activities may include:

- Reviews of recent technological developments, publications, international R&I programmes within the technological area of the cluster;
- Workshops with top-ranked international experts from various disciplines aiming at the elaboration of future KET Biotechnology priorities within this cluster and identifying research gaps;
- Science Intelligence: Gathering information about business trends and market prospects within and outside the EU, including relevant analytical and information/publication activities;
- Promotion of the activities of the cluster, e.g. organizing international conferences, and national or international roadshows highlighting the achievements within the cluster, involving also policy makers and/or the general public.

The Commission considers that proposals requesting a contribution from the EU between EUR 700.000 and 1.000.000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Speeding up industrial exploitation and uptake of results of KET Biotechnology projects.
- Stimulating network and alliance formation for further RTD and industrial innovation based on KET Biotechnology achievements, including the development and practical application of a clustering model.
- Added value beyond the original scope of the KET Biotechnology projects by exploiting synergies and sharing best practice. Increased public awareness of the activities in this area by targeted communication activities.
- More effective execution of activities of common interest, such as IPR management, standardisation and policy making.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

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

In case materials modelling is proposed, the modelling Work Packages should be described similarly to the Review of Material Modelling http://ec.europa.eu/research/industrial_technologies/pdf/modelling-brochure_en.pdf ; If new software is developed, software engineering quality measures should be part of the proposals.

Proposers should consider participation in open data pilot (mandatory for modelling topics) and the European modelling market place initiatives (reference to the 2017 topic).

NMBP 40-2016: Advancing the integration of Materials Modeling in Business Processes to enhance effective industrial decision making and increase competitiveness

SPECIFIC CHALLENGE:

Sustaining and growing businesses requires continuous product innovation. Making meaningful business strategy decisions is an ever more challenging task in a global context. The combination of materials and business modelling to explore what technical solutions are economically viable is not yet exploited to the extend it could. The sheer volume of data and information combined with its dynamic nature demands an ever better understanding of possible options. There is a need for a Business Decision Support System that supports the selection of the optimal material and process taking into account the implementation costs but also the cost of the software tool and its application and the associated risk; a priority, especially for SMEs.

SCOPE:

The proposals should develop an integrated Business Decision Support System (BDSS) that can support decisions on new materials and new processes by calculating through hypothetical scenarios.

The BDSS should enable the integration of materials modelling and business tools and databases into a single work-flow, allowing for flexibility of application to different industrial sectors.

Proposals should include integration of discrete and continuum materials models with structured and unstructured data from multiple data bases containing materials data, commercial data and information on market trends, pricing, customer needs and demands.

The BDSS should enable a multi-criteria optimisation over all stages of product development by allowing the end-user to mirror the operational framework of their company. The structure of the BDSS should allow back-engineering from the end-goal. BDSS should be designed such as to optimise the integration of humans in new more complex industrial environments. The tool should be available to and usable by decision makers in manufacturing companies in the form of a platform which can be confidentially applied by a company. The tool should be validated against measurements, existing data and real financial arguments. Validation of the developed systems on public case studies and training of translators on the system is required. Development of innovative methodologies should be included addressing the necessary model development, innovative ways to connect models and how to use them in varying contexts (adaptive systems and networks).

The consortium is expected to provide expertise on multiple discrete and continuum materials models¹, business decision support systems, data search technology (incl. optimisation, genetic algorithms, symbolic regression, machine learning and cognitive learning).

Possible horizontal aspects addressed by topic:

- This topic is part of the open data pilot.

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between **EUR x and y million** would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Reduction of company costs and increased performance and commercial impact based on effective materials models driven business decisions
- Guidance to companies in developing their strategies with an effective, user friendly materials models driven business decision system
- Increased industrial use of existing materials knowledge and effective materials models
- Improved trust of industrial decision makers in materials modelling and their commercial advantage

¹ http://ec.europa.eu/research/industrial_technologies/modelling-materials_en.html

- Essential company savings in time and money, especially via the elimination of the need for (some) plant trials

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 41-2016: Network to capitalise on strong European position in materials modelling and to allow industry to reap the benefits

SPECIFIC CHALLENGE:

Predictive multi-scale material modelling has the potential to enable economic advantages for all manufacturing industries. There is a need for enhanced and effective interaction between all stakeholders, in particular between those engaged in different types of materials modelling (electronic, atomistic, mesoscopic and continuum materials, process and device modelling) and between translators, who translate industrial problems into materials modelling and manufacturers. In addition a lack has been identified for clear road maps for research on the application and use of materials modelling in industry. Moreover, there is a need to collate different standards and different methodologies for efficient and effective implementation and use of materials modelling tools. Also there is a need to increase the interoperability of software to facilitate integration of various tools in processing and product design.

SCOPE:

The proposed coordination and support action should network the stakeholders and a platform is to be established to advance the use of materials models by industry and to agree on open tools with the wide stakeholder community.

Road Maps for materials and related product and process modelling in industry with a focus on how discrete (electronic, atomistic and mesoscopic) models can be further developed and coupled or linked to continuum models are to be elaborated. The proposers should support the elaboration of methodologies and workflows.

A materials modelling data repository of validated sources should be designed with coherent and concerted connections. Existing communication standards between models and databases should be further developed, alleviating the language gap between different vocabularies. An open simulation platform based on these standards should be designed to allow the flexible use of software components of different vendors. Provision of validated data by third parties should be stimulated.

Benchmarking of tools and experimental data should be supported.

A jointly agreed guidance on software development for academics is to be established and promoted so that such software can be used by industry. Technology Readiness Levels for software, which could help in selecting the right model/software for the end user, should be agreed with the wide community.

The translation of industrial problems into material problems that can be solved by computational simulation should be facilitated.

Training and dissemination should be stimulated across Europe to make the different stakeholders aware of the technical and economic benefits of active use of discrete and continuum materials modelling throughout company operations.

Networking activities such as developing interest groups, workshops, training events, market studies and engaging with regulatory and benchmarking authorities if appropriate can be included.

Possible horizontal aspects addressed by topic:

- This topic is part of the open data pilot.

The Commission considers that proposals requesting a contribution from the EU between EUR 2 and 4 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded**

EXPECTED IMPACT:

- Improved accessibility of materials modelling and related databases by manufacturing end-users
- Increased integration of discrete (electronic, atomistic, mesoscopic) and continuum materials models and databases for industrial use
- Increased efficiency and industrial effectiveness of materials models in industry and research
- Establishment of technical and business-related quality attributes (Key Performance Indicators) that inspire trust in materials modeling
- Industrial best practice (methodologies) for end-users should increase speed of development in industries

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

SPECIFIC CHALLENGE:

Innovation in manufacturing industries can be much faster, if materials modelling is used to focus experimental efforts. Novel modelling solutions need all determining components to be interwoven and available to the entire European community allowing the quick development and market deployment of new materials. Industry wants to know the risks and gains of materials modelling and the resources necessary to use the models efficiently. The industry needs education and/or support by translators analysing the industrial problems and proposing modelling solutions to the companies requesting this, supported by benchmarking. The above services need to be accompanied by tangible components like models, software packages, data, state of the art and connections to key actors. An open simulation platform providing interoperability between discrete and continuum models based on widely agreed communication standards would facilitate the use of materials modelling.

SCOPE:

The project should establish a web based marketplace linking various activities and databases on models, information on simulation tools, communities, expertise, course materials, lectures, seminars and tutorials for at least two manufacturing sectors of the European industry. Projects should address sectors that have common problems in femto, pico, nano and meso-structure design of materials and their manufacturing processes.

The project should agree with the wide European community a standard for organizing modeling data needed to make search and linking between different databases effective and easy. Strategies and test rules pertaining to data integrity and quality, e.g., by user and analytic feedback mechanisms should be established. The proposal should develop practical solutions for the ownership, control and management of distributed databases. The project should ensure wide spread participation.

The project should provide novel tangible avenues for integrating multiple materials models that can address industry relevant challenges. The project should establish integration of materials models (discrete and continuum applied at nanoscale) and databases to obtain software interoperability in an open simulation platform. The development of homogenisation models and the elaboration of wrappers should be stimulated.

The proposal should establish a validation system to provide reliability and accuracy of models and for the comparison of results of simulations between materials models and for comparison with experiments.

The project should stimulate the exploitation of existing software via advice on modelling, education of companies and the stimulation of the provision of translation services especially for SMEs.

The proposal should present a credible business plan for the maintenance of the hub after the project duration.

Possible horizontal aspects addressed by topic:

- This topic is part of the open data pilot.

Activities are expected to focus on Technology Readiness Levels 5 to 7 (or 6?).

The Commission considers that proposals requesting a contribution from the EU between EUR x and y million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Increased innovation in industry based on materials modelling
- Awareness of industry in general and SMEs in particular of the rapid progress of contemporary computational materials modelling tools, and increased use of materials modelling by the manufacturing companies (end-users).
- Broad, fast, and easy information management and exchange both between the modelling community and industry and within the modelling community.
- Ability for manufacturing companies (end-users) to do an effective search of numerical tools and/or providers of numerical simulations who could best suit their needs
- Supply of software developers with comprehensive information about the potential clients and industrial tasks where numerical simulations would be highly desirable and
- Effective information exchange within the academic simulation community to enable faster general progress of material modelling methods.
- Speed up the use of materials modelling by standards and requirements of modelling data repositories including possibly data, modelling codes and validation repositories
- Increased demand for data and materials models.
- Increase the use of materials simulation to comply with regulations.
- Rapid deployment of novel materials modelling solutions in particular manufacturing-targeted domains.

TYPE OF ACTION: Innovation Actions

Special features: Successful projects will be clustered to agree on infrastructure standards to achieve seamless integration of their platforms across the different manufacturing-targeted application areas.

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Actions to support developments in, and acceptance of, nanotechnologies, advanced materials and biotechnology - Science-based risk assessment and management of nanotechnologies, advanced materials and biotechnologies

NMBP 43-2016: Analytical techniques and tools in support of nanomaterial risk assessment

SPECIFIC CHALLENGE:

Nanomaterials are very diverse groups of materials with greatly varying properties. Thorough physico-chemical characterisation of nanomaterials, in their pristine forms but also in the tested environment, is nowadays being recognised as essential for sound assessment of their biological and environmental properties. In order to enable prediction of impacts, itself nowadays a pre-requirement for insuring industrial activity, a classification based on key parameters or biological interactions should be established and scientific foundations established on very well defined and characterised systems. Yet, suitable analytical techniques and equipment, skilful operators, and inter-laboratory studies that would establish confidence are still lacking, even in the “simple”, and most addressed, case of particle size distribution measurements which many laboratories struggle to tackle adequately when confronted with poly-dispersed materials. At the lower limits of the nano-scale these same problems aggravate further. An additional factor is the high cost of the available techniques something that hinders, smaller laboratories, innovation oriented SMEs, and forbids start-ups.

SCOPE:

The objective is to develop relevant analytical methods and corresponding equipment that enable characterisation of ensembles of nanomaterials size, shape, surface and multiple composition (multicomposites ENMs), including the necessary building up of confidence through thorough application and benchmarking. The analytics could also enable studying the longer term fate of particles following their interaction with in complex matrices, i.e. in living systems.

Possible horizontal aspects addressed by topic:

- This topic is part of the open data pilot.
- International cooperation

Activities are expected to focus on Technology Readiness Levels 4 to 6.

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Enable the identification of key descriptors that can be used to reveal correlations associated with health and environmental impacts
- Increased confidence in nanosafety studies findings
- Reduced costs related to the physico-chemical characterisation of nanomaterials in relevant environments.
- On top of safety related objectives, proposals should seek applications of the methods in other areas such as quality control, product traceability, labelling and counterfeiting.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 44-2016: Promoting safe innovation through global consolidation and networking of nanosafety centres and strengthening the European nanosafety cooperation

SPECIFIC CHALLENGE:

The rapid expansion of nanotechnology has brought the question of its safety and the resulting risk management measures. Considerable effort has been put by FP6 and FP7 projects for answering basic scientific and technical questions and will continue under H2020. Supporting the regulatory aspects by providing the technology, skills and conventions necessary for science based implementation of existing rules and consistent development of new ones is ongoing in terms of developing the capacity to measure individual risks in regulatory terms both for toxicity and exposure and the capacity to develop processes and products safe-by-design (i.e keeping the combined risk level below pre-defined values).

The objective of this topic is to support the market related aspects by providing the technology, skills, and processes, necessary for science-based best NanoSafety practices in industrial and commercial activities, for sustainable creation of marketable, and for society approved, products, goods and services.

SCOPE:

The effort should take three main directions: Setting minimum requirements for jobs, skills and/or tools.

These objectives are being addressed by excellence centres currently being established in several EU member states and globally. A wide variety of national and (EU) regional platforms and centres can be observed which are dedicated to research, market follow-up, dissemination of nanosafety. There is the need to consolidate and further develop these first initiatives so as to make available to industry and other stakeholders concerned an European-wide, up-to-date, science-based, complete system capable of managing risks in the field and providing scientific support to more general questions on product quality, technical approvals, and counterfeiting, training and certification system for nanosafety at work.

The proposed CSA should aim at networking these platforms at European level, including the nanosafety cluster. The foundation and basis for the development of the European nano-network will be based on the interaction and adequate communication to generate a step-change in the risk management process. It may include work and resources specific to the participants or other public and private sources. The CSA can be used to pool resources and organise calls for market oriented activities which are of common interest for the platforms.

To ensure fast transfer of knowledge throughout the knowledge chain, from basic research to market implementation, the proposed CSA should also address the strengthening and support to Nanosafety Cluster activities, in particular towards successful communication and outreach.

Possible horizontal aspects addressed by topic:

This topic is part of the open data pilot

In line with the objectives of the Union's strategy for international cooperation in research and innovation (COM(2012) 497), international cooperation according to the current rules of participation is encouraged, in particular with Brazil, South Korea and the United States of America. The quality of the international cooperation will be rewarded in the evaluation of the proposal.

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- An independent science based EU nanosafety reference platform for all stakeholders in nanotechnology that collates information into a comprehensive and accessible European network portal and providing a solution to the problem of data accessibility and transferability, by removing barriers which currently limit knowledge distribution.

- The CSA should mark progress for Guidance to market actors (industry, safety service providers, and public authorities), best practice, standards, technical approvals, environment protection, and operational certification systems.
- The platforms network should prepare a European Hub to provide services and support for stakeholders (e.g. industry, governments, researchers etc.) to create in a sustainable way marketable, societal approved products and goods.
- Involvement of highly renowned actors in the research field and from leading stakeholders from regulatory bodies, standardization bodies, into a seedless dialogue.
- Significant research outputs efficiently disseminated to national and international communities

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 45-2017: Framework and strategies for nanomaterial characterisation, classification, grouping and read-across for risk analysis

SPECIFIC CHALLENGE:

For managing eventual risk, in terms of quantification of hazards and exposure, and engineering-out or reducing non-acceptable risks, Engineered Nano-Materials (ENMs) will need characterising as far as possible in all used media and physiological chemistries. Characterisation includes all parameters deemed necessary for risk analysis. The aim is to identify both the ENMs properties and interactions of the ENM-corona-protein system with organic matter, and the consequences of nanomaterial perturbation on cellular signalling and eventual possible effects at the systemic level. Thorough knowledge in this domain is expected to allow for classification of ENMs based on morphology, composition, complexity/functionality, and by bio-interface. Read-across methods should be defined to reduce unnecessary efforts in testing. The classification approaches should aim to support grouping of ENMs for further risk analysis, to help in developing intelligent testing strategies and identifying "ENMs or properties of concern" that need to be tested more thoroughly. Grouping can take into account quantification of possible adverse effects depending on the use on ENMs in specific applications. Results from these studies should be collected in a form enabling their use in developing "safer by design" guidelines, so that such novel products provide the benefits originally intended by maintaining fullest possible intended functionality and at the same time pose the least possibly risks to humans, the environment and ecosystem services.

SCOPE:

Focus should be on identifying both general (with wide representation of nanomaterial groupings) and particle-specific molecular signatures of exposure and toxicity. Testing should cover effects at several levels of biological organisation and a broad range of representative taxa/models, to ensure maximum read across between species, increase impact and reduce future testing needs. Understanding of the kinetics and equilibrium dynamics of corona/surface modification and core aging in whole organisms, as well as interactions with other potential toxicants, should be developed to enable designing relevant exposures and valid high throughput testing. Relationships between acute and chronic, as well as in vitro – in vivo exposures must be established, to validate HTS tools for risk assessment purposes. Research should also consider the applicability of the proposed studies to the assessment of ENMs impacts on susceptible populations and life-stages, assessing the effect of ENMs on disease-specific and developmental signalling pathways.

The proposed projects should include appropriate data curation expertise, modelling and input into the possible development of Q(n)SP/AR approaches in order to develop user friendly interfaces to enable data driven read-across to other ENMs with similar properties or behaviour, and predictive risk assessment tools.

Possible horizontal aspects addressed by topic:

- This topic is part of the open data pilot.
- International cooperation

Activities are expected to focus on Technology Readiness Levels 3 to 6

The Commission considers that proposals requesting a contribution from the EU between EUR 5 and 7 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded**

EXPECTED IMPACT:

The research approach should be innovative and represent a significant advance beyond the current state-of-the-art in the area of nanomaterial hazard and exposure assessment. Research should provide sustainable solutions to the long-term challenge of nanosafety and reach a level that will allow for regulatory research work to start. Research should demonstrate applicable and scientifically sound grouping and read-across strategies and predictive models for impact and toxicity for use by industry and regulators, including the input towards “safer by design guidance” in specific value chains. Data must be deposited in a recognised and accessible research databank for use beyond the lifetime of the project. Outputs should be tailored to address the needs of each of the stakeholder communities, including the modelling community.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 46-2017: Advanced and realistic models and assays for nanomaterial hazard assessment

SPECIFIC CHALLENGE:

Hazard assessment is largely based on the toxicological profile of the material in question. The reason is that the costs related to hazard control are much inferior to the costs for risk exposure monitoring let alone risk containment or risk mitigation. However with the very big number of new material likely to enter production and use, the usually short period between development and marketing and the increase in societal risk aversion, the classical toxicological testing paradigm so far focusing on in vivo testing is gradually but steadily shifting towards in vitro testing approaches. This is particularly true in the field of nanosafety where, in front of potentially thousands of different nanomaterials, economic constraints make it essential to develop and establish robust, fast and yet reliable and realistic in vitro tests that should be applied in a first tier figuring out "nanomaterials of concern".

Significant progresses have been made in assessing nanomaterial hazard. Yet, knowledge gaps remain on long-term effects (low doses, chronic exposure), both for human health and environmental questions, as and questions arises on the adequacy of the existing in-vitro models and on the relevance of the exposure conditions to correctly assess and predict real-life hazards. It is also necessary to prepare the ground for the next challenge, defining toxicological profiles based on in-silico testing.

SCOPE:

With a view to intelligent testing strategies for nanomaterials, it is of high priority to develop and adopt realistic and advanced in vitro model which have the potential to substantially improve the relevance of in-vitro approaches. Current in-vitro experiments mostly rely on established immortalized single cell lines, which often do not reflect the in-vivo situation. Therefore, new or advanced models, such as co-culture models, 3D cultures or primary cell models should be developed for relevant endpoints lacking, or having inadequate, in-vitro models. Transport through biological barriers could also be addressed, for instance with the objective of assessing the true internal dose of the materials to which living organisms are being exposed, as well as disease models or models with impaired barriers.

Although low-level chronic exposure is a likely scenario, as many ENMs will probably exist at very low concentrations in the environment and be persistent, nano(eco)toxicology studies often focus on acute effects. Thus, assays with chronic exposure, elucidating different mechanisms of action, should be developed and validated against appropriate animal studies and could include for instance effects on growth, reproduction, metabolism, and behaviour.

Similarly, research on the terrestrial environment needs to focus on long-term, ecologically relevant, effects in realistic environmental concentrations of ENMs: effects on populations, communities, and ecosystems e.g., by using long-term effects, mesocosm-based test systems.

Standard tests often ignore the effect of transport in real matrices (biological or environmental) although those have been demonstrated as having potentially significant effect on the tests results. Therefore, realistic exposure conditions should be an integral part of the developments, taking into consideration their biological or environmental relevance, the dynamic and complex nature of environmentally induced transformations and capturing realistic external and internal forms and levels of exposure.

When possible, for validation purposes the testing should be performed on sets of nanomaterials for which in-vivo data are already existing (to minimize animal testing), and on well-defined libraries of nanomaterials to ensure that the experimental results can form a solid and meaningful basis for grouping, read-across and QSARs purposes.

Possible horizontal aspects addressed by topic:

- This topic is part of the open data pilot.
- International cooperation

Activities are expected to focus on Technology Readiness Levels 4 to 6

The Commission considers that proposals requesting a contribution from the EU between EUR 10 and 13 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. **No more than one proposal will be funded**

EXPECTED IMPACT:

- The research approach should be innovative and represent a significant advance beyond the current state-of-the-art. Research should focus on provision of solutions to the long-term challenge of nanosafety and nanoregulation.
- Demonstrated predictive power of in-vivo approaches for in vivo systems to support acceptance in a regulatory framework.
- New models and assay improving prediction of chronic effects in a broad array of representative organisms and changes in ecosystem function.
- Developed test guidelines for further standardisation, and ring testing (including guidance on design of the ring testing).

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

Innovative and responsible governance of new and converging enabling technologies

NMBP 47-2016: Improving nanotechnology (KETs) skills by involving multiple stakeholders

SPECIFIC CHALLENGE:

Recent analysis shows that aspects like health, safety, regulation, environment and recycling are strongly demanded job skills in the European nanotechnology industry. In contrast, nanotechnology studies at universities (and secondary schools) focus on classical disciplines and technologies, so educational contents and job skills required in industry are not well aligned. In addition, with the fast pace of development in KETs, the acquired knowledge and skills quickly become outdated. The project should improve nanotechnology education and skills by promoting integrated efforts between industries, research institutes, universities and secondary schools.

SCOPE:

Best practice examples for constructive and sustainable cooperation between secondary schools, universities, research institutes and industries should be identified. Areas where improvements are required should be highlighted and instruments to address these problems should be developed, including information platforms, on-line and hands-on teaching modules, assessment tools for current and novel education activities and regular personnel exchange between industry and academia.

University curricula should be addressed with a view of giving stronger emphasis to the skills needed in the workplace, including non-industrial (social) employers. It is suggested that non-technological skills for example in communication, management, safety and life-cycle analysis of nano-enabled products should be given more weight in bachelor, master and PhD studies. Model curricula should be established with input from university teachers and administrators, active students, and representatives of major employment sectors. Life-long learning should be integrated in these efforts. The engagement of industry and non-industrial employers in university and secondary school level teaching should be enhanced e.g. through guest lectures and part-time positions in academia.

The inclusion of secondary schools should also address the schools as a major pathway to disperse science-based and accurate information about nanotechnology to the general public. An experimental approach including follow-up studies should be used to identify successful approaches for school programs that emphasize interaction with universities and industries. University efforts should include activities of students and/or professors participating in

programs with schools. Tools to be developed include training in academics of all level in interacting with secondary school students.

For all activities it has to be established that the educational activities identified and developed within the project can be adapted and implemented based on existing resources. This includes the identification of factors that enhance the integration of the topic, the potential problems preventing their application, as well as means to solve them. The implementation of the activities should be done in several EU and associated countries to gather feedback from a wide geographical spread, enhancing transferability and reliability of conclusions and recommendations. The project should include the appropriate disciplines of Socio-Economic Sciences and Humanities. Gender balance should be taken into account.

Possible horizontal aspects addressed by topic:

- SSH dedicated topic
- Gender aspects

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

interaction between industries, research institutes, universities and secondary schools will lead to high-level research-driven teaching at universities, giving "additional" or "soft" skills a central place and will lead to improved lifelong learning of people working in the nanotechnology industry, academia and secondary school teachers. Productive interactions of industries and universities with secondary schools will enhance the integration of nanotechnology into existing teaching programmes.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 48-2016/2017: Presidency events

SPECIFIC CHALLENGE:

An integral part of the LEIT-NMP part of Horizon 2020 is to organise events of a major strategic nature. Examples are events organised together with successive EU presidencies; and also EuroNanoForum, Manufuture, NMP Conferences and World Manufacturing Forum. The proposed Support Action(s) should contribute to creating better synergy between initiatives launched by the Commission and by the Member States, to the benefit of the coherence of the overall actions within the field of research and innovation within the Industrial Leadership part. Member States which will hold a forthcoming Presidency of the European Union are Malta and United Kingdom in 2017, and Estonia and Bulgaria in 2018, and they may be particularly interested in this topic.

In order to ensure high political and strategic relevance, the active involvement of the competent National Authority(ies) will be evaluated.

Proposals should address topics of major relevance at the time of the events. An appropriate equilibrium should be present in the proposed action(s), with balanced presentations of various research and industrial elements and points of view. The conferences organisers should use modern technologies in all phases of the event life cycle, and should include interactive sessions. Outreach activities may be included, such as a press programme or events dedicated to the wider public or schools.

The Member States holding a Presidency of the European Union in the same year are invited to liaise in order to avoid overlaps, and to ensure that each event has clearly identified objectives, messages and target groups.

Participation of non-EU actors is possible.

SCOPE:

The commitment of the national authorities to support the event(s) (from a political point of view, but also with resources) should be a pre-requisite to submit a proposal. The application should be supported by the competent Minister, in a letter added to the application.

The Commission considers that proposals requesting a contribution from the EU between EUR 300 000 and 600 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts. No more than one action will be funded for each Presidency (possibly covering more than one event).

EXPECTED IMPACT:

- Review of research, industrial and/or societal developments linked to the Industrial Leadership part areas, as appropriate;
- Sharing of information and comparison of points of views; and
- Networking various stakeholders and supporting their activities, e.g. natural scientists, social scientists, researchers, industrialists, SMEs investors, environmentalists, museums and schools, non-governmental organisations, ...

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 49-2016: Support for National Contact Points

SPECIFIC CHALLENGE:

Facilitate trans-national co-operation between National Contact Points (NCPs) within the Industrial leadership Part with a view to identifying and sharing good practices and raising the general standard of support to programme applicants.

SCOPE:

Support will be given to a consortium of formally nominated NCPs in the area of Leadership in enabling and industrial technologies. The activities will be tailored according to the nature of the theme, and the priorities of the NCPs concerned. Various mechanisms may be included, such as benchmarking, joint workshops, enhanced cross-border brokerage events, training, and twinning schemes. Special attention will be given to helping less experienced NCPs rapidly acquire the know-how accumulated in other countries.

The focus throughout should be on issues specific to the Industrial Leadership part, with the possible inclusion of interdisciplinary approaches, e.g. by involving Social Sciences and Humanities. It should not duplicate actions foreseen in the NCP network for quality standards and horizontal issues under 'Science with and for Society'.

The proposal consortium can include only NCPs from EU Member States and Associated Countries, who have been officially appointed by the relevant national authorities. The consortium should have a good representation of experienced and less experienced NCPs.

Submission of a single proposal is encouraged. NCPs from EU Member States or Associated Countries choosing not to participate as a member of the consortium should be identified and the reason explained in the proposal. These NCPs are nevertheless invited and encouraged to participate in the project activities (e.g. workshops).

NCPs from third countries who have been officially appointed by the relevant authorities are also welcome to participate in the project activities.

The costs incurred by the consortium for participation of officially appointed NCPs from EU Member States and Associated countries not participating in the consortium, and from officially appointed NCPs from third countries on the official list in part A of the General Annexes of the General Work Programme, e.g. travel costs paid by the consortium, may be included in the estimated budget and be eligible for funding by the Commission.

The Commission considers that proposals requesting a contribution from the EU between EUR 250 000 and 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting another amount. **No more than one proposal will be funded.**

EXPECTED IMPACT:

- An improved and professionalised NCP service across Europe, thereby helping simplify access to Horizon 2020 calls, lowering the entry barriers for newcomers, and raising the average quality of proposals submitted.
- A more consistent level of NCP support services across Europe.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 50-2016: Networking and sharing best experiences in using regional clusters strategies with a focus on supporting innovation in the NMBP thematic area.

SPECIFIC CHALLENGE:

The development of the smart specialisation strategies has put in place a more structured framework for programme and project implementation regarding regional/ sector specialisations. This can help improve the knowledge that can be provided regarding NMBP related actions. Many Member States already identified the need to improve the articulation between NMBP and ESIF.

Regions find it still difficult to mobilise their internal resources in combining technology and regional development. Regional public private partnerships or regional clusters play a key role in this approach to connect EU-wide entrepreneurship and innovation (in particular in SMEs) to the European agenda.

The partners of the CSA should show the EU innovation and industrial policy for new growth in NMBP needs to build on regional resources and potentials. Interlinking the regional ecosystems and clusters into new innovation driven cross-EU value chains could be the key to articulate competitive positions, meet global challenges and achieve a balanced and sustainable growth.

The CSA should bring representatives from: higher education institutions; large companies; SME's, relevant European organisations and associations; as well as national, regional and local authorities from Europe that are involved in preparing regional cluster strategies in the NMBP area.

SCOPE:

The aim is to jointly identify good initiative and novel approaches, key success factors in driving actions forward and to shape strategic priorities for future regional cluster policies at European level in NMBP. Regional clusters are a fertile field where synergies can be achieved.

Regional clusters have been active in the RIS3 and KETs prioritisation process and can continue to play an important part in these processes, for example by acting as a resources channel towards SMEs and help structure KET based industrial value chains. Regional clusters can be key delivery instruments for national and regional smart specialisation strategies, re-industrialisation and SME policy.

The CSA should take into consideration and build on existing or ended coordination actions in the NMBP area that tackled the issue of programming synergetic actions between EU and MS in the NMP Programme and generated results and recommendations for specific co-investment opportunities, linked to global market needs.

The Commission considers that proposals requesting a contribution from the EU between EUR 250 000 and 500 000 would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting another amount. **No more than one proposal will be funded.**

EXPECTED IMPACT:

- Boosting regional structural change through modern regional cluster policies;
- Identify regional cluster and business networks collaboration across borders and sectoral boundaries in the field of NMBP.
- Identification of best regional cluster strategies in the NMBP area;
- Identifying priorities for future regional cluster actions in NMPB; New trends, challenges and visions for cluster policy;
- Defining the role of clusters for regional smart specialization (e.g. cluster mapping, strategic roadmaps, public procurement instruments)

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 51-2017: Governing innovation of nanotechnology through enhanced societal engagement

SPECIFIC CHALLENGE:

In order to reach responsible research and innovation in nanotechnologies, innovative processes are needed to improve the responsiveness of research & innovation processes to public values and concerns and to ensure that research & innovation truly respond to societal challenges and take into account the social and environmental consequences from the outset.

SCOPE:

The proposed action should follow-up on previous EU and national projects in the field of societal engagement and address the governance of innovation and implementation of Responsible Research & Innovation (RRI) through multi-stakeholder pilot projects that will focus on concrete product development at an early stage in order to consider the ways that nanotechnologies can help to address societal challenges and to consider needs and concerns. These stakeholders should include research, producers, professional users and consumers. The proposed pilot projects should also include ex-post evaluations of the learning process between stakeholders in previous engagement projects and societal debates on emerging technologies, contribute to the concrete realisation of RRI conditions in nanotechnologies and produce policy recommendations on how to govern research & innovation in nanotechnologies (and other emerging technologies) in a responsible way.

Supporting activities to be undertaken in the project could include empowering of stakeholders to co-create nanotechnology research and innovation by enabling them to formulate and communicate their interests and concerns, and designing ways to give them a voice in R&I processes. These activities could also include the training of researchers and engineers in ways to include societal considerations in their work and to inform policy makers about the need and possibilities to integrate societal considerations in research & innovation.

This action is to be based on the concept of Mobilisation & Mutual Learning (MML) platforms. The project should include the appropriate disciplines of Socio-Economic Sciences and Humanities. Gender balance should be taken into account.

Possible horizontal aspects addressed by topic:

- SSH dedicated topic
- Gender aspects

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Early and continuous engagement of all stakeholders will be essential for sustainable, desirable and acceptable innovation in nanotechnologies, where R&I is aligned to the values, needs and expectations of society.

The outcomes of the pilot will lead to a roadmap for a responsive R&I system, co-production of knowledge and better acceptability of nanotechnologies outcomes.

The project will build trust between citizens, and public and private institutions, leading to co-creation of new R&I and increased confidence of companies to invest in new technologies.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 52-2017: Enhancing public awareness on nanotechnology

Note: Subject to budget availability, this could be an additional CSA for 2017

SPECIFIC CHALLENGE:

Surveys have shown that the awareness of the public about nanotechnology is low. Innovative outreach activities are needed to improve societal understanding of nanotechnology and to take into account societal expectations and concerns.

SCOPE:

The major efforts of the project should be dedicated to enhancing the general public's awareness and understanding of nanotechnology with balanced, reliable and easily accessible information on how nanotechnology is contributing to solving specific societal challenges and is used in daily life, e.g. via the mass media (TV, daily newspaper...) and websites.

To reach the general public the project should foster communication between journalists and scientists/researchers, e.g. by organising workshops where journalists receive first-hand knowledge of scientific nanotechnology related lab research, inter alia resulting from EU funded projects (FP7 and Horizon 2020). Activities to be undertaken in the project could also include capacity building of scientists/researchers in science communication, establishing a 'journalist in the lab' exchange scheme, conducting public opinion polls, and the development of publishable materials, such as media supplements and media micro sites.

The proposed action should build on previous and current Framework Programme's outreach projects in the field of nanotechnology and should assess the outreach figures attained by the project during its entire life cycle and should monitor whether the target audience has reached a higher awareness and understanding of nanotechnology.

This action is to be based on the concept of Mobilisation & Mutual Learning (MML) platforms. The project should include the appropriate disciplines of Socio-Economic Sciences and Humanities. Gender balance should be taken into account.

Possible horizontal aspects addressed by topic:

- SSH dedicated topic
- Gender aspects

The Commission considers that proposals requesting a contribution from the EU between EUR 1 and 2 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

Enhanced contacts between scientists/researchers and journalists will lead to more publicly available information on nanotechnology that is understandable to the lay public, will improve transparency, enhance public awareness and understanding of nanotechnology and enhance trust in nanotechnology research.

TYPE OF ACTION: Coordination and Support Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.

NMBP 53-2017: (Multi-scale modelling based development of) innovative solutions for the conservation and preservation of post-war cultural heritage**SPECIFIC CHALLENGE:**

Europe's highly diverse and rich cultural heritage is seen as a powerful instrument that provides a sense of belonging amongst and between European citizens. Next to this societal impact, CH has also significant economic impact through activities such as tourism, restoration, and maintenance. However, tangible CH is endangered by significant deterioration of voluntary or involuntary anthropogenic origin and by other threats.

Post-war cultural heritage is often confronted to different deterioration mechanisms than more ancient cultural heritage for reasons such as the use of modern materials. This requires additional research efforts regarding material composition and ageing processes.

SCOPE:

Two main elements should be addressed:

- Projects should develop one or more innovative solutions (functional materials or techniques) for the restoration or preventive conservation of tangible post war (i.e.

post 1945) cultural heritage. To maximise the impact, the most relevant issues and objects should be identified and addressed.

- While modelling and simulation based approaches in the development of advanced materials and devices play nowadays an important role, such approaches have been, so far, less developed in the area of CH conservation. Therefore, the developments should be based on multi-scale modelling (in the sense of linking different types of models such as electron, atomic, continuum etc.) approaches. Key issues such as compatibility, durability, ageing, and reversibility of interventions could be addressed by the modelling approaches.

The proposed materials/techniques are expected to ensure long term protection and security of cultural heritage, taking into account environmental and human risk factors. An environmental impact assessment of the proposed solutions is to be included to ensure the development of sustainable and compatible materials and methods. Focus on innovative and long-lasting solutions in the conservation of cultural assets is expected.

Projects are encouraged to base their modelling software development on on-going efforts in the development of open simulation platforms and to use to a large extent existing models. Projects should have an element of model validation based on experimental data. The majority of resources is expected to be invested in the actual material/technology development and testing, rather than the development of new models.

Standardisation and/or the production of (certified) reference materials may also be covered.

The projects should present clearly measurable objectives for the proposed developments. The core activities regarding the materials/techniques are expected to reach TRL 6 by the end of the project.

Possible horizontal aspects addressed by topic:

A significant participation of SMEs with R&D capacities is encouraged. A participation of relevant Social Sciences and Humanities disciplines is expected.

Projects are expected to contribute actively to on-going activities in the EMMC (European Materials Modelling Council) and clustering activities of other funded projects.

The project proposals should include an outline of the initial exploitation and business plan, backed by credible quantifications, to be further developed further in the proposed project.

Activities are expected to focus on Technology Readiness Levels 4 to 6

The Commission considers that proposals requesting a contribution from the EU between EUR 6 and 8 million would allow this specific challenge to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other amounts.

EXPECTED IMPACT:

- Practical and affordable materials/technique solutions in terms of cost and/or complexity of operation by those who will use them.
- Increased efficiency of materials/technique development for CH conservation, also beyond the specific cases selected by the proposers.
- Increased use of multi-scale modelling in the development of solutions for CH preservation and conservation.
- Improved modelling-based decision making regarding conservation interventions.
- Clear prospect for (quantified) socio-economic gains from the proposed solutions.
- Contribution to open repository of simulation and/or experimental data.
- Contribution to EC policies on cultural heritage.

TYPE OF ACTION: Research and Innovation Actions

The conditions related to this topic are provided at the end of this call and in the General Annexes.