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H2020 opportunities for research and innovation in Production Management and Engineering.

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Horizon 2020 is the new financial instrument implementing the European Union, a global initiative aimed at securing Europe's competitiveness and creating new growth and jobs in Europe. This new EU programme for research and innovation will run from 2014 to 2020 with a budget over €70 billion.

What's new compared with previous framework programs? Horizon 2020 major goal is helping to bridge the gap between research and the market. Research remains essential but innovation plays now an important role. This market-driven approach include creating public-private partnerships to bring together the resources needed. On the other hand, a two year perspective will be provided in order to allow researchers more time to prepare proposals and more scope to make innovative proposals.

The Horizon 2020 calls are structured in three priorities: Excellent Science, Industrial Leadership and Societal Challenges which cluster different thematic areas with funding allocation (Figure 1).

The proposed support for research and innovation under Horizon 2020 aims i) to strengthen the EU's position in science (priority 1) by boosting to top-level research in Europe, ii) to strengthen industrial leadership in innovation (priority 2) with major investment in key technologies, greater access to capital and support for SMEs and iii) to help address major societal challenges (priority 3) shared by all Europeans such as climate change, developing sustainable transport and mobility, making renewable energy more affordable, ensuring food safety and security, or coping with the challenge of an ageing population.

Horizon 2020 aims to raise the level of excellence in Europe's science base and ensure a steady stream of world-class research to secure Europe's long-term competitiveness, supporting the best ideas, developing talent within Europe, providing researchers with access to priority research infrastructure and making Europe an attractive location for the world's best researchers.

The Competitive Industries objective aims at making Europe a more attractive location to invest in research and innovation. It will provide major investment in key industrial technologies, maximise the growth potential of European companies helping innovative SMEs to grow into world-leading companies.

Leadership in enabling and industrial technologies will support the development of technologies underpinning innovation across a range of sectors with a strong focus on developing European industrial capabilities in Key Enabling Technologies (KETs).

What are the opportunities in Horizon 2020 for the Production Management and Engineering (PME) domain?

Priority 2 "Leadership in enabling and industrial technologies" (LEIT) contains six domains: i) Information and Communication Technologies, ii) Nanotechnologies, iii) Advanced Materials, iv) Biotechnology, v) Advanced Manufacturing and Processing and vi) Space. The research and innovation in PME is mainly related with Advanced Manufacturing (management and engineering) but also with Information and Communication Technologies (as support of management).

Priority 1: Excellent Science	
European Research Council	13,0K M€
Future and Emerging Technologies	2,6K M€
Marie Skłodowska-Curie actions	6,1K M€
Research infrastructures	2,4K M€

Priority 2: Industrial Leadership	
Leadership in enabling and industrial technologies	13,5K M€
Access to risk finance	2,8K M€
Innovation in SMEs	0,6K M€

Priority 3: Societal Challenges	
Health, demographic change and wellbeing	7,4K M€
Food security, sustainable agriculture, marine and maritime and inland water research & the Bioeconomy	3,8K M€
Secure, clean and efficient energy	5,9K M€
Smart, green and integrated transport	6,3K M€
Climate action, resource efficiency and raw materials	3,0K M€
Europe in a changing world-inclusive, innovative and reflective societies	1,3K M€
Secure societies-protecting freedom and security of Europe and its citizens	1,6K M€

Figure 1. H2020 priorities, thematic areas and funding (proposal).

The most interesting challenges in the LEIT-NMP work programme are "Factories of the Future" with topics as:

- *Global energy and other resources efficiency in manufacturing enterprises*: development of new value-chain approaches oriented to reducing energy and resource consumption along the whole value chain, including final users and recycling or reprocessing companies through the implementation of common resources optimization.
- *Developing smart factories that are attractive to workers:* creation of new methods and technologies for an optimised use of workers' knowledge to enhance work related satisfaction, taking into consideration safety and ergonomics of the working areas.
- *Innovative product-service design using manufacturing intelligence:* development of tools and methodologies to effectively involve customers and suppliers across the value chain through the collaborative management of engineering knowledge and its exchange between product design, service design and manufacturing.
- *Manufacturing of custom made parts for personalised products:* development of advanced design and manufacturing technologies able to transform product-service data descriptions and protocols into manufacturing operations and processes, seamless data integration across the process and supply chains for the fast production and distribution of personalised products.
- *Sustainable product life cycle management focused on reuse, remanufacturing and recycling related to advanced materials:* development of new methods and technologies for the replacement or reduction of critical raw materials through new equipment concepts, design and components for remanufacturing and recycling.
- *Integrated design and management of production machinery and processes:* development of accurate simulation models and algorithms for model-based control of production machinery and demonstration of the reliability of model-based machines with respect to production accuracy, quality, maintainability and lifecycle return-on-investment.

Regarding LEIT-ICT, also in "Factories of the Future", three interesting topics appear:

- *Process optimisation of manufacturing assets:* Cyber-Physical Systems based processes optimisation for adaptive and smart manufacturing systems with advanced control and new modelling and simulation technologies. Development of agile Cloud-enabled collaboration tools for

process optimisation of manufacturing assets across the supply chain.

- *ICT-enabled modelling, simulation, analytics and forecasting technologies:* development of modelling and simulation methods involving multiple phenomena, including multi-scale and integrated discrete/continuous models taking a holistic approach. Development of integrated knowledge-based systems covering the complete product life-cycle with advanced analytics and self-learning capabilities exploiting the availability of "big data" from smart sensors, historical process files, or human-authored data. And development of integrated information management systems for product-process-production systems embedded into their social, environmental and economic context.
- *Innovation for Manufacturing SMEs:* high-performance computing Cloud-based modelling, simulation and analytics services for modelling multiple interconnected phenomena, integrating novel mobile interfaces for data management and decision support, achieving real-time response. Integration of Cyber-Physical-System modules in manufacturing processes to increase sophistication and automation in production SMEs.

Finally, there are a couple of interesting topics at challenge "Nanotechnology, Advanced Materials and Production" (NMP):

- *Business models with new supply chains for sustainable customer-driven small series production:* development of integrated business model solutions for customer-driven supply chain management for novel distributed manufacturing, sourcing and design solutions linking individual "home-based" designers and manufacturers to the supply-chain.
- *Transformation of the innovation process in industrial value chains by the introduction of open innovation networks:* analysis of existing network innovation solutions and current best practise. Knowledge integration of the value chain and of technology and service providers in the process of innovation.

Priority 3 "Smart, green and integrated transport" contains "Logistics" with three topics:

- *Transport advantages and implications of mutualisation of the supply chain and e-commerce:* new concepts for the design, development and application of consolidation and distribution centres in cities for last-mile distribution and reverse logistics, Co-operative Intelligent Transport Systems (C-ITS) and cloud based services, integrated into an on-line planning platform offering new means of communication amongst vehicles, between delivery vehicles & traffic management and to end users.
- *De-stressing the supply chain: the potential for slow steaming and synchromodality to improve business efficiency and sustainability:* development of a transnational Logistics Information Platform and a well-defined core network of hinterland connections and information systems including e-freight tools, infrastructures and smart coordination mechanisms to be able to use different transportation modes flexibly to deliver maximum value to the shipper or end customer.
- *European Logistics Information Sharing Architecture:* mobile communications for secured information exchange among users, service providers and operators through the deployment of web-based open and platform to enable information exchange across suppliers, manufacturers, logistics providers and retailers without necessitating costly interfaces.

As novelty, the technologies addressed in the LIT-NMP work programme make use of the concept of Technology Readiness Levels (TRLs) as a measure to assess the maturity of developed technologies during its development at the projects:

TRL 1: Basic principles observed.

TRL 2: Technology concept formulated.

TRL 3: Experimental proof of concept.

TRL 4: Technology validated in laboratory.

TRL 5: Technology validated in industrial environment.

TRL 6: Technology demonstrated in industrial environment.

TRL 7: System prototype demonstration in operational environment.

TRL 8: System complete and qualified.

TRL 9: Actual system proven in competitive manufacturing environment.

Europe 2020 is the EU's growth strategy for the coming decade. European citizens want the EU to become a smart, sustainable and inclusive economy in order to achieve high levels of employment,

productivity and social cohesion. EU has set five ambitious objectives on employment, innovation, education, social inclusion and climate/energy, to be reached by 2020. The Innovation Union plan contains over thirty actions points, with the aim of i) making Europe into a world-class science performer, ii) remove obstacles to innovation which currently prevent ideas getting quickly to market and iii) revolutionise the way public and private sectors work together through Innovation Partnerships between the European institutions, national and regional authorities and business.

The Production Management and Engineering (PME) domain of research and innovation is ready to face these challenges.