

Preliminary Recommendations Work Programme 2023-2024

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1 Preliminary recommendations for the WP 2023-2024

1.1 Preliminary recommendations associated to Specific objective 1: 'Excellent, responsive and smart factories & supply chains'

- Consider the 'recovery' of the call topic TWIN-TRANSITION-XX-2022: Smart sustainable production of complex products (RIA) that appeared in first drafts of the HE WP 21-22
 - Associated to R&I Objective 1.5: Advanced Manufacturing processes for smart and complex products
 - We need to define 'complex products' without being too sector-specific
- High-precision manufacturing
 - Is associated to R&I Objective 1.3: Zero-defect and zero-downtime high-precision manufacturing, including predictive quality and non-destructive inspection methods, however this R&I Objective covers many requirements at the same time. A specific call topic on high-precision manufacturing may be required
 - We need to define 'high precision' without being too sector-specific
- Zero-defect and quality
 - Associated to R&I Objective 1.3: Zero-defect and zero-downtime high-precision manufacturing, including predictive quality and non-destructive inspection methods
 - European leadership in top-quality sustainable manufacturing capabilities should be a priority.
 - Software/hardware on factory floor level needs to be covered well. Sensorisation, advanced mechatronics,...
 - Real-time (<msec) interaction and action between agents across all levels of a manufacturing system should be the ambition (associated to the concept 'Decentralised Technical Intelligence (DTI)' that is promoted by the MANUFUTURE ETP: a highly efficient, highly resource-efficient, circular and climate-neutral Manufacturing System, through self-control and self-optimisation (e.g., communication, conflict resolution, decision-making, prediction and adaptation) of all processes along the networks at all levels of a manufacturing system (production network, sites, segments, cells, workplace machines processes), involving all (artificial and human) actors. This is taking further the concept of 'Cyber-Physical Systems' and integrating it in a DTI system. As such, it is also not limited to "zero defect and quality", will enable many self-optimisation processes in the learning factories. It is also associated to data availability, quality of data, monitoring, modelling, modularity, etc...
- Manufacturing value networks and their role in with services associated to manufacturing
 - Is associated to R&I Objective 1.1: Data 'highways' and data spaces in support of smart and real-time connected factories in dynamic and robust value networks
 - This can be associated to the experience with covid, but rather as an example, since there are many potential unexpected events that require resilience.
 - This can be associated to 'reshoring', but this should be seen rather in a context of regional reallocations, taking into account customers (B2B) needs from a regional perspective
- Digital twins plays an important role across many areas, also on a value network level

1.2 Preliminary recommendations associated to Specific Objective 2: 'Circular products & Climate-neutral manufacturing'

- This topic title was included in the first drafts of the HE 21-22 Work Programme, but eventually dropped out: TWIN-TRANSITION-XX-2021: Circular by design manufacturing (IA)
 - This could become 'Circular products through innovative (re-)manufacturing'
- Place manufacturing and re-manufacturing in a central position. The value/functions of the product should be retained much longer and should be designed and manufactured according to this requirement.
 - The value to the customer is also essential of course and this links to Specific Objective 3. See R&I Objective 2.4 and also Specific Objective 3 (since there are many 'service aspects' along the product lifecycle associated to this).
 - The variability of the products that are 'flowing back' is a big challenge, requiring a lot of technologies (sorting, identification / measuring). This creates a lot of complexity / different flows, requiring a lot of support in decision making. Furthermore, how to address a high mixture also in terms of quality.
- The economic aspect of environmental sustainability should be addressed.
 - Making the transition to circular manufacturing an economically viable option. The business aspect should also be an important driver in this transition.
 - Research and innovation will also support compliance with regulation (which is another driver for the introduction of tracking and tracing , IIoT, etc...
- The scope of circular and in a broader sense environmental sustainability needs to be clearly defined within call topics. For instance: Resource-efficiency, including energy or not, coverage of emissions....
- The cross-sectorial value network approach is very important. Circularity can create a lot of new opportunities across sectors and it takes more effort to explore these opportunities
- When addressing 'secondary materials' in circular manufacturing, the measurement of the quality of these materials is an important aspect (depending on the sector in which these will be re-used), also associated to standardisation and certification. The processing of recovered materials needs to be aligned with where they will be reused (in different sectors).
- The pathway for industry that supports this transformation and how the projects contribute to this pathway needs to be addressed. There are many sectorial approaches; there is a need for strategic insight and coordination into how the circular factories will be operated (across sectors)
- Circularity requires data frameworks
 - Associated with R&I Objective 2.5: Digital platforms and data management for circular product and production-system life cycles

1.3 Preliminary recommendations associated to Specific Objective 3: 'New integrated business, product-service and production approaches; new use models'

- R&I Objective 3.1 expresses essentially what we wish to achieve and strengthen within the WP 2023-2024.
 - Two 'optimisation' perspectives can be highlighted:
 - excellence of manufacturing

- environmental sustainability, including circular manufacturing
- The possible emphasis of future call topics in WP 23-24 would be both on the services/business mechanism and on the enabling technological aspects.
- The value networks will need to be addressed further, for instance how they can serve as building blocks for high road strategies towards Smart Industrial Specialisation at the level of organisations and ecosystems. Also focus more on the 'quality' of services ('zero-defect' services).
- Ideally both of the following approach should be pursued:
 - Introduce more requirements for addressing service/business model aspects in different call topics of the programme
 - Request a specific call topic on services/business model aspects in manufacturing which can be based on a revised version of R&I Objective 3.1.
- Address the role of manufacturing 'service' platforms (intermediate players in the manufacturing ecosystem)

1.4 Preliminary recommendations associated to Specific Objective 4: 'Human-centered and human-driven manufacturing innovation'

- Supporting creativity in design and engineering
 - Associated to R&I Objective 4.1: Digital platforms and engineering tools supporting creativity and productivity of research & development processes
 - 'Engineering' Creativity can in particular be stimulated in the design and engineering phase of products and the production
- In order to stimulate innovation via creativity, test facilities should be exploited much more
 - Such 'testing and experimentation facilities' offer environments where equipment can be operated and that is not subject to all regulatory/certification constraints of an industrial manufacturing facility
 - Testing facilities can act as 'sandbox environments' for stimulating creativity and innovative human-centered manufacturing approaches
 - Associated to R&I Objective 4.3: Human & technology complementarity and excellence in manufacturing
- Augmented human capabilities in manufacturing
 - This can be associated to the use of AI in manufacturing, but this goes far beyond human-robot cooperation
 - Digital Twins and augmented/virtual reality are key enablers
 - Associated to R&I Objective 4.2: Advanced human-device interaction.
 - Digitalisation can offer support for accelerating certification of innovative solutions
- Re-skilling: How to bridge new jobs in manufacturing with the existing workforce.
- Address R&I Objective 4.4: Manufacturing Innovation and change management
 - Address all enablers, also non-technology enablers, for instance
 - **Shared leadership** : leadership risks during a change process, the role of worker participation in innovation, labour market impact of new technology implementation, etc
 - the relation between technology and **work organisation**: how to break down silos between different manufacturing company departments (typically between development and production, between IT and OT, between supporting functions, etc.)
 - how to **improve resilience/speed of the organisation** by introducing workflow management systems (QRM, etc), moving decision power

downwards through the introduction of (multi-disciplinary) teams on the shop floor

- Address barriers associated to certification of products and skills in innovative manufacturing
- The development and deployment of an integral and systemic innovation model, integrated with all strategic and operational processes, bringing all crucial aspects (transformation areas AND the implementation process) in one approach, thereby combining technological AND non-technological innovation drivers
- Address R&I Objective 4.5: Technology validation and migration paths towards full industrial deployment of advanced manufacturing technologies by SMEs
 - This objective should be supported with additional activities, amongst which I4MS projects (see the recommendation about testing and experimentation facilities)