

Clustering

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Some questions for you

- Why collaboration between various European research projects is crucial?
- How to select the relevant focus points for inter-project collaboration?
- How inter-project activities can facilitate the internal project activities?

Importance of inter-project collaboration

The DMP cluster represents the growing group of European research projects from the production domain that specifically focus on manufacturing quality improvement and Zero-Defects Manufacturing (ZDM). The goal of the cluster is to facilitate the interchange of ideas among the involved projects and thus accelerate progress in the ZDM area. To achieve this, a ZDMP Cluster Strategy, which is based on collaborative topics that are of common interest to the cluster's projects, has been elaborated. These topics were carefully selected to potentiate the cooperation amongst all cluster projects. The selected topics cover different areas and are perfectly aligned with "DT-ICT-07-2018-2019: Digital Manufacturing Platforms for Connected Smart Factories" four pillars: (i) Platform Building, (ii) Large-scale Piloting, (iii) Ecosystem Building and (iv) Standardization. The first pillar is a technical one, where issues such as common reference architectures, interoperability frameworks, open-source platforms or B2B data sharing should be addressed in a common way. A Catalogue or Handbook of Open-Source components that could be shared also can play a key role within this pillar. The Large-scale piloting pillar addresses common approaches, business KPIs, digital maturity or joint skills, methodologies, and tools for pilot's conduction, and also the joint cooperation on open calls. Platform and ecosystem building intend naturally to lead to an active cooperation on market analysis and business models amongst the cluster projects. The aforementioned pillars are the focus of cooperative dissemination activities to enhance the impact of the cluster projects beyond what is established in their individual impact strategy. Finally, standardization has been addressed as a key cooperative topic in order to identify potential new domains for specific standards and enhance the application of existing ones.

Identified Topics

The identified topics have the aim to build synergy and facilitate inter-project collaboration in conjunction with best-practices and an exchange of lessons learned. Moreover, the joint work on selected topics can significantly accelerate the progress by combining resources of several projects whilst still maintaining the core focus on individual project's goals. The following core topics or working groups (WGs) are in the scope of the DMP Cluster, namely:

- **WG 1 – Standardization** is to promote the wide implementation of the standards within individual projects, as well as cluster activities towards standardization. Other related activities include the establishment of a portfolio of the common standards used by projects, identification of existing gaps in the used standards and establishment of CEN CENELEC Workshops on Digital Manufacturing including the Workshop on zero defects terminology. These standards are partially classified according to 5 domains Security and Safety, Interoperability, Quality, Artificial Intelligence, and Reference Architectures / Frameworks
- **WG 2 – Dissemination** is an important activity to communicate clusters advances. This topic considers the active participation in joint dissemination actions to communicate and promote the cluster results to technology and service providers, as well as other business users and/or stakeholders. This activity foresees:
 - Joint event(s) participation
 - Production of joint dissemination materials such as cluster brochures, posters, blog posts; newsletters or videos
 - Cross-project communication to exchange the content
 - Conference calls for activities coordination
 - KPIs development to assess the reach and success of dissemination activities
 - Open calls promotion through a number of channels available by cluster participants to increase the coverage. In the case of ZDMP, the Open Call offers additional funding for non-project participants to

test the ZDMP platform, as well as suggest and develop new services and application that can potentially improve the ZDMP ecosystem

- **WG 3 – Scientific and Socio Economic Impact** aims at publishing of innovative results in leading journals and conferences. This ensures an effective transfer of produced knowledge to the relevant industry and technical communities, research, and academic practitioners. The activities are based on the following pillars: Scientific, Societal including ethics and digital privacy; Economic. The Scientific includes work on joint research challenges and elaboration of pathways, as well as research publications around a set of identified subjects. Societal pillar deals with issues of usefulness analysis of the research results for the society and knowledge transfer from the projects to academia to educate the new generation of engineers. The last pillar is focused on collaborative efforts to increase the economic impact, otherwise not achievable by single projects and also on suitable business models to support these collaborative activities.
- **WG 4 – Experimentation:** Every project has a set of pilots or use-cases to validate the deliverables of the project within the real-world scenario. In this regard, pilot activities will be jointly addressed to increase knowledge on pilots' description, conducting, and assessment. Analysis of existing pilots' templates and descriptions will be used to achieve a possible common representation methodologies and semantic interoperability.
- **WG 5 – Platforms and Architectures:** Exploiting synergies between technology-based platforms, whilst addressing issues such as architecture, interoperability and standard approaches. Activities involve the analysis of existing reference architectures, specific requirements and needs. This will lead to the identification of reference architectures, interoperability patterns and common cross-domain components, open-source implementations mapped with reference architectures, and interoperability with existing projects marketplaces.

Overview of involved projects

- **Zero Defects Manufacturing Platform (ZDMP)** combines state of the art zero defect technological approaches based on commercial grade or open-source software, with built-in software for any gaps, and with an open development approach and zApp store. It focuses on both Process and Product quality for pre, during, supervisory, and post-production quality issues to ensure manufacturers are enabled for a Zero Defects environment. ZDMP offers an open Industry 4.0 environment where a new generation of developed zero-defect service applications will be available in a marketplace being a part of an ecosystem where ZDMP stakeholders would be able to interact with each other. (<https://www.zdmp.eu/>)
- **European Connected Factory Platform (EFPF)** is a federated smart factory ecosystem and a digital platform that interlinks different stakeholders of the digital manufacturing domain. The EFPF platform enables users to use innovative functionalities, experiment with disruptive approaches and develop custom solutions to maximise connectivity, interoperability and efficiency across the supply chains. (<https://www.efpf.org/>)
- **Qu4lity** demonstrates, in a realistic, measurable and replicable way an open, certifiable and highly standardised, SME-friendly and transformative shared data-driven Zero Defects Manufacturing (ZDM) product and service model for Factory 4.0 through 14 pilot lines. Qu4lity will also demonstrate how European industry can build unique and highly tailored ZDM strategies and competitive advantages through an orchestrated open platform ecosystem, ZDM atomized components and digital enablers across all phases of product and process lifecycle. (<https://qu4lity-project.eu/>)
- **Smart Human Oriented Platform for Connected Factories (SHOP4CF)** aims to find the right balance between cost-effective automation, repetitive tasks and involvement grade of the human workers Another goal is to pursue the highly-connected factory model to reap the benefits of all the data generated within the factory. (<https://shop4cf.eu/>)
- **ConnectedFactories** project establishes a structured overview of available and upcoming technological approaches and best practices with regard to the digitalisation of manufacturing. The project identifies present and future needs, as well as challenges, of the manufacturing industries. The project explores pathways to the digital integration and interoperability of manufacturing systems and processes. (<https://www.connectedfactories.eu/>)



- **KYKLOS 4.0** aims to develop an innovative Circular Manufacturing ecosystem based on novel CPS and AI based technologies, enhanced with novel production mechanisms and algorithms, targeting personalised products with extended life cycle and promoting energy efficient and low material consumption. KYKLOS 4.0 will demonstrate, in a realistic, measurable, and replicable way the transformative effects that CPS (Circular Production System), PLM (Product Life Management), LCA (Life Cycle Analysis), AR (Augmented Reality) and AI (Artificial Intelligence) technologies and methodologies will have to the Circular Manufacturing Framework. (<https://kyklos40project.eu/>)
- **DigiPrime** has the mission to develop a new concept of Circular Economy digital platform overcoming current information asymmetry among value-chain stakeholders, in order to unlock new circular business models based on the data-enhanced recovery and re-use of functions and materials from high value-added post-use products with a cross-sectorial approach. DigiPrime will create and operate a federated model of digital platforms for cross-sector business in the Circular Economy. (<https://www.digiprime.eu/>)

What will ZDMP Achieve

The ZDMP project as an initiating member of the DMP Cluster participates in the work on all identified topics. The following efforts are performed regarding the previously described topics:

- **Standardization.** ZDMP participates in the CWA (CEN Workshop Agreement) Workshop devoted to development of the ZDM terminology. It includes the study of the terminology offered by other standards that is closely related to ZDM, but also the suggestion of new definitions beyond previously published standards from the manufacturing domain. Moreover, another valuable achievement is the list of standards, around 170 items, covering various aspects of the manufacturing, from quality issues to specific data formats, such as JSON addressed by ISO/IEC 21778 standard. For standardization and interoperability the CWA Workshop are launched combining the efforts of several projects and also discussing the utilization of the outcomes of the past initiatives.
- **Dissemination.** Social networks remain one of the most important dissemination sources in the pandemic time. In this regard, ZDMP highlights all the cluster-related meetings and events to draw attention of the wider audience. Another important work direction is the dissemination of the information about the ZDMP Open Call 1 through the cluster members' social networks and web resources. A vivid example is the publication of ZDMP Open Call 1 announcement by ConnectedFactories (<https://www.connectedfactories.eu/news/open-callzero-defects-manufacturing-platform-zdmp>) .
- **Scientific and Socio Economic Impact.** ZDMP has a leading role in managing working groups for a set of selected topics, for instance security, artificial intelligence and machine learning, circular economy, etc. Already there is a set of published articles on conferences, such as I-ESA20 and PRO-VE20, and also journal publications. The next stage will include the inter-projects publications. During the I-ESA20 (<http://ceur-ws.org/Vol-2900/>) conference an article entitled "Digital Manufacturing Cluster Evaluation Methodology", was presented discussing the issues related to performance management of the Cluster activities. The paper proposed the utilization of Goal Question Metrics (GQM) to assess the performance, as well as some KPIs for the Market Analysis and Business Models.
- **Experimentation.** The work to jointly address the inter-project pilots has just started, due to the fact that the experimentation activities intensify in the second part of the project. More results to be expected in the coming months.
- **Platforms and Architectures:** The exchange of views and opinions about the wide range of the platform-related challenges takes place on an ongoing basis. A good example is the cluster meetings devoted to standardization, interoperability and security issues. During the DMP cluster meeting on security, important issues regarding state-of-the-art technologies and approaches, as well as standards that are implemented within the projects were discussed, allowing all participants to remain informed about actual activities of every single project and exchange ideas.

ZDMP Links

• Architecture Component(s)	N/A
• Work Package	WP13
• Tasks	T13.1a / T13.1b / T13.1c

References/Acknowledgments

None