

# Factories of the Future Public-Private Partnership Progress Monitoring Report for 2017



**Factories of the Future**  
Public Private Partnership



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*Disclaimer: This document has been prepared by the European Factories of the Future Research Association (EFFRA) and it reflects the views only of the authors.*

## EXECUTIVE SUMMARY

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The Factories of the Future Progress Monitoring Report is compiled and published on an annual basis by the official representatives of the Factories of the Future PPP: the European Commission and EFFRA. The PPP's overall objective is to increase the European Union's industrial competitiveness and sustainability through research, development and innovation actions, that leads to the development of new knowledge-based production technologies and systems across multiple sectors.

In 2017, seven calls were published and evaluated: two "research and innovation actions", four "innovation actions" and one CSA. The 2017 budget was 120 million euros (86,18 million euros for the FoF-NMBB calls and 34 million euros for the FoF-ICT calls). In total, 175 proposals were submitted, with 154 for the FoF-NMBP calls and 21 of the FoF-ICT calls.

Stakeholders have been mobilised through relevant events organised by the European Commission or by EFFRA (or jointly) within the Factories of the Future PPP, with the aim of promoting the partnership and its results. These events were: Factories of the Future Community Day (16 May 2017); Connected Factories European Scenario building public workshop (28 September 2017); Industrial Innovation Information Days 2017 (3 & 4 October 2017); Digital Platforms for Connected Smart Factories (19 October 2017); and ManuFuture 2017 (24 & 25 October 2017). Furthermore, the Factories of the Future activities were presented in nine additional events, through stands or presentations. One of the main, and unique, tools empowering the mobilisation of stakeholders and communications is the EFFRA innovation portal. In 2017, EFFRA deployed a new version of the Portal, featuring a more accessible layout, easier access to project information and advanced search functions (to increase transparency and usability).

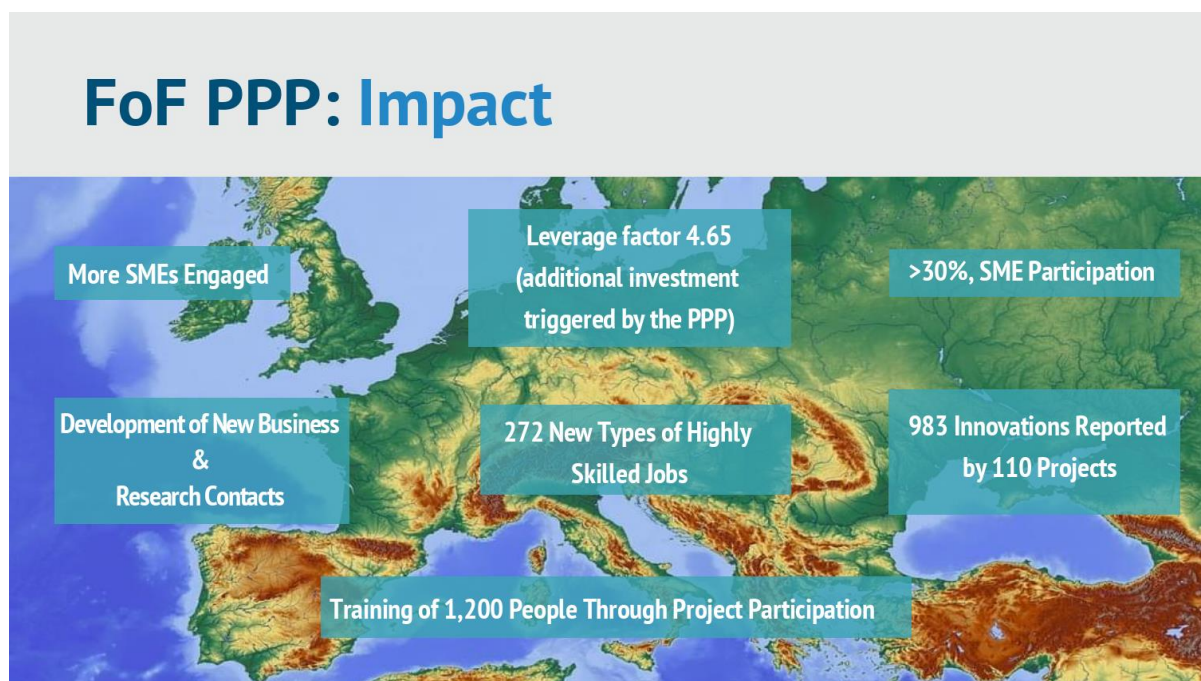


Figure 1: Impact of the FoF PPP

The following is a summary of the overall progress achieved since the launch of the PPP, including a short overview of the relevant KPIs:

- **Mobilised private investments:** based on the information received from the companies through questionnaires, interviews, and data analysis, a leverage factor rate of 4,65 has been achieved. This figure only considers the companies which have participated in FoF projects, thus underestimates the impact of additional investments made by companies belonging to the value chain of the directly participating companies.
- **Number of new high skilled jobs in PPP projects:** 51 projects reported 272 new types of high skilled jobs.
- **Number of new curricula developed in PPP projects:** 31 projects reported 191 new curricula.
- **SME participation:** 31.65 % of the organisations participating in competing consortia competing consortium were SMEs.
- **Significant Innovations:** 110 projects have reported on the EFFRA Innovation Portal, descriptions of 983 results and demonstrators (which went through the EC review process). So far, 56 projects reported 109 patent applications or patent-related activities. 75 projects reported 107 actions that are related to standardisation activities. 15 working items in European Standardisation Bodies were reported and 7 pre-normative research files were also reported.
- **Contribution to the reduction of energy use, emissions, waste and use of material:** regarding CO2 emissions, 40 projects reported an average reduction of 16%. Regarding energy use, 50 projects reported an average reduction of 15%. 41 projects reported an average reduction of 19% in waste generation and 33 projects reported an average reduction of 11% in material resources.

The Factories of the Future partnership continues to make substantial progress: the relevant KPIs and the continuous high interest in the Factories of the Future calls demonstrate that the PPP has identified the right topics and that implementation through projects is effective.

# 1 INTRODUCTION: THE FACTORIES OF THE FUTURE PPP

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This report aims to provide a review of the activities carried out by the Factories of the Future contractual public-private partnership (FoF PPP) in 2017 and the progress made towards the achievement of the objectives in the contractual arrangement under the European Union's Horizon 2020 research and innovation programme.

The Factories of the Future PPP is the European Union's collaborative, multi-sector initiative to support the transformation of manufacturing in Europe through pre-competitive research, development and innovation projects.

The PPP's overall objective is to increase the European Union's industrial competitiveness and sustainability through research, development and innovation, with the development of new knowledge-based production technologies and systems across multiple sectors. This objective should be achieved through a comprehensive approach which addresses the factory shop floor, the value-network, and the eco-system. The overall scope of the FoF PPP can be described as follows:

- Industrial automation, mechanical and electrical machinery and robotics.
- Industrial software for plant design, instantiation and management.
- Competitive and sustainable production technologies.
- Factories eco-systems including material flows and logistics.

The work performed within the PPP in 2017 benefits the following manufacturing sectors, and actors along the value-chains of those sectors.

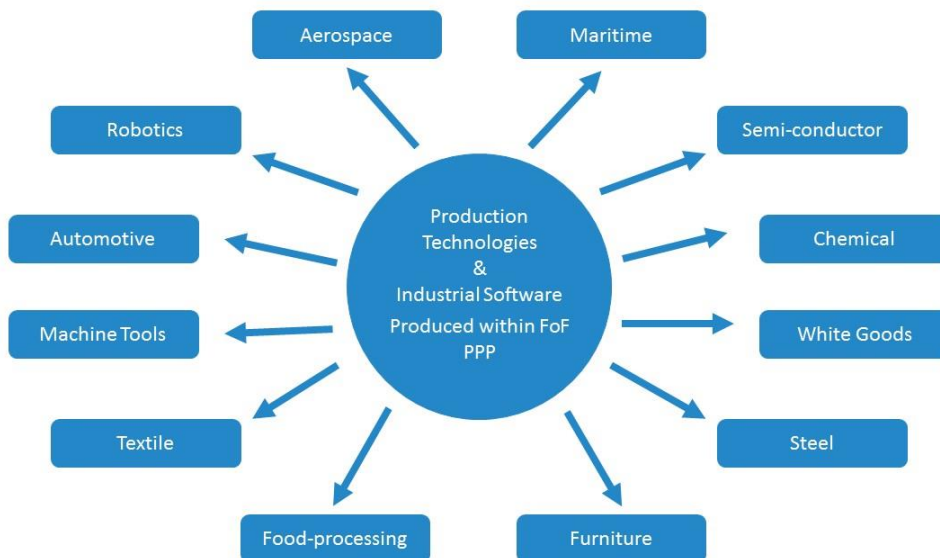


Figure 2: Selection of sectors benefiting from the FoF PPP

The following table provides an overview of PPP projects addressing specific sectors:

<b><u>Sector</u></b>	<b><u>Involved in</u></b>
Additive Tech	FoF2017.12: AMable
Automotive	FoF2017.09: CloudiFacturing / Z-BRE4K
Aviation	FoF2017.09: UPTIME
Diverse SMEs	FoF2017.12: I4MSGo
Food Packaging	FoF2017.12: CloudiFacturing
ICT	FoF2017.12: MIDH
Injection Moulding	FoF2017.0: ProSurf
Laser Technologies	FoF2017.06: ESSIDAL / LASER4SURF / SHARK
LED	FoF2017.10: Repro-light
Logistics	FoF2017.12: L4MS
Machine Industry	FoF2017.09: SERENA / PROPHECY
Machine Tool	FoF2017.09: PreCom / Z-BRE4K
Materials	FoF2017.07: LAY2FORM
Micro-components/Micro-Devices	FoF2017.08: CITCOM
Moulding	FoF2017.06: MouldTex / Himalaia / FoF2017.09: Z-BRE4K
Organic Electronics	FoF2017.08: SmartLine
Smart Mobility	FoF2017.10: FreeWheel
Space	FoF2017.08: SmartLine
Tooling	FoF2017.09: PROGRAMS
Transport	FoF2017.07: RECOTRANS / FoF2017.08: SmartLine
White Goods	FoF2017.09: UPTIME

Through its comprehensive approach, which addresses most of the manufacturing activities in Europe, the PPP aims to support the European Union's industrial policy targets (20% share of EU GDP from manufacturing by 2020 and implementation of technology transfer and training across manufacturing sectors), the Europe 2020 strategy targets of a smarter, greener and more inclusive economy, and the digitisation of industry within a digital single market.

Ultimately, the outcome of the PPP will be to make a significant contribution to the strengthening of industry through manufacturing in Europe. This is particularly important because industry represents a significant portion of Europe's GDP; 64% of private sector investment in research and development is for manufacturing and, more importantly, it provides jobs for 35 million people.

All projects launched since the continuation of the PPP under Horizon 2020 are the result of topics drawn from 'Factories of the Future 2020' – the PPP's strategic multi-annual roadmap.

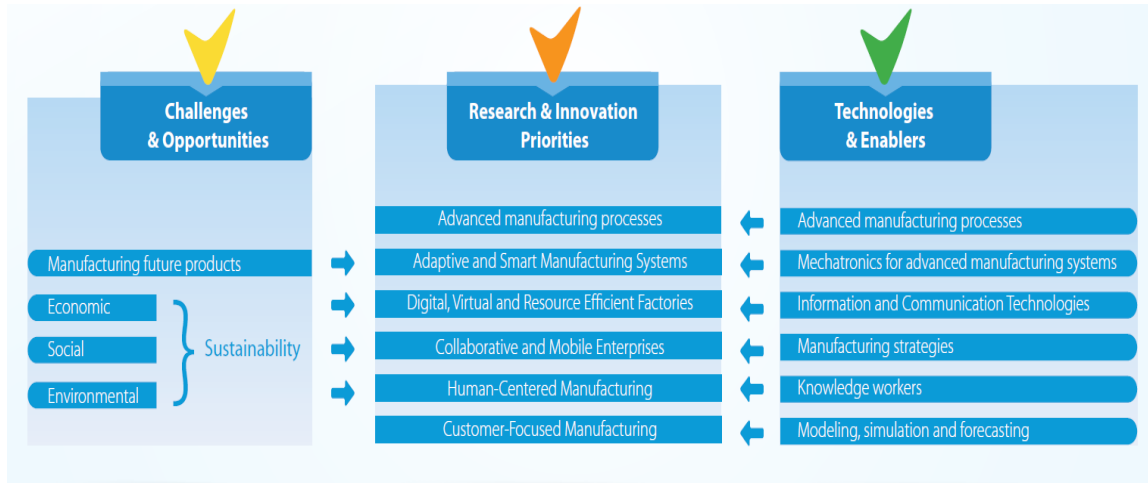


Figure 3: Core Structure of the Factories of the Future 2020 Roadmap

In 2016, in addition to the roadmap, EFFRA published the ‘Factories 4.0 and Beyond’ strategic document to address additional developments since the publication of Factories of the Future 2020 and to provide further guidance for the preparation of the 2018, 2019 and 2020 PPP calls. It is important to recall these key strategic publications because they are at the heart of assuring the broad impact and industrial relevance of the PPP.

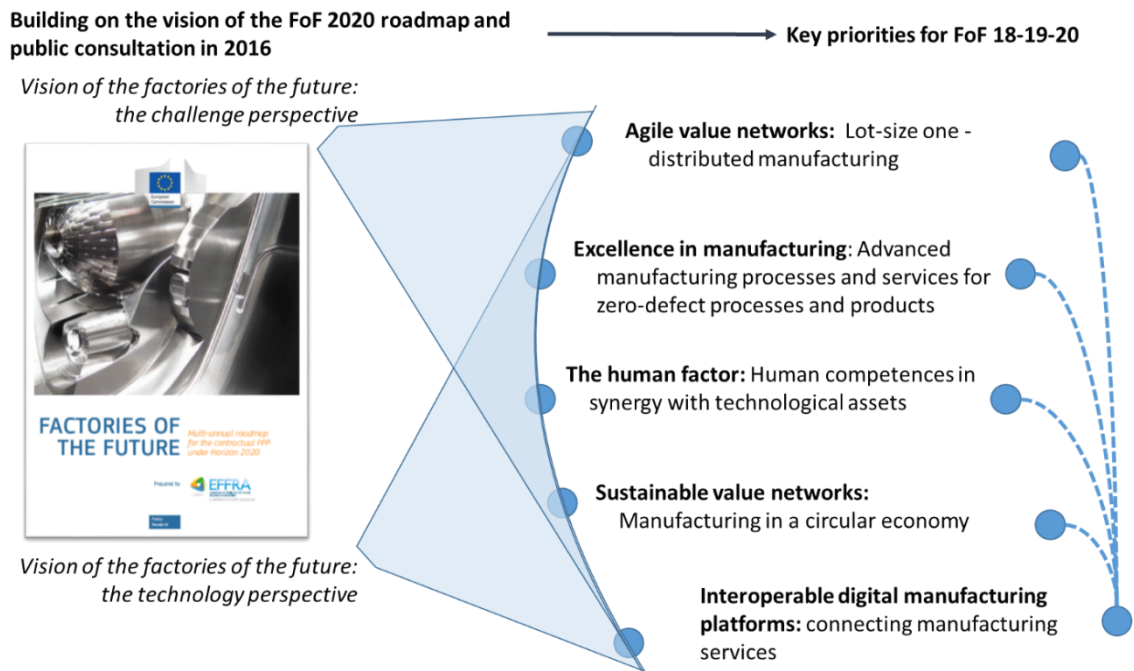


Figure 4: Key Priorities 2018 – 2019 – 2020



## 2 MAIN ACTIVITIES AND ACHIEVEMENTS DURING 2017

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### 2.1 IMPLEMENTATION OF THE CALLS FOR PROPOSALS EVALUATED IN 2017

The FoF calls evaluated in 2017 addressed the following topics:

- New product functionalities through advanced surface manufacturing processes for mass production (FoF.2017.06)
- Integration of unconventional technologies for multi-material processing into manufacturing systems (FoF.2017.07)
- In-line measurement and control for micro-/nano-enabled high-volume manufacturing for enhanced reliability (FoF.2017.08)
- Novel design and predictive maintenance technologies for increased operating life of production systems (FoF.2017.09)
- New technologies and life cycle management for reconfigurable and reusable customised products (FoF.2017.10)
- ICT Innovation for Manufacturing SMEs -I4MS (FoF.2017.12)

Whereas the FoF 6 and FoF 7 calls were Research and Innovation actions, the FoF 8, FoF 9, FoF 10 and FoF 12 calls were Innovation actions. In addition, there was one CSA within the FoF 12 call for I4MS (ICT Innovation for Manufacturing SMEs). The budget allocated in 2017 was 120 million euros (86,18 million euros for the FoF – NMPB calls and 34 million euros for the FoF-ICT calls)

As in previous years the Factories of the Future 2017 calls attracted interest from across Europe. As a result of the 2017 FoF call, 175 proposals were submitted (154 for the FoF NMPB calls and 21 for the FoF ICT calls). 34 FoF NMPB proposals reached the sufficient points to pass the threshold and 18 were able to be funded.

While the 2017 calls were evaluated, the European Commission - with the help of EFFRA - also developed the FoF 2018 call topics with an overall budget of 121 million euros (81 million euros for the FoF NMPB calls and 40 million euros for the FoF ICT calls). All these topics were embedded in the focus area "digitising and transforming European industry and services".

The FoF 2018 call topics were:

- Skills needed for new Manufacturing jobs - DT-FoF-01-2018
- Effective Industrial Human-Robot Collaboration - DT-FoF-02-2018
- Innovative manufacturing of opto-electrical parts - DT-FoF-03-2018
- Pilot lines for metal Additive Manufacturing - DT-FoF-04-2018
- Digital Manufacturing Platforms for Connected Smart Factories - DT-ICT-07-2018

In this context, it should be noted that other calls in the Horizon 2020 programme were partly inspired by the EFFRA Roadmap, such as the NMPB-20–2018 call on a digital 'plug and produce' online equipment platform for manufacturing.

## 2.2 MOBILISATION OF STAKEHOLDERS, OUTREACH, SUCCESS STORIES

### 2.2.1 Mobilisation of Stakeholders and Outreach

In 2017, many events were organised within the framework of the Factories of the Future PPP, either by the European Commission, by EFFRA, or jointly by both parties. In many cases, Factories of the Future topics were embedded within broader conferences and events. All these activities had the aim of:

- Promoting the FoF PPP
- Encouraging participation in FoF calls
- Stimulating interest in advanced manufacturing topics (even if the target audience would not be interested in applying to the call, but has nevertheless interest in manufacturing research topics)
- Broadening the Factories of the Future community
- Showcasing the outcomes of the work developed within the FoF PPP and its projects, and disseminating results
- Promoting and facilitating synergies within the FoF community related to the up-take and exploitation of project results

The following events were organised within the framework of the PPP:

- **Factories of the Future Community Day (16 May 2017)**  
The first Factories of the Future Community Day took place in 2017. It was, after the EFFRA conference in autumn 2016, the second big event providing the Factories of the Future community a platform to share project results and to exchange views on common challenges. Structured around parallel sessions, the event supported networking between projects and industry/research stakeholders.
- **ConnectedFactories European Scenario-building public workshop (28 September 2017)**  
The aim of the workshop was to discuss draft future visions, to explore possible pathways, and to identify practical implications of the digitalisation of manufacturing and the deployment of digital platforms for manufacturing. More information about the progress of this activity can be found [here](#).
- **Industrial Innovation Information Days 2017 (3 & 4 October 2017)**  
The annual Industrial Innovation Information Days 2017 was the main event for the presentation of the annual PPP call topics and for interested participants to network and to identify potential project partners. EFFRA supported this event through its unique Innovation Portal brokerage facility. As in previous Info Days, this facility made it easier for people to upload their presentations and expressions of interest on call topics so that they may find potential partners before, during and after the Information Days.
- **Digital Platforms for Connected Smart Factories (19 October 2017)**  
EFFRA co-organised this workshop with the European Commission with the overall aim of exploring the topic of digital platforms for connected smart factories. The workshop included presentations and input from Factories of the Future projects.

- **ManuFuture 2017 (24 & 25 October)**

Within the ManuFuture 2017 conference, EFFRA organised a session dedicated to Factories of the Future projects. During this session, five project success stories and the FoF PPP were presented to a mixed audience of industry and research stakeholders. In addition, further stakeholder engagement was achieved through the inclusion of expert speakers from the Factories of the Future community in other conference sessions, placing PPP and related experiences in the context of European advanced manufacturing topics.

Factories of the Future activities were also promoted during the following events, either with an FoF PPP/EFFRA stand and/or by Commission officials and EFFRA representatives presenting FoF PPP activities:

- **Digitising European Industry First Stakeholder Forum (31 January & 1 February)**

Because of EFFRA's input and contributions to the planning of this event, the stakeholder forum highlighted the importance of the PPP to a multi-stakeholder audience.

- **Digital Innovation Forum (10 & 11 May)**

EFFRA provided an information booth at DIF 2017 with the aim of promoting the PPP and projects to the embedded and cyber-physical systems community. This stand tied in with the conference's Smart Manufacturing workshop.

- **FUTURING Workshop (27 June)**

The goals of the PPP in the context of sustainability and circular economy were examined during the event. The workshop included interventions from European Commission representatives, stakeholders and international experts from Europe, the US and Asia, with a focus on sustainability and efficiency.

- **I4MS Digital Innovation Hubs (22 September)**

During this event, the work of EFFRA and the Factories of the Future PPP were presented. I4MS initiative-participating projects were presented within the context of the PPP (to which the initiative belongs).

- **Funding & Support Opportunities for Luxembourg Manufacturing (19 October)**

The Factories of the Future PPP, open call topics and project success stories were presented to an audience representing Luxembourg-based industrial companies at this annual national brokerage event.

- **Factories of India 2022 Event (9 September, India)**

For the first time, the Factories of the Future PPP was presented in India by a representative of EFFRA in response to the international interest generated by the success of the PPP. Within the context of fostering cooperation between Europe and India, EFFRA's representative delivered a lecture on the success of the PPP and Horizon 2020. Project success stories were also disseminated.

- **World Manufacturing Forum 2017 (7 to 9 November 2017, Mexico)**

To promote the Factories of the Future PPP and project success stories, EFFRA provided an information stand at this annual international Forum. The PPP has been represented at this annual conference since the inaugural event. In addition, EFFRA's Executive Director presented the PPP in the conference plenary session. Representatives of the Mexican government and of Mexican industry showed significant interest in the Factories of the Future PPP model.
- **ICT Proposer's Day 2017 (9 November)**

This event included the presentation of PPP ICT call topics. EFFRA provided supporting input and widely disseminated the opportunity for stakeholder participation. The EFFRA-coordinated ConnectedFactories project was presented within the context of digitisation within Factories of the Future.
- **European Forum for Electronic Components and System (EF ECS 2017 (5-7 December)**

EFFRA was present in the exhibition and as a speaker to highlight the activities of FoF regarding the digitalisation of manufacturing

Most of these events were public in terms of both participation and dissemination, once again underscoring the openness of the PPP.

### **Communications**

EFFRA continues to use its communications channels to promote and encourage participation in the Factories of the Future PPP, to disseminate project activities and to maintain ongoing links to the wider European industrial and research community. All EFFRA's communications are delivered through specific tools to ensure that the aforementioned activities generate interest, interaction and participation. These tools include the EFFRA website, social media, e- newsletters and print media.

Since the start of Horizon 2020, a strong attention to communication by projects has been developing. Consequently, every Factories of the Future project has its own website and its own communication tools. Furthermore, projects are presented at conferences, industrial and digital trade fairs, and expert workshops.

### **The EFFRA Innovation Portal**

In 2017, EFFRA deployed a new version of the Innovation Portal. The new Portal features a more accessible layout, easier access to project information and advanced search functions. As a result, newcomers, project participants, stakeholders and the public can more easily access information on all of the Factories of the Future projects launched since FP7. This free service supports transparency and contributes to the openness of the PPP.

Furthermore, the new Portal includes a broader selection of characteristics for project reporting from KPIs to the digital mapping framework.

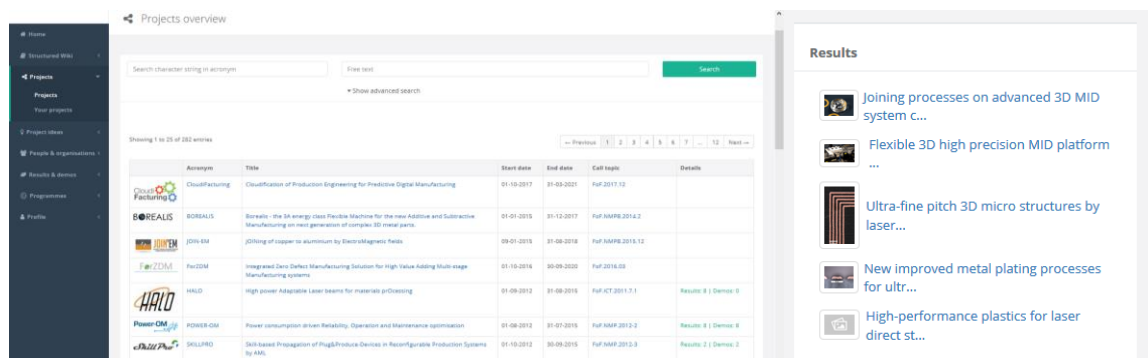


Figure 5: New EFFRA Innovation Portal

The launch of the new Portal strengthens the ability of EFFRA, in collaboration with the European Commission, to measure the progress of projects and to map project achievements in the context of the Factories of the Future 2020 strategic research agenda.

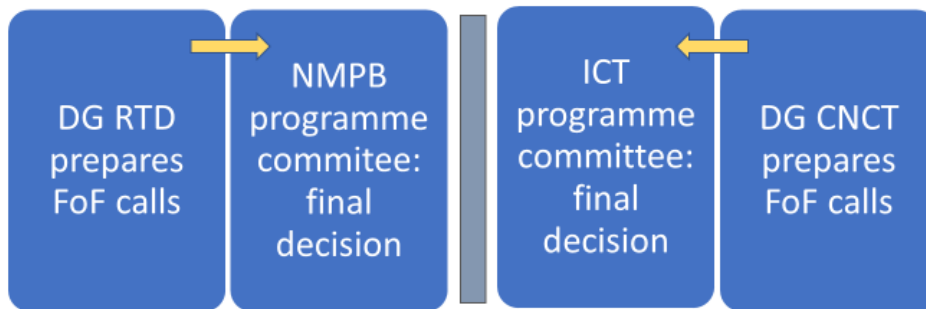
## 2.3 GOVERNANCE

The Factories of the Future PPP is a public-private partnership in which each party has its role. The “public” side is represented by the European Commission (DG Research and Innovation and DG Connect) and the EU members states. The “private” side is represented by the manufacturing stakeholder community composed of industry, research institutes and universities, which are united under the EFFRA umbrella. EFFRA provides the FoF PPP Roadmap and the overall framework for the European Commission for drafting the FoF calls.



Draft FoF call topics - produced by the Commission units in charge of the FoF PPP at DG Research and Innovation (DG RTD) and DG Connect - are then discussed within the Factories of the Future Partnership Board. The Partnership Board is the body that brings together the European Commission officials (representatives of DG RTD and DG Connect) on one side and the experts provided by EFFRA on the other side. The Partnership Board meets several times a year. The composition of the Board reflects the FoF PPP community; in other words, both industry and research institutes/academia are represented.

# Factories of the Future PPP



*Figure 6: Factories of the Future PPP Governance Structure*

All work prepared within the Partnership board then needs to be submitted and approved by the NMBP and ICT programme committees where member states have the final word and the financial authority to approve the calls.

### 3 MONITORING OF THE OVERALL PROGRESS SINCE THE LAUNCH OF THE cPPP

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#### 3.1 ACHIEVEMENT OF THE GOALS OF THE cPPP

The FoF PPP has a very wide spectrum and coverage. It relates directly to several policy objectives of the European Union, such as:

- Boosting growth, investments and jobs
- Making the EU’s economy stronger through the use of new technologies, innovation, ICT and contributing to the creation of digital single market
- Being a strategic programme for the realisation of the Digitising European Industry initiative in the domain of manufacturing
- improving EU sustainability through the development and improvement of sustainable technologies and practices which are reducing waste, increasing energy efficiency and reducing harmful emissions including CO2.

In contrast to earlier EU research programmes where the PPP model did not exist, the FoF PPP has improved the quality of manufacturing-related EU R&D programmes and call topics by bringing together European Commission representatives, industry stakeholders and technology experts. This has been confirmed not only by interviews with stakeholders, Commission experts and member states experts, but also by objective data: notably, industry and SME participation have increased significantly.

With the inclusion of industry-relevant priorities into the calls, more industry and technically oriented RTOs are attracted to the Factories of the Future PPP, which ensures that resources are reaching those who have the highest chance to generate impact.

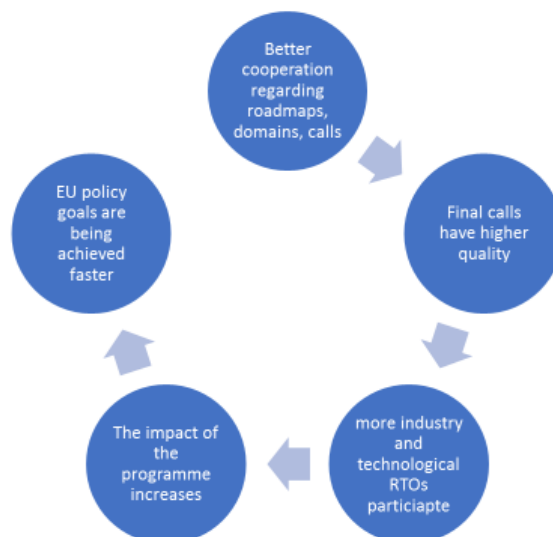


Figure 7: The circle linking the Factories of the Future partnership with EU Policy goals

The partnership has achieved its goal of creating European networks between industry (including large companies, mid-caps and SMEs), RTOs, clusters and universities and other types of organisations.

### Collaboration between the European and the National/Regional level

Moreover, the FoF PPP provided a blueprint for many national and regional initiatives in the manufacturing domain which have launched activities all over Europe and have similar objectives as the FoF PPP:



Figure 8: National/Regional Initiatives

Through cooperation with national and regional initiatives, the FoF PPP continues to increase efficiency by *avoiding a repetition of efforts*, both on the supply side of innovative manufacturing solutions and on the user-side of innovative manufacturing solutions.

### Monitoring of the Roadmap implementation

The European Commission and EFFRA continuously monitor the calls and projects to ensure that the priorities of the Factories of the Future 2020 roadmap continue to be correctly addressed.

With the help of the EFFRA Innovation Portal, information is collected for each FoF project, in an organised structure, following a specific taxonomy. The following illustrations show how the calls and the projects are mapped (particularly how they relate to the roadmap's research domains).



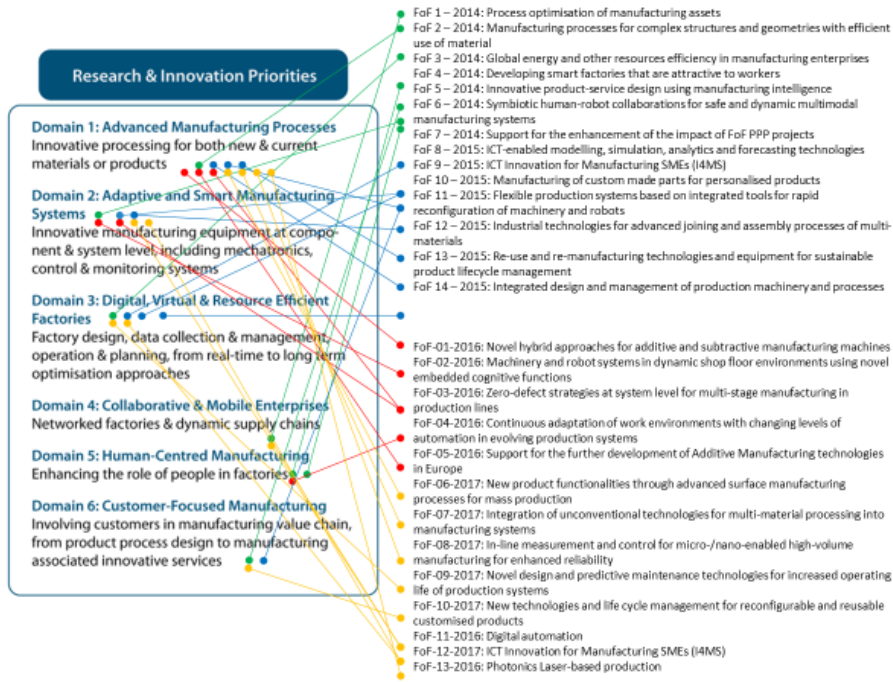


Figure 9: Connections between EC published call topics and the research and innovation priorities of the Factories of the Future 2020 roadmap.

The graphic below illustrates the mapping of the 268 FoF projects on the domains and priorities of the roadmap through the EFFRA Innovation Portal. This enables an analysis of how projects are progressively covering the six domains of the roadmap.

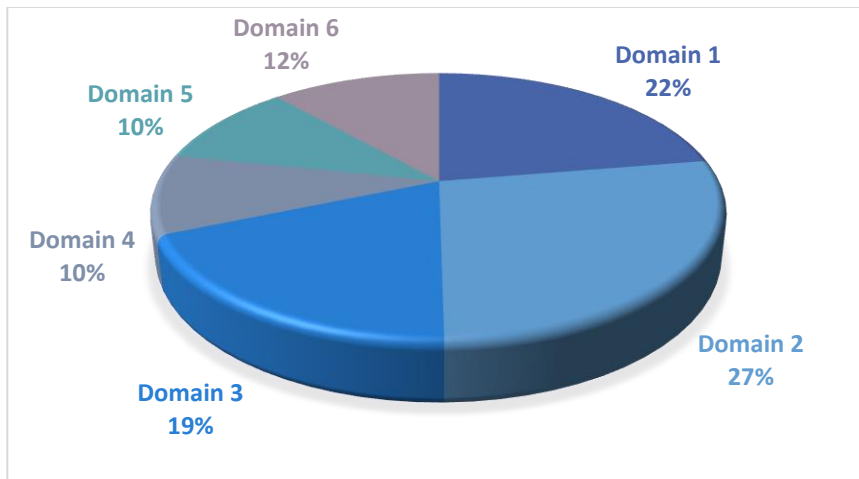
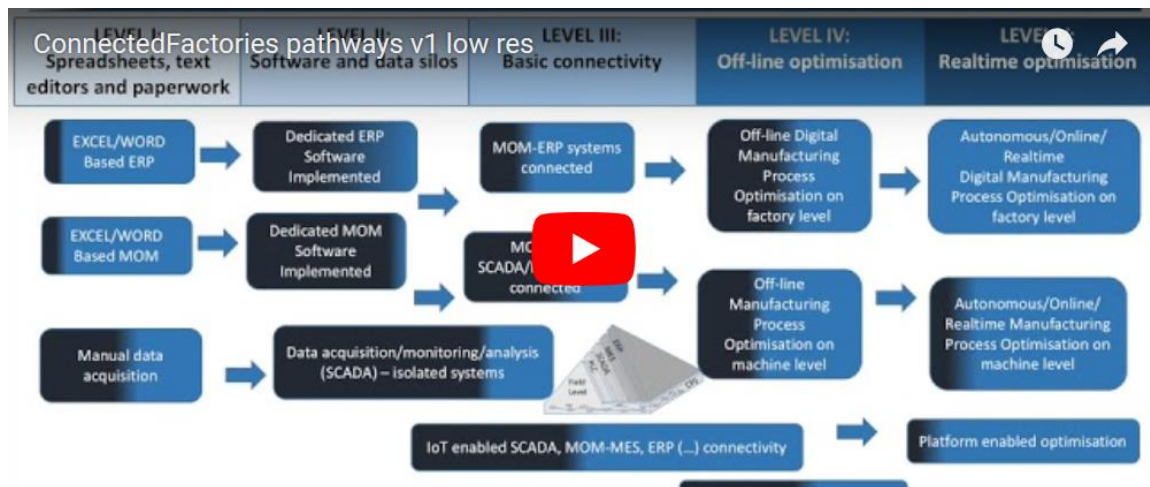


Figure 10: Projects per roadmap domain

### Pathways to Factories of the Future

EFFRA is currently putting a lot of effort in developing pathways to Factories of the Future. The key goal here is to situate demonstrators and best practices on these pathways and hence help companies to get inspiration for laying out their own innovation pathways.

A draft video version of the presentation of pathways is available on <http://www.connectedfactories.eu/scenarios-personas-pathways> or <https://www.effra.eu/scenarios-personas-pathways>



(\*See part six of this report's annex for more information on this)

## 3.2 PROGRESS ACHIEVED ON KPIS.

### 3.2.1 Mobilised Private Investment

Both the European Commission and EFFRA have invested much time and expertise to develop a methodology to approximately estimate the additional private investments that can be linked to the Factories of the Future PPP.

The methodology used took the form of inquiries with experts from companies that have participated in FoF projects. The experts were identified via the information shared with EFFRA by the European Commission, through the well-established network that is the Factories of the Future community (both EFFRA members and non-members), and from information reported in the EFFRA Innovation Portal by project consortia. These inquiries were realised through questionnaires and interviews conducted over a period of four months.

The aforementioned methodology also included the reporting of project results and demonstrators by project coordinators directly into EFFRA's Innovation Portal (the Portal is the principle tool for the report tool for collecting input from the projects. This reporting not only includes the insertion and updating of results and demonstrators but also data associated with the KPIS which coordinators may update via an interactive list.

In advance of the reporting, coordinators were informed that all information included on the Innovation Portal would be considered as public information (comparable to the information that is made available to the European Commission through public reports or deliverables).

The screenshot shows a web-based reporting form for KPIs. At the top right, there are two green buttons: "Save and go back to project" and "Save". The form is organized into two main sections, each with a title and an "edit comment" button. The first section is titled "Patents" and contains two rows of data: "Number of patent applications" and "Number of patents awarded". Each row has an "edit comment" button and a numeric input field. The second section is titled "Standardisation" and contains three rows of data: "Number of activities leading to standardisation", "Number of working items in European Standardisation Bodies.", and "Number of pre-normative research files - prEN - under consultation in ESBs". Each row has an "edit comment" button and a numeric input field.

Figure 11: Innovation Portal: KPI Reporting Form

All actions undertaken in this respect, be it interviews or the collection of financial data, have been conducted on a confidential and voluntary basis. The data requested included information about the financial situation of the companies as well as grants received and their applicability to research and development expenditure. Information on human resources growth during this period was also collected. So far, the outcome of the inquiry has been very positive.

Based on the information received from the companies, **a leverage factor rate of approximately 4,65 has been achieved.**<sup>1</sup>

This figure only represents an estimation of those companies which have directly participated in FoF projects. The figure is higher if one considers additional investments made by customer companies in the value chain of the companies which participated in the Factories of the Future project. Lastly, the additional investments of companies that participated in one of the national/regional initiative that stems or relates to the European FoF PPP need to be considered as well, when measuring the investment mobilised by the PPP.

In summary, when evaluating the overall financial impact of the FoF PPP, one needs to consider all three elements contributing to the impact: (i) leverage factor of companies that directly participated in FoF projects, (ii) additional investment of companies in the value chain of those companies that participated in FoF project and (iii) additional investments of companies which participated in the national and regional initiatives.

### 3.2.2 New Skills and Job Profiles

#### **New high skilled jobs in PPP projects**

51 projects reported 272 new types of high skilled jobs developed in PPP projects, resulting in an average of 5,33 new types of high skilled jobs per project.

The uptake and deployment of new technologies developed in the FoF projects is expected to create high skilled / high value-added job positions in European manufacturing companies in the years to come. The types of new high skilled jobs presented by projects vary significantly, since these depend on the area of development of the project (this also illustrates the **wide applicability and coverage** of the FoF topics). The reported outcomes of the projects in terms of results and demonstrators show a big diversity of skills sourced from the FoF PPP domains, including: robotics programmer, machine designer, maintenance skilled technician, virtual reality manager and programmer, advanced operator with data processing knowledge, skilled technician in data science, process designers, energy and resource efficiency manager, and plastic injection moulding operator. It also includes supplier network design expert, design synthesis-based facility planner, design synthesis-based supply chain manager, re-manufacturing engineer, cockpit supply chain strategist, AR educator/supervisor, manager, controller and monitor of the aluminium electrodeposition pilot plant and of the ionic liquid production, smart robot operators, and smart robot cell developer and technician.

#### **Number of new curricula developed in PPP projects**

31 projects reported 191 new curricula, resulting in around 6.1 curricula per project.

New knowledge and technologies developed in the FoF projects become part of newly designed curricula. These curricula aim to deliver the high skills required to fully exploit the potential of the new knowledge and technologies and drive manufacturing innovation in the years to come.

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<sup>1</sup> Note: This figure is based on a direct inquiry which the EFFRA office performed among companies that participated in one of the FoF PPP projects. 114 companies responded to the inquiry and provided feedback to the EFFRA office. 57 companies filled out all the fields which enabled the EFFRA Office to calculate the leverage factor.

The involvement of leading universities, as well as research centres with doctorate students already generates a flow of the aforementioned knowledge profiles and skills into the curricula. This frequently results in new and/or updated curricula.

Cataloguing the skills and jobs generated (directly or indirectly) by projects in a more systemic approach is a complex activity, however it is one which EFFRA is currently working to refine. Such cataloguing will help EFFRA and the European Commission to identify trends in terms of topics of interest to projects and where a new focus is needed.

## AUTORECON



### AUTORECON<sup>2</sup>

The project AUTOnomous co-operative machines for highly reconfigurable assembly operations of the future has created a master's in industrial automation in University of Patras.



### APPOLO<sup>3</sup>

The APPOLO project organized a Summer school on ultra-short pulse lasers applications in material processing from 3 to 7 July 2017. This summer school was not only aimed at student and young researchers working in the field of material processing by using ultra-short pulse lasers, but also took place in Vilnius, which enabled nearby countries to have access to this kind of training.

### 3.2.3 Impact of a cPPP on SMEs

The aggregated data shows that one of the goals of the FoF PPP, namely to accompany manufacturing SMEs in their modernisation process, has been achieved. This is significant because of the importance of SMEs to Europe's economy where SMEs represent 99 out of every 100 business and provide 57% of manufacturing jobs<sup>4</sup>.

Data over the past years shows that the traditional SME-share in FoF project proposals and FoF projects is around 30%. The FoF calls evaluated in 2017 confirm this figure for the FoF NMPB calls 31,65 % of the organisations participating in a competing consortium are SMEs while for the FoF ICT calls 25.74% of the organisations are SMEs in the FoF<sup>5</sup>. This also means SMEs receive significant support, for example SMEs involved in successful FoF-12-2017 proposals have been allotted €7,217,109.88 in funding, which is above the SME 30% average.

This has occurred within, and contributed toward, an improving landscape for manufacturing SMEs (e.g. SME added-value has increased by 13.4% between 2012 and 2016 and is projected to continue to do so beyond 2017<sup>6</sup>) while employment has also increased<sup>7</sup>.

<sup>2</sup> <https://portal.effra.eu/project/946>

<sup>3</sup> <https://portal.effra.eu/project/1090>

<sup>4</sup> SME Performance Review 2016/2017 (European Commission)

[https://ec.europa.eu/growth/smes/business-friendly-environment/performance-review\\_en](https://ec.europa.eu/growth/smes/business-friendly-environment/performance-review_en)

<sup>5</sup> Figures provided by DG Research & DG Connected

<sup>6</sup> 2017 SBA Factset (European Commission)

<https://ec.europa.eu/docsroom/documents/29489/attachments/1/translations>

<sup>7</sup> 2017 SBA Factset (European Commission)

<https://ec.europa.eu/docsroom/documents/29489/attachments/1/translations>

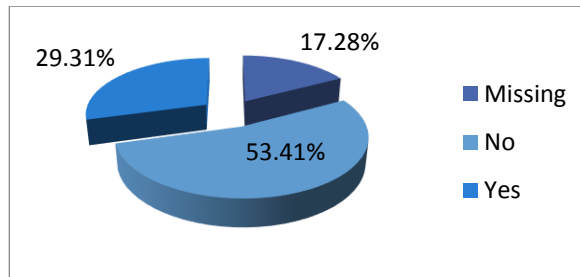


Figure 12: Share of EU funding to SMEs in Horizon 2020 FoF PPP calls closed in 2015, 2016 and 2017

Insight into the experience of SMEs in the FoF PPP can be found in a selection of SME success stories provided in the annex to this report.

### ICT Innovation for Manufacturing SMEs

The FoF PPP runs its own sub-initiative specifically for manufacturing-SMEs with a need for ICT technologies called I4MS (ICT Innovation for Manufacturing SMEs). The European Commission started to invest in the establishment of I4MS in 2013. Nearly 110 million euros have been invested for this initiative since 2013 with a supplementary investment round of 34 million euros in 2017. The goal of I4MS is to enable and foster the collaboration of manufacturing SMEs, start-ups and mid-caps across their value chains through the help of European Digital Innovation Hubs, where companies can run small scale experiments to test digital innovations.

Projects participating in I4MS launch SME-focused calls for focused experiments of short duration. These experiments provide brokerage and transfer of know-how and technology are to SMEs, start-ups and mid-caps improving their products and services, processes, business models and digital skills. As a result, I4MS helps to resolve the competence gap of SMEs. Furthermore, it provides SMEs with the financial means and network to adopt cutting-edge technology that allows them to bring innovative and highly competitive new products and services to the market. 195 experiments that were conducted in phase 1 of I4MS with the participation of 210 SMEs and mid-caps<sup>8</sup>.

Examples of calls (launched in 2017):

- Horse Project: Call for experiments in real industrial settings involving robotics and using the HORSE framework (Smart integrated Robotics system for SMEs)
- ReconCell: Robot assembly experiments in a reconfigurable workcell

<sup>8</sup> Database of experiments (I4MS): <http://i4ms.eu/experiments>

### 3.2.4 Significant Innovations

Since 2014, 110 projects have uploaded on the EFFRA Innovation Portal information about 983 exploitable results and/or demonstrators, all of which went to the EC review process. This makes an average of 7.6 results per project and 4.6 demonstrators per project (where a result can also be marked as a demonstrator).

Extracting the number of 'significant' innovations is a subjective and difficult exercise. In the context of the FoF PPP, significance should be associated to exploitation and creation of value. Associated patents and standardisation activities give an indication of significance, although in manufacturing in particular, patenting is just one of the instruments on the road to exploitation. Furthermore, the association to standards is just one of the indications of industrial relevance and hence industrial or economic value.

In a first approximation, the EFFRA office chose to associate the concept of "significant innovation" to patenting and standardization activities, as it is easily measurable. Notwithstanding this, in the context of the FoF PPP, significance is also associated to exploitation and creation of value (already partially, though not extensively, measured through the leverage KPI), thus EFFRA is working towards the integration of the single project exploitation activities into the portal, to provide more reliable way of measurement.

- Patents

So far, 56 projects reported 109 patent applications or patent-related activities (in last years' monitoring report 94 patent applications or patent-related activities were reported by 41 projects).

Regarding awarded patents, it was reported that 17 patents were granted so far.

- Standardisation activities/ Contribution to new standards

So far, 75 projects reported 107 activities that are related to standardisation activities. 15 working items in European Standardisation Bodies were reported and 7 pre-normative research files were also reported

#### Project examples:



- The **RECAM** project (Rapid Reconfiguration of Flexible Production Systems through Capability-based Adaptation, Auto-configuration and Integrated tools for Production Planning) will conclude in October 2018 and has already applied for 3 patents, one of which has already been awarded. RECAM project partners have links with ROS and oneM2M regarding industrial communication.



- The **AREUS** project (Automation and Robotics for EUropean Sustainable manufacturing ) (has filed two patent applications that participated to the

development of new standards for the DC power supply architectures (further information is included in the annex success stories).



- The **DAEDALUS** project (Distributed control and simulation platform to support an Ecosystem of Digital Automation developerS) focusses on the IEC-61499 standard as an enabler of distributed control and has filed a patent although the project is only halfway



- **Flexicast** (Robust, and FLEXible CAST iron manufacturing) has filed a patent and was active in standardisation



- **MASHES** (Multimodal spectrAl control of laSer processing with cognitivE abilities) applied for a project liaison in the CENELEC technical group related to laser and photonics (more information on this project is also available in the annex success stories)

#### Spin offs:



#### FAREXTRA

The **Satisfactory** project has also resulted in the launch of a spin-off, FAREXTRA. Launched in 2017, FAREXTRA specializes in providing end-to-end software solutions, as well as consulting services, in the fields of on-the-job training, real-time emergency event response and augmented assistance, 3D object detection and recognition, as well as localization and real-time data overlay. The main product to be offered by FAREXTRA is a VR/AR based software platform for training personnel on manufacturing, maintenance, process operations and support.



#### CREMANufacture

The **CREMA** project (Cloud-based Rapid Elastic Manufacturing), generated a spin-off, CREMANufacture. This company provides manufacturers with a powerful platform for creating a digital view of the factory by transforming physical assets into IT services. All assets can be monitored in real time. With these service, assets and people will interact with each other to drastically improve maintenance and production processes.



### 3.2.5 Contribution to the reduction of energy use and CO<sub>2</sub> emissions, the reduction of waste, the reduction in the use of material resources

40 projects have reported an average reduction of 16% in CO<sub>2</sub> emissions; 50 projects have reported an average reduction of 15% in energy consumption. 41 projects have reported an average reduction of 19% in waste generation; 33 projects have reported an average reduction of 11% in the consumption of material resources.

Project examples:



- The [MEMAN](#) project ([Integral Material and Energy flow MANagement in MANufacturing metal mechanic sector](#)) implemented an approach to optimise resource efficiency across 3 manufacturing value chains cases, integrating an analytical toolbox based on MEFA and LCA and providing practical decision-making support. Furthermore, new business models were developed to support the implementation of global energy and resources efficiency along the 3 value chains.



- The BOREALIS project (3A energy class Flexible Machine for the new Additive and Subtractive Manufacturing on next generation of complex 3D metal parts) has:
  - [contributed to the reduction of energy use \(in %\)](#): 40 (Possibility to melt the same quantity of powder with a lower amount of Energy with respect to traditional machine thanks to the optimization of the melt pool formation, the innovative design of the nozzle and thanks to the control architecture)
  - [contributed to the reduction of CO<sub>2</sub> emission \(in %\)](#): 30 (optimized design of a product and its manufacturing with absolute minimum material)
  - [contributed to the reduction of waste \(in %\)](#): 70 (process monitoring towards zero defect)

### 3.3 EVOLUTION OVER THE YEARS 2014 - 2018

The Factories of the Future partnership continues to make substantial progress. The continued high interest in FoF calls and the results demonstrated by the evaluated KPIs show that this PPP is a success in terms of RTD programme implementation and in terms of topics identified. It has clearly identified the right topics, i.e. topics of high industrial, technological and scientific relevance for manufacturing and has improved the quality of EU R&D programmes and call topics (compared to the past) through industry-relevant priorities and wide participation. As a true PPP, Factories of the Future has achieved its goal of creating networks between industry including SMEs, RTOs, universities and other organisations

Furthermore, the PPP has revitalized the interest of manufacturing stakeholders from all over Europe; including large companies and SMEs. The collaborative research and innovation activities result in high participation/subscription levels in the FoF Calls. Through the demo-projects as well as through the many events, many companies are realising the benefits of using new technologies (in terms of efficiency, costs saving, energy and material savings etc) and the benefits of pre-competitive, collaborative research, development, and innovation.

The partnership continues to generate meaningful results which contribute to the transformation of manufacturing in Europe; enabling the realisation of Industry 4.0. The tight integration of information technologies and operational technologies is a key characteristic of the Factories of the Future PPP. The FoF 11 ICT projects on digital platforms show that the PPP is adapting to new trends and new challenges.

Moreover, the FoF PPP has provided a blueprint for many national and regional actors in the manufacturing domain who have launched national and regional activities that are identical, or similar to, the FoF PPP. Thus, the PPP has improved the quality of national and regional programmes in the manufacturing domain.

The coverage of research activities, demonstration activities, up to the industrial validation activities (including those under the I4MS projects), and the related strong link to national and regional (digital) innovation hubs, are laying the foundations for a sound and well-balanced innovation and technology transfer mechanism.

## 4 OUTLOOK AND LESSONS LEARNT

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The modernisation of manufacturing remains a highly important topic on the agendas of both business and political leaders. The surge in manufacturing initiatives all over the world – in North America, in Asia, in Europe – shows that the topics and challenges identified by the Factories of the Future PPP will remain valid for the years ahead. Never have the media given so much attention to the technological industrial revolution which is modernising both economies and societies. The number of conferences, trade fairs, and initiatives addressing the industrial revolution is increasing. The increasing interactions and blurring of lines between mechanical, electrical/electronic, software, and service businesses make it even more interesting for companies and research institutes to engage in cross-disciplinary activities provided by the FoF PPP.

While the interest in the FoF PPP remains very high, providing proof – in concrete numbers – of the positive relationship between research and increased economic output remains a challenge. All actors involved are aware that this positive relation needs to be better described and measured, which is why the monitoring efforts of the PPP and its project are constantly being developed further.

In terms of reporting, the need to integrate the collection of KPIs in the overall official project reporting, validated through the periodic and final reviews by the European Commission, will increase the efficiency, accuracy, and response rate of the collection of results. It would also strengthen the partnership between the public and the private side and the involvement in the process of all project officers and external reviewers, which would lead to more feedback for future improvements of the progress monitoring mechanisms.

## 4.1 ANNEX PART 1 – COMMON KEY PERFORMANCE INDICATORS

	Key Performance Indicator (KPI)	Value in {2017}	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
1	Mobilised Private Investments	Approximately 550 million euros		5000 – 10000 million euros	<p>The written inquiries with companies participating in FoF projects confirmed that companies experience a leverage factor of 4,65 with the FoF PPP. The FoF 2017 calls were worth some 120 million euros and the private investment linked to the FoF PPP were some 550 million euros.</p> <p>This figure is based on a direct inquiry which the EFFRA office conducted among companies that participated in one of the FoF PPP projects. Several hundred companies were approached (the exact number is not known, since not only the EFFRA office contacted companies, but also project coordinators and EFFRA members contacted companies and the EFFRA office does not know how many companies were contacted in the end).</p> <p>114 companies participated in inquiry and provided feedback to the EFFRA office. 57 companies filled out all the fields which allowed that the leverage factor was calculated.</p>
2	New skills and/or job profiles	272 new types of high skilled jobs reported by 51 projects reported			<p><b>Examples:</b> robotics programmer, machine designer, maintenance skilled technician, virtual reality manager and programmer, advanced operator with data processing knowledge, skilled technician in data science, process designers, energy and resource efficiency manager, plastic injection moulding operators, supplier network design expert, design synthesis based facility planner, design synthesis based supply chain manager, remanufacturing engineer, cockpit supply chain strategist, AR educator/supervisor, manager, controller and monitor of the aluminium electrodeposition pilot plant and of the ionic liquid production, smart robot operators, smart robot cell developer and technician.</p>

3	Impact of a cPPP on SMEs	SME participation in the PPP is more than 30%. The above-mentioned leverage factor also applies to SME participating in the FoF PPP, however to a lesser degree.			<ul style="list-style-type: none"> <li>• The participation of SMEs significantly increased with the launch of the FoF PPP.</li> <li>• The overall economic performance of manufacturing companies, which for the most part are SMEs, has seen a positive development over the past years; please see:</li> <li>• <a href="http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Value_of_sold_industrial_production,_EU-28,_2008_-_2016_(2010%3D100).png">ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Value_of_sold_industrial_production,_EU-28,_2008_-_2016_(2010%3D100).png</a>, and</li> <li>• <a href="http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Industrial_production_statistics">ec.europa.eu/eurostat/statistics-explained/index.php?title=Industrial_production_statistics</a></li> </ul>
4	Significant Innovations	983 Innovations reported by 110 projects			<p>110 projects have uploaded on the EFFRA Innovation Portal information about 983 results and/or demonstrators). This makes an average of 7,6 results per project and 4,6 demonstrators per project (where a result can also be marked as a demonstrator).</p> <p>See comments in report</p>

## 4.2 ANNEX PART 2 – SPECIFIC KEY PERFORMANCE INDICATORS FOR THE cPPP

	KPI domain	Key Performance Indicator (KPI)	Value in {2017}	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
1	Contribution to the reduction of energy use and CO <sub>2</sub> emissions	Contribution of the PPP projects to the reduction of energy use in the area of the PPP  Contribution of the PPP projects to the reduction of CO <sub>2</sub> emission in the area of the PPP	50 projects estimate of <b>15%</b>  40 projects estimate of <b>15%</b>			See report for examples
2	Contribution to the reduction of waste	Contribution of the PPP projects to the reduction of waste in the area of the PPP	41 projects estimate of <b>20%</b>			See report for examples
3	Contribution to the reduction in the use of material resources	Contribution of the PPP projects to the reduction of material resources in the area of the PPP	33 projects estimate of <b>20%</b>			
4	Other Monitored Objectives ...	Selected PPP objectives on which the PPP chooses to report				

### 4.3 ANNEX PART 3 - CONTRIBUTION TO PROGRAMME-LEVEL KPI'S

	Key Performance Indicator	Definition/ Responding to question	Type of Data required	Data [Commission]	Baseline at the start of H2020 (latest available)	Target (for the cPPP) at the end of H2020	Comments
1	Patents			109 Number of patent applications (collected by EFFRA)  94 Number of patents awarded (Collected by EFFRA)			See examples under report section 'Significant Innovations'
2	Standardisation activities (project level)  Contributions to new standards (PPP level)			107 activities leading to standardisation were reported by 75 projects (collected by EFFRA)  15 working items in European Standardisation Bodies.  Number of pre-normative research files – prEN - under consultation in ESBs			See examples under report section 'Significant Innovations'
3	Operational performance	Time-to-grant					
5	<b>H2020 - LEIT</b> - Number of joint public-private publications	Number and share of joint public-private publications out of all LEIT publications.	Properly flagged publications data (DOI) from LEIT funded projects				

## 4.4 ANNEX PART 4 – SUCCESS STORIES

A complete list of all projects is available in the EFFRA Innovation Portal ([www.portal.effra.eu](http://www.portal.effra.eu))

### CREMA<sup>9</sup>



The CREMA project (Cloud-based Rapid Elastic Manufacturing) concluded in early 2018. It aimed to simplify the establishment, management, adaptation, and monitoring of dynamic, cross-organisational manufacturing processes following cloud-manufacturing principles. CREMA developed the means to model, configure, execute, and monitor manufacturing processes, providing end-to-end support for Cloud manufacturing by implementing real systems and testing and demonstrating them in real manufacturing environments.



### CREMANufacture<sup>10</sup>

The project generated a spin-off, CREMANufacture. This company provides manufacturers with a powerful platform for creating a digital view of the factory by transforming physical assets into IT services. All assets can be monitored in real time. With these service, assets and people will interact with each other to drastically improve maintenance and production processes.



### Satisfactory<sup>11</sup>



Satisfactory established a collaborative and augmented-enabled ecosystem with the overall aim of increasing satisfaction and working experience in smart factory environments. The SatisFactory solution and its technology products were demonstrated and evaluated in three industrial sites in Italy and Greece. SatisFactory generated 27 demonstrators including a collaborative platform, A.R. glasses and training and a gamification platform.

### FAREXTRA



The Satisfactory project has also resulted in the launch of a spin-off, FAREXTRA<sup>12</sup>. Launched in 2017, FAREXTRA specializes in providing end-to-end software solutions, as well as consulting services, in the fields of on-the-job training, real-time emergency event response and augmented assistance, 3D object detection and recognition, as well as localization and real-time data overlay. The main product to be offered by

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<sup>9</sup> [www.crema-project.eu](http://www.crema-project.eu)

<sup>10</sup> [www.cremanufacture.com](http://www.cremanufacture.com)

<sup>11</sup> [www.satisfactory-project.eu](http://www.satisfactory-project.eu)

<sup>12</sup> [www.farextra.com](http://www.farextra.com)

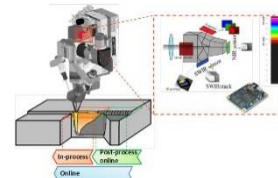


FAREXTRA is a VR/AR based software platform for training personnel on manufacturing, maintenance, process operations and support.



MASHES<sup>13</sup>

MASHES aimed to develop a breakthrough compact imaging system for RT closed-loop control of laser processing. It will be built on a novel multispectral optics and multi-sensor arrangement in the VIS-MWIR spectrum. Absolute temperature, geometry, and speed will be imaged accurately and reliably. RT process control, and cognitive re-adjustment and process quality diagnosis will be embedded. Three key project results<sup>14</sup> are being taken further with a view to commercialisation: (1) an embedded electronics and control system, with a simplified version with one camera for LMD RT control already commercialized, (2) a cognitive control system and interface, consisting of concepts and software modules for RT-control and the quality diagnosis system of LMD and laser welding; and (3) a complete MASHES system which integrates a camera system capable of multimodal monitoring and multispectral imaging in the visible-infrared range, and embedded system for RT monitoring and control of laser processing, and system control software for autonomous control configuration and readjustment capabilities and quality diagnosis.



REEMAIN<sup>15</sup>

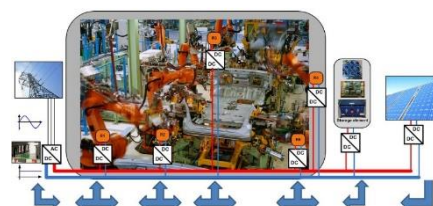
The REEMAIN project (Resource and Energy Efficient Manufacturing) combined cutting edge knowledge and experience from production processes, professional energy simulation, energy and resource planning, and renewable energy and storage to develop and demonstrate a methodology and platform for the boost, of efficiency resources. Three key results are being taken further towards commercial exploitation; a holistic modelling and simulation platform for factories, an electricity storage system prototype for factory environment, and an enhanced solar concentrator collector.



AREUS<sup>16</sup>

The AREUS (automation and robotics for European sustainable manufacturing) project aimed to improve the sustainability of robotic manufacturing by providing a set of integrated innovative technologies and engineering platforms, intrinsically interdisciplinary, modular and configurable. AREUS envisioned and investigated a novel intelligent factory architecture focused on energy efficiency and sustainable robotic manufacturing. The project's strategic focus was on industrial robotics energy efficiency and a DC based factories electrical power supply architecture, which promises to solve the sustainability of the Industry 4.0 factories of the future.

AREUS has developed an innovative DC-based industrial smart grid, which enables the extensive exchange and



<sup>13</sup> [www.mashesproject.eu](http://www.mashesproject.eu)

<sup>14</sup> [portal.effra.eu/project/1434](http://portal.effra.eu/project/1434)

<sup>15</sup> [www.reemain.eu](http://www.reemain.eu)

<sup>16</sup> [www.areus-project.eu](http://www.areus-project.eu)

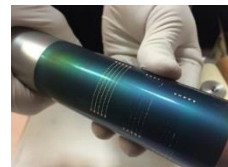
recuperation of energy at factory level, as well as the seamless integration of renewable energy sources, has been successfully developed and demonstrated. Furthermore, the project implemented four industrial demonstrators (e.g. energy-optimal scheduling and control of multi-robot automated assembly) and has also developed seven main exploitable results including the DC-based electrical power supply smart grid architecture to save energy, a novel generation of industrial robots able to work from 600V DC smart grid and multi-robot scheduling and optimization software (SW) tools. Furthermore, the project has achieved three results to be exploited at a higher TRL - (1) a holistic modelling and simulation platform for factories, (2) an electricity storage system prototype for factory environment, and (3) an enhanced solar concentrator collector.



### APPOLO<sup>17</sup>

The overall aim of APPOLO was to establish a hub of application laboratories for equipment assessment in laser-based manufacturing (APPOLO Hub). The project established and coordinated connections between the end-users, universities and laser equipment manufacturers to facilitate faster validation of the process feasibility and adaptation or customization of the technology (equipment) for manufacturing conditions.

APPOLO has generated 11 demonstrators, including breakthrough solutions in laser patterning for reduced friction, ultrafast laser equipment for decorative finishing in automotive chrome plated parts and laser-based metallization of full-size solar cells by laser-induced forward transfer.



### ROBO-PARTNER<sup>18</sup>

Furthermore, the project has achieved three results to be exploited at a higher TRL - (1) a holistic modelling and simulation platform for factories, (2) an electricity storage system prototype for factory environment, and (3) an enhanced solar concentrator collector. ROBO-PARTNER (seamless human-robot cooperation for intelligent, flexible and safe operations in the assembly factories of the future) aimed at the integration of the latest industrial automation systems for assembly operations in combination with human capabilities, combining robot strength, velocity, predictability, repeatability and precision with human intelligence and skills. ROBO-PARTNER has provided a hybrid solution involving the safe cooperation of operators with autonomous and adapting robotic systems through a user-friendly interaction is proposed. The ROBO-PARTNER developed ten demonstrators including a mobile robot for intelligent intra-logistics (and planning algorithms for mobile logistics), an augmented reality package for human-robot cooperation and dynamic safety zones for robotized applications.



Co-FACTOR<sup>19</sup> is also an example of the cooperative clustering between Factories of the Future projects to complement each other's efforts to address shared/related challenges. Co-FACTOR

<sup>17</sup> [www.appolo-fp7.eu](http://www.appolo-fp7.eu)

<sup>18</sup> [www.robo-partner.eu](http://www.robo-partner.eu)

<sup>19</sup> [www.cofactor-eu-project.org](http://www.cofactor-eu-project.org)

clustered with I-RAMP3, ReBorn, SelSus, T-Rex, INTEFIX and Power-OM under the shared topic of smart industrial components.

## CableBOT<sup>20</sup>

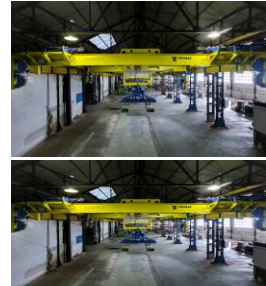
The main objective of CableBOT project was the development of a new generation of modular and reconfigurable robotic devices that can perform many different steps in the life-cycle stages of large-scale structures.



### **CRANEBOT**

Cranebot is an innovative machinery result of combining cable suspended robot technology based on parallel kinematics with a traditional gantry crane. Its purpose is to keep the same load capabilities as in traditional gantry cranes while enabling full 6 degrees of freedom (DOF) control of the payload. Payload is fully controlled in position and orientation while it is being manipulated.

Precision load handling and movement without oscillations are possible in any direction, in any orientation. Automatization or semi-automatization in large workspaces is possible, reduction of work accidents and Increase of productivity. Parallel cable-driven robotics opens enlarged business perspectives in multiple sectors with a wide range of applications.). The robot has been patented.



### **GOODMAN<sup>21</sup>**

The Factories of the Future project GOODMAN has received an Industry 4.0 Award at the major A&T Conference. The A&T conference is the reference exhibition event in Italy for robotics, tests and measurements, intended for manufacturing industries, system integrators, research centres. GOODMAN was one of three projects to receive the prize from a total of 79 high quality entrants.

The GOODMAN project team also recently received a best paper award at the recent International Conference on Serviceology which took place in July. The paper concerned a digital service design approach; an approach originally developed in the CaxMan project that has since been applied in the GOODMAN project.

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<sup>20</sup> [www.cablebot.eu](http://www.cablebot.eu)

<sup>21</sup> [www.go0dman-project.eu](http://www.go0dman-project.eu)

## 4.5 ANNEX PART 5 – SME SUCCESS STORIES

The following success stories highlight the role of SMEs in projects and their achievements.



PREVIEW was € 3,321,853 project which concluded early in 2018. Four out of a total of eight organisations within the consortium were SMEs. PREVIEW developed a cyber-physical system (CPS) for plastic injection manufacturing processes monitoring, control and optimization, by incorporating several innovative and cutting edge technological solutions: advanced artificial intelligence and machine learning techniques, robust industrial wireless communication, IoT and indoor location.

Results realised with the SMEs included Advanced Predictive System for Plastic Injection Moulding Industry, Incremental Fault-Tolerant Wireless Transmission for Sensor Information in Industrial Environments, Integrated data acquisition system for Plastic Injection Moulding machines and moulds and Prioritizing wireless communication for robust industrial process control. Demo activities took place within the facilities of SMEs and these results are now being further exploited<sup>23</sup>.



KRAKEN is an ongoing €5,947,836 project which involves five SMEs out of a total consortium of fifteen organisations. KRAKEN's aim is to develop a disruptive hybrid manufacturing concept to equip SME and large industries with affordable All-in-one machine for the customised design, production/reparation and quality control of functional parts through subtractive and novel additive technologies in vast working areas without floor space requirements. This project enables the SMEs to share their unique expertise and will allow them to exploit cutting-edge technology<sup>25</sup>.

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<sup>22</sup> [www.preview-project.eu](http://www.preview-project.eu)

<sup>23</sup> [www.promolding.nl/preview-pilot-test-promolding/](http://www.promolding.nl/preview-pilot-test-promolding/)

<sup>24</sup> [www.krakenproject.eu](http://www.krakenproject.eu)

<sup>25</sup> [www.krakenproject.eu/the-team](http://www.krakenproject.eu/the-team)

## 4.6 ANNEX PART 6 - SCENARIOS-PERSONAS-PATHWAYS

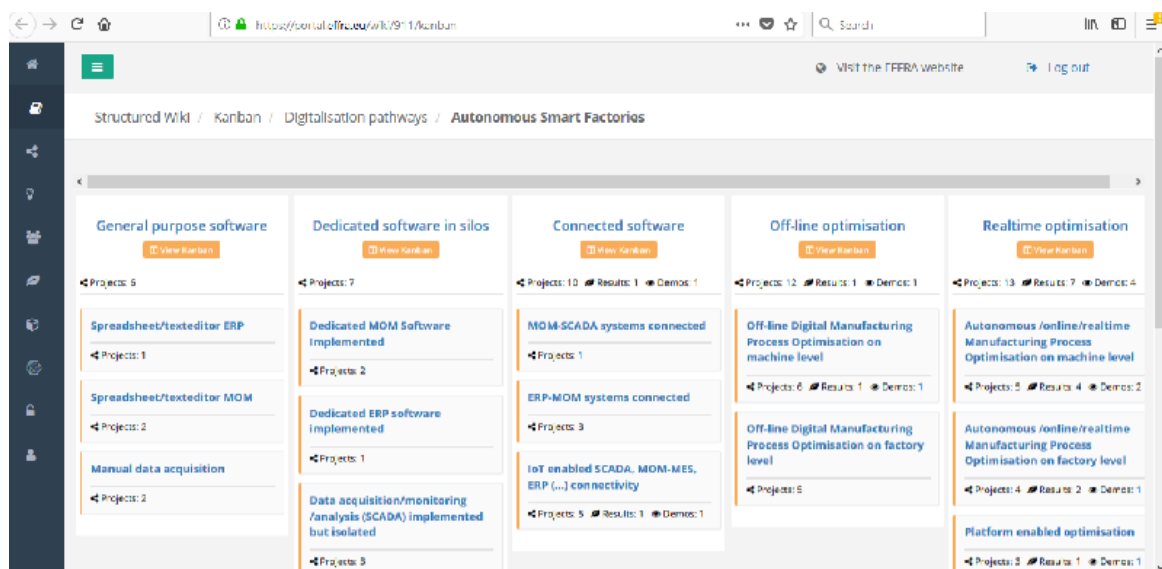
The ConnectedFactories project explores pathways to the digital integration and interoperability of manufacturing systems and processes and the benefits this will bring. Hence, ConnectedFactories will enhance the awareness among companies of the use of digital technologies in the manufacturing industry and provide them with knowledge to make informed decisions regarding technology and business model choices to reinforce the European manufacturing industries' position in the international scene.

Three pathways with a particular scope are being developed: Hyperconnected Factories, Autonomous Smart Factories, and Collaborative Product-Service Factories. More pathways covering different enabling technologies or manufacturing challenges will follow.

Across these pathways, it is important to look at the SME perspective or the perspective of companies where digitalisation is still in the very early stages. This perspective is referred to as the 'Small-Scale Digitised Factories' perspective or pathway.

A video presenting the pathways is available online: [www.effra.eu/scenarios-personas-pathways](http://www.effra.eu/scenarios-personas-pathways).

The pathways have also been progressively introduced on the EFFRA Innovation Portal (see also the screenshot below):







EFFRA Office | BluePoint Building | Boulevard Auguste Reyers 80 | 1030 Brussels | Belgium  
[www.effra.eu](http://www.effra.eu)