European Commission

An ecosystem to accelerate the uptake of innovation in materials technology

Report by the High Level Group of EU Member States and Associated Countries on Nanosciences, Nanotechnologies and Advanced Materials

October – 2017

Research and Innovation

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European Commission
Directorate-General for Research and Innovation
Directorate D — Industrial Technologies
Unit D3 — Advanced Materials and Nanotechnologies

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European Commission
B-1049 Brussels
Manuscript completed in October 2017.

Luxembourg: Publications Office of the European Union, 2017

PDF ISBN 978-92-79-73843-2 doi: 10.2777/407509 KI-05-17-039-EN-N

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Directorate-General for Research and Innovation
2017 Key Enabling Technologies EN

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1. INTRODUCTION

This report aims at designing potential actions at national level to facilitate the technological upscaling of innovative materials and technologies in the EU and in the Associated Countries.

The report is based on the analysis of the situation by a study undertaken by the EC in 2014-2015[1], that has looked into obstacles, barriers and has given recommendations on the needed actions at EU level, and on the work of the High Level Group short-term Task Forces in 2016.

2. CONTEXT

In Europe, the application of innovative materials (here defined as nanomaterials and advanced materials) and materials technologies by European manufacturing enterprises to make innovative products has been slower than in the other regions of the world.

The results of the above mentioned study and workshop in 2014-2015 led to a report (published in 2015) with recommended actions to overcome the barriers to this process, and that taken together would lead to a success in crossing the valley of death as shown in Figure 1.[2]

Building on the above report, the High Level Group discussed this issue in 2016 and established four specific short-term Task Forces to address the cross-cutting aspects that the previous study identified as affecting the development and upscaling of materials, namely materials characterisation, modelling translation, pilot production lines, and safety. The Task Forces made a summary of the state-of-the-art and looked also into regulatory and industry needs, and to possible actions to be taken in synergy by Member States/Associated Countries and the EU to accelerate the commercialisation of innovative materials and materials technology.

The actions listed are expected to speed-up the introduction of innovative materials or of products using them, to enhance efficiency and to support especially SMEs in a better and faster development of their products. Providing technological support to SMEs may positively influence the overall risk assessment carried out by investors and may lead to more or quicker investments in research and development of new innovative materials and new applications. This will ultimately help increasing the competitiveness of the European industry and have a positive impact on growth and jobs in Europe.

[1] Dr S. Fantechi, Dr G. Goldbeck, Dr B. Boskovic, Engineering & Upscaling Survey Analysis, January 2015

[2] Towards a Roadmap for Engineering & Upscaling: Key Discussion Topics, Dr S. Fantechi, Dr G. Goldbeck and Dr B. Boskovic, September 2015

3. BARRIERS AND OBSTACLES IDENTIFIED IN PREVIOUS REPORTS

In the above mentioned survey and report on materials engineering and upscaling undertaken in 2014-2015[3], European research and industry stakeholders identified a number of bottlenecks that need to be addressed in order to accelerate the industrial uptake of nanotechnologies and advanced materials. This analysis was then extended in 2016 through a number of consultations of the European Materials Characterisation Council, the European Materials Modelling Council, the European Pilot Production Network and through four Task Forces set up by the High Level Group in May 2016 on each of the four key cross cutting areas highlighted in the report (i.e. characterisation, modelling, piloting and safety / regulatory compliance).

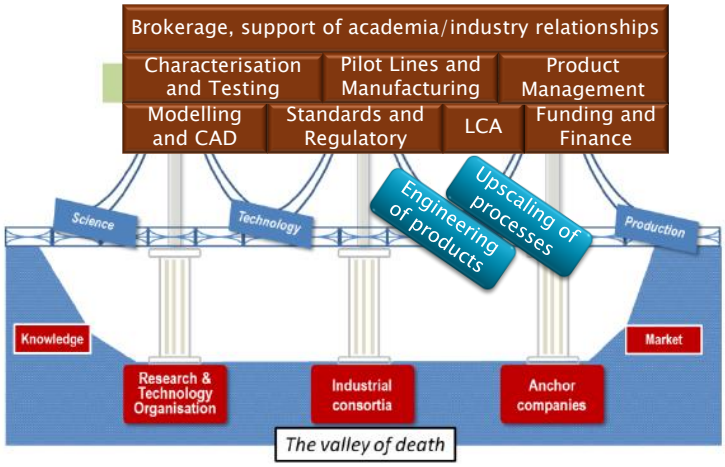

Figure 1: Bridging the valley of death by means of addressing specific aspects for materials engineering and upscaling[4]

The study report on materials engineering and upscaling[5] identified the below listed barriers and obstacles. The report's proposed potential actions have been taken into account by the four Task Forces.

Characterisation

In the field of characterisation, the materials engineering and upscaling report identified the following challenges and obstacles:

- Frequently, standard characterisation methods do not properly capture the full potential of new materials (and their new products), which complicates comparison with current materials/products and evaluation of the benefits of the new materials/products.
- The performance of the product in real life conditions may not be well understood due to inadequate capacity/capability for functional (real) characterisation and testing.

[3] idem

[4] idem

[5] idem

- The more widely available methods are off-line, which means limited insight into the process.
- The quality and homogeneity of the product may be poorly controlled due to a lack of process control and in-line characterisation.
- There is a bottleneck in the provision of advanced in-situ characterisation methodologies to monitor/control materials and processes in real time and under real conditions.
- There is a long lead time for further development of in-line facilities.
- As a technology is moved forward towards a product, choices need to be made about characterisation techniques for process and product. However, from the point of view of an R&D project it is often unclear which techniques might be most suitable for later process monitoring in real production. Hence there is a risk that the chosen method or technique might not be the best.

Modelling

In the field of modelling, the materials engineering and upscaling report pointed out that industry will not base investment decisions on modelling alone, as decisions need to be taken in a business environment. Therefore, translators are needed who can translate industrial problems into aspects that can be simulated by materials modelling and asses the economic value. At European level several preparative activities are taking place. EU funded projects are developing business decision support systems and modelling market places where all information, tools and expertise can be found. They are also developing the tools needed for translators to work with (open translator environment). Horizon 2020 also envisages developing workflows necessary to combine the 4 to 14 models usually chosen for one simulation and platforms giving central access to all expertise and tools needed. But the last step can only be taken at national level: local contact between translators and companies.

Pilot production lines

In the field of pilots, the materials engineering and upscaling report identified the following challenges and obstacles:

- Low industrial technology readiness and low availability from the currently available pilot facilities hampers the rate of new technology uptake.
- The dispersed value chain coverage and availability of the existing pilot lines prevents industry from fully validating and adopting new technologies.
- SME technology uptake is further restricted by their lack of knowledge of the opportunities offered at pilot scale. Resources and geographical obstacles to access and use the pilot lines further aggravate this situation. An improved regional presence may help.

Standards and certification

Specific points made by the materials engineering and upscaling report in this context include:

- Long lead times for standards development.
- Race between functional testing (standards) and new technology.
- Slow response of regulatory responsible service in new /proposed standards.
- The development of standards or modification of existing ones is a long term process. The regulatory framework is evolving as research does, hence the question is: what should the proposed new product comply with?

- As regulations are changing, a business plan cannot be developed if the market and its regulations are not known (i.e. fixed) 3-5 years into the future.
- Long term materials behaviour is unknown which burdens product development.

4. RECOMMENDATIONS BY HIGH LEVEL GROUP SHORT-TERM TASK FORCES

In 2016, the High Level Group set up short-term Task Forces with experts designated by the Member States that have looked into each of the key areas for materials upscaling. They provided the High Level Group with recommendations, which have been discussed by the Group and presented to the EC.

These recommendations take into account that there are a number of dedicated European initiatives and networks which focus already on each of the above key cross-cutting areas for materials development and upscaling: European Materials Characterisation Council (EMCC), European Materials Modelling Council, European Pilot Production Network, and the Nanosafety cluster (all except EMCC have been funded by the NMP-NMBP programme under FP7/Horizon 2020).

4.1. Characterisation

The short-term High Level Group Task Force on Characterisation suggested strategic steps to be taken in order to identify the number, type, geographic distribution and complementarities among fragmented characterisation facilities (excluding the large-scale infrastructure) in Europe. This information will subsequently facilitate the European industry to access European characterisation infrastructure and competence.

The Task Force discussed the characterisation landscape, industry needs, focus actions, and a suggested strategy and aimed to reinforce the activities of the European Materials Characterisation Council (EMCC) towards the establishment of a Roadmap for materials characterisation.

The Task Force looked into the current status with respect to organisational and technical aspects, such as fragmentation and dispersion of characterisation facilities and the lack of national characterisation infrastructures and of roadmaps in some countries.

The Task Force defined specific industrial needs for materials characterisation for engineering and upscaling, such as: access to characterisation competence; access to new characterisation technologies; measurement data and calibration standards and systems; the formation of characterisation clusters and networks to enhance value chain integration and strengthen the interaction between instrumentation/method developers (academic and non-academic), manufacturers and industrial end-users.

The Task Force gave, inter alia, the following recommendations: map the existing characterisation infrastructure at national and EU level, network characterisation infrastructures and competences, facilitate access to industry, develop characterisation methods, develop standard and reference materials and create databases.

4.2. Modelling Translation

The short-term High Level Group Task Force on Modelling Translation recommended the following actions: expand existing national and regional transfer centres with modelling translation expertise, tools and infrastructure, establish a network of translators in the Member States and encourage standardisation of modelling descriptions in national

projects. Member States were invited to provide cases-studies/measures that can motivate SMEs to innovate and academics to participate in translator activities. Furthermore, Member States were invited to provide lists of modelling and translation expertise to help grow the modelling market place and to offer financial support to SMEs to use translators.

4.3. Pilots

The short-term High Level Group Task Force on Pilots underlined that pilot facilities can help to upscale technology and potentially contribute to create new business, jobs and growth across Europe. The Task Force supported the idea of inter-connected innovation hubs and suggested that they could be organised at Member State level providing easy access to pilot facilities or open innovation test beds, which should focus on industrial application of new technologies, cover the full range of value chain services (including services for modelling, characterisation, safety and business liaison activities) and provide open access. These innovation hubs could form a network of local facilities and expertise, as well as link with missing expertise and facilities in other regions.

4.4 Safety

The short-term High Level Group Task Force on Safety recommended further translating safety research into regulatory tools via European and international cooperation. It underlined that safe-by-design approaches can create new opportunities for a competitive edge in innovation and market expansion and that nanosafety centres (between whom more networking is required) can importantly add to the capacity of industry to develop and implement those safe-by-design processes and products. Other recommendations, inter alia, included the need for better communication between material science and risk research (following an interdisciplinary approach), the need for long-term support for research (ensuring continuation of research beyond the lifetime of individual projects) and to continue support for standardisation.

5. CONCLUSIONS BY THE HIGH LEVEL GROUP: POTENTIAL ACTIONS

The High Level Group took note of the Task Force reports and further discussed next steps in its meetings on 1 December 2016, 13 March 2017, 29 May 2017 and 28 September 2017, which led to the below list of potential actions:

5.1	Potential actions that Member States/Associated Countries may carry out:
1	Provide input and information to Horizon 2020 funded Coordination and Support Actions that will carry out mappings of existing national/regional materials upscaling facilities and that will identify existing national actions or measures to facilitate industry access to such upscaling facilities.
2	Promote the prioritisation of upscaling services within the regional/national smart specialisation plans.
3	Encourage the establishment of cross-border European open innovation test beds, built on existing structures, connecting national/regional upscaling services/facilities (potentially supported by a Horizon 2020 funded CSA), with participation of all relevant stakeholders.

5.2	Potential actions that Member States/Associated Countries may carry out in the field of characterisation:
1	Invite the European Materials Characterisation Council (EMCC) to lead the formation of European industry driven characterisation platforms with complementary expertise and methods (in association with Research Technology Organisations and labs).
2	Promote the networking of characterisation infrastructures and competences.
3	Promote industry access to characterisation capacities and capabilities.
4	Encourage the development of real-time measurement methods for industrial applications when applicable, adapted to industrial needs.
5	Support the development of standardised characterisation methods (coordinated internationally), to be funded at EU level.

5.3	Potential actions that Member States/Associated Countries may carry out in the field of pilot lines:
1	Promote the inter-connection of pilot facilities and open innovation test beds at Member State level and between countries (potentially supported by a Horizon 2020 funded Co-ordination and Support Action), providing easy access to pilot facilities, which should focus on industrial application of new technologies.
2	Explore the feasibility of the test beds (potentially supported by a Horizon 2020 funded Co-ordination and Support Action) to cover the full range of value chain services (including services for modelling, characterisation, safety and business liaison activities), or link to those pilot facilities and test beds elsewhere that can provide the required service.
3	Support the open access character of pilot facilities and test beds when applicable.
4	Increase awareness and promote links between technology providers (pilots), technology users (SMEs), consumers and funding providers.
5	Consider organising events for SMEs regarding the use of pilot production facilities, including cross-border opportunities for collaboration, possibly in co-operation with the Enterprise Europe Network or potentially supported by a Horizon 2020 funded Co-ordination and Support Action.
6	Consider promoting brokerage/matchmaking events at regional level in thematic areas, possibly in co-operation with the Enterprise Europe Network. Coaching local end users might be facilitated when applicable.

5.4	Potential actions that Member States/Associated Countries may carry out in the field of modelling translation:
1	Explore the expansion of existing national and regional transfer centres with modelling translation expertise, tools and infrastructure, when suitable.
2	Encourage the establishment of a network of translators at national level.
3	Encourage the standardisation of modelling descriptions in national projects, if required.
4	Suggest that the European Materials Modelling Council (EMMC) working groups collect cases-studies or suggest measures that can motivate SMEs to innovate and academics to participate in translator activities.
5	Suggest that EMMC establishes lists of modelling and translation expertise to help grow the modelling market place.
6	Consider offering financial support to SMEs to use translators if projects are aligned to national funding rules and priorities.
7	Identify lighthouses in the Member States that are willing to take this translator role. Explore the possibility of participation of national institutes in the European translator network managed by EMMC-CSA.

5.5	Potential actions that Member States/Associated Countries may carry out in the field of safety:
1	Encourage the further translation of safety research into regulatory tools via European and international cooperation.
2	Encourage the creation of new opportunities for a competitive edge in innovation and market expansion by safe-by-design approaches if relevant.
3	In co-ordination with ongoing initiatives, help to improve networking between nanosafety centres in order to importantly add to the capacity of industry to develop and implement those safe-by-design processes and products.
4	Encourage better communication between material science and risk research (following an interdisciplinary approach).
5	Encourage long-term support for research when applicable (ensuring continuation of research beyond the lifetime of individual projects) both via Horizon 2020 and national/regional level.
6	Continue support for standardisation through funding at Horizon 2020 and national level.

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The High Level Group of EU Member States and Associated Countries on Nanosciences, Nanotechnologies and Advanced Materials has looked into barriers and obstacles that need to be addressed in order to accelerate the industrial uptake of nanotechnologies and advanced materials. It agreed on a list of potential actions that the Member States and Associated Countries may carry out in four key areas for upscaling: characterisation, modelling translation, pilots and safety. These actions may ultimately help increasing the competitiveness of the European industry (incl. SMEs) and have a positive impact on growth and jobs in Europe.

Studies and reports