



Policy Briefs from the Common Dissemination Booster CDB



Common
Dissemination
Booster

Strategic Indicators from clustering activities in various research fields from national projects funded by the EC in FP7 & H2020





Common Dissemination Booster

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Disclaimer

The information, views and recommendations set out in this publication are those of the projects that took part in the CDB and cannot be considered to reflect the views of the European Commission. The Common Dissemination Booster (Common Support Services for Disseminating Portfolios of Research Results) is funded by the European Commission N° 2016/RTD/J5/OP/PP-04741-2016-CSSDPRR.

Acknowledgements

The Common Dissemination Booster (CDB) is grateful to all of the project cluster groups for their competent work. This compilation of nine Policy Briefs is a small token of showing how much potential you can obtain within European or nationally funded projects by simply grouping them. Thank you!

CDB would also like to thank DG Research European Commission for their passionate guidance, insights and support in these past months.

Particular thanks to: CDB Project Offices Maite Van Wesemael, Ayra-Maria Ba-Trung and Rossella Cravetto, and Dissemination and Exploitation Policy Team Leader, Ioannis Sagias.

Foreword

The Common Dissemination Booster (CDB), has been coined a “pilot project programme” which has proved a truly rewarding exercise and experience. It has demonstrated the great potential that European Research and Innovation projects have when they are clustered for joint dissemination activities. You may express the highest impact results by providing an indication that are extremely relevant for the market.

The CDB and this innovative approach has come at a time when the Clustering, R&I Missions, and the European Innovation Council have been three of the most debated issues in the Brussels R&I arena. They will now be confirmed as a reality as Horizon Europe is launched . Considering the above elements, this compilation of policy briefs serves a taster of how the clusters of projects formed as part of the CDB have maximized and pooled knowledge together to identify priorities and recommendations for policy makers on a series of R&I topics. Having insight and guidance from the collective expertise of multiple projects and their respective consortia, is a useful vehicle for European policy makers. Without a doubt, this warrants further investigation so more projects are guided on shaping the right R&I, industrial, technological and digital policies for the future.

Recently, in November 2019, the European Commission released the timely report Industrial policy: recommendations to support and boost Europe’s leadership in six strategic business areas . which looks into the future of the Digital Single Market (DSM). The strategic areas and future-oriented industrial sectors for the the future of the Digital Single Market (DSM) are: Connected, clean and autonomous vehicles; Hydrogen technologies and systems; Smart health; Industrial Internet of Things; Low-carbon industry; and Cybersecurity. We are proud to have highlighted some of these elements in these clustered policy reports and prioritised areas where attention is required.

Europeans must find ways to sustain European innovative businesses to seek ways to commercialise their products and services more and bring them into new value chains. Dissemination of research results is a key step in this process and the CDB which ran from 2017-2019 has made an impact by providing dissemination services to 56 project groups made up of 304 projects and over 450 individuals.

¹ clustercollaboration.eu/

² europa.eu/rapid/press-release_IP-19-6204_en.htm

Policy Brief Compilation



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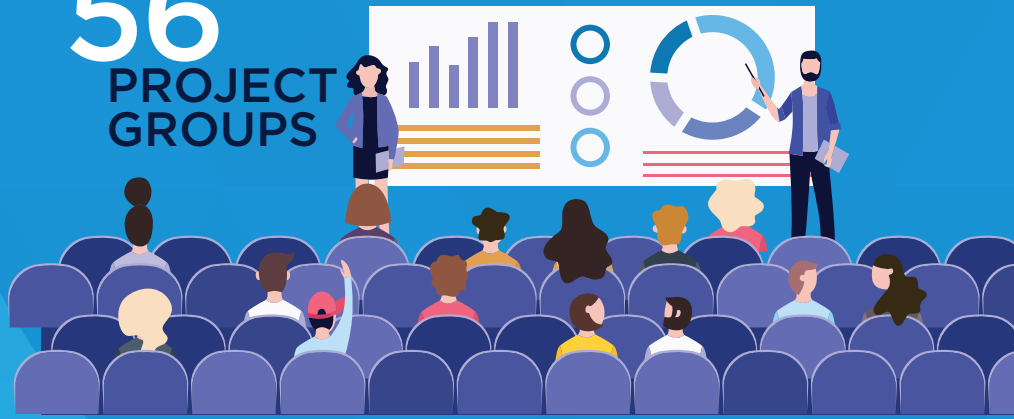
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5 CDB SERVICES



304 PROJECTS

56 PROJECT GROUPS



OVER 450 INDIVIDUALS

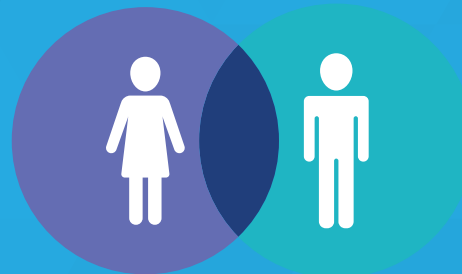


22 EUROPEAN COUNTRIES

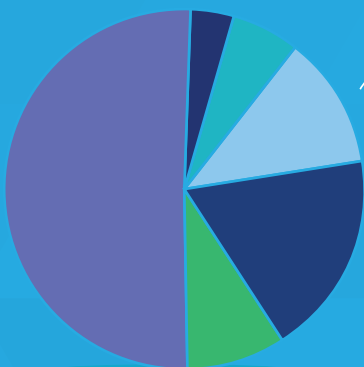


7 NON-EU COUNTRIES

48% FEMALE



52% MALE



ORGANISATION TYPE

- 53% → Academia/Research
- 22% → Small and Medium Enterprise
- 11% → Large Enterprise
- 8% → Government/Public Services
- 6% → IT Consultancy/Development



Making a difference for poverty related diseases

Tuberculosis a global killer

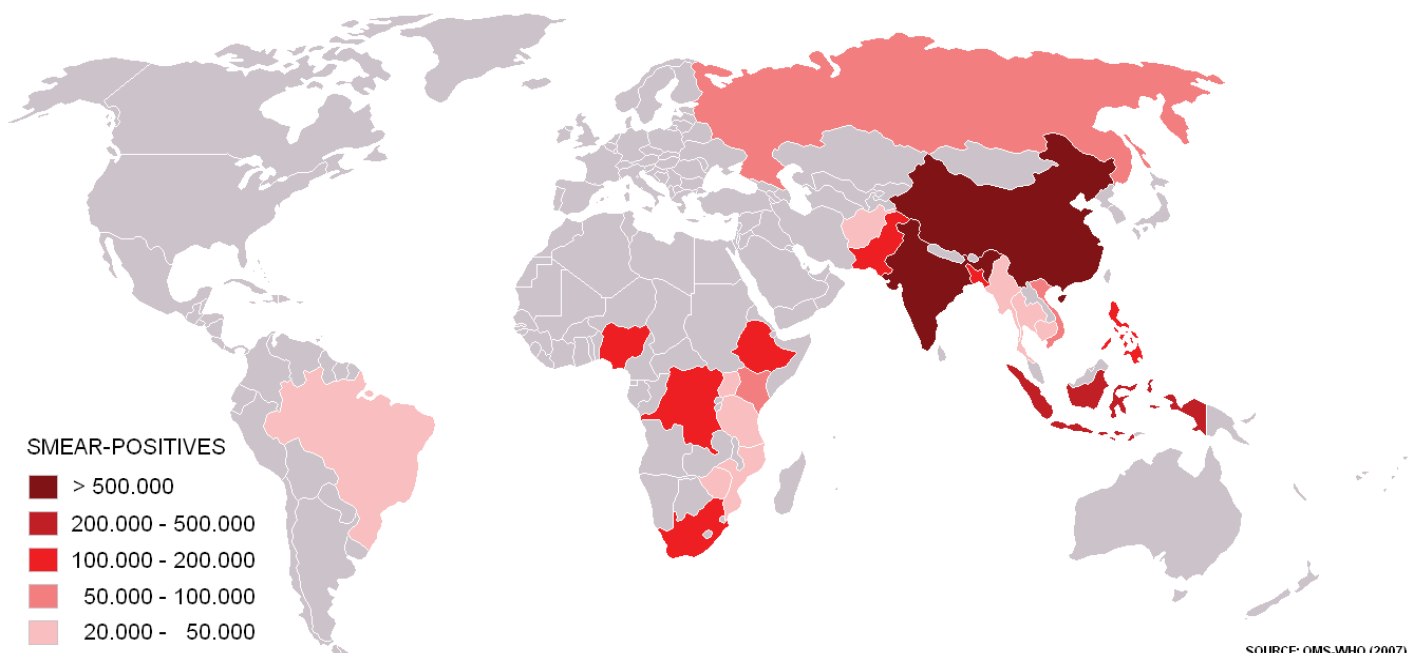
Tuberculosis (TB) remains one of the most important global public health burdens, with ten million new TB cases each year and 1.6 million TB-related deaths. While important progress is being made in diagnosis and treatment, efficacious vaccines that protect against all different forms of TB disease in all target groups and for all indications are considered indispensable in fighting the global epidemic. Furthermore, the World Health Organisation (WHO) indicates that Drug-Resistant TB is a persistent problem expected to be responsible in the future for 25% of all deaths from resistant pathogens. TB is in the class of Poverty Related Diseases. Because they are associated with low- and moderate-income countries, there is often only moderate interest from industry to invest in developing vaccines for these diseases. It then falls to policy makers to step in with creative policy and regulatory actions to fill the gaps that arise.

For example, the temporal spans of current funding instruments are not always aligned with the long development times of vaccines, whereby a certain level of flexibility is needed to re-allocate funding to support the most promising product. Policy makers can also promote the robust and diverse R&I collaboration needed to produce the needed variety of new vaccine candidates, through instruments including public-private partnerships and international, publicly supported networks such as the Global TB Vaccine Partnership. Effective policy formulation can also promote the emergence of a rational process for sustaining vaccine development through bottom-up stimulation of innovation coupled with a neutral evaluation procedure of promising candidates. In such a way, a long-term, sustainable pipeline of new vaccine candidates can be ensured.

The long road to efficacious vaccines

The Bacillus Calmette-Guérin (BCG) vaccine, currently used in countries where TB and leprosy is common, provides protection against disseminated disease but does not prevent primary infection, nor does it prevent reactivation of latent pulmonary infection. In fighting TB, efficacious vaccines are needed that protect against all different forms of TB disease for all indications and in all target groups, including infants, adolescents, adults, and people living with HIV. In addition, there are still scientific knowledge gaps – for example, there is no established preclinical animal model yet that predicts the performance of a vaccine in humans. New technologies and scientific knowledge about the immune response and

animal models are vital for transforming discoveries into clinical trials. Especially for a complex disease such as TB, the way to new and safe vaccine candidates is long and risky and the development of vaccines often takes decades.



Policy challenges

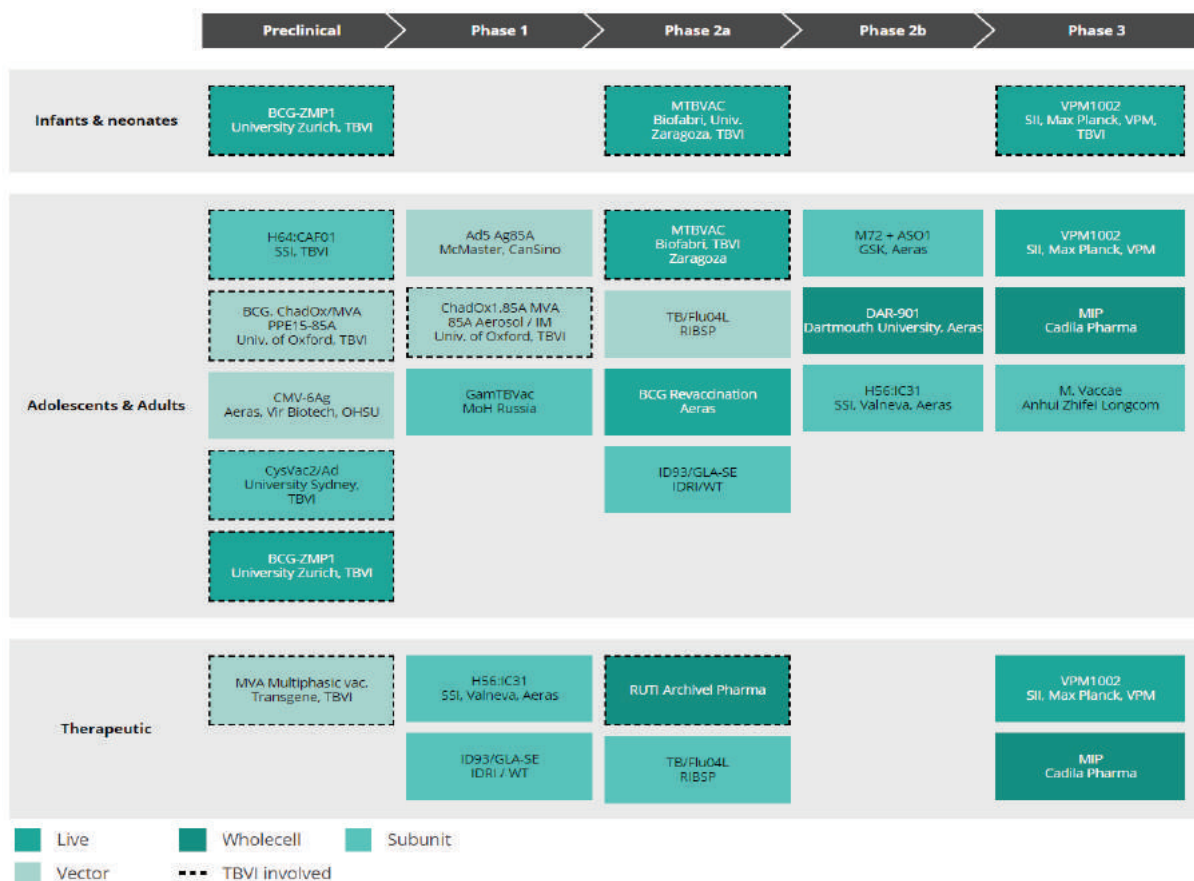
TB is in the class of Poverty Related Diseases. Because they are associated with low- and moderate-income countries, there is often only moderate interest from industry to invest in developing vaccines for Poverty Related Disease, resulting in a so-called market failure. It then falls to policy makers to step in with creative policy and regulatory actions to fill the gaps that arise in the presence of such market failures.

The market does not naturally create strong bridges to the low- and medium-income countries that are the primary targets of vaccine development. This is an area where trans-national policy can foster the effective ties needed between countries.

The development of new candidate vaccines is difficult - in the early 2000s, there were hardly any new TB vaccine candidates in the global pipeline, and there was no prospect of developing a TB vaccine. It has been the collaboration of a diverse set of research organisations that has created the rich pipeline of vaccine candidates that we have now - but this collaboration does not arise easily on its own, and needs support

through national and international policy formulation.

One success story in this respect has been the funding programmes of the European Commission. The TBVAC2020 consortium, consisting of 42 partners, facilitates collaboration and early data sharing between partners and facilitates independent research test facilities where potential vaccine candidates can be evaluated. The impact of this partnership is evidenced by the fact that over 50% of the global pipeline in TB vaccine candidates currently is being evaluated in clinical trials and the majority of the candidates in discovery and pre-clinical development originates from TBVAC2020 and its predecessors under FP 5, 6 and 7. But there are fundamental structural challenges to be addressed in the way vaccine development policy is formulated: although vaccine development can take years or decades, as noted earlier, funding programmes are often for a relatively short period and cause interruptions or even discontinuation in the development efforts.



Recommendations



Align funding tools for collaborative R&I to ensure sustainability

The temporal spans of current funding instruments are not always aligned with the long development times of vaccines. A certain level of flexibility is needed to re-allocate funding to support the most promising product. Funding programmes are often for a relatively short period and cause interruptions or even discontinuation. Sustained funding for collaborative research and innovation partnerships to reach that goal is essential. The Global TB Vaccine Partnership (GTBVP) is a collaboration of vaccine researchers and developers, EC, the WHO, national governments and major funders in the TB vaccine field. The GTBVP aims at identifying and addressing gaps and thereby promote appropriate product development practices in an environment of constrained funding, thereby enabling use of limited global resources to develop TB vaccine candidates that show promise. The GTBVP could be the instrument that stimulates the alignment of funding.

Build on and strengthen existing networks and infrastructures

Collaborative partnerships are essential for the highly-scientific innovation needed for new vaccine production, through cross-fertilization between different disciplines and back-translation (e.g. pre-clinical learn from clinical studies). A number of policy instruments can promote the formation and sustainability of these partnerships. public-private collaborations stimulate product development and improve access

to the market. By building international partnerships, knowledge transfer increases, causing significant improvements in chances of finding new vaccines while at the same time EU excellence is used to build capacity in low- and middle-income countries. Finally, partnerships with an independent and neutral coordinator (who leaves ownership in the hands of the developers) increases confidence and stimulates knowledge exchange. This diversity and international breadth of partnerships creates robust networks and infrastructures fostering new vaccine development.

Ensure innovation progress through a rational process

The research and development process of TB vaccines faces many scientific challenges. Innovations contribute to new technologies and diversification of the vaccine pipeline and should be stimulated. At the same time, given the limited resources, rational progression of promising innovations and standardised processes will contribute to mitigating risks. Policy makers can promote and give official support to an aligned and coordinated bottom up approach to stimulate innovation and discovery by encouraging and enabling scientists to bring forward their innovative ideas, concepts and technologies. At the same time, then can support the development of a rational process through (for example) the TB vaccine development pathway with pre-set criteria based on consensus of the TB vaccine field.

About the Project Group

CDB Project Group:

TBVAC2020

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TBVI

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The Project Group is made up of organisations leading the fight against Tuberculosis through innovation and diversification of the TB vaccine pipeline and through developing innovative technologies.

Projects



TBVAC 2020

tbvi.eu/for-partners/tbvac2020

GA 643381

EMI-TB

emi-tb.org

GA 643558

STRITUVAD

strituvad.eu

GA 777123

TBVI Stage Gate Design Efforts

(Bill and Melinda Gates Foundation)

OPP1169968

Support for TB vaccine R&D activities

(The Norwegian Agency for Development Cooperation)

QZA-13/0333





Protecting society through innovative technologies for cancer screening

Introduction

One of the most important weapons in the fight against cancer is timely screening. Countless lives have been saved through early detection and treatment. As successful as screening programs have been, however, one problem that has plagued screening techniques is the preponderance of so-called false positives, leading to unnecessary surgical intervention.

Although awareness is growing of the major health costs to European hospitals through unnecessary surgeries, it has yet to be translated into policy, such as funding research on innovative approaches to improve screening. One particularly promising avenue is the use of photonics technologies in addition to conventional

techniques, resulting in multi-modal imaging systems that enhance screening accuracy. The projects LUCA, PAMMOTH and SOLUS are developing such multi-modal approaches that show great promise for the future of smart screening. Based upon the experience of these projects, this policy brief sets out a number of recommendations for strong policy formulation supporting the goals of improved screening and reducing costly unnecessary surgeries, and the promotion of innovation technologies for screening in the medical field and beyond. These recommendations are the result of the direct experience of these projects, which are funded by the European Commission under the Horizon 2020 Framework Programme.

Cancer screening

Timely screening is a key life-saver in cancer treatment. As successful as screening programs have been, however, significant problems remain to be solved in order to maximize their effectiveness. Problems that have plagued screening techniques in many different domains, such as breast cancer and thyroid cancer, is the preponderance of false positives – indications of cancer when there is in fact none – and the characterisation or staging of detected tumours.

For example, approximately 50% of positive breast cancer screening outcomes turn out to be false positives. Breast cancer is one of the most common cancers in the world. It is estimated that about one in eight women in Europe will develop breast cancer before the age of 85. Such a high number of false positives leads to a large number of additional examinations could have been avoided. At the same time, the chances for survival increase substantially upon early diagnosis of breast cancer, so the availability of diagnostic tools with a high sensitivity and specificity is vital.

Conventional screening methods for thyroid cancer lead to a large number of invasive procedures due to inaccurate screening results. Annually, about 750,000 patients in Europe receive non-diagnostic and/or false positives results due to poor specificity of current methods. This leads to about 150,000 unnecessary surgeries each year resulting in costs of more than €440m. These costs could be significantly reduced with improved screening methods.

Since conventional cancer screening methods lack the specificity to consistently differentiate between benign and malignant tumours, there still is a considerable need for invasive biopsy procedures to confirm the nature of the tumour.

It is recognized now that both the economic and emotional costs of unnecessary biopsies

and treatment merit the full attention of the healthcare research community and policy makers. Photonics technologies have proven to be a highly promising avenue to tackle these healthcare issues.

In particular, the combination of photonics technologies with established imaging techniques yields multi-modal imaging systems – that is, where innovative photonics systems enhance the sensitivity and specificity of conventional methods, like ultrasound, and thereby improves the diagnostic information.

For example, the LUCA project combines near-infrared diffuse correlation spectroscopy and time-resolved spectroscopy with ultrasound for the screening of thyroid nodules.

Similarly, the SOLUS project combines diffuse optical tomography with both common and advanced ultrasound techniques to support the diagnosis of breast cancer.

Finally, the PAMMOTH project combines photoacoustic with ultrasound mammoscopy for evaluating screening-detected lesions in the breast.

These multi-modal approaches are showing great promise for the future of smart screening, which have the potential to go beyond breast and thyroid cancer screening as innovative tools for other types of cancer diagnoses, screening and therapy monitoring in areas of the body accessible to these techniques.

Policy challenges

Current European health policy is strongly oriented toward support for early screening, with governments supporting numerous programs offering free screening, e.g. for breast cancer or colorectal cancer.

Although awareness of major costs due to inaccurate screenings results and/or diagnoses is gradually growing, this awareness has yet to be translated into policy that supports initiatives or programmes to decrease such costs – such as funding research on innovative approaches to improve the sensitivity and specificity of screening, in particular exploring photonics

as a means to enhance existing methods, and supporting clinical translation and market entry. This can significantly improve individual diagnoses and increase the cost-efficiency of large screening programmes.

In addition, regulatory procedures for the approval of new medical devices in Europe can extend the approval process for innovations in the medical field into years. Recognizing the benefit of these innovations, developing innovative policies that fast-track such innovations into the clinics remains a challenge in the current regulatory landscape.

Recommendations



Enhanced non-invasive breast and thyroid cancer screening programmes

The new photonics technologies being introduced in innovative projects like LUCA, SOLUS and PAMMOTH are making breast and thyroid cancer diagnosis and screening more sensitive and specific, and provides affordable, non-invasive, point-of-care solutions for health systems. In addition, these technologies provide better alternatives for treatment monitoring and follow-up due to their high sensitivity and specificity.

This is an area where policy makers can make a significant difference in making resources available for research and clinical translation to improve screening outcomes, reduce inaccurate results and thereby the financial burden of unnecessary invasive procedures.

Promotion of innovative photonics-based technologies in medicine and beyond

The preliminary results from LUCA, SOLUS and PAMMOTH show the tremendous potential of photonics-based technologies for applications in a variety of medical fields: the potential in endocrinology has been confirmed, and considerable interest in the technology has been observed for the areas of head and neck oncology, rheumatology, paediatric neurology and nephrology, sports medicine and even clinical veterinary medicine.

Photonics technologies can also provide guidance during surgeries as innovative confirmatory or monitoring tools in areas of the body not accessible to these techniques outside surgery.

Monitoring and screening with devices based on photonics technology as means of quality control, e.g. for food or lumber, can extend quality improvements and cost-

savings to fields beyond medicine. Policy makers can ensure that funding initiatives for development and continuous improvement of these ground-breaking photonics technologies are on the political agenda.

Improving the time-to-market for innovative photonics-based technologies

Policy makers could recognise the special characteristics of innovations in the reduction of medical false positive diagnoses to develop innovative policies that enables

such innovations to be fast-tracked into clinics while safeguarding patient safety.

A short time-to-market of innovative photonics-based technologies leads to earlier significant cost-savings for the European healthcare systems.

Policy makers can take motivation from the substantial reduction of the financial burden as well as the enhancement of social and patient well-being through improvements in screening accuracy through the application of photonics technologies.



Projects

LUCA

luca-project.eu

GA 688303

PAMMOTH

pammoth-2020.eu

GA 732411

SOLUS

solus-project.eu

GA 731877

About the Project Group

CDB Project Group:
LUCA

Project Group Leader:

Katharina Krischak,
European Institute for Biomedical
Imaging Research

LUCA, PAMMOTH and SOLUS aim to develop innovative and affordable solutions to reduce invasive therapeutic procedures and to improve cancer diagnosis. In particular, their goal is to develop innovative devices combining ultrasonography technologies and photonics, as well as image reconstruction algorithms, for a multi-parametric characterisation of thyroid and breast cancer. These technologies will also be validated in a clinical setting.



Citizen observatories A voice for citizens in environmental monitoring

A policy brief based on the experiences from Citizen Observatories

Even though citizen science has a long tradition, it has only recently experienced an increasing trend fostered by the age of big data and new developments in Information and Communication Technology (ICT). Such advances have led to the establishment of Citizen Observatories (COs), in which citizen-powered science addresses key issues in the monitoring of our dynamic environment.

While the European Union is supporting this endeavour within the FP7 and Horizon 2020 programmes, there are still obstacles that need to be tackled in order to pave the way for citizens to have an active role and voice in environmental decision-making.

One of the main obstacles for the successful implementation of citizen science and COs in the policy agenda is the readiness level of policy and decision makers in terms of awareness, acceptability, and sustainability. Our policy brief addresses this issue, providing dedicated recommendations that highlight the need for citizen participation in environmental policy-making; stress the fact that citizen science initiatives should be actively supported; outline the need to reduce the gap between bottom-up and top-down approaches and directly address the concerns of policy makers on citizen science.

Citizen Observatories a “voice” for citizens

The involvement of citizens in environmental monitoring has a long tradition (e.g., bird watching, storm hunters), providing non-scientists with the possibility to actively contribute to scientific research as well as to environmental policy-making.

This integration of citizens in environmental monitoring not only advances scientific research, but also promotes environmental stewardship within individual participants and society. Citizen science contributes to awareness-raising, increases scientific literacy, and generates new knowledge, by simultaneously enabling new forms of research and hence changing the way environmental policy-making and monitoring are implemented. More and more, the term citizen science is entering both the policy agenda of municipalities, the European Commission, and more globally, the United Nations.

Yet, engaging citizens actively in scientific and environmental monitoring initiatives remains a challenging task. Often, citizens are not aware of existing citizen science opportunities or/and how to contribute to them.

Citizen science is a key aspect of the EC’s policy agenda but often citizens themselves don’t know how to get involved and contribute.

More recently, citizen science is being facilitated and accelerated through advancements in ICT, with Citizen Observatories (COs) tackling various thematic areas, providing the technological

means for citizens to have a “voice” in the decision-making process.

Mobile internet and smartphone apps coupled with the tech savviness of the young, are enabling the uptake of novel ways to engage and empower citizens in environmental science and stimulate participatory decision-making.

With the value of COs increasing over the past few years, recent transformations in the policy and decision-making process are evident and should continue moving forward. A first step has been the inclusion of citizen science among the five strategic orientations of the new Work Programme 2018-2020 of “Science with and for Society” (SwafS) within the Horizon 2020 framework. Furthermore, citizen science is also increasingly seen as an integral part of the Responsible Research and Innovation (RRI) and Open Science initiatives.





City Oases

CityOases A real example of Citizen Observatories in action

Implemented via the LandSense Citizen Observatory, this mobile application promotes participants to express their perception of greenspaces and open spaces within urban environments. Participants can interactively contribute and get feedback on questions such as *Where is the coolest place to hang out on a hot summer day? How can you find the nearest greenspace or playground that is safe and well equipped?*

The app is centred on finding and evaluating 'City Oases' – the ideal places to hang out in an urban environment. Users are encouraged to evaluate predetermined points or alternatively any other location they would like to share with their fellow citizens, in the app and on social media.

At the heart of the engagement is the recording of the subjective perception of the places and the relevant activities that can be conducted at those places. The locations are additionally documented by user-contributed photos. Furthermore, participants answer questions related to the suitability of a broad range of possible activities and "well-being" factors (e.g. cool spaces in summer).

Ambition:

As part of the STEP 2025 plan, the City of Vienna has significant interest in further developing and improving urban greenspaces and must consider the distribution, diversity and quality of green and open areas. The data and findings from CityOases can help steer the STEP 2025 plan, improve the database of open urban spaces and help citizens and visitors further enjoy Vienna! The app is currently being piloted in Vienna, Austria in close collaboration with Municipal Department 18 (Urban Development and Planning) Furthermore, CityOases is part of the 2019 Austrian Citizen Science Award.



Why are COs important for policy and decision making?

COs have vast potential to impact policy decisions and governance not only at the international or national levels, but also at the regional and local levels, promoting truly responsive governance. In fact, active citizen engagement is more likely in areas where issues are directly affecting their environment or neighborhood.

A citizen-centric solution to environmental monitoring which can influence policy making.

COs provide the possibility to perform impact assessment for existing environmental policies through ground-level observations by those most directly affected. In exchange, citizen scientists provide policy makers with a cost-effective way to rapidly identify, monitor, and address emerging environmental issues.

COs provide a natural conduit for awareness-raising among both citizens and policy makers, as well as a natural input to effective decision support systems.

All in all, this citizen-centric approach to science has the potential to create a step change in environmental monitoring and policy making.

The readiness level of policy makers A challenge to COs

Citizen scientists represent valuable resource for gathering information on various environmental issues, with COs representing a low-cost solution for addressing existing gaps in environmental governance. However, one of the main challenges for the successful implementation of citizen science and COs within the policy agenda is the readiness level of decision makers in terms of awareness, acceptability, and sustainability. Being aware of citizen science initiatives, accepting their novel approach to science, and fostering funding opportunities for the long-term sustainability of COs are vital components to manage environmental challenges and empower resilient communities.

Policy makers need to trust CO data as “scientific” to ensure real impact.

Even though the European Commission is supporting citizen science under FP7 and H2020, many still think that results obtained via citizen-based observations are less reliable and do not meet the quality standards for informed decision-making and environmental governance. The fact is that public authorities are still reluctant to accept “scientific” data from citizen science experiments to complement authoritative data.



Recommendations

How citizens can play their part in environmental monitoring

Environmental policy-making needs citizen participation

Citizen participation in environmental decision-making and governance should be considered as a way to make the policy process more transparent and accepted. Hence, it increases the mutual trust between citizens, policy makers and public authorities. In fact, citizens need to be able to exercise their rights without the feeling of unreasonable resistance or ignorance on the part of authorities or others. Only then will society and science benefit from the huge potential of citizen-powered science and ideas.

Actively support citizen science initiatives

Policy makers should not only accept citizen science initiatives, but also actively support such endeavours. That is, they should facilitate the engagement of citizens in science and innovation by, among other initiatives, fostering scientific education. For example, co-designing innovative and collaborative web platforms and mobile apps can appeal to a citizen's natural willingness to contribute to society and offer channels to have their voices heard.

Reduce the gap between bottom-up and top-down approaches

Much citizen science research in the EU and elsewhere is formulated within the context of the large funded work programmes (e.g. H2020), and consequently originates in a kind of top-down, prescribed fashion. Although this approach serves the important function of directly promoting and connecting citizen science to EU research and policy directions, the risk

arises of not connecting with many existing citizen science initiatives that have arisen in a bottom-up fashion, which is at the very origins of citizen science.

Many such initiatives provide valuable indications of the true data needs of European citizens, which could be fruitfully exploited by the research programmes sponsored by the Commission.

EU policymakers should seek ways to identify and reach out to existing initiatives and incorporate them into the formulation of citizen science research directions, closing the gap and converging to a more holistic policy toward citizen science in the EU.

Directly address the concerns of policy makers on citizen science

Policy-makers are understandably concerned about a number of aspects of citizen science, such as data quality, the potential for introducing bias, and even intentional introduction of inaccuracies (for example, as a result of incentivization).

These concerns can and should be proactively and directly addressed: by presenting the evidence put forward by reputable scientists on the trustworthiness of citizen science data; by placing citizen science within the perspective of overall scientific research methodology, where all data collection is accompanied by measures for risk reduction and quality assurance; and by promoting and disseminating the many studies of responsible citizen science ethics (such as the Ten Principles of Citizen Science published by the European Citizen Science Association¹).

¹ecs.sciencemuseum.org.uk/engage-us/10-principles-citizen-science



About the Project Group

CDB Project Group:

LandSense

Project Group Leader:

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Led by the LandSense Citizen Observatory, this innovative project group aims at demonstrating the societal and economic benefits of involving citizens in environmental decision making and cooperative planning. The project group, a cluster of the H2020 citizen observatories (GroundTruth 2.0, GROW, LandSense, SCENT, WeObserve) is essential for supporting Europe's leading role in integrating citizen science and building resilient communities. Together, these projects empower and enable citizens to become the 'eyes' of the policy makers and to complement existing environmental monitoring systems. Each project has built on previous research and existing, well-tested components related to Earth Observation (EO) data and natural resource management to establish COs that deliver state-of-the-art tools and services to gather citizen-based data. The respective domains of interest are diverse. For example, LandSense focuses on connecting citizens with EO data to address urban, agricultural, and forest monitoring issues across various pilots within the EU. **SCENT** incorporates information retrieved from citizens in flood monitoring, while **GROW** highlights the collection of information on soil resources. The thematic focus of **Ground Truth 2.0** is on flora and fauna, as well as water availability and water quality, for land and natural resource management. **WeObserve** addresses three key challenges that COs face: awareness, acceptability and sustainability, and aims to improve the coordination between existing COs and related regional, European and international activities.



Projects

Ground Truth 2.0

gt20.eu
GA 689744

SCENT

scent-project.eu
GA 688930

LandSense

landsense.eu
GA 689812

WeObserve

weobserve.eu
GA 776740





Agricultural greenhouse gas reduction with perennial biomass crops grown on marginal land

Introduction

To avoid the negative consequences of 'runaway' climate change caused by greenhouse gases (GHG), greenhouse gas reduction (GGR) technologies are needed urgently. Fast growing, low input but high output perennial biomass crops fix carbon from the atmosphere by photosynthesis. Large scale cropping can contribute to negative emissions if the biomass produced is used in long lasting bioproducts (e.g. in construction materials) or used in power stations with Carbon Capture and Storage (CCS). The GRACE CDB group members are developing the perennial sustainable biomass crop Miscanthus to grow on land less suitable for food production. A recent breakthrough is the development of drought tolerant and seeded hybrids. Seeded hybrids have multiplication rates of 100x that of clonal hybrids propagated by rhizomes, driving forward the potential for rapidly upscaling the production of Miscanthus biomass on marginal agricultural lands. Life cycle and sustainability assessments

balancing costs and benefits show multiple paybacks that stack up favourably for the environment and rural economies. We recommend that

1. mechanisms are developed to reward farmers for reducing GHG's in food and non-food production systems;
2. farmers target 10% of less productive land for planting perennial biomass crop production;
3. energy companies are given incentives to use biomass energy with carbon capture and storage at scale;
4. companies are incentivised to replace fossil with renewable bio-based products or
5. start up new production processes with bio-based resources;
6. incentives and information (e.g. sustainability standards) are given to stimulate use of bio-based products and sustainable consumer behaviour;
7. public procurement becomes role model in purchasing bio-based products and services.

Climate change A societal challenge for today

Climate change is one of the most important challenges facing society. Urgent action on GHG emissions reductions are needed across all sectors.

World-wide, agriculture, forestry, and other land use contributes 25% of GHGs (10 -12 GtCO₂eq per year¹). In 2012, agriculture accounted for ~10% of the EUs greenhouse gas emissions and were 24% less than in 1990 due to efficiency improvements in ruminant livestock farming methods including less nitrogen fertilization². Further net GHG reductions from agriculture are needed to achieve the nationally determined contributions (NDCs) of the Paris Agreement³. Expanding the areas of perennial biomass crops (PBCs) on lower grade lands can mitigate carbon emissions by substitution of fossil fuels and carbon sequestration in low carbon soils. PBCs have the potential to provide multiple socio-economic benefits in a beyond petroleum age. Research & development of the perennial C4 grass *Miscanthus* over the past 20 years has delivered seeded scalable hybrids. Synergistic integrated, multi-functional landscape studies incorporating these developments in *Miscanthus* are needed to inform policy, which is crucial to deployment and societal impact.

Policy challenges in addressing climate change

Developing biomass requires coordinated action across often separate government departments with responsibility for land use for agriculture, forestry, natural resources; the energy sector (electricity, heat and transport); and physical/chemical engineering. Complex interactions make policy makers afraid of unforeseen imbalances leading to unintended consequences. The EU and many national research funders have long recognised the value of non-food biomass crops to provide a proportion of emissions reductions through renewable energy into the mix with additional benefits to soils such as sequestration, erosion control. A technical push is required to step from a research funded to a commercial development of fast-growing species in the long term. After 20 years of sustained research and pre-commercialisation funding, there are several hybrids available for a range of biomass value chains. There remain many technical challenges: high up-front costs for crop establishment, harvest logistics, invasive risks and land flexibility and reversion. Stable long-term policies are needed to ensure market pull and to grow the innovation base in SMEs to use agricultural instead of fossil derived carbon feedstocks. Our project group members and consortia recognise the need for long term financial incentives to reward 'good biomass options' for growers and end users, without which potential growers will not plant a perennial crop. We propose to work with experienced policy makers to understand how best to

1 Smith, P., et al., Agriculture, forestry and other land use (AFOLU), in Climate change 2014: mitigation of climate change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 2014, Cambridge University Press.

2 EEA, Agriculture and climate change. 2015, European Environment Agency: Copenhagen. p. 9.

3 eea.europa.eu/downloads/a898650f58a641589eb0ad2cd92b55be/1481900146/agriculture-and-climate-change.pdf.

UNFCCC, The Paris Agreement and NDCs. 2015, United Nations Climate Change. p. unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs#eq-1.





place financial incentives in the right parts of the biomass chains to ensure that barriers: production, transport and storage and utilisation, are overcome. We need to find out how policies can drive a range of value opportunities for the multiple uses of biomass (including cascades of main products, co-products ...). Also, there is a great societal need for raising awareness for sustainable agricultural production and for sustainable consumer behaviour. Our consortium is ready to support the development of material for information campaigns that help to raise awareness on the sustainability advantages of perennial biomass crops for agricultural production and resource supply in a growing bio-economy. Additionally, we will deliver facts and indicators on the assessment of sustainability of perennial crops production that can serve the development of sustainability standard and finally transparency to consumer.

Recommendations

| Put reward mechanisms in place for Greenhouse Gas reduction

Mechanisms should be put in place to reward farmers for reducing GHG's in their whole farm system - delivering both food and non-food products.

| Create incentives across the perennial biomass value chain

-  Incentives should be put into place to encourage farmers to use 10% of their less productive land for planting perennial biomass crop production.
-  Energy companies should be provided with incentives to use biomass energy with carbon capture and storage at scale.
-  Establish incentives for fossil fuel replacement by companies with bio-based resources
-  Incentives and information (e.g. sustainability standards) may also be given to consumers to stimulate use of bio-based products and sustainable consumption.

| Promote new kinds of production processes

Start up new production processes with bio-based resources.

| Public procurement should lead the way

Public procurement should become a role model in purchasing bio-based products and services, showing both private and public stakeholders the value of this approach.



About the Project Group

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The GRACE Project Group is made up of 10 European-funded research projects. All projects lie within the framework of bioenergy, and namely within the development of perennial biomass crops as an option for marginal agricultural lands that are less suitable for food crop production.



Projects

GRACE

grace-bbi.eu
GA 745012

FIBRA

fibrap7.net
GA 311965

GRASSMARGINS

bit.ly/36J011E
GA 289461

LOGISTEC

logistecproject.eu
GA 311858

MAGIC

bit.ly/33spqMo
GA 727698

Miscanthus Breeding

miscanthusbreeding.org

MISCOMAR

miscomar.eu

OPTIMA

OPTIMAFP7.EU
GA 289642

OPTIMISTIC

optimisc.uni-hohenheim.de/en
GA 289159

PANACEA

panacea-h2020.eu
GA 773501

PHYTO2ENERGY

phyto2energy.eu
GA 610797

WATBIO

watbio.eu
GA 311929



European Strategic Actions in Water and Climate Change

Introduction

We are living in an increasingly complex, interconnected, and uncertain world. The variously attributed adage, “It is difficult to make forecasts, especially about the future” has never seemed truer. Decision makers in all walks of life are grappling with the consequences and have worked to reduce the uncertainty of their predictions through more and more sophisticated forecasting techniques. Gradually, however, a movement has emerged that accepts the reality of a complex future and shifts the emphasis to effective reaction over prediction. The software engineering sector adopted the motto “embrace change” with its agile development methods; the business sector subsequently popularized agile management; and policy makers are increasingly applying an approach known as foresight – a powerful set of systematic, participatory, future-intelligence-gathering and medium to long-term vision-building processes to uncover a range of possible alternative future visions and build effective, agile policy capable of confronting these alternative futures.

Nowhere is an unpredictable future becoming so evident as in climate change. Not only are climate events becoming more extreme, but they are also becoming more interconnected, often occurring simultaneously, with

unforeseen consequences. The European Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) communities are rising to the challenge by harnessing the tools of flexible policy development offered by foresight methods, and by improved identification of the emerging sources of uncertainty linked to climate change.

The projects represented in this set of policy briefs (by IMPREX and PLACARD) are directly contributing to reducing the uncertainty of near-term climate predictions and developing response strategies that may help society to better manage the remaining uncertainty. They recognize that the future will involve more and more interconnected events (such as storm surges coupled with high levels of precipitation), and that such “compound” events must be elevated to first-class citizens in climate research. They realise that long-term, slow climate change will be combined in unexpected ways with periodic extreme events. And they understand that climate policy development must evolve accordingly, complementing forecast with foresight, in order to navigate successfully the coming climate disruptions and preserve a safe and secure environment for all Europeans.

The importance of including compound events in the implementation of the Floods Directive

IMPRES Policy Brief

The phenomenon known as compound flooding, caused by the coincident occurrence of multiple flood drivers such as high precipitation events, storm surges or high runoff rates, has caused some of the most destructive flooding in Europe. To date, however, the compounding nature of multiple drivers has not been given sufficient consideration in current flood hazard and risk scenarios developed, for example, in the context of the Floods Directive¹. This may lead to a biased assessment of flood risk, both for current and future climate conditions.

IMPRES puts forward a host of reasons as to why it is important to incorporate compound events into flood hazard and risk assessments, providing related methods and tools:

- Incorporation of compound events can enhance the reliability of flood statistics and consequently flood hazard maps;
- Probability of compound events may change in the future climate;
- Compound events may call for different flood measures, making it imperative to factor them into the flood risk management plans drawn up.



Main Messages

- + Better understanding of the emergence and impact of compound events is needed. Particular attention should be paid that the correlation between flood drivers is quantified more clearly. More emphasis on and support for related research is needed.
- + Awareness and knowledge of compound events needs to be increased at all levels of river basin management.
- + Compound events should be factored in at every stage of implementation of the Floods Directive. The explicit mention of compound events in the Floods Directive as well as in related Guidance Documents should be given proper consideration.

¹ ec.europa.eu/environment/water/flood_risk/

Background

In October 1998 and January 2012 in Delfzijl in the north of The Netherlands, discharge of heavy precipitation on the polder to the sea was blocked due to storm surges happening at the same time, leading to unprecedented flooding. The 2013/2014 flood in the South West of the UK was caused by heavy precipitation on an already saturated soil in combination with high ocean water levels. A common feature of these events was that they were caused by the joint occurrence of two or more drivers, such as heavy precipitation, storm surges at sea or increased water levels in a river, which ultimately led to these extreme events. Even though compound events are known for causing some of the worst flood events, they have often been viewed as an ancillary issue in hazard and risk assessments owing to the difficulties in characterizing and predicting them. Research has shown, however, that compound floods are not only among the most destructive but are also far more common in Europe than often perceived, which is why it is all the more imperative that they be taken into account in flood statistics as well.

Within the framework of the Floods Directive all Member States are obliged to put in place flood risk management plans to

prevent, prepare for and ensure protection from flooding. In line with the Directive, flood hazard and risks are assessed in order to define flood scenarios for different return periods. The Floods Directive accounts for the great variety of flood causes by urging Member States to prepare for different types of floods that are relevant in their territory. Neither in the Floods Directive nor in related Guidance Documents, however, are compound events mentioned. Further, compound events are not sufficiently taken into account when developing flood hazard maps in the Member States. In light of the current debate on how to make Europe fit for future climate and weather conditions, compound events could well become even more relevant, especially given the potential impact that changes in weather patterns and the projected sea level rise - a new flood driver - have on the probability of occurrence of compound events.

The research project IMPREX has explored the occurrence of diverse examples of compound flood events for the current as well as the future climate in five case studies in the Netherlands and in the UK. The results underline the need to factor in compound events in implementing the Floods Directive.



The relevance of compound events

Compound events can cause extreme flood events even if individual drivers are not extreme in themselves

Compound events can be found in any areas of natural hazards, for example, droughts, wildfires, storms and floods. Multiple definitions of compound events have been proposed. The common denominators of most definitions are, however, the coincident or consecutive occurrence of more than one driver, resulting in amplified risk and, ultimately, an extreme (e.g. flood) event. It is important to mention that the individual drivers of compound events in themselves do not necessarily have to be extreme to cause an extreme hazard. Even average precipitation, for example, can cause flooding if it occurs in combination with previously saturated ground. IMPREX has developed methods to estimate the likelihood of different cases of compound flood events.

Incorporation of compound events can enhance the reliability of flood statistics and consequently the reliability of flood hazard maps

One of the challenges faced in implementing the Floods Directive in Member States is the development of reliable flood statistics as the basis for flood hazard maps. Usually flood probabilities are derived from historical flood data that is integrated into hydrological models used to derive useful statistics. Future climate conditions are mapped by manipulating or replacing the input data with information from future climate projections. For events that are governed by multiple drivers, assumptions are made on the statistical correlation between these drivers, which have a big impact on the outcome of the flood probability estimate.

A difficulty that stands in the way of an accurate derivation of the correlation



structure is that observational records are only available for limited time spans, which may not cover very extreme events driven by a rare combination of multiple drivers with an unknown mutual dependence. This in turn may lead to biases in the derived flood statistics and risks. On the basis of a number of case studies of compound flood events, IMPREX has enhanced the understanding of the statistical dependence of flood drivers. For instance, it provided a method involving a high-resolution regional climate model simulation for current and future climate conditions, which was coupled with hydrological and/or hydraulic models. It provided much longer time-series of relevant variables than available from observations. This approach was used to analyse statistical dependencies between drivers of flood events when deriving flood risk. This method was applied to different case studies in order to quantify the effect of the dependency between flood drivers and how this might change in future climate. The method was thus shown to be transferable to other applications.

The results highlight not only the need to incorporate compound events into flood hazard assessments. In fact, they also show that it is possible and should be further explored for the implementation of the Floods Directive.

Probability of occurrence of compound events may change in future climate

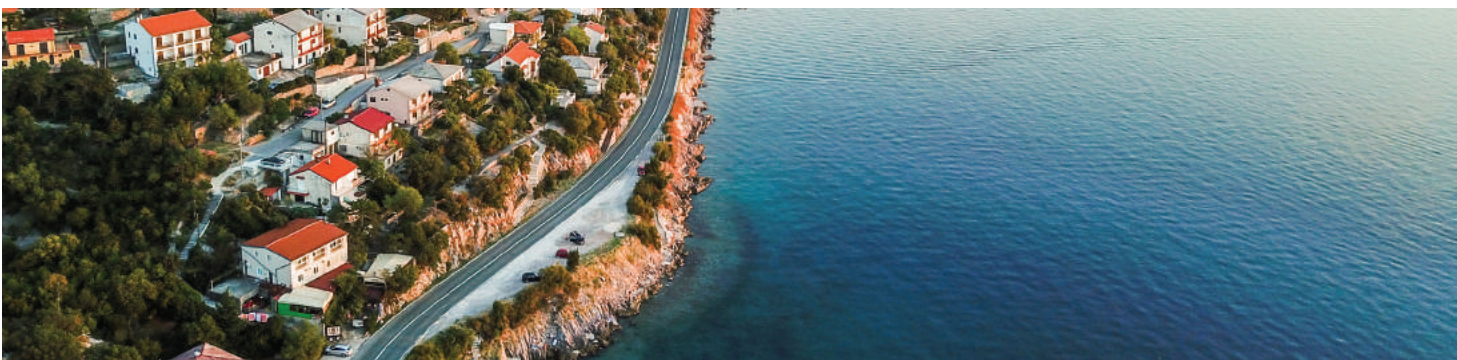
One of the biggest unknowns in climate research is the effect of the changing climate on weather patterns.

This leads to great uncertainty in future climate scenarios and, consequently, flood scenarios. This also gives rise to challenges for Member States when it comes to drawing up flood hazard maps in the context of implementation of the Floods Directive. When considering changing weather patterns it is important not only to look at changing patterns of isolated flood drivers but also to explore more deeply how climate change alters the correlation structure between such drivers, as this may affect the probability of compound events. A change in the correlation between drivers can be caused by altered large-scale atmospheric circulation patterns affecting storm statistics, or changes in hydrological phenomena that affect flood risk, increasing or decreasing it accordingly; in both cases, the potential impact on the financial risk and preparatory measures is substantial. For this reason, a better understanding of the driving forces behind compound events is paramount.

The current debate on how to give greater consideration to climate change impacts in flood hazard and risk maps should not leave out the potential changes in the probability of extreme events due to compound scenarios.

Compound events may call for different flood measures, making it imperative to factor them into the flood risk management plans drawn up

The Floods Directive requires Member States to select appropriate flood measures based on a prior assessment of flood hazard and risk. When it comes to choosing flood measures that also take compound scenarios into account, however, there is limited understanding and experience. This becomes especially critical if flood measures designed to counteract flooding caused by individual drivers, fail in compound events. IMPREX has investigated a few such cases which show that compound events may require different flood measures than those that would be necessary if the driver were to occur on its own. One case study shows how the coincidence of extremely high river discharges of River Rhine and Meuse in combination with storm surge off the Dutch coast and projected sea level rise does not allow for the water to be discharged to the sea, which in turn leads to a huge flood risk resulting from the fact that the flood measures can no longer work here. The same holds true for another case study, where the simultaneous occurrence of peak flows meant two rivers (Dommel and Aa) were no longer able to discharge into the River Meuse, resulting in severe flooding. The outcome here shows how vital it is to take the risk of compound events into account when evaluating suitable flood measures, for example, when putting together programmes of measures as part of flood risk management plans.



Recommendations

IMPRES not only provides evidence on why proper consideration of compound events is much needed also in the context of implementation of the Floods Directive, but also shows how compound events can be incorporated into flood statistics, enabling better preparation and protection from some of the most destructive floods ever seen. Based on the work conducted within IMPRES, the following recommendations are made:

Improve the understanding of compound flood events and the correlation between drivers through research.

The integration of compound events into flood scenarios is crucial to be able to accurately gauge the probability of extreme events and improve flood statistics. Better understanding of underlying meteorological and hydrological processes of compound events is needed. A first step has been taken in the form of the European COST action DAMOCLES, a recent initiative (involving IMPRES partners) that seeks to coordinate research and improve the assessment of compound events.

Raise awareness of compound events with policy and decision makers and strengthen related management capacities.

Several EU Member States have had hands-on experience with compound events. This experience should be actively shared in order to deepen our knowledge and bridge the gap between research and practice.

Include compound events in the European policy framework for flood risk management.

Flood risks resulting from compound events need to be taken into account at every stage of implementation of the Floods Directive, from deriving flood statistics and developing flood hazard maps to determining flood measures. Proper consideration should therefore be given to the possibility of explicitly specifying compound events as a potential flood source in the Floods Directive as well as in related Guidance Documents



Weather Worries: The future of Europe depends on how it manages the risks of climate extremes PLACARD Policy Brief

Why the EU should worry about the weather

Geo-political power shifts, uncertain economic development, migration, populism, BREXIT – Europe lives in tumultuous times with multiple challenges. In 2017, President Juncker started a debate on the Future of Europe: What future do we want for ourselves, for our children and for our European Union? A White Paper mapped out the drivers of change in the next decade, presenting a range of scenarios for how Europe could evolve by 2025 (see also box on page 2).

The emphasis is on the choices to be made to shape the unavoidable transformation of the Union rather than to be carried with them. That same year, three European think tanks emphasised that climate change should be one of the key challenges that need to be addressed in this process. These focussed mainly on mitigation: the challenges posed by the energy transition required to meet the goals of the Paris Agreement¹, of which the EU was one of the main driving forces. However, even if the goals of Paris would be achieved, and even more so when these goals would not be achieved, Europe's future will be affected by both slow-onset climatic changes but also by the changing occurrence of extreme weather events.

In recent years, large scale floods, freak storms, heatwaves and scorching droughts have already affected large parts of Europe. Their frequency and scope is projected to increase and may increasingly exceed the capabilities of individual Member States to save lives and limit economic damage.



The frequency and scope of extreme weather events is projected to increase and may increasingly exceed the capabilities of individual EU member states to save lives and limit economic damage

¹ ec.europa.eu/clima/policies/international/negotiations/paris_en

5 Different future scenarios for the EU

- 1 Carrying on:**
The EU27 focusses on delivering its positive reform agenda
- 2 Nothing but the single market:**
The EU27 is gradually re-centred on the single market
- 3 Those who want more do more:**
Willing member states do more together in specific areas
- 4 Doing less more efficiently:**
A focus on delivering more faster in selected areas, doing less elsewhere
- 5 Doing much more together:**
Member states decide to do much more together across all policy areas.



Choices about the future of the European Union have upsides and downsides for climate risks

At first sight, a scenario in which Member States would do much more together would offer the best opportunities to enhance future resilience and manage climate risks. Existing mechanisms like the Union Civil Protection Mechanism and the EU Strategy on Adaptation to Climate Change along with their supporting implementation mechanisms like knowledge networks, pooled resources and solidarity-based funding schemes could readily be strengthened.

A scenario in which the EU would re-centre its focus on the single market could lead to innovative market-driven solutions to climate risks boosted by increasing roles of the private sector

The EU's position in international climate negotiations would be bolstered. However, such a scenario also has the pitfalls of over-regulation, sluggish coordination and a mismatch between the slow development of formal guidelines and frameworks on the EU level versus the needs of fast decision-making to address urgent climate risks at local and regional levels. Expansion of the EU may further dilute or slow down Climate Change Action and Disaster Risk Reduction response capabilities.

In a scenario in which the EU would re-center its focus on the single market, much less coordination and cooperation can be expected in prevention, preparedness,

response and recovery, and increased inequality between regions can be expected. However, this scenario may lead to innovative market-driven solutions to climate risks, boosted by an increasing role of the private sector, including but not limited to financial instruments like in the insurance business. In a scenario in which a limited number of Member States with similar challenges would enhance their collaboration on climate risks ("coalitions of the willing"), there would be a greater disparity in the rate of development between Member States with regards to science, economy and security and differences in the willingness to act. But Member States facing similar issues can move faster in developing solutions without waiting for other Member States to move at the same speed. This can lead to a tailored approach, with efficient and prompt response capabilities related to specific needs and innovations. Other Member States would have the opportunity of joining over time. In a scenario in which the EU would do less but more efficiently, obviously future climate resilience will depend on the selection of CCA and DRR as one of the priority areas.

A scenario in which Member States would do much more together would offer the best opportunities to enhance future resilience and manage climate risks



Recommendations

The EU's future is unknown - how can the EU manage extreme weather risks under this uncertainty?

Not only from a governance, but also from a climate perspective, the EU will look completely differently in a few decades. The current EU Strategy on Adaptation to Climate Change and the Union Civil Protection Mechanism require strengthening to effectively address the increasing risks posed by different possible EU futures.

- 📣 It is recommended that DG CLIMA guidance on developing adaptation strategies and DG ECHO advice on Risk Assessment are updated, taking into account the results of foresight work.
- 📣 The forward-looking approaches used in foresight should be showcased for all relevant actors, in order to help them to prepare for the range of possible futures across Europe.
- 📣 Advances that have been made in sharing of data, knowledge and good practice can be sustained, but also weakened or even nullified, depending on the direction the EU takes. Therefore, specific guarantees with effective institutional and financial support have to be developed both at the EU level and between Member States, in order to sustain or enhance existing mechanisms and ensure resilience in an uncertain future.
- 📣 There is a need for the continued building of a CCA and DRR expert community that should be at least partially independent from EU funding.
- 📣 Collaboration and cooperation between actors across administrative borders should be strengthened and agreement on logistics, legislation, distribution of resources between the EU and MS actors pursued.

References

Leitner, M., Coninx, I., Swart, R. and Lourenço, T.C. 2019. Foresight workshop summary: The future of Europe depends on how it manages the risks of climate extremes. PLACARD project, FC.ID, Lisbon.

Further reading

The future of Europe and the future of climate action: reflections and scenarios for the EU27 by Gaventa, J., Dufour, M., Nesbit, M., Paquel, K and Primova, R. (C3S, 2017) and the White Paper on the Future of Europe - Reflections and scenarios for the EU27 by 2025 (European Commission, 2017).



Conclusions

The policy briefs presented in this booklet exemplify a two-pronged approach emerging within the CCA and DRR communities:

- + Improve our short-term prediction capability by adapting to the new realities of climate change. This means not only studying and tracking ever-more frequent extreme single events, but also identifying new trends such as the formation of extreme compound phenomena and raising awareness about them in research, response, and policy-making groups.
- + Acknowledge the fundamental uncertainty that will underlie future climate change management and adopt methodologies, particularly the processes of foresight development, that increase our capacity for elastic, flexible policy development appropriate to confronting the challenges that lie ahead.

About the Project Group

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Bingo

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Projects



BINGO

projectbingo.eu
GA 745012

CLARA

clara-project.eu
GA 745012

HIDRALETRA

(FCT - Portuguese national funding agency for Research and Technology)

IMPRES

impres.eu
GA 745012

LIS-WATER

lis-water.org
GA 745012

PLACARD

placard-network.eu
GA 745012

RESCCUE

rescuee.eu
GA 745012



A shift to rail in Europe Policy recommendations from Shift2Rail

Introduction

Rail transportation has the potential to be a key element in addressing a number of challenges facing today's society. In particular, a significant shift from road to rail transportation can become a central component in the fight against climate change, a challenge specifically acknowledged in the EC long-term vision for the economy. In order to achieve this objective, the rail industry must acquire more market attractiveness. Uptake of innovative technologies will enable integration into emerging digital logistics chains and drastically improve cost efficiency. But the rail sector is highly fragmented in Europe, with technical and organisational incompatibilities at many levels. The Shift2Rail Joint Undertaking (S2R JU) is a public-private partnership under the Horizon 2020 Framework Programme established to

manage and coordinate mission-oriented Research and Innovation (R&I) activities for a major transformation in rail systems in Europe. This policy brief recommends a sharp focus on a limited number of priorities in order to optimize resources and avoid dispersion of effort. It was elaborated within the context of the Common Dissemination Booster, funded under Horizon 2020, and is based upon the results of the projects participating in the CDB services.



Europe's Rail Transportation System

Shift2Rail

Shifting transportation from road vehicles to rail is an important component in the effective addressing of climate change, which has also been acknowledged within the EC long-term vision for the economy in 2015 (28 November 2018). However, in order to achieve these strategic goals, rail transport must acquire more market attractiveness. This will occur through a combination of factors, such as improved cost-efficiency and smooth integration into the emerging digital logistics chains. Digital integration will enable a host of automation possibilities, further enhancing cost efficiency. These possibilities include automation of signalling and traffic management, enhanced information systems, and even automated train operation. The technological challenges are

formidable: European national rail systems often exhibit incompatibilities at many levels, from infrastructure and rolling stock to signalling. Organisational challenges are created by the diversity of manufacturers and infrastructure managers. Societal challenges can be addressed through decarbonisation initiatives that directly combat greenhouse gas emission. The problem is not only technological, logistical, and societal, however – it is also a problem of innovation management. The rail sector has been traditionally plagued by the slow diffusion of innovations, in contrast to the rapid uptake of new technologies in other transport sectors such as the automotive industry. Effective approaches are needed to address also these kinds of issues.



Drastic cost reduction:

Private sector can build up efficient and economically sustainable supply chains



Increased competitiveness:

Quality, reliability and attractiveness of rail services for businesses and passengers



Impacts:

New employment opportunities in public and private spheres



Policy challenges

The severe fragmentation of the current European rail landscape outlined above creates challenges for policy makers to achieve meaningful, lasting impact. Not only technological and organisational fragmentation has proven to be a problem, but also the fragmentation of more policy-related initiatives such as targeted research programmes - both those directed at the creation and uptake of technological innovation in the rail sector, and those directed at collaborative initiatives to promote coordination and alignment with overall EU policy.

Working with the capabilities provided by the JU instrument, the challenge becomes to develop and promote coordinated strategic research agendas that collectively are able to support the achievement of lasting impact in the rail

industry, overcoming the obstacles of fragmentation. It also makes it possible to introduce more powerful policy support for uptake of technological innovations in the rail industry, overcoming “legacy thinking” and inertia among key actors and offering other types of support such as leverage of EU funding when appropriate to ensure that market uptake can be initiated and carried through to successful conclusion.



Recommendations

| Focus on a limited number of priorities

The results of Shift2Rail have indicated that, rather than trying to address all challenges at the same time, it is more efficient and effective to focus on a limited number of priorities and address emerging challenges such as automation, digitalisation, decarbonisation and the need to increase the attractiveness of rail freight and its integration into digital multimodal mobility and logistics chains.

| Address innovation uptake

Due to the complexity of administration and of the customer-supplier network, the uptake of innovative technologies and transport means in rail is plagued by inefficiencies and slowdowns. Policy should be developed to ensure and accelerate the deployment of innovation on the rail network. Policymakers should track new and innovative approaches such as real-time management of operations through new concepts such as virtual coupling and platooning, and the utilization of artificial intelligence in achieving smart logistics and communication. The introduction of autonomous trains and automated freight operation, while seemingly fraught with uncertainty, will in fact create more predictability together with increased flexibility. The assertive introduction of policy to promote uptake of such innovations will help to overcome the natural inertia that has traditionally been associated with the rail industry.

| Promote economic attractiveness

Pay particular attention to cost reduction in rail, increasing the competitiveness of the sector (including comparisons with other modes of transportation) and the quality, reliability and attractiveness of rail services for businesses and passengers. Emphasise that the drastic reduction of costs through innovation uptake and other improvements will reduce the need for national subsidies by Member State governments, as private industry is able to build up efficient and economically sustainable supply chains. A growing rail sector will provide new employment opportunities both in the public and private spheres, further enhancing its attractiveness within the overall economy of the European Union.



 Projects

Shift2Rail

shift2rail.org

IN2TRACK

bit.ly/35fGkyD
GA 730841

IMPACT-2

bit.ly/2t44VYT
GA 777513

FR8HUB

bit.ly/2RRyS8O
GA 777402

FR8RAIL

bit.ly/2LNKgPo
GA 730617

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IMPACT-2

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The Project Group is part of the bigger Shift2Rail programme which has the ambition to reposition rail as the preferred mode of choice delivering environmental benefits contributing to a single European Railway area, supporting the competitiveness of European Railway Technology suppliers and more broadly boost the competitiveness of the EU economy as a whole.





Big data in Europe for 2020 and beyond: Policy insights and recommendations from current H2020 big data projects

Introduction

This policy brief reflects current developments within the several Big Data research projects funded under H2020 and, combined with insights from the BDV PPP summit in Riga, aims to contribute to ongoing challenges in Europe around the regulation of big data. This policy brief is a product of the Common Dissemination Booster, funded under H2020. The policy recommendations are based on projects participating in the CDB services.

One of the main challenges identified in this policy brief is that of regulating big data. The contributors represent a multidisciplinary set of scholars, researchers and practitioners involved in either implementing big data solutions, researching data policy and governance, or finding technological solutions for implementing data policies. These activities are distinctly different and yet are intrinsically connected through questions of how Europe can maximize big data benefits while simultaneously

protecting rights of individuals and companies.

In the policy brief, we draw from a set of insights and lessons learnt that are based on recent H2020 projects around big data development and implementation in different sectors, ranging from traffic and transport to online retail to the public sector and more. The main solutions offered from the projects are (among others) a data governance taxonomy, tools for automated compliance, a Data Asset Marketplace and a roadmap for using big data for policymaking. The main recommendations are to support integration and interoperability of public administration databases; to support development of data markets and provide guidance on their effective use, to support work on the adoption of privacy-preserving technologies for big data and AI and to promote data-driven policymaking and regulatory automation.

Big data and AI

Big data and AI are currently top-of-mind themes in many technical-and non-technical debates. Where on the one hand, big data technologies come with a set of large claims and promises concerning its disruptive potential in many, if not all sectors, it also comes with large risks, be they societal, economic or scientific.

Data governance is becoming increasingly important on both a strategic-and operational level for companies, governments and organisations alike, due to the role of data taking more centre-stage in many day-to-day processes and decisions. Going truly “data-driven” is a slow process, often regarded as highly risky, and much innovation in data governance models is emerging to address this issue. The DigiTranScope project is developing a strong taxonomy for data governance.

Sector-specific or cross-sectorial interactions between the availability and the need for data are matched via data marketplaces and/or via particular data resources or platforms that offer datasets or algorithms or specific software for analysing data. Access to data and data marketplaces is crucial for stimulating data-driven (economic) activity, as is confirmed by the EWSHOPP project, Big Data Stack and the TransformingTransport pilot projects.

Governments are also realising the enormous potential of the data available in their respective databases and other sources of data, and are striving to unlock the public value of this data by making their data sources interoperable across borders and administrations. Such actions are being supported by important European-level initiatives such as the Once Only Principle¹ and the European Interoperability Framework². Using big data for policymaking is a developing area of interest, that comes with promises and challenges: a roadmap



for research has recently been developed by the Big Data Policy Canvas project.

At the same time, landmark European legislation such as the General Data Protection Regulation (GDPR) has made it necessary to ensure that powerful technologies such as big data and AI are implemented under full respect of privacy preservation considerations. Where the MYHD project is offering technological solutions to ensure safe data sharing and patient data control mechanisms via blockchain-based mechanisms, the E-SIDES project has developed a highly insightful gap analysis on why and how technological solutions (PPTs) lack uptake and what we can do about it, while the LeMo project has shown the complexity of the data regulatory landscape, and the connection between different data regulations.

¹ ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Once+Only+Principle

² ec.europa.eu/isa2/eif_en



Policy challenges

Developing policy for big data and AI, that is, developing strategies and approaches to maximize societal, scientific and economic benefit, is every bit as pressing and challenging as developing and adopting big data and AI technologies themselves. A critical challenge for policymakers is to recognize the crucial importance of data as the “fifth freedom” in the European Single Market and to develop a coherent, consistent concept of the nature of data so that policy can support its effective governance and promote the development of innovative governance models.

Although data marketplaces can thrive on their own, policy formulation can provide much needed support through, for example, the facilitation of cross-border flows and creating transparent, simplified regulation of data rights.

The arrival of the GDPR has unfortunately created a false dichotomy in the minds of too many entrepreneurs and businesspersons who believe that privacy preservation and innovation are incompatible. It is an urgent policy challenge at the highest levels to ensure that this false dichotomy does not take root and slow down the pace of European innovation.

Policy development strives to keep pace with the rapid advance of big data and AI technology, but the complex web of factors ranging from privacy mandates (e.g. user consent) to regulatory frameworks inevitably slows it down. And yet, the technology itself contains the seeds of policy innovation, through the largely unexplored potential of data-driven policymaking, whereby the data itself enables rapid and transparent implementation and monitoring, and AI-assisted policy compliance monitoring.

Recommendations

| Develop and implement different data governance models

Data-driven digital services cover many areas and sectors and involve a large number of stakeholders along the value chain. Yet successful data platforms seem to develop in a converging manner. Ensure that data silos and economic power due to such silos can be better understood and managed, due to network effects. More research is needed on how we can consider and take on board the multiplicity of stakeholders and how, via for instance the taxonomy on different data governance models, we can better understand the role of data governance in balancing different data interests.

| Support integration and interoperability of public administration databases

The integration and interoperability of government data is becoming increasingly urgent as government holds massive and rapidly growing amounts of data that are dramatically underexploited. In this regard, new solutions are needed that balance the need for data integration with the safeguards on data protection, the demand for data centralisation with the need to respect each administration's autonomy, and the requirement for ex ante homogenization with more pragmatic, on-demand approaches based on the "data lake" paradigm. Data integration has long been a priority for public administrations but with the new European Interoperability Framework and the objective of the once only principle it has become an unavoidable priority. As an example, the Data & Analytics Framework (DAF) by the Italian Digital Team aims to develop and simplify the interoperability of public data between PAs, standardize and promote the dissemination of open data, optimize data analysis processes and generate knowledge to be reused.

| Support development of data markets and provide guidance on their effective use

Provide policy support for the creation of open data initiatives from different governments in the world. The availability of more data is crucial for organizations and citizens, empowering them to analyse and use these data for a plethora of applications. Support for development of tools for big data management and exploitation is another action which has a great effect in reducing this gap. The first thing to note (even though it might seem obvious, but many times is not well understood) is how requirements vary for different types of applications, stakeholders and organizations. The criticality of the requirements varies greatly. Another important action is to create an awareness of what AI and Big Data are, in what problems and circumstances they can help, and even more importantly, in which cases they are not useful.

| Support work on the adoption of privacy-preserving technologies for big data and AI

The flexible interpretation of privacy and privacy-preserving technologies, which is both a blessing and a curse for professionals designing and using these technologies, could be addressed by policies that offer guidelines on how to insert legal definitions of privacy into design requirements that are tailored to different big data contexts. Policies aimed at bridging differences in EU and US approaches to privacy and competition law could help deconstruct implementation barriers for privacy-preserving technologies. Although US companies handling data of EU residents must comply with GDPR and align US and EU approaches to data protection, the US approach remains quite different. Sector specific policies and best practices for the handling of sensitive data are also perceived as assets by a wide spectrum of professionals. Promotion of collecting and disseminating best-practices would be very helpful.

| Promote data-driven policymaking and regulatory automation

Technology is constantly trying to catch up and provide solutions for organizational changes, which is natural. However, if we would like to make maximum usage of the technology, it would be very beneficial if policies, regulatory frameworks, legislation etc. are written in a machine-readable form that would enable the rapid implementation and monitoring of them. By formulating and describing policies in a way that could be easily transformed into contractual terms, e.g. in smart contracts, we could increase the transparency and the common understanding of the policies from users who are not accustomed to the details of the technology. We need deterministic methods that will be responsible for modelling and storing data privacy policies and user consent. This will be the engine for determining whether data is allowed to be stored, accessed, or transferred based on the owner of the data and the purpose for which it will be used, together with the relevant privacy policies.



Further information and a relevant appendices can be found in the full version of the policy brief here:
big-data-value.eu/policy-blog-series

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The PG BDVe aims to develop the Innovation Ecosystem that will enable the **data and AI-driven digital transformation in Europe** delivering maximum economic and societal benefit, and, achieving and sustaining Europe's leadership on **Big Data Value creation** and **Artificial Intelligence**. The PG is led by the Big Data Value eCcosystem Project (BDVe) which provides coordination and support for the current and future H2020 projects within the Big Data Value Public-Private Partnership.

Projects



AEGIS

aegis-bigdata.eu
GA 745012

BDVe

big-data-value.eu
GA 745012

BigDataOcean

bigdataocean.eu
GA 745012

BigDataStack

bigdatastack.eu
GA 745012

BigPolicyCanvas

bigpolicycanvas.eu
GA 745012

e-Sides

e-sides.eu/e-sides-project
GA 745012

euBusinessGraph

eubusinessgraph.eu
GA 745012

Data Pitch

datapitch.eu
GA 745012

DataBio

databio.eu
GA 745012

EW-Shopp

ew-shopp.eu
GA 745012

FashionBrain

fashionbrain-project.eu
GA 745012

My Health My Data

myhealthmydata.eu
GA 745012

K-PLEX

kplex-project.eu
GA 745012

Lemo-H2020

lemo-h2020.eu
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QROWD

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SLIPO

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GA 745012

SODA

soda-project.eu
GA 745012

SPECIAL

specialprivacy.eu
GA 745012

Transforming Transport

transformingtransport.eu
GA 745012





Benefits of Novel Lactobacilli Research

Introduction

Following the consolidation of the Experimental Microbiome and GENOLACT research projects into the GeLACTO research partnership, it was revealed that key policy changes have to be enacted from low-level industrial regulations to national policies across Europe and beyond.

GeLACTO is a research partnership that specialises on the study of lactobacilli with results that include an extensive taxonomy of more than 200 lactobacilli species, and a comprehensive analysis of the properties of lactobacillus Plantarum and its effects on nutrient absorption.

In light of this, GeLACTO has come out with the following policy recommendations which can be carried out based on the research partnership's extensive lactobacilli research:

- + Food safety regulators should adopt a more updated lactobacilli taxonomic framework
- + Agriculture ministries should exploit GeLACTO's research in technology to improve agricultural yields and livestock output
- + Humanitarian agencies should explore the use probiotic strains for use in medical applications such as the use of probiotics for the treatment of malnutrition
- + Define new guidelines for safety assessment and for the definition of health claims of novel starter cultures and probiotics



Novel Lactobacilli Research

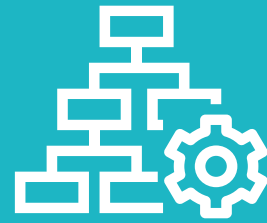
The expanded knowledge achieved on the taxonomy and the resistome of Lactobacilli ^[1] (GENOLACT Project) coupled with the identification of the Lactobacillus genes and molecules capable to promote animal growth (Experimental Microbiome Project) greatly impact not only the scientific community, different research companies and industries, but also has wide applicability for regulatory bodies, agriculture and industrial policy, and even science diplomacy.

Several food and agricultural policy sectors may benefit of the research carried out in GENOLACT and Experimental Microbiome, including the whole chain of the probiotics and of the food and feed regulatory bodies and policy development sectors.

This policy brief proposes alignment of newly identified lactobacilli species to the overall taxonomy record for research, academics and market data. Then, based on the available body of knowledge and intended use, legislative bodies and consultancy agencies can then align food and policy development sectors that incorporate lactobacilli in their policy, regulations and standard rules such as food and nutrition, pharmaceuticals, and agriculture.

Lactobacilli are microorganisms encountered in a wide variety of habitats. They constitute a significant component of human and animal microbiota and they are widely used in medical and food industries as both probiotics and starter cultures due to their broad applicability.

ExperimentalMicrobiome and GENOLACT are two H2020 projects which focus on the study of Lactobacillus under complementary perspectives. Below are the results produced by the project group:



Comprehensive Lactobacillus Taxonomy

A more stable taxonomic framework for providing more information on their antimicrobial resistance



Lactobacillus Plantarum Comparative Genomics Database

In-depth analysis of the properties of L.plantarum's influence on the growth of its animal host

Policy challenges

The need for taxonomic 'correction' has been known for a long time, but until recently, the methodologies needed to reliably group the current *Lactobacillus* species into new genera were not available. The result of the GeLACTO projects directly addresses this challenge. Dependence on outdated fundamental knowledge of lactobacilli taxonomy by agricultural and industrial policy makers, regulators and the market across the world means GeLACTO's research results has applications for the following areas that involve lactobacilli:

**Agricultural
development
policies**



**Food safety
assessment
regulations**



**Food and beverage
industry labelling
regulations**



**Pharmaceutical
safety testing and
regulations**



**Animal feeds
regulations**





**Probiotics
regulations**



Recommendations

Based on the challenges above, we propose the adoption of a new, unified list of *Lactobacillus* species where applicable, thereby leading to:

-  **Reclassification/subdivision of the genus *Lactobacillus* into more uniform taxonomic nuclei providing accurate molecular markers that can be used for regulatory approval applications.**
-  **Reclassification for facilitating scientific communication related to lactobacilli and preventing misidentification issues, which are still the major cause of mislabelling of probiotic and food products reported worldwide.**

We propose the following recommendations for policy and regulatory changes:

Adopt the more updated lactobacilli taxonomic framework for safety food regulations

The increased use of food cultures to ferment perishable raw materials has potentiated the need for regulations to assess and assure the safety of food cultures and their uses. These regulations differ from country to country, all aimed at assuring the safe use of food cultures which has to be guaranteed by the food cul

GeLACTO's research, under GENOLACT, has produced a taxonomy identifying a nearly 200 *Lactobacillus* and related (e.g., *Pediococcus*, *Leuconostoc*, *Fructobacillus*, *Oenococcus*) species and showed that the *Lactobacillus* genus comprises 10 phylogroups (see below), a paper by Salvetti et al (2018).

The 10 phylogroups Salvetti et al (2018)

- ✚ *Lactobacillus delbrueckii* group (which contains *L. acidophilus*)
- ✚ *Lactobacillus alimentarius* group (which contains *L. farciminis*)
- ✚ *Lactobacillus perolens* group
- ✚ *Lactobacillus casei* group (which contains *L. rhamnosus* and *L. paracasei*)
- ✚ *Lactobacillus sakei* group
- ✚ *Lactobacillus coryniformis* group
- ✚ *Lactobacillus salivarius* group
- ✚ *Lactobacillus reuteri* group or *Lactobacillus fermentum* group
- ✚ *Lactobacillus buchneri* group (which contains *L. brevis*)
- ✚ *Lactobacillus plantarum* group

This paper proposes adoption of newly identified lactobacilli species to the overall taxonomic framework for food safety regulations. At present, the information used by the food processing and labelling industry is outdated and based on a less comprehensive taxonomy. Partially, this is caused by difficulty in changing a system that has already been in place for a long time.

This currently results in mislabelled products which can prevent effective information exchange and confusion when communicating the contents of processed food products. This presents a problem as the food industry is characterised by an interdependent chain of processes and systems.

The Labelling guidelines were developed to provide information that will help consumers make informed choices. Probiotic products on the market must meet label claims regarding the numbers and types of viable microbes present in the product and maintenance of viability (as indicated by colony-forming units, or CFU), dosage, but more importantly - **using the current nomenclature to identify the genus, species, and strain of all organisms included in the product.**

The improvement and refinement of lactobacillus taxonomy (an important result of the GENOLACT project) is important not just for the industrial applications, for the correct labelling of products and

components, but especially for the FC safety assessment sectors. In the EU, this is set out in the General Food Law, where food cultures (FC) are treated similarly to all other ingredients used in food, which need to be safe. Key entities involved in the FC safety assessment in the EU such as European Food Safety Authority, International Dairy Federation, and European Food and Feed Cultures Association have proposed **additional tools and methods to evaluate the safety of FC** with the unique target of keeping a high level of food safety and to protect human life and health, and these can be updated to take into account GeLACTO's results.

On the market side, FC suppliers have also implemented **control points** to evaluate if the FC produced are safe and used in a safe way. This is where the updated taxonomic framework can be applied.



Agriculture ministries should exploit GeLACTO's research in technology to improve agricultural yields and livestock output

We propose the exploitation of GeLACTO research to explore the role of lactobacillus in **improving agricultural yields and livestock output**. Some benefits of this research can result in:

- ✦ Improved **crop performance**
- ✦ **Accelerated large scale composting** efforts
- ✦ **Odour control** in large scale composting operations
- ✦ Enriched soil for **promoting plant growth**
- ✦ **Improved livestock yields**

The research and results of the two projects may contribute to explore the growing concern with the sub-therapeutic use of Antibiotic Growth Promoters (AGP) in animal feed, greater appreciation of the role of the microbial ecology of the gastro-intestinal tract in determining animal productivity, increasing numbers of probiotic products which reduced morbidity or mortality, and benefits for the consumer through improved product quality.



Development of probiotic strains for use in medical applications such as malnutrition treatment

While strides have been made in uplifting more families out of poverty and there are disaster and conflict relief systems that are generally in place, another avenue that could be explored is the **use probiotics for improving the nutrient absorption for humans** suffering from malnutrition.

Using GeLACTO's research, (specifically the outputs of Experimental Microbiome), **probiotics could be further improved and geared towards treating malnutrition** and alleviating famine.

This can then be achieved through **public-private partnerships**, where food or pharmaceutical industry players can use the improved understanding of lactobacillus to **produce and supply improved probiotic products** to government agencies, or non-governmental humanitarian organisations that deal specifically with famine and malnutrition.

Definition of new safety assessment guidelines and evaluating health claims of novel starter cultures and probiotics

A more accurate designation of the specific Lactobacillus species, resulting from GeLACTO's research, can be used to formulate probiotic products can help communicate ingredients' specific benefits. Alternatively, governments can also utilise the results of **GeLACTO for effective science diplomacy**, facilitating **technology transfer across borders** to help build economic and technological links between countries and markets.





Since numerous types of microbes are used as lactobacillus, **safety is intricately tied to the nature of the specific microbe** being used. From a scientific perspective, a suitable description of a probiotic product as reflected on the label should include:

- ✦ Genus and species identification, with nomenclature consistent with current scientifically recognized names
- ✦ Strain designation
- ✦ Viable count of each strain at the end of shelf-life
- ✦ Recommended storage conditions
- ✦ Safety under the conditions of recommended use
- ✦ Recommended dose, which should be based on induction of the claimed physiological effect
- ✦ An accurate description of the physiological effect, as far as is allowable by law
- ✦ Contact information for post-market surveillance

Considering the constant need for the improvement and definition of safety assessment guidelines of novel starter cultures and probiotics and that the taxonomy used in the industry is outdated, organisations on both the regulators and industry side can benefit from GeLACTO. Medical and Pharmaceutical industries can benefit from **better selection of starter cultures** for specific food preparations, probiotic strains and bacterial molecules to be used as a **treatment of malnutrition**, to enhance the potential of specific dietary regimes, through GeLACTO's research.



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Projects



GeLACTO

Experimental Microbiome

GA 659510

GENOLACT

clara-project.eu

GA 659801





Zero-Defect Manufacturing

The next era after Total Quality Management

Introduction

Manufacturing represents approximately 21% of the EU's GDP and 20% of its employment, providing more than 30 million jobs in 230.000 enterprises, mostly SMEs. Europe has embraced and has become a world leader in Industry 4.0, an initiative to bring a quantum leap in manufacturing efficiency and effectiveness. As Industry 4.0 has matured, the concept of Zero-Defect Manufacturing (ZDM) has become a subject of interest, both for single-stage and for multi-stage manufacturing systems improve the process efficiency and product quality, minimizing, eliminating or compensating defects and process errors. The ZDM cluster of projects coordinates a series of innovative, yet consistent R&I approaches to the essential challenges of ZDM, each from its own perspective and in representative critical domains. However, some gaps identified in European policy formulation are impeding the full achievement of

European ZDM leadership. ZDM research and development involves long temporary horizons that could be better addressed with innovative R&D funding approaches. Policy level support for the dissemination of a ZDM standardisation culture could help the latter in better taking root within the European industry. Finally, targeted communication and outreach initiatives at the European level could help raise awareness of the strategic contribution of ZDM to the overall goal of continued European manufacturing excellence and worldwide leadership. These recommendations are the result of the direct experience of the projects involved in the ZDM cluster and are based on the activity that projects carried out within the Common Dissemination Booster.

Zero-Defect Manufacturing

Industry 4.0 refers to the concept of factories in which machines are augmented with connectivity, possibly wireless, and sensors - becoming Cyber-Physical Systems (CPS) - and connected to a system that can visualise the entire production line, control single processes and group of processes, and make decisions on its own. Within the industry 4.0 concept, Zero-Defect Manufacturing (ZDM) has the goal of improving the process efficiency and the product quality while minimising and eliminating defects and process errors.

Europe is pursuing as a strategic priority the adoption of new technologies and methodologies in the industrial field and therefore marches towards the integration of industry 4.0 best practices. Awareness on the ZDM approach for multi stage manufacturing - its potentiality and the benefits in terms of sustainability, process optimisation and innovation - should therefore be improved, especially towards specific industrial stakeholders at a European level. Moreover, EU projects active within the ZDM field, often face a progress interruption in their R&I activities due to their lifespan. The uptake of the EU projects' results could be hindered by the lack of standardisation initiatives that could serve to involve industrial players.

This document aims at proposing recommendations at a policy level in order to fulfil the gaps that are slowing down the full achievement of the ZDM approach and impeding a potential European ZDM leadership.



Context

Europe has embraced and become a world leader in Industry 4.0. As Industry 4.0 has matured, the concept of ZDM become a subject of interest. ZDM is driven by the need to minimize and eliminate product quality defects and process errors. Traditional quality control methods, such as Statistical Process Control or the Six Sigma method, require more resources than actually available for the SMEs case; senior management time and resources may be limited, resulting in improvement projects that are underfunded and under prioritized. Furthermore, reports have shown serious limitations in highly changeable production contexts characterized by customized batches, small quantities (or even unique products) and in-line/on-line product inspections and multi stage production environments. Moreover, statistical process control shows limitations, because it does not allow a real time control of the process, is limited in providing data for feed-back and feed-forward control of interacting processes, does not allow real time correlation of data originating from different processes, fails to track a single product and provide associated information. This is where the ZDM cluster of projects comes in. This cluster coordinates a series of innovative yet consistent approaches to the essential problems of ZDM, each from its own perspective and in representative critical domains. The Z-FactOr approach introduces production strategies targeting early defect detection, followed by prediction of how the defect will be generated in production and avoiding this through recalibration of the production process, and finally the utilisation of emerging additive and subtractive 3D technologies to rework the product. Addressing the same core issues from a different perspective, STREAM-OD utilizes leading edge simulation technologies coupled with real-time production feedback data once again to identify defects before



they enter irrevocably into production and adjust the production parameters to eliminate the defects. An important component of this approach is Reduced Order Modelling, which strips down the complexity of the simulation models to the extent that they can literally be handled by a smartphone. The GOODMAN project aims at the development of ZDM strategies in multi-stage production systems through the integration of quality control and process control using an agent-based Cyber Physical Systems, smart inspection systems, and advanced data analysis tools. As a result, it is possible to achieve earlier, real-time detection of defects, at the single process level as well as inter-stage processing at the global level, triggering mitigation actions and avoiding defect propagation to downstream processes. Finally, the ZAero project focusses on ZDM in an aerospace context. In the aerospace industry high-quality standards have to be met. In-situ visual inspection is used for quality control, which is currently causing huge productivity losses during lay-up and has become a real bottleneck in carbon fibre parts manufacturing. ZAero targets inline quality control methods for the key process steps, utilising sophisticated system level decision support systems to assist human decision-making and enhancing efficiency.





Policy challenges

Manufacturing represents approximately 21% of the EU's GDP and 20% of its employment, providing more than 30 million jobs in 230,000 enterprises, mostly SMEs. Moreover, each job in industry is considered to be linked to two more in related services. European manufacturing is also a dominant element in international trade, leading the world in areas such as automotive, machinery and agricultural engineering. The strategic importance of Europe's manufacturing leadership was acknowledged in the "Manufacturing 2030" report that the European Commission published for the "Factories of the future" section of the Horizon 2020 program. Thus, it is critical that European policy supports the continued excellence of European manufacturing, and ZDM is one key component.

However, some gaps identified in European policy formulation are impeding the full achievement of its goals of ZDM leadership. Current Research and Innovation policy in the major research programmes such as H2020 foresees structuring of R&I projects with temporal horizons that are aligned with general funding horizons according

to generic technological considerations. Taken that ZDM involves long temporal horizons that are met with difficulty by current funding policies, there is a risk of progress interruption and compromising of achieved results. ZDM is intrinsically multi-disciplinary and requires homogeneous progress in all its technological pillars, including measurement systems, process automation, signal acquisition and processing, network connectivity, industrial informatics, data analytics and knowledge management. Furthermore, whereas some strategic technological domains (such as 5G) have received significant support at the European R&I policy level for standardisation initiatives, ZDM is not yet a beneficiary of this type of policy support, with the result that the standardisation need in ZDM has yet to be fully embraced by companies, hampering its diffusion in industry. In a similar vein, EC policy has yet to provide for the dissemination at EU level of awareness-raising communication initiatives, likewise inhibiting the development of a consistent, effective European-wide strategy for ZDM leadership.



Recommendations

| Continuation of Horizon2020 research projects, Technical Orientation of Research

The required timeline of ZDM Research and Development projects is longer than the funded Horizon2020 period, with the majority of Horizon2020 ZDM projects ending with results at TRL 6 or 7. Consequently, a lot of effort is still needed to bring those results to the market and to fully validate the methodology and concepts defined. Although the existing funding process does provide unique opportunities for further research, it doesn't fully utilize the dynamics of an already established team that could work to bring those results to the market. Innovative R&D funding approaches would drastically shorten the required time and effort towards marketable results, thus bridging the valley of death to improve the EU's commercialization activity.

As has been already done by the Commission for the advanced materials research sector, it would be particularly relevant to fund ZDM research projects with pilot lines as a continuation of projects, as ZDM is more relevant to the system approach that is applied to the entire manufacturing units. In this way, the ZDM approaches developed in the initial projects will be fully validated, showing the real improvements that will guarantee a higher commercial take up of the project results.

The continuation of Horizon2020 projects would also be beneficial for the organisations involved, as this action would decrease the time needed for innovation delivery or uptake. Furthermore, the action would be beneficial as it would decrease unwanted mobility of researchers and the risk of progress interruption.

The establishment of a European- wide interconnected network of ZDM Pilots could also be foreseen to facilitate knowledge exchange, stakeholders' engagement and, in the long term, the growth of customer base.

Standardisation

Although a lot of effort has been done by the active projects in order to record and promote the standardisation needs in Zero-Defect Manufacturing, this remains a funded research goal and has not yet been embraced by companies. The ZDM working groups' outcomes regarding standardisation need to be communicated through the communication means described in Recommendation No 3. In that way, industry groups can provide important insight and help accelerate the formation of pre- standardisation groups.

| Dissemination & Communication actions

When dealing with the ZDM concept, it would be effective to use EC channels to implement appropriate actions able to trigger interest from stakeholders in the industrial field, through dedicated actions towards specific segments and not just the general public.

Specifically, EC could use its channels (and database of contacts) to disseminate EU ZDM projects' results towards academic and/or scientific associations in a quite regular manner (for instance: Universities and Research Centres, Scientific Societies and Scientific Committees of Technical Chambers). European Universities can be also enrolled in alerting the public on the Zero-Defect Manufacturing concept.

EC could also use its channels and database to create awareness around the ZDM paradigm and the projects which are involved in the cluster (for instance towards: boards of industrial players, representatives from industrial associations, their contacts with the industry and policy makers, their experience, and their communication channels and activities).

These communications could rely on a consistent communication message able to highlight the benefits of the ZDM approach towards sustainability, a better use of resources, the optimisation of the production process, innovation, increased competitiveness for the industry, waste reduction, etc. This, in order to convey an idea of ZDM as the next era after Total Quality Management.



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ZDM

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Projects



ForZDM

forzdmproject.eu
GA 723698

IFaCOM

ifacom.org
GA 285489

GOODMAN

goOdman-project.eu
GA 723764

MIDEMMA

GA 285614

MEGAFIT

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MUProD

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z-FactOr

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ZAERO

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