



# Discussion paper: facilitating policy dialogue on cluster cooperation with the United States of America

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**Abstract:** The discussion paper provides inputs for a policy discussion on cluster cooperation and policy arrangements on clusters with the United States of America (USA). The report contains information on existing EU-USA cluster collaboration and good practices, which can be good practice examples for other clusters from Europe in their collaboration approach towards the USA.

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## 1. Objective of the report

The aim of this discussion paper is to provide an overview on the existing European Union (EU)-United States of America (USA) cluster cooperation activities, and highlight good practices/success stories and opportunities for future cluster-based exchange.

This report builds on the analysis and overview provided by the "Preparatory Briefing on the United States of America". Its content is mainly based on desk research and targeted interviews with relevant local and European contact points.

## 2. Existing EU-USA cluster cooperation

In recent years the USA economy has been growing at a constant rate. In 2017, the USA economy grew at a rate of 4.5% and is expected to reach a growth rate of 5.4% in 2018<sup>1</sup>. Due to its large population and stable political situation, the USA is one of the most competitive markets in the world. The country is the leader in many industrial sectors such as the ones covered in this report: energy, aerospace, biotechnology and information and communication technology (ICT), and water. These sectors are constantly evolving and increasing their long-term relevance and potential impact on future economies. Thus, these sectors offer more potential gains due to their current expansion, status of innovation, attention from consumers, and relevant agreements between the European Union (EU) and USA. Moreover, the aforementioned sectors can provide opportunities for European and USA clusters to cooperate in the fields of technology transfer, innovation and business development (more information about the five sectors is included in the updated Preparatory Briefing developed by the ECCP and published in September 2018).

The EU and USA are longstanding trade and investment partners. The EU-USA economic relationship accounts for a large percentage of the world's trade in goods and services. With the aim of strengthening this relationship, the EU and USA have established many joint initiatives and Memorandum of Understandings (MoUs) in numerous sectors of shared interest. Furthermore, in several cases the plans of the EU and USA economies share a common interest for the aforementioned sectors, as well as a vision on how to achieve the sectors' objectives.

### 2.1. Policy dialogue on cluster cooperation

An EU-USA Cooperation Arrangement on Clusters was signed in April 2015 between the US Department of Commerce (DoC) and the DG GROWTH. The objective of this agreement is to facilitate transatlantic linkages between EU and USA clusters, and to help SMEs to find strategic partners<sup>2</sup>. The USA interest in cooperating with the EU is a clear sign of mutual objectives to work through clusters

<sup>1</sup> <http://www.multpl.com/us-gdp-growth-rate/table/by-year>

<sup>2</sup> EC DG Grow, [http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item\\_id=8240&lang=en&title=Cooperation-Arrangement-on-Clusters-signed-in-Washington-D%2EC%2E](http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8240&lang=en&title=Cooperation-Arrangement-on-Clusters-signed-in-Washington-D%2EC%2E)



on common thematic areas, boost exchange of knowledge and increase the collaborative opportunities between the clusters of the two regions.

The US DoC supported cluster matchmaking missions and took an active part in the Washington cluster workshop in November 2015, in the Hannover Fair matchmaking mission held in April 2016 (jointly organised with DG GROW and the ECCP team) and in the 2017 High-Level EU Cluster Mission to the US (jointly organised with ECCP and BILAT USA 4.0 project). The workshop organised in November 2015 aimed to exchange best practices on cluster mapping, portals and policies for intensifying transatlantic cluster cooperation between the EC and the US DoC. The main outcomes of this workshop were related to advancements in terms of cluster mapping in both regions, as well as the need to establish stronger linkages between the mapping of industrial clusters and cluster organisations on portals to facilitate cluster collaboration<sup>3</sup>. In addition, in 2017, the High-Level EU Cluster Mission to the USA was organised as a follow-up to the EU-USA Cooperation Arrangement on Clusters<sup>4</sup>.

The EU-USA cluster matchmaking event organised in April 2016 was complemented by a high-level cluster policy seminar on “Clusters in the EU and the USA: Opportunities for Collaboration and Growth”. The seminar provided the opportunity to identify some of the key challenges and priorities that need to be addressed within the framework of the EU-USA Cluster Cooperation Arrangement and, in particular, how to drive forward transatlantic cluster cooperation<sup>5</sup>. The 2017 High-Level EU Cluster Mission included the US-EU Cooperation Seminar and Matchmaking Event, which was organised at TechConnect World Innovation in Washington, D.C., as a follow-up to the EU-US matchmaking event organised at Hannover Messe in April 2016. The aim of this seminar was to facilitate the linkages between European and US clusters, and help SMEs find strategic partners<sup>6</sup>.

Other EU Directorates-General (DG’s), such as the DG for Research and Innovation (DG RTD), have implemented projects with the USA and have recognised the usefulness of using and channelling support through clusters to promote international cooperation in research, development and innovation (RDI). For example, the project BILAT USA 4.0 funded by the European Framework Programme Horizon 2020 was launched in February 2016. The project is conducted over a three-year period and is focused on developing industry and cluster cooperation<sup>7</sup>. Cooperation between the BILAT USA 4.0 project and the ECCP has been established through the joint organisation of the High-Level EU Cluster Mission to the US in 2017. Furthermore, the European Network of Research and Innovation Centres and Hubs, USA (ENRICH in the USA)<sup>8</sup>, a project also funded by European Framework Programme Horizon 2020, aims to be a central contact point for European R&I actors seeking to grow and reinforce collaboration across the Atlantic.

<sup>3</sup> [http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item\\_id=8590&lang=en](http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8590&lang=en)

<sup>4</sup> <https://www.clustercollaboration.eu/news/high-level-mission-us-and-cluster-matchmaking-event-opening-research-and>

<sup>5</sup> <http://www.clustercollaboration.eu/event-calendar/eu-us-matchmaking-event-hannover-messe-germany>

<sup>6</sup> <https://www.clustercollaboration.eu/news/high-level-mission-us-and-cluster-matchmaking-event-opening-research-and>

<sup>7</sup> For information ECCP partners inno TSD is involved in BILAT 4.0 project as leader of the mentioned work package on industry and cluster cooperation, and SPI is also involved in the activities. Joint activities and cooperation could be investigated.

<sup>8</sup> <https://usa.enrichcentres.eu/>



## 2.2. Overview of EU-USA cluster to cluster cooperation

The EU and the USA are each other's largest investment, trade and research and development (R&D) partners. The EU-USA cluster to cluster (C2C) cooperation is a growing reality grounded in common interests, such as the promotion of innovation, job creation and economic growth<sup>9</sup>. In this context, the dialogue between the DG GROW Cluster Unit and the US DoC was established for facilitating transatlantic linkages between EU and USA clusters. There are several examples of C2C cooperation initiatives between the USA and the EU. As mentioned above, this cooperation was formally established through collaboration agreements that aim to enlarge the cooperation that already exists in some of the major economic sectors. In this context, it is important to highlight that some cluster sectorial areas are both strategic for the EU and the USA, due to their strong cluster communities. In fact, the majority of the USA traded sectors are focused on areas that also have an important cluster representation in EU member states. Thus, this opens a window of opportunity to foster C2C cooperation between the USA and EU.

Silicon Valley (known worldwide for its high concentration of start-ups and global technology companies) is an example of a USA ICT cluster that cooperates very closely with many different European clusters to promote RDI. Organisations from several EU member states have established a presence in Silicon Valley in order to facilitate and strengthen the collaboration of EU clusters with organisations and companies based in Silicon Valley, primarily with a focus on ICT but also other sectors such as biotechnology. These cooperation activities also go beyond clusters, for example Portugal Ventures has established an accelerator in Silicon Valley to help strengthen the linkage between Silicon Valley and Portuguese clusters and their members<sup>10</sup>; while French Tech has also established a strong presence through its San Francisco consul representation.

The French ICT cluster "Systematic", a world-class cluster focused on software-dominant industrial systems with a strong societal dimension<sup>11</sup>, is another example of EU-USA C2C cooperation. This cluster is represented in the Boston technology hub, one of the world's leading technology clusters.

Furthermore, the EU and USA cooperation in the field of photonics has been increasing in recent years. In this context, the Florida Photonics Cluster has developed cooperation activities with the European Photonics Industry Consortium (EPIC)<sup>12</sup>; while the OptoNet e.V (Germany) and the New York Photonics | Rochester Regional Photonics Cluster have also identified common interests for international C2C cooperation<sup>13</sup>.

The EU and USA have a shared interest in the biotechnology sector, which has been leading to various cooperation opportunities among organisations from both regions. The Massachusetts Life Sciences

<sup>9</sup> <https://www.state.gov/documents/organization/241643.pdf>

<sup>10</sup> <http://en.portugalinsf.com/index.php/portugal-in-san-francisco>

<sup>11</sup> <http://www.systematic-paris-region.org/>

<sup>12</sup> <https://www.clustercollaboration.eu/cluster-organisations/florida-photonics-cluster>

<sup>13</sup> <https://www.clustercollaboration.eu/cluster-organisations/optonet-ev>



Center has been cooperating with BioWin<sup>14</sup> (Belgium) and Alsace BioValley (France)<sup>15</sup> to promote the development of innovative and collaborative R&D projects under the framework of the International Collaborative Industry Program (ICIP)<sup>16</sup>. In addition, the BioTechMed Mazovia Cluster (Poland) has also developed cooperation activities with BioBay San Francisco<sup>17</sup>.

Aqua-Valley (France)<sup>18</sup> is also an example of a European cluster that has been cooperating with USA organisations in the water sector. In 2017, Aqua-Valley participated in the Water Technology Innovation Cluster Leaders Meeting, which was organised by the USA Environmental Protection Agency (EPA) during the Water Environment Federation Technical Exhibition & Conference (WEFTEC). The purpose of this meeting was to foster and strengthen collaboration between clusters, namely among Aqua-Valley, the US Water Council, and AccelerateH2O (USA)<sup>19</sup>.

Moreover, the EU Global Cleantech Cluster Association, which in 2010 only included three USA clusters as new members, is also an example of C2C collaboration. Currently, the EU Global Cleantech Cluster Association has 16 USA clusters as members, which fosters networking and opportunity sharing between the USA and EU<sup>20</sup>.

The organisation of matchmaking events has also been one of the main tools to foster collaboration between EU and USA clusters. The EU-USA Cluster Matchmaking event in Milan Expo 2015<sup>21</sup>, the Hannover Fair matchmaking mission held in April 2016, and the 2017 High-level EU Cluster Mission to Philadelphia, Boston and Cambridge<sup>22</sup> represented opportunities for clusters from both regions to learn about each other and identify cooperation interests. Moreover, the International Cancer Cluster Show Case<sup>23</sup>, the USA based BIO events<sup>24</sup>, and the TechConnect World Innovation Conference<sup>25</sup> are examples of events that promote the connection between industry players, which can also play a key role in the stimulation of C2C cooperation.

### 3. Good practices / success stories related to cluster cooperation

As indicated by the previous section, the EU and the USA have a long history of well-established cluster cooperation, which remains a priority for clusters and their SME members within the EU and the USA.

<sup>14</sup> <https://www.clustercollaboration.eu/cluster-organisations/biowin>

<sup>15</sup> <https://www.clustercollaboration.eu/cluster-organisations/alsace-biovalley>

<sup>16</sup> <http://www.masslifesciences.com/wp-content/uploads/ICIP-2014-FAQ-FINAL-27Mar141.pdf>

<sup>17</sup> <https://www.clustercollaboration.eu/cluster-organisations/biotechmed-mazovia-cluster>

<sup>18</sup> <https://www.clustercollaboration.eu/cluster-organisations/pole-eau-french-water-cluster>

<sup>19</sup> <http://www.pole-eau.com/Communication/Actualites/Le-Pole-en-action/Participation-du-Pole-Aqua-Valley-au-Cluster-Leaders-Meeting-organise-par-l-Environmental-Protection-Agency-U.S.-EPA-a-l-occasion-du-salon-WEFTEC-2017-a-Chicago-USA>

<sup>20</sup> <http://www.globalcleantech.org/>

<sup>21</sup> <http://www.clustercollaboration.eu/international-cooperation/united-states-america>

<sup>22</sup> <https://www.clustercollaboration.eu/event-calendar/high-level-eu-cluster-mission-usa-including-us-eu-cluster>

<sup>23</sup> More information available at <http://www.internationalcancercluster.org/>

<sup>24</sup> More information available at <https://www.bio.org/events>

<sup>25</sup> <https://www.techconnectworld.com/World2019/>



Five success stories of international cooperation established between a USA organisation and a cluster from an EU member state are presented to illustrate the importance of continued C2C cooperation between the two regions and to provide information that can help other clusters developing similar agreements. The success stories include details on the sector and stakeholders concerned, the process that has led to cooperation, policy support, common activities, and an indication of the main outcomes /results of the cooperation to date<sup>26</sup>. The information has been collected through a literature review and interviews with the relevant organisations.

### 3.1. Success story 1: AutomotiveNL and MEDC

Cooperation between AutomotiveNL and MEDC	
<b>Partners:</b> <ul style="list-style-type: none"><li>AutomotiveNL (Netherlands, EU)<sup>27</sup></li><li>Michigan Economic Development Corporation (MEDC) (Michigan, USA)<sup>28</sup></li></ul>	
<b>Sectors and subsectors concerned:</b> <ul style="list-style-type: none"><li>Automotive sector</li><li>Smart mobility</li><li>Automated and autonomous vehicles technologies</li><li>Lightweight material technology</li><li>Smart manufacturing technologies</li></ul>	
<b>Context:</b> <ul style="list-style-type: none"><li>AutomotiveNL is the Dutch cluster organisation of the innovative automotive sector with over 175 members. The cluster core focus areas are Smart Mobility, Green Mobility, Manufacturing &amp; Materials, advancing towards the Engineer of the Future. AutomotiveNL pursues innovation, education and knowledge transfer, validation and globalisation. In addition, it fosters new businesses and promotes educational activities<sup>29</sup>.</li><li>MEDC is a public-private partnership agency and economic development corporation dedicated to job creation in the state of Michigan. The MEDC, in collaboration with around 100 economic development partners, aims to create the necessary conditions to assist businesses in their growth strategies and foster the creation of a state-wide business community.</li></ul>	

<sup>26</sup> Information on budget or funding is not publicly available.

<sup>27</sup> [www.clustercollaboration.eu/cluster-organisations/automotivenl](http://www.clustercollaboration.eu/cluster-organisations/automotivenl)

<sup>28</sup> <https://www.michiganbusiness.org/>

<sup>29</sup> [www.automotivenl.com/en/organization/mission-and-vision](http://www.automotivenl.com/en/organization/mission-and-vision)



**Type of cooperation:** Knowledge and business sharing

- On April 2018, the State Secretary for Economic Affairs and Climate Policy of the Netherlands and the Governor of Michigan signed a MoU regarding the Automotive Industry of Michigan and The Netherlands. The MoU aims to leverage the strengths and assets from both automotive sectors to promote sustainable growth and innovation.

**Objective:**

- This cooperation aims to (i) increase cooperation in automotive matters, (ii) enhance the interconnection between automotive supply chains, and (iii) promote the demonstration and deployment of innovative technologies and processes in the automotive sector.

**Policy support:**

- AutomotiveNL works closely with the Ministry of Economic Affairs and Climate Policy, the Municipality of Helmond, the Provinces of North Brabant and Limburg, Brainport Development, Brabant Development Agency (BOM), Limburg Development and Investment Company (LIOF), Netherlands Foreign Investment Agency (NFIA), and the Dutch Ministries of Economic Affairs and Infrastructure and the Environment, along with their implementation organisations Netherlands Enterprise Agency (RVO) and Connekt. Another valuable governmental supporter is Rijkswaterstaat, the Dutch public works and the water management department<sup>30</sup>.

**Results/outcomes:**

- In June 2017, the Detroit Regional Chamber hosted a delegation of 15 representatives from the Netherlands' most successful mobility companies to discuss smart mobility and smart city solutions.
- In the same month, a second delegation from the Netherlands featuring key representatives from AutomotiveNL and Brainport Region joined the Detroit Regional Chamber for a tour on Southeast Michigan, which included meetings with representatives from Ann Arbor SPARK, Ford Motor Co. and the Michigan Department of Transportation<sup>31</sup>.
- In October-November 2017, both entities organised an Innovation Mission.
- In April 2018, the State Secretary for Economic Affairs and Climate Policy of the Netherlands and the Governor of Michigan signed the MoU regarding the Automotive Industry of Michigan and The Netherlands.
- In September 2018, both entities were involved in the co-organisation of the Intelligent Vehicle Testing Symposium 2.0 at the ITS World Congress in Copenhagen.

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<sup>30</sup> <http://www.automotivenl.com/en/organization/partnerships>

<sup>31</sup> <http://www.detroitchamber.com/michigans-mobility-assets-key-topic-of-netherlands-delegation-visit-to-detroit/>



## 3.2. Success story 2: Plastipolis Pôle de Compétitivité and The Polymer Ohio/ Mississippi Polymer Institute/ Ohio Bioproducts Innovation Centre

### Cooperation between the Plastipolis Cluster and three USA partners<sup>32</sup>

#### Partners:

- Plastipolis (France, EU)<sup>33</sup>
- The Polymer Ohio (Ohio, USA)<sup>34</sup>
- The Mississippi Polymer Institute (MPI, Mississippi, USA)<sup>35</sup>
- Ohio Bioproducts Innovation Centre (OBIC, Ohio, USA)<sup>36</sup>

#### Sectors and subsectors concerned:

- Plastics sector
- Automotive sub-sector
- Production Technology and Heavy Machinery sub-sector



#### Context:

- Plastipolis is a French Pôle de compétitivité established in 2005 in the plastic sector and comprised of more than 340 members, including 230 firms (90% SMEs). It has a consolidated turnover of €5.5 billion due to its extensive network (4,000 contacts in both industry and academic). Plastipolis is part of the EC/DG GROW funded WIINTECH2020 ESCP-4i project, which facilitates its international activity.
- The Polymer Ohio is an association based in Ohio aiming at making Ohio companies more competitive and enabling them to grow faster.
- The MPI has the goal of growing high-tech polymer and polymer-related industries in the state. MPI has played a key role in growing the state's multibillion-dollar-per-year, high-tech polymer industry, and has directly assisted in the creation of thousands of jobs.
- OBIC was created by the College of Food, Agricultural and Environmental Sciences of the Ohio State University.

<sup>32</sup> <http://www.clustercollaboration.eu/achievements/inspiring-eu-us-direct-cluster-cooperation-developed-plastipolis>

<sup>33</sup> <http://www.plastipolis.fr/>

<sup>34</sup> <http://polymerohio.org/>

<sup>35</sup> <http://www.thepolymerinstitute.com/>

<sup>36</sup> <http://bioproducts.osu.edu/>



**Type of cooperation:** Internationalisation of Plastipolis and project partners

- The cluster has signed MoUs with three USA based partners from Ohio and Mississippi regarding polymers, composites and bio-based materials:
- Signed a first MoU with PolymerOhio – June 2011. This partnership was renewed in 2015 for another 3 years.
- Signed a MoU with OBIC, within the Wiintech project, on university exchange – October 2013.
- Signed a MoU with MPI – October 2013.
- As next steps, the cluster aims to pursue the collaboration with existing partners, find new partners in other areas within the USA and look for opportunities at the technological, business and training levels.

**Objective:**

- The overall aim of the agreement signed by Plastipolis is to set up a permanent representative office in the USA where a staff member will be located directly in its partner's premises and working on business and networking opportunities and joint projects between France and the USA at academic, technological and business levels.

**Policy support:**

- WIINTECH 2020 (an EC funded pilot project between 2012 and 2014 with a group of eight European clusters in the materials and processes fields) is designated as an ESCP-4i since 2016. WINTTECH 2020 promotes the development of a joint inter-cluster cooperation strategy towards international clusters outside of Europe, and as such has supported the cooperation between the Plastipolis and its three USA partners.

**Results/outcomes:**

- Collaboration extended beyond the original partners to include: Plastipolis (EU); PolymerOhio and OBIC (Ohio); Ben Franklin Technology Partners, EEB Hub and University of Pennsylvania (Pennsylvania); University of Southern Mississippi; and Mississippi Polymer Institute (Mississippi).
- Establishment of business cooperation between Plastipolis and its USA partners, including the expected placement of a permanent representative office in the USA (State of Mississippi) on the thematic areas of waste management and recycling, green transportation and renewable energies. For example, PolymerOhio hosted an intern from Plastipolis for one year. Furthermore, activities within the context of the thematic areas include information exchanges, coordination of respective actions, identification of joint projects for technology development and commercialisation and facilitation of partnerships between French and Ohio companies.
- Plastipolis continues its cooperation actions with USA clusters. The actions perceived include locating a staff member in the premises of the US partner (Polymer Ohio) to work on networking opportunities and joint projects between France and the US<sup>37</sup>.

<sup>37</sup> <http://www.lyon-communiqués.com/communiqués/plastipolis-fait-le-plein-de-contacts-a-la-foire-de-hanovre-et-pose-des-c148417.htm>



- MPI and Polymer Ohio were invited to the Plastipolis Forum in 2014 (Polymer Ohio) and in 2016 (MPI).
- Organisation of visits in Auvergne Rhône Alpes in June 2014 with the regional mobility program for MPI and with of USM (University linked to MPI) in June 2015.
- Regular meetings during international trade fairs: NPE 2015 and K 2016.
- In particular, different working sessions have been held between Plastipolis and MPI in 2017 (Le Bourget Paris Air Show- May 2017), as well as in 2018 (NPE trade fair at Orlando – May 2018). Continued and improved cooperation steps including staff exchanges and industrial visits are being designed.

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### 3.3. Success story 3: BlueTech Cluster Alliance

#### BlueTech Cluster Alliance (BTCA)

**Partners:**

**Charter Members of BTCA:**

- Forum Oceano (Portugal)
- Marine Institute (Ireland)
- Oceans Advance (Canada)
- PLOCAN (Plataforma Oceánica de Canarias) (Spain)
- Pôle Mer Mediterranee (France)
- **The Maritime Alliance** (USA)
- UK Blue Growth Network (UK) (includes Cornwall Marine Network and Marine South East)

**Regular Members of BTCA:**

- GCE Subsea (Norway)
- Pôle Mer Bretagne Atlantique (France)

**Sectors and subsectors concerned:**

- Maritime industry
- Blue and ocean economy
- Water/wastewater industries (The Maritime Alliance)





**Context:**

- BTCA was established in January 2017 by nine leading BlueTech clusters (Canada, France, Ireland, Portugal, Spain, UK and USA). (NOTE: 2 clusters are part of the UK Network).
- BTCA includes seven Charter Members that constitute the Steering Committee; in addition, a 2<sup>nd</sup> French cluster and a leading Norwegian cluster have joined as Regular Members.
- BTCA was established with the aim of fostering innovation and sustainable, economic development in the maritime domain.
- In order to become a member of BTCA, an organisation must meet the following criteria:
  - Formal, industry-oriented, BlueTech “cluster” organization (not a general association, government entity, university, or the like);
  - There should be a history of, and budget for, attending leading international shows, which is where most BTCA meetings take place;
  - There should be a history of demonstrable collaboration between international clusters, including promoting business-to-business opportunities.

**Type of cooperation:**

BTCA clusters collaborate at multiple levels:

- Leveraging differences in the cluster organisation structures, funding sources and areas of focus to promote sustainable, science-based ocean and water industries.
- Enhancing C2C and B2B collaboration through the organisation and participation in events and initiatives that promote the Blue Economy. In this regard, BTCA clusters take advantage of major trade shows to meet and promote collaboration among their respective members.
- Promoting Best Practices and goals to foster economic development and innovation.
- Sharing information about education and workforce development in each region.
- Linking accelerator and incubator efforts as they develop across clusters.
- Extending membership to other developed and developing BlueTech clusters that promote international cross-cluster collaboration.
- Developing cluster capacity building for developing countries.

**Objective:**

- BTCA aims to promote sustainable investment and growth regarding the knowledge-based ocean and water industries, to the mutual benefit of all parties, through active regional, national and international collaborations. To do so, the cluster organisations in the alliance work together in areas where members of the participating clusters can share information, collaborate on R&D initiatives, and jointly pursue business development opportunities.

**Policy support:**

- BTCA is affiliated with two organisations involved with policy related to the maritime industry: the Inter-American Committee on Ports at the Organization of American States (Washington DC) and the Institute of the Americas (San Diego, CA).

**Results/outcomes:**



The activities that are being implemented by BTCA are focused on: attracting funding to the industry; fostering capacity building across Triple Helix; promoting internships at different clusters and cluster member companies; and linking accelerators, B2B opportunities, and incubators; etc. The collaboration established has already provided some outcomes, such as the following:

- San Diego companies have found French partners via Pôle Mer Mediterranee.
- The Maritime Alliance has introduced French, Portuguese and Spanish companies to potential USA partners.
- Development of cooperation opportunities between The Maritime Alliance and Forum Océano to support a new Brazilian Blue Economy cluster.
- Organisation, participation, and support of EU-USA events.

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### 3.4. Success story 4: Niedersachsen Aviation and Pacific North-West Aerospace Alliance

#### Cooperation between Niedersachsen Aviation and Pacific North-West Aerospace Alliance

**Partners:**

- Niedersachsen Aviation (Niedersachsen, Germany, EU)
- Pacific North-West Aerospace Alliance (PNAA, Washington, USA)

**Sectors and subsectors concerned:**

- Aerospace sector
- Aerospace and Regenerative Energy





**Context:**

- Niedersachsen Aviation is a leading manufacturing cluster in the European aerospace supply chain. Promoted by the State of Niedersachsen, it connects more than 250 companies in the aviation and aerospace industry based in Northern Germany, providing a platform for exchange, cooperation and information. The cluster aims to enhance the competitiveness of the regional aerospace community and support businesses and research institutions<sup>38</sup>.
- PNAAs is a network of aerospace suppliers in the American Northwest. The aerospace cluster in Washington State area comprises thousands of companies in the aerospace value-chain, from commercial and military jets to unmanned systems and space age rockets, located around the main plants of Boeing in the Seattle area<sup>39</sup>.

**Type of cooperation:** Knowledge and business sharing

- Niedersachsen Aviation and PNAAs have developed a mutual collaboration since 2010. Both clusters are supporting each other in developing closer business relations between the regions.
- Within the EU-funded project “EACP Abroad” (COSME) a concept to further expand the European Network of Clusters to six non-European clusters has been developed.
- Niedersachsen Aviation led the collaboration activity towards the aerospace cluster in Seattle and transferred the bilateral collaboration with PNAAs to a European level. This was confirmed by the signing of a MoU between EACP and PNAAs in 2017, with the aim of reaffirming the partnership on a European level.
- In 2012, the State of Niedersachsen and the State of Washington signed a MoU to enhance collaboration with a special focus on the aerospace and clean tech sectors. This MoU was renewed in 2017 at the Paris Air Show.
- The MoU between EACP and the Pacific North-West Aerospace Alliance was signed in 2017 during the annual General Assembly of EACP that was hosted by Niedersachsen Aviation in the city of Braunschweig. Similar MoUs have been signed between EACP and aerospace clusters from Canada, Brazil, United Arab Emirates and Japan in the framework of the EACP Abroad project.
- The terms of the MoU entitles Niedersachsen Aviation as the point of contact for the entire EACP network.

**Objective:**

- The overall aim of this cooperation is to promote extensive exchange between the aerospace clusters on both sides and encourage business cooperation between the members of both organisations.

<sup>38</sup> [www.clustercollaboration.eu/cluster-organisations/niedersachsen-aviation](http://www.clustercollaboration.eu/cluster-organisations/niedersachsen-aviation)

<sup>39</sup> [www.pnaa.net](http://www.pnaa.net)



**Policy support:**

- Niedersachsen Aviation is a founding member of the European Aerospace Cluster Partnership (EACP), a network of 43 European aerospace clusters from 18 countries. The EACP was under the framework of CLUNET, a PRO INNO EUROPE project<sup>40</sup>

**Results/outcomes:**

- Since 2010, Niedersachsen Aviation organises yearly company missions to the Seattle Region on the occasion of the annual PNAAC-Conference in close co-operation with PNAAC.
- In 2017, EACP and PNAAC signed a MoU supported by Niedersachsen Aviation.
- In 2017 and 2018, the annual company mission to Seattle organised by Niedersachsen Aviation was opened to all EACP members. In 2018, 42 participants from 30 companies attended with mission, which included the participation in the PNAAC-Conference and networking opportunities for local original equipment manufacturers (OEMs), 1<sup>st</sup> tiers and European suppliers<sup>41</sup>.
- Several mission participants were able to develop active business relations out of the missions including new contracts from OEMs of the Seattle area.
- In 2018, PNAAC honoured the long-term relationship with Niedersachsen Aviation and the enhanced outreach to the entire EACP network by awarding Norbert Steinkemper as representative of Niedersachsen Aviation with the Chairman's Award of the year.
- In 2017, PNAAC and Washington State representatives attended the Global Aerospace Cluster (GAC) Summit organized by EACP and supported by ECCP in occasion of the Paris Air Show. In 2018, PNAAC and Niedersachsen Aviation jointly moderated a workshop during the 2<sup>nd</sup> GAC Summit on international cluster collaboration during the Farnborough Air Show.

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<sup>40</sup> [www.eacp-aero.eu/about-us.html](http://www.eacp-aero.eu/about-us.html)

<sup>41</sup> [www.clustercollaboration.eu/news/company-mission-seattle-about-start](http://www.clustercollaboration.eu/news/company-mission-seattle-about-start)



## 3.5. Success story 5: EUROBIOMED and Biocom

### Cooperation between EUROBIOMED and Biocom

#### Partners:

- Eurobiomed (France, EU)<sup>42</sup>
- BIOCUM (California, USA)<sup>43</sup>



#### Sectors and subsectors concerned:

- HealthTech
- Biotechnologies, Medical Devices, Diagnostics, and Digital Health



#### Context:

- EUROBIOMED is a healthcare cluster established in 2009, at the initiative of the Provence-Alpes-Côte d'Azur and Languedoc Roussillon regions (France). With almost 300 members, the cluster leads European rankings in all stages of innovation: education, basic research, translational and clinical research, technological innovation centres, start-ups, and manufacturing. It provides resources and offers solutions for businesses and research organisations aimed at strengthening the healthcare sector in Southern France. The services include developing R&D projects, personalised support for businesses together with an acceleration programme, international expansions, networking, and organisation of scientific and business events, among others<sup>44</sup>.
- Biocom works on behalf of over 1,100 members to drive public policy, build an enviable network of industry leaders, create access to capital, introduce cutting-edge workforce development and STEM education programs, and create robust value-driven purchasing programs.

#### Type of cooperation: Knowledge and business sharing

- EUROBIOMED and Biocom signed a partnership agreement on behalf of their member companies during the 2014 BIO International Convention in San Diego, California (USA).
- The terms of the agreement focus on accelerating the international development of the member companies of the two clusters.

#### Objective:

- The overall aim of the agreement is to strengthen the ties between the two French regions of Provence-Alpes-Côte d'Azur (PACA) and Languedoc Roussillon (LR) with the American State of California.

<sup>42</sup> [www.eurobiomed.org/](http://www.eurobiomed.org/)

<sup>43</sup> [www.biocom.org/s/](http://www.biocom.org/s/)

<sup>44</sup> [www.clustercollaboration.eu/cluster-organisations/eurobiomed](http://www.clustercollaboration.eu/cluster-organisations/eurobiomed)



- The agreement plans to develop the individual businesses of the two clusters through training, advisory on European and USA regulations, access to mutual networks, scientific and business collaborations between members, support for soft landing, etc.
- Bringing the clusters together is also expected to help in raising funds through referrals to private investor partners<sup>45</sup>.

**Policy support:**

- EUROBIOMED is part of the Global Alliance for the Development of International Food Bio-Based Clusters (EU4FOOD), a voluntary partnership that aims at targeting a growing market area at the intersection between food, biocircular economy and pharma sector<sup>46</sup>.
- EUROBIOMED receives funding support from several French national and regional authorities, such as Direction Générale des Entreprises, Région Provence-Alpes-Côte d'Azur, Toulon Provence Méditerranée, CCI Marseille Provence, and Bouches du Rhône<sup>47</sup>.
- To support and strengthen this partnership, the PACA Region also signed an agreement with the City of San Diego in 2017, mentioning that the biotech sector was a key priority for joint actions.

**Results/outcomes:**

- Joint actions between EUROBIOMED and Biocom include workshops, events, conferences, and bi-annual trade delegations that aim to promote an active dialogue between California life science companies and their counterparts in France<sup>48</sup>.
- As an example, in March 2018, EUROBIOMED and Biocom organised, in the framework of the Enterprise Europe Network, a Life Sciences Company mission to the French Provence Alpes Côte d'Azur Region. This mission included workshops, visits to R&D centres and B2B matchmaking sessions<sup>49</sup>.

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<sup>45</sup> [www.businesswire.com/news/home/20140624006059/en/Eurobiomed-Biocom-Sign-Cooperation-Agreement-BIO-International](http://www.businesswire.com/news/home/20140624006059/en/Eurobiomed-Biocom-Sign-Cooperation-Agreement-BIO-International)

<sup>46</sup> [www.clustercollaboration.eu/escp-profiles/eu4food](http://www.clustercollaboration.eu/escp-profiles/eu4food)

<sup>47</sup> [www.eurobiomed.org/en/who-are-we/funding-supports/](http://www.eurobiomed.org/en/who-are-we/funding-supports/)

<sup>48</sup> [www.biocom.org/s/international](http://www.biocom.org/s/international)

<sup>49</sup> [www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vkik5wnar9wa?ctx=vg9pk7ho53zu&tab=1&start\\_tab1=5](http://www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vkik5wnar9wa?ctx=vg9pk7ho53zu&tab=1&start_tab1=5)



## 4. Opportunities/potential for further EU-USA cluster cooperation: thematic focus

There is significant potential for the implementation of C2C cooperation between EU and USA organisations, with a specific thematic focus. Thus, the opportunities discussed in this section are founded on the analysis presented by the updated Preparatory Briefing developed by the ECCP, which provides further justification for fostering C2C cooperation efforts on the sectors described.

### 4.1. Energy sector

The energy sector is a sector that is grounded in the importance of innovation and technological breakthroughs, which can lead to impactful changes in the energy domain. In this context, the encouragement and facilitation of knowledge transfer is crucial for the development of this sector. Therefore, given the importance of the energy sectors in the USA and the EU, there are significant opportunities for C2C cooperation, especially in areas of global interest such as global warming.

There are several EU-USA C2C cooperation cluster examples in the energy sector that can illustrate the aforementioned growing cooperation opportunities. Thus, it is relevant to highlight examples of clusters that want to establish future cooperation actions in the energy field, such as the Centre for Energy Technologie Cluster - Free Enterprise Association<sup>50</sup>, House of Energy<sup>51</sup>, and Team Humber Marine Alliance<sup>52</sup>. Furthermore, the Finnish cluster MERINOVA<sup>53</sup> is an energy cluster from the Vaasa region that has developed several contacts with the Tech Park Arizona, which offers a soft-landing programme with demonstration and testing capabilities for cooperation. The cluster has also exchanged good practices with Virginia Tech and the Pittsburgh Regional Alliance.

In parallel, the EC has made efforts to stimulate the C2C cooperation between the EU and USA in the energy sector through the framework of the Clean Energy Ministerial (CEM), which aims to promote common energy policy approaches that encourage and facilitate the transition to a global clean energy economy<sup>54</sup>. The EC and the USA also cooperate under the framework of the Mission Innovation initiative, which aims to accelerate the development of clean energy innovation in order to achieve performance breakthroughs and cost reductions to provide widely affordable and reliable clean energy<sup>55</sup>.

<sup>50</sup> <https://www.clustercollaboration.eu/cluster-organisations/centre-energy-technologie-cluster-free-enterprise-association>

<sup>51</sup> <https://www.clustercollaboration.eu/cluster-organisations/house-energy>

<sup>52</sup> <https://www.clustercollaboration.eu/cluster-organisations/team-humber-marine-alliance>

<sup>53</sup> <https://www.clustercollaboration.eu/cluster-organisations/oy-merinova-ab>

<sup>54</sup> <http://www.cleanenergyministerial.org/>

<sup>55</sup> <http://mission-innovation.net/>



Moreover, the shared interest in the energy sector is also represented by the establishment of the Europe Leading Blue Energy (ELBE)<sup>56</sup> and the Geo-Energy for the XX1st Century (GEO-ENERGY EUROPE)<sup>57</sup>, which are second generation ESCP-4is with an internationalisation strategy towards the USA. ELBE aims to contribute to positioning Europe as the world technological and industrial leader in Blue Energy and promote cooperation with target third countries such as the USA. In parallel, the main goal of the GEO-ENERGY EUROPE project is to create an ESCP focused on the sustainable use of the subsurface for energy, as well as to develop and propose an implementation roadmap for a joint internationalisation strategy that includes targeting cooperation with USA organisations.

The review of the existing strategies and MoUs suggests European clusters could find particular cooperation opportunities with and through USA clusters in the domains of clean energy (renewable energy and fuels and technologies, and nuclear energy) and smart grid energy technologies.

## 4.2. Aerospace sector

The aerospace sector is a very competitive sector at the global level. The USA and EU are considered world leaders in this sector led, respectively, by the major aircraft manufacturers of Boeing and Airbus Industries. Several industry forecasts and long-term growth predictions are generally positive for both regions, which highlights the importance of developing and implementing innovative products and new service concepts in the aerospace sector<sup>58</sup>.

In 2017, the USA aerospace sector had a positive trade balance of \$85 billion, which supports the creation of thousands of high-wage jobs<sup>59</sup>. The aerospace sector provides national and regional economies with major growth and development opportunities, generates technology driven investments, as well as the creation of high-wage jobs. Considering these favourable industrial conditions, numerous aerospace cluster organisations have been created, which have a key role in structuring the value chain and helping SMEs to enter this highly competitive sector. At a European level, this has also led to the creation of specific European cluster networks, such as the European Aerospace Cluster Partnership<sup>60</sup>, which enables national and regional clusters to work more closely together.

Currently, there 41 Aerospace and Defence clusters registered in the ECCP platform that target the USA for the development of international activities<sup>61</sup>. This reveals that European clusters are highly interested in cooperating with the USA, which can lead to the development of several C2C cooperation opportunities and agreements.

Furthermore, the State of Washington has identified in its aviation industry strategy the priority to continue developing the relationship with Airbus and provide additional opportunities for Washington companies to access its supply chain and those of other international OEMs. From a European

<sup>56</sup> <https://www.clustercollaboration.eu/escp-profiles/elbe>

<sup>57</sup> <https://www.clustercollaboration.eu/escp-profiles/geo-energy-europe>

<sup>58</sup> <http://www.clustercollaboration.eu/cluster-networks/european-aerospace-cluster-partnership>

<sup>59</sup> <https://www.selectusa.gov/aerospace-industry-united-states>

<sup>60</sup> <http://www.eacp-aero.eu/>

<sup>61</sup> <https://www.clustercollaboration.eu/cluster-list>



perspective, Airbus is sourcing more than \$10 billion in procurement from the USA with a strong interest in the Washington Aerospace Cluster. Airbus plans to double its procurement in the State of Washington by 2020. The strong ties between Airbus and the Washington Aerospace Cluster provide an opportunity for greater collaboration between the Washington Cluster and European aviation clusters on behalf of European industry<sup>62</sup>.

It is also interesting to highlight the existing cooperation between the European Space Agency (ESA) and the National Aeronautics and Space Administration (NASA) in the field of space transportation, as well as the Galileo programme that is built on a Public Private Partnership (PPP) led by the Europeans, with strong involvement of international partners including the USA<sup>63</sup>. This cooperation between space agencies enhances the importance for clusters to follow the example and collaborate in this sector in order to compete on a global level.

### 4.3. Biotechnology sector

The biotechnology sector comprises a wide range of fields such as pharmacy, food, agriculture, environment, medicine and energy. This is a sector in which cluster cooperation has proven important in improving the performance and competitiveness of the sector. In fact, the biotechnology sector is a strategically important sector for both the EU and USA. This sector was identified as one of Europe's strongest sectors for global competitiveness, economic growth and quality of life, grounded in the importance of industry clusters and partnerships<sup>64</sup>.

Currently, there are 45 European Biopharmaceutical clusters registered with the ECCP that target the USA for the development of international activities, such as missions, events, study visits and fairs. In fact, clusters such as Tuscany Life Sciences Cluster<sup>65</sup> and Norway Health Tech<sup>66</sup> are already cooperating with USA organisations from the biopharmaceutical sector. Thus, there are several opportunities for the development of EU-USA C2C cooperation activities in the biopharmaceutical sector<sup>67</sup>.

In 2017, the High-level EU Cluster Mission to the USA, organised by the ECCP and BILAT USA 4.0, included a European delegation composed of cluster organisation representatives from different industry sectors such as Biotechnology and Medical<sup>68</sup>. In this context, matchmaking tours represent an important opportunity for European clusters to meet with USA leading organisations in the field of biotechnology and identify cooperation opportunities. In addition, events such as the Bio 2018<sup>69</sup>, which is the largest biotechnology industry conference in the world, should be considered for promoting C2C collaboration between EU and USA clusters.

<sup>62</sup> <https://www.engr.washington.edu/files/facresearch/uw-arc/docs/wa-aero-industry-strategy2013.pdf>

<sup>63</sup> <http://www.arianespace.com/vehicle/ariane-5/>

<sup>64</sup> [https://www.mizuohobank.com/fin\\_info/industry/pdf/mif\\_122.pdf](https://www.mizuohobank.com/fin_info/industry/pdf/mif_122.pdf)

<sup>65</sup> <https://www.clustercollaboration.eu/cluster-organisations/tuscany-life-sciences-cluster>

<sup>66</sup> <https://www.clustercollaboration.eu/cluster-organisations/oslo-medtech>

<sup>67</sup> <https://www.clustercollaboration.eu/cluster-list>

<sup>68</sup> <https://www.clustercollaboration.eu/event-calendar/high-level-eu-cluster-mission-usa-including-us-eu-cluster>

<sup>69</sup> <http://convention.bio.org/2018/>



The EU Framework Programme Horizon 2020 has a strong focus on developing European industrial capabilities in Key Enabling Technologies (KETs), such as Biotechnology<sup>70</sup>. Thus, this programme could also represent an opportunity for EU and USA cluster organisations to cooperate and promote the development of KETs. The H2020 projects RELENT<sup>71</sup> and CuraBone<sup>72</sup> are two examples of Horizon 2020 projects in the Medical Biotechnology field that include the participation of USA organisations.

#### 4.4. ICT sector

The ICT sector is an example of a sector that has benefitted from ongoing C2C cooperation actions between the EU and the USA. For the ICT sector, the role of innovation and the transfer of knowledge to and from businesses are crucial to enhance the competitiveness of industry players at the global and the national/regional levels. ICT technologies also have key enabling and cross sectoral functions and contribute to value chain integration in almost every major industrial sector. Thus, there are several examples of ICT C2C cooperation between the EU and the USA.

The European SmartCityTech Go Global (ESCT Go Global) is a second generation ESCP-4i that aims to promote the increase of international partnerships and agreements between international stakeholders in the SmartCityTech domain. This includes establishing ties with USA clusters and organisations in order to set up international activities<sup>73</sup>. Furthermore, Mobility Goes International - In Action (MobiGoIn-Action) is also a second generation ESCP-4i focused on initiating international business collaborations for European SMEs in the automotive and smart cities markets, particularly in the field of technological innovation for smart mobility. This partnership also targets the USA for the development of cooperation partnerships<sup>74</sup>.

Furthermore, the European Semiconductor Cluster Internationalisation Project (Silicon Europe Worldwide) is a cluster partnership that aims to implement the third country internationalisation strategy as defined within the previous Silicon Europe project<sup>75</sup>. This network includes clusters from the Netherlands, Germany, United Kingdom, France, Italy and Belgium, which share a common interest with the USA market and believe USA clusters can help them and their cluster members entering this market. Within this project, a fact-finding mission to upstate New York was organised in November 2016<sup>76</sup>.

The EC has also been focused on stimulating ICT C2C cooperation between the USA and EU through international cooperation projects, such as the PICASSO<sup>77</sup> and DISCOVERY projects<sup>78</sup>. The PICASSO project aims to reinforce EU-USA ICT collaboration in pre-competitive research in key enabling

<sup>70</sup> <http://ec.europa.eu/programmes/horizon2020/en/h2020-section/nanotechnologies-advanced-materials-advanced-manufacturing-and-processing-and>

<sup>71</sup> [https://cordis.europa.eu/project/rcn/199747\\_en.html](https://cordis.europa.eu/project/rcn/199747_en.html)

<sup>72</sup> [https://cordis.europa.eu/project/rcn/205559\\_en.html](https://cordis.europa.eu/project/rcn/205559_en.html)

<sup>73</sup> <https://www.clustercollaboration.eu/escp-profiles/escp-go-global>

<sup>74</sup> <https://www.clustercollaboration.eu/escp-profiles/mobigo-in-action>

<sup>75</sup> <http://www.silicon-europe.eu/projects/silicon-europe-worldwide/project-description/>

<sup>76</sup> <https://www.clustercollaboration.eu/tags/usa?page=1>

<sup>77</sup> <http://www.picasso-project.eu/>

<sup>78</sup> <http://discoveryproject.eu/>



technologies related to societal challenges of common interest, such as 5G Networks, Big Data, Internet of Things and Cyber Physical Systems. In parallel, the DISCOVERY projects promote transatlantic dialogues for EU-USA ICT R&I cooperation through workshops and engagement activities.

The ICT sector is a large, transversal and enabling sector that can facilitate the development of direct ICT driven services, as well as many cross sectoral activities. The business development and market opportunities are thus very diverse and it is difficult to selector or exclude any particular sub-sector. Nevertheless, certain areas might prove more interesting for accelerating C2C cooperation in the short-term and these include: blockchain, Internet of Things (IoT), Big Data, machine learning, and Artificial Intelligence (AI)<sup>79</sup>. All these sub sectors are expected to be the main drivers of growth in the ICT sector for the coming years and where Europe has some leading business and innovation actors.

## 4.5. Water sector

The water sector is one of the most important sectors in the USA and in many EU Member State economies. Currently, both the USA and the EU face problems related with the efficiency of water supply and water treatment<sup>80,81</sup>. This leads to the need of fostering technological innovation to address the current challenges of water sustainability and to harness breakthrough R&D activities in order to develop more efficient water supply technologies<sup>82</sup>.

The challenges of the water sector are essentially grounded in the lack of efficient water technologies and innovation policies that meet the needs of the contemporary scenario. In this context, the water innovation cluster organisations play an important role in the stimulation of cooperation activities between EU and USA water clusters and the numerous public sector actors that are engaged in this sector. Thus, EU-USA C2C cooperation can stimulate strategic investments and support the establishment of regional policies that effectively take into account the water sector challenges and remove the barriers impacting the sector's innovation.

Currently, there are eight European water clusters registered with the ECCP that target the USA for the development of international activities, such as Aqua-Valley (France)<sup>83</sup> and WaterCampus Leeuwarden (Netherlands)<sup>84</sup>. The interest of the EU clusters in cooperating with USA water organisations demonstrates that both regions share similar challenges, which can lead to numerous cooperation opportunities.

In 2014, the Pôle Eau French Competitiveness cluster signed a MoU with The Water Council (USA) with the aim of strengthening existing partnerships between French and USA organisations and encouraging cooperation with universities, as well as collaboration and idea sharing among the

<sup>79</sup> <https://atradius.nl/rapport/market-monitor-ict-usa-2018.html>

<sup>80</sup> <https://www.eea.europa.eu/publications/92-9167-025-1/page003.html>

<sup>81</sup> <https://www.epa.gov/watersense/how-we-use-water>

<sup>82</sup> <https://www.epa.gov/water-innovation-tech/water-technology-innovation-10-market-opportunities>

<sup>83</sup> <https://www.clustercollaboration.eu/cluster-organisations/pole-eau-french-water-cluster>

<sup>84</sup> <https://www.clustercollaboration.eu/cluster-organisations/watercampus-leeuwarden>



entrepreneurs in the respective programmes<sup>85</sup>. The signing of this MOU paves the way for more countries across Europe to develop cooperation agreements with The Water Council.

The Water Joint Programming Initiative (JPI) identifies international cooperation as a priority to support the European leadership in water science and technology. Thus, the Water JPI mapped R&I activities in seven priority countries with which further collaboration could be promoted, including the USA. This represents an opportunity for EU and USA clusters to cooperate on shared challenges, such as water supply and water treatment<sup>86</sup>. In addition, actions similar to the Coordination and Support Action IC4WATER<sup>87</sup>, which aims to promote international cooperation in the water sector, could represent an opportunity to foster cooperation between EU and USA clusters.

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<sup>85</sup> <https://thewatercouncil.wordpress.com/2014/05/01/french-ambassador-delattre-visits-global-water-center-mou-signed/>

<sup>86</sup> [http://www.waterjpi.eu/index.php?option=com\\_content&view=article&id=468&Itemid=1001](http://www.waterjpi.eu/index.php?option=com_content&view=article&id=468&Itemid=1001)

<sup>87</sup> [http://www.waterjpi.eu/index.php?option=com\\_content&view=article&id=541&Itemid=1068](http://www.waterjpi.eu/index.php?option=com_content&view=article&id=541&Itemid=1068)