

## Open Call Collection OC-2017-1

### Proposal Reference OC-2017-1-22105

**Title:** Aedes Invasive Mosquitoes (AIM) COST ACTION

**Acronym:** AIM

#### Summary

In tropical areas, *Aedes* mosquitos cause >100m symptomatic cases/year of viral diseases, such as dengue, yellow fever, chikungunya and Zika, and thousands of deaths. With increasing trade and travel, several *Aedes* species have been introduced into Europe and are now spreading spectacularly rapidly becoming a widespread significant public health risk which needs to be effectively addressed, as testified by recent cases of autochthonous chikungunya and dengue transmission.

Transboundary risks require effective surveillance, risk assessment, and vector control, with efficient dissemination of information and guidance to stakeholders, requiring collaboration between the normative, research, public health, commercial and civil society sectors at international, national and local scales. This is not happening. Despite the range of institutional guidelines available, current mitigation activities are largely uncoordinated, and implemented piecemeal nationally or locally, reducing cost-effectiveness and impact.

AIM Cost Action will build a gender, age and geographically balanced network from critical stakeholder sectors. The Action will assess and review current surveillance, control and analysis practices, develop best practice guidelines and protocols ensuring consistency across Europe. It will facilitate development of new tools and identify priority research topics. Recommendations to standardise and streamline entomological and spatial analysis will promote enhanced risk assessments needed for reliable targeting and planning. Critical elements maximising impact will be involvement of civil society and citizen scientists, as well as collaborative dissemination ensuring that technical outputs and guidelines are customised at different geographical scales for each operational stakeholder group. Lessons learned will be transferrable to other emerging vector borne diseases worldwide,

#### Key Expertise needed for evaluation

##### Health Sciences

Infectious diseases

##### Health Sciences

Parasitology

##### Health Sciences

Public and environmental health

##### Biological sciences

Zoology, including animal behaviour

##### Health Sciences

Databases, data mining, data curation, computational modelling

#### Keywords

Medical Entomology

Invasive Mosquitoes

Mosquito vector monitoring and surveillance

Mosquito vector control

Risk of Arbovirus (dengue, chikungunya, zika) transmission



## TECHNICAL ANNEX

### 1. S&T EXCELLENCE

#### 1.1. Challenge

##### 1.1.1. Description of the Challenge (Main Aim)

The surveillance and control of *Aedes albopictus* and other *Aedes* Invasive Mosquito (AIM) species and the management of the risk of introduction and spread of Exotic Invasive *Aedes* Mosquito Borne Viruses (EAIMBV; e.g. dengue, DENV; yellow fever, YFV; chikungunya, CHIKV; Japanese encephalitis, JEV, and ZIKAV) in Europe require multidisciplinary research (e.g. entomological, epidemiological, environmental, climatic, demographic, mathematical, statistical, computational), cost-effective conventional/innovative methods, strong linkage between academics, public health (PH) professionals and policy-makers at the national and international level, as well as more an integrated private sector and a better informed and engaged society.

**These activities require an effective transboundary network of partners integrating all these stakeholder groups in Europe and beyond to identify and fill knowledge gaps, enhance research effectiveness, standardise, optimise and promote new country-tailored surveillance and control procedures, and improve dissemination.**

##### 1.1.2. Relevance and timeliness

**More than half of human population is at risk of contracting an EAIMBV** which cause debilitating economically damaging illnesses and thousands of deaths/year in tropical regions. With no effective vaccine for most EAIMBVs, **avoiding being bitten and/or controlling vector abundance are the only ways to reduce disease incidence.** Even for YFV, for which an effective vaccine is available, recent epidemics in Angola and Brazil demonstrate the substantial risk of epidemics<sup>1</sup>. In addition, *Aedes* mosquitoes also transmit new emerging threats, as testified by the 2015-16 ZIKAV epidemics in Latin America, which has been associated to severe neurological complications and increased occurrence of microcephaly<sup>2</sup>.

Although these diseases are only endemic in the tropics<sup>3</sup>, colonization of southern Europe by *Ae. albopictus* has caused a few **autochthonous CHIKV & DENV cases** in France<sup>4</sup> and Croatia<sup>5</sup> since 2010, as well as a **CHIKV outbreak in northern Italy** in 2007 (with >250 confirmed symptomatic cases)<sup>6</sup>. The latter led to a vector control plan involving more than 280 municipalities and 4.2 million inhabitants, whose cost ranged between 7.6 and 5.3 million € from 2008 to 2011<sup>7</sup>. In addition, Increasing globalization has led to **more cases of importation of arboviruses through infected travellers returning from endemic to non-endemic regions** (e.g. >1,100 DENV cases in Europe in 2010, rendering DENV the second most frequent reason, after malaria, for admission to hospital after return from abroad<sup>8</sup>) **and to the recurrent introduction of *Ae. albopictus* (and other AIMS)**, mostly by used-tire and lucky-bamboo trade, and their spread by passive transport throughout most of Europe. Despite the obvious and increasing PH challenge emerging in Europe (which is predicted to increase due to climate change<sup>9</sup>), only a few European research groups or networks have specific expertise on AIMS. In fact, in the decades since the successful eradication of malaria (the most devastating mosquito-borne disease worldwide), **the relatively small European medical entomology community has mostly focussed on endemic vectors** (e.g. *Culex* mosquitoes, sandflies, ticks) and endemic pathogens (e.g. West Nile virus, Leishmania, tick-borne-diseases).

AIM-COST Action intends to **rectify this imbalance** by enhancing and promoting scientific and technical knowledge on surveillance and control of these **invasive mosquitoes**, and to disseminate this information by developing a large multidisciplinary Pan-European network of academics, PH professionals, research businesses and researchers working with civil society.



## 1.2. Objectives

### 1.2.1. Research Coordination Objectives

The status of AIMS in Europe is changing extraordinarily fast, while expertise and implementation of surveillance and control strategies are still very fragmented among CCs and NNCs and, in some cases, even inconsistent. **AIM-Cost Action intends to develop synergies between scientists, decision-makers, productive sector and civil society necessary to harmonise and rationalise sustainable approaches - both conventional and novel – for the surveillance, control, analysis and dissemination across Europe and beyond.** The following coordination objectives will be implemented by three integrated Working Groups (WGs; see Section 3).

**MONITORING & SURVEILLANCE of AIMS and EAIMBVs (WG1).** Valuable guidelines for conventional surveillance have been produced by European Centre for Disease Control (ECDC)<sup>10</sup> and World Health Organisation Europe regional Office (EU-WHO)<sup>11</sup>. These, however, are more competitive than collaborative, costly to apply, and assuming rather high level of expertise and tools available, and are thus not applied systematically across Europe, with no widely accepted quantitative evaluation, nor assessment or comparison tools. **The AIM-COST Action will assemble a critical mass of medical & veterinary entomologists, epidemiologists/PH professionals to negotiate a broad consensus on how best to customise national implementation of surveillance/control interventions within a standardized and sustainable framework, including modern citizen science approaches, in order to harmonise the use of PH surveillance data and spatial analyses methods across Europe and streamline the analytical, modelling and mapping process.** WG1 Specific, Measurable, Achievable, Relevant and Timely (SMART) objectives are to: i) systematically review current methodologies and practices for sampling, monitoring and identifying AIMS, as well as for data analysis and for mathematical/statistical/computational modelling; ii) establish the pros and cons and cost-effectiveness of alternative approaches and produce recommendations for more affordable approaches (including Citizen Science community based ones) which could also be implemented in lower-income countries; iii) facilitate ToK to less experienced stakeholders, promote data sharing and harmonization to assure comparable outputs; iv) identify integrated research to develop novel surveillance tools and methods (including citizen science community based ones); and v) provide a set of guidelines containing recommendations for best practice sampling, surveillance, spatial modeling and map output production taking into account the needs of the stakeholders by assessing the outputs from the perspective of both producers and end-users (e.g. PH officers, the public) in order to ensure the maximum integration and impact at the EU level and beyond. Synergy with innovative private companies will allow transforming identified needs into novel/improved cutting-edge surveillance tools (e.g. trapping, molecular identification techniques, softwares).

**CONVENTIONAL & INNOVATIVE CONTROL TOOLS (WG2).** The European Mosquito Control Association (EMCA) in collaboration with EU-WHO provides guidelines for AIM control in Europe<sup>12</sup>. However, recommended approaches are conventional and do not take into account that the mean national preparedness and capacity to deal with AIM invasion and colonisation is very heterogeneous among CCs/NCCs, due to differences in technical knowhow, ecology, political priorities and familiarity with the target species. **This WG aims to provide the means to overcome these heterogeneities in preparedness and capacity to fight against AIMS and trigger optimization and innovation in AIM control.** SMART objectives are to: i) systematically review of AIM conventional control methodologies across CCs/NCCs, identify locally tailored sustainable control tools and assess their effectiveness and environmental and social impact; ii) promote the development of key innovative Citizen Science community based control activities; iii) facilitate ToK to less experienced stakeholders and promote data sharing; and iv) promote evidence-based AIM-control interventions. Innovative private companies in the field of mosquito

control will be involved in order to pave the way toward development of novel/improved control tools.

**Information, data, protocols gathered in WG1 & WG2 will be synthesised as guidelines and disseminated as recommendations customised to end user groups** (see 2.2.2 and WG3).

### 1.2.2. Capacity-building Objectives

The AIM-COST Action capacity-building objectives are:

**-Creating a Pan-European multidisciplinary network of scientists with common background** on AIM bionomics, surveillance and control in order to identify and develop innovative research concepts and ideas and to promote the implementation of optimised/innovative monitoring/control campaigns projects in synergy with the ECDC, EU-WHO and the ECSA/Wilson Institute Global Mosquito Alert Consortium. .

**-Nurturing a new generation of medical entomologists** with inter-disciplinary expertise on IAM related activities and international collaborative perspectives, and able to maintain & improve expertise and capacity to prevent or control IAMs and related health risks in Europe and beyond.

**-Creating a synergistic relationship between scientists private companies, citizen scientists and decision-makers across Europe and beyond** for the implementation of best practices and innovative tools in local AIM and EAIMBV surveillance/monitoring and control campaigns in order to overcome present fragmentation in knowledge and interventions and eventually improve health and well-being in Europe and beyond. This will involve each sector learning new skills and perspectives.

**-Raising public awareness** of AIMs, related health risks and control options to obtain a more informed consensus on preventive Citizen Science community-based interventions, as well as on possible innovative control approaches to be implemented under different epidemiological scenarios.

**-Jointly refining, optimizing, customising and delivering guidelines and protocols for AIM surveillance/monitoring/control** in conjunction with international Agencies (e.g. ECDC, EU-WHO, EMCA) and PH end-users to promote their implementation at national and local scales. Outputs from the work will also be shared through the Global Mosquito Alert Consortium (GMAC) to European Citizen Science Groups (ECSA) to share both data and best practice through available open systems.

## 1.3. Progress beyond the state-of-the-art and Innovation Potential

### 1.3.1. Description of the state-of-the-art

The existing context of surveillance, control and analysis capabilities and coordination has been summarised in previous sections, so following paragraphs focus on underlying cause of the PH risks: **the mosquito vectors themselves**. Mosquitoes in general, and AIMs in particular, have been spectacularly successful invasive pests at a global scale. AIM's aggressive day-time biting behaviour makes them dreadful nuisance pests and their capacity to transmit exotic anthroponotic arboviruses (i.e. DENV, YFV, CHIK, ZIKA, JEV) creates the conditions for autochthonous transmission in non-endemic countries. These vectors can be transported over long distances in trade goods, aircraft, ships and vehicles, and thrive in urban centres where artificial containers serve as larval breeding sites. Many can survive low winter temperatures. **Europe is now facing invasion by and spread of (at least) four Aedes mosquito species<sup>13</sup>**.

- The Asian Tiger mosquito *Aedes albopictus* is capable of transmitting several EAIMBVs and has spread dramatically worldwide and is projected to continue to do so<sup>14</sup>. It is listed in the top 100 invasive species<sup>15</sup>. ECDC confirms its establishment in 12 CCs/NNCs (including **all** Mediterranean countries) and temporary introduction in Belgium, Czech Republic, Germany, The Netherlands and UK. So far it have caused >250 symptomatic CHIKV cases in north-east Italy<sup>6</sup> in 2007 and autochthonous transmission of DENV and CHIKV in France<sup>4</sup> and Croatia<sup>5</sup> in more recent years.

- ***Aedes koreicus*** - a major JEV vector in its native range - was recorded in Belgium (2008)<sup>16</sup>, Italy (2011)<sup>17</sup> and more recently in Russia<sup>18</sup>, Slovenia<sup>19</sup>, Switzerland<sup>20</sup>, Germany<sup>21</sup> and Hungary<sup>22</sup>. Like *Ae. albopictus*, it readily adapts to urban habitats, but is more tolerant of cold temperatures and able to outcompete *Ae. albopictus* in colder European regions.

- The Asian bush mosquito ***Aedes japonicus*** – also a vector of JEV in its native range - was detected then eliminated from northern France in 2000 and Belgium in 2002, but is now present in several central European countries<sup>23</sup>. It has less specialised requirements for aquatic habitats, tolerates higher organic concentrations and lower temperatures than *Ae. albopictus*, and is less heat tolerant, thus being more suited to northern than southern European countries<sup>24</sup>.

- Finally, ***Aedes aegypti*** – the most efficient vector of YF, DEN & ZIKA viruses – cannot survive cold winters. It disappeared from southern Europe in the 50's (before which it caused large YFV & DENV outbreaks)<sup>25</sup> but is now found on the Black Sea coast<sup>26</sup> and in the Portuguese tropical island of Madeira, where it caused a DENV outbreak in 2012<sup>27</sup>. Further introductions into European territories, with associated disease risks, are testified by cases reported in The Netherlands<sup>28</sup>, UK<sup>29</sup> and Germany<sup>30</sup> raising concerns about a possible DENV resurgence and the potential efficient transmission of other EAIMBVs.

### 1.3.2. Progress beyond the state-of-the-art

Knowledge on bionomics of AIMs in temperate regions is limited and mostly focussed on *Ae. albopictus*. Invasion into new areas is dealt with by national/local institutions and research activities are driven by academic rather than PH priorities. The networking and ToK opportunities made available by the AIM-COST Action **will canvas the wider stakeholder community and so help address this fragmentation, minimise duplication by harmonising objectives and improve efficiency by optimising protocols at a Pan-European level**. Importantly, rather than prioritising high impact scientific publications, AIM-COST Action intends to interact directly with PH institutions and authorities in charge of AIM and EAIMBV monitoring and control, and to involve SMEs and Citizen Science Communities in the translation of research results into optimised/novel tools. Specific details on expected progresses are presented in the WG description in Section 3. This ACTION will trigger a novel trans-boundary approach, promote ToK and collaboration horizontally between sectors as well as vertically between different stakeholders (researchers, private companies offering "know-how" and novel tools; policy makers, public and private companies in charge of AIM and AIMBD surveillance and control; civil society and Citizen Science initiatives now underway in at least 6 EU countries), and make upstream technical outputs and capabilities more closely aligned to real world needs and more relevant to a wider medical and veterinary ("One Health") context.

### 1.3.3. Innovation in tackling the challenge

The AIM-Cost Action intends at innovating the field of AIM research and control (and more generally of medical/veterinary entomology and epidemiology of diseases caused by EAIMBV) in Europe and beyond by promoting coordination in the planning and implementation of surveillance, control, risk assessment and dissemination into a streamlined process where activities feed into each other, and the skills and priorities of stakeholders who traditionally work in isolation are properly integrated. Examples include linking: i) researchers with longstanding direct experience on AIMs with those from countries more recently invaded/colonized by AIMs; ii) "pockets of excellence" in Europe and research groups in less research-intensive countries; iii) academics and PH officers/policy-/decision-makers in charge of prevention/ control of AIM and related health risks; iv) academics/PH officers and private companies producing tools for AIM monitoring, surveillance and control; iv) academics/PH officers working with the civil society; v) academics/PH officers with international organisations releasing guidelines for mosquito surveillance and/or control (E-CDC; EU-WHO; EMCA; GMAC; UNEP). This is expected to encourage: i) technical improvements such as the development of novel concepts for surveillance of AIMs (e.g. by smart phone applications, Task 1.1), of innovative control approaches (T2.3) and streamlining ways to model AIM actual/

potential spread (T1.2); ii) targeting integration and customisation dissemination of outputs from AIM/EAIMBV modelling/surveillance and control and of surveillance/control interventions in the field (T1.2); iii) improvement of the capacity of research/public health institutions to assess the effectiveness of conventional and innovative control interventions and to detect and prevent insecticide resistance spreading (T2.2); iv) raising of public awareness on mosquito vectors and related health risks and expansion of growing Citizen Science more knowledgeable Pan-European community (T3.2); v) optimisation/development of mosquito surveillance/control tools (T1.1; T2.3).

## 1.4. Added value of networking

### 1.4.1. In relation to the Challenge

CCs and NNCs are investing variable amounts of money to either prevent AIM invasion, reduce their nuisance and/or to prevent autochthonous transmission of EAIMBV. Such implementation at national scale precludes using unified systems of surveillance, prevention, control and analysis needed to tackle transboundary problems. AIM-COST-Action intends to overcome the current fragmentation by scientific exchanges and ToK programmes, with particular reference to: mobility schemes mostly devoted to Early Career Investigators; Annual Conferences gathering academics, PH officers, policy/decision makers, citizen science leaders and private companies involved in the production of tools for AIM surveillance and control; regular meetings and workshops; a dedicated Website (Section 2, WG3). This will allow the identification of standard protocols and guidelines for AIM research, monitoring, surveillance, risk-analysis and control, the sharing of national experiences with conventional and innovative control approaches and the optimisation of cost-effective collection/control tools. It is envisaged that the AIM-COST network will be eventually **endorsed as the reference community** providing guidance at national and international scales.

### 1.4.2. In relation to existing efforts at European and/or international level

The EU-FP7 Health Programme (2007-13) recognized the need to prioritize Research and Innovation in the field of Vector-Borne Diseases (VBD). Several FP7-projects focused on mosquito vectors of malaria and dengue in tropical regions. **IDAMS, DENFREE and STOP DENGUEFP7 projects** all worked on surveillance, control and risk assessment of dengue and its vectors in endemic tropical areas. On the other hand, specific investments on mosquito vectors in Europe have been much lower and mostly focused on endemic vector species involved in the transmission of endemic arboviruses. This was the case of **FP7- EDENext** (2010-14) - which addressed research issues related to the ecological and epidemiological components of emergence and spread of pathogens transmitted by ticks, sandflies, midges and mosquitoes (primarily *Culex pipiens* as vector of West Nile Virus) with the final goal to build the basis for a better control – and of **FP7-KBBE Vmerge** focusing on the risk of emerging viral diseases in two main transmitted by mosquitoes (mostly *Culex*), and biting midges. **FP7-Infrastructure-2010 INFRAVEC (2010-15)** was aimed at creating EU infrastructures to bridge the existing gaps in implementation of transgenic technologies in the control of malaria vectors in Africa and of *Ae. albopictus* in Europe.

**The ongoing H2020 Health Programme (2013-2020) has otherwise largely de-prioritized funding in the VBD field**, until the 2015-epidemics of ZIKAV in Latin America Europe stimulated the investment of €45m in four research consortia to investigate a range of epidemiological issues with little focus on the mosquito vectors. At present the only H2020-project focused on mosquito vectors is the follow-up to **INFRAVEC** (i.e. **INFRAVEC2**, <https://infravec2.eu/>; 2017-21), funded by the Research Infrastructure Program (INFRAIA) that aims to develop and share large infrastructures and biological resources for research on mosquito born diseases.

Other ongoing international initiatives/projects complementary to this Action include: the WHO-Europe Regional Framework for Surveillance and Control of Invasive Mosquito Vectors and Re-Emerging Vector-Borne Diseases (2014-2020) (<http://www.euro.who.int/en/publications/abstracts/regional-framework-for-surveillance-and-control-of-invasive-mosquito-vectors-and-re-emerging-vector-borne-diseases-2014-2020>) which stresses

the need for Member States to improve their systems of mosquito vectors surveillance and control; WIN (Worldwide Insecticide resistance Network; 2016-17 <http://win-network.ird.fr>) funded by WHO-TDR to bring together internationally recognized institutions to track insecticide resistance in mosquito arbovirus vectors worldwide and provide key recommendations to improve insecticide resistance surveillance and deployment of alternative vector control tools; the International Atomic Energy Agency IAEA-RER5022project ([www.iaea.org/projects/tc/rer5022](http://www.iaea.org/projects/tc/rer5022)), aiming at developing capacities for surveillance and application of SIT control; LIFE-CONOPS ([www.conops.gr](http://www.conops.gr); 2013-17), funded by Europe in LIFE+ Environment Policy and Governance programme and aiming to develop new prototype devices and implement them for eco-friendly AIM-monitoring; VECTORNET ([www.vectornet.ecdc.europa.eu](http://www.vectornet.ecdc.europa.eu); 2014-18) a network of entomologists funded by ECEC and EFSA that aims to share data on the geographic distribution of arthropod vectors (including invasive mosquitoes), transmitting human and animal disease agents; EURNEGVEC COST Action TD1303 ([www.eurnegvec.org](http://www.eurnegvec.org); 2013-17), a transboundary network of partner institutions involved in education and research related to arthropod vectors among which mosquitoes, but with particular reference to endemic species; MediLabSecure (2014-2018) a network of laboratories in Countries of the Mediterranean and Black Sea regions funded by DEVCO/Europe Aid aiming at consolidating a Laboratory Network on the emerging viruses that are pathogens for humans and/or animals and including capacity building in medical entomology; lastly, a working group within the European Mosquito Control Association (EMCA; <http://www.emca-online.eu/>) focus on AIM and promoting scientific/technical exchanges between EMCA members, with no/little dedicated funds. Notably all these project are expiring within 2018; the networking opportunities made available by AIM-COST will thus represent a crucial instrument for the European medical entomology community to continue to interact and develop new projects and actions in synergy with WHO-Europe Regional Framework for Surveillance and Control of Invasive Mosquito Vectors and Re-Emerging Vector-Borne Diseases. Moreover, in creating a large inclusive pan-European stakeholder community with representatives of ALL these projects, AIM-COST Action will provide a cost-effective way to build on the earlier networks and to establish synergies with ongoing ones at a time when there are few other avenues available to involve a large number of academic partners, PH institutions and private stakeholders in AIM/EAIMBV related surveillance, control, analyses and dissemination.

The added value of AIM-COST action in relation to former/existing projects/networks is further supported by the following features: i) the close working relationship between some of AIM-COST participants and the international agencies (WHO-EU, ECDC, EFSA, AIEA, EMCA) – which has been built up through years of close collaboration - will ensure extensive instrumental involvement of these bodies in AIM-COST Action; ii) the inclusion among AIM-COST members of representatives of all above mentioned research projects, accounting for the best synergy between research output from these projects, generally lacking of sufficient resources for training, networking and outreach dissemination, and networking/training/dissemination opportunities created by AIM-COST; iii) inclusion in AIM-COST of a large number of academic partners, public health institutions and private stakeholders from all EU countries facing the problem of AIM/EAIMBV necessary to promote translation from results of research project to actual interventions in the field; iv) possibility for AIM-COST (particularly, if funded within 2017) to proceed in parallel with INFRAVEC2 paving the way for a larger number of research groups to build the solid and state-of-the art expertise necessary to take advantage of the key specialised research facilities made available by INFRAVEC2, which at present can only be exploited by few highly-qualified research groups from most research intensive Countries.

Finally, the AIM-COST will take advantage of the **MOSQUITO ALERT CONSORTIUM** (<https://ecsa.citizen-science.net/blog/press-release-global-mosquito-alert>) currently being developed under the auspices of the **European Citizen Science Association (ECSA)**, the **Woodrow Wilson International Center for Scholars** and the **United Nations Environment Program (UNEP)** to take advantage of existing national pilot project exploiting smart-phone applications for mosquito monitoring and surveillance (e.g. [www.vecmap.com](http://www.vecmap.com), [www.zanzamapp.it](http://www.zanzamapp.it), [www.mosquitoalert.com](http://www.mosquitoalert.com), <http://www.mueckenatlas.de/>; [www.muggenradar.nl](http://www.muggenradar.nl),



<http://mosquitoweb.ihmt.unl.pt>, <http://project-lovcen.me/page>) in order to develop a common global platform for mosquito monitoring. A first preliminary meeting of main stake-holders has been held in Geneva in April 2017 (with the participation of some AIM-COST members), and the initiative is now looking for appropriate funding. The networking opportunities created by AIM-COST have the potential to greatly contribute to the creating of this global platform and of an innovative and powerful approach for mosquito monitoring in Europe and beyond.

## Section 2 - IMPACT

### 2.1. Expected Impact

#### 2.1.1. Short-term and long-term scientific, technological, and/or socioeconomic impacts

AIM-COST Action is expected to have the **following major positive impacts in scientific, technical and socio-economic arenas**, as follows.

**-Scientific impact:** i) development of research synergies and definition of new research priorities in VBD field by integration of west/east-European and NNC research communities with a common interest on AIM bionomics in temperate areas, but little/no history of collaboration; ii) ToK from countries and research groups with experience of established AIM populations and autochthonous EAIMBV transmission to those without such experience iii) establishment of a new generation of highly-qualified scientists trained to deal with invasive vectors & VBD beyond country boundaries.

**-Technological impact:** i) optimisation/standardization of AIM surveillance/control approaches across Europe and beyond by integration of west-/east-European and NNC research/PH communities with a common interest but with little/no history of collaboration; ii) development/optimization of more affordable tools, methodologies and approaches in AIM/EAIMBV surveillance/control also through citizen science programmes which could be effectively implemented also in lower-income countries, by critical review of shared data; iii) translation of surveillance and control research and analyses into actual products/methodologies by means of the promotion of links between research groups, PH-professionals, Citizen Scientists and private companies in the sector.

**-Socio-economic impact:** i) improved of cost-effectiveness of surveillance/control interventions against AIMS and associated health risks in Europe and beyond, by production of customised guidelines for surveillance/control and for modelling outputs by integration of AIM-COST research groups and stakeholders (e.g. policy/decision-makers, public users); ii) education of the civil society on AIM and health associated risk, as well as on best practice to prevent AIM reproduction; iii) direct involvement of the civil society in Citizen Science projects which offer more cost-effective monitoring activities (e.g. by smart phone apps) as an alternative to more skill-intensive and expensive surveys; and iv) improvement of health and well-being in Europe and beyond, by reducing risk of EAIMBV and mosquito nuisance.

### 2.2. Measures to Maximise Impact

#### 2.2.1. Plan for involving the most relevant stakeholders

The most relevant stakeholders to interact with the specialist technical network partners are: i) **policy/decision-makers:** AIM-Cost Action already includes as Secondary Proposers about 30% Government/Intergovernmental Organisations (except Higher Education), and will put a great effort in establishing strong partnership with additional ones, as well as with international organisation involved in AIM and related health risk surveillance and/or control (e.g. ECDC, WHO-EU, AIEA, EMCA). These will provide a link between specialists and policy/decision-makers to transmit AIM-COST Action outputs, receive dissemination material and customised guidelines, and be invited to Annual Conferences to specify their needs and then contribute to the resulting recommendations;

ii) **private companies producing tools for mosquito monitoring and control**: at the start of the Action special efforts will be made to involve more of SMEs in CCs and NNCs in addition to those already involved as Secondary partners, by means of dedicated dissemination and promotion activities, as well as by extensive coverage of the countries that supported the Action proposal; all these companies will be invited to assist in the production of improved and more cost-effective products tailored to meet identified users' needs. Their involvement will also provide a valuable 'think tank' to promote cutting-edge solutions; iii) **civil society** will be involved by direct consultation, through established and developing Citizen Science programmes via the ECSA network, and through brochures and fliers, creation of dedicated pages on social networks, articles in popular science journals, press releases, participation in scientific TV and Radio programs, conferences and lectures in schools.

### 2.2.2. Dissemination and/or Exploitation Plan

AIM-COST Action clearly recognises that the success of surveillance, control and modelling activities depends not only on technical excellence, but also on the degree to which they are useful to the public health and PH care professionals, acceptable to the public and appealing to the funding bodies. This in turn depends on a clear mutual understanding of what is actually required, what the activities entail, why they are being done and what they aim to achieve. Such understanding requires detailed and iterative collaboration between all stakeholders from the outset which in turn relies on effective dissemination of objectives, planned activities, results and impact. Therefore, **an entire WG will be dedicated to "Dissemination, Customisation & Communication"** (WG3) to facilitate and promote customisation and uptake of AIM-COST Action outcomes. WG3 will therefore be focused not only on traditional project dissemination through a Website and allied networks (Task 3.1), but also on developing and disseminating guidelines for surveillance, control (Task 3.2a) and modelling (Task 3.2b), activities covered by the other WGs. These will be tailored to the specific requirements at the regional/country level scale in order for them to be easily understood, accepted and implemented by end-users and decision-makers. Scientific publications will be published in Open-Access Journals and full use will be made of the outreach opportunity to Civil Society through both ECSA and the expanding Citizen Science community in Europe and through the GMAC and its links to the Global CS Community.

At the kick-off meeting, the AIM-Management Committee will define provisions linked to the **management, exploitation and protection of Intellectual Property Rights (IPRs)** according to COST "Guidelines to dissemination and exploitation", in order to monitor proper IPR implementation and protect the participants' legitimate interests throughout the Action (see Section 3.2).

## 2.3. Potential for Innovation versus Risk Level

### 2.3.1. Potential for scientific, technological and/or socioeconomic innovation breakthroughs

- **Scientific breakthrough** will be derived from the foundation of a Pan-European medical entomology community revitalised by a new generations of Early Career Investigators in VBD field with an holistic vision, a strong knowledge of PH sector needs and mechanisms, and capable of thinking and planning beyond country boundaries and accessing a thriving, innovating and expanding Citizen Science community both in Europe and beyond.

- **Technological breakthroughs** will be derived from synergies among different sectors (research, PH, SME's, civil society, many already signed up as Secondary partners) which is expected to lead to novel tools and approaches to AIM surveillance, control and analyses. Recommendations to rationalise and harmonise guidelines will lead to more timely and efficient surveillance and control. Importantly the diversity of partner sectors will force a more effective outreach by researchers and specialists, which itself is a breakthrough and increases impact.

- **Socio-economic breakthroughs** will be derived from the improved cost-effectiveness and impact on health and quality of life that the improved approaches and tools will eventually deliver.

As the proposal does not involve directly measurable impact or investment, a formal quantitative risk/return trade off assessment using the usual Sharpe Ratios that indicate the preferred high returns with low risk cannot be produced. It is, however possible to provide some qualitative indications as follows. None of the major expected returns are considered to have high risks, and those with medium risk have readily identifiable mitigation strategies (see Table below).

There is however a proviso to this overview, namely that the greatest risk to the sustainability of a revitalised entomological/VBD surveillance and control community is the long term availability of funding support. Much of this is currently derived from the public sector, even if delivered through private enterprise, and support is therefore determined by public sector priorities which are beyond the control of this, or any other technical and advocacy project. Raising awareness of public sector and providing with detailed cost/benefit analysis are activities planned within the AIM-COST in order to mitigate this risk. Nevertheless, politicians in ITCs have shown to be quite resilient to warnings related to costs and risks associated to AIMs and EAIMBDs. However, the increased awareness in the civil society achieved by AIM-COST outreach activities is expected to influence common people to change their attitude to this issues and eventually force administration to invest more efforts in supporting projects designed to ease adverse effects of AIMs and EAIMBDs.

Highest Return Impacts	Implementation Risk	Mitigation
Involvement of early career investigators in existing networks	Low	Successful system for recruiting ECI developed during Cost Action TD1303 (84 STSM realized, 11 to be during 4 years) will be implemented.
Involvement of public sector representatives	Medium	Appointment of a deputy at the beginning of the Action that could replace primary institution at the meetings representative of public sectors too busy to participate
Sustainability of networks established	Low	Training and new network collaborations will make network members better qualified to attract funding, <b>but see general provision above.</b>
Development of Novel Control tools	Medium	It may well take longer than the project lifetime to materialise. Mitigation would be to encourage proof of concept activities and proposals within project activities
Rationalisation of Guideline Implementation	Low	Project is designed to attract input from all relevant stakeholders to ensure consensus outcomes and recommendations
Improved integration of surveillance and analyses	Medium	Whilst technical requirements straightforward, depends on data sharing as well as ToK to succeed. Mitigation through strengthening long term network collaborations
Improved cost effectiveness of surveillance and control	Low	AIM Cost will assemble sufficient diversity of skills to generate the communication pathways needed to link surveillance and control activities
Better targeted and customised outreach by researchers	Low	Central activity of AIM Cost is to bring researches and users into contact, to ensure effective translation of research outputs

## Section 3 - IMPLEMENTATION

### 3.1. Description of the Work Plan

The work plan will be implemented through 3 Working Groups (WGs), as detailed below. Participants to each WG will include academics, PH officers, private companies members, leading

citizen scientists and public sector/policy maker representatives. Activities to be implemented at the WG and at the Action level are summarized after WG description.

## **WG1 – MONITORING & SURVEILLANCE of AIMs and EAIMBVs**

**Task 1.1 – Review, optimisation and ToK of AIM monitoring and surveillance.** The practicality and efficiency of current sampling protocols for collecting different mosquito stages (i.e. eggs, larvae, resting/ovipositing/host-seeking adult females, resting males), AIM identification based on morphology using identification keys or molecular approaches (PCR; molecular genotyping; MALDI-TOF), National EAIMBV surveillance programs will be systematically reviewed, based on country level case specific data. Information and knowledge exchange will be facilitated and promoted at country level to maximise stakeholder involvement, to identify needs and gaps of different approaches, with the final aim of refining the interventions from inception to assessment to consolidate and harmonise recommendations for each species/pathogene and level of expertise. The contribution of citizen science to monitoring and surveillance by innovative smart phone mosquito monitoring applications already available in some European countries will be exploited and supported by interactive communication tools and platforms to facilitate inputs and information exchange, in synergy with the existing effort to organize a **Global Mosquito Alert Consortium (GMAC;** <https://ecsa.citizen-science.net/blog/press-release-global-mosquito-alert>; see 1.4.2).

**Task 1.2 - Integrating surveillance data analysis, spatial modelling & mapping to ensure the quality and applicability of future technical outputs at the European level.** Surveillance data provide the opportunity to produce spatial model of predicted vector distributions of areas that have not been adequately sampled in the field. The surveillance data must however be standardised and representative. In addition the modelling methods and the covariates data also need to be reliable and harmonized to ensure comparable outputs for different areas and from different practitioners. Finally, the outputs themselves need to be tailored for a range of potential users in the academic, PH administration and public arenas. Task 1.2 will assess the major potential 'roadblocks' in the work chain from sampling to dissemination, and provide a set of guidelines containing recommendations for best practice sampling, modeling and output production to ensure the maximum integration and impact at the EU level of the three sets of activities. Such a Road map will not only be valuable within the context of AIM/EAIMBV assessments, but will be widely applicable to other vectors, their hosts and the diseases they carry.

**WG1 MILESTONES: ML1.1 -** Critical review and cost benefit analysis of different approaches implemented across Europe for AIM surveillance/monitoring, experimental design, data recording, statistical treatment of the results, spatial modeling mapping and identification of needs for harmonization and optimal exploitation (Year 2-Trimester III); **ML1.2 -** Identification of gaps and needs in applied spatial modelling leading to production of Roadmap (Y3-IV)

**WG1 DELIVERABLES: DL1.1 -** Report/publication on sampling design for monitoring and surveillance of AIMs and EAIMBV in Europe, (Y3-I); **DL1.2 -** Publication of best practices and white papers for AIM monitoring and surveillance, including modern citizen science approaches and Road Map for AIM mapping from data to models derived from STSMs (Y4-III)

## **WG2 – CONVENTIONAL and INNOVATIVE CONTROL TOOLS**

**Task 2.1 – Review, optimisation of current control options.** The control of AIMs where there is a risk of EAIMBV autochthonous transmission (e.g. when, for an infected human imported case is reported to health authorities) consists of focal spraying of adulticide insecticides. Preventive larval control based on habitat management campaigns to reduce availability of potential larval habitats and/or treatment of non-removable breeding sites (e.g. rain catch basins) are strongly recommended to reduce abundance of AIMs and related nuisance, but are rarely effectively implemented by public administrations. Private citizens are also investing considerable resources to reduce the nuisance using focal insecticide treatments and/or spatial/personal repellents and

trapping devices whose effectiveness is rarely assessed. The main focuses of this task are exchanges of information and knowledge and provision of recommendations for optimising at the Pan-European level methodologies to control AIM, for each species/geographical context. The practicality and efficiency of current control methods and the trends will be systematically reviewed, based on country level case specific examples. A critical prospective analysis for the use of public health pesticides in future decades taking into account the risk of insurgence and spread of insecticide resistance will be discussed in the frame of current Biocide European directive.

**Task 2.2 - Quality evaluation of AIM control operations.** Mosquito control operations are conducted by public or private agencies, depending on the specific country regulation and local situations. As these operations are usually publicly funded, they should be conducted with maximum transparency and quality control and external independent evaluation. Quality evaluation in mosquito control is largely unattended in Europe and thus strongly required in parallel with mosquito control operations. Preliminary experience developed in some countries will be gathered and analysed to assess cost-benefit, and protocols for quality evaluation in different settings will be developed alongside provision of training.

**Task 2.3- Innovative vector control tools/New Paradigms.** A limited number of mosquito larvicides (e.g. bacterial toxins and insect growth regulators, IGRs) and adulticides (e.g. pyrethroids) are presently available to control AIM and alternative efficient control solutions with low environmental impact are still lacking. Alternative innovative methods for the control of mosquito vectors of arboviruses - such as Wolbachia infections, paratransgenesis, Attractive Toxic Sugar Baits, mass-trapping, auto-dissemination, innovative sterile male releases and transgenic approaches - are under development aiming in most cases at a niche role rather than becoming the default intervention across a wide range of settings. Successful demonstration of cost-effectiveness of novel interventions in certain settings in CCs/NCCs is required to facilitate registration processes, policy endorsement, and expansion-scale up strategies also in other places. Knowledge base acceptance of novel approaches to the target populations is particularly relevant in case of possible implementation of biotechnology-based approaches and transgenic technologies. Novel control approaches will be compared with current methods and gaps in deployment of alternative AIM control tools will be identified. Strengths and weaknesses of each method, for a range of settings and geographical contexts, will be assessed in terms of efficiency, environmental, operational and ethical constraints, by assessing specific use cases, and by literature reviews. Conditions/sites where such alternative methods could be deployed will be identified and recommended. Network members will also provide guidance to the implementation and cost-effectiveness analysis of possible local pilot trials of novel control interventions supported by external funds and to the approaches to be implemented to raise of public awareness on vector control options in order to stimulate evidence-based decisions and informed consensus.

**WG2 MILESTONES:** **ML1**- Systematic mapping of conventional and novel AIM control practices (Y2-II); **ML2** - Input to improved monitoring procedures and protocols for efficiency of interventions (Y3-III); **ML3** - Systematic socioeconomic analysis and public awareness of novel practices/tools (Y4-II).

**WG2 DELIVERABLES:** **DL1** - Report/publication on conventional and novel AIM control practices in Europe (Y2-IV); **DL2** - Report on feasibility of scaling-up, cost-benefits and community acceptance of conventional and innovative AIM control approaches (Y4-IV).

### **WG3- DISSEMINATION, CUSTOMISATION AND COMMUNICATION**

**Task 3.1 - Dissemination within the COST-Action network & to scientific external audience.** Traditional methods will be used to disseminate AIM-COST ACTION activities and outputs - primarily a dedicated Website ([www.aimcostaction.org](http://www.aimcostaction.org)). This will contain a wide range of content including but not limited to formal Action documents (objectives, meeting presentations, minutes),

details of participants, outputs and publications, downloads, links to other relevant networks and projects, factsheets, news and events and a science blog.

### **Task 3.2 – Customisation: guidelines for surveillance/control and for modelling outputs.**

This overarching task consists of 2 subtasks, as follows: **T3.2a** Surveillance and control guidelines: as set out above, existing guidelines for surveillance and control are not widely or consistently used at the national level and require customisation to local conditions. This task will disseminate guidelines developed by WG1 and 2 to a range of stakeholders to solicit feedback and enable appropriate revision. **T3.2.b** Mapping and Modelling Outputs. Maps are powerful dissemination and advocacy tools – “a picture is worth a thousand words”. They can also be, if inadvertently, misleading. They may not map the right parameter (e.g. presence or absence rather than abundance); they may provide the wrong level of detail (e.g. km vs. administrative unit level); they may use inappropriate designs or simply be too complicated. The specific question to be addressed in this task is how to optimise existing mapped outputs for end users. The WG activities will therefore focus on the detailed customisation and translation of technical products for each defined user group, through: i) a WS to consult representative producers and users to identify dissemination needs (e.g. what information should be disseminated and to whom, what methods to use, who is responsible for the dissemination, and feedback loops should validate usability); ii) an STSM for preparation of dissemination guidelines; iii) presentation of the draft guidelines to Users at dedicated session during AC, for feedback; iv) Incorporation of feedback / guideline finalisation. Full use will be made of the links to the GMAC and to UNEP Environment Live so that all Citizen Science involved in innovative community led monitoring can input their views on the type of up-to-date and accurate information they wish to use. GMAC will feed into this process experience from using already available Citizen Science data on mosquito nuisance (risk of bites).

**WG3 MILESTONES:** **ML1** - Website functional (Y1-I); **ML2** - Delphi and specialised questionnaires designed, tested and distributed (Y1-IV); **ML3** - Partner assessment of draft guidelines for customisation of surveillance outputs (Y3-I); **ML4** - Partner assessment of draft guidelines for customisation of control output (Y3-IV); **ML5** - Partner assessment of draft guidelines for map customisation of modelling (Y4-II).

**WG3 DELIVERABLES:** **DL1** - Web platform and science blog platform (Y1-II); **DL2** - Report on results from Delphi and specialised questionnaires(Y2-I); **DL3** - Synthesised feedback with recommendation for customising surveillance, control and modelling guidelines (Y4-III); **DL4** - Guidelines for customisation of mapped outputs (Y4-IV).

## **WORKING GROUP ACTIVITIES**

Following the Kick-off meeting (KoM) and **in preparation for the first AIM-Annual Conference (AC)**, Delphi and specialised questionnaires for the need analysis will be designed, tested, distributed and analysed (WG3). The stakeholders report and the needs analysis based on the collected facts and findings will be presented during the AC and represent the baseline for design of the guidelines and tools meant for use within the citizen science deployment and integration into the network activities.

WG ACTIVITIES are tentatively foreseen to be as follows. **Particular care will be given in assuring: i) involvement of early career and ITC investigators; ii) gender balance; iii) balanced participation of participants from different country/institution and academic, public health and private sectors.**

**-Four Annual Conferences (AC; 2-3 days)** which will include plenary sessions on specific topics as proposed by MC and WGs, reflecting WG activities.

**-Working Group Meetings (WGM; 1-1.5 days)** will be organized in conjunction with AC (in order to minimize travel costs) to discuss required strategies for achievement of WG DLs & MLs, identify specific needs, define priorities and organize activities. Communication within WGs will be

maintained by regular teleconferences. Reports will be prepared and disseminated within the AIM-COST network.

**-At least 4 WorkShops (WS; 1-2 days)** will be organized in conjunction with ACs to share knowledge and experience on identified topics, finalize white papers, develop novel research agendas and interact with international organizations (ECDC, WHO-EU, EMCA, UNEP), validate with the relevant stakeholders major directions covered by guidelines and expected input of the citizen science contributions to monitoring and surveillance. Tentative topics to be agreed during KoM are: “Cost-benefit assessment of conventional and innovative AIM monitoring tools (e.g. smart phone mosquito monitoring applications)” (WG1); “Cost-benefits and drawbacks in Innovative New Vector Control Paradigms” (WG2); “Communication and outreach approaches for citizen science community engagement in AIM monitoring, surveillance and control” (WG3); “From AIM-COST results to refinement and customisation of guidelines for AIM monitoring, surveillance and control in Europe” (WG3). Other topics will be identified in case resources for more WS will be available. Reports will be prepared and disseminated within the AIM-COST network.

**-At least 4 Training Schools (TS; 4-5 days)** will be organized following WG proposals and MC agreement on selected relevant topics requiring ToK to obtain homogenisation of knowledge across and beyond Europe and standardisation and customization of practices. Tentative topics to be approved are: WG1: 1. “AIM collection, identification, monitoring, EAIMBV identification and shared database construction”; 2. “Statistical and mathematical data analyses” and/or “Entry level mapping and modelling with established user friendly tools” WG2: “Assessment of Effectiveness of Conventional and Innovative AIM control tools”; WG3: 1- “The use of modelling and mapping and their customizations for flexible design of monitoring, surveillance and control actions”. Other topics will be identified in case resources for more WS will be available. Reports and teaching material will be disseminated within the AIM-COST network and globally through GMAC.

**-Short Term Scientific Missions (STSM)** will be selected by MC based on applications by single CC/NCC members or by WGs, with the aim to provide: i) required technical inputs as specified in WG descriptions above; ii) training on specific topics/techniques/ field activities in best qualified groups; ii) ToK from “pockets of excellence” in European science and technology to less research intensive countries; iii) counter-balance of unequal access to cutting-edge infrastructures; iv) support to individual inter-group mobility; v) strengthening of existing networks and fostering new collaborations; vi) recommendations for data sharing. Special prioritising considerations will be made by the MC to support COST policies and promote gender balance, ECI, new applicants and to broaden geographical inclusiveness.

WGs will also collaborate to the organisation of Reports will be disseminated within the AIM-COST network after completion of all activities listed above. **Further Dissemination Activities** and **Outreach Activities** to communicate AIM-COST outcomes to the civil society will be implemented as detailed in WG3 and in 2.2.1, respectively.

### 3.1.1. GANTT Diagram

Year-Trimester	Y1-I	Y1-II	Y1-III	Y1-IV	Y2-I	Y2-II	Y2-III	Y2-IV	Y3-I	Y3-II	Y3-III	Y3-IV	Y4-I	Y4-II	Y4-III	Y4-IV
MC	KoM			M1				M2				M3				M4
Core Group	KoM	TC	TC	M1	TC	TC	TC	M2	TC	TC	TC	M3	TC	TC	TC	M4
WG1, 2, 3		TC	TC	M1	TC	TC	TC	M2	TC	TC	TC	M3	TC	TC	TC	M4
Annual Conference				1				2				3			4	
Work Shops				WG1				WG2				WG3.1				WG3.2
Training Schools			WG3			WG1				WG2			WG3			
WG1							ML1		DL1			ML2			DL2	
WG2						ML1		DL1			ML2			ML3		DL2
WG3	ML1	DL1		ML2	DL2				ML3			ML4		ML5	DL3	DL4
WG1,2,3			STSMs (following approval by MC) and reports produced													
WG1,2,3	WEB	DISSEMINATION/OUTREACH/COMMUNITY ENGAGEMENT ACTIVITIES														

MC= Management Committee; M=meeting; TC=TeleConference

### 3.1.3 Risk and Contingency Plans

None of the major expected returns are considered to have high risks, and those with medium risk have readily identifiable mitigation strategies (see 2.3.1). However, in addition to the risks identified in 2.3.1 Table, the complexity and heterogeneous background of AIM-COST participants may create networking problems/difficulties. These are not expected among academic/scientific groups, as these groups have always valued the few intra-European networking opportunities available in the field. The same is expected to be true of SMEs who will perceive direct opportunities and benefits and have enthusiastically contributed to this proposal. PH-professionals and policy makers, which comprise a major part of the end user constituency for proposed customized guidelines, are more likely to require careful targeting and continuous motivation. Much of this will be carried out by national COST-Action representatives, and ACs will be specifically designed and advertised to assure the involvement of end-users. Guidelines will be sent to all relevant PH Institutes and Ministries for comments. The success of the involvement of civil society either as end-user or as active actors in some proposed actions (e.g. public engagement by smart phone applications in Task 1) is difficult to predict and will be actively pursued by targeted outreach activities (2.2.1).

More in general, the quantity and quality of the activities proposed within AIM-COST Action are ambitious, as they cover a wide range of topics & actions which would benefit of additional resources. **Action partners will be actively encouraged and supported (e.g. by dedicated STSMs) to apply for additional co-financing by national/international agencies.**

## 3.2. Management structures and procedures

The coordination and organisation of AIM-COST ACTION will strictly follow COST regulations. The main administrative body will be the **Management Committee (MC)**, as defined in the COST Vademecum (COSTV). The first MC meeting (Kick-off meeting, KoM) will be organized within 3 months of the approval of the ACTION in order to nominate the **Grant Holder**, the **Action Chair**, the **Action Vice-Chair**, **WG-Coordinators and deputy Coordinators**, **STSM Coordinator and Assessment Committee** (STSM-AC including 8 members: Action Chair or Vice Chair, STSM Coordinator, WG1-3 Coordinators and Deputy coordinators), a **Dissemination Group** (DG, including a Webmaster, a DG Coordinator and deputy Coordinator), a **IPR-Committee** (IPRC, including IPRC coordinator and deputy Coordinator, see 2.2.2). The Action Chair and Vice-Chair, WG Coordinators/Deputy Coordinators, STSM, DG and IPR-Committee Coordinators will form a **Core Group (CG)** which will: i) regularly monitor and report ACTION approve WG's concerted milestones and deadlines for the deliverables of the ACTION; ii) propose corrective measures and contingency plans, if needed; iii) approve dissemination documents and guidelines proposed by WGs; iv) fix dates and locations of ACs and elect the Organising Committees; iv) address potential IPR issues highlighted by IPR-Committee; v) report to MC during AC or, in case of urgent matters, by email. The CG will have Tele-Conference calls at least each 3 months and will meet in conjunction with AC. If needed, CG will decide on pressing issues by electronic voting. MC-members will coordinate independently the participation of the respective national teams and advise them on the use of cooperation tools to facilitate organization of and applications to WGs, TSs and STSMs. **All coordinating groups mentioned above will be appointed taking care to optimise balance between: i) research intensive versus ITC countries; ii) academic and public health sectors; iii) public and private sectors; iv) experienced researchers and Early Career Investigators (ECI).** In addition, **representatives of International/European organizations** (e.g. ECDC, WHO-Europe, IAEA, EMCA, ECSA, GMAC) will be asked to be part of **an Advisory board** to provide strategic perspectives and guidance during project. Some of them already informally agreed to take this role. **The identification of clear CG, WG, STSM-AC, DG and IPRC responsibilities will account for effective quality management and assure decisional efficacy and transparency.**



**AIM-COST ACTION domain name has already been acquired ([www.aimcostaction.com](http://www.aimcostaction.com))** and the Website will be fully established within 3 months from the starting date of the Action. The general structure and content of the website will be decided by the MC and implemented by the WebMaster. Strategies for seeking additional financial support to ensure the website maintenance even after the end of the ACTION will be implemented by MC. Access will also be available to UNEP Environment Live through GMAC.

### 3.3. Network as a whole

**The AIM-COST Action Secondary Proposer (SPs) composition is ideal to achieve the proposed Action-goals.**

-From the **geographical perspective related to public health risks**, the AIM-COST network is ideally composed, as it includes among SPs representatives from all the Member States COST-Countries (CCs) presently colonised by one or more AIMs (Austria, Belgium, Bosnia & Herzegovina, Bulgaria, Cyprus, Croatia, France, Germany, Greece, Hungary, Italy, Malta, Montenegro, The Netherlands, Portugal, Romania, Serbia, Slovenia, Spain, Switzerland, Turkey), or having reported the introduction of at least one AIM species (Czech Republic, FRY Macedonia, Slovakia and UK) or being colonized by endemic *Aedes* species (Cyprus, Greece and Turkey), and thus facing actual health risks. In addition, 4 NNCs (Albania - the first European country to be invaded by *Ae. albopictus* in 1979 – Armenia, Moldova and Tunisia from where local experts acting as SPs in the present network identified IAM presence) are included as SPs. AIM-COST network also includes SPs from Israel, where *Ae. albopictus* is established since 2008<sup>31</sup>. The first AIM-COST action dissemination activities will specifically target research/PH groups from CCs/NNCs suitable for invasion and colonisation by AIMs, in order to build the most-inclusive transboundary community possible and transfer knowledge and outputs also to Countries which are likely to face the same problem in future years.

-From the **geographical perspective related to Inclusiveness of Target Countries (ITCs)**, the AIM-COST network is again ideally composed as it includes SPs from **all research intensive CCs** (i.e. Austria, Belgium, France, Germany, Greece, Italy, The Netherlands, Spain, Switzerland), as well all **ITCs** facing or risking to face AIM invasion (i.e. Bosnia-Herzegovina, Bulgaria, Cyprus, Czech Republic, Croatia, Hungary, Malta, Montenegro, Portugal, Romania, Slovenia, Slovakia, FYR Macedonia, Republic of Serbia and Turkey) accounting for strong potential of ToK.

-From the **critical mass & expertise perspective**, AIM-COST SPs already include instrumental components to achieve the Action goals: Academics from a variety of scientific disciplines (ranging from Biology to Human and Animal Health, Agricultural sciences, Social, Computer & Information Sciences), members of national/local Public Health Institutes, policy makers and of Private Companies. includes less research-intensive COST Member States. AIM-Action aims to further increase number of members with particular reference to the three latter components (presently accounting for about 40% of the total SPs) by direct commitment of national COST-Action representatives and appropriately targeted dissemination campaigns. In addition, 3 research groups from US (International Partner Country) are included among SPs in order to communicate their experiences in facing AIM invasion, related health issues and cost-benefit data and create synergies with European members. Notably, AIM-COST network includes ECSA representatives, who will be instrumental for establishing link with the civil society. The only significant gap in the present network composition is the lack among SPs of ECDC, WHO-Europe, IAEA and EMCA representatives, which will be instrumental for contributing, endorsing and disseminating the Action guidelines/recommendations. Members of these Organisations have already be contacted and informally indicated agreement for involvement of their Organization after AIM-COST initiation, when they are expected to contribute to the project by providing strategic perspectives and guidance as members of the advisory board.

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### **COST Mission and Policies**

AIM-COST ACTION will fully respond to **COST MISSION** by connecting the local, national and international scientific community dealing with Aedes Invasive Mosquito (AIM) research, surveillance, control and analysis in Europe and beyond, with public health and commercial sectors. This will facilitate new concepts and product (in synergy with the private sector) for AIM surveillance, control and analysis. It will also encourage transboundary and cross-sector perspectives in research and implementation, providing unprecedented networking and training opportunities to established and the Early Career Investigators (ECIs) who represent >50% of the secondary proposers. From the start, the Action MC will identify and encourage participation of additional ECIs by actively advertising all activities and objectives, using material specifically designed for effective transfer of knowledge and training to a younger audience. In addition ECIs will comprise at least 50% of members of the Short Term Scientific Mission-Assessment Committee, the Editorial Board, the Dissemination Group and of the IPR-Committee, and will be encouraged to act as Working Group Coordinator or Deputy Coordinators.

Not only will Europe's research excellence and innovation capacities in the field be improved but the Action will increase uptake of research by public health policy makers and so enhance its impact. It will also focus on closing the gap between national decision makers and regulatory bodies planning the surveillance and control of AIMS to increase transboundary consistency, collaboration and uptake. Critically, dissemination and outreach activities will enhance civil society awareness of health risks associated with AIMS and of best practice to prevent and control them. Finally, the technical, operational, and procedural lessons learned will be relevant to those working with other vectors and diseases and their related health threats particularly the rising number that are spreading from introduction focii or in response to environmental changes.

AIM-COST ACTION will fully respond to **COST POLICIES**, as follows:

**a) Excellence and Inclusiveness & International Cooperation:** Extensive cross border networking will counterbalance unequal access to knowledge, infrastructure, funding and resources and provide integration of researchers from ITC and NNC to the leading knowledge hubs of Europe. The Action has gathered a total of 137 Secondary Proposers from 26 COST Member Countries (15 of which ITCs), 4 NNC Institutions, 2 COST International Partners and 3 European/International Organisations. As well as its wide geographic coverage, the Action already includes several National Health Institutes and private companies as well as many of the academic/research community, and of current or recently completed EU funded projects in the field. This guarantees a synergistic interaction of many sectors, helps continuity from previous programmes, and maximises impact of research on public health policy makers as well as on the productive sectors.

**b) Gender Balance** the main proposer of this Action is female and women represent 50% of secondary proposers and efforts will continue to attract them throughout. Particular care will be taken to assure that gender balance is maintained in membership of leading Action roles and in the access to its Activities.

## Network of Proposers - Features

### COST Inclusiveness target countries

57.69 %

### Number of Proposers

137

### Geographic Distribution of Proposers

Country	ITC/ non ITC/ other	Number of institutions from that country	Number of researchers from that country	Percentage of the proposing network
Albania	other	5	7	5.11 %
Armenia	other	4	5	3.65 %
Austria	non ITC	3	3	2.19 %
Belgium	non ITC	2	2	1.46 %
Bosnia and Herzegovina	ITC	6	6	4.38 %
Bulgaria	ITC	8	10	7.3 %
Croatia	ITC	2	2	1.46 %
Cyprus	ITC	1	1	0.73 %
Czech Republic	ITC	4	4	2.92 %
France	non ITC	9	9	6.57 %
Germany	non ITC	2	2	1.46 %
Greece	non ITC	3	3	2.19 %
Hungary	ITC	1	1	0.73 %
Israel	non ITC	2	2	1.46 %
Italy	non ITC	13	13	9.49 %
Kosovo (under UNSCR 1244/99)	other	1	1	0.73 %
Malta	ITC	1	1	0.73 %
Montenegro	ITC	1	1	0.73 %
Netherlands	non ITC	2	2	1.46 %
Portugal	ITC	2	3	2.19 %
Republic of Moldova	other	4	4	2.92 %
Romania	ITC	6	6	4.38 %
Serbia	ITC	5	5	3.65 %
Slovakia	ITC	1	2	1.46 %
Slovenia	ITC	4	4	2.92 %
Spain	non ITC	8	9	6.57 %
Switzerland	non ITC	5	5	3.65 %

Tunisia	other	3	3	2.19 %
Turkey	ITC	3	5	3.65 %
United Kingdom	non ITC	7	7	5.11 %
United States	other	3	4	2.92 %
fYR Macedonia	ITC	5	5	3.65 %

### Gender Distribution of Proposers

50.4% Males

49.6% Females

### Average Number of years elapsed since PhD graduation of Proposers with a doctoral degree

12.5

### Number of Early Career Investigators

71

### Core Expertise of Proposers: Distribution by Sub-Field of Science

58.4% Biological sciences

13.1% Veterinary science

12.4% Health Sciences

2.2% Agriculture, Forestry, and Fisheries

2.2% Earth and related Environmental sciences

10.2% Other

1.5% Unspecified

### Institutional distribution of Network of Proposers

58.4% Higher Education & Associated Organisations

29.9% Government/Intergovernmental Organisations except Higher Education

4.4% Business enterprise

3.6% Standards Organisation

3.6% Private Non-Profit without market revenues, NGO

Higher Education & Associated Organisations:80

- Number by Field of Science of Department/Faculty of Affiliation

Health Sciences:10

Agriculture, Forestry, and Fisheries:1

Agricultural biotechnology:3

Biological sciences:37

Other social sciences:2

Clinical medicine:2

Veterinary science:16

Basic medicine:2

Computer and Information Sciences:1

Other agricultural sciences:2

Earth and related Environmental sciences:2

Animal and dairy science:1

- Number by Type

Research Oriented:37

Education Oriented:43

- Number by Ownership

Fully or mostly public:73  
Fully or mostly private:6  
50-50 Public and Private:1

Business enterprise:6

- Number by Market sector of unit of affiliation  
Professional, Scientific And Technical Activities:5  
Other Service Activities:1
- Number by Type  
Private enterprises:6
- Number by Ownership and International Status  
Independent Enterprise:6
- Number by Size  
SME (EU Definition provided underneath after selection):6

Standards Organisation:5

- Number by Membership type  
With no government membership:3  
Including at least partial government membership:2
- Number by Level  
Regional - European:1  
National:3  
International:1

Private Non-Profit without market revenues, NGO:5

- Number by Type  
Other:2  
Charity:2  
Trade or Professional Association:1
- Number by Level  
National:1  
International or European:4

Government/Intergovernmental Organisations except Higher Education:41

- Number by Level  
Central and Federal Government:19  
International:3  
Local government:19
- Number by Type  
Government department or government-run general public services:28  
Other Public Non-Profit Institution:6  
Non-R&D executive agencies, including sector specific regulatory bodies:3  
European RTD organisation:1  
R&D Funding and/or R&D Performing bodies:3

**COST Country Institutions(26)** : Austria , Belgium , Bosnia and Herzegovina , Bulgaria , Croatia , Cyprus , Czech Republic , France , Germany , Greece , Hungary , Israel , Italy , Malta , Montenegro , Netherlands , Portugal , Romania , Serbia , Slovakia , Slovenia , Spain , Switzerland , Turkey , United Kingdom , FYR Macedonia

**Near-Neighbour Country Institutions(4)** : Albania , Armenia , Republic of Moldova , Tunisia

**COST International Partners(2)** : Kosovo (under UNSCR 1244/99) , United States

**European Commission and EU Agencies(0)**



**European RTD Organisations(1)**  
**International Organisations(2)**

## Network of Proposers - Details

### Main Proposer's Details

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<b>Sub-field of Science of Department:</b>	Health Sciences	<b>Core Area of Expertise:</b>	Biological sciences (Parasitology)

## Secondary Proposers' Details

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