87th General Session World Assembly
World organisation for animal health Paris, 26-31 May 2019

87 SG/10

Original: English

https://doi.org/10.20506/TT.2985

STRATEGIC CHALLENGES TO GLOBAL CONTROL OF AFRICAN SWINE FEVER

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***Summary**: The recent escalation of the African swine fever (ASF)[1] epidemic around the world has placed the majority of the world's swine population under direct threat. To respond to this challenge, well-coordinated national, regional and global efforts will be required, not only by governments of the OIE Member Countries, national Veterinary Services and other public institutions, but also by a range of different stakeholders, including but not limited to the pig production industry, universities, research centres, forestry management bodies, hunter's association, tourism and animal transportation organisations, civil society sector and international organisations. A holistic, inter-sectoral and trans-disciplinary collaborative approach, with effective and participative allocation and management of sufficient resources, will be of paramount importance to prevent further spread and to control ASF worldwide.*

On the ground level, Member Countries should ensure the correct implementation of relevant OIE international standards and best practices in order to effectively control ASF. These include, among others, the following measures: risk-based prevention and surveillance programmes, adequate biosecurity in pig production sectors and hunting grounds, pig traceability and movement control, effective official controls, wild pig management, safe culling and disposal of animals and their contaminated products, improved collaboration among the multiple sectors involved, and continued education and awareness raising programs for all relevant parties.

The response to the global threat must involve coordinated actions by international organisations, research and scientific institutions, development partners, pig and meat producers, governmental agencies and other stakeholders to prevent further spread of this virus. It must ensure the wellbeing of farmers and poverty reduction, protect animal welfare, prevent disastrous economic loses, and allow further contribution of the pig sector to global health, wealth, equity and sustainability. Development of effective and safe vaccines for domestic pigs and wild boar is more important than ever, given the current global ASF threat associated with the worsening epidemiological situation and the lack of a vaccine to contain ASF outbreaks.

There is an urgent need for an international consensus to design an appropriate global strategical framework and to carry out adequate actions related to the reduction of the burden of ASF, promotion of economic prosperity, ensuring food security and facilitating safe trade of pig commodities. Regional and national ASF control strategies should be based on the best practices, appropriate enforcement of the legislation and close coordination with stakeholders. Member Countries should increase their technical capacities and expertise, identify and use the relevant scientific knowledge, and engage in risk communication with relevant stakeholders.

1 http://www.oie.int/en/animal-health-in-the-world/animal-diseases/african-swine-fever/

Integration of participatory approaches and stakeholder engagement, participation and ownership in the ASF response are as essential for the development of a global agenda for ASF control as they are for making technical recommendations for use by national Veterinary Services. Well-structured and properly implemented communication campaigns, targeted for establishing behavioural change and intersectoral collaboration should be an essential component of any ASF control programme.

This article explores the global burden of the ASF situation, challenges for effective control and eradication, lessons learned and the key factors that need to be considered for a global coordinated response.

***Keywords**: African swine fever (ASF) – best practice –control – global threat – inter-sectorial and trans-sectorial cooperation – harmonisation of measures.*

1. Global African swine fever situation

1.1. Current ASF outbreak situation

ASF has officially been notified to the OIE by Member Countries from Sub Sahara Africa, Europe and Asia[2] (**Fig. 1**). Based on the gene encoding protein p72, African swine fever virus (ASFV) has been currently classified in 24 different genotypes. Only genotype I in Sardinia Italy and genotype II in Europe and Asia are known to be present outside Africa. The outbreaks notified by Georgia, Russia, and later by the People's Republic of China, Mongolia, Vietnam and Cambodia in Asia, and Belgium in Europe, constitute some of the most evident long-distance transmission of the disease described in recent literature.

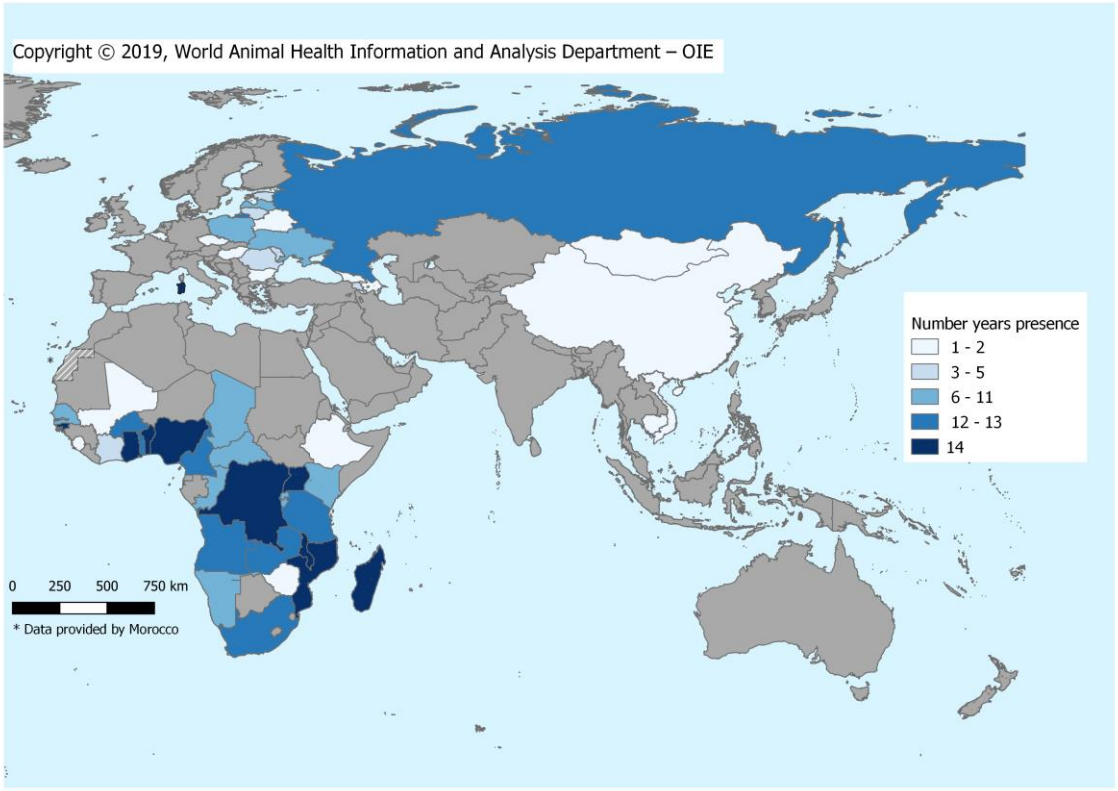

Fig. 1. Cumulative presence of ASF at country level (2005–2019)

2 Notified by OIE Member Countries from 1 January 2018 to 20 March 2019

The number of countries or territories reporting the disease present has also increased in the last few years. During the second semester of 2018, 25 out of 113 reporting countries declared the disease as present (**Fig. 2**). Under-reporting remains a challenge to achieving a comprehensive understanding of the global situation.

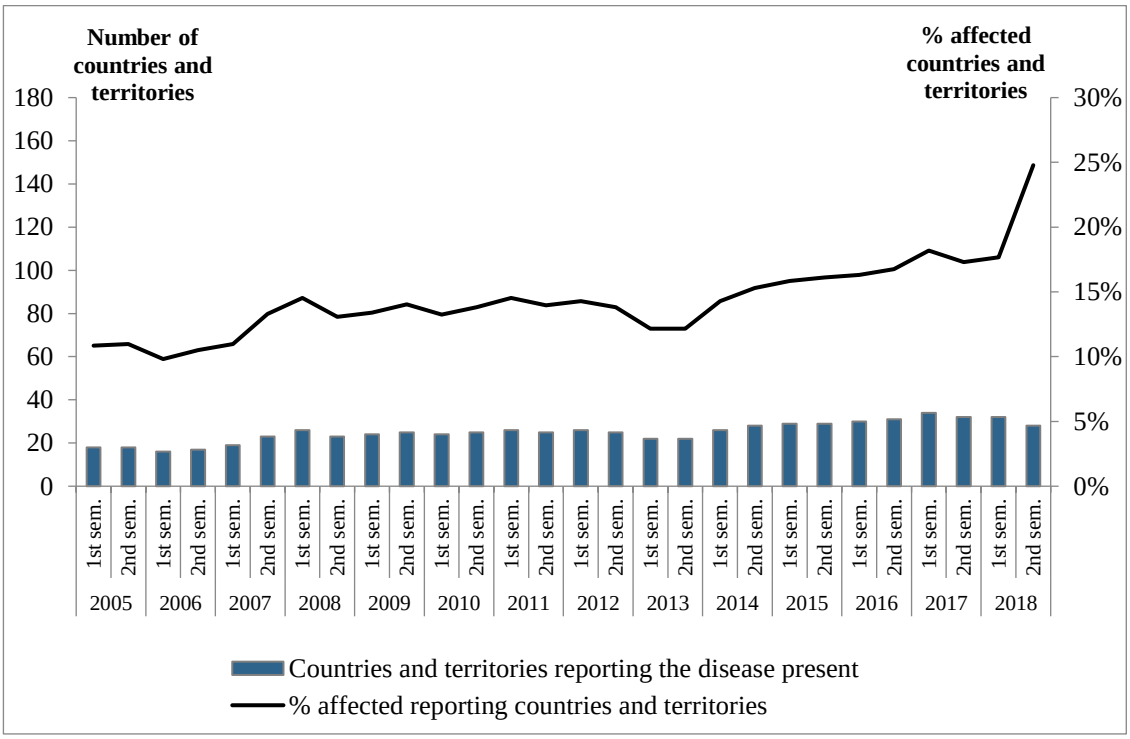

Fig. 2. ASF notification trends (2005–2018)

According to the data on the control measures reported to WAHIS in 2018, disease notification and precautions at the border are the most common disease control measures implemented by the reporting countries. It should be noted however that close to 10% of the countries reported that the disease was not notifiable at a national level. For those Member Countries being affected by ASF, zoning and national movement controls were often implemented. However, in most countries targeted surveillance and control of wildlife were seldom applied.

Despite the current difficulties faced by Member Countries to stop the spread of ASF, it should be noted that ASF has been eradicated in domestic and wild pigs during the last century (i.e. Spain, Portugal, France, Malta, Belgium, The Netherlands, Brazil, Haiti, Dominican Republic and Cuba). Recently, the Czech Republic declared that the disease was successfully eradicated in the country.

More information about the disease, epidemiological situation, geographical distribution, control measures and communication material is available at OIE web-pages on ASF[3,4]. OIE has also developed a global awareness campaign, with communication tools available in several languages[5].

3 http://www.oie.int/en/animal-health-in-the-world/animal-diseases/african-swine-fever/

4 http://www.oie.int/fileadmin/Home/eng/Animal_Health_in_the_World/docs/pdf/Disease_cards/AFRICAN_SWINE_FEVER.pdf

5 https://trello.com/b/GloiZoik/african-swine-fever-oie

1.2. Socio-economic impact

The global spread of ASF is a worldwide threat to the livestock sector, impacting the livelihoods of farmers and stakeholders, with the potential to have severe consequences for food security. Trade restrictions that often accompany the occurrence of ASF add considerable economic burden, particularly to exporting countries. ASF outbreaks often result in the closing of export markets and impacts not only the pig and meat sector but also the global supply of key commodities for which other industries including pharmaceuticals and cosmetics are heavily dependent. Prolonged ASF outbreaks that negatively affect pig production are creating a dynamic and uncertain situation in global markets and value chains, as well as having collateral effects on other sectors such as corn and soybean.

Control measures, in particular mass depopulation, also add to the political and socio-economic burden. In addition, pork producers in many countries dealing with other endemic animal diseases sometimes not only lack skilled veterinarians and diagnostic laboratories, but also access to technologies and resources needed to establish adequate biosecurity and best practices in disease management, animal welfare and good farming practice according to the international standards.

Pork is a key part of the diet and culture of many Member Countries and maintaining a supply of affordable pork is of paramount importance for food security. In many low-medium income countries, pigs are often an additional source of household income highly relevant for rural development. Studies have shown the ASF outbreaks affected the frequency of meat in the population diet and also the ability to pay for education and medical fees, particularly in the most vulnerable communities.

Despite the lack of detailed data on the socio-economic impact of ASF, it can be confidently stated that ASF outbreaks have severely negative effects on household income and food security. A worsening international situation for ASF will contribute to the failure of the pig sector to reach its full potential, generate employment and alleviate poverty, and will act as a disincentive to investment in the pig sector. Control of ASF at a global level would therefore contribute to achieving the Sustainable Development Goals, in particular Goals 1 (no poverty) and 2 (zero hunger).[6].

1.3. Pig industry

The pig industry plays a key role in providing a source of animal protein, livelihoods and income generation at a global level. Due to the increase in the worldwide demand for meat, pigs have become an important source of animal protein, because of their fast growth, efficient feed conversion, quick turnover, and prolificacy. Pork is the most consumed meat from terrestrial animals, accounting for over 37% of global meat intake, followed closely by chicken (35.2%) and beef (21.6%) (FAO, 2013).

The pig producing sector is characterised by two distinct production systems: the large-scale industrialised pig farming system with increasing vertical integration of the value chain; and traditional small-scale production system, often subsistence-driven. Although the factors that cause animal diseases, particularly in the case of transboundary animal diseases (e.g. ASF, Classical Swine Fever or Foot and mouth disease), are complex, the direct or indirect impact of epidemics on the change of animal production systems are obvious. Essentially, as the world keeps changing in terms of population displacement, urbanisation, globalisation, international transport and the growing demand for and the increasing trade in animals and animal products, producers are requested to increase their capacities, hygiene and farming practices, to better prevent and control animal health risks while providing adequate quantities of products in relation to increasing market demands. On the other side, there is progressive decrease in the number of small-scale producers, and backyard holdings, because they cannot keep animal production competitive and sustainable, even for local markets.

The large-scale pig sector has grown steadily over the past decades, but the increase has been uneven around the globe. Large populations are present in China, Western Europe, central and eastern areas of the United States, Central America, and southern Brazil. In Africa, pig numbers are growing steadily, reflecting the increased adoption of good pig husbandry practices in a continent where ruminants are by far the dominant livestock species.

6 https://sustainabledevelopment.un.org/

Despite the increasing importance of industrialised pig farms, around 43% of all pigs produced worldwide can be considered as being from small-scale or back-yards farms, mostly located in low-medium income countries where pigs are valued for their ability to convert agro-industrial by-products and household waste into quality animal protein. This farming system is also characterised by limited investment in biosecurity, housing and technologies, and a poor awareness and compliance with animal health related national regulations and OIE international standards (e.g. surveillance and reporting, movement control, biosecurity, etc.).

The global pig industry is currently facing unprecedented changes due to globalisation and market uncertainties such as increasing economic tensions, volatility of feed prices, growing demand for pork but with significant price competition (from other pork producers, but also other animal proteins), and more recently the global spread of ASF causing loss of productivity, restrictions to international trade and evident changes in the sector structure.

2. Key features of recent ASF outbreaks

The recent geographical expansion of ASF has demonstrated several key features: i) slow ASF transmission within affected farms; ii) long distance transmission; iii) high incidence in pig farms with low biosecurity, such as backyard farms; iv) establishment in wild pig population and v) environmental contamination.

2.1. Epidemiological characteristics

ASF is a contagious disease with a high case fatality rate often reaching 90–100%. However, recent field data as well as experimental studies have indicated a relatively slow spread of the virus, during the initial phase of ASF infection especially in commercial farm where early identification of the first ASF lethal cases could be shadowed by concomitant diseases. The initial slow spread of the virus limits the number of secondary cases and therefore, if promptly detected, allows time for better organisation and implementation of the required control measures. On the other hand, ASF detection is likely to be delayed as it will take longer for the disease to be suspected and recognised, increasing the likelihood of secondary outbreaks.

African swine fever virus (ASFV) is stable over wide ranges of temperatures and pH levels for long periods. The extreme environmental resistance of the ASFV, along with low contagiosity, maximises both local persistence and geographical spread of the virus.

Pigs with clinical signs have high viral loads in all body secretions, particularly in blood, thus infected pigs and pork products are regarded as high-risk sources of infection. Taken together with the fact that ASFV is extremely stable in the environment, it's not surprising that long-distance spread has been linked with transport of contaminated pork (e.g. Portugal and Spain in 1957 and 1960, respectively, Georgia in 2007 and more recently in Asia in 2018–2019). The continued increase in movement of pig products (i.e. fresh meat, pig meat products) will pose an ever-increasing risk for transboundary and transcontinental spread of ASF, if risks associated with this trade are not managed in accordance with the OIE international standards.

ASF can also be transmitted by vectors (Wilson A.J. *et al.* 2017). Three ASF epidemiological cycles have been described previously, namely: i) 'sylvatic cycle', which involves the natural hosts of the ASFV (i.e. warthogs and soft ticks of the *Ornithodoros moubata* complex in Southern and Eastern Africa); ii) 'tick-pig cycle' described in parts of sub-Saharan Africa and during the epidemic on the Iberian Peninsula in the last century, where soft ticks (*Ornithodoros erraticus*) played an important role in the persistence and transmission to domestic pigs; and iii) 'domestic (pig-pig) cycle', which is the vast majority of the current global outbreaks where the ASF virus is directly transmitted among domestic pigs via the oro-nasal route, through ingestion of pork or other contaminated products (i.e. contaminated swill), or indirectly through fomites, without any role of natural reservoirs.

Recently, a new geographically contained epidemiological cycle, termed the 'wildboar–habitat cycle', was observed in Central and Eastern Europe, which consists of both direct transmission between wild pigs and indirect transmission via the wild pig habitat. This could be attributed to infected wild pigs having high viral loads, and ASFV being resistant to autolysis and remaining viable in putrefied wild pigs and carcasses for several weeks, resulting in long term environmental contamination and local persistence in the wild pig population. The possible presence of competent vectors should be considered when assessing the risk of habitat persistence.

2.2. The ASF transmission dynamics

The role of movements of pigs, pig meat and pig meat products mean ASF transmission dynamics can be complex, requiring an understanding of economic factors, sociocultural aspects, the quality of the relationship with veterinary authorities, even animal welfare aspects, infrastructure and local trade patterns.

Incursion of ASF into a previously free country is often by anthropogenic means, occurring through the introduction of contaminated materials (e.g. pig products, swill) or live animals into pig farms. Illegal or uncontrolled imports of pig meat products is also important, and can be either accidentally by tourists, farm workers or hunters returning from endemic areas, or intentionally by smuggling meat products for personal or commercial use. The spread of the disease within the country is most likely due to poor farm biosecurity via indirect contact through illegal movement of pigs, contaminated fomites or feed (i.e. swill feeding) or as spill over from affected wild pig populations in the vicinity of farm.

Additionally, social and economic factors such as poverty level, herd size and gross income from the pig production have been associated with ASF outbreaks in the domestic cycle. The fact that the ASF outbreaks still occur primarily, but not exclusively, in farms with low biosecurity, shows that there is a need to be aware of the livelihood circumstances that often prevent farmers from implementing preventive measures for disease transmission. The structure of the pig industry, both commercial but particularly backyard systems where swill feeding is still common practice, are a major determinant of the epidemiology of ASF. Incidences of ASF in large commercial farms in Asia shows the importance of controlling feedstuffs and feed production.

ASF cases in wild pigs were initially solely regarded as spill over events from domestic pigs. Due to the high case fatality rate, it was initially predicted that the disease would fade out spontaneously in the wild pig population. This, however, has been proven to be otherwise in Europe where the infection in wild pigs has remained steady at a prevalence below 5%, even in low density areas, most probably due to the environmental contamination. The combination of contagiosity (intrinsically low), high lethality and environmental stability has allowed ASFV to be maintained in the wild pig population, even at very low wild pig density, and represents a major challenge for effective control. Additionally, lack of biosecurity measures during hunting practices and inadequate wild pig management influenced further spread of ASF.

2.3. Prevention and control measures

One of the major challenges for the control of ASF is that there are no safe vaccines available that provide adequate protection of domestic pigs and wild pig. Although continued research is urgently needed, it is unlikely that a safe, effective and potent vaccine will be available soon.

Therefore, farm biosecurity and good farming practice are considered to be the most effective tool for preventing ASF introduction to pig holdings. Many ASF outbreak investigations have reported biosecurity shortcomings and poor early detection as a critical factor for virus introduction and spread. The improvement of biosecurity in the backyard sector represents an important challenge, due to the sector's heterogeneity and the costs for implementation and maintenance. Special efforts and supportive measures (including private and public incentives) should be made to improve implementation of biosecurity and to promote awareness to improve the early detection of ASF, particularly among small-scale producers.

The application of international standards on animal identification, biosecurity and official control of movement of animals and animal product are important elements for ASF prevention.

During an ASF outbreak, control measures should include timely and appropriately applied depopulation, disposal of carcasses, disinfection, zoning and movement restrictions. In the absence of vaccination, stamping out is of utmost importance, but this can be difficult for many governments that lack infrastructure and resources. It might even be counter-productive in contexts where farmers compensation is insufficient, and the enforcement of the movement restrictions are not adequate or early detection is not in place. Lack of resources and access to technologies could result in control methods that are not in compliance with OIE standards, which could complicate the overall epidemiological situation, and cause inter-cycle ASF transmission and welfare issues.

The approach to prevention and control involves multiple steps composed of several activities, including enhancing early warning capacity through both passive and active surveillance; collection, testing and safe disposal of carcasses; a strict ban on hunting and feeding of wild pigs in the immediate vicinity of infected wild populations; control of touristic activities and overall wild pig management; with recurrent training and awareness campaigns carefully applied, especially in newly infected areas, as has shown to be successful in Europe (e.g. Czech Republic).

Surveillance should be conducted for both domestic and wild pig populations. Surveillance, based on testing of dead and sick animals, is the most effective method for early detection to ASF, particularly when low mortality is observed as may occur during the initial recent introduction of the virus.

Risk communication and awareness campaigns among farmers, forestry guards, hunters and field veterinarians, is crucial to improve disease surveillance for early detection and reporting, promote biosecurity, and reduce specific practices that may increase risk of infection such as swill feeding or using boar from other holdings for reproduction. It is of utmost importance to pay attention to anthropologic factors, and to include social scientists when designing ASF prevention and control programme.

Control measures should be based on a planning framework and implementation methods which could properly address communication interventions capable to induce behavioural change among all key actors, which is necessary to correctly address the human-related risk factors for the transmission of ASF. This is needed because disease control interventions rely heavily on stakeholders and community engagement, participation and ownership, but also on intersectoral coordination and collaboration for prevention, control and mitigation strategies.

Depending on the region, control of ticks should be addressed in the control strategy, which would require specific entomology expertise that may not always be available within the Veterinary Services,

Improved understanding of the ASF outbreak situation, epidemiological characteristics of ASFV, anthropogenic and socio-economic factors, as well as the limits of the current control measures will be the key to developing adequate measures and interventions for its global control, both in the domestic and wild pig population.

3. ASF control strategies

3.1. Country-based ASF control programmes

Sustainable disease control should be the sum of risk-based measures at the national and local level taken by all relevant stakeholders under the overall management and quality assurance provided by the national Veterinary Authority. However, it should be acknowledged that many countries do not fulfil these criteria, and at local level, the livelihoods remain affected and producers may not receive the adequate institutional support to allow them to protect their assets with the means available.

Countries that have been successful in eradicating ASF in the past did so through the development and implementation of an effective response incorporating the following components: i) comprehensive legislation based on OIE standards; ii) budgetary resources and emergency funds, with disease compensation schemes; iii) internal chain of command within Veterinary Authority and capacities for external coordination; iv) network of field veterinarians and veterinary para-professionals to carry out specific control measures; v) animal identification and movement control; vi) epidemiological surveillance; vii) laboratory capacities; viii) early warning and rapid response system; ix) safe collection and removal of carcasses and animal by-products; x) inspection and official controls at different levels, including border control; xi) training and awareness raising campaigns; xii) strong public-private partnership; and xiii) regional and cross-border coordination.

At present, the situation in the majority of affected countries remains highly dynamic. The national policies implemented to control ASF have been shown not to be always effective, partially because they are not evidence-based with regards the disease ecology, and partly due to a lack of technical or financial capacities. As the disease continues to expand into new territories, preparedness and control activities need to be constantly adjusted to adapt to situations observed in the field that may be contrary to what was expected. Due to such complex situations and challenges faced by the national Veterinary Services, regional and international support will aid in maintaining stability of its structure and sustainability of policies and ensure adequate dialogue with key stakeholders and development partners.

3.2. Regional ASF control strategies

Experiences have shown that attempting to control ASF at a country level is not likely to be successful and sustainable unless the efforts are part of a coordinated regional approach embedded into supra-national frameworks. One of the objectives of a regional strategy is to expand borders of the control area to the outermost countries of the region. Evidently, this cannot be achieved without close cooperation and coordination among the Member Countries of the region.

In 2004, FAO and OIE jointly launched the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF–TADs) to achieve the prevention, detection and control of transboundary animal diseases and in particular to address their regional dimensions. The initiative combines the strengths of both international organisations to achieve agreed common objectives and serves as a facilitating mechanism to empower regional alliances in the fight against TADs based on regional priorities.

Under the umbrella of the GF-TADs Europe, the Standing Group of Experts on ASF (SGE–ASF) was set up in 2014 to build up a closer cooperation among countries affected by ASF and thereby, address the disease in a more collaborative and harmonised manner across Europe. The SGE–ASF promotes regular exchange of information and best-practices among risk managers and international and national experts with a view to coordinate disease control policies and build science-based national control strategies. It is considered to be a unique opportunity to engage affected countries in a fruitful regional dialogue and increase transparency and trust.

Based on the SGE–ASF Europe model, similar initiatives, adapted to the regional context are being launched in Asia (Beijing, April 2019) and the Americas (Ottawa, May 2019).

In the context of the European Union, the regional strategic approach was initially drafted in 2015[7] and regularly revised ever since, with the aim of establishing harmonised measures in response to the ASF epidemiological situation in the EU, supported by a robust evidence-based legal framework which includes regionalisation. This strategic approach includes measures to be implemented by EU Member States affected by the disease and those which are at risk.

In 2017, the Regional strategy for the control of African swine fever in Africa was launched jointly by FAO, African Union–Interafrican Bureau for Animal Resources (AU–IBAR) and International Livestock Research Institute (ILRI). The strategy follows three principles: i) the generation of evidence on the pig sector for a strong knowledge-based approach; ii) an area and sector specific approach to tailor interventions to specific situations; and iii) a holistic approach to promote gradual transformation of the current extensive production system into a more bio-secure, small-scale and semi-intensive production system. The strategy also identified the stakeholders and institutions responsible for its implementation. It is anticipated that the strategy will guide the prevention and control of ASF efforts in the continent contributing to better trade of pigs and pork throughout Africa and beyond and in so doing improve the livelihood and food and nutrition security of producers and other actors.

The harmonisation of regional strategic initiatives towards a global ASF control should be science-based considering, among other, ASF epidemiology, pig production practices, socio-economic, environmental aspects of each region or sub-region and the capacities of governments, public and private sectors and recent lessons learnt in controlling ASF.

7 https://ec.europa.eu/food/sites/food/files/animals/docs/ad_control-measures_asf_wrk-doc-sante-2015-7113.pdf

4. Global control of ASF

Having in mind the global socio-economic impact of ASF, the control of the disease is a shared interest and should be considered as a global public good. The Veterinary Services of both affected and not affected countries have the mandate to safeguard animal health and welfare and should lead the implementation of effective coordinated countermeasures to minimise the global impact of the disease.

The global control of ASF will reduce the burden of ASF, will contribute to alleviate poverty by improving the livelihoods of pig producers in low- and middle-income countries, protect free countries and will ensure safe international trade of pigs and their products.

The control of ASF on a global scale would require recognition that different regions of the world face different sets of problems. It will require a deep understanding of the diverse production systems, role of wildlife and vectors, as well as the economic considerations regarding, among other factors, the cost of the disease and the benefits of access to national and international markets.

The analysis of the lessons learnt from past and existing global animal disease control and eradication strategies and programmes (i.e. rinderpest, FMD, PPR, rabies, zoonotic tuberculosis and antimicrobial resistance) demonstrate the importance of a strong political support. Countries attempting to implement control measures for ASF should have in place, or progressively acquire, appropriate structures, organisation, capacities as well as human and financial resources, to conduct activities aiming at the control or eradication of ASF. Such a system, aligned with OIE standards on quality of Veterinary Services, will guarantee the effective management of the countermeasures and their sustainability in the long run. It should be based on strong partnerships among the public and private sector, international organisations and the civil society.

In addition to the above enabling factors, the following key success factors need to be carefully considered in any sustainable global approach to ASF control:

1. Justification: A compelling economic case is necessary to achieve a sustainable global political consensus for action. The rationale for investment needs to be elaborated through engagement of all stakeholders and should be based on field experiences. The case should compile scientific evidence on the socio-economic impact of the proposed activities at national, regional and global level and should provide coherent foundation for the feasibility of the global control of ASF.
2. Planning: To increase the efficiency of the intervention and optimise the use the scarce resources, a detailed and transparent planning process is needed. This requires a multi-disciplinary approach to identify the strategic objectives, expected outcomes and timelines for the key milestones. An appropriate strategic plan must be supported by the development of tactically feasible and ongoing operational planning, to ensure a strong engagement and accountability mechanism by all relevant actors.
3. Capability: The actors involved in the implementation of the strategy should have the operational capability and capacity to deliver the strategy through its operational plans. National Veterinary Services are the frontline for the control of ASF and play a vital role in protecting the swine sector. Strong Veterinary Services based on international standards and principles of good governance improve animal health, make local and international trade safer and consequently, support rural development and open the growing national and international markets to small producers in rural communities (e.g. traditional products for local market). The quality of the Veterinary Services gives confidence to private sector investment that results in an improved national economy and livelihoods.
4. Intelligence framework: High quality field veterinary services enable the gathering of disease intelligence, which when combined with modern information management technologies and a robust science and research process, will assist to address the gaps in the scientific understanding of ASF. The intelligence framework supports performance monitoring and provides insights to operational planning, and the identification and promotion of best disease control practices. Stakeholders need be encouraged to identify their own research needs and evaluate the potential for innovations to be incorporated into the regional and national strategies.

5. Resources: Engaging public and private funding partners through effective advocacy and by demonstrating the value of ASF control will encourage sustainable investment and create an enabling policy context for the implementation of the strategy. Regular monitoring and communication of the impact of the strategy to key stakeholders will showcase and justify a sustained investment.

6. Inter-sectoral coordination: Coordination and communication across different sectors, domains and disciplines are key to effectively controlling ASF. The control strategies should be based on a participatory approach, information-sharing and coordinated interventions among all stakeholders. A successful implementation of the strategy requires that interested parties from all sectors are engaged to achieve a sense of cohesion, empowerment and inter-dependence at national, regional and global level.

7. Regional cooperation: The effective implementation of ASF control programme strongly depends on good regional and sub-regional coordination and cooperation. Regional platforms facilitate the proper understanding, efficient transposition of recommendations and best practices into regionally harmonised national control strategies. Strong regional and sub-regional cooperation motivates and engages countries to support each other, facilitates knowledge exchange and builds capacity. Successful implementation will allow pockets of disease areas to be avoided that can jeopardise the regional efforts.

The design and implementation of a global ASF control framework should be based on an internationally agreed framework intended to harmonise actions and provide adaptable, achievable guidance for country and regional strategies. It would require creating interdisciplinary collaborations and communications in all aspects of prevention and control of ASF. Such a framework should have a common vision and address the need for interdisciplinary and transdisciplinary collaboration, and to learn from experience gained in other global animal health initiatives.

4.1. Challenges for the implementation of the ASF Global Control Strategy

There are several persistent challenges for designing and implementing sustainable ASF control and eradication programs at a national, regional and global level. Veterinarians, farmers and hunters in many parts of the world, struggle in their efforts to fight ASF at the source of infection, but there is also realisation that there is strong need to collaborate across different disciplines, levels and domains. For effective control of ASF, the involvement of other authorities, including those dealing with customs and border control and in local communities, with proper understanding of their roles and responsibilities to implement required measures when and where it's needed, is of utmost importance.

These challenges for global control of ASF could be analysed in different phases, i.e. i) development of ASF control and eradication framework (e.g. policy development, funding, education, training), ii) implementation (e.g. surveillance, multi-sector and multi-domain collaboration), and iii) monitoring and evaluation of its effectiveness.

Although it is expected that Veterinary Services should take key role in prevention and control of ASF, in many countries other services could be responsible for proper coordination of multiple services, depending on political, social and economic context. Recent studies of the role of human behaviour in epidemiology and the spread of ASF across long distances, advocate for taking a whole society approach in the design and implementation of global ASF strategy. This would imply a transdisciplinary level of collaboration, with the inclusion of stakeholders beyond the typical domain relevant to veterinary and wild animal fields. Such approach could better address complex global ASF challenges, due to the consideration of local contexts and the inclusion of community stakeholders, which should also implement their services (e.g. collection and safe disposal of community garbage, food waste, or dead animals).

However, some considerations should be taken into account in developing a strategical framework to combat ASF, which include: understanding of different pig production systems in different areas (e.g. small-scale farms and commercial farms); impact of disease control measures on the poor swine keeper, meat processing industry, and consumers; understanding the effects of ASF on the production of pigs, food security, livelihoods and the ecosystem; considering cost effectiveness of specific control measures, but also social and political acceptance and overall feasibility.

Finally, but with tremendous importance and priority, the biggest gap identified for ASF control, in terms of effective solutions, is the development and availability of effective, potent and safe vaccine against ASF for domestic pigs but also wild pigs. Furthermore, development of reliable diagnostic tools, including rapid field DIVA test is of huge importance. This highlights the need for a global and transdisciplinary research coordination, in the framework of public-private-partnership supported by OIE and FAO, that attracts scientists and industry and accelerates the delivery of innovative solutions for ASF, similarly to other emerging global threats.

Proper understanding of such challenges is essential to address the complexity in the design of ASF strategy in line with the acknowledgement of potential challenges and risks, their causes and possible solutions that have the potential to solve multiple challenges and to mitigate risks. The specific challenge of global ASF control strategy will be in developing effective measures which will ensure further contribution of pig production to global wealth, and sustainability.

Sustainable improvement of the Veterinary Services' compliance with the international standards via the PVS Pathway and continuous capacity building is also required to improve the ability of Veterinary Authorities and relevant national Veterinary Services to implement activities for control and eradication of ASF.

5. Conclusions

In the context of specific characteristics of ASF and the unprecedented global spread of the disease, there is urgent need to revise the current understanding of ASF and improve inter-sectoral and trans-disciplinary collaboration and communication between all stakeholders, to facilitate the development of adequate scientific approaches and effective tools towards sustainable control of ASF.

The challenges to control ASF, in relation to major aspects of this disease (e.g. policy making, sustainable funding with cost-sharing among stakeholders, development of effective disease control tools, surveillance in all populations and sub-population, education, training and awareness raising, disease notification and reporting), demand multi-actor, multi-domain and multi-level collaborations, and with full commitment of all authorities and stakeholders.

Based on the very complex epidemiological situation and global threat of ASF, global control of ASF needs to be understood and managed at local, regional and global levels, including by preventing further spread through movement of animal and animal products, with particular attention to anthropogenic transmission of ASFV. In addition, comprehensive communication and awareness campaign tailored to country's needs and realities, should be implemented worldwide.

Communication is central to the stakeholders' participatory approach and is of importance to promote dialogue among all sectors involved in outbreak prevention and response, to strengthen relationships, build trust and enhance transparency among all those working towards averting or bringing an outbreak to an end.

The global approach to ASF control should be based on an internationally agreed framework intended to harmonise regional and national strategies. It should consider the key success factors and provide a coordinated approach and vision for the reduction of the burden of the disease. Countries, supported by international organisations, regional economic communities and development partners, should lead the efforts and drive the changes necessary to achieve a global control of ASF.

The GF–TADs, representing fully committed Veterinary Services of Member Countries, with the strong support of the FAO, OIE and other partners, offers the ideal global platform to discuss holistic approach for global control of ASF, and common or equivalent mitigation measures based on sound scientific and technical grounds, and specific regional characteristics.

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