

Thematic Evaluation Series

Evaluation of FAO's role and work on antimicrobial resistance (AMR)

Annex 3. Contribution by the AMR expert panel

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Note: Given the broad multidisciplinary technical nature of antimicrobial resistance (AMR), an expert panel was established to support the evaluation team in assessing the scientific and technical soundness of FAO's work on AMR. The expert panel formed an integral part of the evaluation process. The panel was composed of senior experts from major disciplines associated with AMR, with reference to the One Health approach required for AMR work. It included representatives of international organizations, professors and experts in their personal capacity. The panel provided inputs at two stages of the evaluation process: (1) during the data collection phase, and (2) in the finalization of the evaluation report. During the data collection phase, the expert panel advised the evaluation team in assessing the technical soundness of selected FAO AMR publications. For the finalization of the evaluation report, the panel provided comments on certain sections of the report and recommendations, responding to a set of questions prepared by the evaluation team.

The following sections include (A) the report of the expert panel meeting, (B) methodology used and results of the assessment of FAO AMR publication (C) brief bios of the panel members.

Part A: Report of the AMR expert panel meeting

Attendees: Panel members - Arshnee Moodley, Celia Manaia, Elisabeth Erlacher-Vindel, Elizabeth Tayler, Eric Ottow, Lise Korsten and Mohan Chadag; Evaluation team - Paul Rossiter and Ana Mateus; FAO Office of Evaluation (OED) - Rachel Bedouin and Anshuman Bhargava.

A. Meeting details

Once the evaluation report was available, a final virtual meeting with the panel was organised to discuss their views and comments on certain sections of the report. Key points made by the panel during the discussion are summarised below. The meeting was guided by the following discussion questions:

Question 1: Does the evaluation adequately reflect the roles and responsibilities of FAO as an actor within the global AMR architecture?

Question 2: To what extent is the assessment of FAO's work technically sound?

Question 3: Additional inputs or suggestions on how to further strengthen FAO's scientific approach to its work on AMR at all levels?

B. Overall comments on the evaluation

The panel was positive that the evaluation adequately reflected the roles and responsibilities of FAO within the global AMR architecture. It noted that the assessment was technically sound, and the subsequent recommendations were important. It emphasised the value of the evaluation in summarising all of FAO's work on AMR in an easily accessible format and considered the evaluation report to be an important piece of communication for FAO. Some panellists also highlighted the limitations of the report, including the relatively limited number of interviews conducted at the farm level and the small number of countries selected for the case studies. Since AMR work is very context specific and AMR activities can vary considerably across countries, increasing these numbers would have strengthened the basis of evaluation evidence. Similarly, throughout the report more emphasis should have been given to AMR work at the country level to be able to measure FAO's impact, probably supported by larger quantitative data. However, these limitations were understandable given the current COVID-19 restrictions and the relatively recent work of FAO on AMR in most countries.

The panel provided helpful comments on a range of matters which fall under the broad heading of improved management and coordination by FAO of its AMR role and work. It strongly agreed with and emphasised the need for a long term strategic and programmatic approach for FAO's work on AMR. The panel reiterated FAO's comparative advantages in working across AMR disciplines with a range of stakeholders at the national and regional levels. To further strengthen FAO's approach to AMR, it suggested the need for FAO to synthesize existing AMR research to develop evidence-based priority actions for countries in different contexts.

C. Questions 1 and 2

As in the evaluation report, the panel unanimously emphasised the important role played by FAO on AMR and welcomed the need for FAO to have a longer-term strategic approach to AMR and to embed it within the organization's overall strategy. Panellists highlighted that the Tripartite strategy, currently being developed, should provide a clearer collaborative framework for the work jointly implemented by the three organizations. They agreed that collaboration on AMR is vital at

all levels and there is room for closer relations between FAO and the World Organisation for Animal Health (OIE) at regional and national levels, especially on the development of AMR guidelines associated with animal health. Further, suggesting that a long-term organizational strategy would ensure a cohesive approach to AMR at the national, regional and headquarter levels, and improve coordination with its partners.

The panellists agreed with the assessment in the report of FAO's comparative advantages on AMR, re-emphasising FAO's ability to work on a range of issues associated with AMR (including plant health and environment), its close working relations with country governments and its work at the farm level. They highlighted the need for FAO to focus on these advantages, generating greater efficiency. The Panel felt that the importance of FAO's role in ensuring a One Health (OH) approach on AMR should be emphasised more in the recommendations. It also indicated that the recommendation on stronger internal management of FAO's work on AMR is important for a greater coordination and collaboration to leverage on disciplines across the OH spectrum.

Further, as indicated in Recommendation 1, the panel highlighted that FAO should draw upon its close working relationships with partners to raise the visibility of AMR issues across countries and regions. Its key advantage is to work at the political and strategic level to convince national governments to allocate resources to AMR activities. This would also ensure sustainability of AMR work. FAO should use its links with governments to develop sustainable national strategies on AMR or implement the AMR national action plans. In many countries there remains a lack of collaboration between different government departments and national stakeholders. Large organizations such as FAO should improve coordination of AMR work already being carried out at farm level by smaller agencies and groups, and then help in multiplying this effect. Similarly, FAO's AMR work needs to do more to embed AMR activities into national systems.

Another point raised by the Panel was the relative importance given to short term trade benefits versus the long-term impact of AMR across countries. Given FAO's mandate in the food and agriculture sectors, FAO should play an important role in drawing the attention of FAO Members to the long-term consequences of AMR.

On other issues, some panel members emphasised the need for stronger monitoring of FAO's work and its impact, with more quantitative data and coordination within the organization. The panel also acknowledged the need to strengthen the role of the reference centres and its network, and their better utilization. For example, the panel noted the absence of FAO Reference Centres for AMR in Africa.

D. Question 3

The panel suggested that FAO can further strengthen its approach to AMR by helping countries to identify evidence-based priority actions in different contexts. Playing on its comparative advantages FAO can help in synthesizing existing AMR research for countries that is meaningful and covers the One Health spectrum. This would help in identifying priority actions for countries and tracing areas that need further research. It remains critically important to develop the evidence-base on AMR in different contexts in order to convince national authorities of the need to fully support this work. FAO can play an important role in putting this evidence base together and could accelerate the transfer of research from regions where it is produced to regions where it is needed. This would also help in systematizing FAO's own work on AMR and in defining its targets and regional priorities. Additionally, greater internal management and coordination on AMR would also help in strengthening its scientific approach

Part B: Assessment of FAO's AMR publications

Introduction

1. Given the technical nature of FAO's work on AMR, its publications on AMR form an important part of its overall outputs on AMR. At the same time, these publications also cover different disciplines and technical areas associated with FAO's work on AMR. In order to perform a comprehensive assessment of these publications, the evaluation team put together and engaged the AMR panel of experts. The panel included experts from all major disciplines linked with AMR. The following paragraphs detail the methodology used and the overall results of the assessment. Key messages from the assessment are included in the full report of the evaluation.

1.1 Methodology

2. A total of 56 publications, briefs and other documents were collected by the evaluation team (ET) on AMR. These were put together from the FAO website, shared by interviewees directly with the ET or collected through the internal Evaluation Reference Group (ERG).¹ The only criteria for this wider set of documents was that FAO should be a key author. This set of documents was then studied for key characteristics (associated technical area within AMR, division/department, geographic focus, year of publication, FAO partner/co-author, and language). A subset of 18 publications² published from 2016 onwards was finally selected from this set for the assessment so as to coincide with the implementation of the FAO AMR AP. These publications were all that satisfied the criteria set out in Appendix 2.
3. The 18 publications were then assigned to the 10 experts that were part of the AMR Expert Panel, set up for this evaluation. The experts covered all areas of expertise under AMR and also represented key organizations working on AMR.³ The publications were assigned to each expert based on their area of expertise; the criteria used is listed in Appendix 2. The evaluation team also provided each assessor with two scoring matrices. One for the 18 publications and a brief one for the FAO Action Plan on AMR 2016-2020.⁴ All matrices submitted by the experts were compiled to see variations in scores between assessors, across publications and scoring criteria. The next few sections provide a brief analysis of the quantitative scores and feedback provided by the experts.

1.2 Limitations

4. Due to the composition of the expert panel, only publications that were available in English could be assessed. However, in the broader set of documents collected only two were in languages other than English. Generally, the publications were assigned as per area of expertise of the assessors but unfortunately this was not possible; in some cases, one of the two assessors did not have expertise in the specific subject area. This was not considered to be a major issue, since it was ensured that the other assessor had subject area expertise. Moreover, it could further be useful to get external perspectives, which in

¹ Composed of representatives from all FAO divisions and regional offices working on AMR.

² Listed in Appendix 3.

³ Composition of the AMR expert panel in Part C.

⁴ Available in Appendix 1.

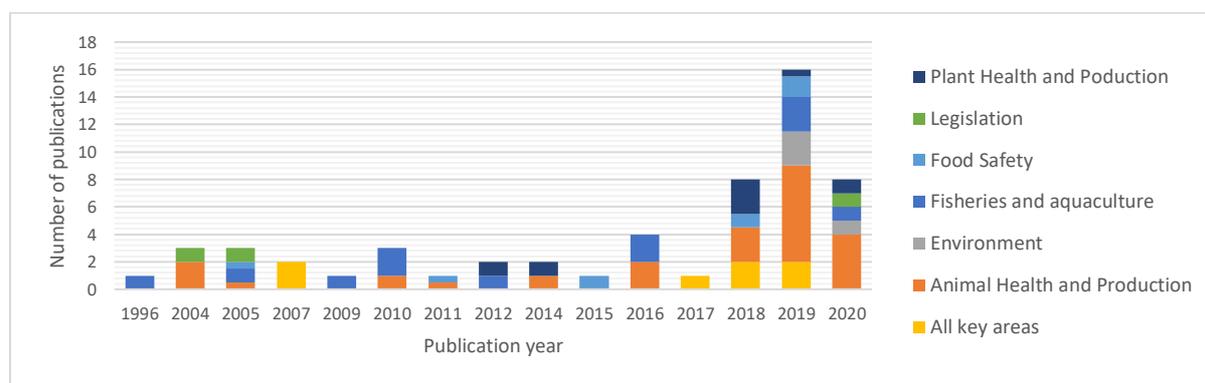
the case of a cross cutting area like AMR are important. Lastly, some of the publications could not be reviewed twice due to the limited number of experts on the panel; nevertheless, since the scores for all other publications were very consistent across the two assessors, this was not considered to be a major limitation. Additionally, to further ensure consistency, all scores were reviewed by the AMR expert on the evaluation team.

2. Analysis

2.1 Descriptive statistics

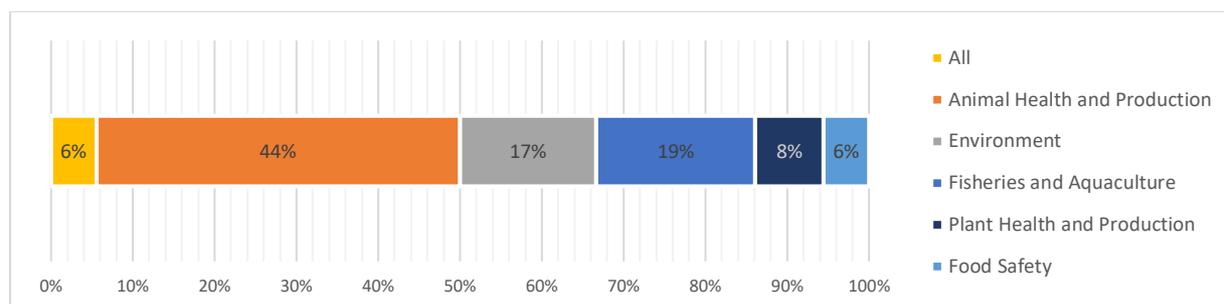
- From the initial set of documents collected, a substantial proportion of the material (around 25 percent) was published in collaboration with the Tripartite organizations (OIE and the World Health Organization [WHO]), going back to 2005. However, only around 9 percent had intersectoral contributions from across FAO divisions. Further, since 2015, there has been an increase in the number of publications on AMR, which has mainly been driven by the work on animal health and production. The number of publications on fisheries and aquaculture across the years have remained constant and publications on AMR in the environment have only been available in recent years (i.e., 2019 and 2020). For plant health and production, the documents have been irregular with a growing number of publications observed from 2018 onwards.

Figure 1: FAO AMR documents by year of publication (n=56)



Source: Evaluation team

- The publications selected for the assessment covered all key AMR areas and regions, except legislation. Figure 2 details the composition of the subset. The subset also included publications from the regions and a few country level publications. However, no publications from the FAO Regional Office for Near East and North Africa (RNE) and Regional Office for Europe and Central Asia (REU) were part of the subset as either there were none or did not match the selection criteria. The country level publications included in the assessment were from the Regional Office for Asia and the Pacific (RAP).

Figure 2: Composition of publications selected for assessment (n=18)

Source: Evaluation team

2.2 FAO publications

- The publications were scored across key questions around relevance, innovativeness and overall quality (including methodological rigour, comprehensiveness of the narrative, referencing and collaboration). There were no correlations between the scores and the publication year, technical area and the leading division. Most publications received a high score with an overall average of 5 out of 6. Only two publications have been given an overall low score (3 and 4). Both of these were summary reports of working group meetings, and were not standalone FAO publications.

2.2.1 Relevance

- Most of the FAO publications were deemed very relevant (score of 5 out of 6) by the experts, apart from a couple of the publications focused on fisheries that scored slightly lower and three summary reports that scored low. The publications were aligned with the goals of FAO and covered one or more of the focus areas set by the FAO AMR Action Plan 2016-20 (AMR-AP). Publications that were based on the knowledge, attitudes and practices (KAP) surveys or included characterising the structure of livestock and aquaculture production systems and the economics of it, were deemed very relevant. These were perceived to provide a better understanding of antibiotic use and AMR issues at country level. Experts also valued the recent publications focused on AMR in the environment and deemed these to be very relevant due to the current lack of evidence on AMR in this sector. Some of the publications were deemed to have impact on policy making at both international and country levels. However, for some, the experts noted that it was not clear who the intended audience was. It was suggested that future FAO publications should identify target audiences in order to ensure the maximum impact of recommendations and guidance provided. Furthermore, these publications should also be clear on the external validity of the findings and recommendations within and across geographical regions. Furthermore, to make the publications more relevant to target audiences, the economic aspects of AMR should also be included.

2.2.2 Overall quality

- The publications that scored high were perceived to be of high technical quality within the remit of the FAO AMR-AP and provided a solid narrative with statements supported by evidence. These also provided recommendations that were well aligned with findings. Moreover, country-specific publications that took into account the socioeconomic context were also deemed of high quality.

10. Publications that scored lower in terms of quality across one or more categories usually lacked references to support statements and provided vague recommendations that were not always supported by the findings. Furthermore, in some of these lower quality publications there was also a lack of explanation of how recommendations should be implemented and nor were these tailored to the context or audience. Lack of standardised terminology and clear definitions across FAO publications was also found to affect quality of publications. Across the KAP analysis studies, quality was affected by the use of convenience sampling and the lack of triangulation to validate findings.

2.2.3 Innovativeness

11. All FAO publications except the two studies associated with the KAP analysis scored low under this criteria. Incorporation of economic aspects in the two publications was deemed innovative by experts, as it was considered an important component in animal production that is often overlooked in AMR publications. Economic factors such as low cost of antimicrobials and profit from antimicrobial sales are important drivers for behaviour of antimicrobial users (e.g., farmers, veterinarians) and sellers (e.g., drug shop owners, pharma representatives). Furthermore, it was deemed that publications could score higher if, as part of the methodology, they use online platforms and open access tools to collate data and generate evidence on antimicrobial usage (AMU) and AMR at country level. Additional, aspects that are not traditionally covered in AMR publications are where more work is required, included socioeconomic and climate change.

2.3 FAO Action Plan on AMR 2016-2020

12. The FAO AMR-AP achieved high scores in the assessment conducted by most experts. The four Focus Areas identified in the FAO AMR-AP and the need of a OH approach was deemed highly relevant by experts. The document was considered to be well written and of high quality but was not supported by a strategic framework and did not address specific stakeholders that are key players on AMR (e.g., pharmaceutical industry and public society and consumers associations), nor did it consider gender issues. Moreover, it was noted that the FAO AMR-AP did not provide details on how it should be used at the country level, in particular on the role of FAO, its approach to AMR activities, the engagement of both public and private sectors and the financial commitment needed. The FAO-AP also lacks indicators on how to assess the impact of FAO's work on AMR and achievement of goals towards the focal areas proposed. Furthermore, it was highlighted that the FAO-AP does not take into the consideration the constant evolution and diversity of animal and agricultural production systems and the different scenarios in which FAO activities would be implemented.

Part C: Composition of the AMR expert panel

Arshnee Moodley

Arshnee Moodley leads the CGIAR AMR Hub that was launched in 2019, with the aim to support efforts to mitigate the risks of agricultural associated antimicrobial resistance (AMR) in low- and middle- income countries working within a One Health framework. She is a microbiologist with a PhD in antimicrobial resistance and zoonosis from the University of Copenhagen (UCPH), Denmark. She also holds an Associate professorship at the Department of Veterinary and Animal Sciences at UCPH, Denmark.

Celia Manaia

Célia Manaia's research interests include the study of the diversity and ecology of bacteria in human-impacted areas, with special emphasis on potential impacts of antibiotic resistant bacteria and genes as environmental contaminants. She is currently an associate professor at Escola Superior de Biotecnologia, Universidade Católica Portuguesa and has a background in Biochemistry, specializing in Microbiology. Dr Manaia is also Vice-President for Research and Internationalization at the Porto Regional Center of the Universidade Católica Portuguesa and a member of the Direction Board of the Portuguese Society of Microbiology.

Elisabeth Erlacher-Vindel

Elisabeth Erlacher-Vindel is the Head of the Antimicrobial Resistance and Veterinary Products Department of the World Organisation for Animal Health (OIE). Before joining the OIE, she worked in a professional dairy organisation, where she was the Deputy Director of the Scientific Department and Head of the Food Safety and Environment Unit. Dr Vindel graduated from the Veterinary University, Vienna, Austria and has experience working as a field veterinarian in different countries, dealing with research and providing advice and expertise in the field of animal health, food safety, veterinary drugs and environmental issues.

Elizabeth Tayler

Liz Tayler has over twenty-five years of experience in international and UK public health, development and health diplomacy. She has a medical and public health training. She works at the Tripartite Joint Secretariat for AMR, in WHO, supporting collaboration between FAO OIE and WHO at global, regional and country levels. She has been supporting the establishment of the multi partner trust fund to support AMR action. Prior to this she used to lead the team in WHO that supports countries to develop and implement national action plans for AMR and developed the tripartite Monitoring and Evaluation Framework.

Eric A. Ottow

Eric A. Ottow is an agrobiologist working at BASF in the unit Sustainability & Governmental Affairs. He chairs the Antifungal Resistance Project Team at CropLife International focusing especially on the class of azole fungicides that represent an important tool for the management of fungal diseases in agriculture and human medicine. As such, Dr Ottow is a member of the Plant & Environment Health Group within the Global AMR R&D Hub that aims to further improve the coordination of international initiatives and collaboration in the field of global AMR R&D using a One Health approach.

Jacqueline Alvarez

Jacqueline Alvarez is the leader of the Science and Risk unit of the Chemicals and Waste Branch at UNEP. Her Unit's strategic focus is to support countries in the environmentally sound management of chemicals and waste throughout their life cycle including emerging issues, assessment of risks

and monitoring of trends to keep the environment under review. Dr Alvarez started her career in the Ministry of Environment of Uruguay in the field of chemicals and waste and has worked on chemical safety, risk assessments and policy development. She has also worked for the Basel, Rotterdam and Stockholm Conventions Secretariat in its Technical Assistance Branch.

Jeroen Dewulf

Jeroen Dewulf is a professor in Veterinary Epidemiology at the Faculty of Veterinary Medicine of the Ghent University. His main research interests are quantitative epidemiology and control of zoonoses with a specific emphasis on antimicrobial resistance and antimicrobial use in animal production. He is a member of the European Surveillance on Veterinary Antimicrobial Consumption (ESVAC) network and chair of the JPI-AMR network on quantification of antimicrobial consumption in animals at herd level. Professor Dewulf graduated as a veterinarian from the Faculty of Veterinary Medicine of the Ghent University, Belgium and has completed a PhD on the epidemiology and control of classical swine fever.

Lise Korsten

Lise Korsten is a professor in the Department of Plant and Soil Sciences, section Plant Pathology in the Faculty of Natural and Agricultural Sciences at the University of Pretoria. Prof Korsten developed South Africa's first biological control agent for fruit and has established a research group in sanitary and phytosanitary aspects of international trade. Her current projects focus on food safety for the South African fresh produce industry, postharvest pathology aimed at reducing postharvest losses in supply chain and mushroom health and safety. She has previously served on the board of the National Laboratory Association and programmes of the Department of Science and Innovation/ Fresh Produce Exporters: Postharvest Innovation programme for South Africa. She has also been a South African National Accreditation Systems technical assessor for more than ten years.

Tong Zhang

Tong Zhang is a Professor in Environmental Biotechnology Laboratory in Department of Civil Engineering, the University of Hong Kong. He was previously the Yi Xing Chair Professor at Nanjing University. His research interests include biodegradation of emerging pollutants (antibiotics, PPCP and EDCs) and antibiotic resistance genes. He has served as an advisor for the Beijing Genomics Institute on Environmental Microbiology and Biotechnology, and as a country liaison for the American Society of Microbiology. He holds degrees in Environmental Science and Engineering from Nanjing University, and a Ph.D. from the University of Hong Kong.

Vishnumurthy Mohan Chadag

Vishnumurthy Mohan Chadag supports the implementation and delivery of the Sustainable Aquaculture Research Program at WorldFish with a focus on aquatic animal health management. He holds a PhD in aquatic animal pathology from the University of Stirling, Scotland, and has worked as an academic at the College of Fisheries, University of Agricultural Sciences, Mangalore, India. Previously, he worked for the Network of Aquaculture Centres in Asia-Pacific supporting sustainable aquaculture research and development programs with 18 Asia-Pacific governments. He was previously the Chairperson of the Fish Health Section (FHS) of Asian Fisheries Society (AFS).

Appendix 1. Scoring matrices

A. The following standardized criteria and approach was used for assessment:

No.	Criterion	Assessment approach with comments/justification for each
1	Methodological rigor and coherence. In the case of publications with recommendations, are these aligned with findings in scientific technical reports?	Scale of 6 (1=poor; 6=excellent)
2	Comprehensiveness of the narrative	Scale of 6 (1=poor; 6=excellent)
3	Referencing (whether referencing is up to date, if it is balanced across relevant disciplines and it indicates that the publication takes account of and/or builds on earlier work)	Scale of 6 (1=poor; 6=excellent)
4	Is the publication relevant to the key policy and development challenges surrounding the issue that the paper addresses?	Scale of 6 (1 = not at all relevant; 6 = extremely relevant)
5	Is the publication relevant to the key goals and approaches set out in the FAO AMR Action Plan?	Scale of 6 (1 = not at all relevant; 6 = extremely relevant)
6	Innovativeness/novelty ⁵ – Would novelty be expected, if yes, what kind of novelty was observed?	Scale of 6 (1=poor; 6=excellent)
7	Appropriateness/quality ⁶ - Does the publication meet the national or international standards of rigor?	Scale of 6 (1=poor; 6=excellent)
8	Collaboration - If it is a multi-disciplinary publication, is it co-authored by people with relevant backgrounds?	Scale of 6 (1=poor; 6=excellent)
9	Overall quality of publication (including additional criteria at the discretion of the expert)	Scale of 6 (1=poor; 6=excellent) Brief narrative

In addition, each publication was scored on the following cross-cutting issues:

- i. Inclusion of gender issues.
- ii. Evidence of a One Health approach.

B. The following standardized criteria was used for assessment of the FAO Action Plan on AMR (2016-2020):

No.	Criterion	Assessment approach with comments/justification for each
1	Methodological rigor and coherence: Is the FAO Action Plan aligned with findings in scientific technical reports?	Scale of 6 (1=poor; 6=excellent)
2	Relevance: Is the FAO Action Plan relevant at the global and country level? Please provide details of any important gaps you may notice.	Scale of 6 (1=poor; 6=excellent)
3	Overall quality of Action Plan (including additional criteria at the discretion of the expert)	Scale of 6 (1=poor; 6=excellent)

⁵ Novelty was described as the originality of the publication in its aims and objectives and the appropriateness of the study design.

⁶ Quality was defined as meeting international or national standards of rigor for study design, methodology, interpretation of results, presentation of hypotheses and conclusions from the research.

Appendix 2. Selection and assignment criteria for the assessment

Criteria for selecting publications for the assessment	
1	All publications assessed should have been published on the FAO website or accessible online
2	Publications should cover the period 2016-2020
3	The publications should have FAO as one of the key authors
4	The selected set of publications should cover all key sectors (animal health, plant health, aquaculture, environment, food safety)
5	The publication should be available in English

Criteria for assigning publications to expert panel members	
1	There should be no involvement of the panel member in the writing of the publication either directly or through his/her organisation
2	Each panel member should be assigned a maximum of 3 publications
3	One of the three publications assigned should be the FAO Action plan on AMR 2016–2020
4	The panellists should be assigned the publications based on their area of expertise

Appendix 3. List of publications assessed

	Publication Name	Year
1	Drivers, Dynamics and Epidemiology of AMR in Animal production	2016
2	Antimicrobial resistance policy review and development framework	2018
3	Antimicrobial Resistance in the Environment. Summary Report of an FAO Meeting of Experts. FAO Antimicrobial Resistance Working Group	2018
4	Antimicrobial Resistance and Foods of Plant Origin Summary Report	2018
5	Biocides and Antimicrobial Resistance Summary Report of an FAO Meeting of Experts FAO Antimicrobial Resistance Working Group	2018
6	Antimicrobial movement from agricultural areas to the environment: The missing link. A role for nuclear techniques	2019
7	Aquaculture development. 8. Recommendations for prudent and responsible use of veterinary medicines in aquaculture. FAO Technical Guidelines for Responsible Fisheries. No. 5. Suppl. 8.	2019
8	Monitoring and surveillance of antimicrobial resistance in bacteria from healthy food animals intended for consumption. Regional Antimicrobial Resistance Monitoring and Surveillance Guidelines – Volume 1	2019
9	Prudent and efficient use of antimicrobials in pigs and poultry. FAO Animal Production and Health Manual	2019
10	Tackling antimicrobial use and resistance in pig production, lessons learned in Denmark	2019
11	The performance of antimicrobial susceptibility testing programmes relevant to aquaculture and aquaculture products	2019
12	Antimicrobial resistance in water in Latin America and the Caribbean: a scoping review protocol	2019
13	Carriage of carbapenemase- and extended-spectrum cephalosporinase-producing Escherichia coli and Klebsiella pneumoniae in humans and livestock in rural Cambodia; gender and age differences and detection of blaOXA-48 in humans	2019
14	Knowledge, attitudes and practices of livestock and aquaculture producers regarding antimicrobial use and resistance in Vietnam	2019
15	Exploring the Socioeconomic Importance of Antimicrobial Use in the Small-Scale Pig Sector in Vietnam	2020
16	FAO Expert working group meeting "scoping exercise to increase the understanding of risks of AMR in aquaculture"	2020
17	Towards a bottom-up understanding of antimicrobial use and resistance on the farm: A knowledge, attitudes, and practices survey across livestock systems in five African countries	2020
18	The Costs, Benefits and Human Behaviours for Antimicrobial Use in Small Commercial Broiler Chicken Systems in Indonesia	2020