The Centre for Science and Environment (CSE) is a public interest research and advocacy organisation based in New Delhi. It researches into, lobbies for and communicates the urgency of development that is both sustainable and equitable.

CSE has helped shape policies and build public awareness to bring change for three decades; is recognized for its role in capacitating public institutions and regulatory agencies.

Success stories include:

- Championing equity in climate change negotiations
- Supporting public transport and sustainable mobility practices (CNG in Delhi)
- Mobilizing the country through a water literacy programme that catalyzed important policy changes on decentralised water and wastewater management
- Changing perspective on food safety and becoming a trigger for the current Food Safety and Standards Act and Authority in India
- Supporting public health outcomes by strengthening regulatory oversight around pesticides, heavy metals, junk foods, transfats (and now antibiotics)

Centre for Science and Environment, New Delhi, India

Plays an important role as a southern think tank that articulates the perspectives and policies of the global south.

Workshop on Integrated Surveillance Framework for Antimicrobial Resistance

*Focusing on Animals and Environment*

March 4-6, 2019

Lusaka, Zambia

AMR surveillance in food animals and environment: policies, systems and tools

Amit Khurana, Director, Food Safety and Toxins Programme, CSE
• **International Workshop in Nov 2016.** Experts from governments, inter-governmental organizations, civil society representing human, veterinary and environment sectors
  
  – **Developed countries:** Denmark, Netherlands, Sweden, UK
  
  – **Developing countries:** Bangladesh, Kenya, Philippines, South Africa, Sri Lanka, Thailand, Vietnam and India
  
  – Representation from the **WHO** (SEARO and country-level), **FAO** (Head Quarter and Regional Office for Asia Pacific), **OIE** (Regional Commission for Asia Far East and Oceania)
  
  – **International organizations:** International Livestock Research Institute (Kenya), ReACT – Action on Antibiotic Resistance (US), Institute for Agriculture and Trade Policy (Europe), Third World Network (Switzerland), Médecins Sans Frontières (India)
Framework for Guidance

### Responsible Antibiotic Use in Food Animals

<table>
<thead>
<tr>
<th>THEMATIC AREAS</th>
<th>Policy/law/ regulations/ standards/ programmes</th>
<th>Implementation tools- Infrastructure/ capacity/systems/ resources</th>
<th>Advocacy/awareness and education/ training/curriculum</th>
<th>Record keeping/ database generation/ collation/ dissemination and research/survey</th>
<th>Review/monitoring /feedback</th>
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<tbody>
<tr>
<td>Supply of antibiotics</td>
<td>Production Systems</td>
<td>Reduce need for antibiotics</td>
<td>Veterinarians and veterinary services</td>
<td>Farms and farmers</td>
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### Surveillance of Antibiotic Use, Residues and Resistance

<table>
<thead>
<tr>
<th>THEMATIC AREAS</th>
<th>Antibiotic use in food animals</th>
<th>Antibiotic resistance in animals and food from animals</th>
<th>Antibiotic residues in food from animals</th>
<th>Environmental surveillance of residues and resistance</th>
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### Environment Management to Contain Antimicrobial Resistance

<table>
<thead>
<tr>
<th>THEMATIC AREAS</th>
<th>Registration/ licensing (based on environment risk assessment)</th>
<th>Biosecurity/sanitation and hygiene/good manufacturing Practices</th>
<th>Waste management</th>
<th>Research</th>
</tr>
</thead>
</table>

Short-term (S): <1 yr; Medium-term (M): 1-3 yrs; Long term (L): 3-5 yrs; Continues throughout: (S-M-L)
# Responsible Antibiotic Use in Food Animals

## Thematic Areas

### Supply of Antibiotics

- Assessment of existing laws and regulatory framework before formulation of new laws (S)
- National policy and regulatory framework on responsible antibiotic use with focus on (S):
  - Approval and authorization of antibiotics for animals
  - Standard treatment guidelines for treating animals
  - Banishing out of non-therapeutic use such as disease prevention and growth promotion
  - Restricting use of critically important antibiotics for humans
  - Antibiotic use under supervision and prescription
  - Mitigating likelihood impact on small-holder farmers
- Regulations to restrict antibiotics in animal food and premix, registration of feed and premix, prescription and use of only registered products (S)
- Regulations for importation of feed, feed premix and antibiotics for animal use (S)
- Labelling laws for feed, premix (S)
- Labelling laws for antibiotics for species-specific use (S)
- Regulations to control online marketing or direct distribution of antibiotics, premix, antibiotics feed or any other products with antibiotics (S)
- Laws to ensure licensing of manufacturers, distributors and sellers of antibiotics, feed, premix and other inputs (S)
- Laws to ensure prescription sale, including penalty for unregistered sale (S)
- Plan to set reduction targets for antibiotic use by a certain date and with a review process (S)

### Production Systems

- Develop guidelines for biosecurity (S)
  - Plan programme for internal and external biosecurity
  - Programme to support small-holder farmers to implement biosecurity
- Programme to research, develop, promote access to alternatives such as vaccination, probiotics etc. (M)
- Plan for research and development of appropriate animal breeds which are, for example, resilient to disease (M)

### Farms and Farmers

- Law for licensing/registration of veterinarians and those involved in fisheries (S)
- Law to delink antibiotic prescription and incentives (S)
- Programme for accessible, affordable and quality diagnostic services to support judicious use of antibiotics (M)
- Programme for targeted, livestock specific veterinary services to provide free or low cost advisory services to farmers (M)

### Consumers

- Labelling law for food from animals produced with or without routine use of antibiotic (S)

## Implementation Tools

### Advocacy/ awareness and education/training/curriculum

- Establish authority for approving veterinary drugs and market authorization (S)
- Develop systems to enable data collection of antibiotic production, sale and import (M)
- Provide enforcement systems through stakeholder agendas including customs, infrastructure, human resource such as those required for auditing and controlling companies providing inputs (e.g. feed), ensuring prescription sale etc. (M)

### Record keeping/database generation/collation dissemination and research/survey

- A national database of licenced antibiotic producers, importers, traders and retailers including defaults available online (S)
- An online national/regional/sub-regional database on antibiotic production, sale and national database on import of antibiotics (S)
- Online dissemination of updated policy, regulation and data including list of approved and unapproved antibiotics (S)
- Annual report of antibiotic sale correlated with consumption and resistance data (S)

### Review/monitoring/feedback

- Periodic review and mapping of antibiotic production, import, sale as per sectors with consumption and resistance data for continued advocacy, awareness, and future policy and practice (S-M-L)
- Annual report on antibiotic sale (S-M-L)
- Periodic review of use and success of alternatives, with reference to antibiotic use and resistance data at the farm/sub-regional/regional/national level, for continued advocacy, awareness, and future policy and practice (S-M-L)

- Periodic monitoring of records at veterinary practice levels, for continued advocacy, awareness, and future policy and practice (S-M-L)
- Periodic assessment of initiatives with antibiotic use data (S-M-L)
## Responsible antibiotic use in food animals

### Supply of antibiotics

<table>
<thead>
<tr>
<th>Policy/Law/regulations/standards/programmes</th>
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</thead>
<tbody>
<tr>
<td>• Assessment of existing laws and regulatory framework before formulation of new laws <em>(S)</em></td>
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<tr>
<td>• National policy and regulatory framework on responsible antibiotic use with focus on <em>(S)</em></td>
</tr>
<tr>
<td>• Approval and authorisation of antibiotics for animals</td>
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<tr>
<td>• Standard treatment guidelines for treating animals</td>
</tr>
<tr>
<td>• Ban/phasing out of non-therapeutic use such as for mass disease prevention and growth promotion</td>
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<tr>
<td>• Restricting use of critically important antibiotics for humans</td>
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<tr>
<td>• Antibiotic use under supervision and prescription</td>
</tr>
<tr>
<td>• Mitigating livelihood impact on small holder farmers</td>
</tr>
</tbody>
</table>
Responsible antibiotic use in food animals

Supply of antibiotics

- Regulation to restrict antibiotics in animal feed and premix, registration of feed and premix, prescription and use of only registered products (S)
- Regulation on import of feed, feed premix and antibiotics for animal use (S)
- Labelling law for feed, premix (S)
- Labelling law for antibiotics for specie-specific use (S)
- Regulation on online marketing and direct distribution of antibiotics, premix, antibiotic feed or any other products with antibiotics (S)
- Law to ensure licensing of manufacturer, distributor and sellers of antibiotics, feed, premix and other inputs (S)
- Law to ensure prescription sale, including penalty for unauthorized sale (S)
- Plan to set reduction targets for antibiotic use by a certain date and with a review process (S)
Responsible antibiotic use in food animals

Supply of antibiotics

- Authority for approving veterinary drugs and market authorization (S)
- Systems to enable data collection of antibiotic production, sale and import (M)
- Necessary enforcement systems through agencies including customs, infrastructure and human resource including those for auditing/inspecting companies providing inputs (e.g. feed), ensuring prescription sale etc. (M)

- Awareness and training of regulators, customs officials, distributors and sellers to ensure approved sale, documentation etc. (S-M-L)

- National online database of licensed antibiotic producer, importer, traders, retailers including defaulters (S)
- Online national/regional/sub-regional database on antibiotic production, sale, import (M)
- Online dissemination of updated policy, regulation and data including list of approved and unapproved antibiotics (S)
- Annual report of antibiotic sale correlated with consumption and resistance data (M)

- Periodic review/mapping of antibiotic production, import, sale as per sector (S-M-L); Annual report on antibiotic sale (S-M-L)
Responsible antibiotic use in food animals
Reduce need for antibiotics

- Develop guidelines for biosecurity (S)
  - Plan/programme for internal and external biosecurity and its enforcement
  - Programme to support small-holder farmers to implement biosecurity
- Programme to research, develop, promote access to alternatives such as vaccination, probiotics etc. (S)
- Plan for research and development of appropriate animal breeds. Which are, for example, resilient (S)

- Develop systems to ensure adoption and implementation of appropriate biosecurity measures at the farm level (M)
- Systems to register antibiotic free alternative products and their use (S)
- Support for programmes on development and adoption of vaccines (M)
- Investment and research in development of appropriate animal breeds with disease resilience (M)
Responsible antibiotic use in food animals
Reduce need for antibiotics

- Awareness and training of farmers, registered practitioners, veterinarians and other stakeholders on need for biosecurity, judicious antibiotic use and importance of alternatives *(S-M-L)*

- National online database for approved and unapproved vaccines and other alternatives *(S)*

- A list/database/rating of farmers/producers successfully adopting biosecurity and using alternatives and not antibiotics *(M)*

- Periodic review of use and success of alternatives, with reference to antibiotic use and resistance data at the farm/sub-regional/regional/national level *(S-M-L)*

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Advocacy/ awareness and education/ training/ curriculum

Record keeping/ database generation/ collation/ dissemination and research/ survey

Review/ monitoring/feedback
## Responsible antibiotic use in food animals

### Veterinarians and veterinary services

<table>
<thead>
<tr>
<th>Policy/Law/regulations/standards/programmes</th>
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<tbody>
<tr>
<td>• Law for licensing/registration of veterinarians <em>(S)</em></td>
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<tr>
<td>• Law to delink antibiotic prescription and incentives <em>(S)</em></td>
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<tr>
<td>• Programme for accessible, affordable and quality diagnostic services to support judicious use of antibiotics <em>(S)</em></td>
</tr>
<tr>
<td>• Programme for targeted, livestock specific veterinary services to provide free advisory services to farmers <em>(M)</em></td>
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</table>

<table>
<thead>
<tr>
<th>Implementation tools - infrastructure/capacity/systems/resources</th>
</tr>
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<tbody>
<tr>
<td>• Set up licensing authority for veterinarians and those involved in fisheries <em>(S)</em></td>
</tr>
<tr>
<td>• Develop capacity and infrastructure to ensure veterinary diagnostic services <em>(M)</em></td>
</tr>
<tr>
<td>• Develop system to dis-incentivize antibiotic prescription by veterinarian <em>(S)</em></td>
</tr>
</tbody>
</table>
Responsible antibiotic use in food animals
Veterinarians and veterinary services

• Awareness, training and education of veterinarians (*S-M-L*)
• Necessary AMR focus in curriculum and continuous professional medical education (*S-M-L*)

• National online database of registered veterinarians, and those who prescribe more antibiotics and without testing (*M*)
• An updated list of diagnostic services available (*S*)

• Periodic monitoring of records at veterinary levels (*S-M-L*)
Responsible antibiotic use in food animals
Farms and farmers

- Law for licensing and monitoring of commercial farms and farmers based on country-level scenario (M)
- Programme to incentivize/dis-incentivize farmers based on extent of antibiotic use (S)

- Set up licensing authority for farms and registration of farmers (S)
- Enabling system to dis-incentivize/incentivize antibiotic use at farm level (M)

- Targeted education on AMR and judicious antibiotic use for farmers (S-M-L)
- Farmer training in agro-ecological/alternative/participatory farming practices (S-M-L)

- National database of registered farms and farmers including those who are non-compliant or use more antibiotics (M)

- Periodic monitoring of records at farm levels (S-M-L)
Responsible antibiotic use in food animals

Consumers

- Labelling law for food from animals produced with or without antibiotics (S)

- Systems to ensure compliance of labelling laws (S)

- Consumer awareness on antibiotics in food and AMR, labelling of food from animals raised without antibiotics and role of sustainable diets (S-M-L)
- Awareness and promotion of Institutional procurement of food raised without antibiotics (such as through a score card system used to incentivize/dis-incentivize food procurement) (S-M-L)

- Public database of farmers/producers raising farm animals without antibiotic use (M)
- Database of farmers/producers not in compliance to labelling laws (M)

- Periodic assessment of initiatives with those of antibiotic use data (S-M-L)
**SURVEILLANCE OF ANTIBIOTIC USE, RESIDUES AND RESISTANCE**

<table>
<thead>
<tr>
<th>Policy/legislation/standards/programmes</th>
<th>Implementation tools—infrastructure/capacity/systems/resources</th>
<th>Advocacy/education and training/curriculum</th>
<th>Record keeping/database generation/collation/dissemination and research/survey</th>
<th>Review/monitoring and feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of existing laws before formulation of new laws (S)</td>
<td>Systems to enable collection and collation of farm-level antibiotic use data (M): o Harmonised system for data collection and analysis o Ensure farmers’ responsibility to provide data o Factor-in priority market sectors</td>
<td>Awareness campaigns for farmers to self-regulate themselves and keep records (M-L)</td>
<td>Online systems for collating and analyzing prescription data and farmer use data. This should include antibiotic consumption in different food sectors, therapeutic and non-therapeutic use, with weight as a unit (M-L)</td>
<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
</tr>
<tr>
<td>Legal provision for obtaining farm-level antibiotic use data (S)</td>
<td>Commission an expert advisory group/stewardship committee to decide on key elements such as networking, expert panels, development of standards, and monitoring. The group should develop detailed standards, protocols, sampling site, type and frequency of sampling, testing methods and reporting systems (M-L)</td>
<td>Awareness campaigns for veterinarians/authorized practitioners (M-L)</td>
<td>Data collection, collation and analysis at regional and sub-regional level from laboratories, food processors, imported food and those generated from surveys at farm-level (M-L)</td>
<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
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<tr>
<td>Regulation to ensure prescription audit of veterinarians/authorized practitioners (M)</td>
<td>Identify, establish and strengthen national reference laboratories that decide upon standards, protocols, organisms, data management mechanisms (M-L) o Ensure quality and harmonization with national/international data and establish links with resistant bacteria and resistance genes in humans and environment o Enable collaboration between labs to provide support, build access to WHO, FAO and OIE labs</td>
<td>Training programme on documentation for farmers and veterinarians/authorized practitioners (M-L)</td>
<td>Development of training material and protocols for resistance data collection and management following by enabling environment to collect data (M-L)</td>
<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
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<tr>
<td>National AMR surveillance programme to monitor resistance in animals and food from animals across all sectors (M)</td>
<td>Training needs assessment for those conducting surveillance (M-L)</td>
<td>Training needs assessment for those conducting surveillance (M-L)</td>
<td>Development of training material and protocols for resistance data collection and management following by enabling environment to collect data (M-L)</td>
<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
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<tr>
<td>Law compelling farmers and food processors to provide samples for analysis and share their internal data on resistance (S)</td>
<td>Development of training material and protocols for resistance data collection and management following by enabling environment to collect data (M-L)</td>
<td>Development of training material and protocols for resistance data collection and management following by enabling environment to collect data (M-L)</td>
<td>Development of an online integrated information system, publishing of annual reports and public dissemination of data to ensure transparency (M-L)</td>
<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
</tr>
<tr>
<td>Ambitious and achievable resistance reduction targets (M-L)</td>
<td>Development of an online integrated information system, publishing of annual reports and public dissemination of data to ensure transparency (M-L)</td>
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<tr>
<td>National antibiotic residue monitoring policy programme for food from animals (S)</td>
<td>Development of an online integrated information system, publishing of annual reports and public dissemination of data to ensure transparency (M-L)</td>
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<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
</tr>
<tr>
<td>Standards for antibiotic residues in food from animals such as chicken, eggs, milk, fish (S)</td>
<td>Development of an online integrated information system, publishing of annual reports and public dissemination of data to ensure transparency (M-L)</td>
<td>Development of an online integrated information system, publishing of annual reports and public dissemination of data to ensure transparency (M-L)</td>
<td>Development of an online integrated information system, publishing of annual reports and public dissemination of data to ensure transparency (M-L)</td>
<td>Periodic review and mapping of data on antibiotic use, resistance and residues as part of Integrated surveillance for continued advocacy, awareness, and future policy and practice (M-L)</td>
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**SNAPSHOT**

Surveillance of antibiotic use, residues and resistance
Surveillance of antibiotic use, residues and resistance
Antibiotic use in food animals

Policy/law/regulations/standards/programmes

- Assessment of existing laws before formulation of new laws (S)
- Legal provision to obtain farm-level antibiotic use data (S)
- Regulation to ensure prescription audit of veterinarians/authorized practitioners (M)

Implementation tools - infrastructure/capacity/systems/resources

- Systems to enable collection and collation of farm-level antibiotic use data (M):
  - Harmonized system for data collection and analysis
  - Ensure farmer’s responsibility to provide data
  - Factor-in priority markets/sectors

Advocacy/awareness and education/training/curriculum

- Awareness campaigns for farmers for self-policing and keeping records (S-M-L)
- Awareness campaigns for vets to prescribe antibiotics judiciously and keep records (S-M-L)
- Training programme on documentation for farmers and veterinarians (S)
- Training needs assessment of those conducting surveillance, development of training material etc. for data collection and management followed by enabling environment to collect data (S)
- Advocacy at community/institutional level based on antibiotic use data reports (S-M-L)
Surveillance of antibiotic use, residues and resistance
Antibiotic use in food animals

Record keeping/database generation/collation/dissemination and research/survey

- **Online systems** for collating and analyzing *prescription data* and *farmer use data*. This should include antibiotics and classes, weight as unit, total antibiotic consumption in different food sector, therapeutic and non-therapeutic use *(M)*
- **Surveys at farm level** for data collection across different sectors *(M)*
- **Setting up of data standards**, ensuring the *quality assurance of data* *(S)*
- **Establishment of national repository**, publishing of annual reports and public dissemination of data to ensure transparency *(M)*

Review/monitoring/feedback

- **Periodic review and mapping of data** on antibiotic use, resistance and residue as part of *integrated surveillance* for continued advocacy, awareness and future policy and practice *(S-M-L)*
### Surveillance of antibiotic use, residues and resistance

**Antibiotic residues in food from animals**

- **National antibiotic residue monitoring policy/programme** in food from animals *(S)*
- **Standards for antibiotic residues** in food from animals such as chicken, eggs, milk, fish *(S)*

<table>
<thead>
<tr>
<th><strong>Implementation tools - infrastructure/capacity-systems/resources</strong></th>
</tr>
</thead>
</table>
| • Develop **comprehensive residue monitoring framework** which enables surveillance of approved and unapproved antibiotic use *(S)*  
  – Export oriented residue monitoring framework could be considered for adaptation based on domestic antibiotic use  
| • Ensure **availability of funds, infrastructure, resources** for data collection *(S)* |

<table>
<thead>
<tr>
<th><strong>Advocacy/awareness and education/curriculum</strong></th>
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</table>
| • **Awareness campaigns** on importance and need of residue monitoring *(S-M-L)*  
  • **Training needs assessment** for those conducting surveillance *(S)*  
  • **Development of training material and protocols** for residue testing and data management followed by enabling environment *(S)*  
  • **Capacity building and training programmes** *(M)*  
  • **Advocacy at community/institutional level** based on antibiotic residue data reports *(S-M-L)* |
Surveillance of antibiotic use, residues and resistance
Antibiotic residues in food from animals

Record keeping/database generation/collation/dissemination and research/survey

- Data collection, collation and analysis at regional and sub-regional level from laboratories, food processors, imported food and those generated from surveys at farm-level (S-M-L)
- Correlation with antibiotic use and resistance data (S-M-L)
- Development of an online integrated information system and publishing of annual reports and public dissemination of data to ensure transparency (M)

Review/monitoring/feedback

- Periodic review and mapping of data on antibiotic use, resistance and residue as part of integrated surveillance for continued advocacy, awareness and future policy and practice (S-M-L)
### Surveillance of antibiotic use, residues and resistance

#### Antibiotic resistance in animals and food from animals

- **National AMR surveillance programme** to monitor resistance in animals and food from animals across all sectors *(S)*
- **Law compelling farmers and food processors** to provide samples for analysis and share their internal data on resistance *(S)*
- **Establish ambitious and achievable** resistance reduction targets *(S)*

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<td>Implementation tools - infrastructure/capacity/systems/resources</td>
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</table>

- **Commission an expert advisory group/steering committee** to decide on key elements such as networking experts/labs, develop, terms of reference, priorities, linkages and international collaboration *(S)*
- **Identify, establish and strengthen national reference laboratories** who decide upon standards, protocols, organisms, data management mechanisms *(M)*:
  - Ensure quality and harmonization with national/international data and establish linkages with resistance in humans and environment
  - Enable collaboration across labs to provide support, build access to WHO, FAO and OIE labs
Surveillance of antibiotic use, residues and resistance
Antibiotic resistance in animals and food from animals

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**Implementation tools - infrastructure/capacity/systems/resources**

- Develop and strengthen lab infrastructure, professional capacity, standardization of sample collection and testing protocols and assure quality both internally and externally through External Quality Assurance Scheme. *(M)* - sector specific; *(L)* - integrated quality assurance
- Ensure surveillance systems for harmonization across all sectors such as animal, human and environment. Integrated surveillance could begin with a pilot initiative *(S-M-L)*

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**Advocacy/awareness and education/training/curriculum**

- Awareness campaigns on importance and need of resistance surveillance across stakeholders *(S-M-L)*
- Training needs assessment for those conducting surveillance *(S)*
- Development of training material and protocols for resistance data collection and management followed by enabling environment for resistance surveillance *(S)*
- Capacity building and training programmes including integrated programs with the WHO, FAO, OIE collaborating centers *(M)*
- Advocacy at community and institutional level based on antibiotic resistance data reports *(S-M-L)*
Surveillance of antibiotic use, residues and resistance
Antibiotic resistance in animals and food from animals

- Data collection, collation and analysis at regional and sub-regional level from laboratories, food processors, imported food and those generated from surveys at farm-level (S-M-L)
- Correlation with antibiotic use and residue data (S-M-L)
- Development of an online integrated information system and publishing of annual reports and public dissemination of data to ensure transparency (M)
- Develop early warning system (S)

- Periodic review and mapping of data on antibiotic use, resistance and residue as part of integrated surveillance for continued advocacy, awareness and future policy and practice (S-M-L)
### Surveillance of antibiotic use, residues and resistance

**Environmental surveillance of residues and resistance**

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<thead>
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<th>Policy/law/ regulations/ standards/ programmes</th>
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<tbody>
<tr>
<td>• National AMR surveillance programme to monitor resistance in environment (S)</td>
</tr>
<tr>
<td>• Regulation on antibiotic residues in effluent and waste from industries and farms (S)</td>
</tr>
<tr>
<td>• Standards for waste discharge from farms, slaughter houses, animal food processing industry, pharmaceutical industry and healthcare settings (S)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation tools - infrastructure/ capacity/ systems/ resources</th>
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</thead>
<tbody>
<tr>
<td>• Monitoring and surveillance framework including monitoring of antibiotic residues and AMR in indicator bacteria in environment, farms, factories, slaughter house, wet market, processing unit, health care facilities, vet care facility (prioritization based on ground realities) (M)</td>
</tr>
<tr>
<td>• Assess infrastructure needs, accordingly build/strengthen appropriate infrastructure and capacity (M)</td>
</tr>
<tr>
<td>• Develop systems to adapt, standardize, compare data across countries (M)</td>
</tr>
</tbody>
</table>
## Surveillance of antibiotic use, residues and resistance

### Environmental surveillance of residues and resistance

#### Advocacy/awareness and education/training/curriculum

- Awareness campaigns on importance and need of environmental surveillance across stakeholders (**S-M-L)**
- Training needs assessment for those conducting surveillance (**S**)
- Development of training material, protocols and data management (**S**)
- Capacity building and training programme (including at university level) (**M**)
- Training of peer/participatory monitoring systems (**M**)
- Advocacy at community/institutional level based on surveillance data reports (**S-M-L**)

#### Record keeping/database generation/collation/dissemination and research/survey

- Data collection, collation and analysis at regional and sub-regional level (**S-M-L**)
  - Selection of sentinel sites to begin with
- Correlation with animal antibiotic use and AMR data (**S-M-L**)
- Development of an online integrated information system and publishing of annual reports and public dissemination of data to ensure transparency (**M**)
- Develop early warning system (**S**)

#### Review/monitoring/feedback

- Periodic review and mapping of data with antibiotic use and resistance in animal and human for continued advocacy, awareness and future policy and practice (**S-M-L**)

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**Note:** 

- **S** indicates activities prioritized by stakeholders.
- **M** indicates activities prioritized by managing authorities.
- **L** indicates activities prioritized by local communities.
**SNAPSHOT**

Environment management to contain antimicrobial resistance

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<tr>
<th>ENVIRONMENT MANAGEMENT TO CONTAIN ANTIMICROBIAL RESISTANCE</th>
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<tbody>
<tr>
<td>Registration/licensing (based on environment risk assessment)</td>
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<tr>
<td>Review/monitoring/ feedback</td>
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Environment management to contain antimicrobial resistance
Registration/licensing (based on env. risk assessment)

- **Policy on registration** of farms, factories, slaughter houses, wet markets, processing units, feed manufacturers, health care facilities, veterinary care facilities *(S)*
- **Siting guidelines and licensing** for farms, factories, slaughter houses, wet markets, processing units, feed manufacturers, health care facilities, veterinary care facilities *(S)*
- **Policy on environment risk assessment** for registration and renewal of antibiotics for humans and animals *(M)*

- **Regulatory system for enforcement** of laws, ensuring compliance with adequate funding and capacity *(M)*
  - Small producers to be facilitated through required measures
- **Tool for environmental risk assessment** for siting, registration and renewal of antibiotics *(S)*
Environment management to contain antimicrobial resistance
Registration/licensing (based on env. risk assessment)

- Sensitise regulators, industry and farmers (S)
  - Inclusion of environment management in antibiotics awareness week
- Build capacity of regulators (S)
- Development of customised material for awareness and training (S)

- Public database of licensed farms, factories, human and veterinary healthcare settings (S)

- Comprehensive review framework for policy/regulations and standards (S-M-L)
### Environment management to contain antimicrobial resistance

**Biosecurity/sanitation & hygiene/good manufacturing practices**

<table>
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<tr>
<td>Development of guidelines, best practices for farms, factories, slaughter houses, wet market, health care facilities, veterinary care facilities (S)</td>
<td>Regulatory system for enforcement of laws, ensuring compliance with adequate funding and capacity (M)</td>
<td>Adopt progressive pathways to improve management (S-M-L)</td>
<td>Develop incentives and disincentives for compliance including performance benchmarks and rating system (such as through pond and farm health cards) (S)</td>
</tr>
<tr>
<td>Training and hand-holding on biosecurity (S)</td>
<td>Sector-specific manuals and guidelines on progressive management pathways to improve environment management (M)</td>
<td>Inclusion of biosecurity in farmer-field school curriculum or similar such approaches (S)</td>
<td>Database on biosecurity/sanitation and hygiene/GMP compliance performance/ rating system (depending on local circumstances decision on public disclosure can be made) (M)</td>
</tr>
<tr>
<td>Review of progressive pathways to improve biosecurity management (S-M-L)</td>
<td>Review of guidelines for their success and impact (S-M-L)</td>
<td>Review/ monitoring/ feedback</td>
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**Note:**
- (S) = Small scale
- (M) = Medium scale
- (L) = Large scale
### Environment management to contain antimicrobial resistance

#### Waste management

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<tr>
<td><strong>Waste management</strong></td>
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<tr>
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<tr>
<td>• Standards for antibiotic residues and microbial quality in effluent and solid waste from industries, sewage treatment plants, farms, health care facilities, processing units, slaughter houses <em>(S)</em></td>
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<tr>
<td>• Policy on Extended Producers Responsibility for expired antibiotics <em>(S)</em></td>
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<td></td>
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<tr>
<td>• Standard Operating Procedures (SOPs) on waste management for industries, sewage treatment plants, farms, health care facilities, processing units, slaughter houses, wet market, feed manufacturers <em>(S)</em></td>
</tr>
<tr>
<td>• Regulatory system for enforcement of laws, ensuring compliance with adequate funding and capacity <em>(M)</em></td>
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<tr>
<td>• Stakeholder training on waste management guidelines and SOPs <em>(S)</em></td>
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<tr>
<td>• Online database on waste discharge quality, rating system, compliance/non-compliance <em>(M)</em></td>
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<tr>
<td>• Development of success/failure indicators/milestones as part of review framework <em>(M)</em></td>
</tr>
<tr>
<td>• Compliance status with review framework <em>(S-M-L)</em></td>
</tr>
</tbody>
</table>

**Review/Monitoring/Feedback**
Environment management to contain antimicrobial resistance: Research

Policy/Law/Regulations/Standards/Programmes

- Assessment of situation/knowledge on residues and AMR bacteria in effluents & wastes for policy making and regulations (S)
- Programme for developing and promoting innovation in environmental monitoring (S)

Implementation tools - Infrastructure/Capacity/Systems/Resources

- Development and adoption of test protocols (S)
- Research on waste treatment technology w.r.t. resistant bacteria, genes, APIs (S-M-L)
- Research on transmissions pathways of AMR among different environment compartments including human, animal and agriculture for prioritizing intervention (S-M-L)
- Cost-benefit analysis to assess socio-economic implications of antibiotics use (M)
- Documentation of best practices (M)
## Environment management to contain antimicrobial resistance

### Research

<table>
<thead>
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<th>Advocacy/ Awareness and Education/ Training/ Curriculum</th>
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<tr>
<td>• <strong>Survey of existing knowledge, attitude and practice at ground level</strong> <em>(S)</em></td>
</tr>
<tr>
<td>• <strong>Stimulation of international collaboration on research related to AMR</strong> <em>(M)</em> practice <em>(S-M-L)</em></td>
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<td>• <strong>Centralised database</strong> on ongoing research/ research output <strong>(S)</strong></td>
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<tr>
<td>• <strong>Sharing data on an international platform</strong> <em>(for e.g., Global Environment Monitoring System)</em> <em>(S-M-L)</em></td>
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<tr>
<td>• <strong>Review of research agenda for future policy and practice</strong> <em>(S-M-L)</em></td>
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For information contact:

Amit Khurana
K_amit@cseindia.org

Rajeshwari Sinha
S_rajeshwari@cseindia.org