World Organisation for Animal Health

Australian Government
Department of Agriculture, Fisheries and Forestry

UNIT 4
RISK VALUE CHAIN

Department of Emerging diseases and Global health

Animal Health Research Centre (CISA)

Institute for Agronomic and Food Research (INIA)

Spain's Research Council (CSIC)

Contact: martinez.marta@inia.csic.es

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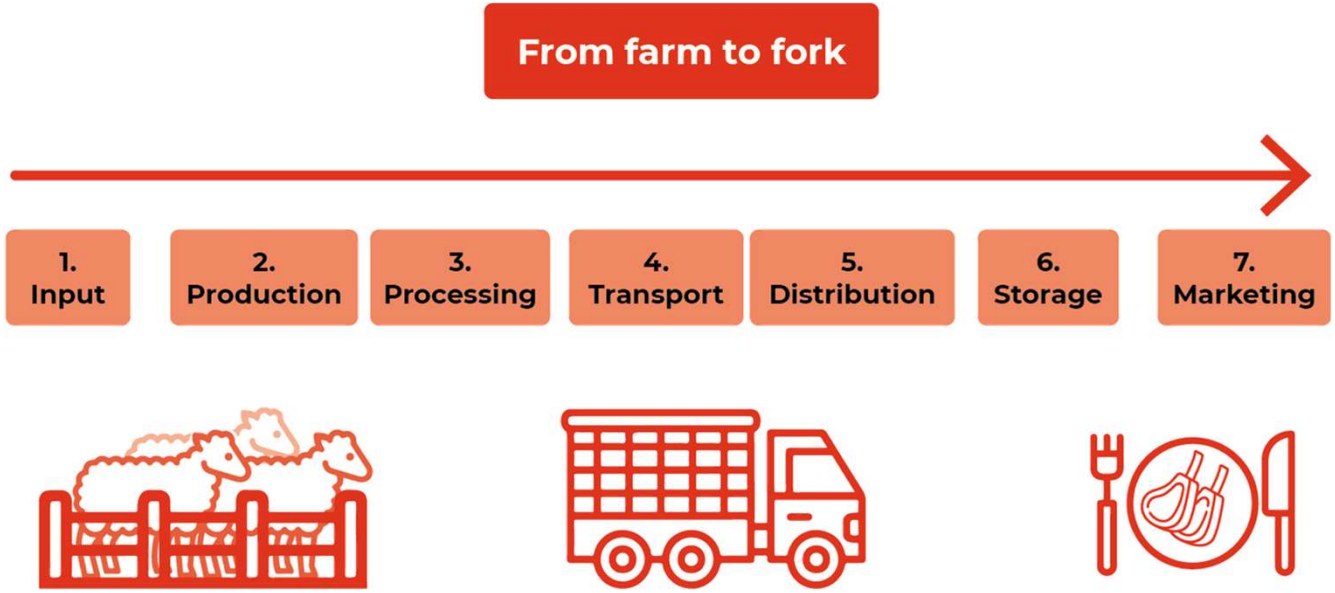
Outline

- Value chain
- Value chain and disease risk
- Risk-based methodology
- Value chain mapping
- Exercise on identification of stakeholders
- Exercise on identification of risk pathways
- Exercise on identification of critical control points

Value chain

A **value chain** is a sequence of activities through which animals and animal products move from production to consumption. It consists of:

- Input
- Production
- Processing
- Transport
- Storage
- Marketing

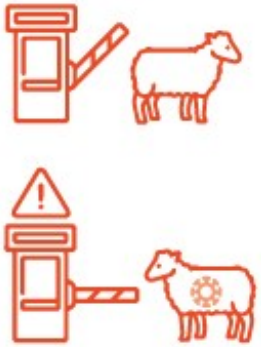


Any **vulnerability** at these points **amplifies disease risk**

Understanding the value chain

- Identification of **critical points** for disease introduction and transmission
- **Biosecurity enhancement** where disease risk is highest at various stages of the chain
- **Outbreak investigation**: facilitating origin and spread of diseases (back- and forward- tracing)
- **International trade** and disease imports: to implement proper quarantine, testing, inspection protocols, etc
- **Economic impact assessment**: planning appropriate responses and targetting interventions to minimize disruption to unaffected parts of the chain or to model potential disruptions

Understanding the value chain

Identification of critical points for disease introduction and transmission	Biosecurity enhancement	Outbreak investigation	International trade and disease importation	Economic impact assessment
				

Value chain and disease risk

The interconnected nature of these chains increases disease risks through:

Uncontrolled animal movement and trade

Contaminated inputs (water, feed, bedding…)

Inadequate hygiene or temperature control

Poor biosecurity at markets, abattoirs or storage

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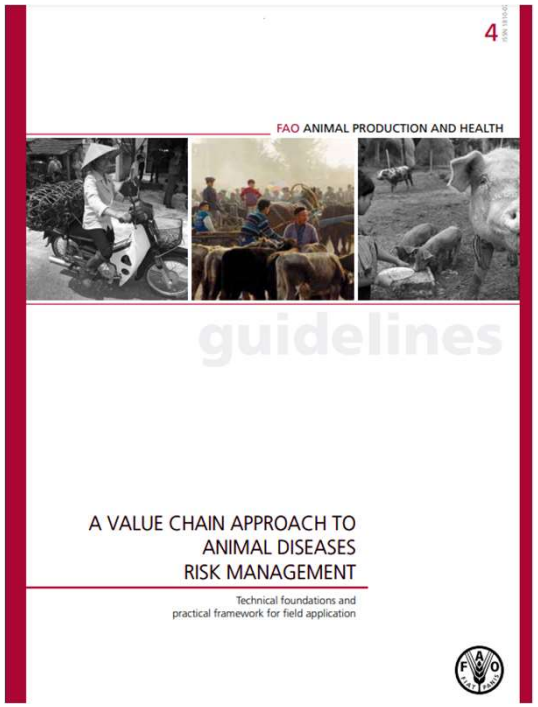
Risk-based methodology for effective disease control



- Value chain analysis: Identifies **production and trade networks** that influence disease movement
- Risk assessment: Determines **high-risk hotspots** where interventions are needed.
- Stakeholder involvement: Involves producers, traders, and regulators in **risk reduction strategies**

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Value chain mapping for disease prevention: define the objective

1. **Identify transmission hotspots**– e.g. live markets, transport routes
2. **Trace movement pathways** – Map animal movement and trade networks
3. **Track potential disease introduction points**– e.g. imports, border crossings
4. **Improve outbreak response strategies**

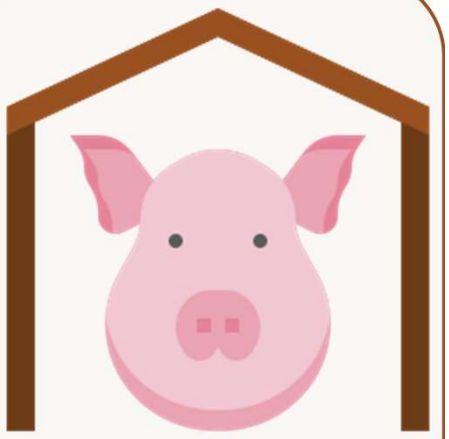
Example: If the focus is African Swine Fever (ASF) surveillance, the map should track **pig movement**, **slaughterhouses**, **feed suppliers**, and **high-risk borders**.

Value chain mapping for disease prevention: steps

1. **Identify key stakeholders** – Farmers, traders, slaughterhouses, retailers
2. **Trace movement pathways** – Map **how livestock moves** between regions, including informal trade
3. **Recognize high-risk nodes** – **Markets, transport hubs, and processing centres** often act as **amplification points**
4. **Assess biosecurity gaps** – Identify **weak points** in quarantine, hygiene, and surveillance
5. **Develop risk mitigation strategies** – Implement measures like **movement restrictions, vaccination programmes, and improved sanitation**

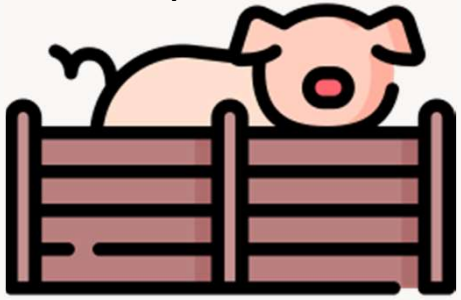
Identification of critical control points (CCPs) in the value chain

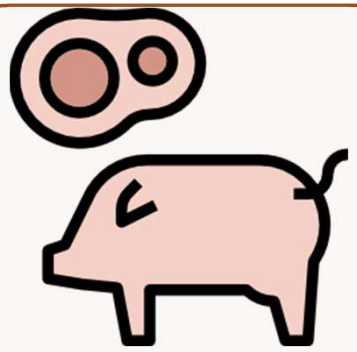
"Hotspots" or CCPs along the chain



Farm, slaughterhouse or live market

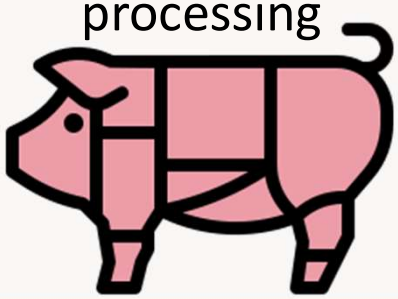
Transport

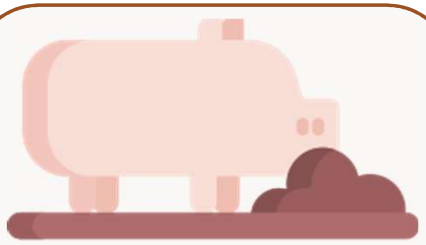




Butcher, retailer

Slaughter and processing





Feed contamination

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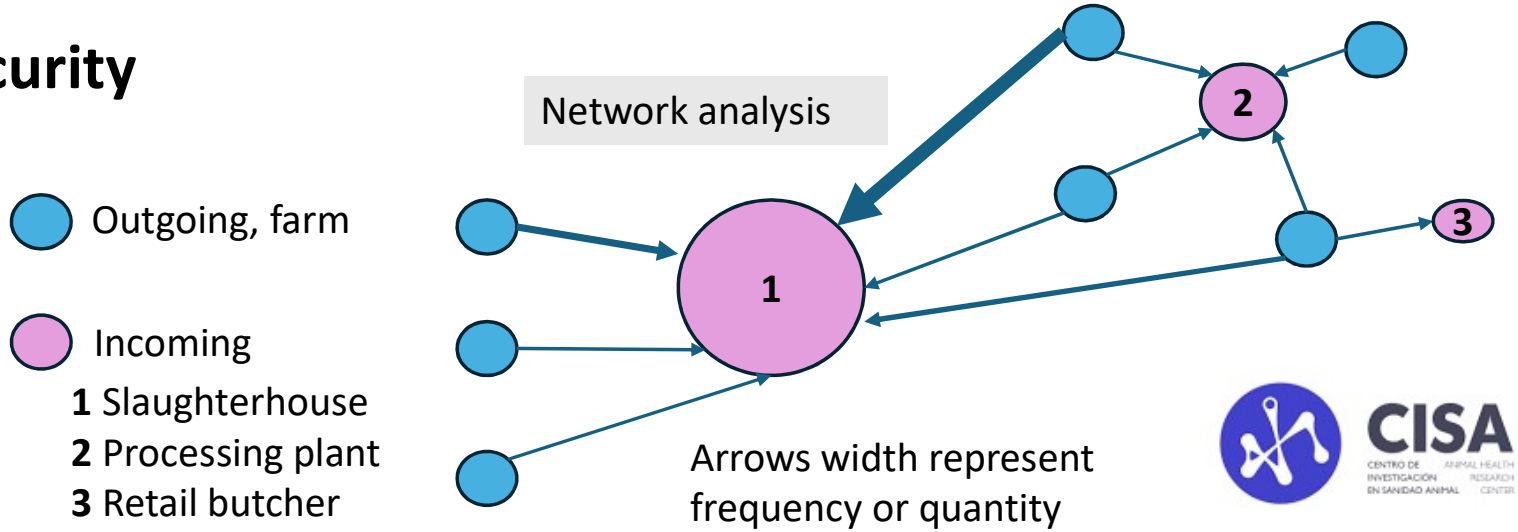
What to consider in CCP identification

- **Source and commodity:** disease risk, health checks
- **Movements**: origin, destination, quantity. Is there a risk amplification point? i.e. premises receiving movements from many different sources or distributing to many different destinations. Method: Network analysis
- **Biosecurity**



What to consider in CCP identification: risk assessment exercise

Select one of the following

1) Identify **potential movements to and from** the chosen premises
2) Identify potential **CCP** to assess the **value chain disease risk** at entry, spread and impact at one of these sites. Then think of **risk-based measures to minimize the risk** at each CCP

Solution example:
1) Potential movements

Incoming movements	Outgoing movements
Live animals: farms, households, import company	Processing plant
Slaughtered animal: slughterhouse, household, import company	Market
	Coldstore
	Export

Slaughterhouse & processing plants

Solution example:
2) Identification of CCP

Entry (E)	Spread (S)	Impact (I)
Origin of animals	Lairage conditions	Quantity processed
Health status of animals	Health status of animals	Number of sourcing farms
Number of animals processed	Cross-contamination	Distance to farms
Location	Distance to farms	Number of destination plants

Slaughterhouse & processing plants

RISK = E x S x I

Solution example:
CCP risk-based measures

Entry (E)	Spread (S)	Impact (I)
Origin of animals: animal or batch identification	Lairage conditions: biosecurity, C&D	Quantity processed
Health status of animals: certificate, vet inspection	Health status of animals: Ante-mortem health checks	Number of sourcing farms
Number of animals processed: C&D, welfare	Cross-contamination: biosecurity, training	Distance to farms
Location: biosecurity	Distance to farms: C&D	Number of destination plants

Slaughterhouse & processing plants

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Quiz question: risk-based surveillance and value chain mapping

Which of the following are benefits of using value chain mapping for risk-based disease surveillance? (Select all that apply)

✓ A) Identifying high-risk disease transmission points such as markets and transport routes

✓ B) Improving targeted surveillance by focusing on known disease hotspots

✗ C) Eliminating the need for laboratory testing and diagnostics

✓ D) Enhancing early detection of outbreaks by tracking animal movement patterns

✓ E) Supporting rapid response planning by visualizing disease spread pathways

*Value chain mapping helps identify **critical control points** for disease transmission, improves **surveillance efficiency**, enhances **early outbreak detection**, and supports **response planning**. However, **laboratory testing remains essential** for confirming disease presence.*

Classifying the risk of a value chain

Risk = Likelihood of disease entry x Amplification potential x Impact

Example:

Classification	Entry	Amplification	Impact
Low-risk	Strict biosecurity, controlled movements	Strict biosecurity, quarantines	Minimal economic impact, contained outbreaks
Moderate-risk	Controlled movements, some biosecurity gaps	Some control, but spillovers possible	Localized losses, temporary market closure
High-risk	Frequent movements, weak biosecurity	High animal density, weak movement control	Trade bans, mass culling required

Assigning risk score of a value chain

Risk = Likelihood of disease entry x Amplification potential x Impact

Example:

Entry	**Amplification**	**Impact**	**Final Risk Score**
High	High	Severe	**Very High (🦠🦠)**
High	Moderate	Moderate	**High (🦠)**
Moderate	Low	Moderate	**Medium (⚠)**
Low	Low	Low	**Low (✓)**

Risk management of a value chain

Risk = Likelihood of disease entry x Amplification potential x Impact

Example:

✓ **Low Risk** – Requires **routine monitoring**.

⚠ **Moderate**– Needs **active surveillance and biosecurity upgrades**.

🚨🚨 **Very High Risk** – Requires **urgent interventions and movement controls**

Value chain map– Data for analysis

Farm data:

- Location
- Species
- Type of production
- Number of animals
- Health records
- Biosecurity status

Market and trade data:

- Frequency of sales (movements per day, week or month)
- Volume of trade (number of animals or products, or kgs)
- Commodity
- Origin/ destination

Movement records:

- Date
- Source and destination
- Type of commodity
- Quantity
- Route
- Control measures pre-movement

Value chain map – Data for analysis

Slaughterhouse data:

- Location
- Species
- Capacity
- Source and destination
- Vet inspection
- Waste disposal
- Biosecurity

Economic/market

- Market trends
- Regional disease outbreaks

Disease surveillance, disease trends:

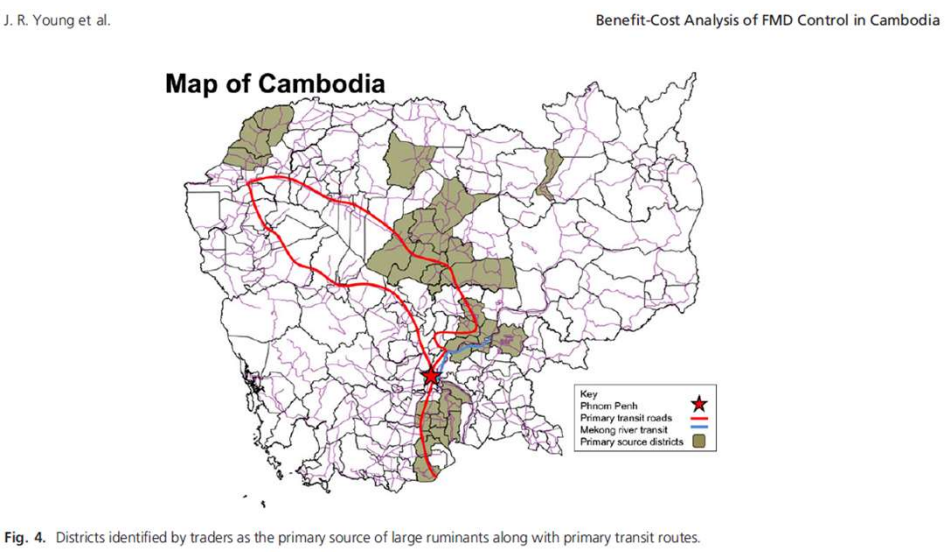
- Outbreak history and investigation records
- Surveillance design and results
- Clinical signs, suspicion records
- Lab tests
- Vaccination status

Creating a value chain map in GIS software

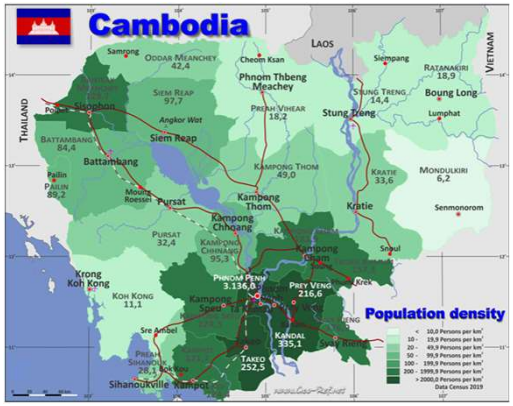
1. Open your GIS software
2. Add data layers – Upload livestock movement data, market locations, and disease outbreak reports.
3. Mark key locations – Use colour codes for high-risk vs. low-risk areas.
4. Connect nodes – Draw lines between farms, markets, transport routes, and processing centres to visualize disease transmission pathways.

Use digital tools to visualize disease risk

- **Heatmaps** – Show **high-density animal trade areas**.
- **Real-time outbreak tracking** – Integrate **disease alerts** with GPS data.
- **Movement restriction zones** – Highlight **quarantine and containment areas**



Young et al., 2014, doi:10.1111/tbed.12292



Geo-ref.net/khm.htm

Analyze and interpret the map

Key questions to answer:

- **Where are the disease hotspots?**
- **Which transport routes are high-risk?**
- **Which farms/markets need urgent surveillance?**
- **Are there seasonal disease patterns?**

Monitor and update the map regularly

Since disease dynamics change over time, value chain maps need to be regularly updated. Accuracy could be maintained through:

📅 **Monthly surveillance reports** – Update **animal movement and outbreak data**.

📱 **Crowdsourced disease alerts** – Farmers can **report symptoms via mobile apps**.

📍 **New trade route monitoring** – Identify **emerging high-risk corridors**.

💡 **Integrating machine learning** – AI-based tools can predict **future outbreak risks**.

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Conclusion. Digital value chain mapping is a game-changer

🚀 Prevents disease outbreaks by identifying risk hotspots early.

📍 Optimizes surveillance efforts in rural areas.

🔍 Enhances traceability and movement control measures.

📊 Improves communication between farmers, veterinarians, and policymakers.

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