Royal Veterinary College
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Importance of assessing the economic impact of disease

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- Thank you to SASVEPM for inviting me and giving me the honour of presenting at the conference
- I want to recognise the support of Norbrook Pharmaceuticals and LCIRAH in the work I carry out

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Introduction - What is economics?

- A strict definition of economics would be the *study of the use of scare resources with competing demands*
- The starting point when using an economic approach would be to develop an **understanding of the allocation of resources** in the system of interest, in order to:
  - Describe current allocation of resources
  - Determine if the allocation is **optimal**
  - Assess if the **reallocation** will lead to a situation closer to optimality

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Introduction - What is economics?

- Within this analytical framework there needs to be a recognition that at the time of any assessment:
  - There is a given **set of technologies**
    - There may well be better technologies available that are yet to be discovered
    - Discovery is influenced by **government policy** and powerful companies
  - There is a given **set of prices**
    - These prices could be set by the market – supply and demand
    - However they are likely to be influenced by **government policy** and/or sheer power by dominant buyers and/or sellers of goods

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Introduction - The institutional environment

- The additional aspects form the **institutional environment**
- They include the **rules** laid down by society for any process, be it consumption or production
- And include the **enforcement** of these rules
- This powerful **combination** of rules and enforcement **influence** the measure of **optimality** that is held so dear in economics

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Introduction

- Economics and animal health

- A societal strategy to manage a disease or a group of diseases is also defined by the animal health specialist
- The economist is brought in to:
  - Justify the focus on this disease – impact assessment
  - Determine if the strategy is economically profitable

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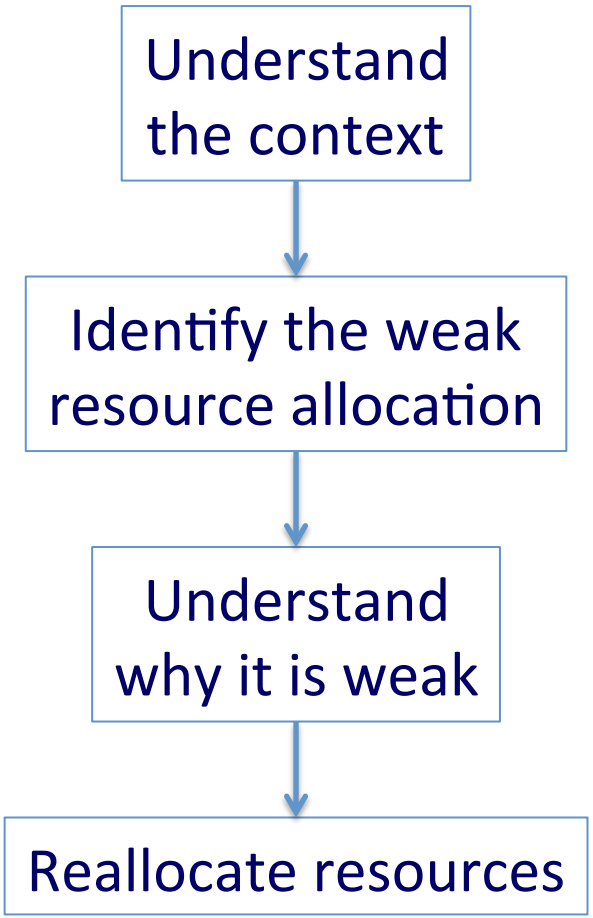
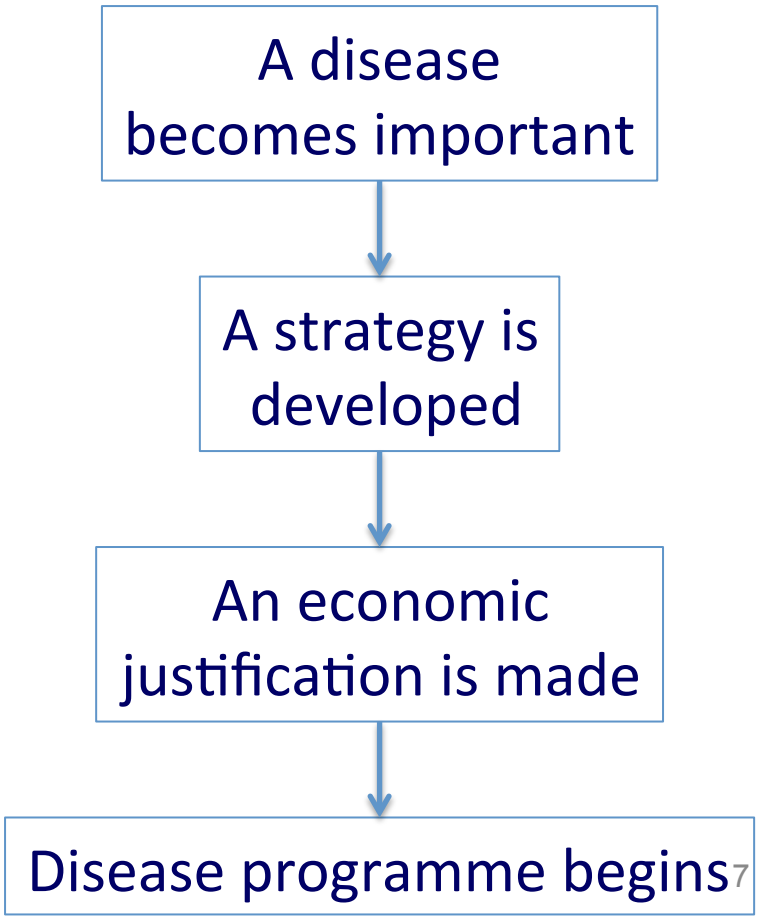
Introduction

- Differences in the approach

An economic approach



An animal health approach



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Introduction

- Differences in the approach

An economic approach

Understand the context

Adding value through searching for **optimality**

why it is weak

Reallocate resources

An animal health approach

A disease becomes important

Adding value through **advocacy**

An economic justification is made

Disease programme begins

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Introduction

- The challenge

- The pragmatic approach to animal health in many cases has worked
- Rinderpest has been eradicated globally, and a number of diseases have been eliminated from large populations of animals
- Plus animal health status of populations under the control of people has improved markedly

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Introduction

- The challenge

- The pragmatic approach to animal health in many cases has worked

So is there a need for a shift in how we do business?

- Plus animal health status of populations under the control of people has improved markedly

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Introduction

- Over the next three days I will cover three core areas:
  - the impact of the disease
  - the economic assessment of the intervention
  - How economics shapes responses to disease presence and risk
- My intention is to give an overview of the ways economics is being used in animal health and to indicate where there needs to be more research and implementation

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Introduction

- Over the next three days I will cover three core areas:
  - the impact of the disease

I will present arguments on the need for data capture and analysis systems that allow **PRIORITISATION**

  - economics is being used in animal health and to indicate where there needs to be more research and implementation

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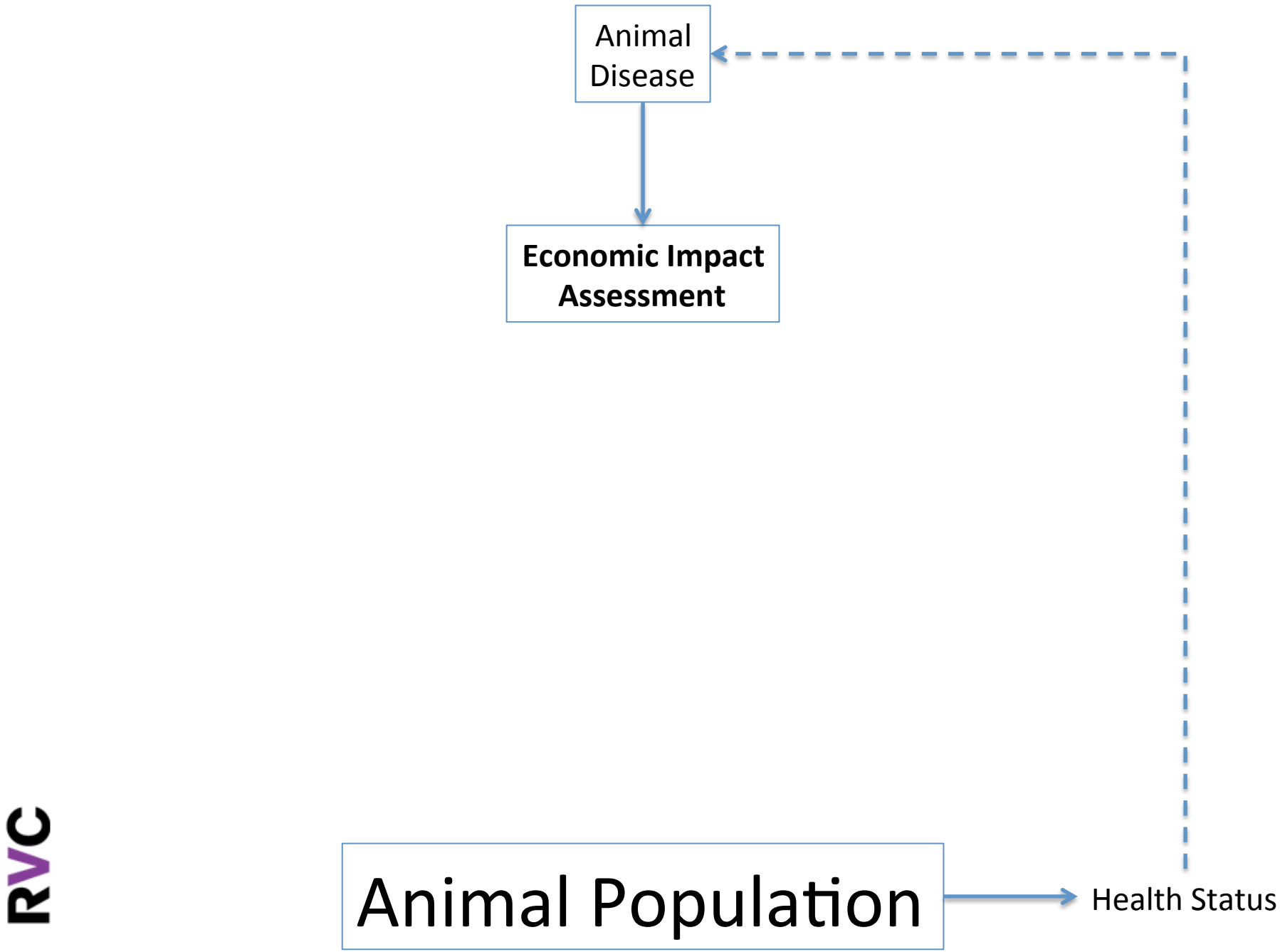
Animal Disease
Economic Impact Assessment
Animal Population
Health Status

Impact Assessment

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Question

What would you include in an economic impact assessment of an animal disease?

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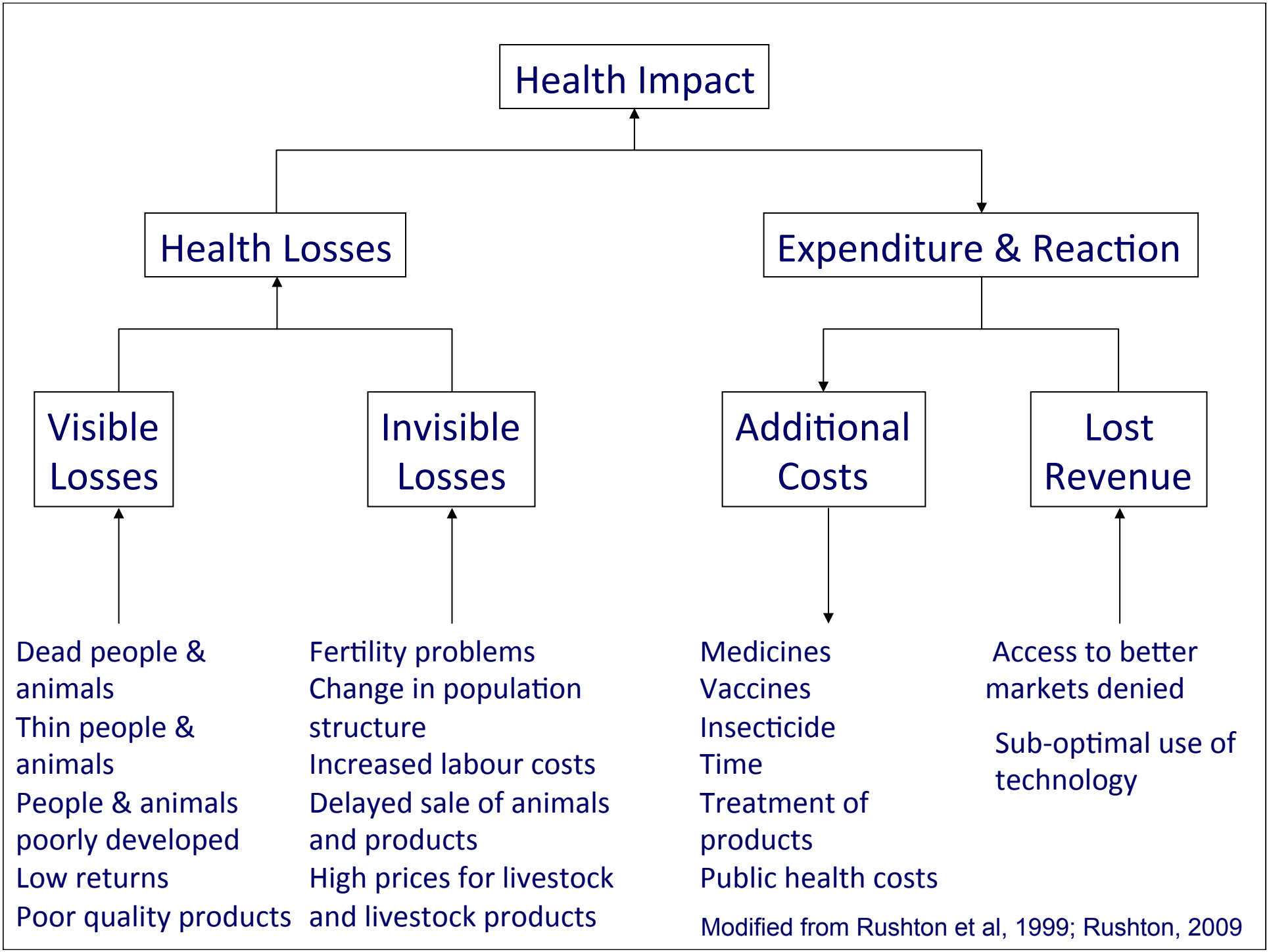
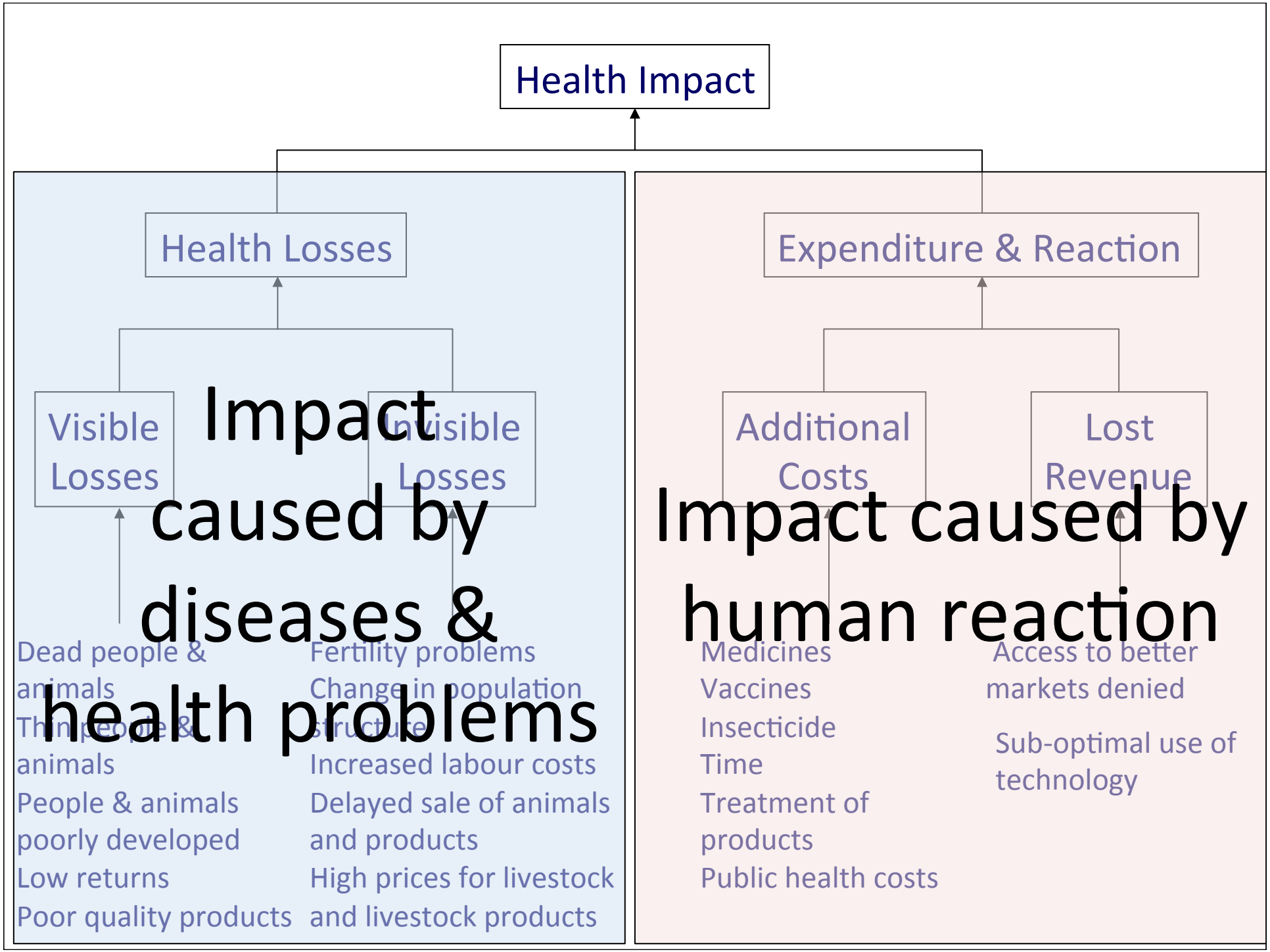

Health Impact
Health Losses
Expenditure & Reaction
Visible Losses
Invisible Losses
Additional Costs
Lost Revenue
Dead people & animals
Thin people & animals
People & animals poorly developed
Low returns
Poor quality products
Fertility problems
Change in population structure
Increased labour costs
Delayed sale of animals and products
High prices for livestock and livestock products
Medicines
Vaccines
Insecticide
Time
Treatment of products
Public health costs
Access to better markets denied
Sub-optimal use of technology
Modified from Rushton et al, 1999; Rushton, 2009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Impact caused by diseases & health problems
Impact caused by human reaction
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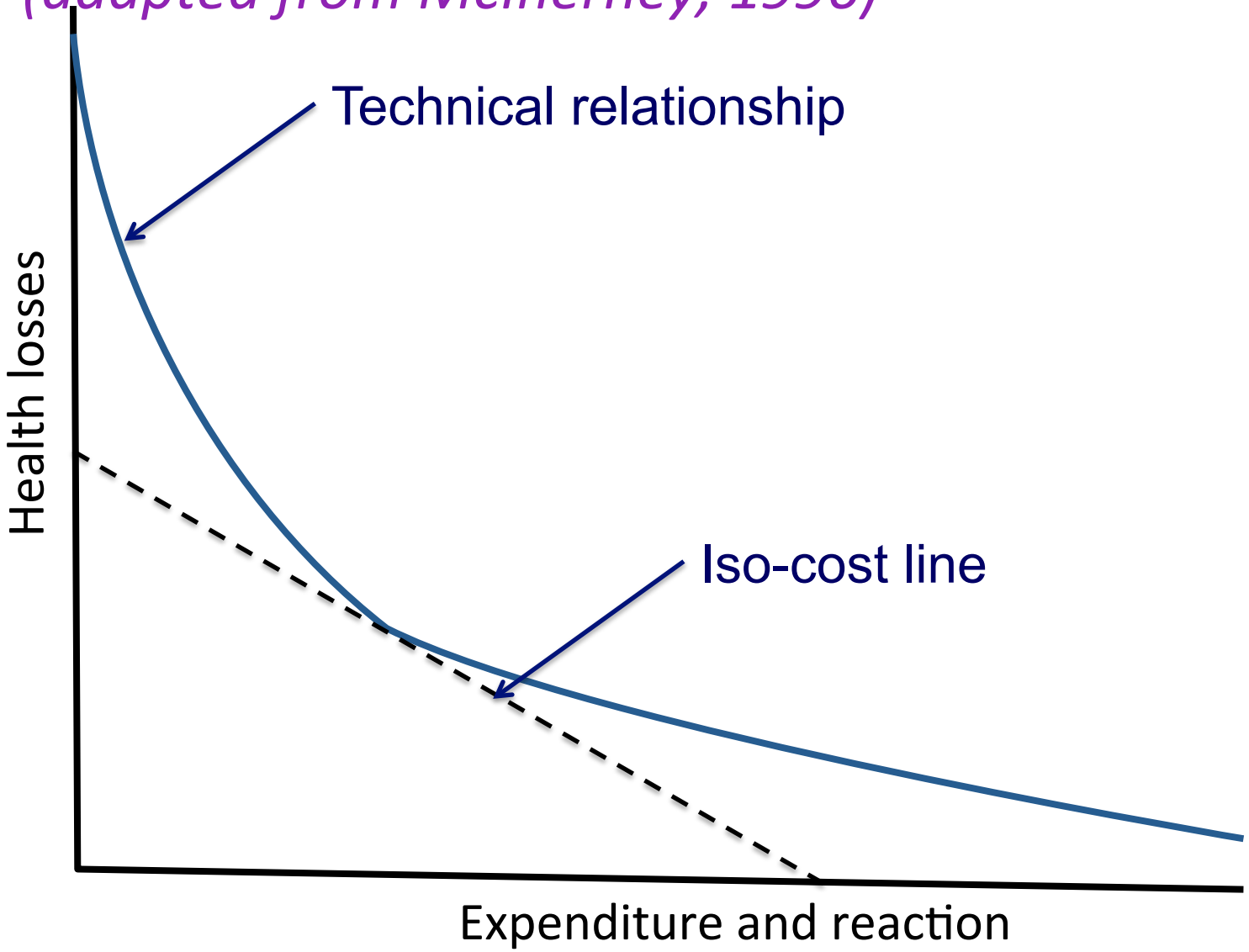
Health Impact

- Health Loss versus Expenditure and Reaction (adapted from McInerney, 1996)



Health Impact

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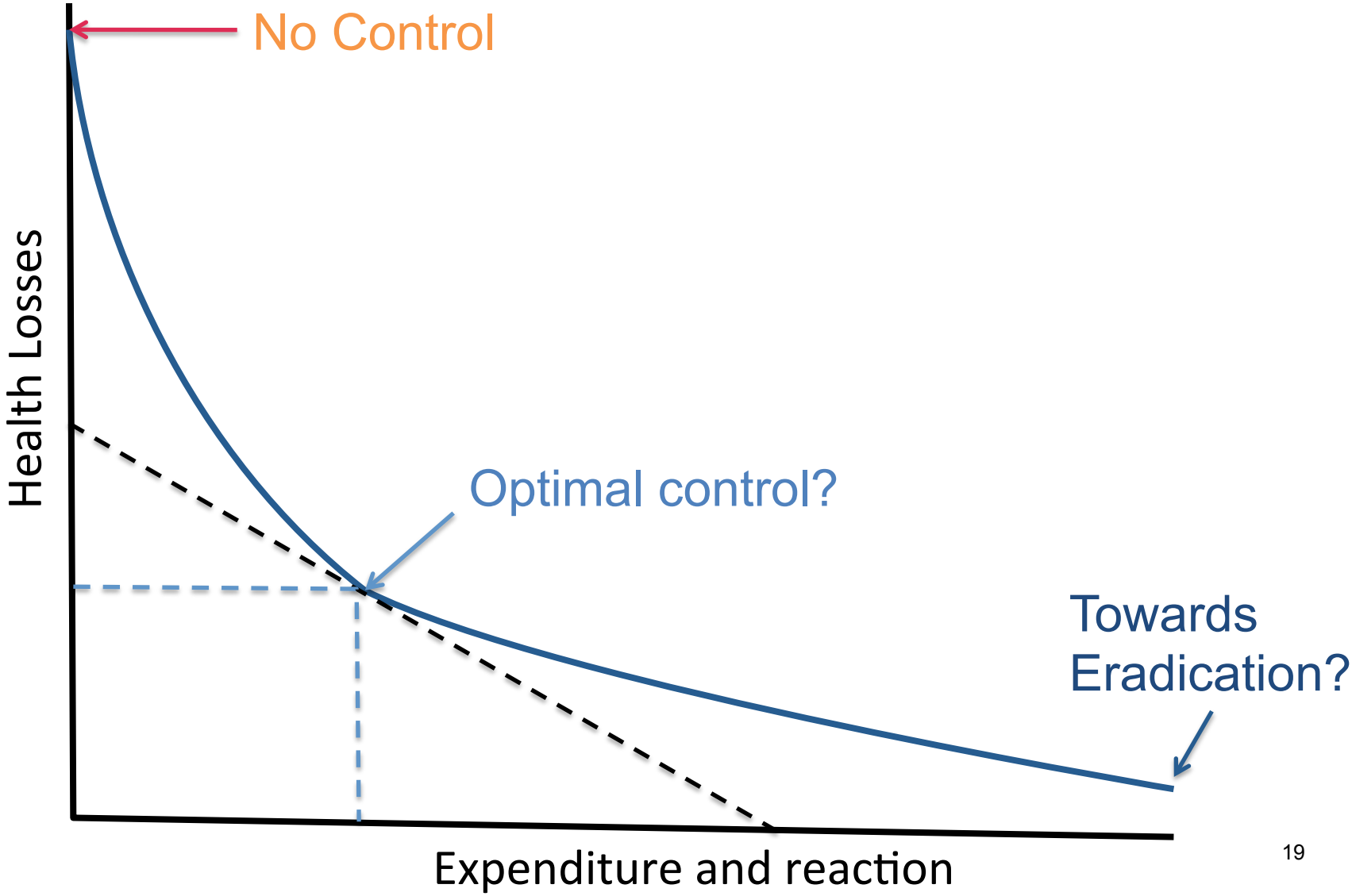

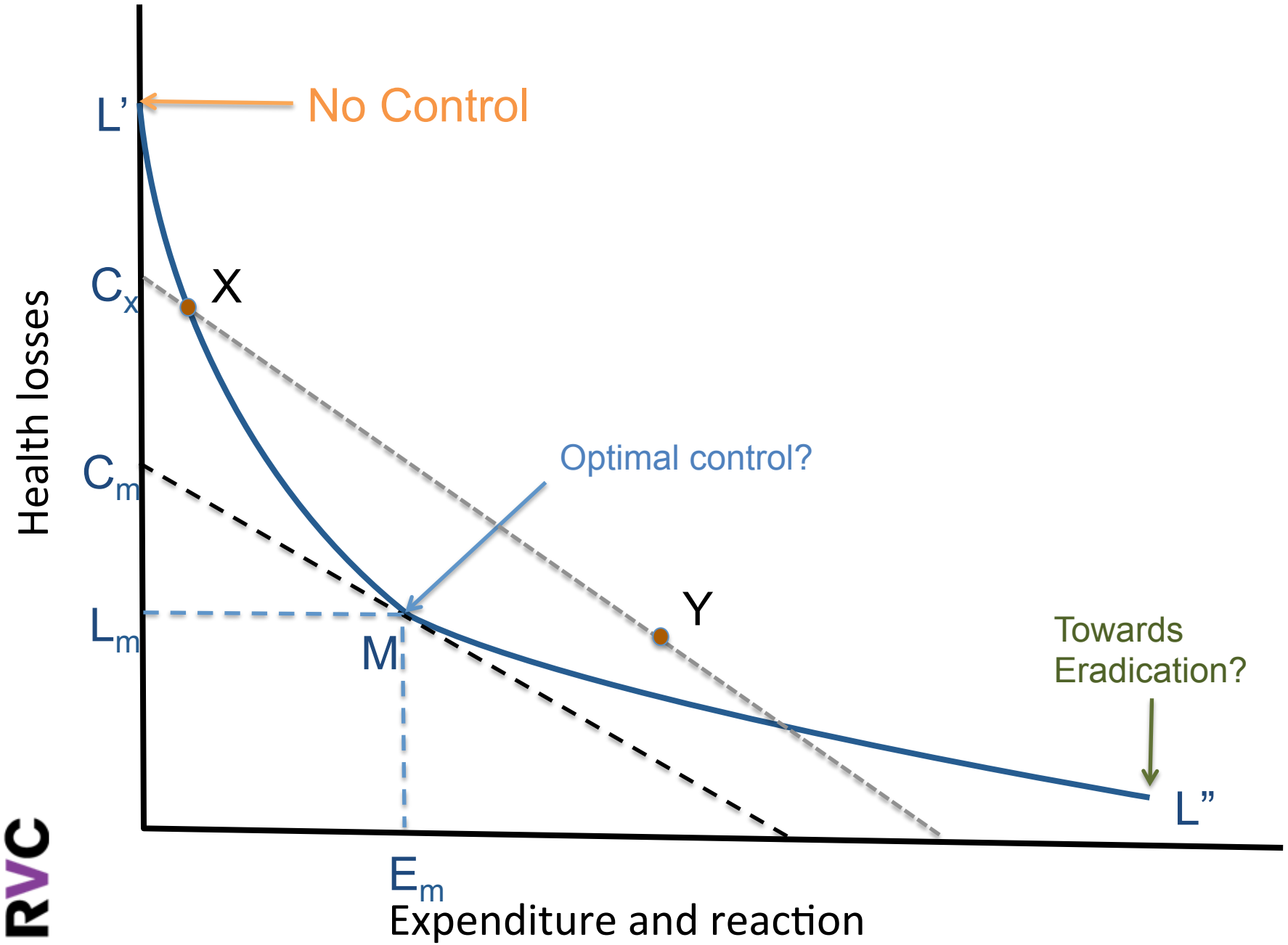
L'
No Control
C_x
X
C_m
Optimal control?
L_m
M
Y
Towards
Eradication?
L"
E_m
Health losses
Expenditure and reaction
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Economic Framework for Health

- Key issues

- **Ratio** between the **value** of **Losses** to the **value of Expenditure and Reaction** is critical to define the optimal control point
- **Health Losses** are based in **changes in biomass** of humans and animals
  - **Quantity** – human and animal lives saved
  - **Quality** – healthier humans and animals
  - **Efficiency of production** – great relevance to livestock
- The changes in biomass need to be valued

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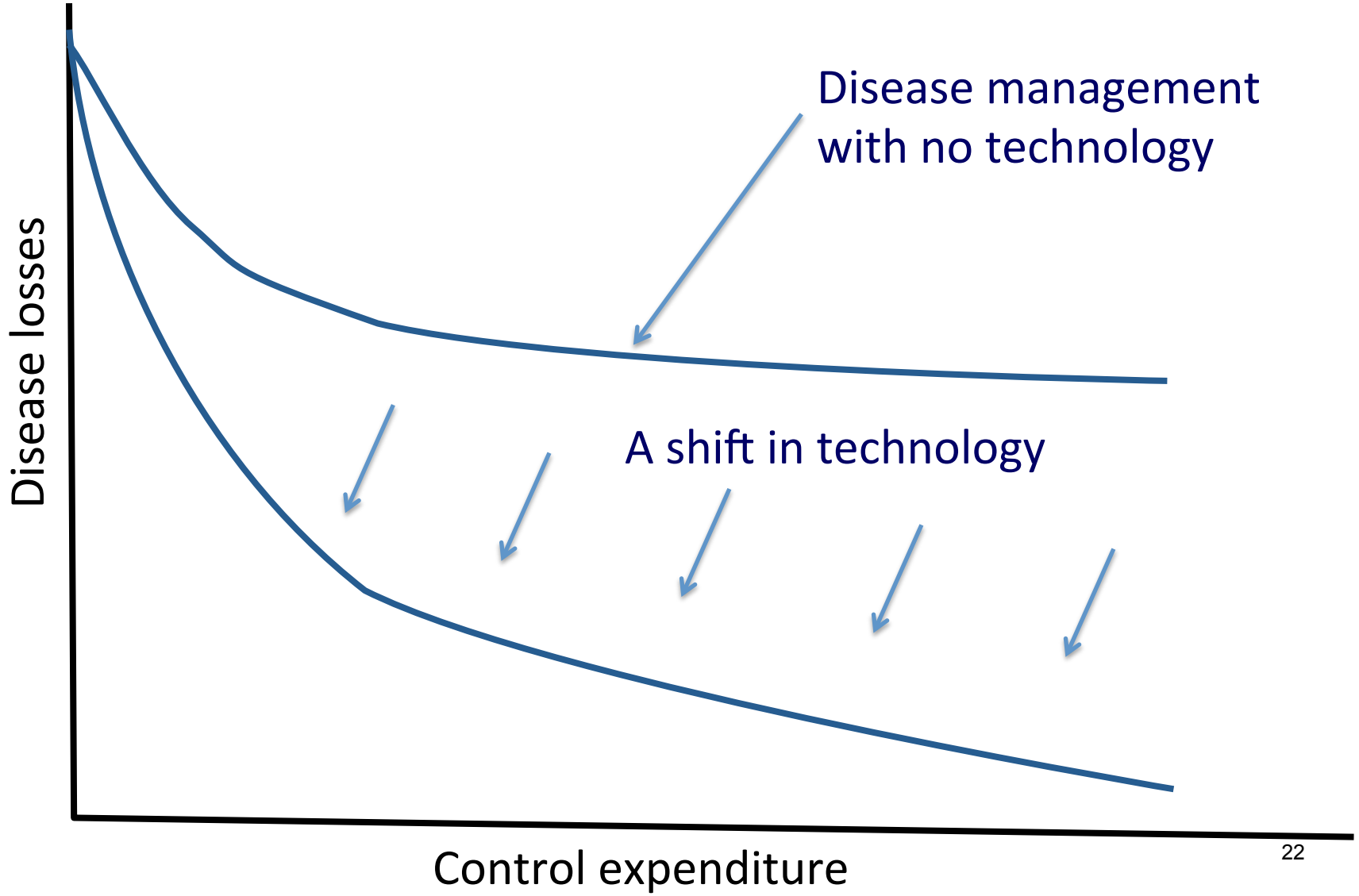
Change in technology



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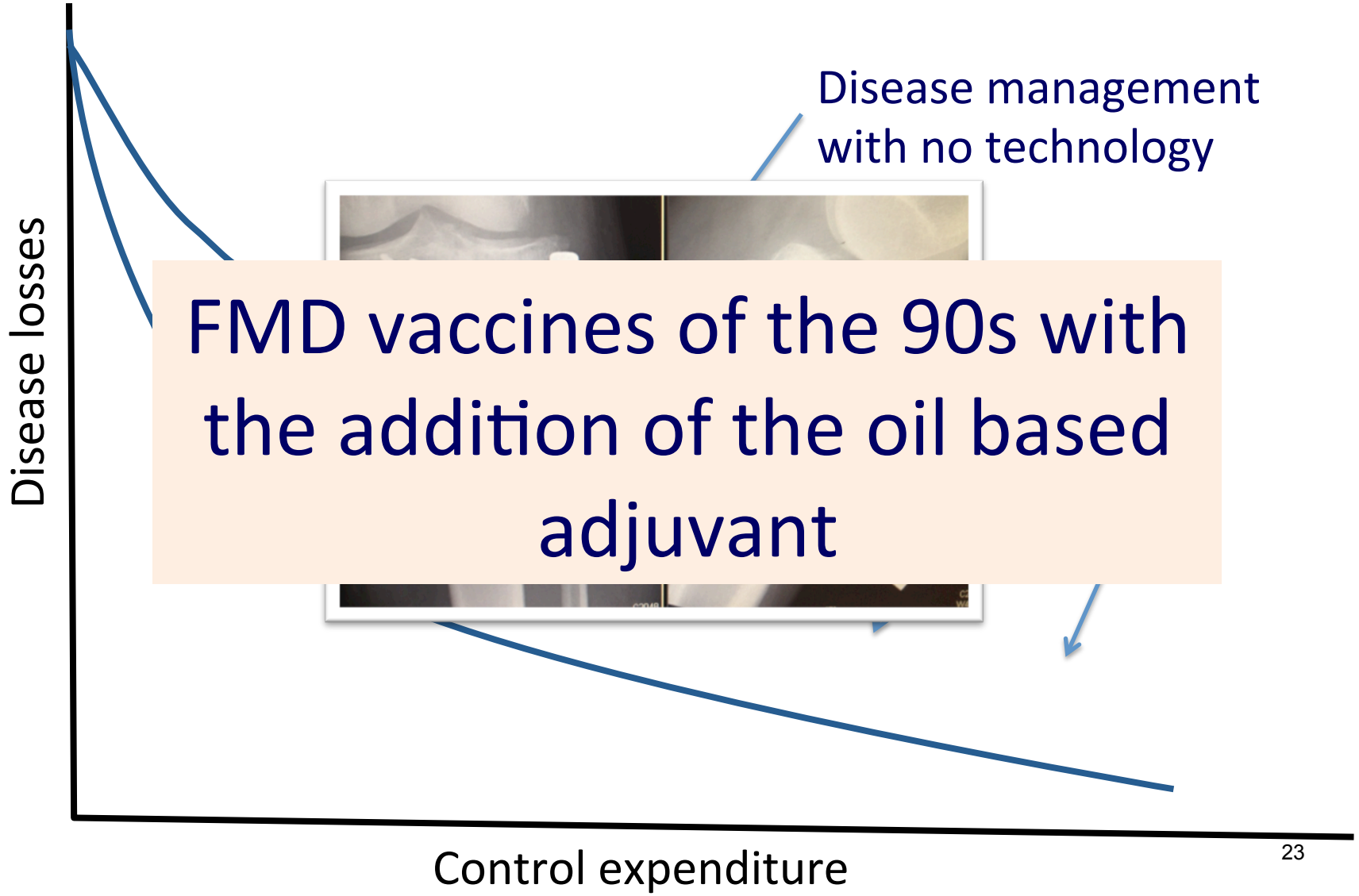
Change in technology



FMD vaccines of the 90s with the addition of the oil based adjuvant

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Expenditure issues
– *fixed and variable cost issues*

- The classic way of thinking about technology shifts is through the lens of technological advance
- There is a tendency to forget that many of our advances have come about through managerial and institutional development change
- And this requires **fixed cost** investments in health systems across the species
- Investments that need **public funding** support alongside **private sector engagement**

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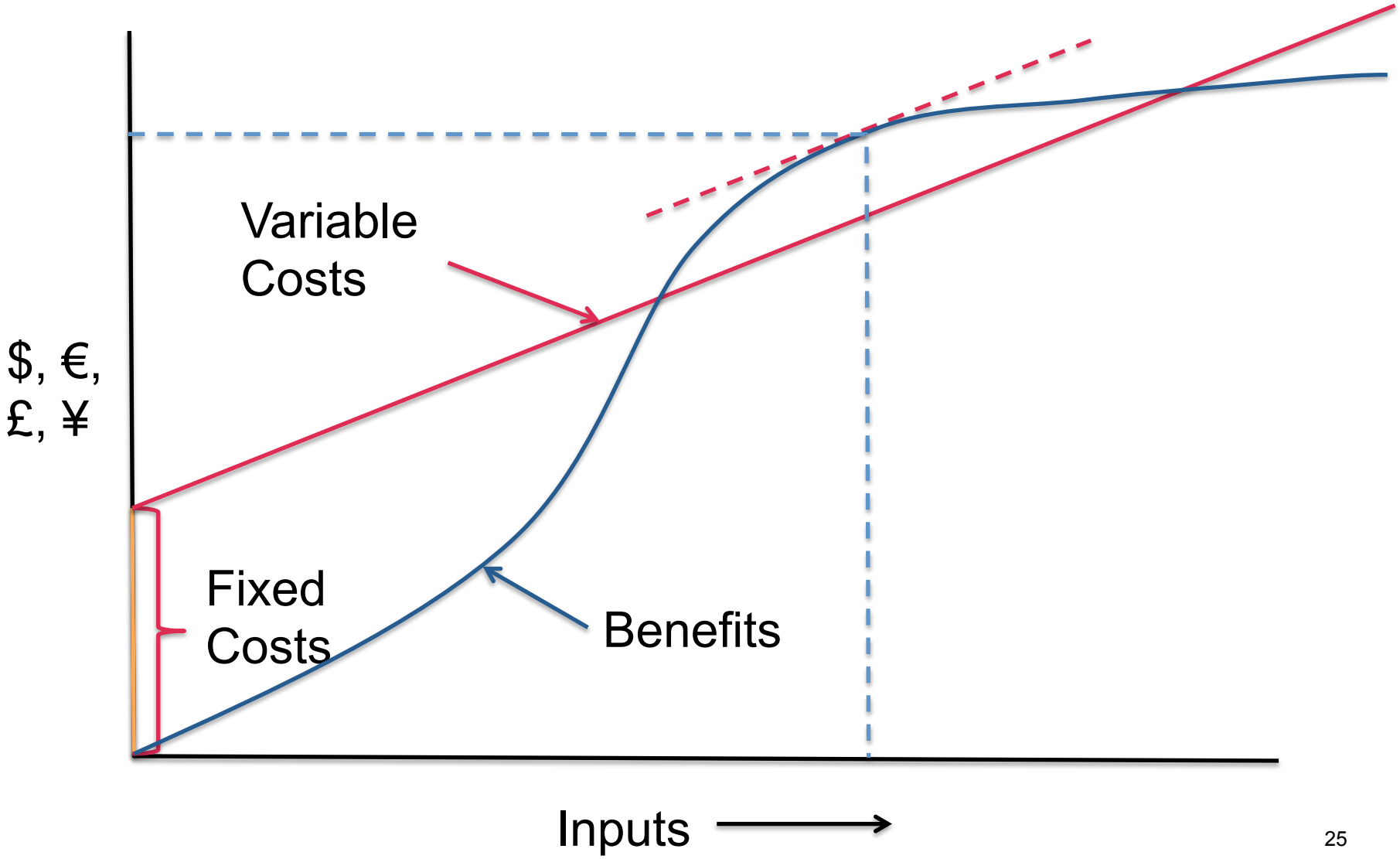
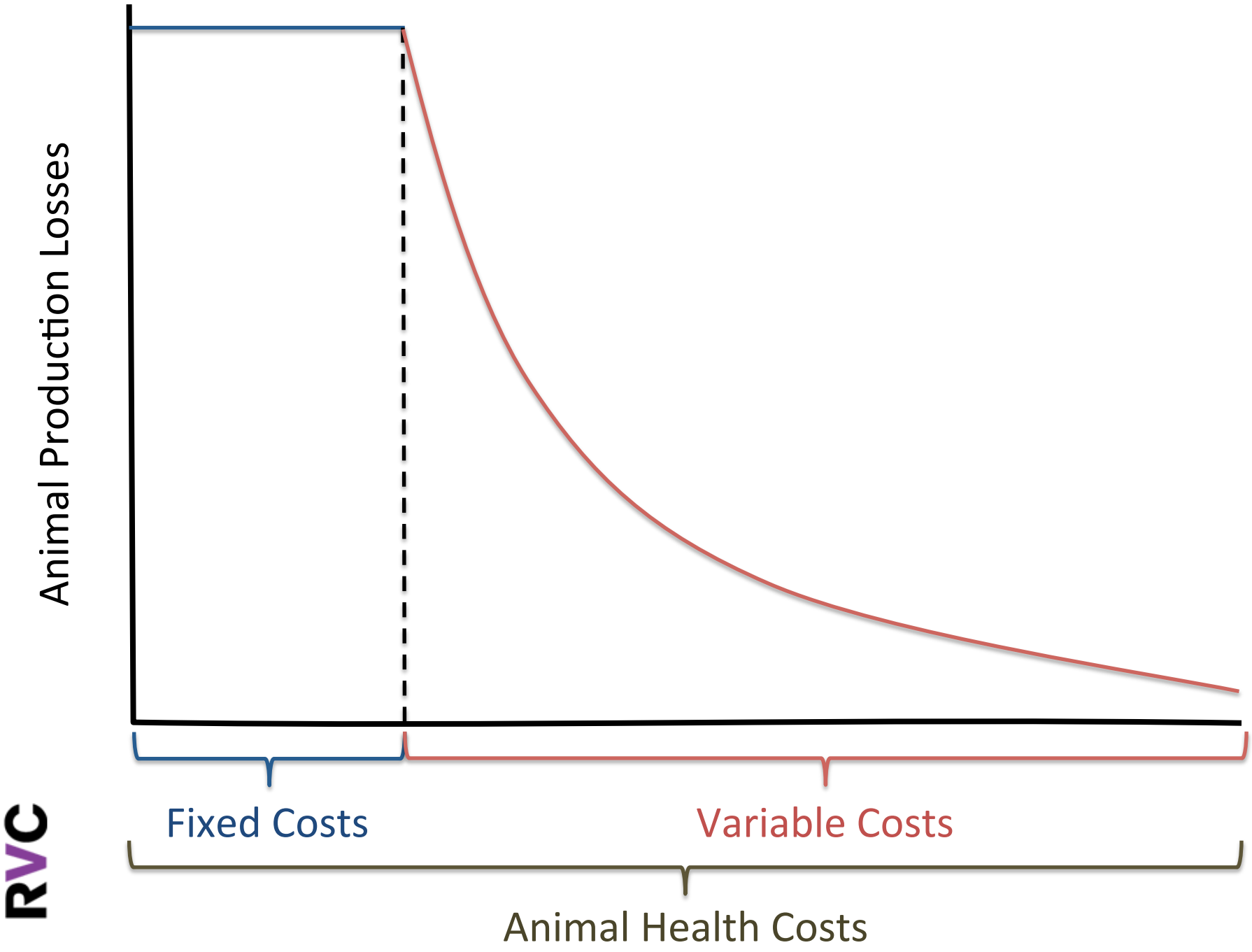
Cost benefit analysis with a fixed costs (adapted from Tisdell, 2009)




Animal Production Losses
Fixed Costs
Variable Costs
Animal Health Costs
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Importance of impact assessments

- Good impact assessments provide **support** for **advocacy** for disease management
- A series of impact assessments will indicate **resource allocation between diseases**
- Detailed impact assessments **indicate where resources** are being **used** to manage **a disease**
- They allow indicates of **misallocation** of **resource** and where resource use can be **improved**

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Disease impact assessments

- what has been done

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Searching for data

- So what is known about animal disease impacts?
- In a search for for reviews and development of data there are some global, regional and national studies
- Yet these studies are limited in number for individual diseases
- In the search for data there are no standardised methods being applied to assessment disease impact

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Studies encountered

- Reviews
  - CABI animal health and production compendium (Rushton, 2002; Rushton, 2009)
- At a global level
  - Global burden of disease – largely human disease (Horton, 2010)
  - World Bank Livestock Disease Atlas (World Bank, 2011)

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Studies encountered

- At a specific region level
  - ILRI's study on research for poverty alleviation funded by DFID (Perry et al, 2002)
- At a country level
  - MAFF funded study carried out by Richard Bennett and VLA in the 1990s (Bennett, 2003) and revised and updated in 2005 (Bennett & Ijeplaar, 2005)
  - FSA assessment of food borne disease burdens (Jones, 2009)
  - D2R2 – DEFRA tool (Simmons, 2011)

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Studies encountered

- Specific diseases
  - Otte et al (2008) – HPAI
  - Knight-Jones and Rushton (2012) – FMD
  - Alarcon et al (2013) – PMWS
- This is not an exhaustive list but provides some information on how to approach to assessing the impact of health issues

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Major results from the studies mentioned

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Global Burden of Disease (Horton, 2010)

- Global Burden of Disease was first initiated in 1990 funded by the World Bank
- It was repeated in 2007 supported by the Bill & Melinda Gates Foundation and published as a series of articles in 2010 in the Lancet
- 2007 work involved 486 scientists from 302 institutions in 50 countries

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Global Burden of Disease

- The initial study looked at 107 diseases and injuries, and assessed 10 risk factors
- The second was expanded to include 235 causes of death and 67 risk factors
- The 1990 study shifted health priorities with NCDs being given more attention.
- The availability of two studies at different points in time allow useful comparisons on what has improved and what needs further work.

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Global Burden of Disease

- The importance of this work in human health is great and lessons can be learnt both from the process of the development of the concepts and the implementation of this exercise.
- The questions for the current study is how has animal health responded?

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Global Animal Disease Studies

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CABI compendium

- CABI commissioned an assessment of the impact of livestock disease in 2001 to mirror their study of plant disease impacts
- The review revealed a lack of common methodology and some fundamental aspects of comparing disease across regions and countries
- Main points can be found in Rushton (2009) pages 193-197

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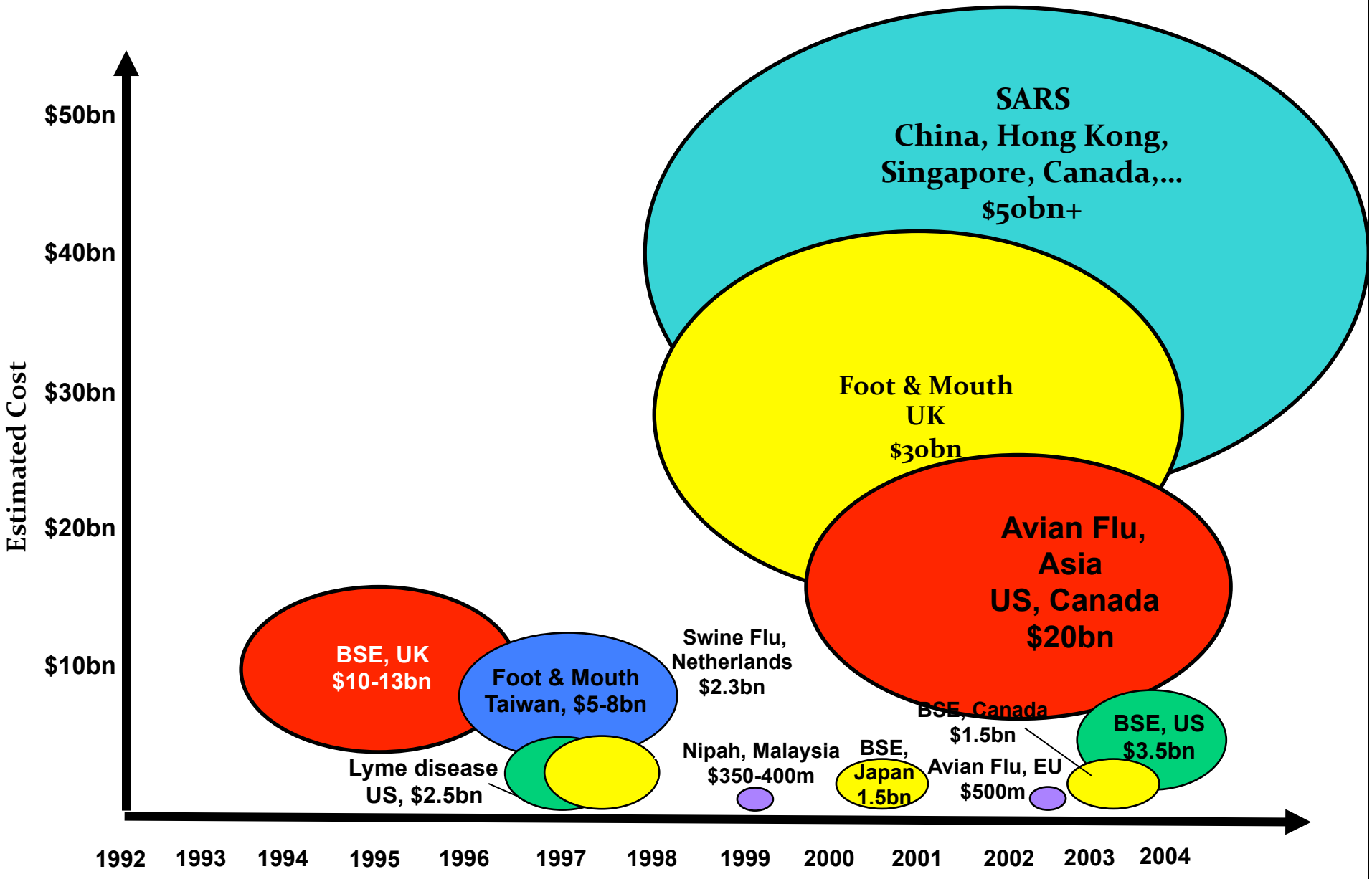
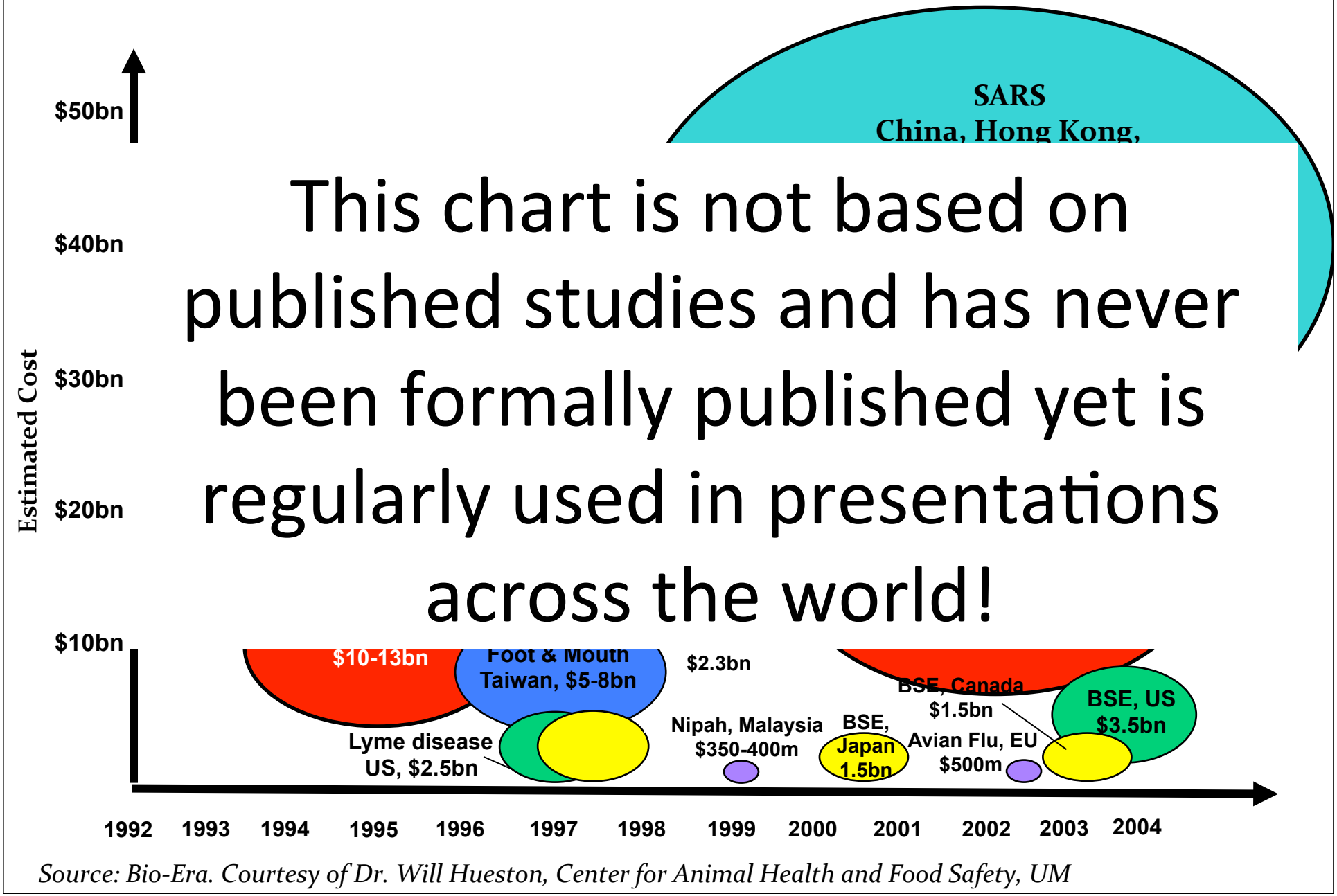
Economic Impact of Selected Diseases



Source: Bio-Era. Courtesy of Dr. Will Hueston, Center for Animal Health and Food Safety, UM

Economic Impact of Selected Diseases



This chart is not based on published studies and has never been formally published yet is regularly used in presentations across the world!

Source: Bio-Era. Courtesy of Dr. Will Hueston, Center for Animal Health and Food Safety, UM

World Bank Livestock Disease Atlas

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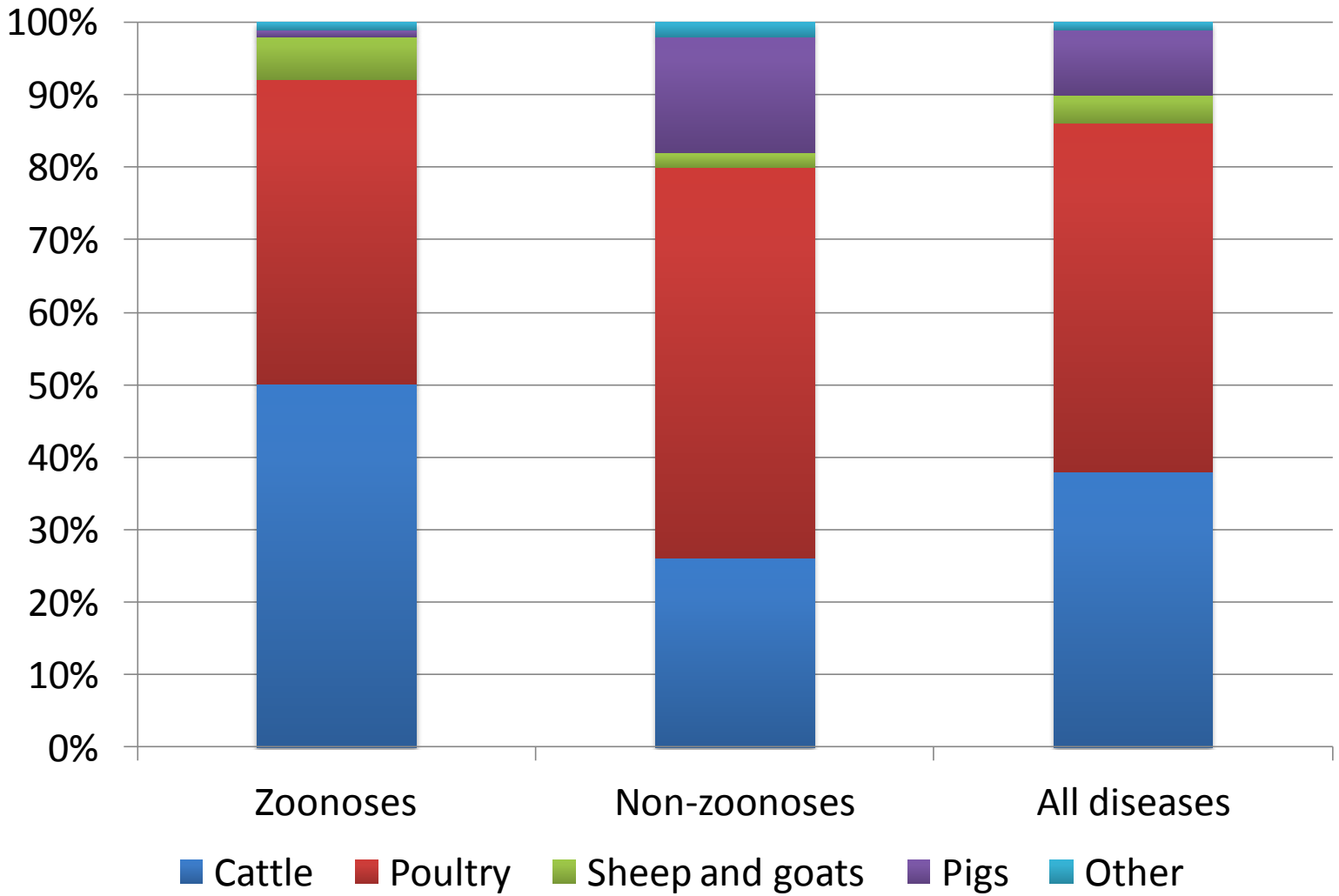
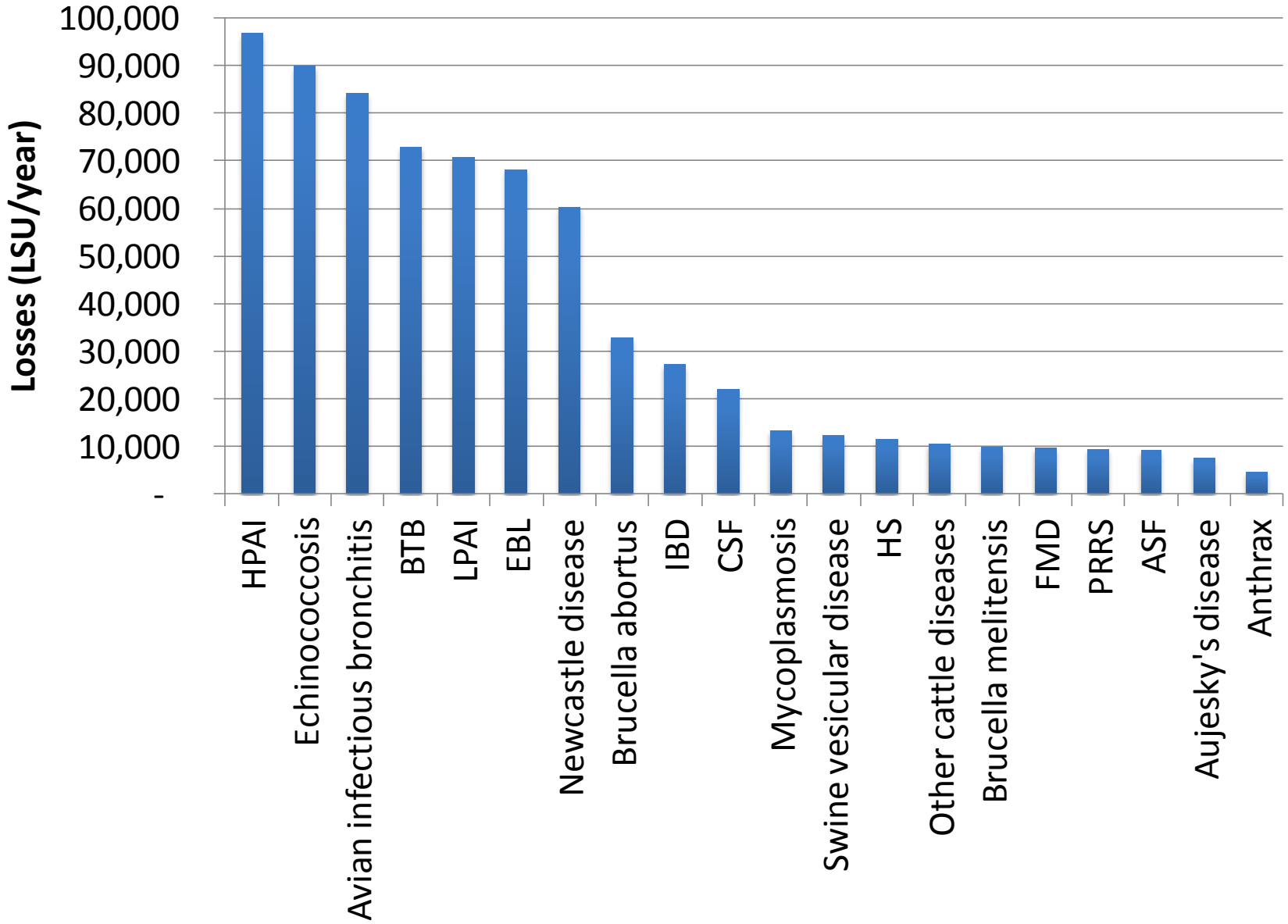
Proportion of Animal Disease Impact by Disease Group and Species (data from World Bank, 2011, authors analysis)



Estimated livestock losses by disease measured as LSU/year (data from World Bank, 2011)



Observations of the global studies

- Both human and animal disease studies are based on the impact of disease alone – losses in human and animal life
  - Global burden of disease is based on DALYs
  - Livestock Disease Atlas is based on Livestock Units lost
- Therefore the costs of surveillance, control and prevention have not been included
- Livestock disease atlas fails on equine disease
- Neither considering the emerging problem of AMR

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Example – UK endemic disease

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Endemic disease impact in the UK

- MAFF commissioned Richard Bennett to coordinate a study on the impact of endemic diseases in the Great Britain in the 90s (Bennett, 2003)
- The work involved significant collaboration with VLA
- 30 endemic diseases were covered which were selected based on present and past expenditure on disease management by MAFF
- The work was updated in 2000s with an additional 5 diseases – 35 in total (Bennett and IJpelar, 2005)

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35 endemic diseases in GB
(Bennett & IJpelar, 2005)

- Standardised method for each disease
  - Livestock populations at risk, production systems affected, annual incidence
  - Physical effects of disease on production (e.g. on milk, meat, egg, fibre etc production)
  - Valuation of effects
  - Treatment and prevention measures and costs
  - Human health implications and costs
  - Animal welfare implications

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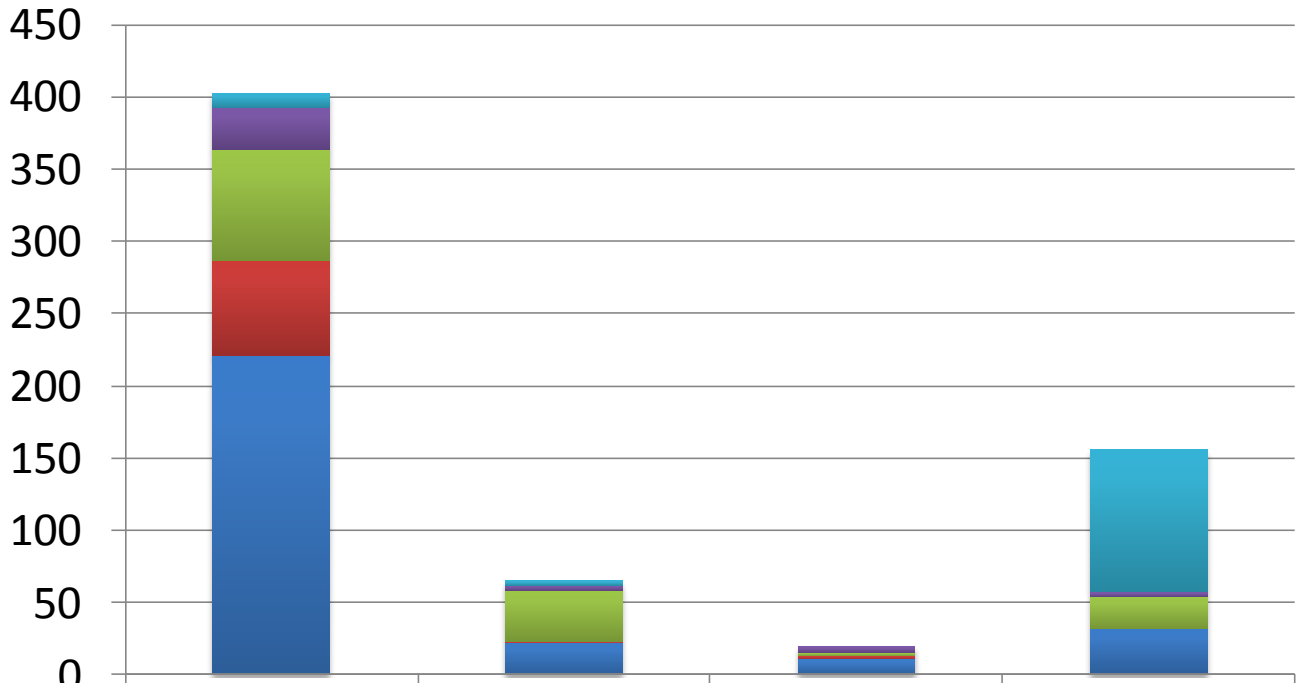
Summary results for three sheep diseases

	Acute Enzootic Pneumonia			Blow fly strike			Enzootic abortion		
	low	*best*	*high*	*low*	*best*	*high*	*low*	*best*	*high*
Animals affected ('000 head)	22	36	61	426	564	692	605	834	834
Disease effects (m£):	0.3	2.4	4.8	0.2	0.5	0.8	0.8	1.4	1.6
of which: Liveweight loss	-	-	-	-	-	-	-	-	-
Mortality / premature cull	0.0	0.0	0.1	0.1	0.3	0.6	-	-	-
Abortion / stillbirth	-	-	-	-	-	-	0.8	1.4	1.6
Carcass condemnation	0.2	2.3	4.7	-	-	-	-	-	-
Fleece damage	-	-	-	0.1	0.2	0.2	-	-	-
Treatment costs (m£)	0.0	0.0	0.0	0.2	0.2	0.3	0.0	0.0	0.0
Control costs (m£)	7.0	9.4	10.3	1.5	1.5	1.5	8.1	16.5	35.5
Monitoring costs (m£)	-	-	-	-	-	-	2.5	2.5	2.5
Human health costs (m£)	-	-	-	-	-	-	0.0	3.4	8.6
TOTAL COSTS (m£)	**7.3**	**11.8**	**15.1**	**1.9**	**2.2**	**2.6**	**11.3**	**23.8**	**48.2**
Welfare Impact Scores:									
Animal welfare loss	12	22	43	244	376	550	76	194	264
Human welfare loss	-	-	-	-	-	-	0	0	2

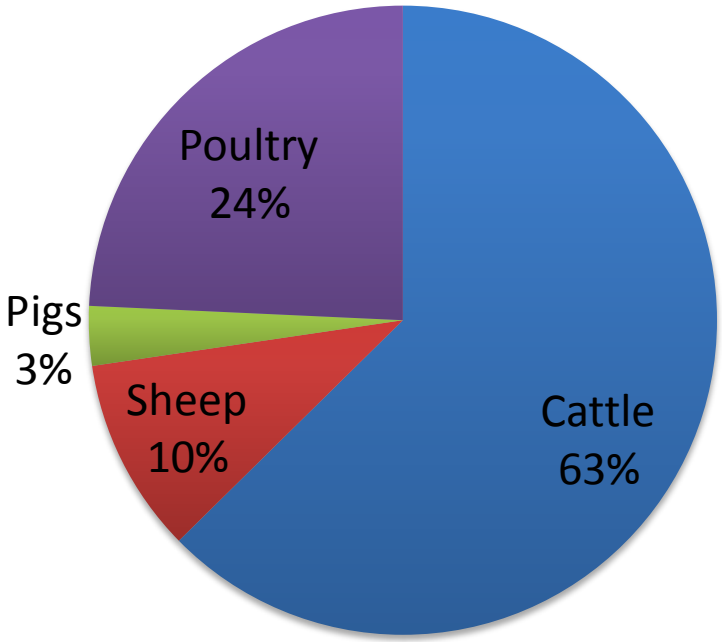
Endemic disease impact in Great Britain (data from Bennett and IJpelar, 2005)



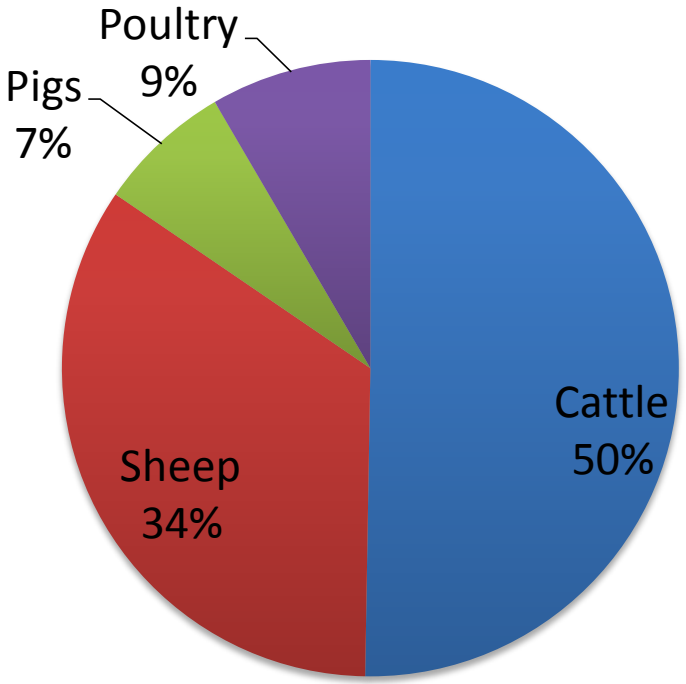
	Cattle	Sheep	Pigs	Poultry
Human health	10.7	3.4	0	98.6
Monitoring costs	28.6	2.5	4.6	3.7
Control costs	77.5	35.2	1.9	22.2
Treatment costs	65.2	1.7	2.7	0
Disease	221	21.9	10.5	31.7

Disease impact and livestock populations (data from Bennett and IJpelar, 2005 and DEFRA, 2006)

Proportion of endemic disease impacts



Proportion of livestock units



Oberservations of the Great Britain study

- The estimate of losses focuses on the change in **production**, **NOT** a change in **productivity**
- The disease list is old, does not include campylobacter, HPAI
  - It fails on emerging disease issues - blue tongue, Schmallenberg
  - Or risks such as African horse sickness
- The figures are now out of date and of little relevance to the UK problems of bovine tuberculosis control
- Such work needs to be done and it needs to generate longitudinal data series

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An economic framework to provide information for animal health decision making

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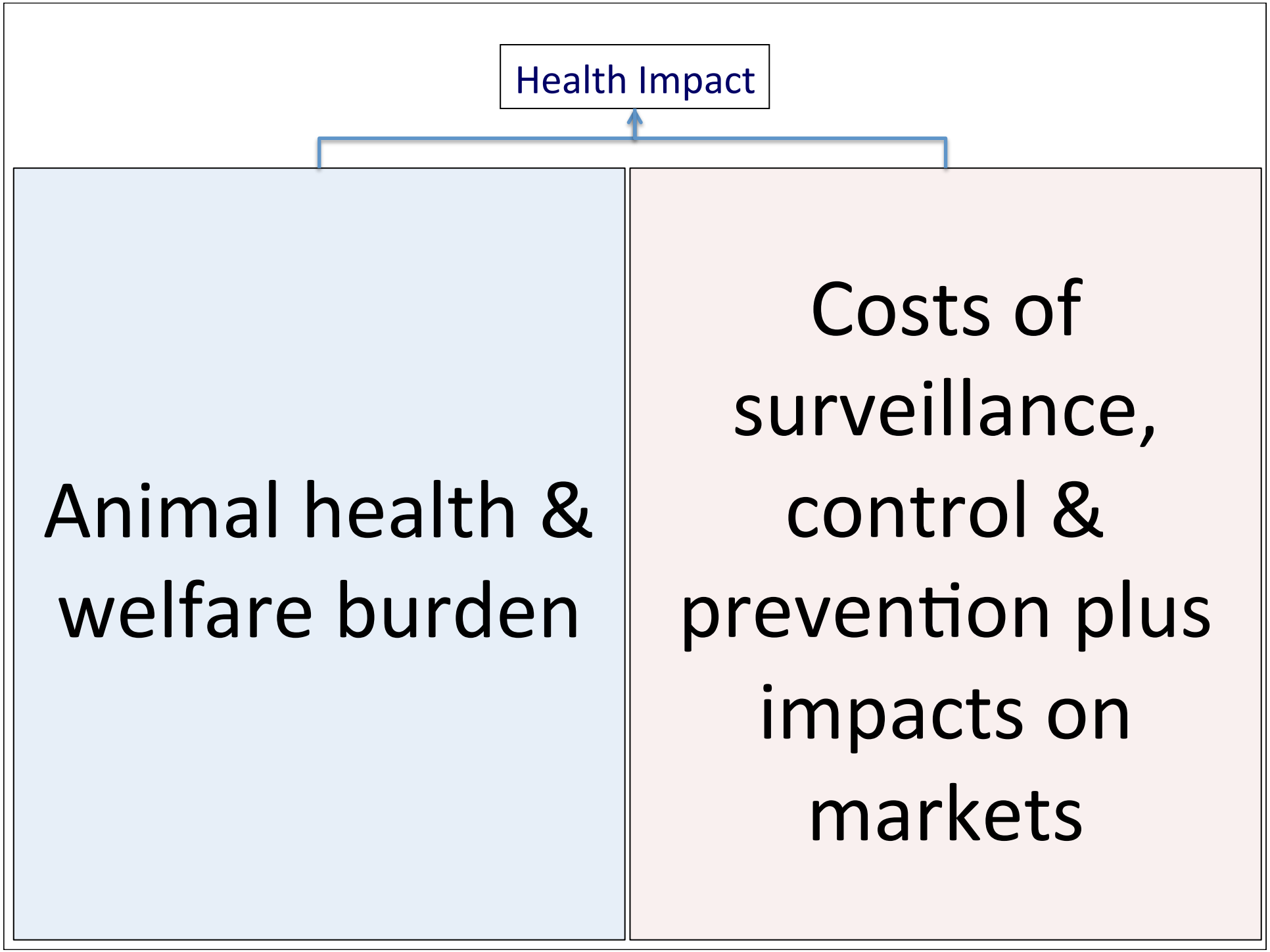
Health Impact
Animal health & welfare burden
Costs of surveillance, control & prevention plus impacts on markets

Animal health & welfare burden

- The need for animal population data – the scale
  - FAOSTAT is currently being updated
  - There needs to be further efforts at a national level
- The need for production parameter data – the productivity and efficiency (James & Carles, 1996)
  - Available for the intensive systems in OECD countries
  - Patchy for intensive systems in other areas
  - Lacking for extensive systems in most countries and particularly in developing countries

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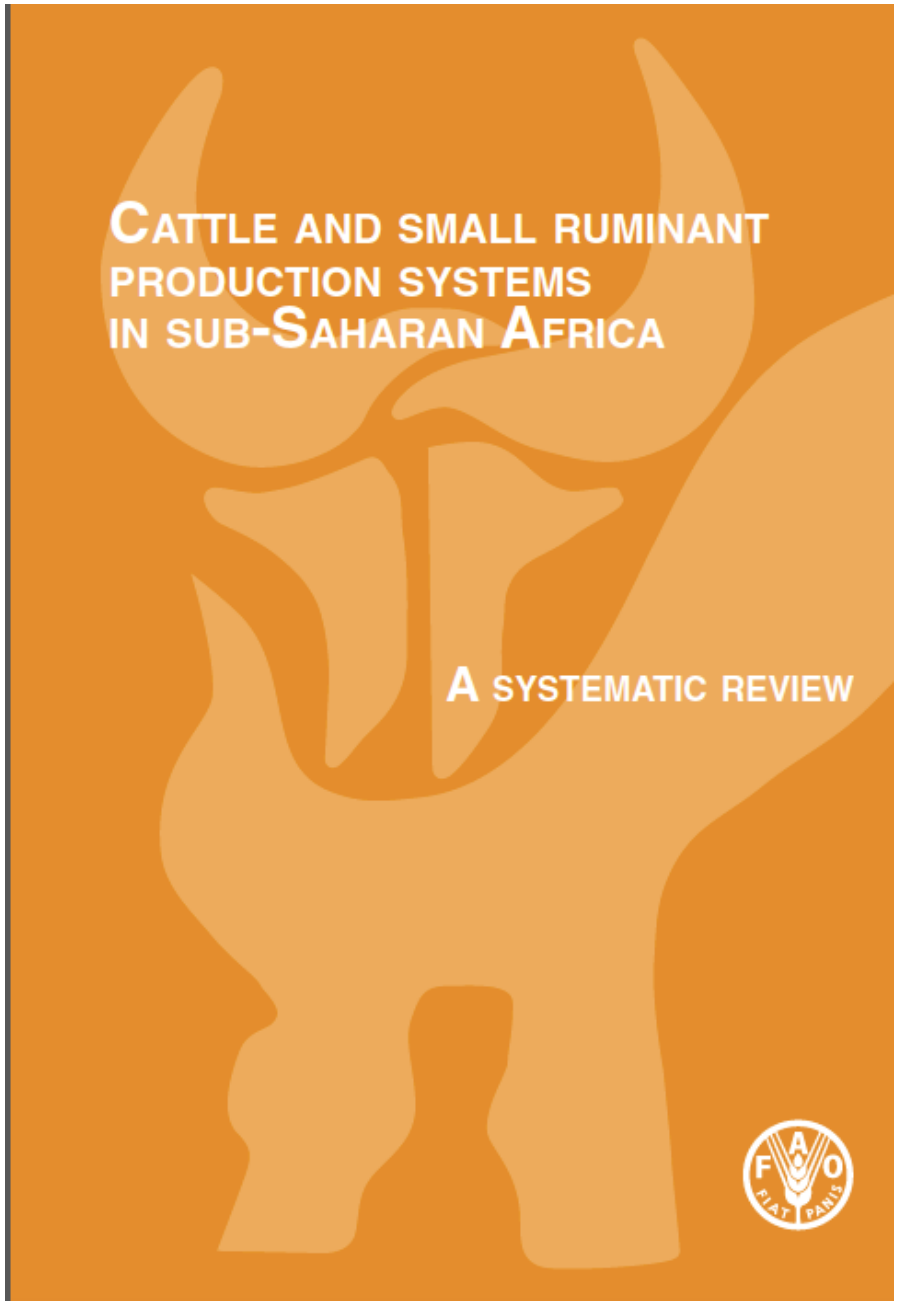

Otte & Chilonda, 2002

Animal health & welfare burden

- Data on disease presence
  - Transboundary animal diseases there are some data
  - Endemic diseases very little data or inconsistent
  - Data on health and welfare issues are absent
- The need for agreed models for the analyses
  - Population models that reflect systems of production
  - Agreed metrics in terms of changes in animals and outputs with a relationship to key inputs used

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Animal health & welfare burden

- Data on disease presence

Data capture and storage remain problematic

Research is needed on modelling approaches

A cadre of people need to be educated to perform the work

outputs with a relationship to key inputs used

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The costs of surveillance, control & prevention

- There is some capture of expenditure of the public sectors on animal health
  - But it is not consistent or frequent
- There is capture of private expenditure in pet healthcare through national statistics departments
- It is rare to see data on private expenditure on livestock health (Gilbert & Rushton, 2014)
  - BVD in UK (Bisdorff et al – ISVEE 14)
  - Rinderpest globally – FAO (2012)

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Core investments in animal health

- There has been a slow, yet increasing, understanding of the need for core investments in animal health
- This recognises the need for money – public and private – to support:
  - Education – vets, livestock owners, pet owners
  - Research – antimicrobials, immunologicals
  - Coordination – managing resource use across the public, private and NGO sectors
- Animal health systems need this core investment both in periods of quiet and to respond to periods of crisis

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Core investments in animal health

- There has been a slow, yet increasing, understanding

Core investment is likely to vary according to animal population, animal use and societal attitudes

Research is required on the size of this core investment for an effective animal health system

in periods of quiet and to respond to periods of crisis

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Market distortions and market shocks due to animal disease

- Market data on livestock products
- Information on the impact across the food systems
- Assessment of market impacts at all levels from input suppliers, production, processing, retailing and consumers
  - Good reference work for market shocks - Longworth et al (2007) for the AI outbreak in The Netherlands
  - Market distortions the early work by Lovell Jarvis

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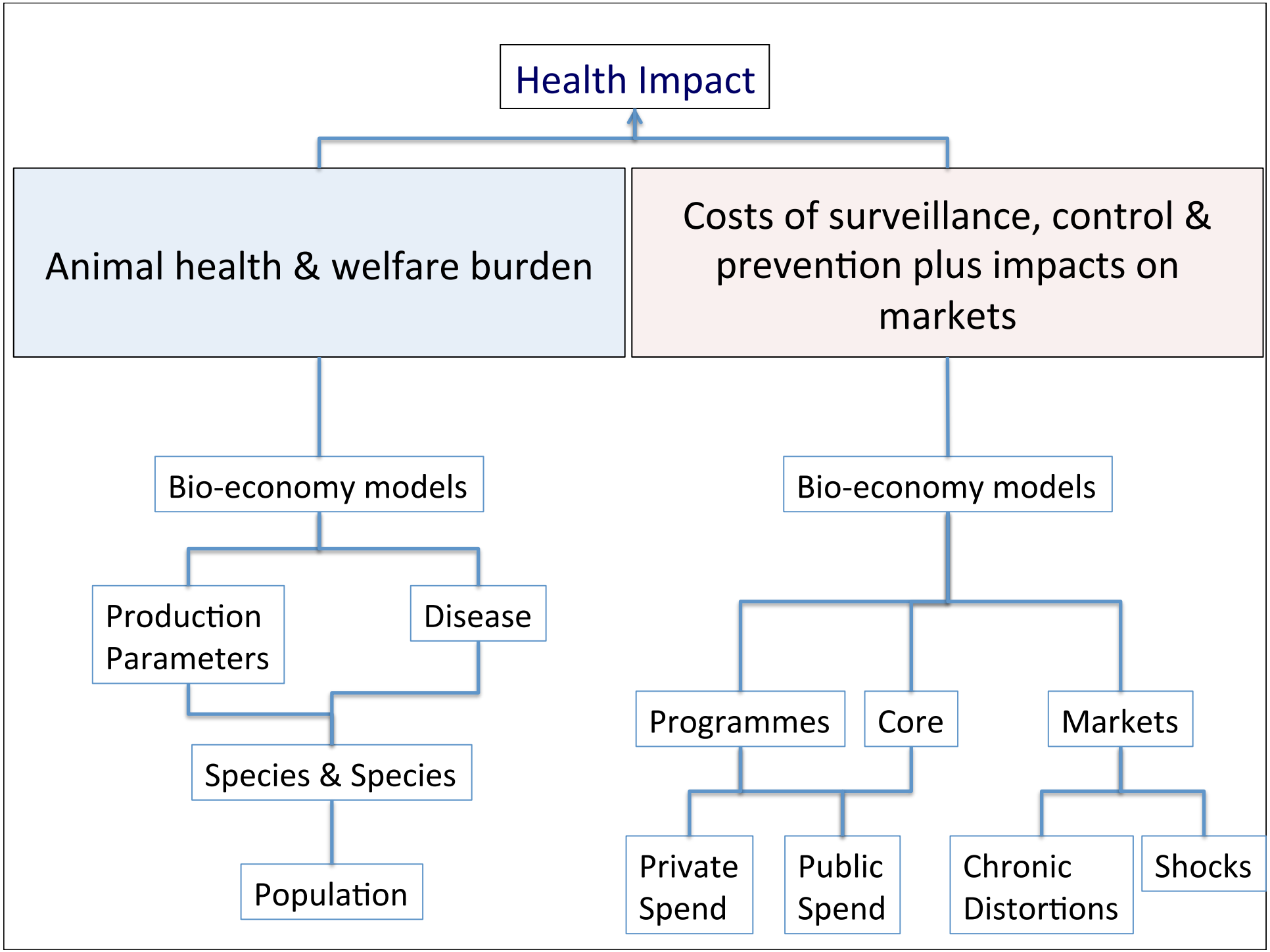
Health Impact
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Costs of surveillance, control & prevention plus impacts on markets
Bio-economy models
Production Parameters
Disease
Species & Species
Population
Bio-economy models
Programmes
Core
Markets
Private Spend
Public Spend
Chronic Distortions
Shocks

At a micro-level

- Animal health and welfare burdens can be used as a basis for **outcome measures**
- Animal health system costs will affect animal health status and burdens
- For specific animal health programmes it would be possible to develop a **library of cost-effectiveness measures and cost benefit analyses**
  - A potential production surface?

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At a sector level

- Animal health & welfare burdens by country and by region will highlight the level of problems in the animal population
- Linking these to overall costs of animal health systems should help to identify where resource use is ineffective and inefficient
- Assessment of the effectiveness of the overall animal health system should be possible

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Reflections

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We need better disease impact assessments

- Data on the impact of disease would allow:
  - Diseases to be **prioritised** by level of impact
  - To assess the **allocation of resources** – time, money, logistics – for **each disease**
  - Explore the **allocation between different diseases**
  - Explore the allocation of resources for specific disease
- These **inter** and **intra resource allocations** for animal diseases would allow a much more nuanced use of economics
- Such impact assessments provide **baselines** for the economic assessments of interventions

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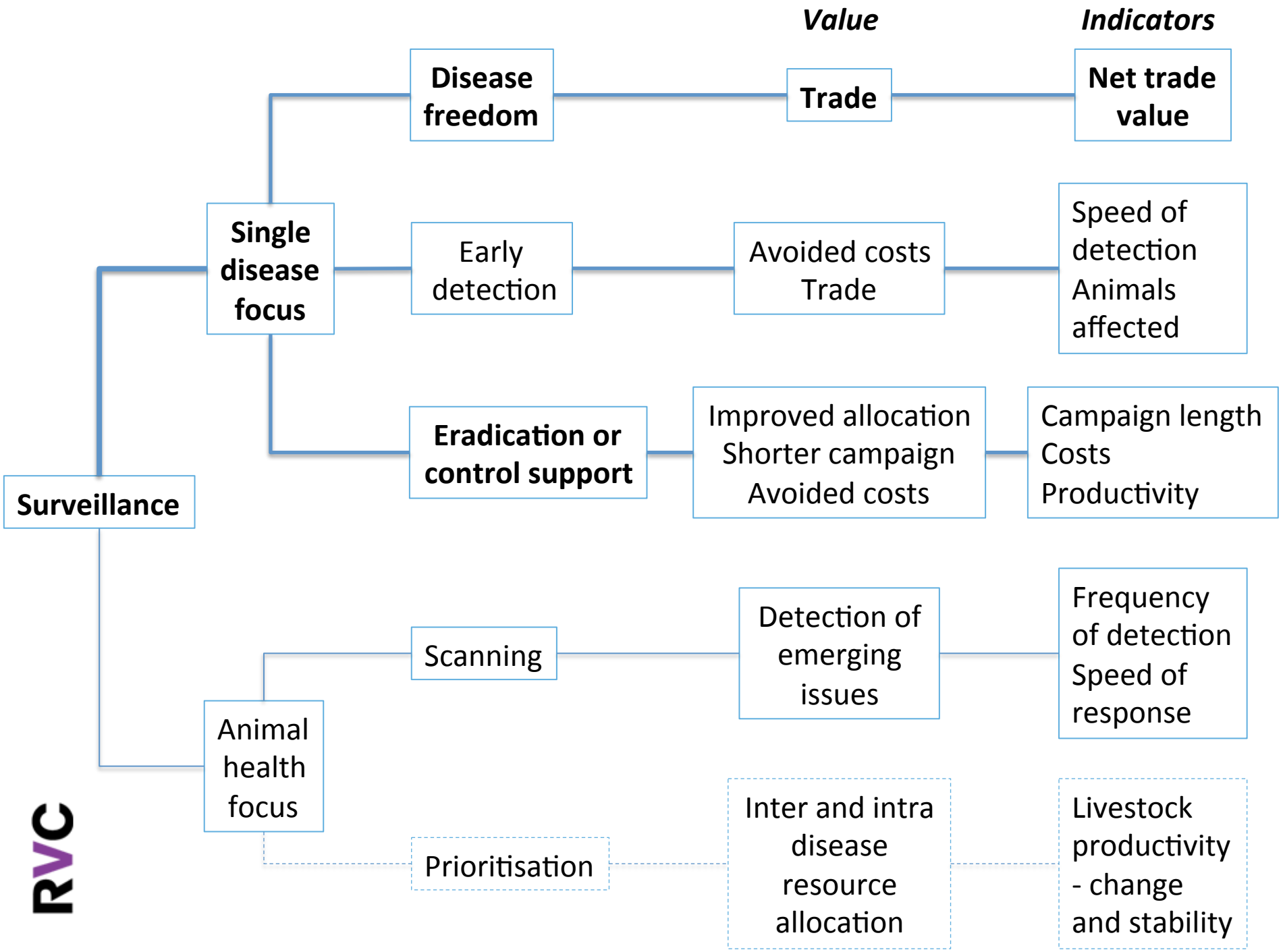
Value
Indicators
Surveillance
Single disease focus
Disease freedom
Trade
Net trade value
Early detection
Avoided costs
Trade
Speed of detection
Animals affected
Eradication or control support
Improved allocation
Shorter campaign
Avoided costs
Campaign length
Costs
Productivity
Animal health focus
Scanning
Detection of emerging issues
Frequency of detection
Speed of response
Prioritisation
Inter and intra disease resource allocation
Livestock productivity - change and stability
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Key message

- We need to start developing data collection and capture that details:
  - Production loss
  - Costs of surveillance, prevention and control
  - Changes in market access
- These data need to be in structure that allow longitudinal data capture
- Our surveillance systems need to designed to do this and to regular prioritise animal health issues

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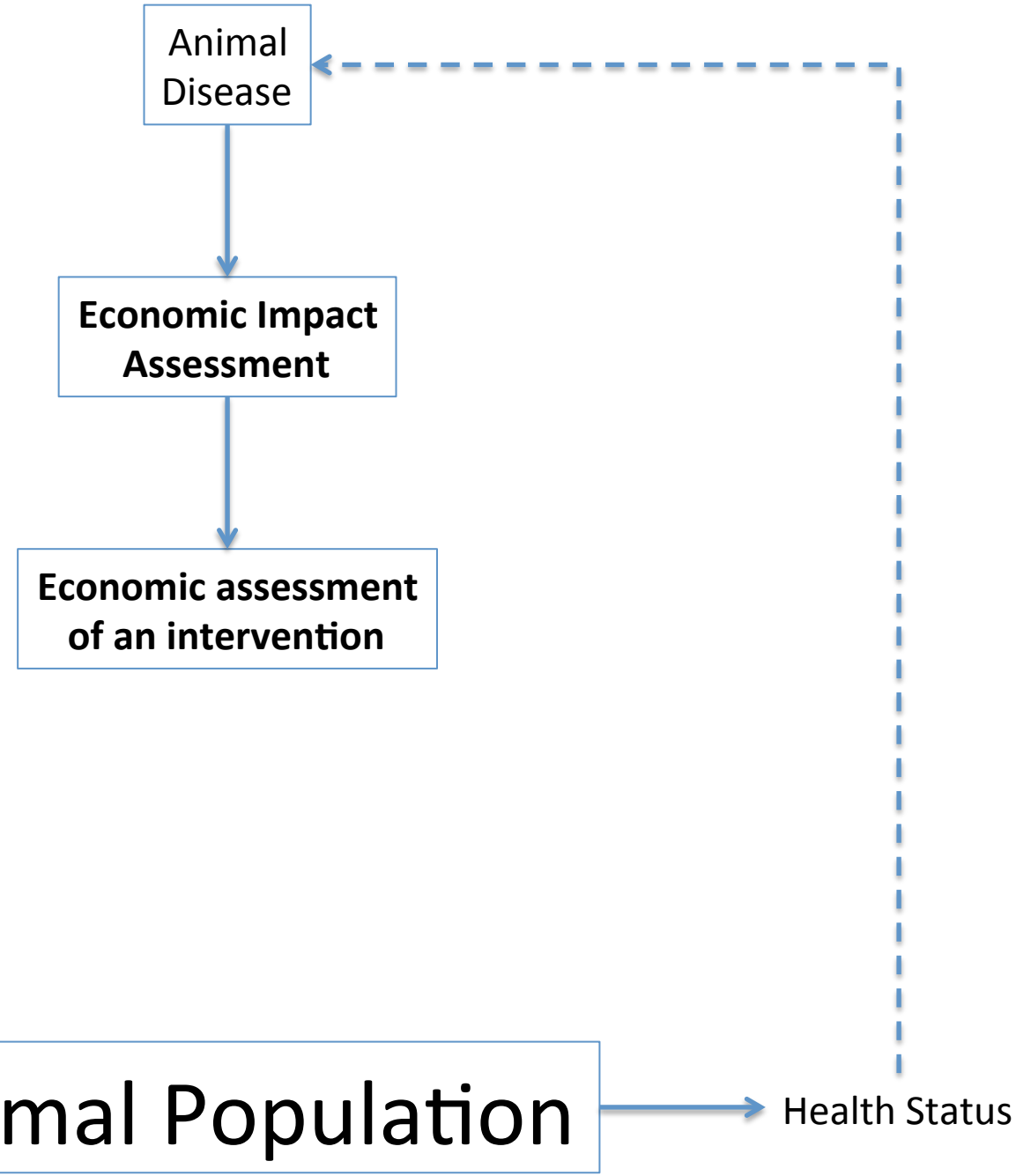
Data on:
- Scale – populations, farms
- Disease
- Parameters – fertility, mortality, sales
- Prices - markets



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A new society

- International Society for Economics and Social Science of Animal Health
- We will hold a first meeting for a day before SVEPM in Inverness in March 2017
- We will be inviting papers and posters to cut across the animal health, economics and social sciences
- We want to create a bridge

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Further information

- For more information on NEAT please look at
  - www.neat-network.eu
- For information on NEOH please look at
  - http://neoh.onehealthglobal.net
- For information on the work we are involved in with agriculture and health please look at
  - http://www.lcirah.ac.uk/home
- For courses offered at RVC please look at
  - http://www.rvc.ac.uk/Postgraduate/Distance/Index.cfm
  - http://www.atp-ilhp.org

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