What is Impact:
Defining and Demonstrating Impact

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AESIS
NETWORK FOR
ADVANCING & EVALUATING THE SOCIETAL IMPACT OF SCIENCE

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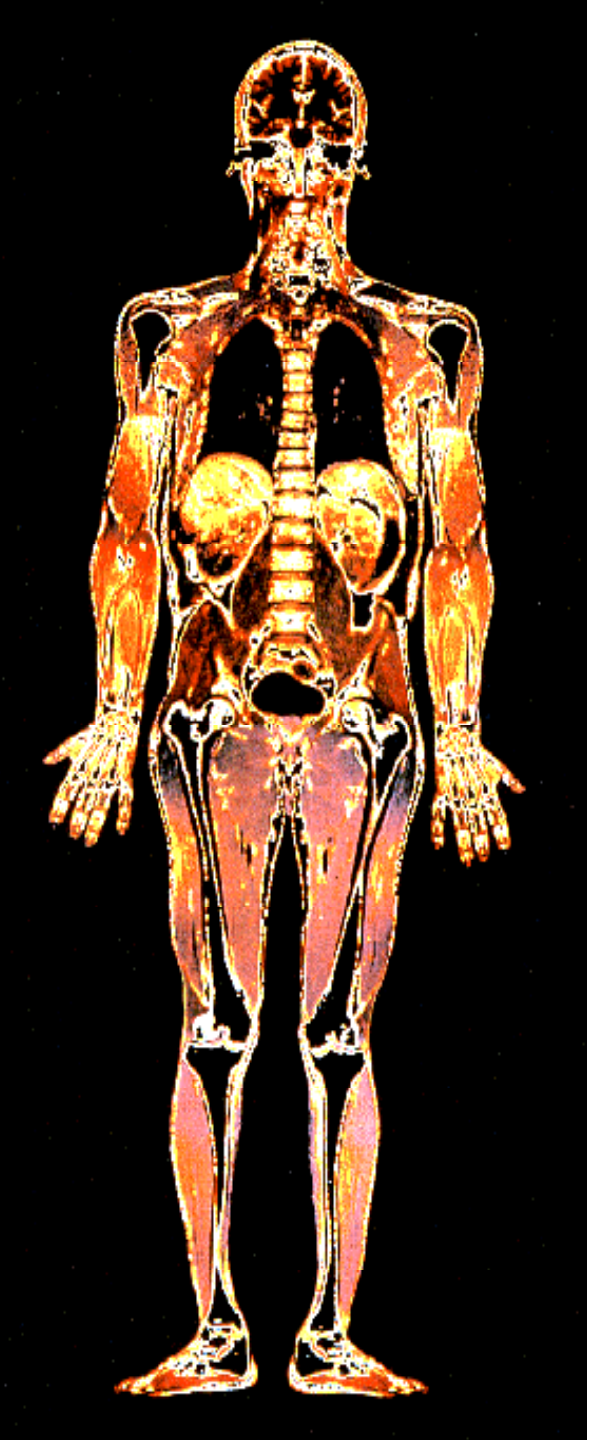


Research, Innovation & Commercialisation

First 20 years:

- Medical scientist working on new medical technology, working in University Hospital Medical Schools, the NHS and with industry
- Published extensively and raised large amounts of grant funding and investment
- Partnership working internationally and with commercial companies
- Researched and developed ideas and solutions that were available for patient benefit and of commercial interest
- Patented and licenced ideas
- Formed two companies to commercialise research and sold one to the US

Research, Innovation and Commercialisation

Recent 30 years:

- Continued impact oriented research plus licensing, start-ups, spin-outs & commercialisation opportunities
- Extended personal commercial innovation activity into a range of technologies and businesses that was wider than medical and health technology
- Panel member for two rounds of the UK research assessment exercise
- Corporate role as Pro Vice Chancellor in Universities and Executive Director in large Teaching Hospitals.
- Non-Executive Director in a range of commercial ventures
- Chair and Founder of Medipex Ltd, a company to commercialise IP emerging from the health sector
- Chair of the Institute of Knowledge Transfer
- Formed investment funds to support the commercialisation of Medical Technology

Definition and Terminology

Impact considers the following

Utilising OECD (Organisation for Economic Co-operation and Development), EU and other governmental definitions

- Will individuals be materially affected by the activity ?
- Will organisations/communities be materially affected by the activity ?
- How will that material change be achieved ?
- Are there outcomes that need to be achieved along the route to impact ?

Magnitude of and nature of impact is important

Teminology

- Evaluation – Assessment of whether an activity did what it was meant to do and whether and to what degree it was successful
- Academic impact – Positive contribution to the advancement of knowledge, hence impact factor of publications. We are not concerned with this form of impact
- Economic impact – The overall long-term, net change in the local/regional/national finances
- Social or Societal impact – Non financial indicators such as educational attainment, health, poverty etc

Societal Impact

More

- Stronger economy
- New companies
- Exports
- Jobs
- Stronger society
- Better Health
- Better Education
- Independence in old age

Less

- Inequalities
- Poverty
- Sickness and disease
- Unemployment
- Social care burden
- Crime/violence/terrorism
- Pollution
- Climate change

Personal perspective of impact (1)

- Impact had been used in research for many years, since the 1970s - terms like ‘impact factor’ were embedded in the vocabulary of research
- In my own research I wanted to improve the health of patients (help them get better quicker or stop them becoming ill) – in the 1970s to 1990s I wasn’t aware that I was focussing on impact
- As an assessor for the UK research assessment exercises in 1996 and 2001, and a University lead for submissions, I experienced the then strategy, and problems, of focusing on research *outcome*, as it was called then, rather than impact

Personal perspective of impact (2)

- From the early 2000s the word impact increased in usage – and over-usage
- Narratives and indicators associated with the impact on Economic Transformation particularly in relation to regional/ national/European structural funding
- Narratives but fewer indicators around Social Transformation, often presented to counter or complement the emphasis on economic impact
- Increase use of the term in driving wider funding decisions, only in some cases with an increased understanding and acceptance of the difference between impact and evaluation

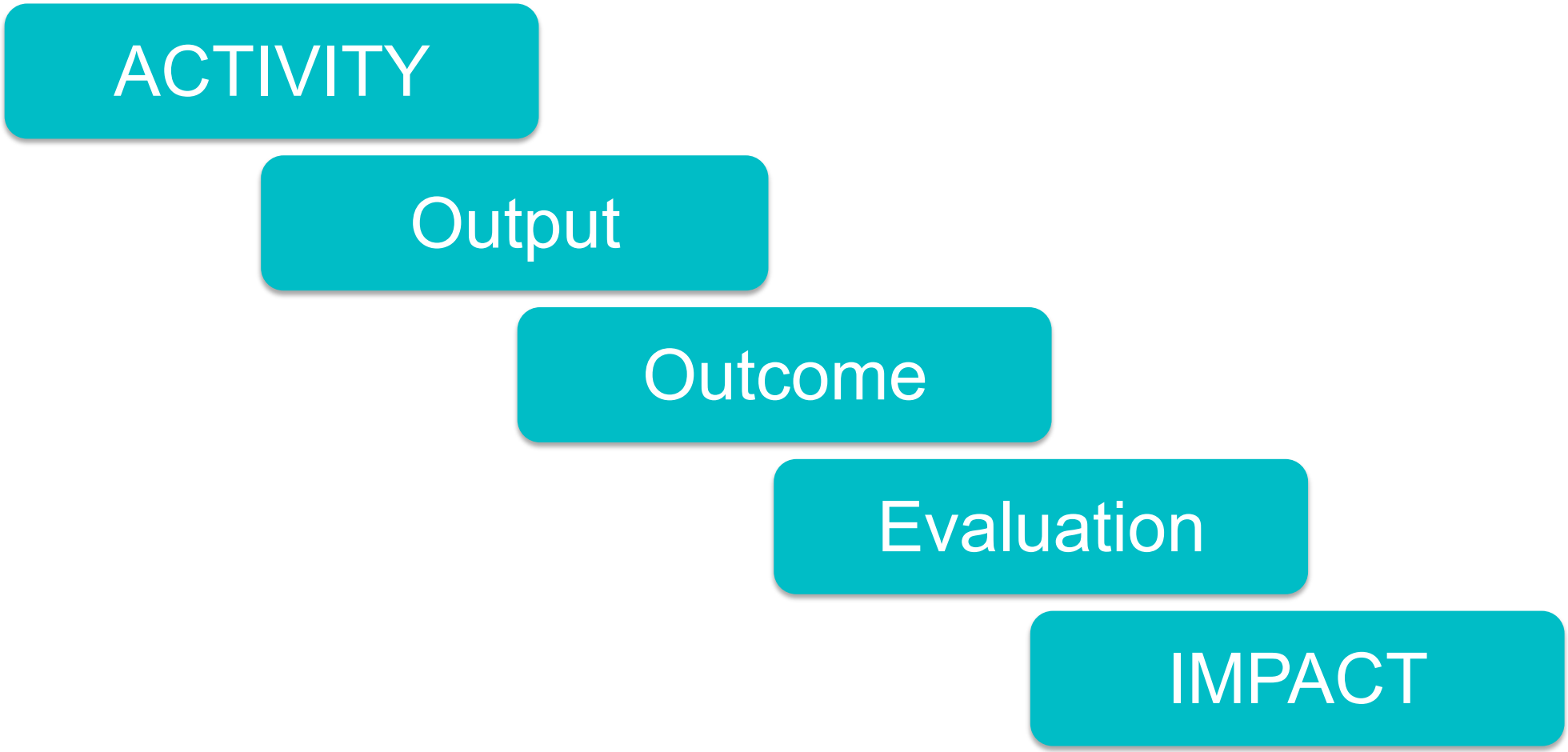
Personal perspective of impact (3)

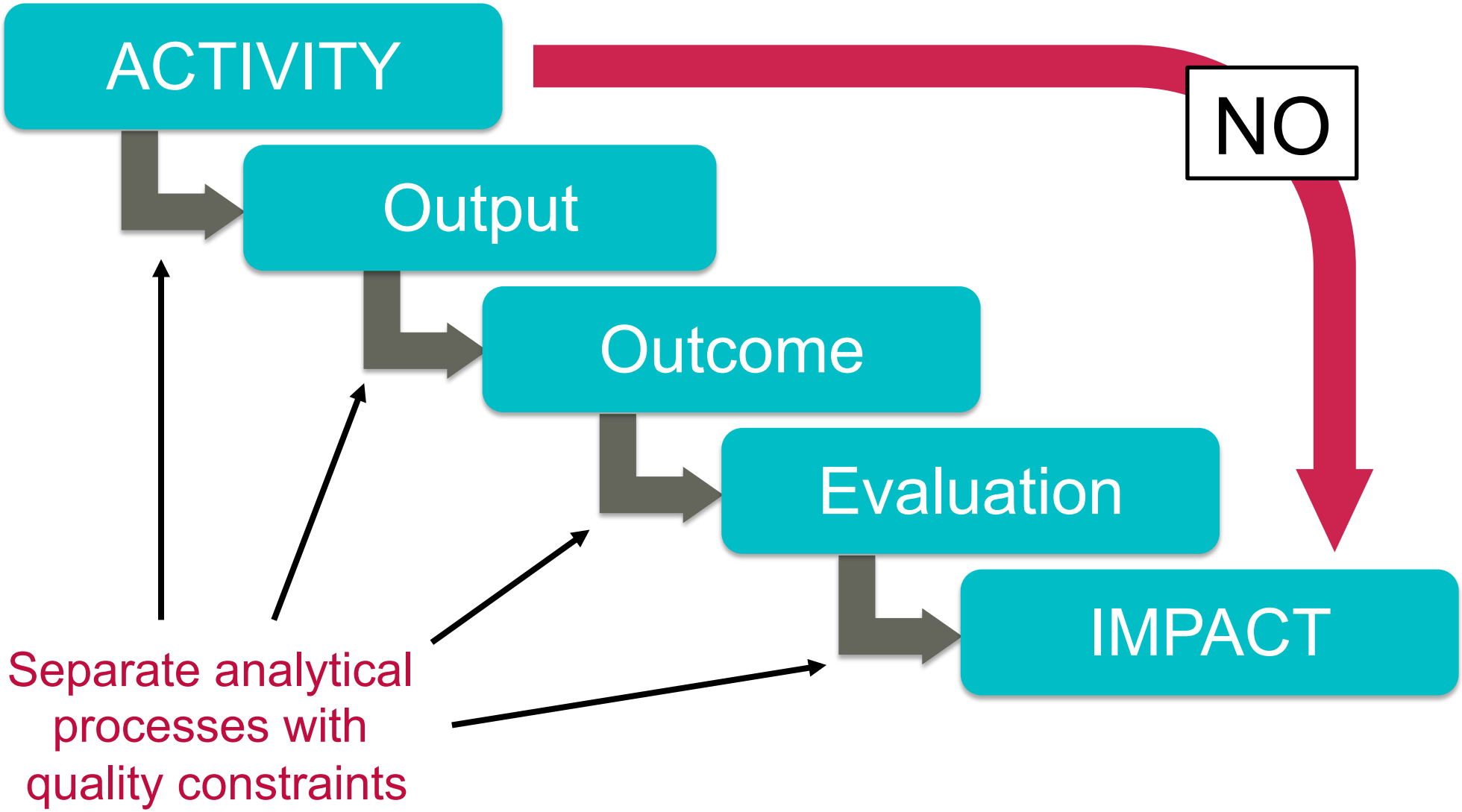
- Tendency to concentrate on ‘impression management’ to convince people of impact, particularly the reliance on good news stories
- Funded organisations (such as Universities) and individuals comply with or object to the measurement of impact – but rarely considered changing what they do or how they do it, to *increase* impact
- Generally little awareness that funding bodies might be wanting to use the measurement of impact as a lever for change and to support their policy agendas

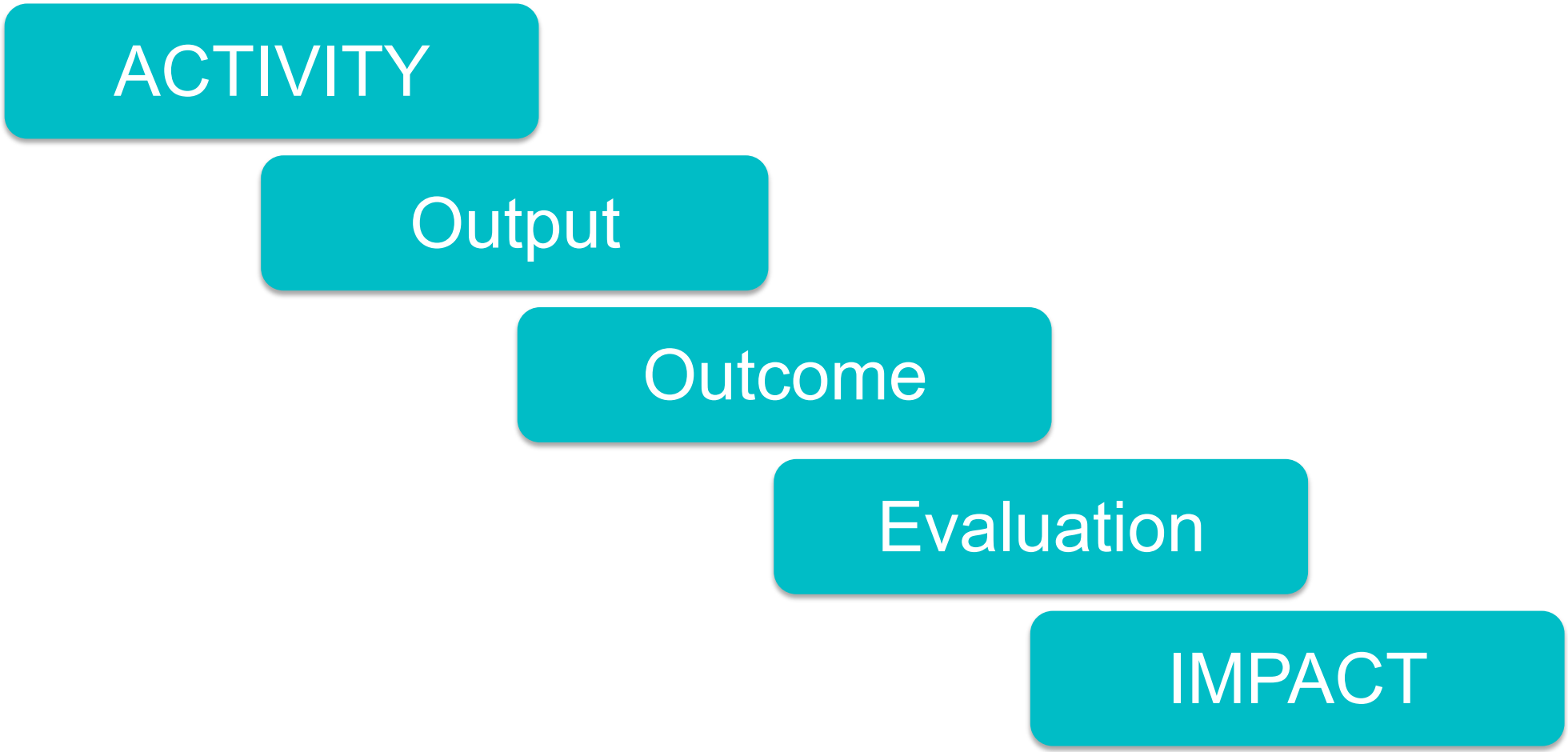
Impact Dichotomies

Research	or	Education
High quality research	or	Any innovative activity
Economic impact	or	Social impact
Short term impact	or	Long term impact
Quantitative indicators	or	Qualitative indicators
Unbiased assessment	or	Marketing information
Rigorous	or	Impression focused
Objective	or	Subjective (opinion lead)
Transparent	or	Defensive
Funded	or	Unfunded

The Impact Journey:
Partial impact consideration arising from current research

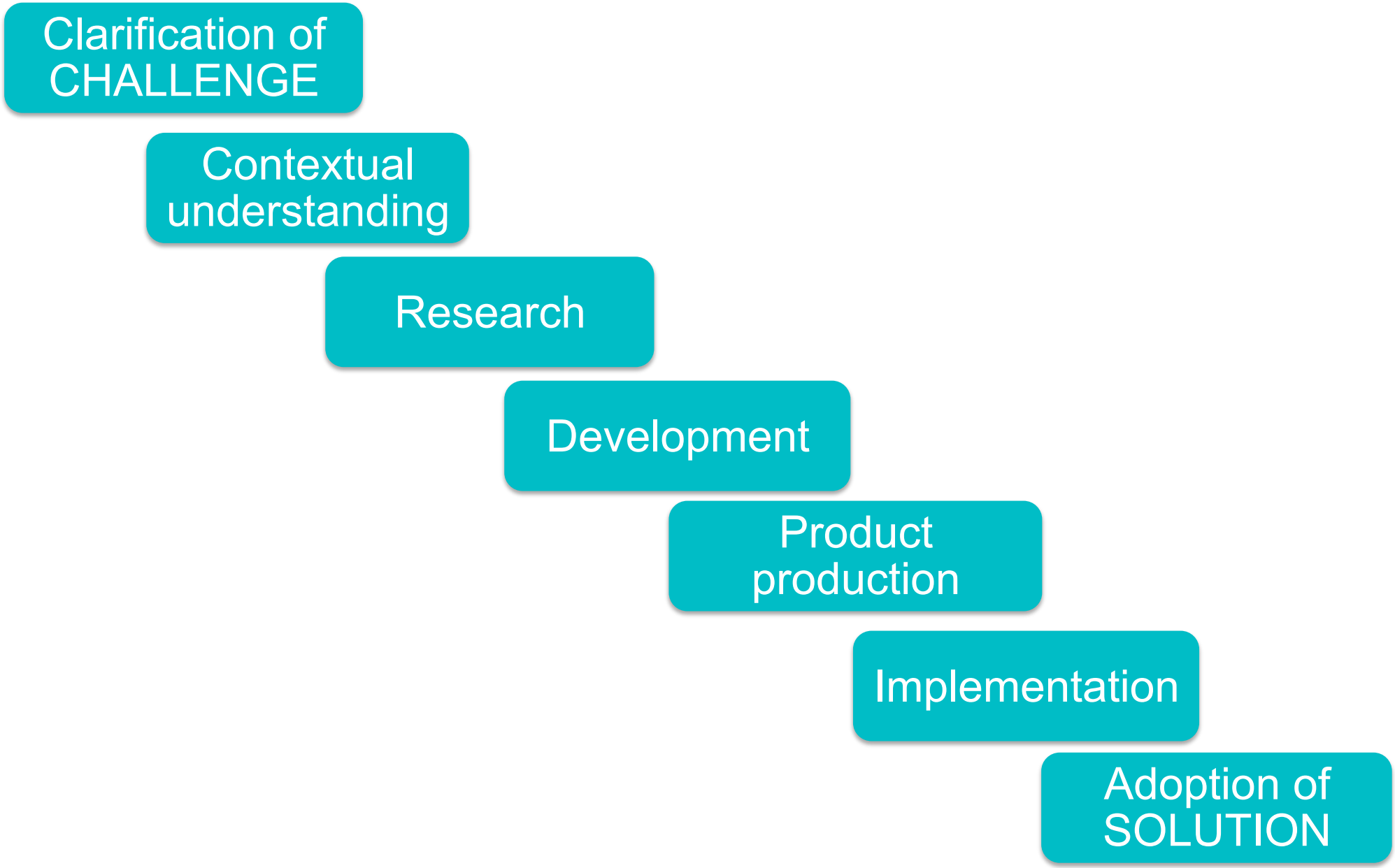


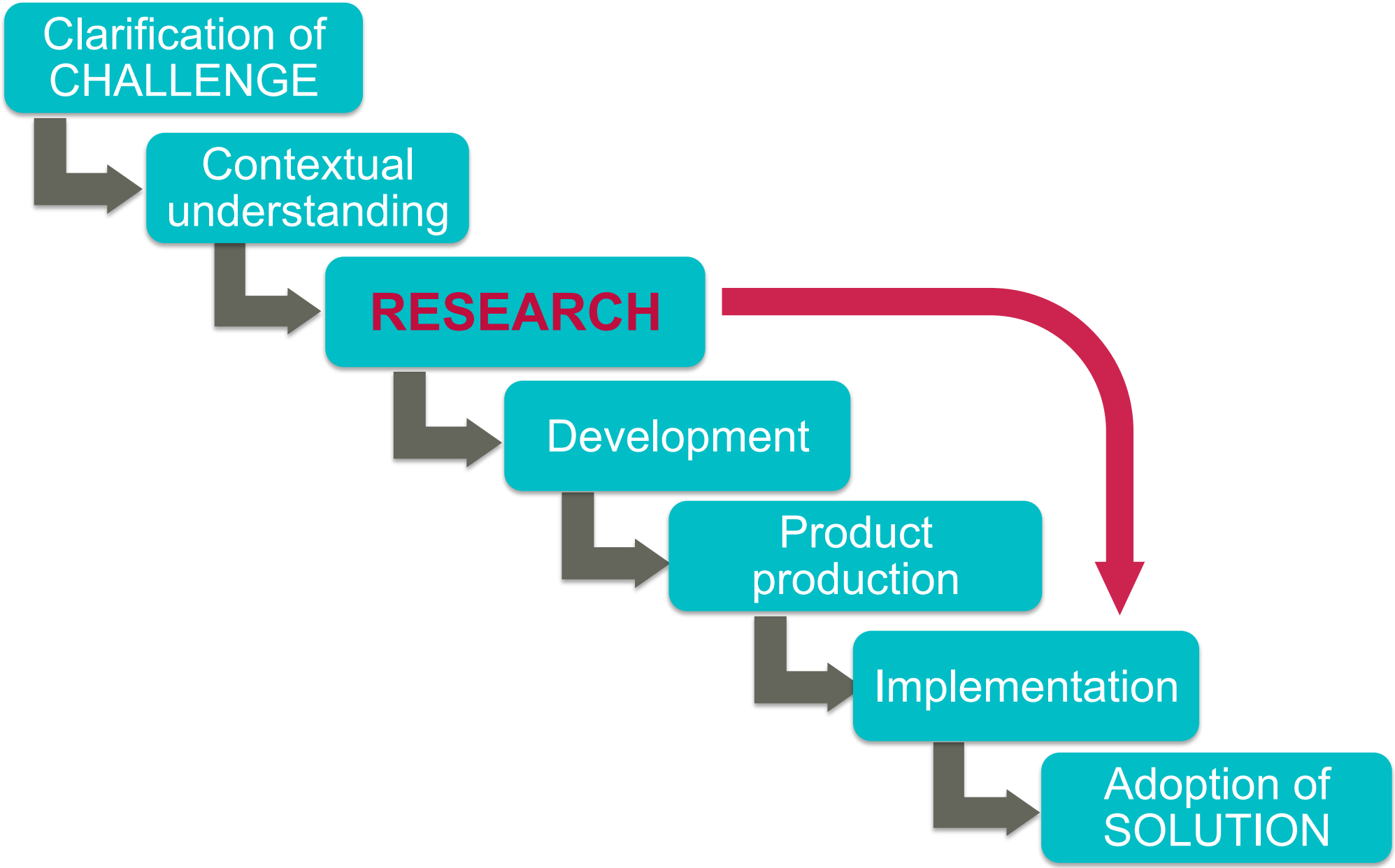


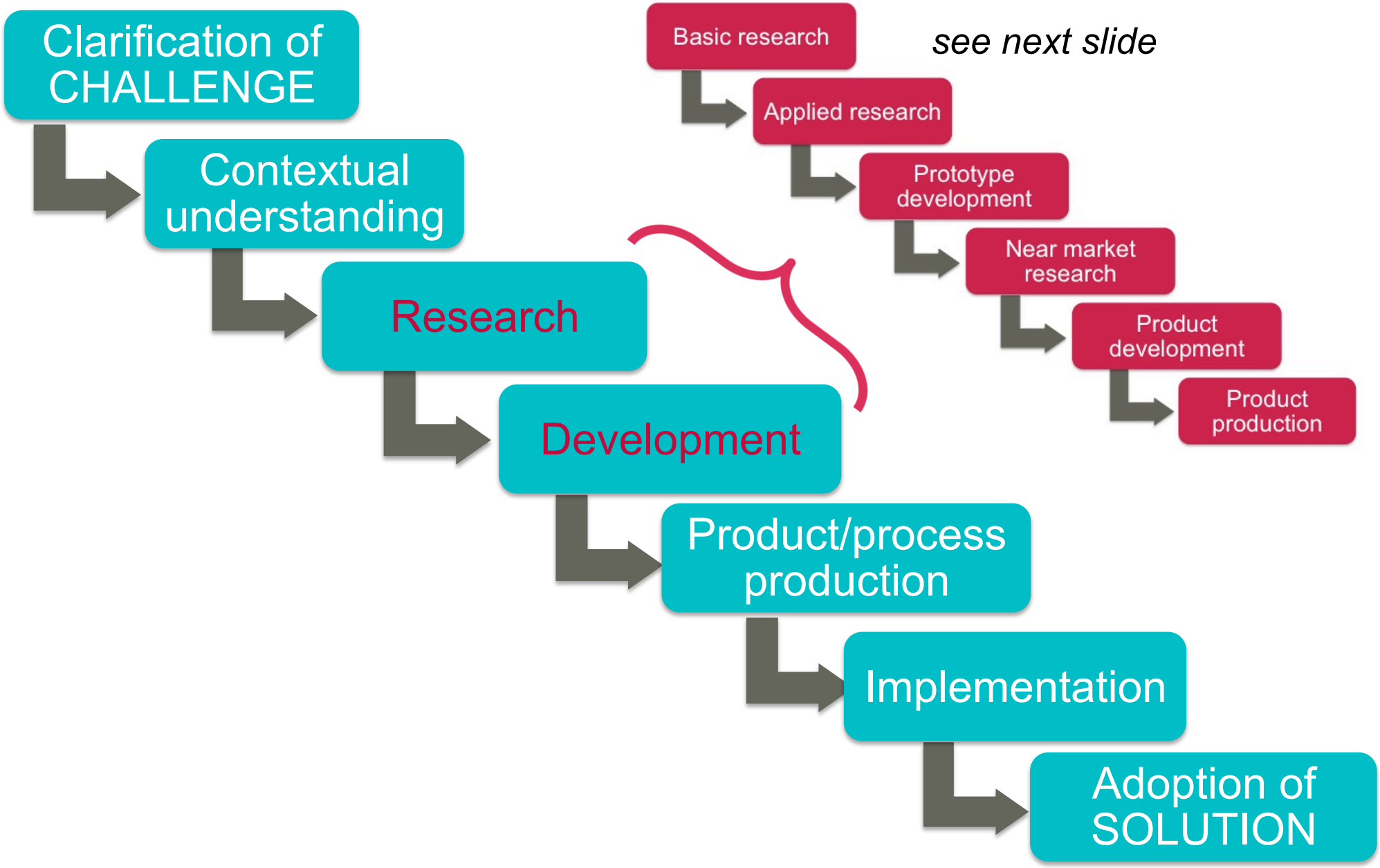


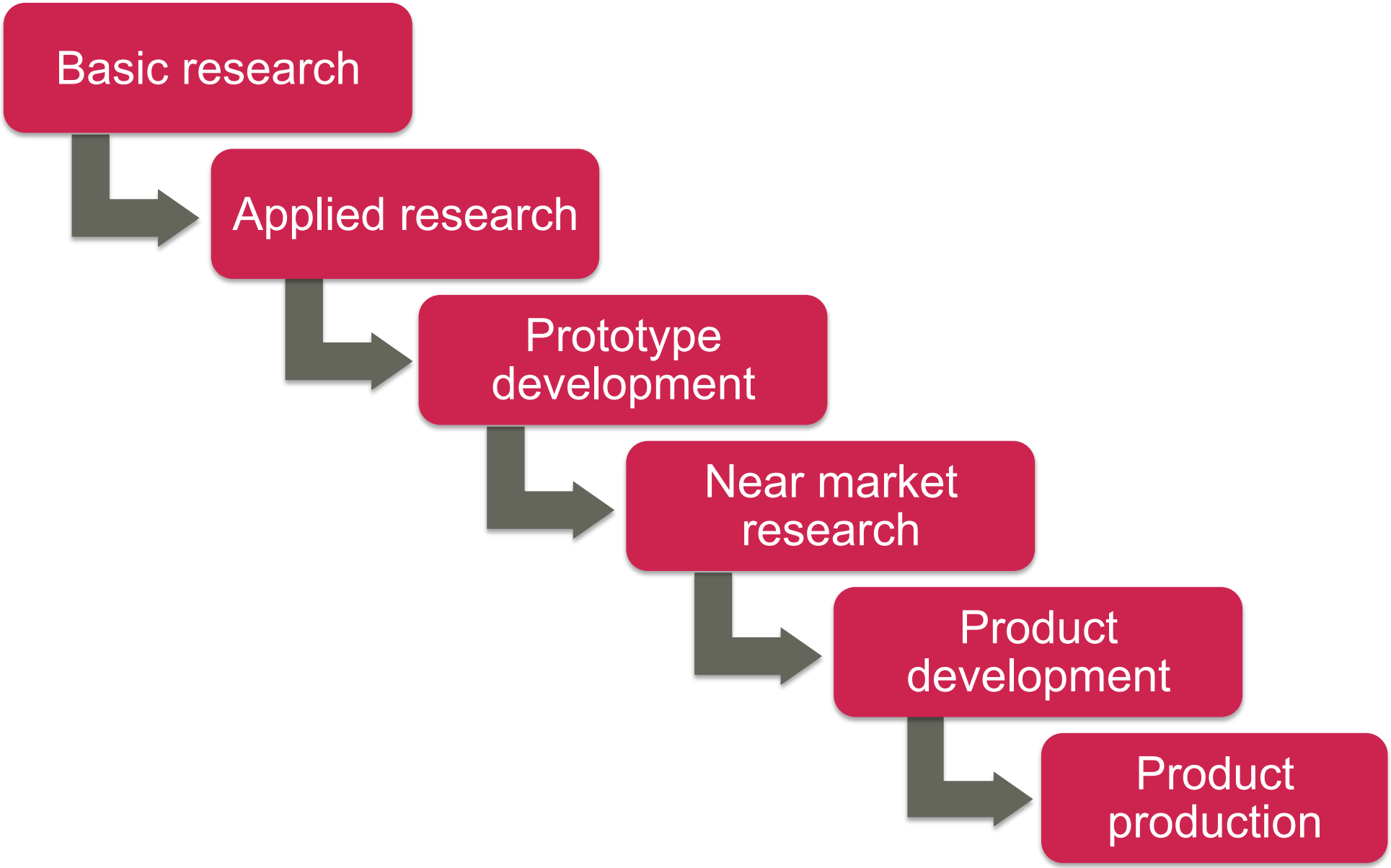
The Impact Journey:
Full impact consideration from a comprehensive research/innovation programme

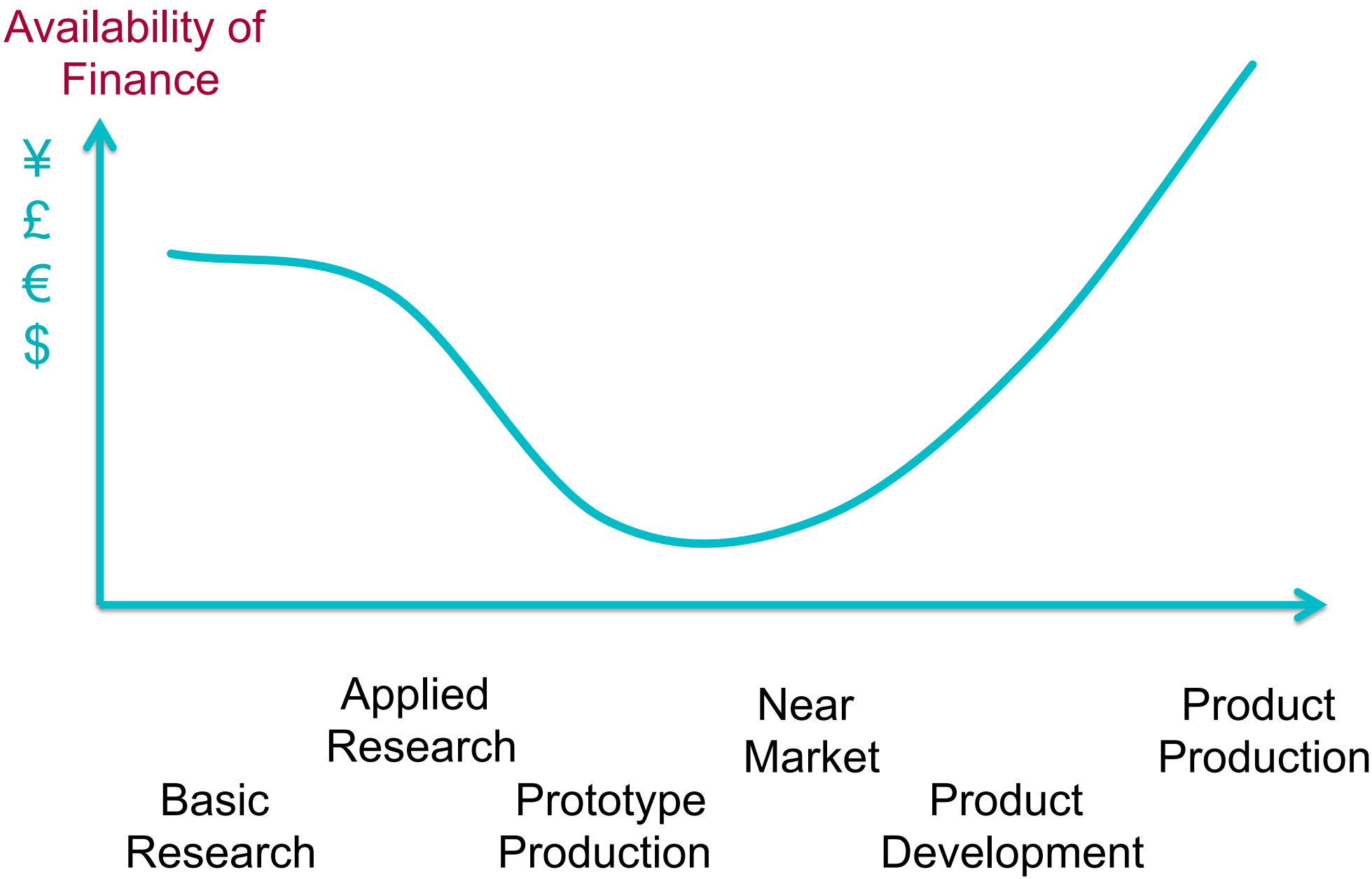
- What is the challenge that needs to be resolved?
- How could this challenge be resolved?
- Is there new or emerging understanding, science, methodology or technology which indicates than *now* is the time ?
- Who else is interested; are they partners or competitors?
- What would success look like ? Essentially what parameters would you measure to demonstrate success (and show the impact)?
- If you identify a solution, do you need to undertake further work to ensure it is implemented and becomes widely adopted, to achieve maximum impact ?
- What is the end point and exit strategy?

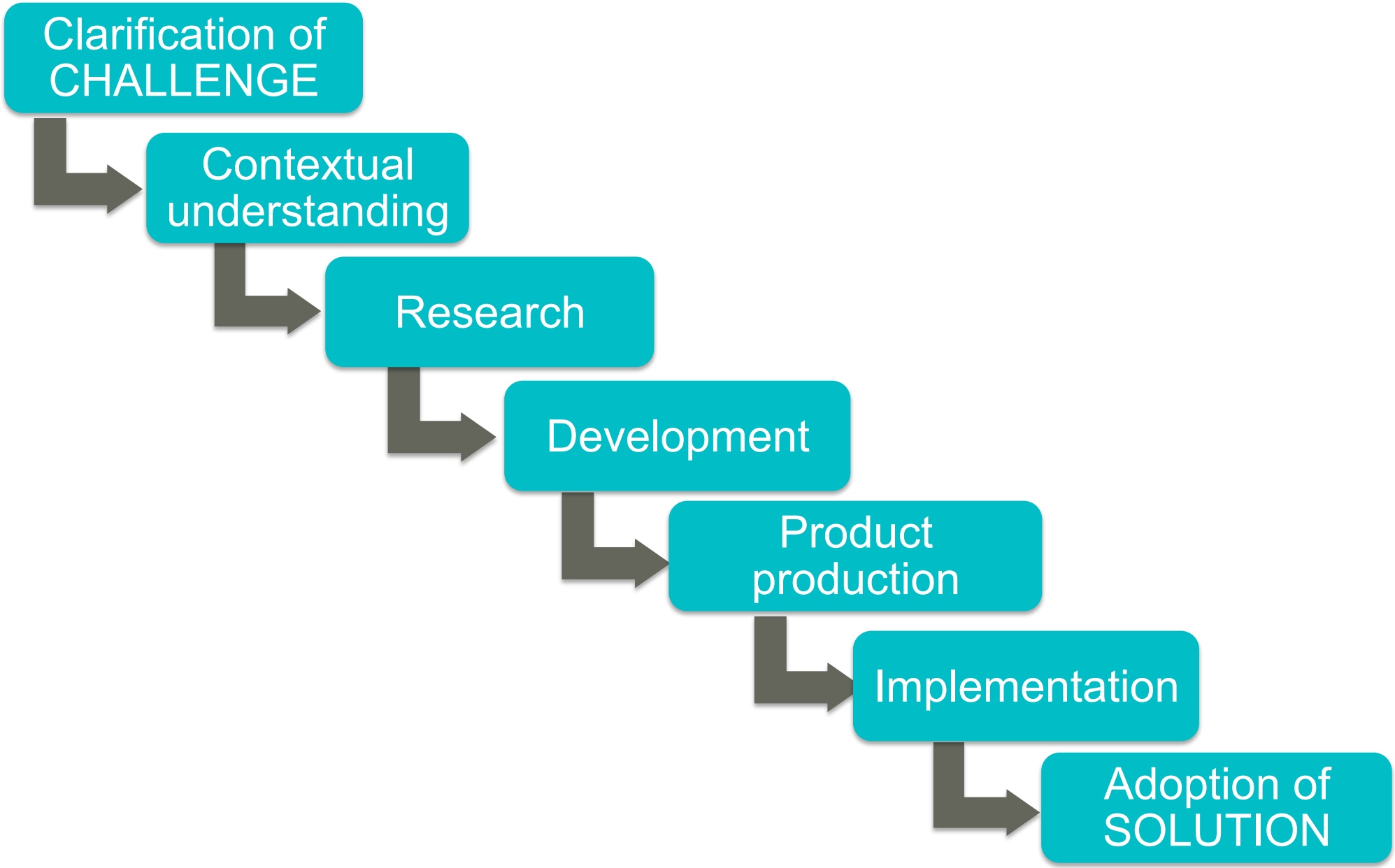








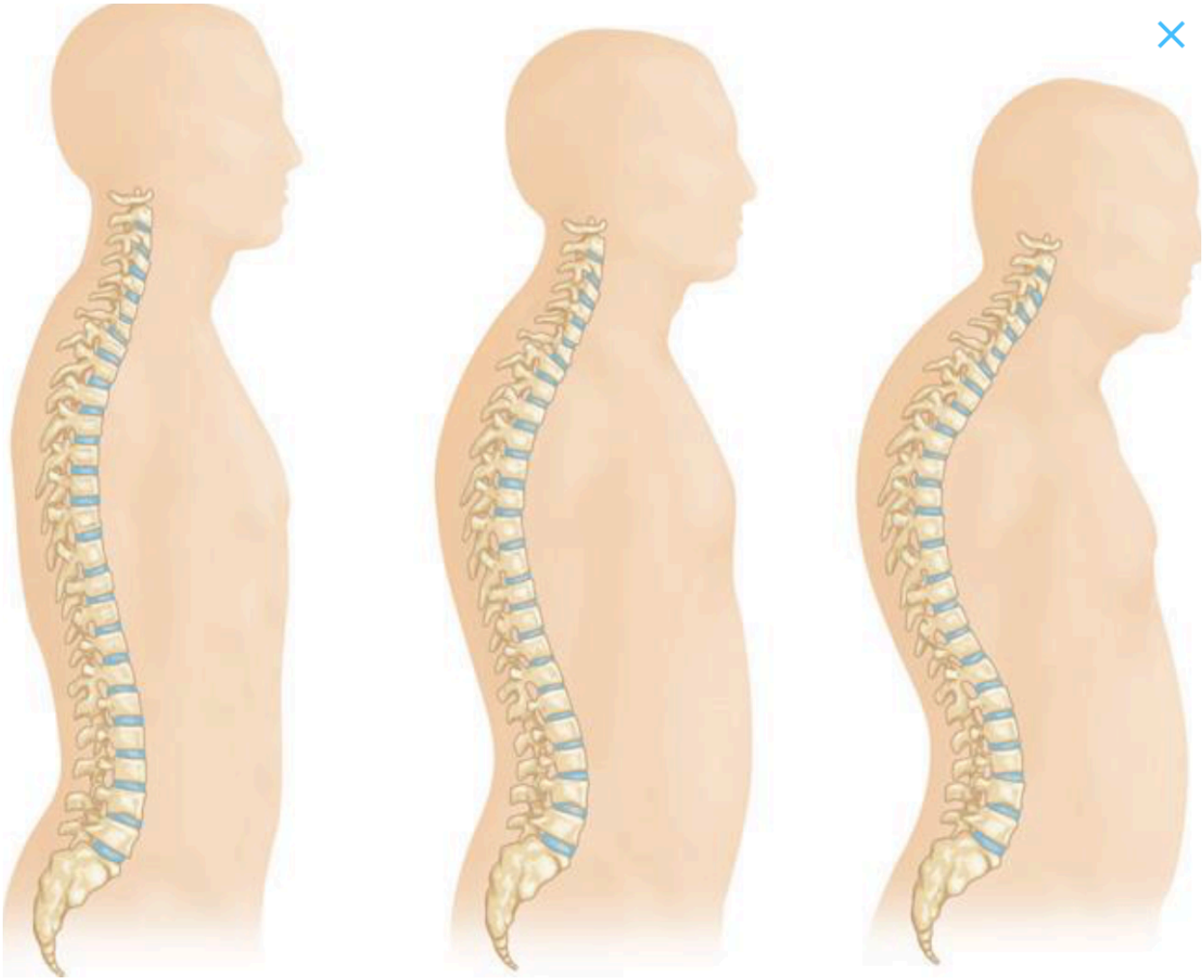




Case Study 1:
Research, Development and Implementation

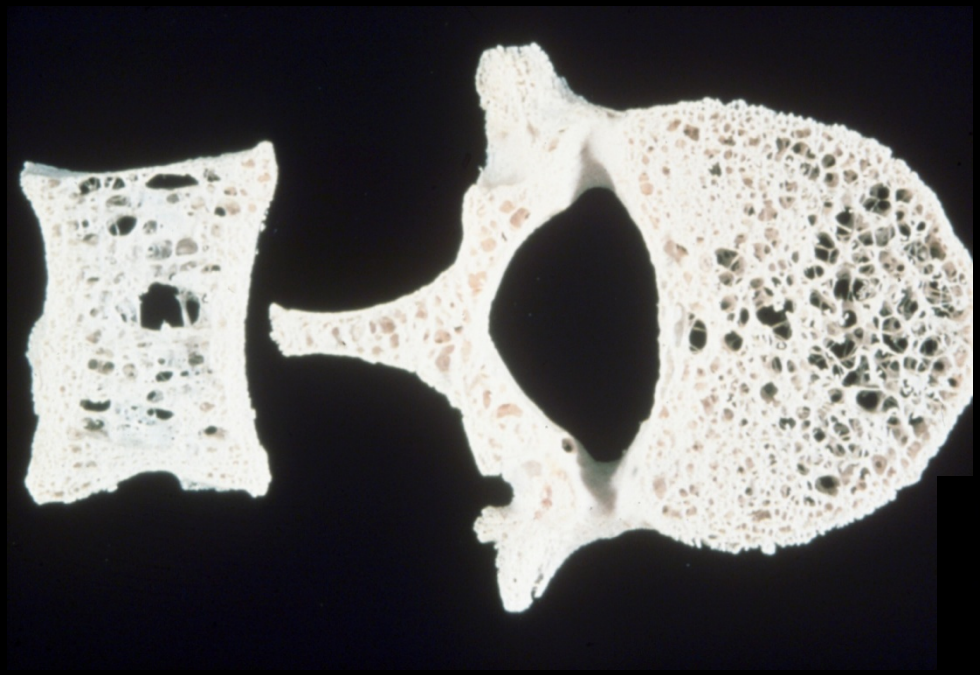
Non-invasive bone mineral measurement and the development of bone scanners for osteoporosis

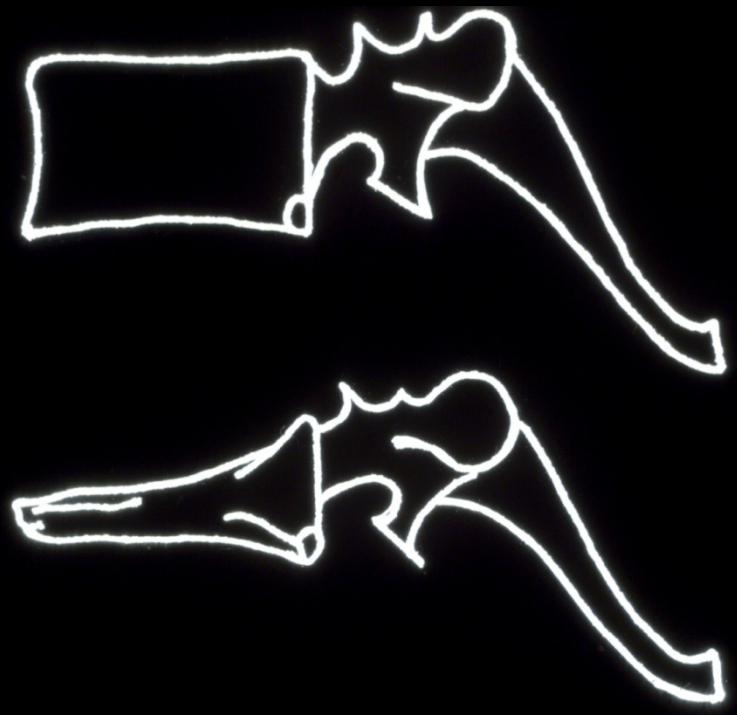
Visual appearance of osteoporosis over time

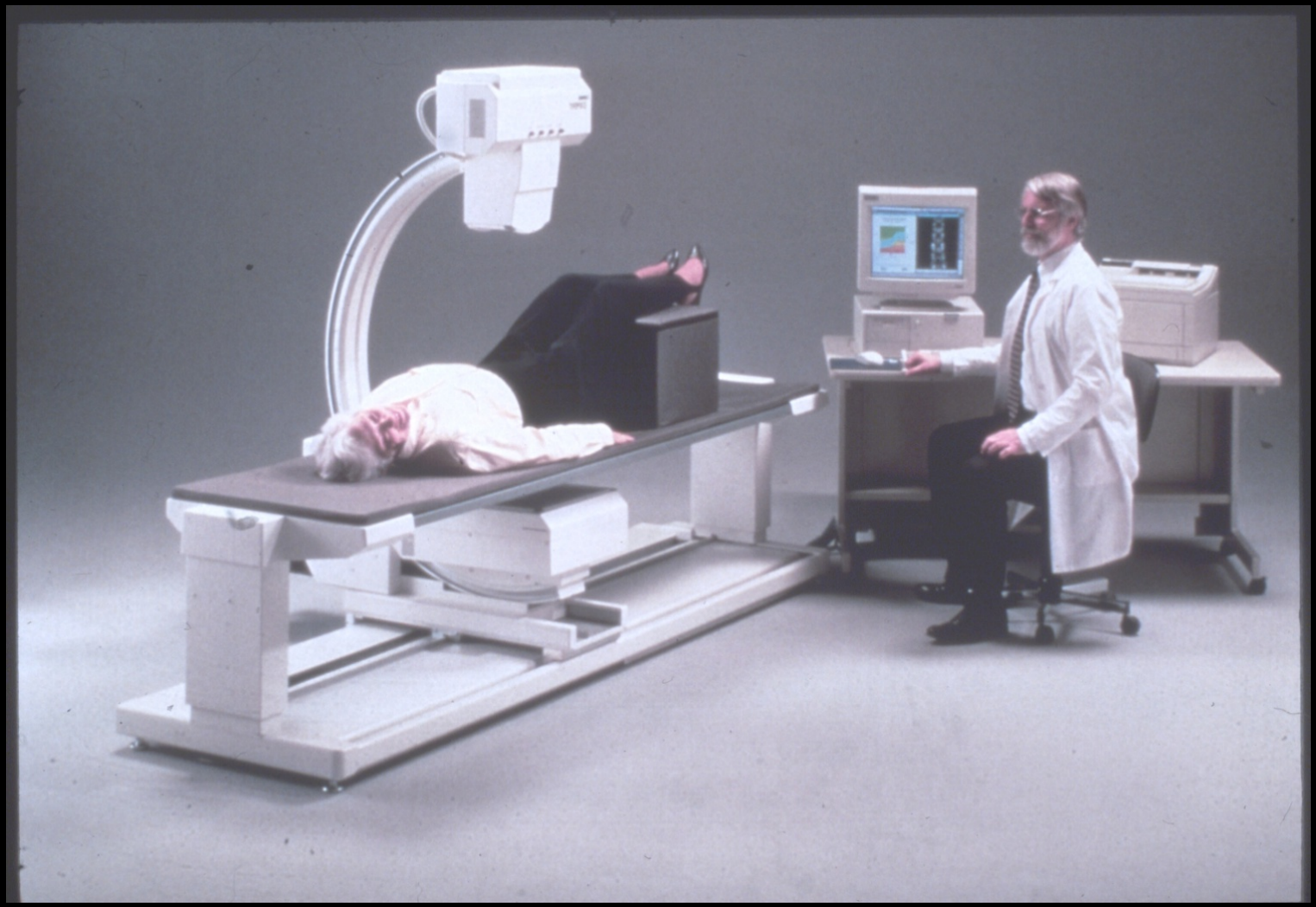


Osteoporosis - Incidence and burden

- Osteoporosis affects ~75 million people in Europe, USA & Japan.
- Worldwide, 1 in 3 women over age 50 will experience osteoporotic fractures, as will 1 in 5 men aged over 50.
- In Europe, disability due to osteoporosis is greater than most cancers and is comparable or greater than rheumatoid arthritis, asthma and high blood pressure related heart disease.
- In women over 45 years of age, osteoporosis accounts for more days spent in hospital than many other diseases, including diabetes, myocardial infarction and breast cancer.
- A 10% loss of bone mass in the vertebrae can double the risk of vertebral fractures, and similarly, a 10% loss of bone mass in the hip can result in a 2.5 times greater risk of hip fracture .

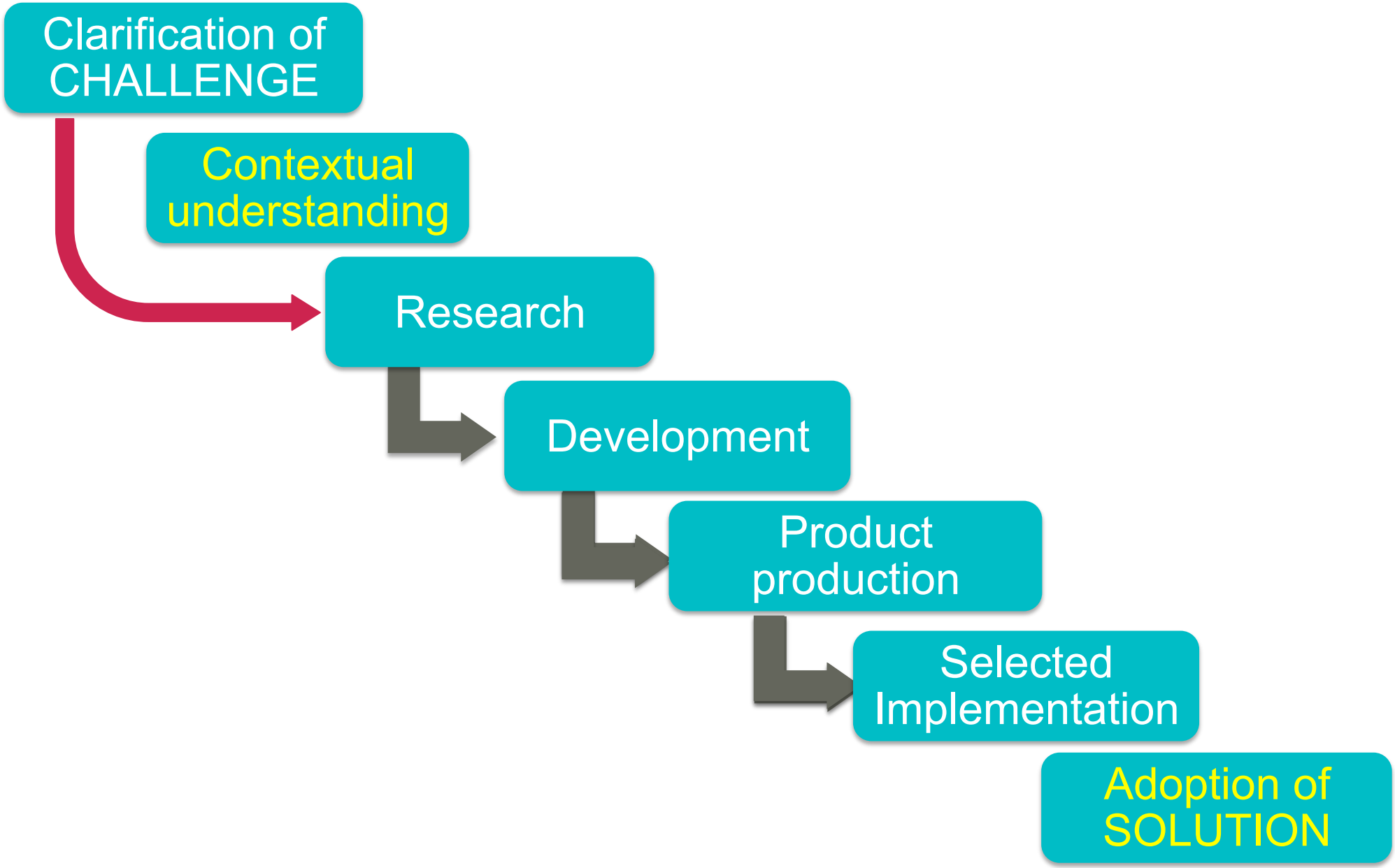


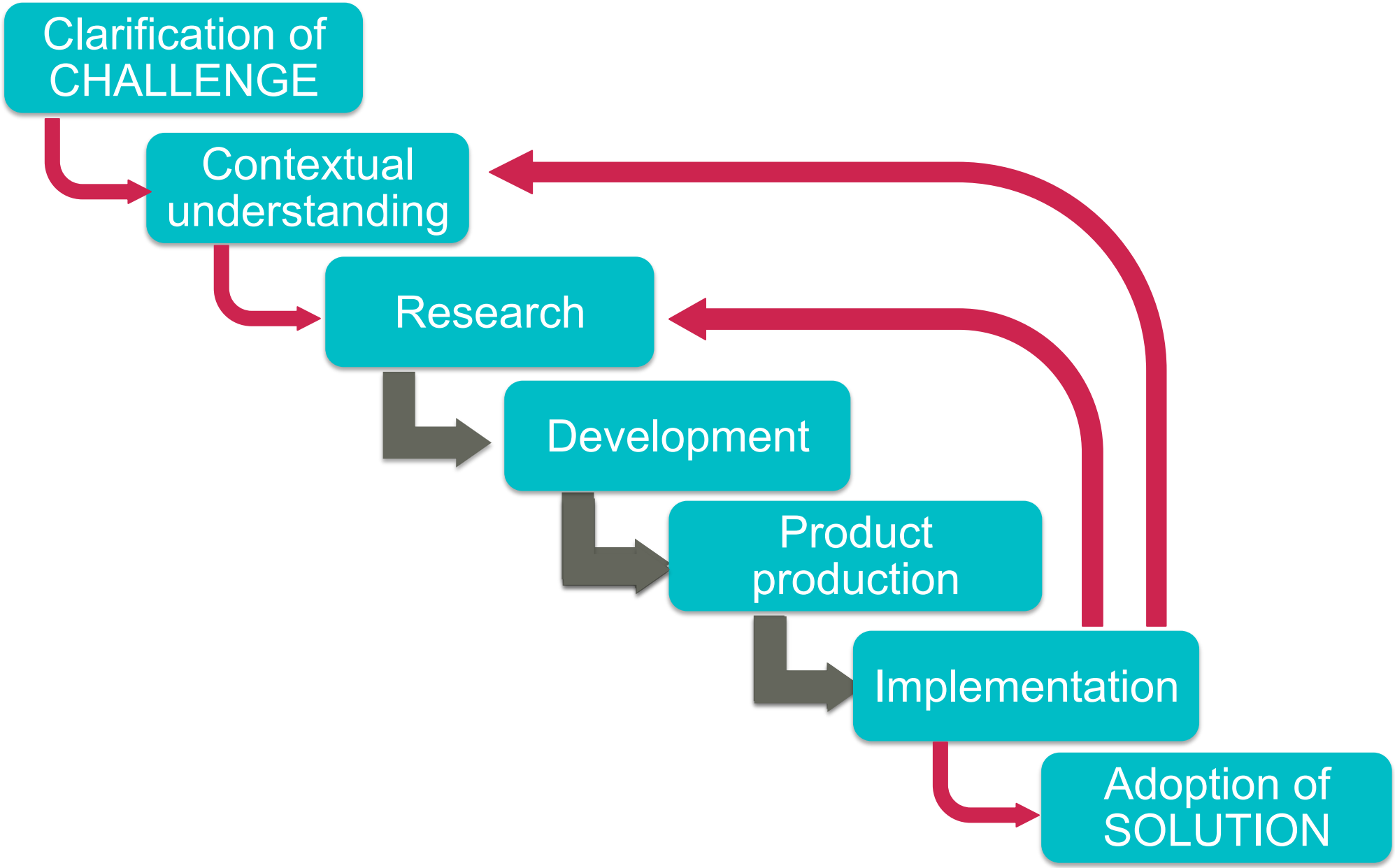




Bone Scanners for Osteoporosis (UK)

First research abstract published	1963
Development of equipment	1974 - 1980
Commercial equipment available	1978 - 1982
Purchased by research groups	1978 - 1988
Initial purchase by health systems	~1990
Questions about cost effectiveness	1994
Advocacy campaign	1995 - 1998
Widespread medical and health use	2000
Impact on societal health	?





Case Study 2:
Research through to Commercialisation
Magnetic Resonance Imaging

Stimulated by the success of X-ray computerised tomography

Computerised Tomography (CT)

Tomo~ From the Greek meaning ‘a slice’

~graphy adapted from the English/American and meaning:

‘a machine for a hospital costing a load of money which will make its manufacturers a fortune’

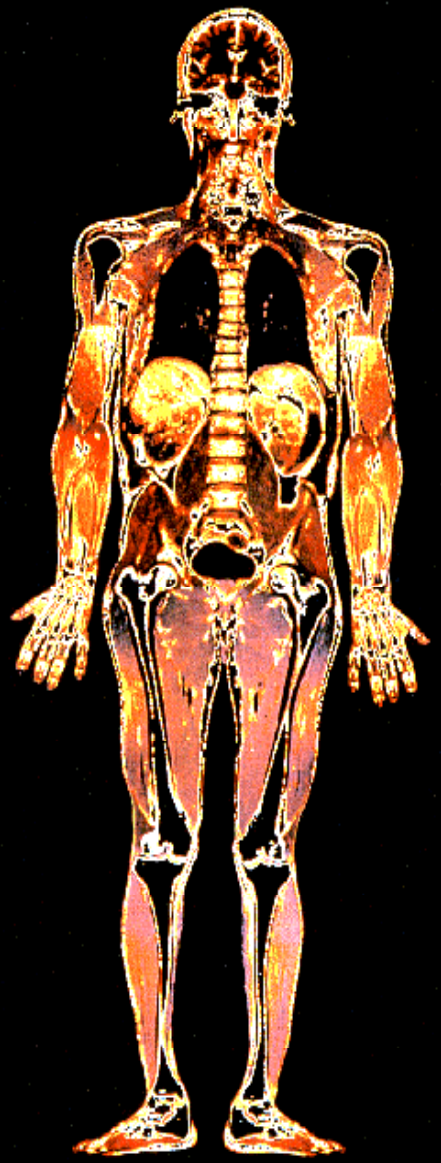
Computerised Tomography (CT)

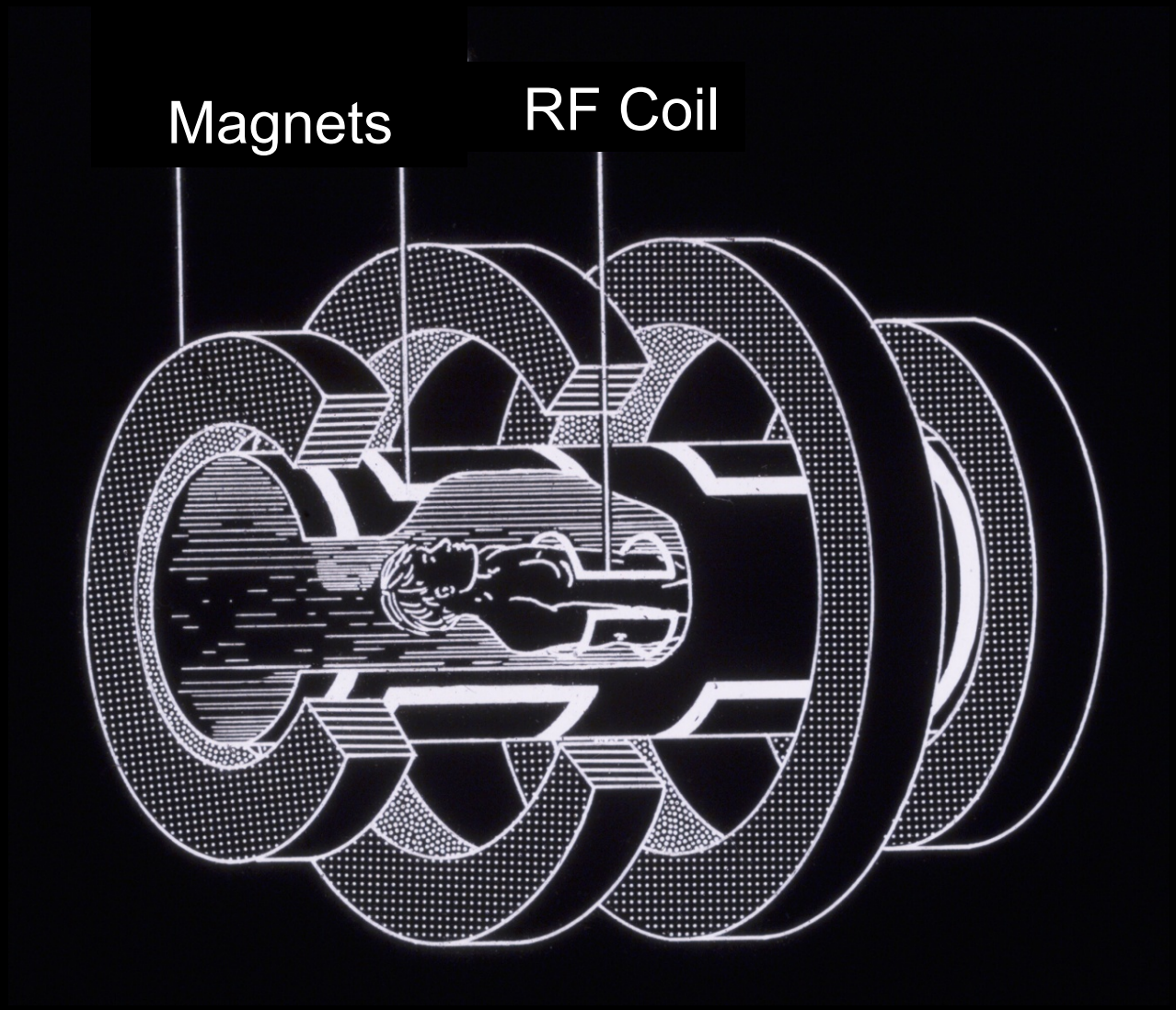
Developed by EMI in the early 1970s, systems were quickly installed many hospitals. Changed the attitude towards ‘scanners’.

- Back-projection mathematics (1917)
- Semiconductors (1960s)
- Mini-computers (1970s)

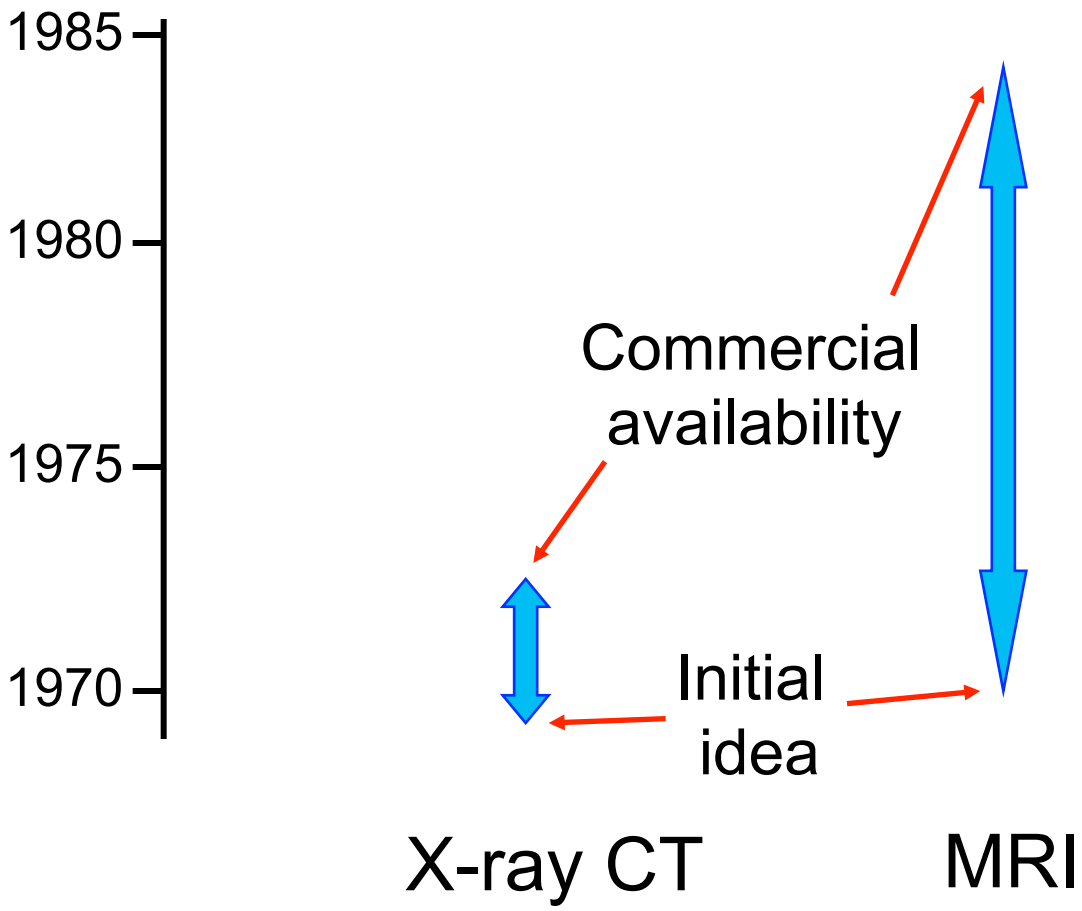
Legislation introduced in the USA to restrict their use.

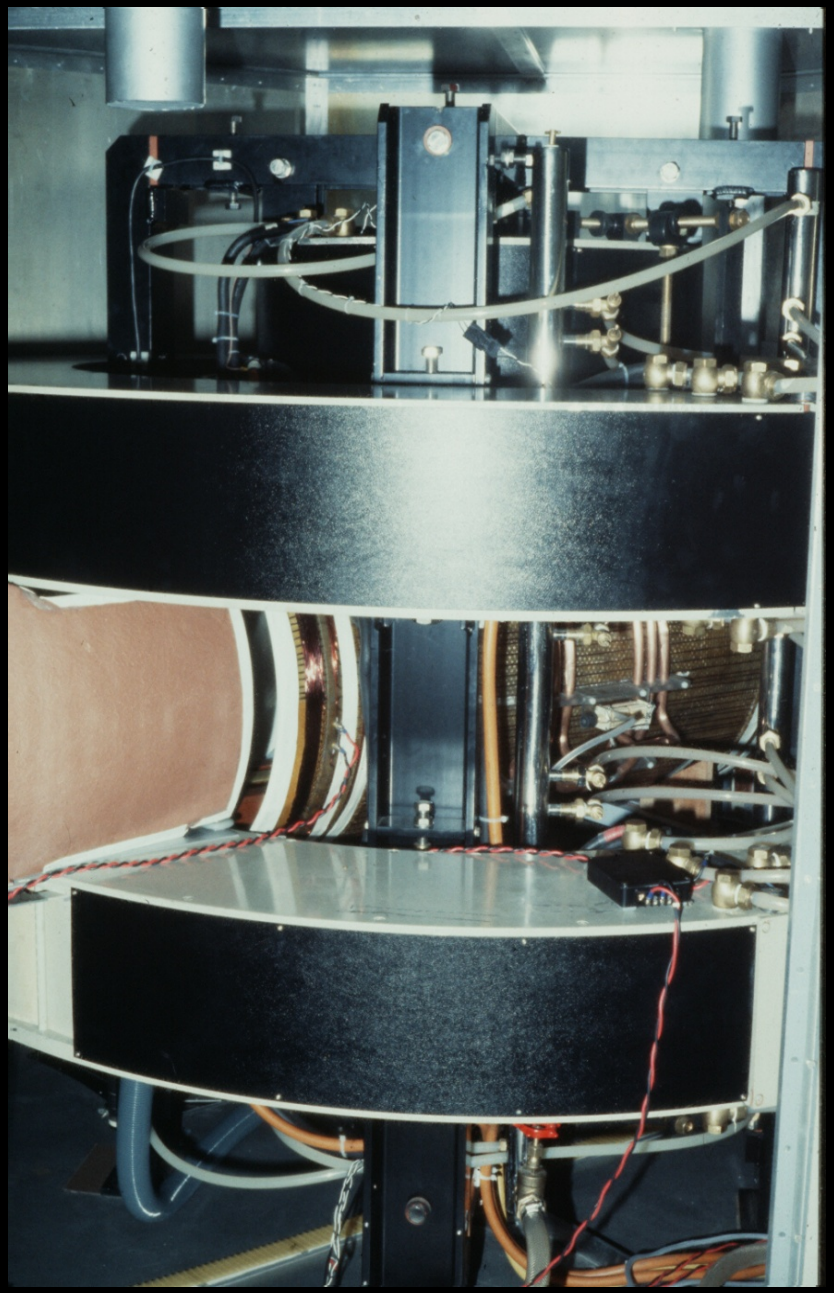
Magnetic Resonance Imaging

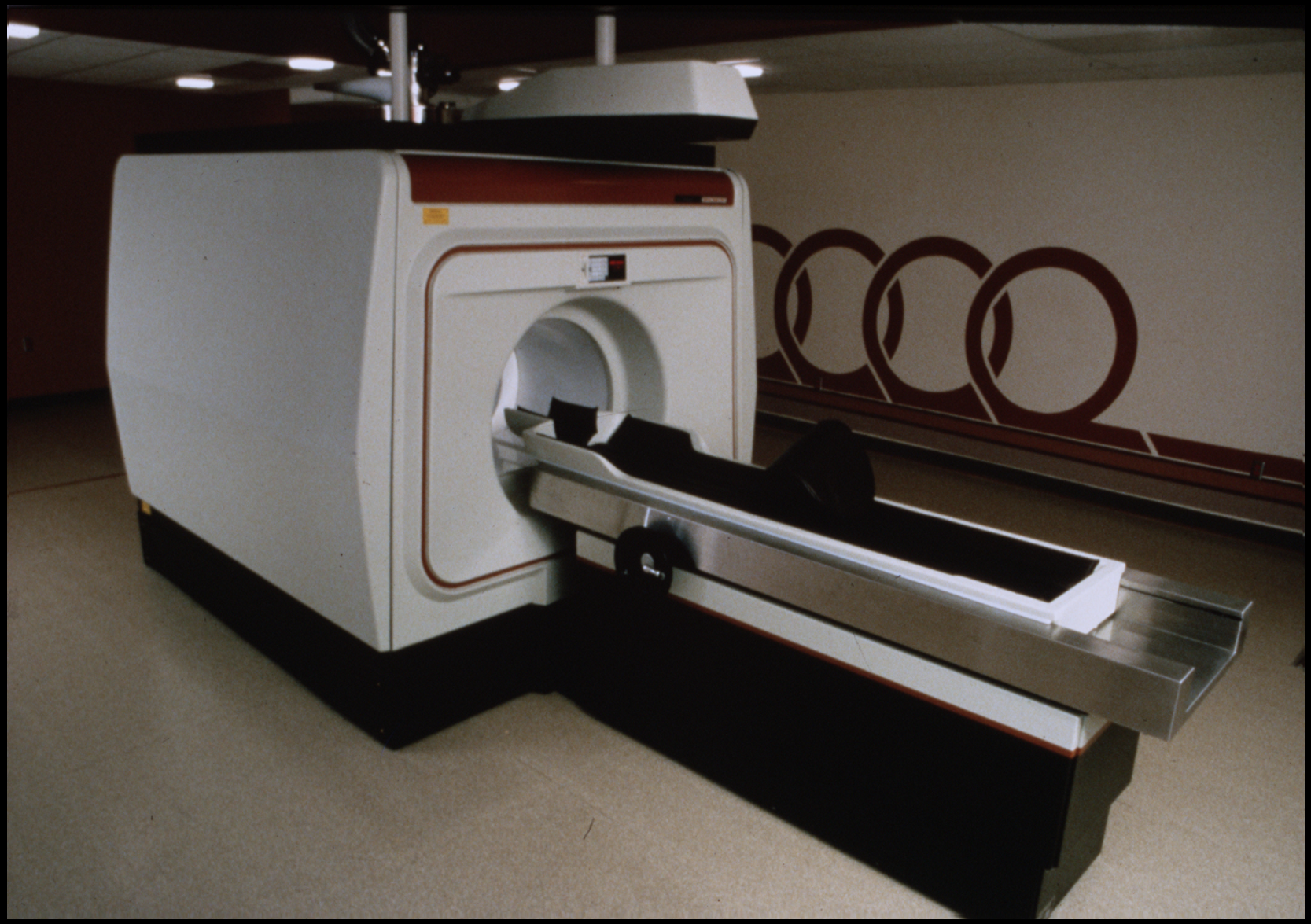


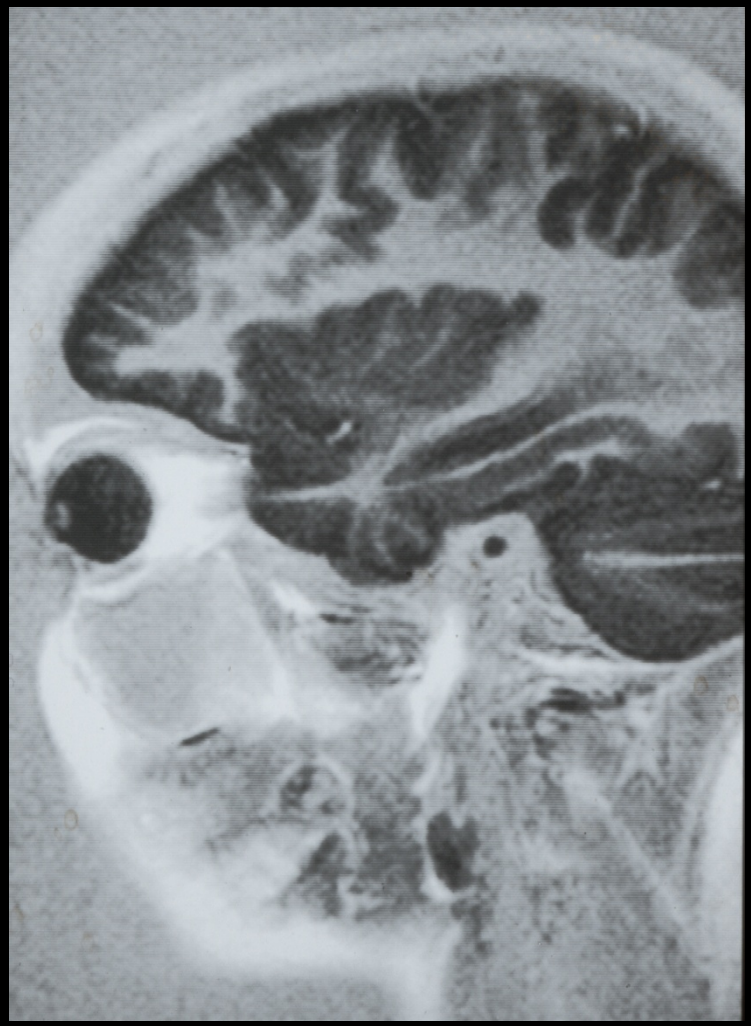


Development of X-ray CT and MRI









cm

Magnetic Resonance Imaging (1)

Following the impact and financial success of CT, the science/engineering of MRI was funded and developed	1974 – 1982
Paper which underpinned the practical approach to clinical MRI	1980
Development of low field commercial system (University spin-out)	*1982 - 1985*
Development of low field commercial systems from global imaging companies	1983 > 1989
Sale of company	*1986*

Magnetic Resonance Imaging (2)

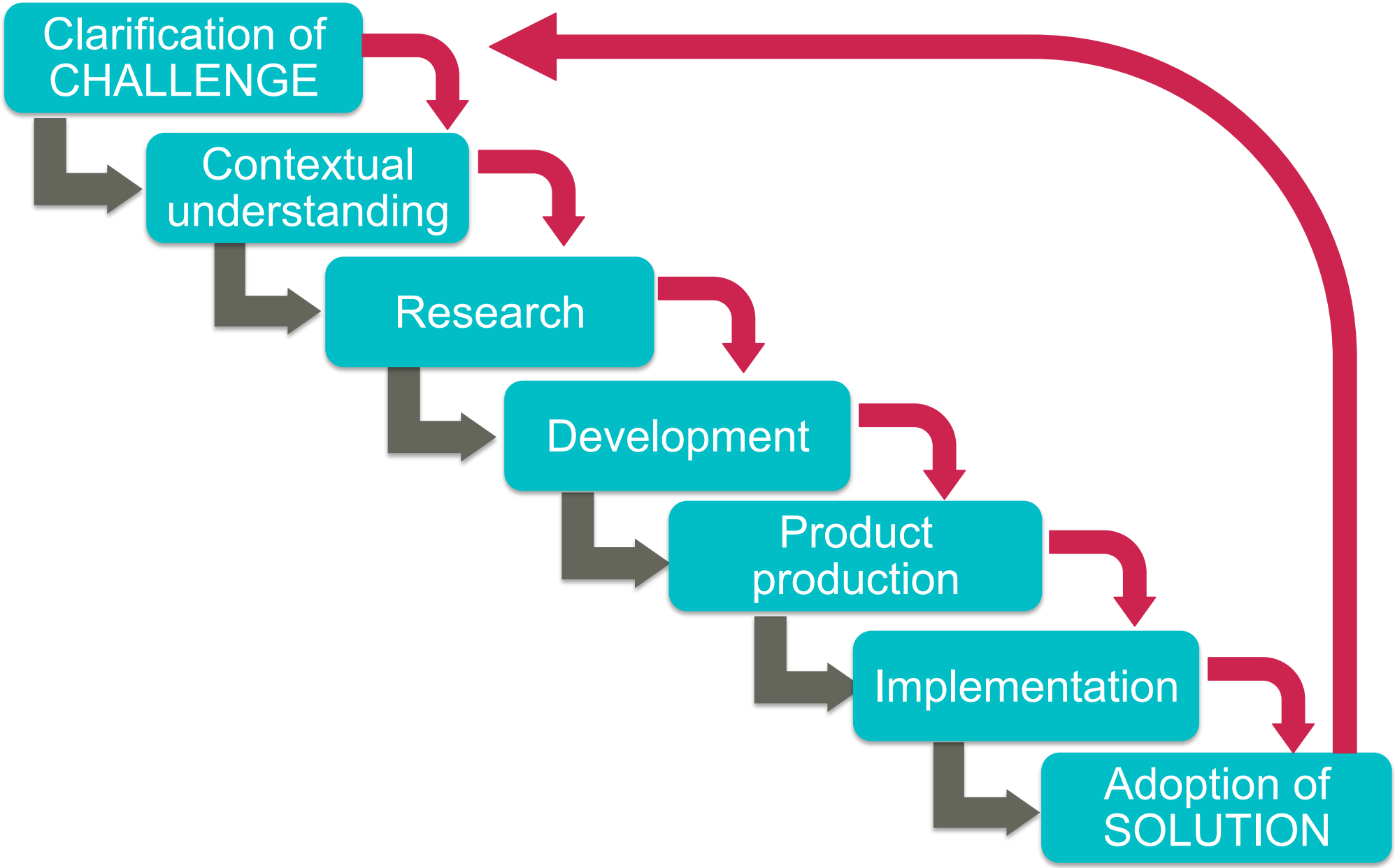
Development of high field MRI systems by global imaging companies — 1987 > 2010

Wide availability in health systems with an 'impact' on health care and patient management — 1995 >

Clinical and cost effectiveness (ie everyday use in non-selected patients) started to become clearer — 2005 >

Which impact is important?

- Commercial impact
- Health system impact
- Individual patient impact
- Health Economic impact



Case Study 3: Contextual understanding, implementation and adoption

Kangaroo Care

Babies and families in neonatal units

- ~10% of babies admitted to neonatal units; about 70,000 annually in UK
- Numbers and length of stay increased almost threefold since mid-1990s
- This is due to improved survival at lower gestation, increased multiple births, increased maternal age

Kangaroo/skin-to-skin care

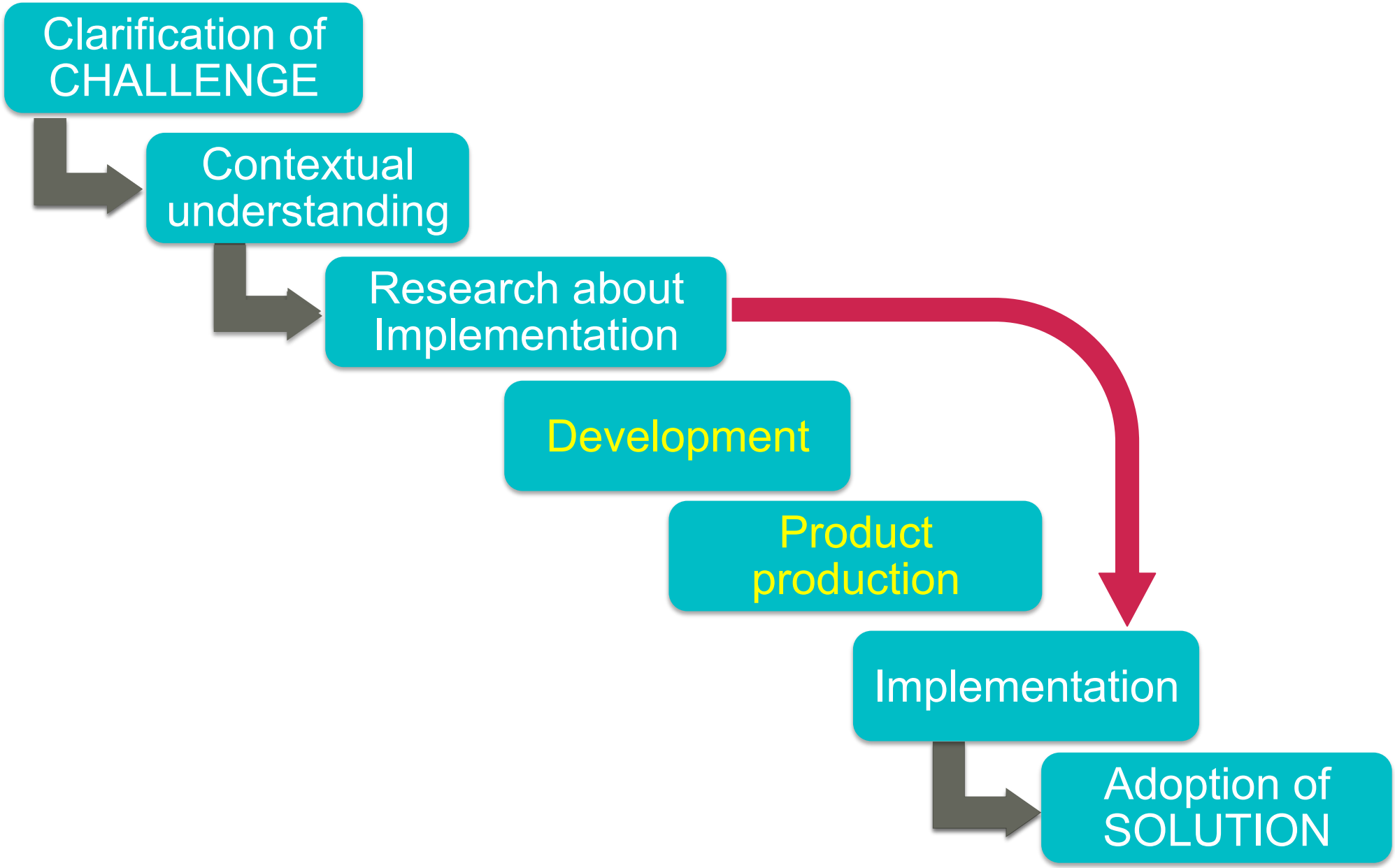
Significant improvements in the following

- Breastfeeding
- Head circumference growth
- Oxygen saturation
- Hypothermia
- Serious morbidity at two and six months

With no adverse effects

Health research and impact

- This is much wider than medical research
- Not only can it have a significant impact on population health it can have a greater impact per unit cost than medical research
- A health dividend produces an economic dividend
- Can produce conflict with technological/ commercially focussed interventions which could have a commercial/economic impact



Case Study 4:
Long-Term Strategic Research Programme

Thin film nanoscience - High Power Impulse Magnetron Spluttering (HIPIMS) Research Group

Engineering Research

500,000 researchers

Materials Research

100,000 researchers

Thin Film Research

10,000 researchers

Plasma Vapour Deposition (PVD)

3,000 researchers

High Power Impulse Magnetron Spluttering (HIPIMS)

200 researchers

High Power Impulse Magnetron Sputtering Research Group

- First joint UK/Fraunhofer Centre
- Partnerships with major German and UK global companies
- Extensive patent portfolio

HIPIMS Research Group – 20 years old

- University investment in the best equipment and infrastructure
- Prestigious international quality publications and significant patent portfolio
- The group has raised major funding from EU, Government and Industry
- International leaders in the science and technology of HIPIMS and run the Global Conference on HIPIMS
- First joint UK / Fraunhofer Research Centre
- Major international industrial partners

Case Study 5:
Contextual understanding and implementation

Contract from an SME to review a manufacturing process in order to improve business efficiency

- Business School identified ways to streamline the company's processes
- Engineering identified way to improve the manufacturing process

Consequences:

- Positive response from company and good PR for University ✓
- Income to the University and justification for government funds ✓
- Improved cost-effectiveness for the company ✓
- Staff redundancies so negative job creation ✗
- Company did not re-invest savings to grow company ✗
- Overall economic and societal impact – more ✗ than ✓

Concluding Remarks

Distorting impact

- Increase in ‘impression management’ by institutions.
  - PR and marketing require ‘good’ news stories as opposed to stories about strong impact
  - Proof by example of good impact rather than a comprehensive overall assessment of impact
- Over-reliance on surveys and subjective assessment
- Reticence about using rigorous quantitative indicators
- Focus on ‘academic impact’
  - Profile on academic social media sites
  - Commercial internet sites set up to ‘increase impact’

Impact – General

- Impact can take a long time to become apparent
- Impact is not static – it continues to change with time
- Impact is not always positive – also it can move from positive to negative
- The narrative and presentation of impact has become an industry and may distort actual impact

Impact – Measurement

- Measurement of impact needs to be prospective not retrospective
- Parameters of impact should be determined prospectively to enable measurement and the creation of evidence
- Impact needs to be evidenced, often quantitatively - this may require some cultural adjustment in some academic areas
- Impact requires external independent validation - this often needs to be sought out

Impact – Resource Implications

- The measurement of impact is time consuming
- The accurate measurement of impact is expensive
- Funding is generally not available to demonstrate or measure impact - if it is, too much is expected for too little funding
- The production of evidence to demonstrate impact needs funding to find it and measure it properly
- Everyone thinks its everyone else's responsibility to fund the cost of impact assessment

Impact - Planning

- Choose research problems that *a priori* you expect to have an impact - potential impact could influence an early research strategy
- Impact should be part of the plan

Scenarios

Scenario 1. Impact of an organisation with a high profile focus

- A new Institution for the Natural Environment has been created. Its mission encompasses teaching, research and innovation and it wishes that each of these areas should have a demonstrable in impact.
- Your role is to recommend the strategic and operational imperatives for this new organisation, if it is to deliver an impact agenda.
- You may wish to focus on a selected area of the Natural Environment to act as an exemplar (eg sustainable land use, aquaculture, agricultural economics, etc).
- As this is a new organisation there will not be a need to change existing cultures and processes, but staff expectations may need to be addressed.
- You may wish to offer suggestions as to priorities for the evolution of the impact agenda.

Scenario 2. Impact from high quality research

- A department in a STEM subject in a research intensive organisation must identify how it should demonstrate that its research is having an impact, and should also indicate the magnitude of that impact.
- Your role is to recommend the organisational processes and practical changes that need to be put in place to obtain results over a three-year period.
- You may wish to focus on a selected STEM subject area to act as an exemplar (eg engineering, medical school, physics etc)
- What performance indicators would you propose to identify and measure impact?
- What internal changes will need to be made and what change management processes would you recommend?

Scenario 3. Impact from an organisation with a strong external focus

- An existing organisation has self-classified itself as ‘entrepreneurial’ or ‘innovative’, and it intends to be widely engaged with external organisations in the private and public sectors.
- Your role is to recommend the organisational processes and practical changes that need to be put in place to achieve this over a three-year period.
- Your recommendations should concentrate on impact which occurs as a consequence of (i) students and education and (ii) innovation and specialty expertise.
- Careful consideration will need to be given to the relationship with external organisations.
- How will impact be recognised, given the role that external organisations may have, and how will you recognise high quality impact activity?

Scenario 4. The consequence that a focus on impact has on internal organisational processes and structures.

- A large general University has a council/governing body which has decided that there should be a greater focus on impact across the organisation.
- Your role is to recommend the internal support department organisational processes and changes that need to be put in place to achieve this over a three-year period.
- You will need to assume that certain activity will be devolved to specialist academic departments; what can be devolved and what can be centrally managed?
- What might the financial consequences be? Can this be done on a cost-neutral basis or will there be a need for investment? If the later would might be the basis for a business case?
- You may wish to offer suggestions as to priorities for the evolution of the impact agenda

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Extra Slides to support Q&A

Impact Indicators

Impact Indicators

- Consider whether you wish to just measure research based University activity just from research
- Use accessible data
- Use verifiable data
- Start by measuring some aspect of impact using the easier parameters
- Ideally indicators should be measured prospectively

Lead Indicators and Qualifiers

Basic lead indicators reflect the opportunity to create impact

Example: Number of patents

Qualifiers for the lead indicators will reflect impact

Example: Size of patent portfolio *(income from licences and sales of patents per annum)*

Surrogate Indicators (4)

- Some data relevant to impact are difficult to acquire and are not verifiable (eg job creation)
- Use an accessible and verifiable indicator that is a suitable surrogate for this parameter

Impact Indicator and Surrogate Indicator

The basic lead indicator which reflects the opportunity to create impact

Example: Number of start up companies

Qualifiers for the lead indicator will reflect impact and be a surrogate for new jobs

Example: Number of start-up companies (*with a financial turnover of more than €100k per annum)*

Health Sector Specific Impact Parameters:

Sector Specific Impact Parameters – Health

High Level – Examples

- Epidemiologically adjusted Mortality Rates
- QUALYs (Quality Adjusted Life Years)
- Human Development Parameters (IQ etc)
- Clinical Effectiveness (this has a specific definition in medicine and health)
- Economic Cost Effectiveness
- Change in national policy

All supported by high quality evidence

Sector Specific Impact Parameters – Health

Intermediate Level – Examples

- Clinical Efficacy (this has a specific definition in medicine and health)
- Measurable change in clinical practice (and its magnitude)
- Survival rates
- Patient response and reaction (eg reduced discomfort/stress)
- Cost reduction
- Change in local/regional policy

All should be quantifiable and verifiable

Sector Specific Impact Parameters – Health

Preliminary Level – Examples

- Potential clinical efficacy
- Potential change in clinical practice
- Preliminary changes in survival rates
- Preliminary patient response and reaction
- Predicted cost reduction
- Change in departmental/institutional policy

These measures of 'impact' are unlikely to be rigorously quantifiable or verifiable