



Engineering Better Patient Care

Embedded Engineering Design Process: Meeting Unmet Clinical Needs



What is Design?

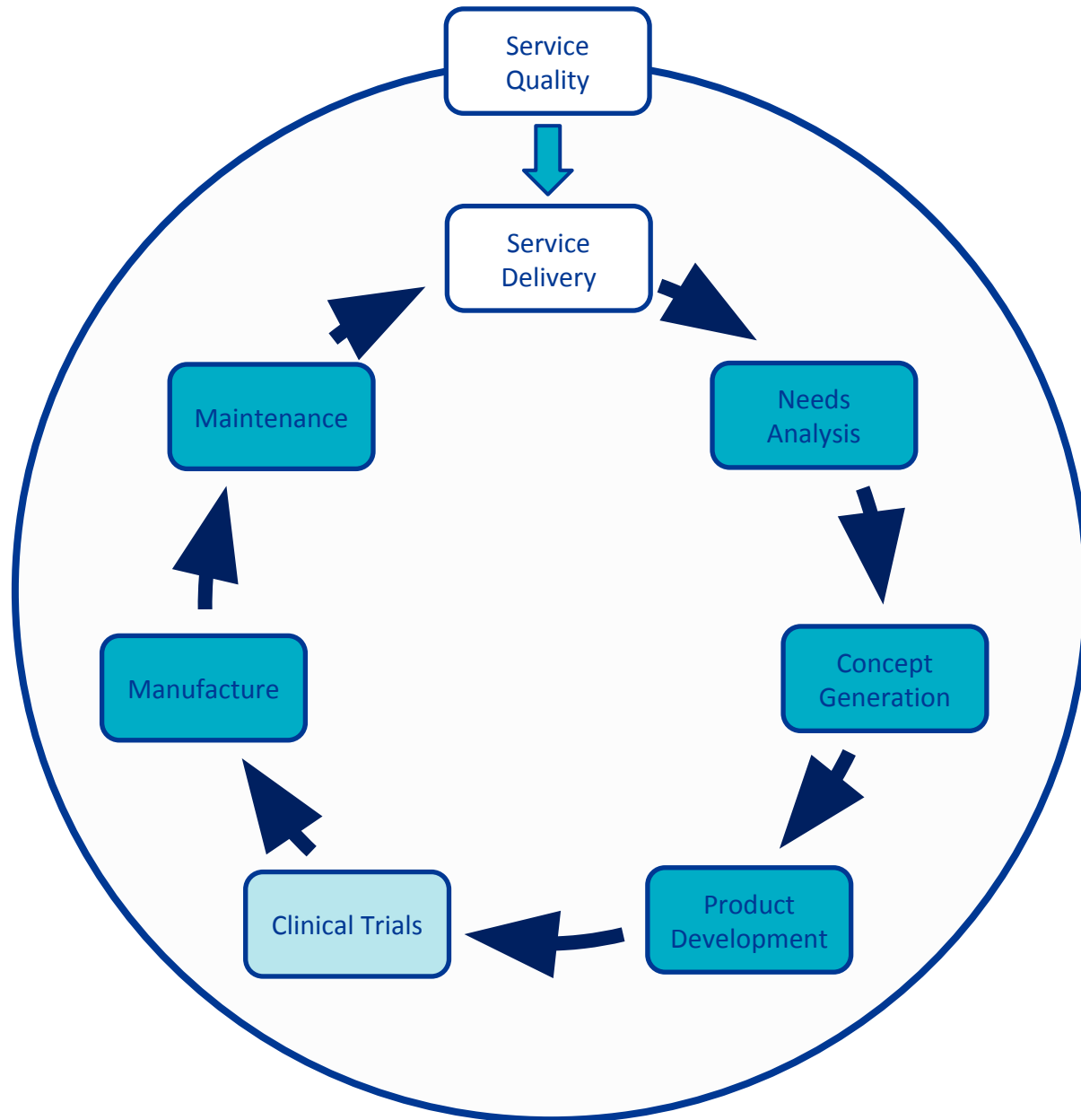
- The engineer, and more generally the designer, is concerned with **how things ought to be** - how they ought to be in order to attain goals, and to function - Herbert Simon
- **All people are designers. All that we do, almost all the time, is design, for design is basic to all human activity.** The planning and patterning of any act toward a desired, foreseeable end constitutes the design process. (modified) – Victor Papanek
- Design is less about how things look and more about **how we look at things** – based on Design Council
- The **business of better**

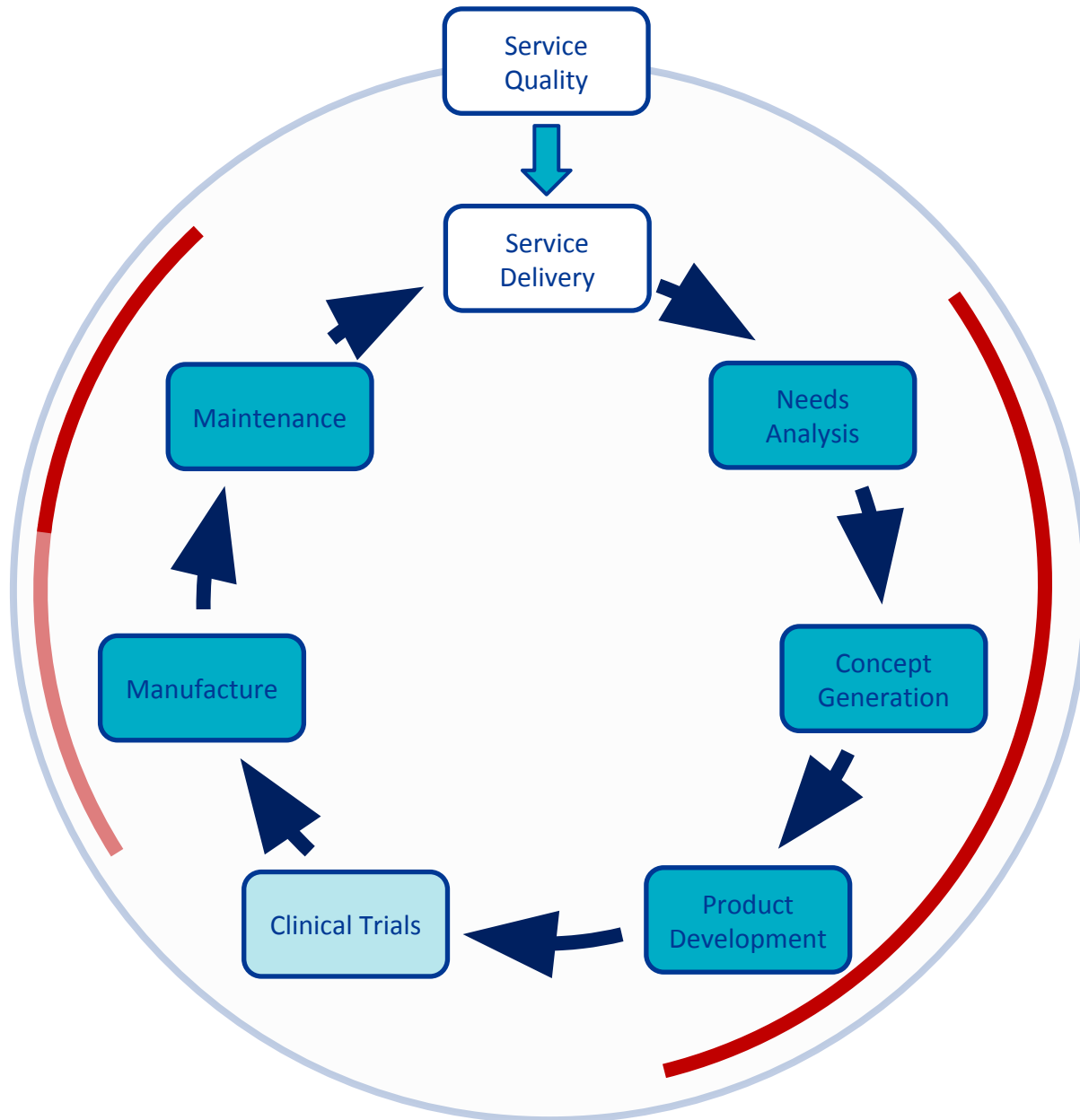
Service
Quality

Kind
Safe
Excellent

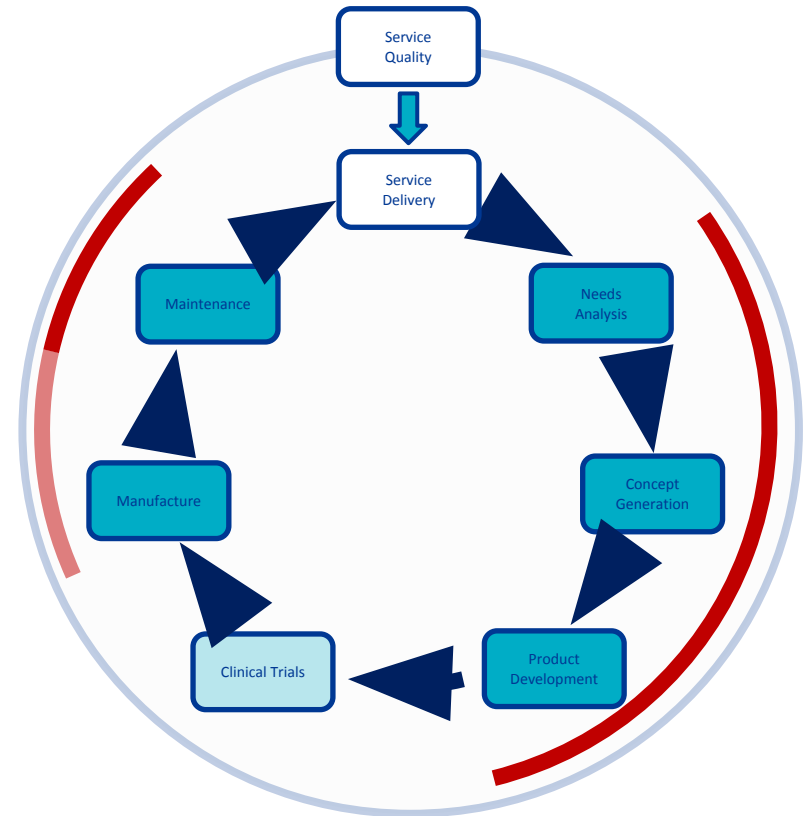
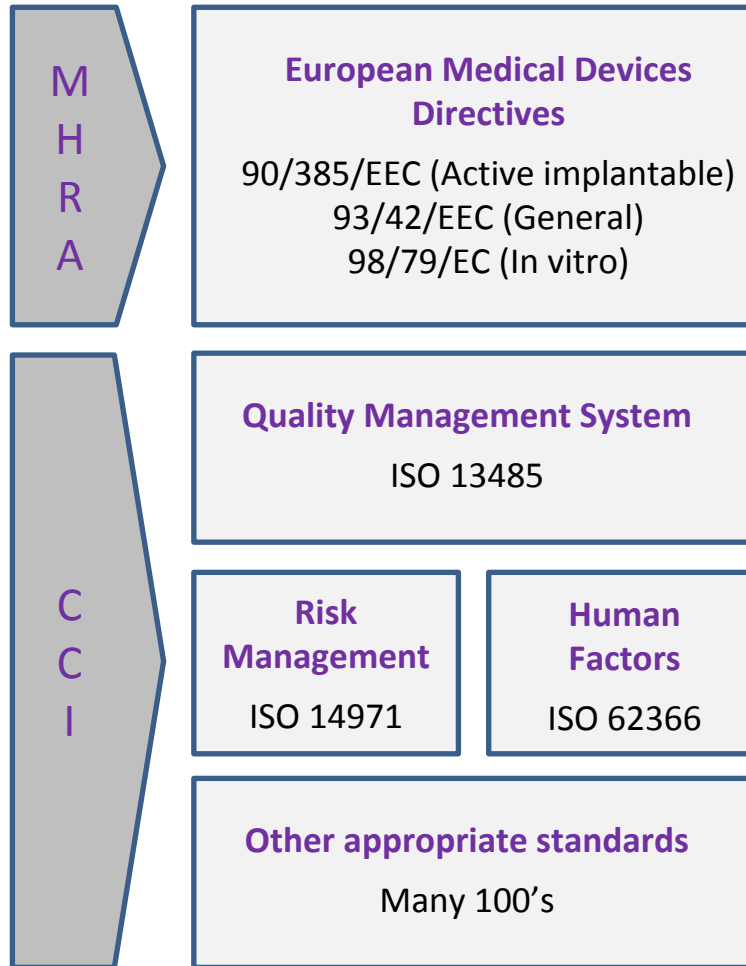
Good design
requires a
robust process

Kind
Safe
Excellent

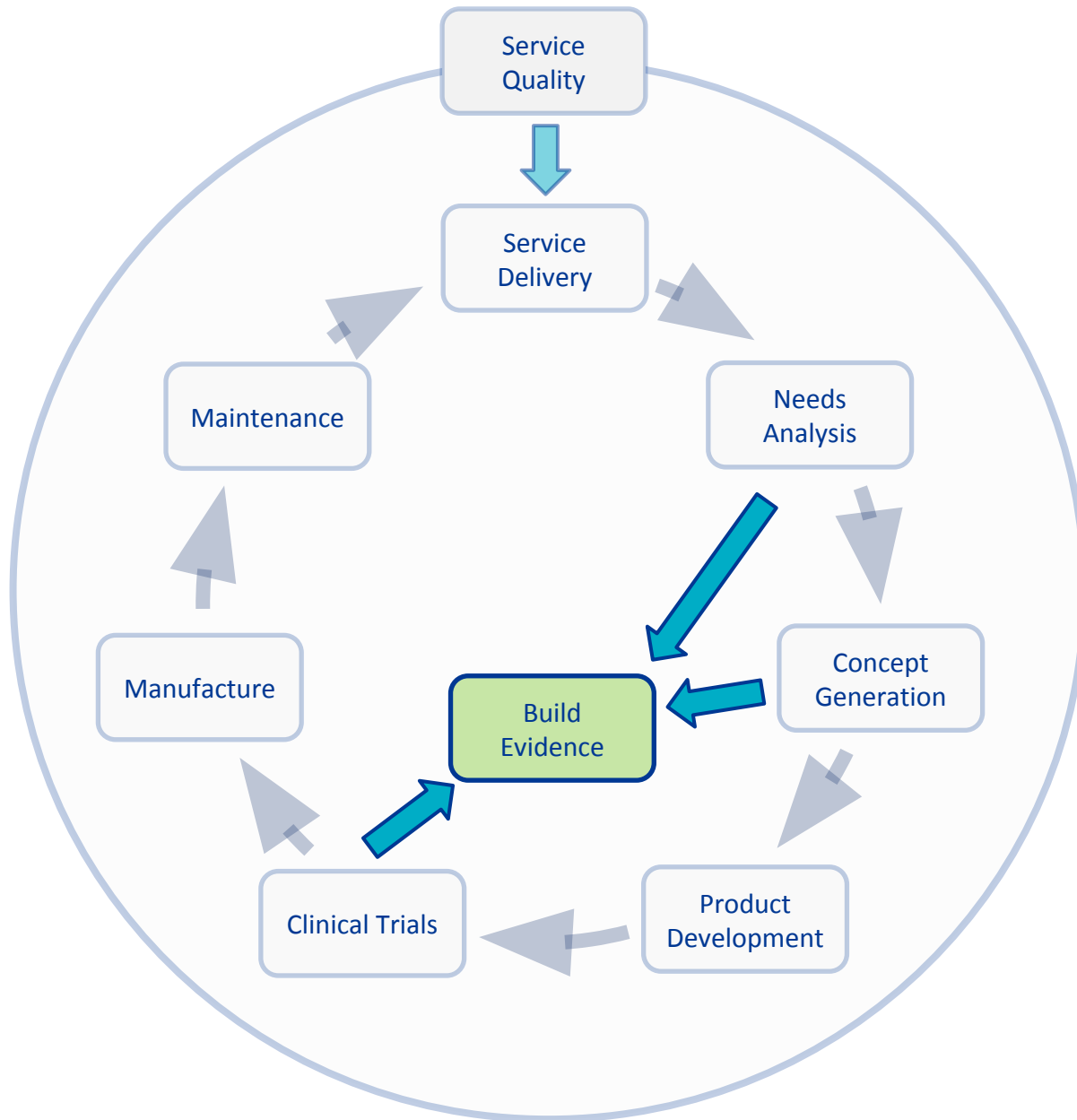


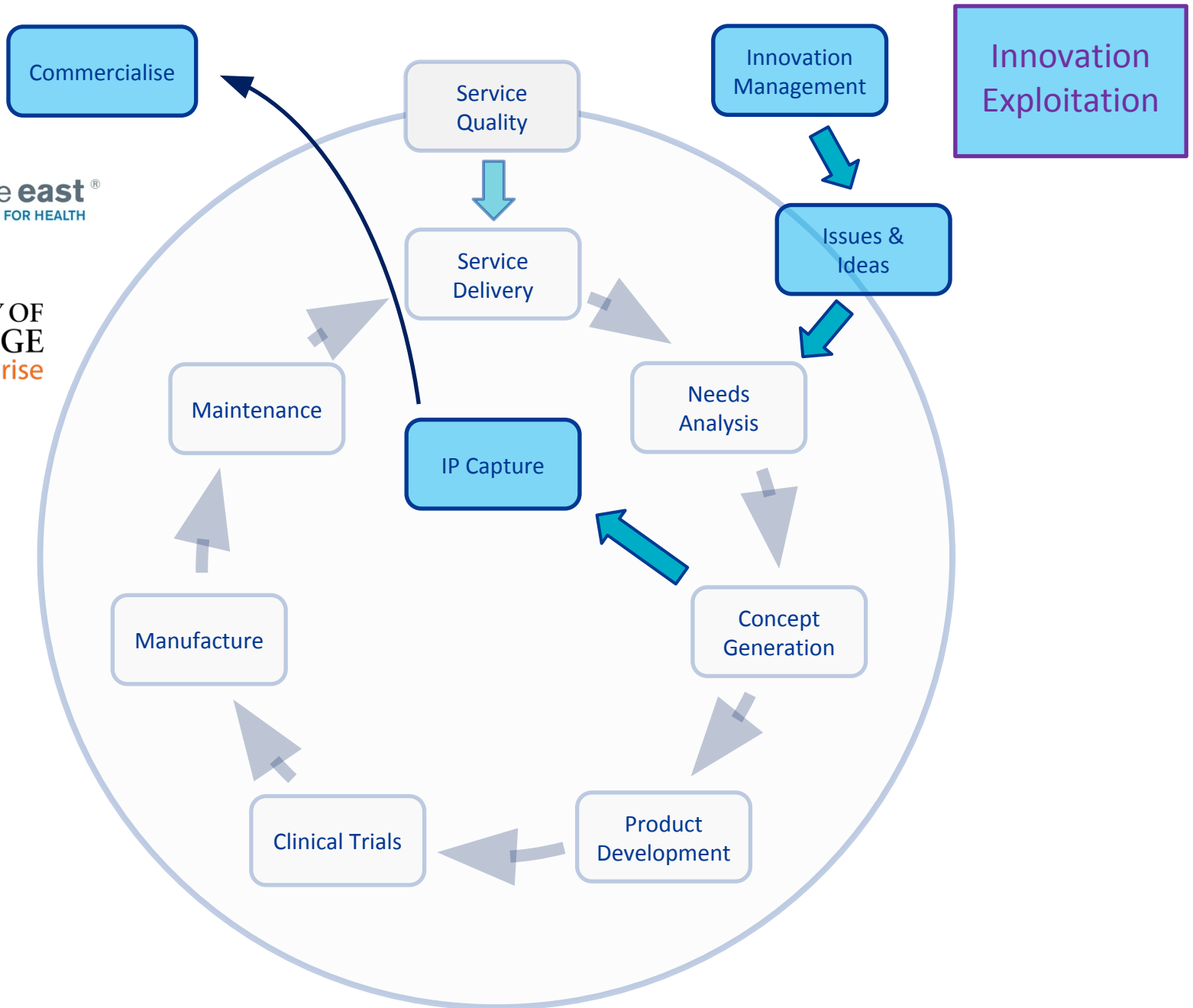


Standards

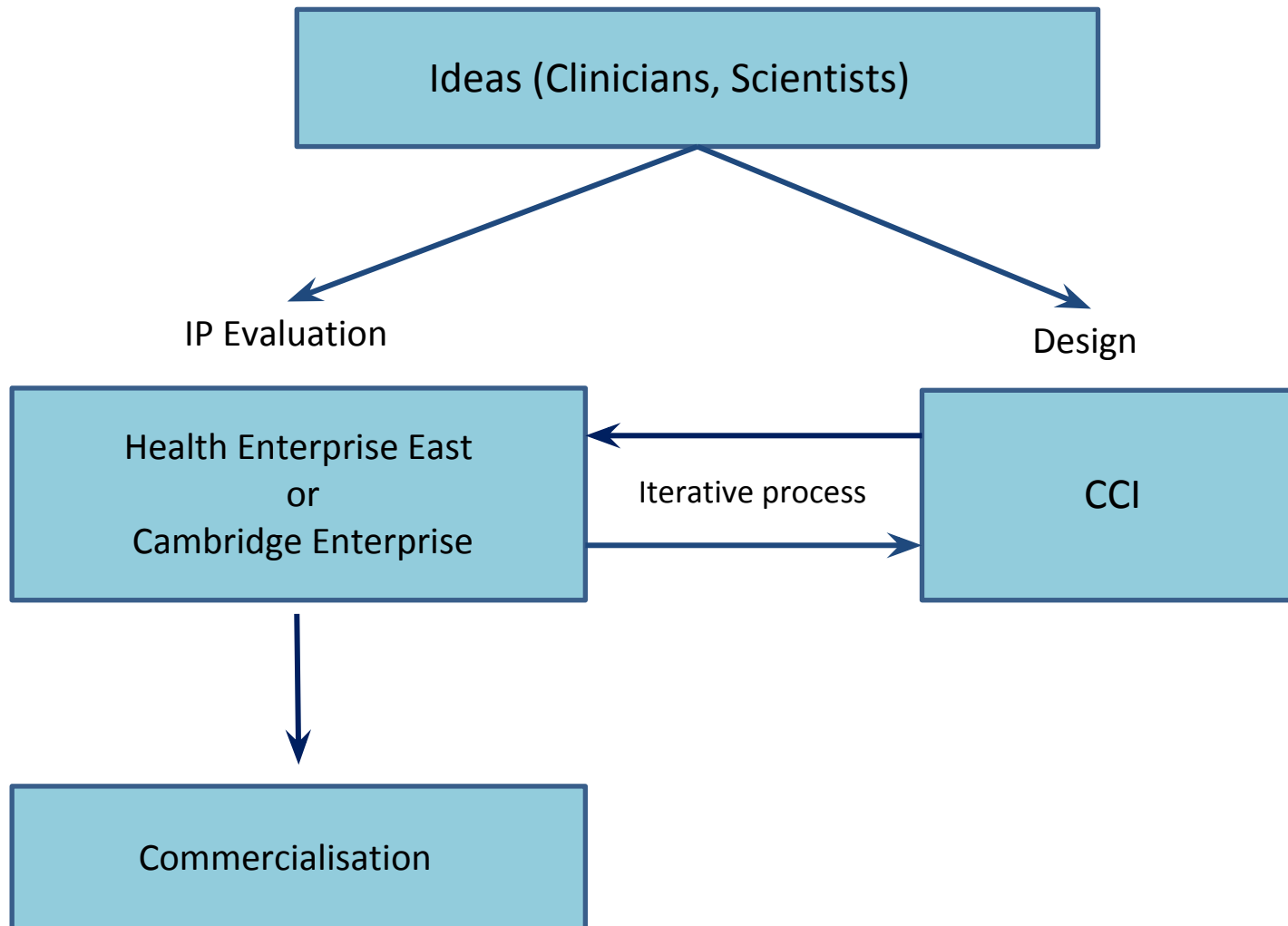


Clinical Case





IP Capture & Commercialisation



Service
Quality

Kind
Safe
Excellent

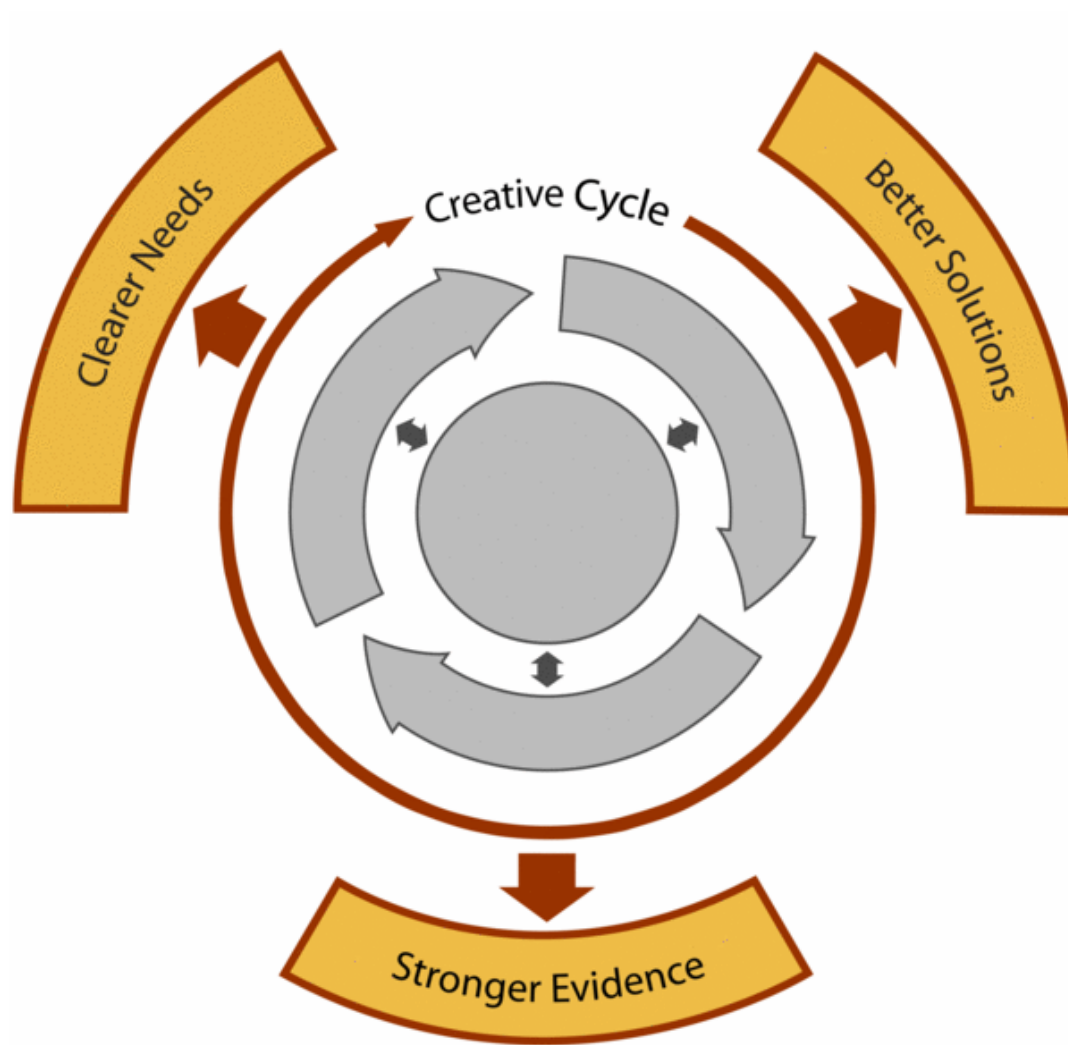
Good design is about
asking the right questions

- What are the **needs**?
- How can they be met?
- How well are they met?

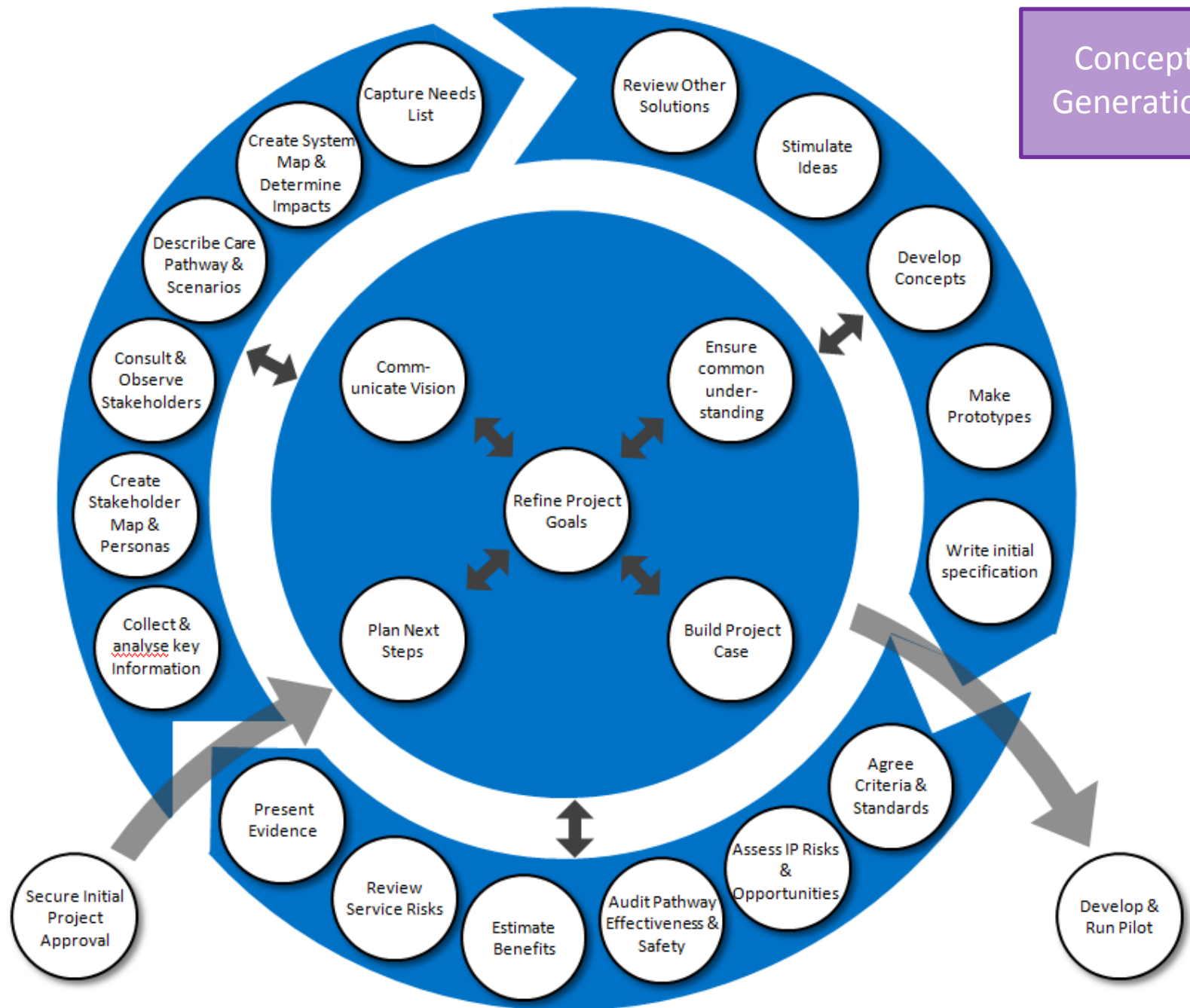
Explore
Create
Evaluate



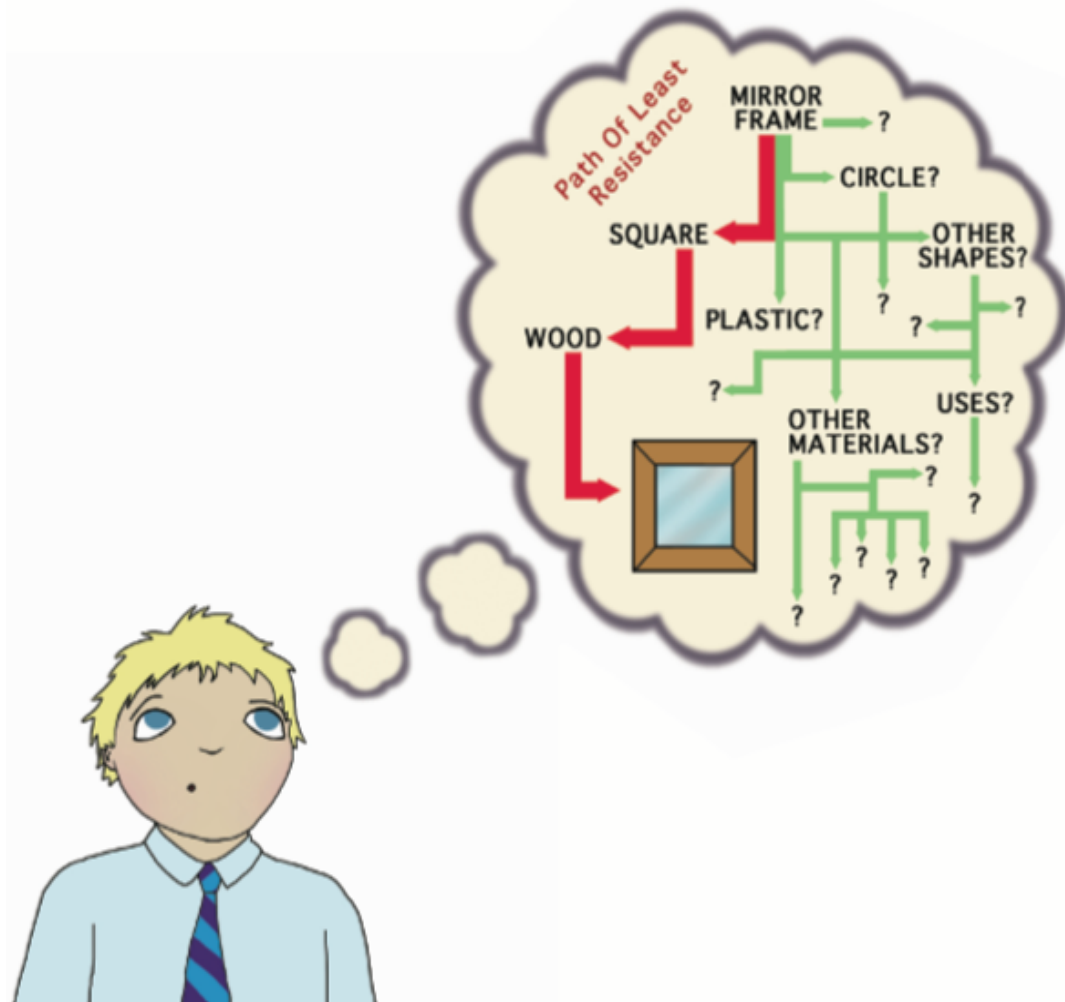
Iterate to
improve



Concept Generation



Fixation – the path of least resistance



Today's un-met need

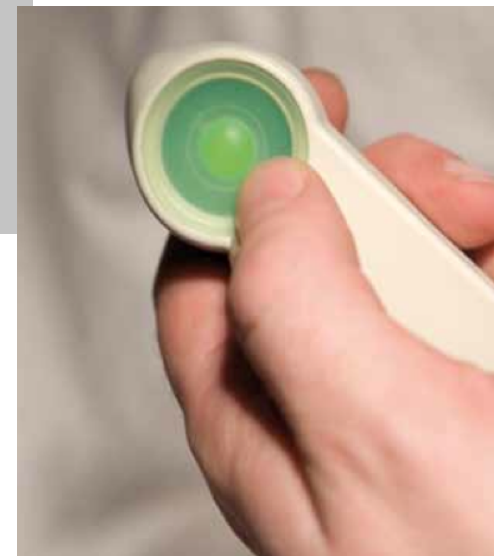


Getting from A to B

Assumptions

- Single pole
- Vertical pole
- Mounted on bed corner
- Must be clamped
- Must use device clamps

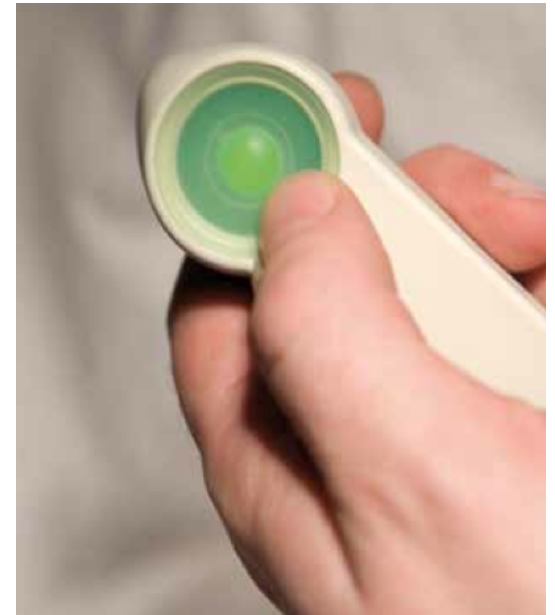
Patient Controlled Analgesia Pump



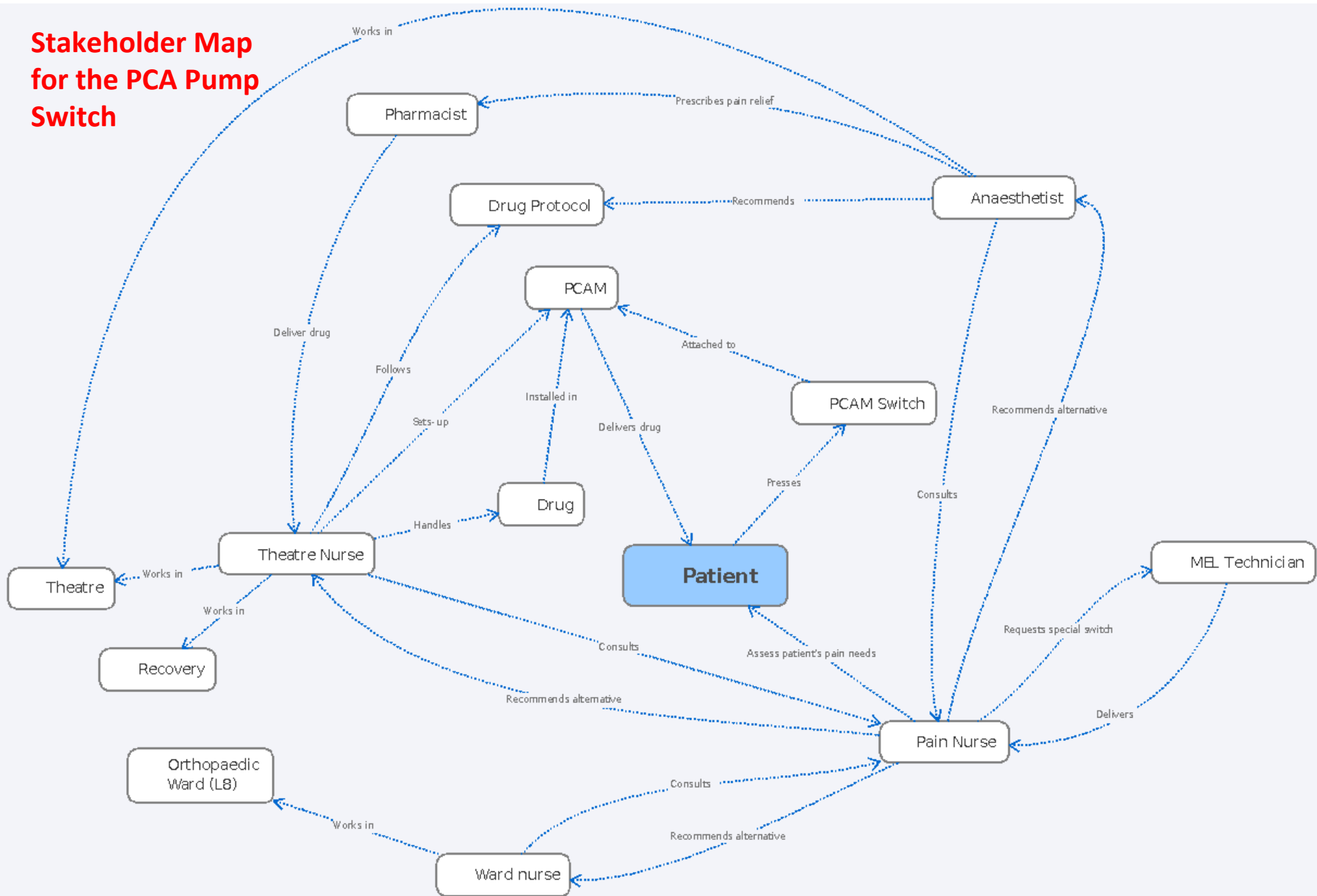
The Problem

- Estimated 20% **of patients** can't press the button
- Potential **reduction** to **1%** with the right switch

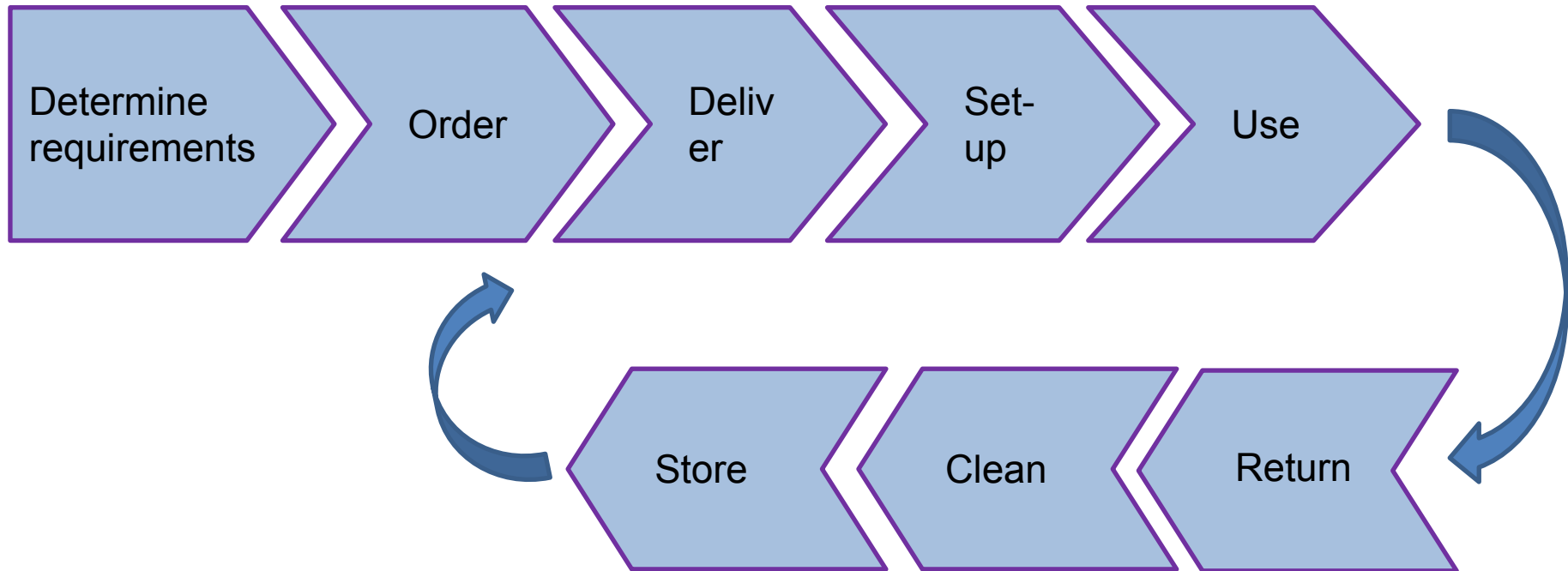
Source: Addenbrookes NHS Trust (Pain Team)



Stakeholder Map for the PCA Pump Switch



A Switch Service



Detail Matters

Requirement	Stakeholder(s)	Measure
Store		
The device should be able to be stored on a shelf in the Medical Equipment Library	Medical Equipment Library Technician	A height x B width x C length
Cleaning		
The system should be cleanable to trust infection control standards on a daily basis typically using a wipe	Infection control, HTA or Nurse	All areas that may cause a risk are accessible to standard wipe
The system should have no absorbent surfaces	Infection control, HTA or Nurse	No absorption of cleaning or bodily fluids
The system should be suitable for end of use assembly	Medical Equipment Library	It should be possible to disassemble for cleaning without damaging the components.
The system should be suitable for end of use assembly	Medical Equipment Library	All components must be suitable for end of use assembly
Transport		
MEL to recovery		
MEL to ward		
Recovery to ward (bed)		
Ward to MEL		
Locating in hospital		
The equipment should allow for location	Varied	RFID mountable using cable
Install		
It should be possible to train	MEL Technician	Assembly in less than 1 minute without reference to a manual and no prior experience of the system
It should be possible to work	MEL Technician	Someone who has never used the system before can work out if components are missing without reference to a manual
It should be possible to install	Nurse	Installation in less than 1 minute without reference to a manual and no prior experience of the system
It should be possible to install on the body	Nurse & patient	The switch must be locatable at any point within the bed area up to a height of 50 cm
The switch should not interfere	Nurse & patient	The switch 'arm' must support multiple orientations that are at least 30 cm apart from another orientation to achieve the same location
The switch mount must be	Nurse & patient	Resist a force of between 5-10 N from any direction
It should be possible to check	Nurse	A HCP who is not trained should be able to spot common incorrect installation issues
Training		
It should be possible to train	Nurse & patient	Training in less than 3 minutes without reference to a manual and no prior experience of the system. 90% of patients should be able to correctly remember these instructions without further training.
It should be possible for training	Nurse & patient	A clear practise mode that is clear which mode it is in
It should be possible to train	Nurse	It should be possible to train staff familiar with PCA within 10 minutes
It should be possible to train	Nurse and visitor	Training in less than 1 minute without reference to a manual and no prior experience of the system. 90% of visitors should be able to correctly remember these instructions without further training.
Adjust		
It should be possible to check	Nurse	Installation in less than 1 minute without reference to a manual and no prior experience of the system
It should be possible accurately	Nurse	One person can locate to within an accuracy of 1 cm within less than 1 minute
The patient should be aware	Patient	90% of patients remember that adjustment is possible
Use		
A patient should be able to	Patient	The patient can activate the switch on 95% of attempts within 5 seconds and know they have been successful 95% of the time
Emergency Removal		
It must be possible to remove	Any HCP	It should be possible to remove/relocate the system with 5 seconds
Return		
The system must work within the existing equipment return system	HCP/MEL technician	The system must comply with the return protocol and system
Maintain		

- Storage
- Cleaning
- Transport
- Locating
- Installing
- Training
- Adjustment
- Use
- Emergency removal
- Return
- Maintenance
- Testing

- Stakeholders

- Measures

The PCA Switch



The business of better

