# Designing KMS for complex engineering environment

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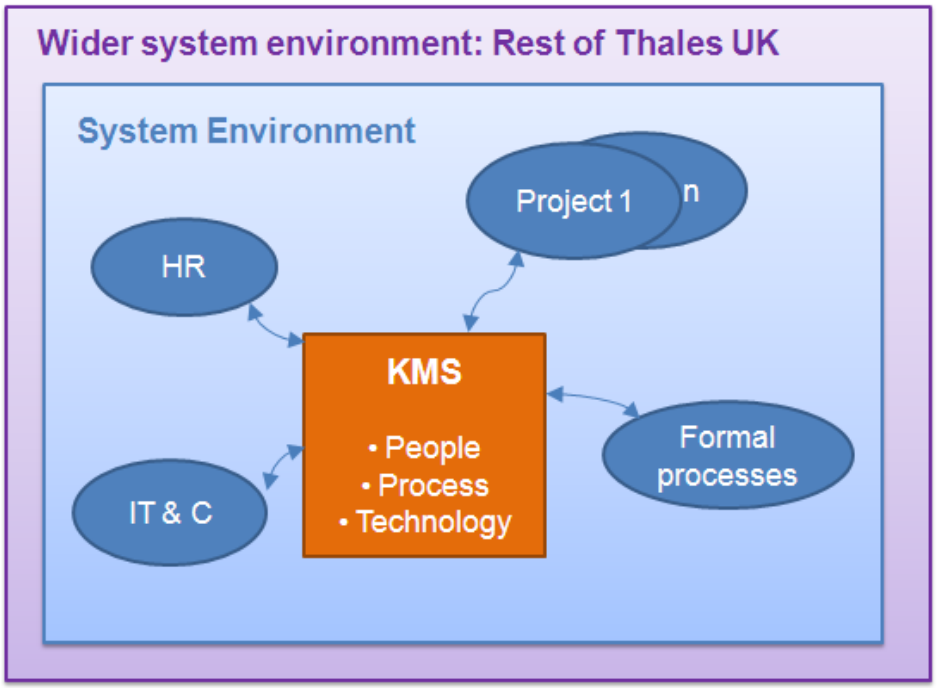
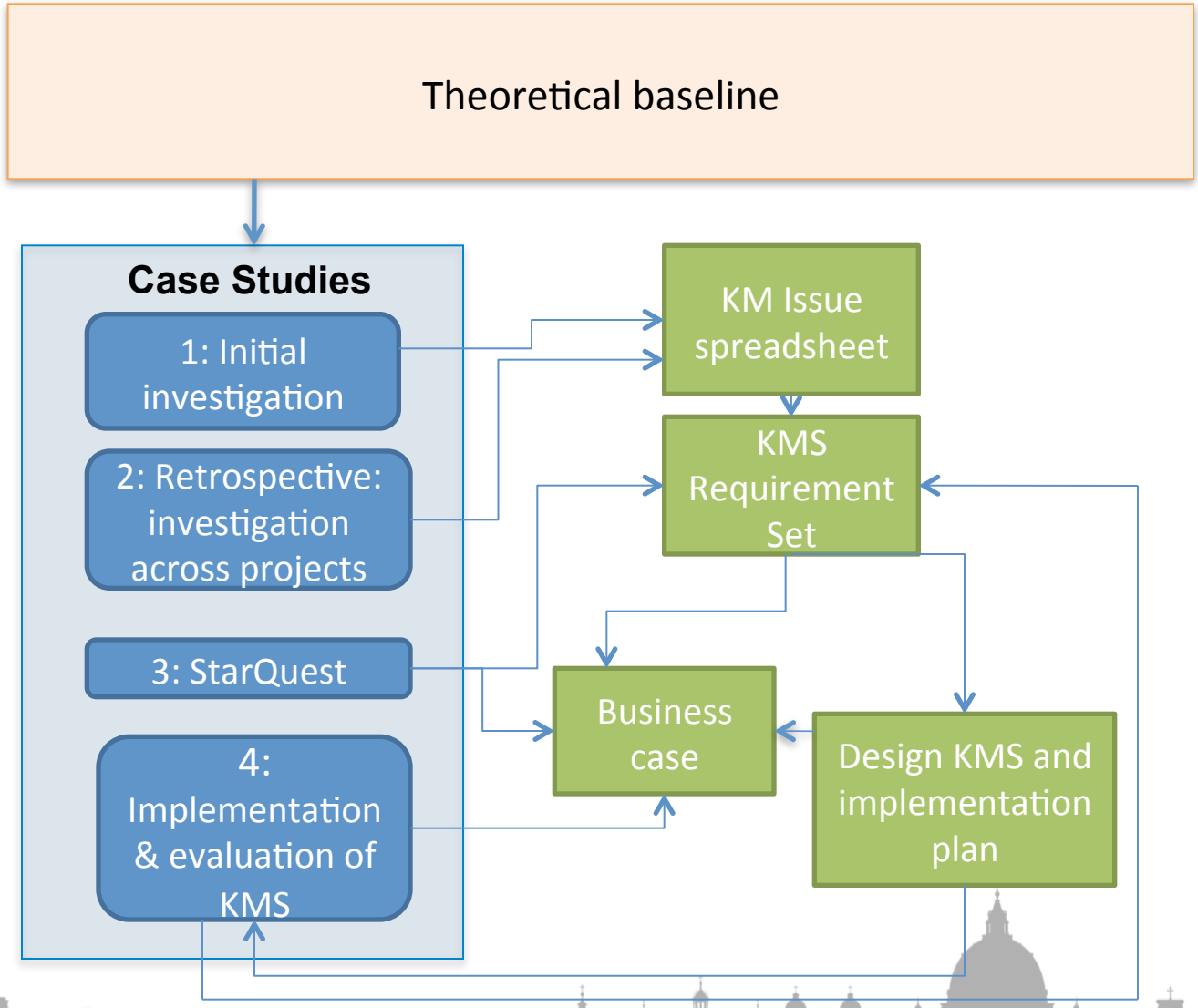
# EngD Project

Systems engineering approach

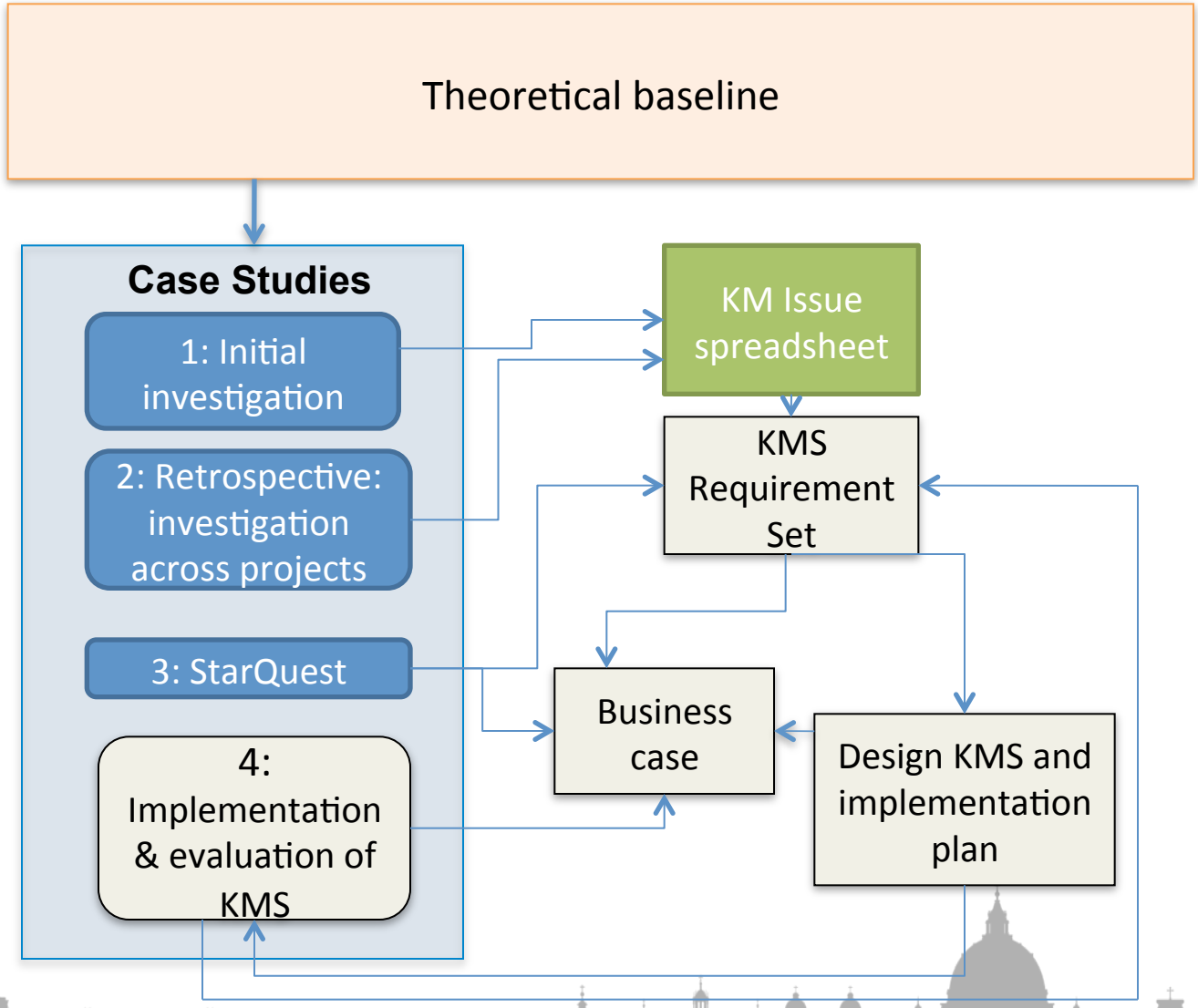
- Design KMS
- Feasible
- Addressing identified KM issues
- In Defense electronics domain



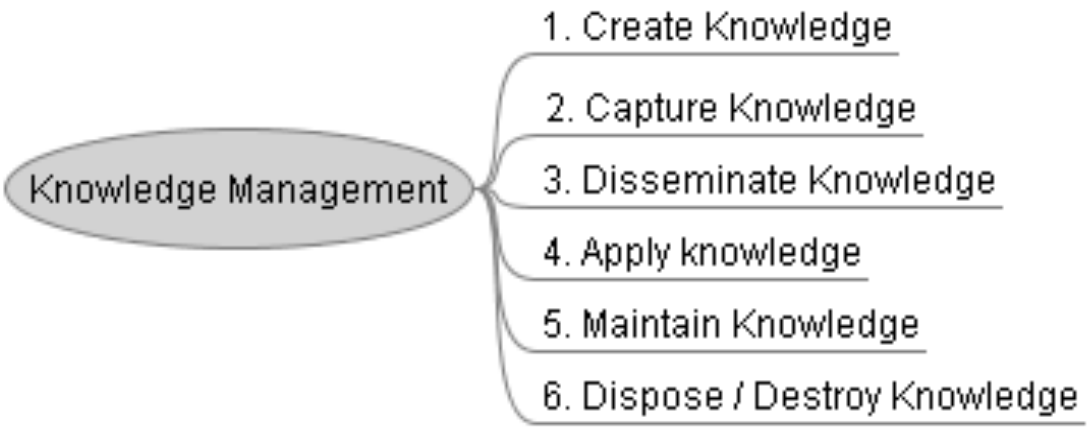
# Overview of EngD



# In this presentation



# Theoretical baseline



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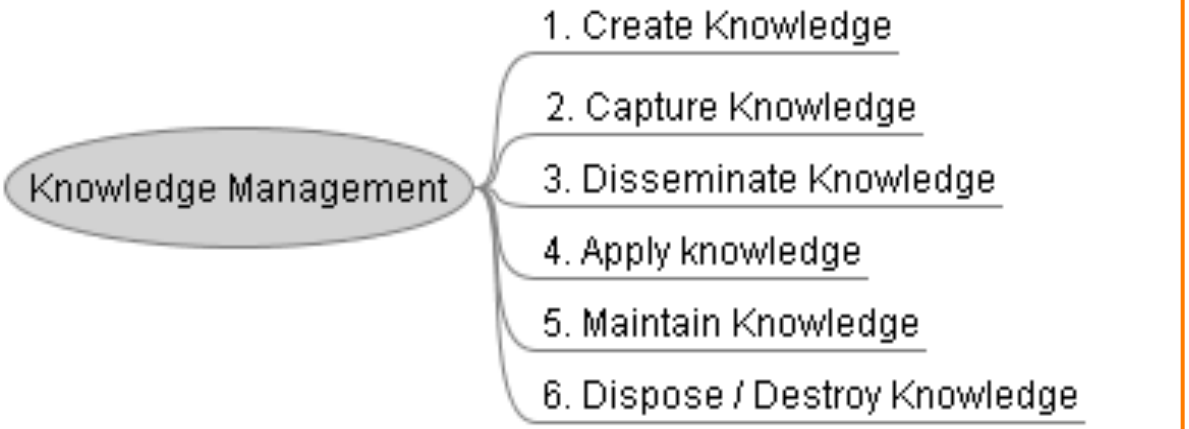
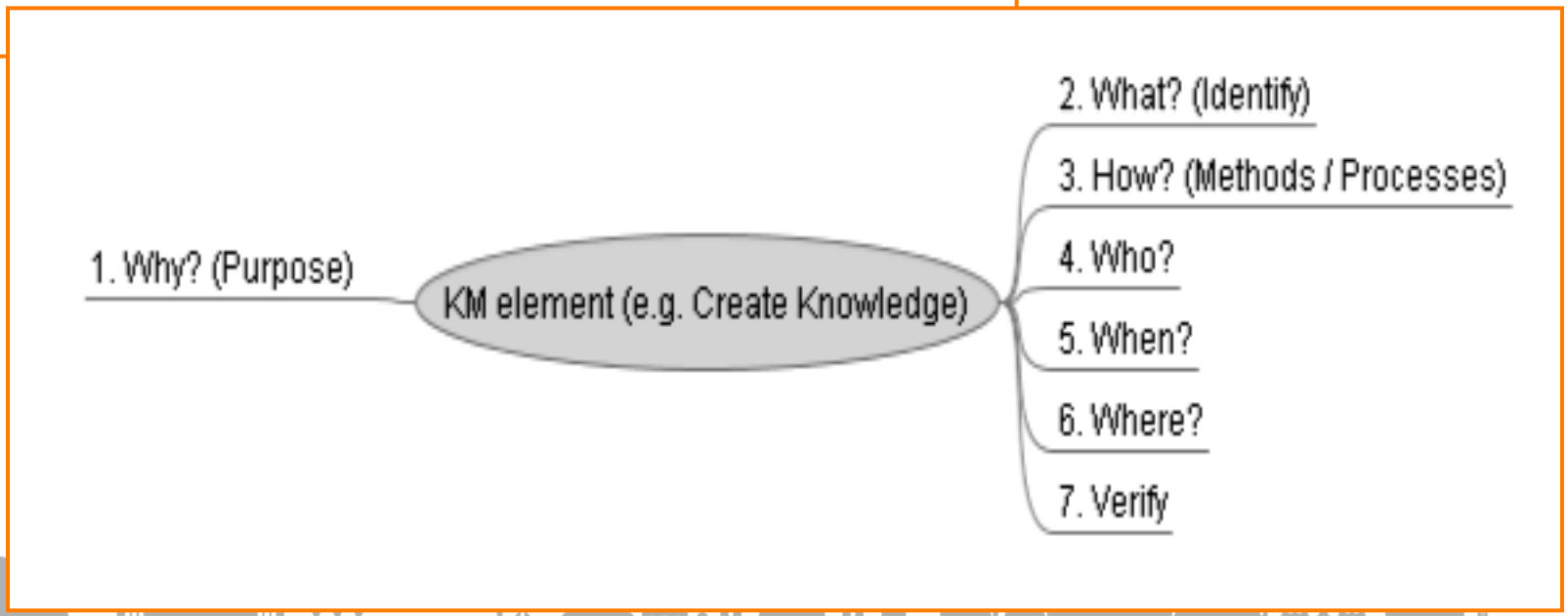
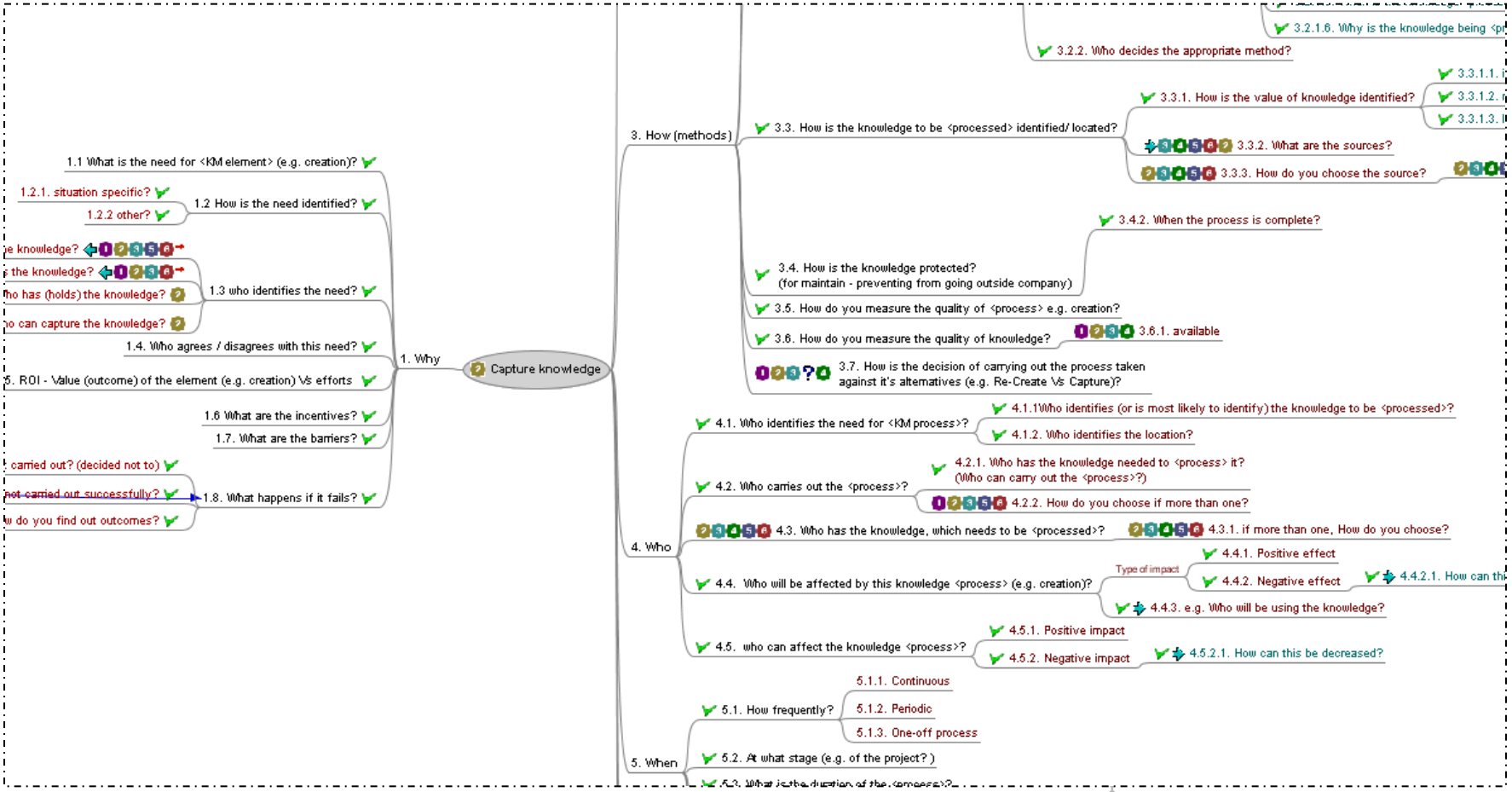


# Example problem map: Capture



# Theoretical baseline: Observations

Commonalities between KM activity problem maps:

- One question → one answer for all KM activities
  - E.g. “Who created a particular knowledge?”
- One question → different answers for each KM activity
  - E.g. “how do you measure a quality of a particular KM activity?”

# Theoretical baseline: Initial verification

Three generic business issues identified by the company:

- Preserving knowledge of retiring employees
- Knowledge transfer between teams
- Preserving knowledge from a project which is being shut down

- A good fit between KM activity problem maps and business issues maps

# Looking back

In Theoretical baseline:

- Problem space explored theoretically
- Determined a way of exploring business issues

Next:

- What are the KM issues inside the company?

# Case Study 1 : Initial investigation

- Finding KM issues in the company
- 12 Semi structured interviews
- Use of the first layer of Theoretical baseline to generate discussion
- Senior engineers across all projects phases.

# Case Study 1 : Project phases

| Project phase activities |
| --- |
| Handling initial customer contact, Creation of outline response, system level definition |
| Technical definition during bid |
| Migration from bid team to project team |
| Project start-up – project technical definition |
| Project development |
| Flow of information from development to production |
| Transition to post design services |

**"What are the KM issues in your project phase activity?"**

# Case Study 1 : Results

| Project phase activities/ Knowledge Lifecycle Process | Create | Capture | Disseminate | Apply | Maintain | Dispose |
|---|---|---|---|---|---|---|
| Handling initial customer contact, Creation of outline response, system level definition | | ✓ | ✓ | | | |
| Technical definition during bid | | ✓ | ✓ | | | |
| Migration from bid team to project team | | ✓ | ✓ | ✓ | ✓ | |
| Project start-up – project technical definition | | ✓ | ✓ | | ✓ | |
| Project development | | ✓ | ✓ | ✓ | | |
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Reasons behind decisions not captured : difficulties when introducing change

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| Project development | | ✓ | ✓ | ✓ | | |
| Flow of information from development to production | | | ✓ | | ✓ | |
| Transition to post design services | | ✓ | ✓ | ✓ | | |

# Looking back

In case study 1:

- Initial list of KM issues recognised by individuals in the company
- The location of issues in KM activities

Next:

- Investigate further, deeper
- From more experts

# Case study 2: Retrospective investigation

- Based on past projects and experience
- Increased depth
- 20 experts interviews
- KM in formal Engineering lifecycle processes
- Example and causes of KM issues

# Case study 2: Results

| Formal engineering lifecycle phases / Knowledge Lifecycle Process | Create | Capture | Disseminate | Apply | Maintain | Dispose |
|---|---|---|---|---|---|---|
| Initial Customer Contact, Capture and develop opportunity | ✓ | ✓ | ✓ | | | |
| WinBid | | ✓ | ✓ | ✓ | | |
| Plan product | ✓ | ✓ | ✓ | | | |
| Manage Program | | ✓ | ✓ | ✓ | | |
| Develop | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Services, Support | | ✓ | ✓ | | ✓ | |

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| Develop | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Services, Support | | ✓ | ✓ | | ✓ | |

Wrongly estimating capability: results in redesign

# Case study 2: Top Issues

| Issue | No. of agreements | Project phase |
|---|---|---|
| Lessons learnt - Not captured, not used | Highest | Develop, Manage Program |
| Knowledge created during the program is lost | High | Develop, Support |
| Communicating/ capturing the requirements for the development team. | High | WinBid |
| Availability of Domain experts | High | Develop |
| Knowledge loss due to geographically distributed projects | Medium | Manage Program |
| Repetition of work | Medium | Develop, Manage Program |

# KM Vs MK: exploring possible division

| KM<br>(Knowledge Management) | MK<br>(Managing Knowledge) |
|---|---|
| Operational level | Strategic level |
| Action: improve execution of KM Task | Action: Change in a formal process or a strategy |
| e.g. Capturing project knowledge: | |
| Towards the end of project, people quickly move on to next project without formal capture of lessons learnt. | There is formal requirement to capture non-manufacturing knowledge generated during the project. |

# Case study 2: Top Issues

| Issue | No. of agreements | Project phase | Issue Type |
|---|---|---|---|
| Lessons learnt - Not captured, not used | Highest | Develop, Manage Program | KM |
| Knowledge created during the program is lost | High | Develop, Support | MK |
| Communicating/ capturing the requirements for the development team. | High | WinBid | MK |
| Availability of Domain experts | High | Develop | MK |
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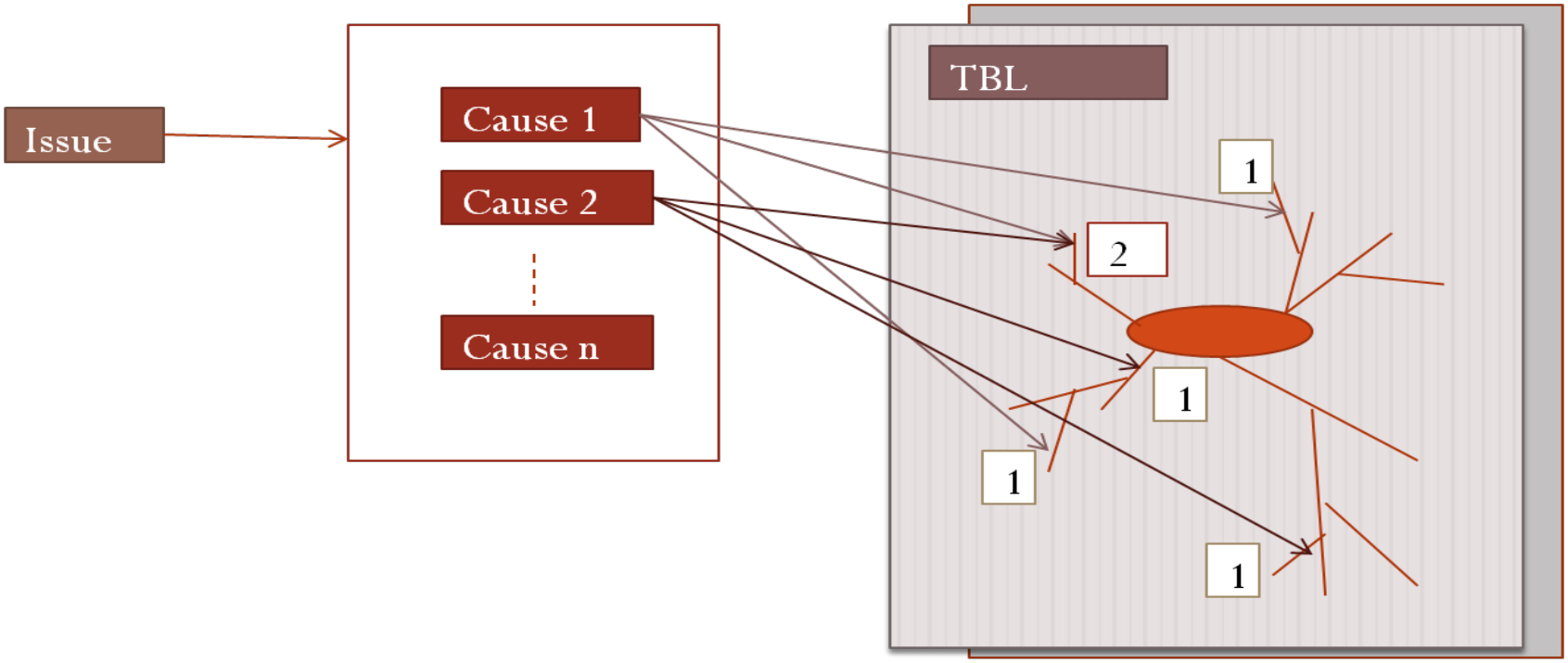
# Case study 2: Linking to theoretical baseline



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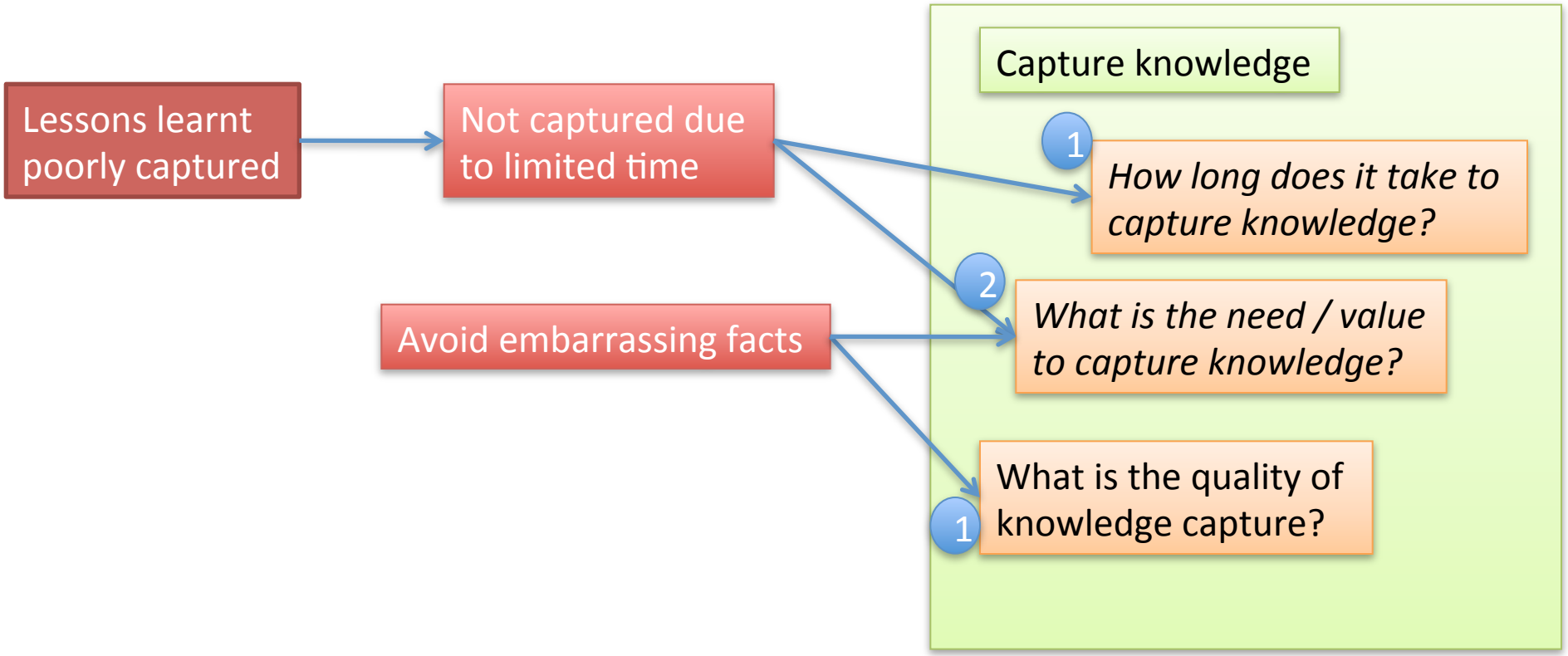
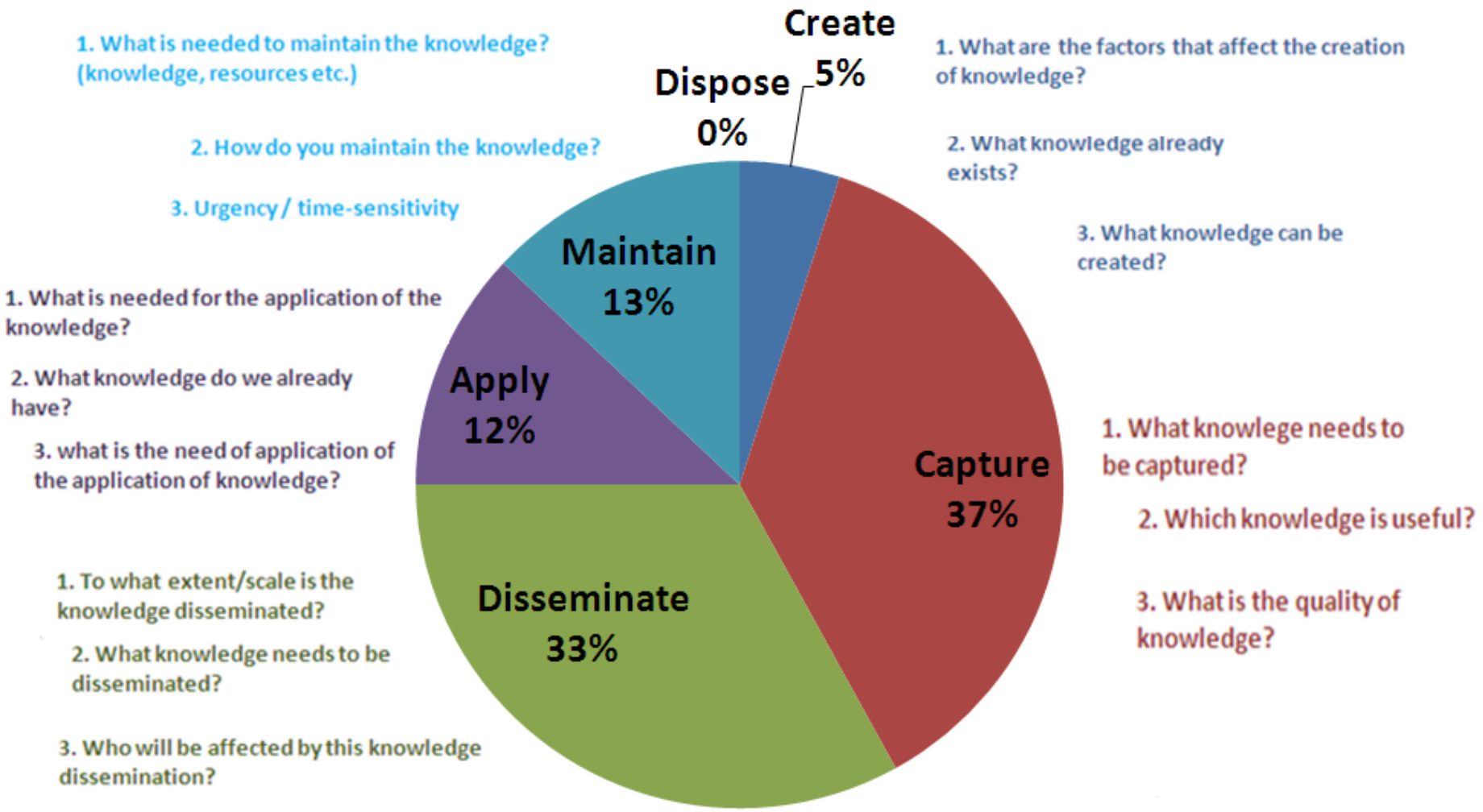


# Case study 2: Linking to theoretical baseline

| Capture | Count | Disseminate | Count |
|---|---|---|---|
| What knowledge needs to be captured? | 7 | To what extent/scale is the knowledge disseminated? | 11 |
| What is the quality of knowledge? | 7 | What knowledge needs to be disseminated? | 8 |
| Who has the knowledge, which needs to be captured? | 7 | Who will be affected by this knowledge dissemination? | 7 |
| Who will be affected by this knowledge capture? | 7 | How do you disseminate non-explicit knowledge? (Tacit or Informal) | 6 |
| How do you capture non-explicit knowledge? (Tacit or informal) | 6 | Who carries out the (is responsible for) the dissemination? | 6 |
| Which knowledge is useful? | 5 | What is the need for dissemination? | 5 |
| Who carries out the capture? | 5 | Which knowledge is useful? | 5 |
| Who can affect the knowledge capture? | 5 | What are the factors that affect the dissemination of knowledge? | 5 |
| What is the need for the capture? | 4 | Where does the knowledge go? (output after dissemination) | 5 |
| What are the possible / desired characteristics of this knowledge? | 4 | ROI - Value (outcome) of the dissemination Vs efforts. | 4 |

# Case study 2: Linking to the theoretical baseline




**Top 3 questions associated with each KM activity**

# Looking back

In Case study 2:

- Explored KM issues in more depth, thoroughly.
- Linking with formal engineering lifecycle processes
- Quantify the outcomes

Next:

- Studying the implementation of a search engine
- Impact on KM requirements around it

# Case Study 3: StarQuest

- Studying implementation of in house developed semantic search engine: StarQuest
  - Feedback on StarQuest
  - Impact on overall KM of the individual users
  - Investigate KM issues/questions were addressed by StarQuest
- Live
- Across two different teams

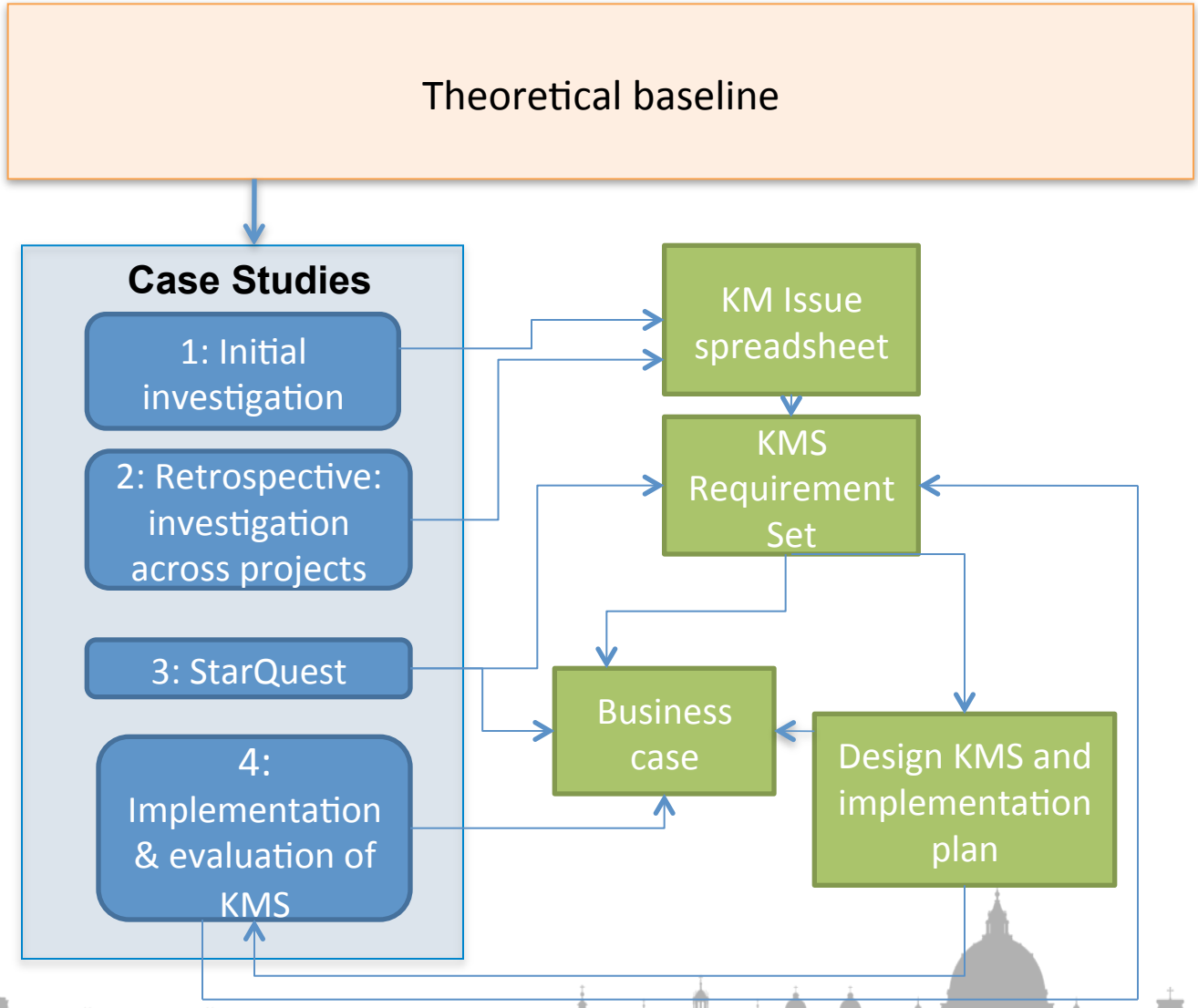
# Case study 3: Emerging findings

- Fills the current gap for searching internal unstructured knowledge
- Saves time per query
- Better value for time spent searching
- Discovery tool
- Positive effect on knowledge Sharing
- Desired wider coverage

# Next steps

- Formalising requirement set
- Identify case study project for implementation of partial KMS
- Design partial KMS addressing chosen set of requirements
- Implement and evaluate the partial KMS as a case study
- Feeding in to business case

# Summary


Theoretical baseline
Case Studies
1: Initial investigation
2: Retrospective: investigation across projects
3: StarQuest
4: Implementation & evaluation of KMS
KM Issue spreadsheet
KMS Requirement Set
Business case
Design KMS and implementation plan

# Thank you

Any questions?