

## Value Roadmapping Guidance

### The objectives of this deliverable are:

- To raise awareness of a customised roadmapping process – “Value Roadmapping” - designed to support business appraisals of early stage technologies.
- To present the underpinnings of the Value Roadmapping approach
- To provide guidance on how to apply a half-day Value Roadmapping workshop including Workshop Slides and Facilitation Notes

### Executive Summary

## 1 Executive Summary

Deciding to invest in early stage technologies is one of the most important tasks of technology management and arguably also the most uncertain. It assumes a particular significance for technology companies in emerging markets, which have to make appropriate investment decisions. Technology managers already have a wide range of methods and tools at their disposal, but these are mostly focused on quantitative measures such as discounted cash flow and real options techniques. However, in the early stages of technology development there seems to be dissatisfaction with these techniques as there appears to be a lack of accuracy with respect to the underlying assumptions that these models require. In order to complement these models this paper will discuss an alternative approach that we call value roadmapping. By adapting roadmapping techniques the potential value streams of early stage technologies can be plotted out and hence a clearer consensus based picture of the future potential of new technologies emerges. The approach can also be used to identify new opportunities for more mature technologies. Roadmapping is a workshop-based process bringing together multifunctional perspectives, and supporting communication in particular between technical and commercial groups.

**Contents**

**Contents**

1 Executive Summary ..... 1

2 Background of Value Roadmapping.....3

3 Starting the Value Roadmapping Process.....5

4 Workshop Guidance .....9

5 References ..... **Error! Bookmark not defined.**

Annex 1 Briefing Note .....27

Annex 2 VRM Template .....31

## Background

# 2

## Background of Value Roadmapping

Decision makers in technology-based firms face a significant challenge: how to make appropriate business appraisals for early stage technologies. This challenge includes a realistic determination of the value that a specific technology can bring to the organisation, in comparison to the cost of developing or acquiring that technology. However it remains difficult for technology managers to make assumptions on which to base their decisions, as future applications of an early stage technology may not be so clear or have yet to be identified.

Early stage technologies can be recognised by assessing the technical and market uncertainty of a specific technology. If these are high then the technology is in an early stage. In addition, such an assessment can be aided using technology readiness levels (TRLs). These TRLs are used, amongst others, by the United States General Accounting Office and NASA to establish best practice in technology management for defence projects. TRLs focus on the development of the technology and for our purposes we define an early stage technology as a technology that is operating in levels 1-3, which is the stage before it is introduced to sub-systems or components in new product development.

Although there are numerous techniques and tools available, many decision makers are still not satisfied when it comes to valuing early stage technologies. Most of the available techniques are quantitative in nature and are derived from financial valuation techniques and decision theory, such as the use of discounted cash-flow, decision trees and real options.

Although widely accepted when technologies have a certain level of maturity and applications have been defined, for early stage technologies these approaches can be mathematically sophisticated but contextually naïve.

Instead of focusing on quantitative techniques, both practice and literature shows there is an interest in having more non-quantitative (qualitative) techniques for valuing technologies. These techniques

should aim to structure reasoning and serve as an aid to decision makers in shaping their judgment. Research [1] has shown that companies that only use financial or quantitative based methods are underperforming against companies that use both qualitative and quantitative methods. Yet many firms refrain from using formal valuation methods until the technology becomes more mature (and hence more certain) and rely on “gut feel”.

In this guidance we propose a candidate solution that has been developed as part of the EPSRC IMRC research project Business Appraisals for Technology Potentials at the Centre for Technology Management, Cambridge University. The approach is based on the longstanding experience of the research centre in roadmapping. This technique has been adapted to support the valuation of early stage technologies - the Value Roadmap. Value Roadmapping is a technique to structure and support brainstorming based on the future potential of technologies.

The results presented in this document have been tested and validated in six cases. Two blue chip companies, two SMEs and two research institutions.

## Starting VRM

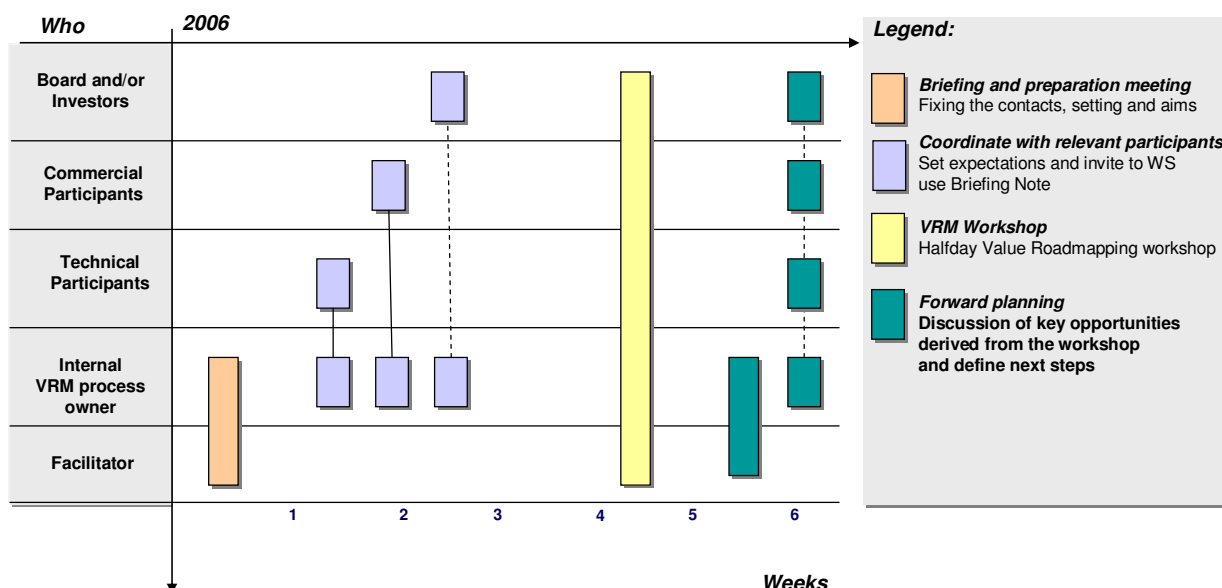
### 3 Starting the Value Roadmapping Process

The VRM approach is a specific configuration of more general roadmapping approaches, specifically designed to support the exploration of the value opportunities for technology, for either of the following situations:

- Early stage technology where the route to market is long and uncertain
- More mature technology where there is a particular strength, and new opportunities are sought for its exploitation

Planning is important to ensure that the business issue is appropriate for the VRM approach, and whether any modifications should be made (for more extensive guidance on customisation see T-Plan [2]). It is important to be clear about:

- The focus and scope of the application, and the aims of the workshop
- The appropriate participants to involve (6-12), representing a combination of deep technical knowledge, broad industrial experience and business acumen
- The appropriate timeframes for the roadmap (short-, medium- and long-term) - this depends on the rate of change in the business and strategic horizon.



## Participants

### *Facilitator*

This person is competent in roadmapping and has good knowledge of the value roadmapping process. It is recommended that this individual is somewhat detached from the technology and organisation as to keep an objective outlook on the development of the value roadmap.

### *Internal VRM process owner*

This person is the key internal owner and driver of the Value Roadmap activities. Typically he/she has a commercial background and is responsible for bringing new technologies to market. The key role of this person is to coordinate and drive the roadmapping process internally – getting the

right people on board and setting appropriate aims.

*Technical participants*

These are the key people involved with the technology under scrutiny. Their background is technology (e.g. R&D). Their specific role during the workshop is to lay out the current and future expectations of the technology. Furthermore they will be encouraged to envision and explain possible links to applications and markets and identify relevant value streams.

*Commercial participants*

It is important to have both a technical and a commercial perspective and hence it is vital to ensure sufficient commercial presence. Their specific role is to bring a business context to the workshop. This context can for example be the alignment with the overall corporate strategy, the identification of market requirements, potential sales and routes to market etc. Furthermore they will be encouraged to link this knowledge with the technology in order to identify relevant value streams.

*Board and/or investors*

If not already included in the existing line up, it is important to include support from the decision makers in the company. Their participation is highly recommended as they provide the investment perspective.

## **Briefing and preparing the workshop**

Key items for this initial meeting are to:

- Discuss the concept and process of Value Roadmapping (facilitator and internal VRM process owner)
- Set the aims of the workshop
- Identify the principal technical performance parameters of the technology to be analysed in the workshop (if appropriate)
- Identify the people who will participate (see list above)
- Prepare briefing note and invitation (see Annex 1)

## **Internal coordination**

Key items for this activity are:

- Obtain buy in of the relevant participants
- Arrange dates, location etc.
- Inform decision makers

## **VRM Workshop – refer to chapter 4.**

A more detailed description on the process of the workshop is described in the next chapter.

Important at this stage are the following additional tasks to prepare for the workshop:

- Print the Value Roadmap template chart (see Annex 2), for smaller groups we recommend printing it A0 size, for larger groups best to print 4 times A0
- To customise the presentation (e.g. agenda etc.)

Reserve some time before the start of the workshop to set up the room (e.g. pin up chart, distribute post-its, arrange room setting preferably u-shape).

**Forward planning - this is described in chapter 5.**



## Workshop Guidance

### 4 Workshop Guidance

The Value Roadmapping (VRM) approach has been designed as a standardised half-day workshop. The workshop guidance provides the slides (see also electronic file) and the instructions for the facilitator.

The slides in this file are based on material used to develop and test the VRM approach, and should be modified as appropriate to suit the application.




***Business appraisal of technology potentials***

***[Company Name / Area]***  
***Value Roadmapping Workshop***

***[Date]***

***[Facilitator/s names]***

---

 Centre for Technology Management  UNIVERSITY OF CAMBRIDGE

At the start of the workshop the facilitator(s) introduce themselves, and explain the background to value roadmapping and the agenda for the workshop. The reasons for the workshop in terms of business context should be introduced by the internal VRM process owner and/or the business sponsor (senior manager, etc.). In addition to the facilitator, and as shown in the process, it is advisable to have an internal VRM process owner with whom the facilitator can prepare

the workshop (see also chapter 3).

Furthermore at this stage the facilitator should ask all participants to introduce themselves. The Value Roadmapping process is best carried out with a balanced mix of commercial and technical people in order to obtain a wide range of views while appraising the future business potential of new technologies. As these people might not know each other it is advisable to do a round the table introduction.

### ***VRM Aims***

- **To provide a structured framework for mapping and exploring potential value streams based on the selected technology (either early stage or technology push situation)**
- **To identify focused short term and long term opportunities to follow up**
- **To support the process of managing technology for value in the firm, providing input to technology strategy, planning, exploitation, etc.**
- **To support communication between technological and commercial functions in the business**

## Agenda

- 10:00 Introduction, background aims & workshop agenda
- 10:10 Map technology (current, short-, medium-, long-term & vision)
- 10:55 Identify future value opportunities (value streams) and focus
- 11:40 Break
- 11:50 Map market and business trends & drivers for priority opportunities
- 12:25 Identify barriers & enablers for priority opportunities
- 12:45 Review and way forward
- 13:00 Close

The main activities during the workshop are:

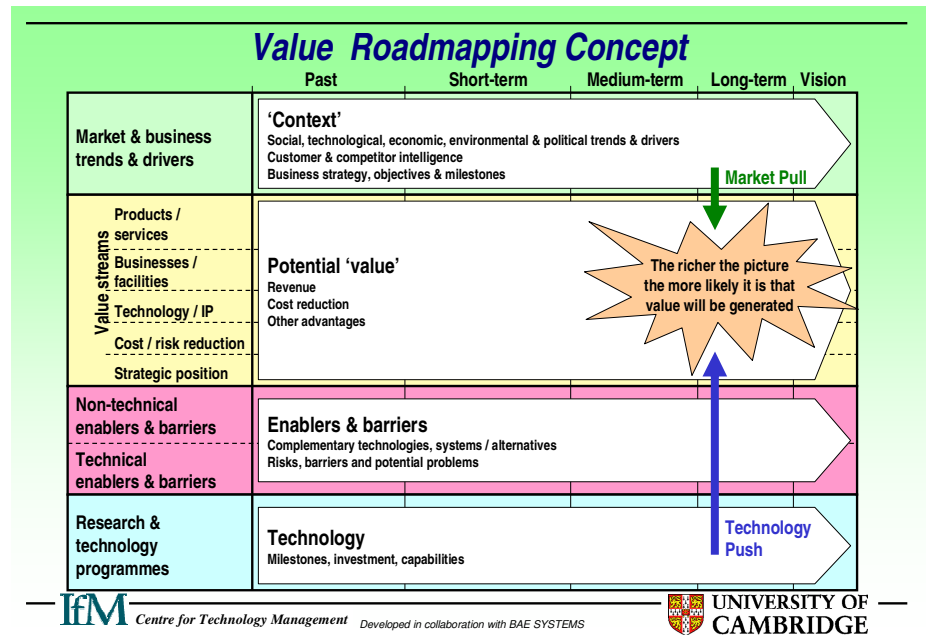
- Map technology (current, short-, medium-, long-term & vision)
- Identify future value opportunities (value streams) and focus
- Map market and business trends & drivers for priority opportunities
- Identify barriers & enablers for priority opportunities
- Review and way forward

This 'reference' agenda provides a reasonable indication of how long each activity should last. It has been designed to be as efficient as possible, and a key responsibility of the facilitator is to keep the process going, using the timing in the agenda as a guide, but adapting the timing as appropriate, depending on progress (VRM is an inherently exploratory process). It is important to remain flexible.

Most of the work is done by the participants, capturing knowledge and views on a VRM wall chart, using post-it notes and other workshop materials, driven by a series of simple process steps /

activities / discussion.

If more time is available (e.g. by 2-4 hours, up to a full day), then expanding the agenda is possible, and more progress can be made, with the opportunity to explore interesting opportunities / issues in more depth.



This is the standard Value Roadmapping template that has been proven to work in a variety of cases, although it may be beneficial to adapt it depending on the specific application context (see generic roadmapping guidance).

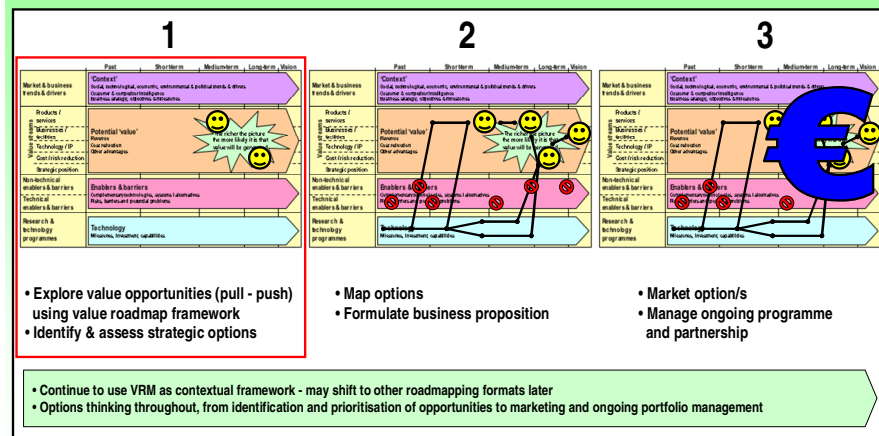
The basic stages of the process are illustrated, through the progressive population of the wall chart by the participants, through a series of brainstorming, prioritisation and discussion, capturing views on post-it notes. The main stages are:

- 1) Capture the future evolution of the focus technology/s, together with complementary technology and competitor technology in the bottom layer of the roadmap. Quantify technical performance measures, milestones and targets as clearly as possible.
- 2) Use the information captured in the technology layer to

stimulate a creative brainstorm of all of the possible ways in which value could be generated from the technology capability, using the broad value-stream themes as prompts.

- 3) Prioritise the opportunities using arrow post-it notes and 'sticker vote'
- 4) Explore market environment and key drivers for priority opportunities, using the top layer of the roadmap
- 5) Capture barriers and enablers as they occur, but revisit them at the end for the prioritised opportunities
- 6) Review priority opportunities and identify key learning points, way forward and actions

## Value Roadmapping Concept... way forward



The VRM approach provides an efficient first step, after which the roadmapping approach can be used to explore interesting opportunities in more depth, and then to manage the development and exploitation of the focus technology over a longer period of time.

### Photo-slide of approach

The VRM approach is 'post-it driven', and relies entirely on the willingness of all participants to contribute by brainstorming and discussing the views they have, across the full scope of the roadmap. A key success factor is 'post-it density and distribution'. Participants should be encouraged to consider all aspects (what, why, how, when, who, where), including facts, forecasts, questions, speculation, etc.

The VRM chart provides a framework to capture, share and discuss knowledge across the full scope of the enterprise ('strategic landscape'), and to focus on the most interesting opportunities that could arise from the development of the technology, and the key enablers and barriers to exploitation.

It is highly desirable for one or two key participants to support the facilitation, in terms of taking a lead in the capture of information on the chart. Post-it notes should be clearly articulated, placed on the chart one-by-one, and the content explained briefly. Limit discussion to points of clarification - ideas stimulated by the post-it note should generate further post-it notes. Participants should be given a few minutes to generate a small pile of post-it notes each, and then asked to start placing them on the chart.

Guidance on how to facilitate the interaction of participants with the wall chart are described in T-Plan [2] in more detail, including facilitation techniques and customisation aspects.

## Agenda

- 10:00 Introduction, background aims & workshop agenda
- 10:10 Map technology (current, short-, medium-, long-term & vision)
- 10:55 Identify future value opportunities (value streams) and focus
- 11:40 Break
- 11:50 Map market and business trends & drivers for priority opportunities
- 12:25 Identify barriers & enablers for priority opportunities
- 12:45 Review and way forward
- 13:00 Close

The first group activity aims to create a complete (to the best knowledge of the participants) view of how the focus technology will / might evolve.

Other technologies should also be considered, such as complementary technology that is also required for the successful development and exploitation of the focus technology. Where possible technology performance metrics should be identified, and their evolution considered.

Map technology (current, short-, medium- , long-term & vision)

### ***Instructions***

For focus technology:

- What is current state of art (projects, capability, performance)?
- What are the long-term aspirations / vision for this technology?
- What are the stepping stones towards this vision?
- Competing technology?

- *Use post-it notes to capture ideas (brainstorm) on roadmap*

This slide provides a checklist of issues to consider when populating the technology layer of the VRM chart. Stimulate the brainstorm with appropriate questions / observations, where appropriate.

Keep the rate of post-it note generation as high as possible, allowing for essential discussion as appropriate. If the post-it capture rate dries up, after prompting, move on to the next stage.

Often at this stage some technical (and non-technical) barriers are identified - capture these as required (this layer of the roadmap will be revisited later).

Photo - Example of filling the technology layer



## Agenda

- 10:00 Introduction, background aims & workshop agenda
- 10:10 Map technology (current, short-, medium-, long-term & vision)
- 10:55 Identify future value opportunities (value streams) and focus
- 11:40 Break
- 11:50 Map market and business trends & drivers for priority opportunities
- 12:25 Identify barriers & enablers for priority opportunities
- 12:45 Review and way forward
- 13:00 Close

The second group activity aims to identify possible ways in which value could be created through the development of the focus technology.

The 'value stream' layers of the roadmap provides a checklist for thinking about the various ways in which value can be generated. The more ideas captured the better - 'all ideas are good', as they stimulate new ideas from participants.

## Identify future value opportunities (value streams), focus and prioritise

### Instructions

Based on our understanding of how technology will develop:

- What possible value, opportunities and benefits (etc.) could arise?

- Products & services
- Businesses & facilities
- Technology & IP
- Cost & risk reduction
- Strategic position

Consider all possible sectors:

- Transport
- Construction & Infrastructure
- Agriculture, Forestry & Food
- Mining & Primary
- Manufacturing
- Chemicals
- Services & Retail
- Utilities
- Pharmaceuticals & Medical
- IT, Communications & Software
- Defence
- Education
- Etc.

- Use *post-it notes to capture ideas (brainstorm) on roadmap*
- Use *arrow post-it notes to focus on most interesting opportunities* (*explain nature of value expectation on arrow post-it note*)
- Use *'sticker vote' to prioritise opportunities*

This slide provides a checklist of issues to consider when populating the value stream layers of the VRM chart. Stimulate the brainstorm with appropriate questions / observations, where appropriate.

Keep the rate of post-it note generation as high as possible, allowing for essential discussion as appropriate. If the post-it capture rate dries up, after prompting, move on to the arrow post-it note activity.

The arrow activity provides a first-pass filter to identify the opportunities of most interest to participants. Opportunities of three types tend to emerge:

- 1) 'Pot of gold' opportunities, of significant scale, and generally longer term.
- 2) 'Low hanging fruit' opportunities, demonstrating the value of the focus technology, and if possible generating cash flow.
- 3) Enabling technologies / platforms, which underpin/unlock the main value propositions, and require specific attention.

Photo – showing use of arrows

Retain a flexible approach - one (perhaps two) arrows each, possibly directed towards technology & commercial opportunities separately (use different colours). Once arrows have been placed participants should each explain their views to the group.

Prioritise the opportunities using a 'sticker vote' (first identify and 'remove' duplicate arrows). Each participant is asked to vote on the opportunities (arrows) that they believe to have the most potential value. The criteria for this judgement may need to be discussed prior to the vote. Provide sufficient stickers to each participant so that they can vote on approximately 1/4 - 1/3 of the options identified by the arrow post-it notes.

The sticker vote provides a quick way of identifying the most valuable opportunities, as identified by the participating group as a whole. It may be necessary to discuss the voting criteria first ('imagine you are investing your own money - £10K per sticker - where would you put it?'). One sticker per arrow (don't vote for duplicates). Number the 'stickered arrows' in order of number of votes received.

Photo - Example of structuring the value streams

Photo - Example of structuring the value streams

### *Agenda*

- 10:00 Introduction, background aims & workshop agenda
- 10:10 Map technology (current, short-, medium-, long-term & vision)
- 10:55 Identify future value opportunities (value streams) and focus
- 11:40 Break
- 11:50 Map market and business trends & drivers for priority opportunities
- 12:25 Identify barriers & enablers for priority opportunities
- 12:45 Review and way forward
- 13:00 Close

The third group activity aims to explore the market context for the prioritised opportunities (arrows & stickers), identifying and discussing the broad (macro) trends & drivers that influence the opportunities and associated markets (e.g. social, technological, economic, environmental, political, legislative, infrastructural, industrial, etc.), together with 'micro' drivers specific to prioritised opportunities (e.g. competitors, customer needs, etc.).

Use post-it notes to capture content on top layer of roadmap.

Map market and business trends & drivers

### *Instructions*

**For most interesting opportunities:**

- What are the key market and business trends and drivers that influence the value potential of these opportunities?
  - Macro & Micro
  - Social, Technological, Economic, Environmental, Political, Legal, Infrastructural
- *Use post-it notes to capture ideas (brainstorm) on roadmap*

This slide provides a checklist of issues to consider when populating the market layer of the VRM chart. Stimulate the brainstorm with appropriate questions / observations, where appropriate. At this stage it is possible to link the prioritised opportunities specifically to items in the market layer. This is done labelling the corresponding market post-its with the same number as the opportunities.

Keep the rate of post-it note generation as high as possible, allowing for essential discussion as appropriate. If the post-it capture rate dries up, after prompting, move on to the next activity.

Photo - Example of Value Roadmap with Market & Business Trends and drivers

### *Agenda*

- 10:00 Introduction, background aims & workshop agenda
- 10:10 Map technology (current, short-, medium-, long-term & vision)
- 10:55 Identify future value opportunities (value streams) and focus
- 11:40 Break
- 11:50 Map market and business trends & drivers for priority opportunities
- 12:25 Identify barriers & enablers for priority opportunities
- 12:45 Review and way forward
- 13:00 Close

The fourth group activity aims to identify the key enablers and barriers that could help or hinder the development and exploitation of the focus technology, including:

- Technical barriers that need to be overcome (research priorities), and enablers such as key partnerships.
- Non-technical (e.g. commercial, financial, organisational, skills, etc.)

Participants are likely to have partially populated these layers already - the purpose of this session is to re-visit these issues, focusing on the priority opportunities.

### Identify barriers & enablers for priority opportunities

#### *Instructions*

For most interesting opportunities:

- What could hinder progress? (technical & non-technical)
- What could help progress? (technical & non-technical)
- *Use post-it notes to capture ideas (brainstorm) on roadmap (link to opportunity numbers)*

This slide provides a checklist of issues to consider when populating the enablers & barriers layers of the VRM chart. Stimulate the brainstorm with appropriate questions / observations, and link by using opportunity numbers, as appropriate.

Keep the rate of post-it note generation as high as possible, allowing for essential discussion as appropriate. If the post-it capture rate dries up, after prompting, move on to the next stage.

Photo - Example of Value Roadmap with technical and non technical barriers and enablers

### *Agenda*

- 10:00 Introduction, background aims & workshop agenda
- 10:10 Map technology (current, short-, medium-, long-term & vision)
- 10:55 Identify future value opportunities (value streams) and focus
- 11:40 Break
- 11:50 Map market and business trends & drivers for priority opportunities
- 12:25 Identify barriers & enablers for priority opportunities
- 12:45 Review and way forward
- 13:00 Close



The final session aims to wrap up the workshop, by confirming the priority opportunities / issues, agreeing the way forward and key actions. Key learning points should be identified, relating to the enterprise and the VRM process.

### Review and way forward

## *Instructions*

**What have we learned?**

- Which opportunities are worth taking forward, and how?
- How well did value roadmapping workshop meet your aims?

• *Please fill in questionnaire...*

This slide provides a checklist of issues to consider during the review. Capture points on flip chart.

To support process learning, it is recommended that participants complete a short questionnaire providing their views of the benefits and utility of the process, and where improvements could be made.

**Close**

Thank participants for their active participation.

### References

## 5 References

- [1] Cooper, R.G. (2001), Winning at new products, 3<sup>rd</sup> Edition, Basic Books, Perseus Publishing, New York.
- [2] R Phaal, CJP Farrukh, DR Probert (2001), T-PLAN: Fast Start to Technology Roadmapping – planning your route to success, Centre for Technology Management, Published by University of Cambridge, Institute of Manufacturing.

## *Annex 1*

## Annex 1 Briefing Note

- Company Name -

## Value Roadmapping Workshop

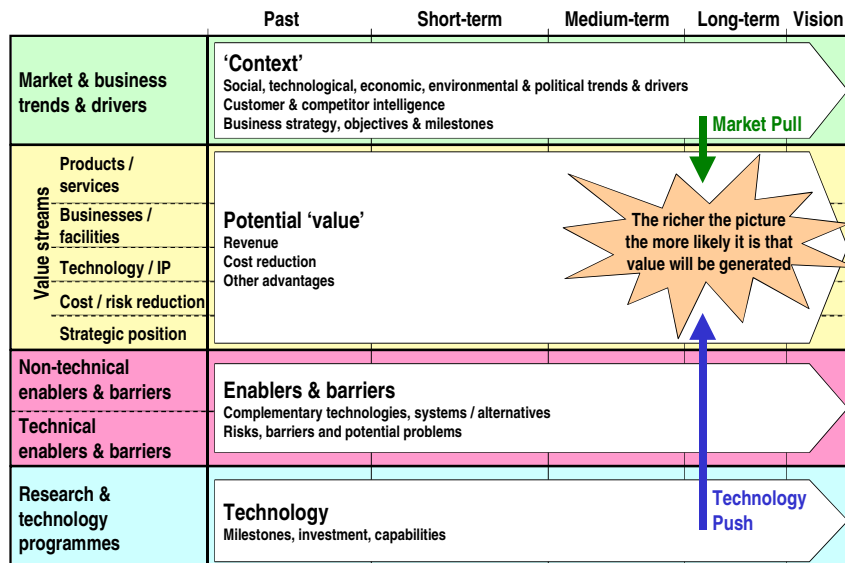
- Location-

- Date -

## Briefing Note

### Background

How to evaluate R&D projects is one of the major problems facing managers. Although traditional valuation tools such as DCF/NPV still dominate the area, there is still a lack of techniques to explore potential value at the early stages of technology development, when hard financial data is not available. Due to this gap, a value roadmapping approach has been developed and piloted, and we are now looking for further case companies.



# BATP: Value Roadmapping Guidance

## Aims

The aim of the value roadmapping (VRM) tool is to support the identification and exploitation of value opportunities, integrated with other valuation concepts, frameworks and tools. It is most appropriate for an early stage technology development or for exploring new applications for existing technology (technology push).

The VRM workshop aims to:

- Explore the future potential of a relevant technology selected by the company
- Identify and assess strategic options
- Populate the value roadmap accordingly
- Summarise and conclude

## Draft agenda

	Who: Responsibility	What: Content	How: Setting	
1000	Martin & CTM	• Introduction, background, aims & workshop agenda	Plenary, presentation	1000
1010	All	• Define <b>Technology</b> (current & short term, vision & medium term)	Brainstorm – post it session	1010
1055	All	• Define <b>Value Streams</b> and filter top 10	Brainstorm – post it session	1000
1140	All	• Define <b>Market &amp; Business Trends &amp; Drivers</b> & filter top 3 value streams	Brainstorm – post it session	1030
1225	All	• <b>Barriers and Enablers</b> (brainstorm on technical & non-technical)	Brainstorm – post it session	1100
1245	All	• Identify potential gaps		1130
1300		• Define 1-3 opportunities for in-depth VRM & next steps	Clustering & Evaluation	1200

## Preparation

Identify and review relevant information (current and future markets, strategy, products & services, processes and technology), including hot topics. List strategic opportunities and threats that you think XYZ technology can or should respond to. Come along to the workshop prepared to share your knowledge and expertise in an active and creative process.

## Annex 2

## Annex 2 VRM Template

	Current	Short-term	Medium-term	Long-term	Vision
Market & business trends & drivers					
Value streams	Products / services				
	Businesses / facilities				
	Technology / IP				
	Cost / risk reduction				
	Strategic position				
Non-technical enablers & barriers					
Technical enablers & barriers					
Research & technology programmes					