Roadmapping Software Survey Report

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Introduction

This report summarises the findings of a survey examining current practice in technology roadmapping (TRM) with a particular focus on roadmapping software and the context in which TRM was applied. The survey is part of a final year manufacturing engineering student’s project at the University of Cambridge and was overseen by the Centre for Technology Management (CTM).

A questionnaire (see Annex) was compiled and circulated to a TRM User Group hosted by the CTM. The user group comprises of approximately 50 members from industry, and academia who have experience of studying or applying TRM in different contexts. The questionnaire was aimed at capturing the feedback from firms who have actually applied TRM and the requirements they would need from a TRM software solution. There were 14 responses (29% response rate) to the questionnaire all of which were industrialists with experience of applying the TRM technique

Question 1 - TRM Aims

The purpose of this question was to establish the aims that stimulate the introduction of TRM in the firm. Respondents generally reported multiple aims, covering all of the options provided (greater than 40% response for each option). Figure 1 also shows what firms considered the most important aims in introducing TRM, with the two most important being to support general business strategy / planning and technology planning / strategy initiatives.

Another aim of TRM that emerged was predicting when particular technologies would become obsolete and when new generation technologies would be needed.
Question 2 - Achievement

The objective of this question was to gauge the degree of success of technology roadmapping initiatives in firms. Due to the sample group being a TRM User Group it was expected that firms would have a relatively high level of experience in applying the technique however Figure 2 shows a surprisingly high number of respondents for whom TRM is an ongoing process and a part of strategy (greater than 40%)

![Figure 2. Success in TRM completion and continuation](image)

Question 3 - TRM tools, techniques and methods

The objective of this question was to assess whether a lack of effective tools and techniques is a barrier to successful and sustained TRM within firms. Figure 3a shows that for the majority of respondents this does not pose a significant barrier, possibly due to their level of experience with TRM. The question also sought to establish whether TRM software could help overcome this barrier (see Figure 3b). Some respondents have experience of using TRM enterprise software solutions.

![Figure 3a. Is a lack of TRM tools](image)

![Figure 3b. Can TRM software help overcome this barrier?](image)
Question 4 - Other barriers to successful TRM

The objective of this question was to identify what other barriers there are to TRM initiatives within firms. Figure 4 also shows what respondents regarded as the most important barriers to success. Overall, the main barriers (greater than 40%) to successful TRM were:

- Initiative overload / distraction from short-term tasks.
- Resistance due to organisation culture / politics.
- Lack of commitment from senior management.

![Figure 4. Barriers to successful TRM](image)

Question 5 - Factors influencing TRM software adoption

The objective of this question was to establish what factors would most influence a firm in whether or not to adopt a TRM software solution. By a large margin the two greatest influences are the software cost and cost model (licences) and how easy the software is to use (see Figure 5).

![Figure 5. Factors influencing TRM software adoption](image)
Question 6 - Software components

A software solution for technology roadmapping was proposed that could consist of two major components:

- A graphical presentation tool for displaying roadmapping data.
- A central database/repository for storing roadmapping data.

The objective of this question was to assess whether a firm would require both of these components or, if separable, either the presentation tool or the database. The dependency of this requirement on organisational context and the level of R&D activity and dispersion are discussed later in the report. Figure 6 shows that 79% of firms would require a database component in the software and more than 60% of respondents would require both components.

Software requirements

A list of requirements that describe some of the more important features that each of the above components should possess was compiled. Respondents were asked to rate each of the requirements as being a high, medium or low requirement depending on its importance or the firm’s particular needs. These were then translated into numerical values (3, 2 or 1 respectively) and the requirement given a normalised rating, which was expressed as a percentage of the maximum score it could achieve (i.e. number of respondents multiplied by three).

The results for the graphical presentation and database components are shown in Figures 7 and 8 on the following two pages. No requirement received a rating less than 50% with the majority receiving ratings between 70% and 90%. Therefore all these requirements are important and good TRM software would possess most, if not all these functions.

The exercise also proved useful for capturing other requirements. With regards the presentation tool this highlighted the shortcomings of using Microsoft PowerPoint as a presentational tool as it is slow and laborious to update roadmaps and Microsoft Project was suggested as a better application for maintaining links between roadmap elements. The important issue of including the date a roadmap element was last updated was also raised and the ability to capture brainstorming outputs from a roadmap workshop directly to computer via an intelligent whiteboard was suggested. With regards additional database requirements, compatibility with enterprise software solutions such as Oracle and SAP was recommended.
Question 7 - Graphical presentation requirements

Figure 7a. **Ease of creation**

- Compatible with and supports the human process of roadmapping.
- Ability to quickly update roadmaps by importing data.
- Intuitive software with a simple user interface, catering for both novice and advanced users.
- Web publishing capability and support for multi-user, distributed participation in roadmap creation.
- Facility to export a snapshot of a roadmap into PowerPoint for use in presentations.

Figure 7b. **Display format**

- Clear, easy to understand format similar to roadmaps produced using PowerPoint.
- Multi-layered structure (e.g. Technology, Product/Service, Business/Market).
- Choice of graphical representation of roadmap elements, shapes, colours etc.
- Highly customisable to requirements of individual organisations.
- Ability to set a common template for whole organisation to use.
- Facility to include annotations, notes and link to supporting documentation.

Figure 7c. **Roadmap manipulation**

- Ability to drill up/down to view varying levels of detail.
- Ability to filter/group roadmap elements based on their various attributes.
- Dynamically linked roadmaps & elements, which show how changes affect other connected roadmaps.
- Ability to add more roadmaps in a hierarchical structure as roadmapping matures in the organisation.
Question 8 - Database requirements

Figure 8a. Data structure

- A set of attributes that clearly identify and define roadmap elements.
- Consistent naming convention for roadmap elements to prevent cross-roadmap confusion.
- Weighting of element attributes in terms of importance or uncertainty.
- Hierarchical data structure to allow varying levels of detail to be extracted from the database.
- Record details of dynamically linked roadmap elements and report the effect of any alterations.

Figure 8b. Remote working

- One central database accessible by distributed roadmap users via internet, intranet or local area network.
- Data available to users as read-only. Database updated by authorised roadmap owners only.
- Replication of data for collaborative working and remote roadmap creation.
- Ability to share/reuse data across a number of roadmaps.

Figure 8c. Control of data

- Security features such as passwords & firewalls to prevent unauthorised access.
- Ability to link to other business/management information systems and import/export data.
- Roadmap owners informed by email of any changes to be made arising from roadmapping sessions.
- Facility to sort / filter data based on attributes prior to exporting into presentation software.
- Sufficient spare capacity to store more data as roadmapping matures in the organisation.
Business context

This section aimed to establish the business context in which TRM was applied in terms of organisational size and industry sector.

Figure 9. Company and business unit size (turnover and staff numbers)

Figure 10. Industry sector
Question 9 - Organisation size

The objective of this question was to examine the range of organisation size in the survey sample group in terms of both staff numbers and turnover, for both the organisation and for the particular business unit of the respondent. Figure 9 shows that a range of company size is included in the response but that responses are skewed towards the larger organisations with greater than 50% of companies having more than 20,000 staff and in excess of £1billion in turnover. There is greater variation in respondent’s business unit size across a range of staff numbers and turnover.

Question 10 - Industry sector

The aim of this question was to assess the range of industry sectors that were represented in the survey and to enable sector specific trends to be identified. A number of companies reported that their companies spanned more than one sector and due to the small sample size there was not a particularly wide spread of sectors. Figure 10 shows that the largest sector was aerospace and defence (21% of responses) with other dominant sectors including electronic and electrical equipment, engineering and machinery, and telecommunications.

Question 11 - Technological complexity

This question aimed to assess the complexity of a business’s technology, defined in terms of the number of product families and the rate of technological change. Figure 11 shows that all respondents indicated that their business was based on product families, while 58% relied on mature or slowly evolving technology.

![Figure 11. Technological complexity](image)

Question 12 - R&D activity

The objective of this question was to establish the extent of R&D activity within the surveyed firms. This information is used in a later section of the report to assess whether it influenced the success of TRM initiatives or requirements for TRM software. Figure 11 shows a wide
variation in the extent of R&D activity across firms with no noticeable trends amongst the TRM User Group.

![Figure 12. Level of R&D activity](image)

**Question 13 - Dispersion of R&D activity**

This question aimed to assess the degree of dispersion of a business’s R&D activities. This information is also used in a later section of the report to examine whether it influenced TRM initiatives or requirements for TRM software. Figure 12 shows that responses are skewed towards highly dispersed R&D activity.

![Figure 12. Dispersion of R&D activity](image)

**Characteristics of TRM companies**

This section of the report aims to establish whether there are any trends amongst firms who have successfully implemented TRM initiatives and the contextual reasons behind some of the responses given in the survey.

A significant number of respondents (43%) reported that TRM had become an ongoing process and a part of strategy within their firm; 67% of these firms relied on multiple product families and rapidly evolving technology. Organisation size was another important characteristic of successful TRM with 67% of firms with ongoing TRM having more than 20,000 staff. Certain sectors also had more success with TRM with the aerospace and electronics industries each accounting for 33% of the firms that had attained this level.
A key objective of the survey was to examine whether a link existed between business context and requirements for software components. It was proposed that the database would permit roadmap information to be stored on a central server and shared across the organisation, forming a core element of knowledge management within a firm. As a result it was expected that the database component would be required by larger organisations, with substantial and dispersed R&D activity and who are reliant on rapidly evolving and complex technology.

A correlation between a firm’s software requirements and organisation size was found. Of the firms that reported a requirement for a database component (i.e. just a database or both database and presentation components), 73% had more than 20,000 employees.

No correlation could be found between the extent of a firm’s R&D activity and its software requirements with R&D activity in those firms that expressed a need for a database component being roughly evenly distributed over the activity scale. However, a positive correlation between a database requirement and R&D dispersion for these firms was found with 79% of firms having dispersed R&D activity (levels 4&5 on the dispersion scale). Interestingly, those firms that reported a requirement for just a graphical presentation software component had a high degree of R&D activity, which was also widely dispersed.

Of the firms that desired a database component 60% relied on rapidly evolving, complex technology. All the firms that required just a graphical presentation component were reliant on mature or slowly evolving technology.

**Discussion and conclusions**

This survey provided a useful means for assessing current practice in TRM and in particular the issues surrounding and the requirements for TRM software. It has shown that software can be a useful tool for facilitating TRM but that there are also other significant barriers to successful TRM initiatives. A list of requirements for TRM software was provided, all of which would need to be present in a software package if it is to meet the needs of the survey respondents.

It should be noted that the response rate to the questionnaire was quite low and therefore potentially biased by individual perspectives. A few anomalies did arise; for example in Question 3, 86% of respondents reported that a lack of tools was not a barrier but then 62% replied that software could overcome this barrier. A possible reason for this is that firms could already be using software to support TRM already and whilst a lack of tools may not be a barrier for many firms, TRM on an enterprise scale would not be possible without software. Therefore software could be a TRM enabler in this context.

Although the sample size for the survey was relatively small, it did allow the formation of a number of useful correlations between the requirements for software components and a firm’s business context, with organisation size, dispersion of R&D activities and technological complexity and rate of change being the key drivers for a database software component.
Annex: Questionnaire
Roadmapping Software Questionnaire

This questionnaire aims to examine what organisations have done to date with technology roadmapping (TRM) and the context in which it was applied. It also tries to ascertain what key features are required from a roadmapping software tool.

1. What were your aims in starting TRM? (Please mark an X in all that apply and a XX in most important)

<table>
<thead>
<tr>
<th>Aims</th>
<th>General business strategy and planning</th>
<th>Justification of technology/R&amp;D investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology planning/strategy initiatives</td>
<td></td>
<td>Development of new products/competencies</td>
</tr>
<tr>
<td>Communication of technology plans</td>
<td></td>
<td>Exploration of future business/tech’y scenarios</td>
</tr>
<tr>
<td>Co-operation between business units</td>
<td></td>
<td>Improved synergy across business units</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. How far has your organisation got with TRM? (Please mark an X in the appropriate box)

<table>
<thead>
<tr>
<th>Progress</th>
<th>Did not complete first application</th>
<th>Done once don’t plan to do again</th>
<th>Done once plan to do again</th>
<th>Has been done more than once</th>
<th>Is an ongoing process, part of strategy</th>
</tr>
</thead>
</table>

3. One barrier to successful TRM identified by recent research is a lack of effective tools, techniques and methods to support it.

(Please mark an X in the appropriate box)

<table>
<thead>
<tr>
<th>Barrier to TRM</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this a significant problem in your organisation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you feel TRM software would help overcome this barrier?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. If you DO NOT feel that a lack of software tools is the main barrier to successful and sustained TRM within your organisation, which of the following barriers are also significant? (Please mark an X in all that apply and a XX in most important)

<table>
<thead>
<tr>
<th>Barriers to TRM</th>
<th>Lack of clear business need</th>
<th>Lack of commitment from senior management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiative overload/ distraction from short-term tasks</td>
<td>Right people/functions not involved</td>
<td></td>
</tr>
<tr>
<td>Resistance due to organisation culture/politics</td>
<td>Inappropriate timing of initiative</td>
<td></td>
</tr>
<tr>
<td>Integration into existing strategy &amp; planning systems</td>
<td>Lack of effective facilitation/training</td>
<td></td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Which of the following factors would most influence your decision whether or not to adopt a TRM software tool? (Please mark an X in all that apply and a XX in most important)

<table>
<thead>
<tr>
<th>Factors</th>
<th>Cost and the cost model, e.g. licences</th>
<th>Ease of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration with existing IT systems</td>
<td></td>
<td>Does it support for the human process of TRM?</td>
</tr>
<tr>
<td>Availability &amp; cost of facilitation and training</td>
<td></td>
<td>Organisation’s level of experience with TRM</td>
</tr>
<tr>
<td>After-sales software support</td>
<td></td>
<td>Other (please specify below)</td>
</tr>
</tbody>
</table>

It is proposed that a software solution for technology roadmapping could consist of two major components:
- A graphical presentation tool for displaying roadmapping data
- A central database/repository for storing roadmapping data

The database would form a central element of knowledge management within the organisation.

6. If the components (graphical presentation and central database) of a TRM software tool could be separated, which would your organisation need? (Please mark an X in the appropriate box)

<table>
<thead>
<tr>
<th>Components</th>
<th>Graphical presentation</th>
<th>Central database</th>
<th>Both</th>
</tr>
</thead>
</table>

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A set of requirements has been compiled (see next page) that outlines some of the more important features that technology roadmapping (TRM) software could possess. General software requirements such as operating system compatibility, communication protocols are not included here but are assumed to be satisfactory.
**Roadmapping Software Requirements**

Please could you place an H=High, M=Medium or L=Low in the right-most column depending on how important you think that requirement is.

### 7. Graphical Presentation Requirements

#### 1. Ease of creation
- a) Compatible with and supports the human process of roadmapping.
- b) Ability to quickly update roadmaps by importing data.
- c) Intuitive software with a simple user interface, catering for both novice and advanced users.
- d) Web publishing capability and support for multi-user, distributed participation in roadmap creation.
- e) Facility to export a snapshot of a roadmap into PowerPoint for use in presentations.

#### 2. Display format
- a) Clear, easy to understand format similar to roadmaps produced using PowerPoint.
- b) Multi-layered structure (e.g. Technology, Product/Service, Business/Market).
- c) Choice of graphical representation of roadmap elements, shapes, colours etc.
- d) Highly customisable to requirements of individual organisations.
- e) Ability to set a common template for whole organisation to use.
- f) Facility to include annotations, notes and link to supporting documentation.

#### 3. Roadmap manipulation
- a) Ability to drill up/down to view varying levels of detail.
- b) Ability to filter/group roadmap elements based on their various attributes.
- c) Dynamically linked roadmaps & elements, which show how changes affect other connected roadmaps.
- d) Ability to add more roadmaps in a hierarchical structure as roadmapping matures in the organisation.

Are there any other important graphical presentation requirements that are not included above:

### 8. Database Requirements

#### 1. Data structure
- a) A set of attributes that clearly identify and define roadmap elements.
- b) Consistent naming convention for roadmap elements to prevent cross-roadmap confusion.
- c) Weighting of element attributes in terms of importance or uncertainty.
- d) Hierarchical data structure to allow varying levels of detail to be extracted from the database.
- e) Record details of dynamically linked roadmap elements and report the effect of any alterations.

#### 2. Remote working
- a) One central database accessible by distributed roadmap users via internet, intranet or local area network.
- b) Data available to users as read-only. Database updated by authorised roadmap owners only.
- c) Replication of data for collaborative working and remote roadmap creation.
- d) Ability to share/reuse data across a number of roadmaps.

#### 3. Control of data
- a) Security features such as passwords & firewalls to prevent unauthorised access.
- b) Ability to link to other business/management information systems and import/export data.
- c) Roadmap owners informed by email of any changes to be made arising from roadmapping sessions.
- d) Facility to sort / filter data based on attributes prior to exporting into presentation software.
- e) Sufficient spare capacity to store more data as roadmapping matures in the organisation.

Are there any other important database requirements that are not included above:

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Context in which TRM was applied

9. Organisation Size

(Please place an X in the appropriate box)

No of employees in organisation

<table>
<thead>
<tr>
<th>&lt;25</th>
<th>25-100</th>
<th>100-250</th>
<th>250-500</th>
<th>500-1000</th>
<th>1000-5000</th>
<th>5000-20000</th>
<th>&gt;20000</th>
</tr>
</thead>
</table>

No of employees in business unit

<table>
<thead>
<tr>
<th>&lt;25</th>
<th>25-100</th>
<th>100-250</th>
<th>250-500</th>
<th>500-1000</th>
<th>1000-5000</th>
<th>&gt;5000</th>
</tr>
</thead>
</table>

Turnover of organisation

<table>
<thead>
<tr>
<th>&lt;£1million</th>
<th>£1million-£10million</th>
<th>£10million-£100million</th>
<th>£100million-£1000million</th>
<th>&gt;£1000million</th>
</tr>
</thead>
</table>

Turnover of business unit

<table>
<thead>
<tr>
<th>&lt;£1million</th>
<th>£1million-£10million</th>
<th>£10million-£100million</th>
<th>£100million-£500million</th>
<th>&gt;£500million</th>
</tr>
</thead>
</table>

10. Which option best describes your industry sector?

(Please put an X in the appropriate box)

Aerospace & defence
Automotive
Chemicals
Construction
Consultancy
Electronic & electrical equipment
Engineering & machinery
Food production
Household & textiles
IT hardware
Mining, Oil, Gas
Personal & consumer goods
Pharmaceuticals
Other (please specify):
Public Services
Steel & other metals
Software & Computer Svcs
Telecommunications
Transport
Utilities

11. Which statement best describes the technological complexity of your business?

(Place an X next to one option)

Multiple product families incorporating rapidly evolving technology
Single product family incorporating complex or rapidly evolving technology
Multiple product families incorporating mature or slowly evolving technology
Single product family incorporating mature or slowly evolving technology
Other (please specify)

12. How much R&D activity is there within your organisation?

(Please mark an X on the scale below)

1 (Very little) 2 3 4 5 (Major part of organisation)

13. How dispersed are your R&D and technology planning activities?

(Please mark an X on the scale below)

1 (Centralised) 2 3 4 5 (Highly dispersed)

END OF QUESTIONNAIRE. MANY THANKS FOR YOUR TIME

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