Key Success Factors for Initiating Technology Roadmapping (TRM) Process: A Case Study of a Leading Thai Firm

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Abstract

This paper explores key success factors (KSFs) for initiating technology roadmapping (TRM) processes in a Thai firm. Longitudinal and in-depth case studies were carried out in two businesses of the firm. The cases point to similar key success factors to the generic set found in existing TRM literature, but provided detailed descriptions which might be specific to the project objectives and cultures. Interestingly both cases highlight "people" factor (including roles of top management, project champions, participants, facilitators, and team dynamics), as the most important KSF category, versus "process" and "data". This led to the development of a KSFs framework, emphasizing "people" as the main driver to open up the TRM process, sharing the knowledge, integrating it into existing business tools, and keeping it alive. Therefore, this paper seeks to enrich the existing TRM field with a practical framework, and providing guidance to Asian and other practitioners alike whom are planning to initiate TRM processes in their organizations.

Introduction

Nowadays, companies are facing many challenges in both domestic and global market. The product life cycle is getting shorter while the complexity and the demand for customization on products are increasing. Therefore, it is important for companies to have a systematic way to effectively identify potential products or services for the future, map them onto technology alternatives, and develop resource allocation plans. This approach will help companies to ensure that the required technologies and infrastructures will be ready when needed.

The development of a technology/product roadmap can help a company strengthen its competitive landscape and maintain its leadership in the future. Moreover, the development of roadmap would help provide a strategic direction to leverage R&D investments as well as to lead the company's innovation activities.

Fundamental Concept of Technology Roadmapping

"Roadmapping" and "Roadmap" are words describing the process and the product of roadmap development, respectively. Technology roadmapping is simply defined as an approach to portray the integration of science/technological considerations into product and business planning as well as to provide a way to identify, evaluate, and select alternatives that can be used to achieve a desired objective. Technology roadmaps are widely used in industry, government, and academia (Petrick and Echols, 2004; Richey and Grinnell, 2004; Rinne, 2004; Wells, 2004; Phaal et al., 2003; Gerdsri, 2005). Their popular applications are for developing strategies, planning resources, and identifying gaps and opportunities in R&D.

Robert Galvin, former Motorola Chairman and advocate of science and technology roadmaps, said "A roadmap is an extended look at the future of a chosen field of inquiry composed from the collective knowledge and imagination of the brightest drivers of the change (Galvin, 1998)."

A roadmap visibly represents a dimension of structure and relationship among elements. Figure 1 presents a generic form of a product/technology roadmap. In this roadmap, business drivers; D2 and D3, are determined to be key forces that will drive business changes in the future. These changes would lead to a potential market opportunity as presented by M2 on the diagram. To capture this opportunity, an organization plans to launch a new product called P2 which the design and development of this product requires a new technology known as T2. An organization also needs to invest in research and development activities; RD3, to make T2 ready for use by the time it is needed.

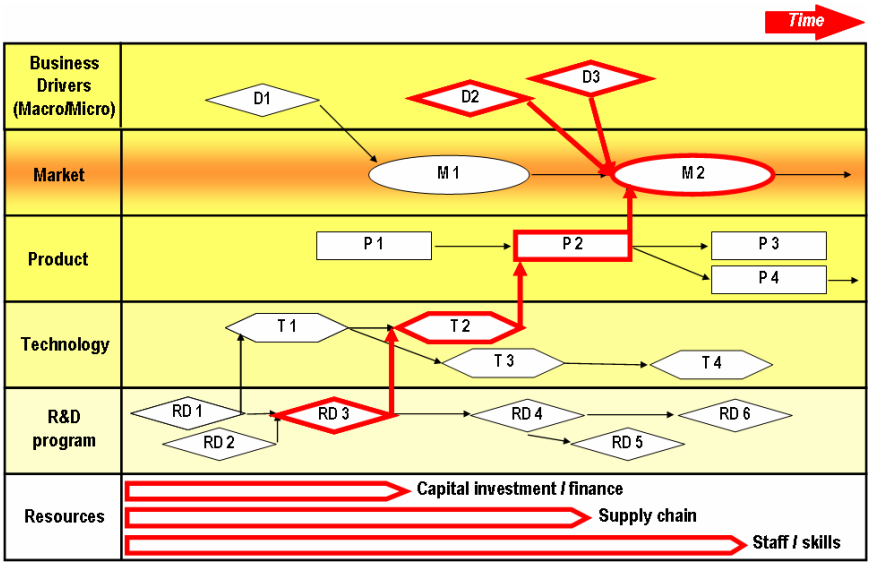

Figure 1: Generic Business/Product/Technology Roadmap

Key Success Factors (KSFs) for Technology Roadmapping Implementation

Defining Success

There is no specific definition to describe the term "success" for technology roadmapping implementation. Generally, the success is depended on an organization's objectives and the objectives should be varied according to different stages of TRM implementation. For example, in the initiation stage when the technology roadmapping concept is introduced to an organization, the success would be measured through how well the TRM concept has been communicated and adopted by key stakeholders. In this case, the success can be ensured by focusing not only on the expected benefits that an organization would gain from implementing TRM but also on the customization of the TRM process to align with an organization's needs. Later on in the full-scale implementation stage, the success would be measured by the quality of the content presented in a roadmap and the continuity of TRM implementation as an on-going process.

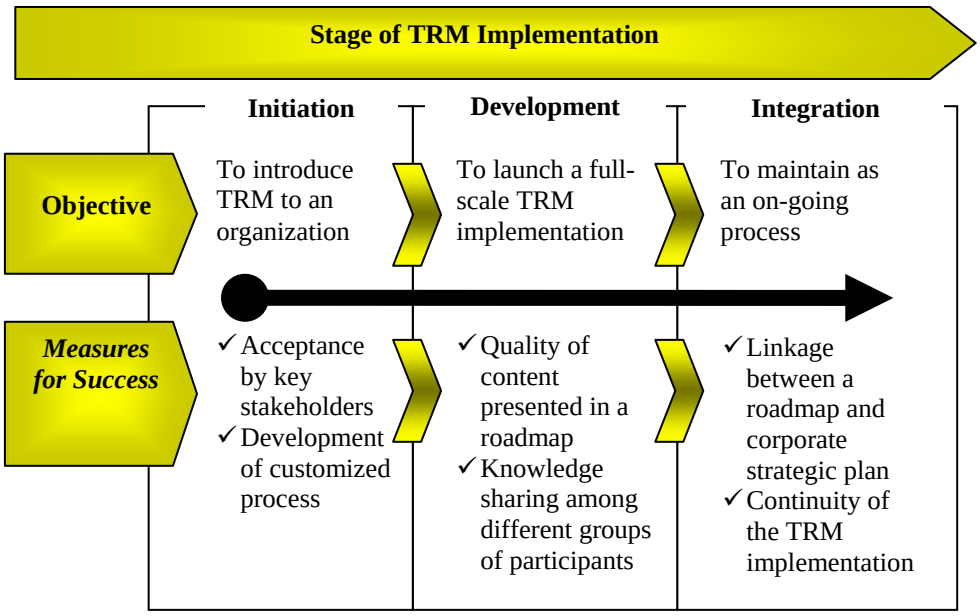

Figure 2: Measures for Success in Different Stages of TRM Implementation

Key Success Factors for TRM Implementation

Based on extensive literature reviews, the existing literature was extensively reviewed to explore significant factors contributing to the success of TRM implementation as they were captured and shared in lessons learned from the field. Ten key success factors were identified from eight major sources as classified in Appendix A. These ten factors can be aggregated into three main components: people, data, and process. The detailed explanation of each key success factor is summarized below:

1. **Clear business needs:** A roadmapping initiative must have a clear sense of purpose and ownership (Australia, 2001). This would help to gain commitment from all participants.

2. **Commitment from senior management:** The most important factor for success is the commitment of senior executives with decision making authority for the roadmap implementation. The embedding of rewards and incentives to encourage bottom-up support for roadmaps is also important (Australia, 2001).

3. **Right people/functions involved:** Champions must be identified to coordinate, drive, and obtain buy-in from other key stakeholders (McMillan, 2003). Champions must have motivations for credible and visionary roadmaps (Kostoff and Schaller, 2001). A multifunctional team (size 3-35) should be formed to implement a roadmapping process. The members of this group should be diverse but have relevant knowledge and background to the subject (Phaal et al., 2003). Participation should be broadened to both disciplines and technologies that have potential to introduce innovations in the future. The roles and responsibilities of each player must be clearly defined. The continuity of participation is desirable, at least for a core set of participants (Phaal et al., 2000). Internal facilitators must be assigned to challenge the content (Albright and Kappel, 2003) and keep people on task and schedule (McCarthy et al., 2001).

4. **Desire to develop effective business processes:** All key stakeholders and participants must be convinced on how roadmap activities will help to achieve the vision, industry goals and also improve the bottom lines of individual players (Australia, 2001). The business units have to endorse and own the process in order to achieve maximum benefit for the company (McMillan, 2003). The strategic development team should participate in the TRM development to coordinate a roadmap with the company-wide planning activities.

5. **Company culture & politics to support participation/progress:** The leaders for TRM implementation must set the boundaries and constraints on the roadmap scope. They are also responsible for determining the structure of the working groups and the design of a final roadmap (Australia, 2001). The strong leadership is important (DOE, 2002).

6. **Timing and planning of the initiative:** The scope of TRM implementation needs to be pre-defined covering the unit of analysis, focus, resources, venue, scheduling, participants, and available information (DOE, 2002; Phaal et al., 2003). The major costs incurring during TRM implementation is time that individuals spend in developing and reviewing the roadmap. The costs and commitments required from participants to the process should not be underestimated (Australia, 2001; Kostoff and Schaller, 2001).

   A game plan covering purpose, background information, workshop preparation, and follow up activities should be set. Key people who will involve in TRM implementation should be identified and invited at least 30 days in advance so that they would have enough time to develop a sound understanding of the roadmapping methodology and what it will mean for their own organization. Devoting time to recruit the right people to the workshop(s) will ultimately be rewarded in the quality of the ideas raised (Australia, 2001).

The workshop sessions need to be planed with adequate time for participants to determine technological categories, explore issues and priority items in sufficient depth, and identify cross-cutting themes and next steps. It is important not to cover too many technologies and pose too many questions for a single workshop. For any given roadmap, it may be preferable to allow one to two days for the workshop (Australia, 2001). From international experience, organizing/conducting workshops and developing a technology roadmap can typically require at least six months.

7. **Clear and effective process for developing an on-going TRM:** Technology roadmapping process is not a black box approach. The structure and process need to be customized to fit the particular company context and extended purpose (McCarthy et al., 2001; Albright and Kappel, 2003; McCarthy, 2003; Phaal et al., 2003). The normalization and standardization of the process should be considered across different roadmaps (Kostoff and Schaller, 2001).

8. **Effective tools, techniques, and methods:** A set of common tools and templates with simple language must be prepared (Albright and Kappel, 2003). The criteria for filtering, rating, and prioritizing need to be defined. (Kostoff and Schaller, 2001; McMillan, 2003).

9. **Effective facilitation and training:** Both TRM participants and Management need to be educated and trained to properly use and apply roadmaps (Kostoff and Schaller, 2001; McMillan, 2003). A workshop environment should be conducive to creative thinking and spur participants to share their ideas for the future. Workshop design and structure are critical to ensure that the technological depth and breadth intended is achieved. The quality and experience of facilitators are key success factors for roadmap workshops. For a diverse industry, specific workshops according to technology or business specialization will allow greater depth of assessment of technical issues (Australia, 2001).

10. **Required data, information and knowledge:** The types and reliable sources of information used for TRM analysis need to be specified at the beginning (Kostoff and Schaller, 2001; Phaal et al., 2003). The data analysis must be exercise in a systematic process. A wide range of science and technology knowledge disciplines must be considered along with social science (McCarthy et al., 2001). Building databases of roadmap information is also important as the process of TRM implementation becomes on-going activities (Albright and Kappel, 2003).

A Case Study of a Leading Thai Firm in Initiating Technology Roadmapping Process

Case Background

The technology roadmap development project was carried out for one of the leading Thai firms. This firm has multiple strategic business units (SBUs). Its ultimate objective is to have a corporate master roadmap representing the future direction of new market opportunities, product development, technological requirements, and R&D activities. Beyond that, the firm is also interested in integrating the roadmapping process into its existing strategic planning process.

Approach of Engagement

Our research team was called in to help the firm implementing technology roadmapping process. Our suggested plan was to develop a product/technology roadmap for each strategic business unit and then compile them at the end to represent as a corporate master roadmap.

Starting from the beginning, the research team worked closely with the idea champion -a person who sees the value of technology roadmapping process and tries to bring it in his/her organization- to understand the firm's requirements for TRM implementation, work culture, and potential limitations which may occur during the implementation. The idea champion and the research team worked together to setup a workshop plan. The idea champion communicated with other key stakeholders to rally for their buy-in and support. Since it was the first time that the technology roadmapping concept was introduced to the firm, the idea champion had to communicate with the top management regarding the balance of the expectations between process learning and high quality of roadmap content. The kick-off meeting for TRM implementation was organized by inviting the President of the firm to inform his staffs about the needs and expected benefits from TRM implementation.

Two strategic business units were chosen to be on the pilot project as they seemed to be ready and their work attitude was more dynamic and welcome to challenges (See the detailed criteria for selecting the first two participating SBUs in Appendix B). The TRM working teams were formed for both SBUs. The team leader was appointed to be a project manager of each SBU team. As a part of Asian culture, seniority is still an issue; therefore, the ideal team leader should have a strong commitment on the expected values of TRM, good communication skills, sufficient seniority, and influence to recruit/invite appropriate participants. The 6-8 member team was assembled from key staffs involving in strategic planning, marketing, product development, engineering, and R&D activities in each SBU (See the detailed criteria for selecting the team members in Appendix C).

Once the working teams were formed, our research team conducted an initial need assessment for each SBU so that the design of TRM process can be properly customized in order to match with the types of information available. In a case that the needed information is not available, the research team gave advices to the working team to temporarily substitute that information with the team's judgments during the workshop sessions and then come back with the correct information later on. This approach would help keeping the momentum of working team to continue through the TRM process without any interruption.

The step-by-step workbook and examples were also distributed in the workshop. The facilitator and members of research team helped creating the dynamic atmosphere during the workshop sessions so that the members of the working team can challenge each other on the related issues.

Discussions and Conclusions

Through the observations from this case engagement, the research team confirms that the key success factors for TRM implementation identified from several literatures are valid. The research team emphasizes that "people" is the most important factor to the success comparing to "data" and "process"; even though the lack of some information in this case engagement became a barrier in the roadmapping process. Furthermore, as an organization aims to keep its roadmap alive, people would be more crucial as they are the ones who sustain the process and update the data. Finally, the research team conceptually illustrates the interaction among people, data, and process as shown in the diagram below.

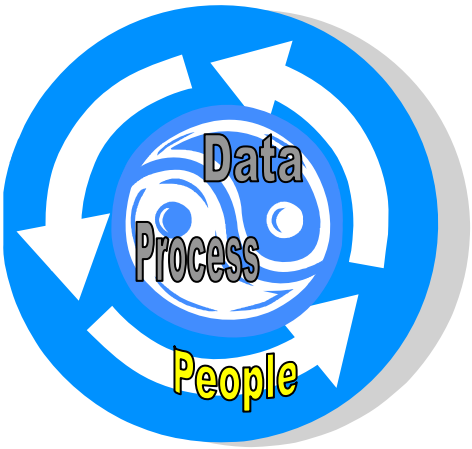

Figure 3: Conceptual Illustration of the Interaction among Data, Process, and People As the KSFs for TRM Implementation

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Appendix A: KSFs Identified in Existing Literatures

KSFs	Phaal et al (2001)	McMillan (2003)	Albright and Kappel (2003)	Nauda and Hall (1991)	US DOE (2000)	Australian Department of Industry, Science & Resources	Kostoff and Schaller (2001)	Dixon et al (2003)
1. Clear business needs	X	X			X		X	X
2. Commitment from senior management	X				X			X
3. Right people/functions involved	X	X	X	X	X	X	X	X
4. Desire to develop effective business processes	X	X	X	X	X	X		
5. Company culture & politics to support participation/progress	X				X	X	X	
6. Timing and planning of the initiative	X				X	X	X	X
7. Clear and effective process for developing an on-going TRM	X		X	X	X		X	X
8. Effective tools, techniques, and methods	X	X	X	X		X		X
9. Effective facilitation and training	X	X	X		X			
10. Required data, information and knowledge	X		X		X	X	X	X

Appendix B: Criteria for Selecting the First Two SBUs for the Roadmapping Project

1. The product owner and the sponsor of this TRM project in targeted SBU should be able to clearly identify.
2. Senior management for that SBU has an interest in the outcome and the application of roadmapping.
3. The potential project team members can be easily identified according to the criteria as listed in Appendix C. Their work schedules can be synchronized for the regular workshop meeting.
4. Senior management for that SBU recognizes that the participation of each member in the roadmapping project is considered as a part of their regular workload.
5. To some extent, the strategic data (eg. market information, product attributes, and technology characteristics) of this product is available.

Appendix C: Criteria for Selecting the Project Team Members

The members of project team will be selected based on their expertise and experience in their business. Their responsibilities could be along an organization's value chain (representing the research and development group, product design and development group, engineering group, manufacturing group, marketing group, service group, and management group). The members should be selected from the staff who have little or no bias regarding the outcomes of the study. Also, they must be in a position to understand the overall scope of the issues and to influence the decision-making process.

In summary, the criteria for selecting project team members can be summarized as follows:

- The members must have in-depth knowledge in the relevant area.
- The team should be formed in a way that the differences in ideas are well represented and balanced across the members.
- The team should be formed in a way that the members from different groups are well represented.