



Technology Roadmap: A Strategic Business Tool

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Abstract: Businesses across the globe are being subjected to unprecedented pressures on account of fierce competition, repeated cycles of global recessions and consequent need for improving operational efficiencies and cost-effectiveness for retaining the market share and survival in the business. Consequently, organizations are looking forward to technology adoption and undertaking technology based projects to address bottlenecks and find solution to business problems. Even though technology investments are made by organizations, but unfortunately, these technology investments are unable to yield business benefits envisaged prior to investments. This paper is the result of a research work undertaken to examine this unpleasant reality. This study has examined the issues of judicious investment decisions for investments related to technology adoption and qualitatively analyse the impact of having a pre-defined technology roadmap within the organization, on the overall business performance of the organizations.

Keywords— Roadmap, Technology Roadmap, Business Strategy, Business Tool

1. INTRODUCTION

While the need for strategic alignment of IT with business is adequately emphasized in literature, there is limited evidence of the same being put into practice. Organizations continue to struggle with challenged IT-projects that fail to deliver as per the expectations of businesses one one-hand, while IT continues to believe that business is not being driven by a defined roadmap defined, requirements are volatile and technology is changing at an unprecedented rate.

With frequent cycles of global recessions, business organizations across the globe are being challenged with a fierce competition for sustenance of their businesses and survival in market. Consequently, business units within the organizations are increasingly being subjected to tremendous pressures to improve their operational efficiencies and reduce costs. For such initiatives, PMOs are being set-up and R & D projects are being initiated under the accountability of PMOs to help achieve strategic goals of improvements. These R & D projects are invariably requiring use of latest and available technology solutions on one hand, but the technology investment decisions

are often being subjected to frequent reviews and criticisms by audit groups internally as well as externally. The objective of this research is to thoroughly examine these issues related to judicious investment decisions for investments related to technology adoption and qualitatively analyse the impact of having a pre-defined technology roadmap within the organization, on the overall business performance of the organizations.

2. TECHNOLOGY ROADMAP

A Technology Roadmap is “a plan that matches short-term and long-term goals with specific technology solutions to help meet those goals”. It is important to mention that the goals and objectives need to be defined properly at the organizational level, enabling all the business units be it business or IT to be guided accordingly for subsequently setting the respective goals and objectives at Business Unit (BU)-level.

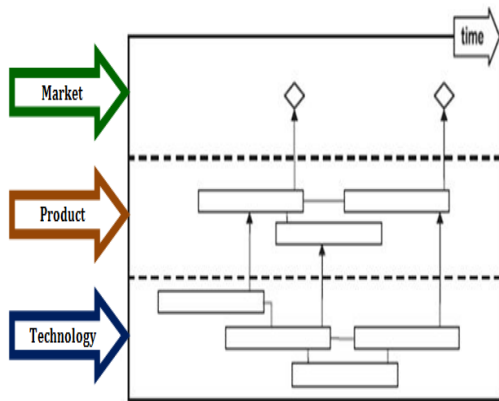


Figure 1: High-Level Technology Roadmap - Example

As per the published work[2] of Dr. Rob Phaal, who is globally recognised as an expert of road mapping, has successfully managed more than 200 road mapping projects, and is working at “Centre for Technology Management” at the “University of Cambridge Institute for Manufacturing” since 1997, following are the benefits of having a defined roadmap within the organizations:

- I. Maintaining a Technology Roadmap helps BUs in reaching a consensus about a set of business needs and the technologies required to satisfy the needs
- II. Maintaining a Technology Roadmap also helps to forecast technology evolution & development.
- III. Maintaining a Technology Roadmap also provides a motivation to plan and coordinate technology developments.

3. RESEARCH BACKGROUND AND CONTEXT

Globalization and the internationalization of the markets in IT-industry have increased competitive pressures on business enterprises. Recent global recession has only worsened the problem and impacted the US and Europe markets and indirectly created huge pressures on Indian IT-companies, because most of the customers and revenues for IT-majors were historically linked to US and Europe markets [1]. These pressures have led companies to engage in technology based projects that are not only critical to their performance, but also vital for survival of the enterprise. Majority of the companies continually strive to produce

better results by undertaking strategic projects. Distressingly, recent industry trends have found that majority of these projects exceed budget, are completed past scheduled deadlines and do not meet original business objectives. One solution to this problem that has been slow to gain popularity in SMBs and start-up organizations is the implementation of a Technology Roadmap within the organizations. The objective of this research is to have a better understanding of the elements that contribute to the impact of having a technology roadmap on the organizational success in the current scenario of global recession and cost-cuttings.

4. OBSERVATIONS ON PREVIOUS WORK

In research work of Thomas A. Kapel[3] different perspectives on roadmaps are discussed based on a total of ten case-studies forming the scope of study, but cause & effect relationships are not firmly established in this study. In yet another research work published by R.N. Kostoff & R.R. Schaller[4], an attempt has been made to emphasize the need for having an integrated roadmap as decision support tool which should have flexibility for accommodating changes but there is limited evidence that road mapping practices are being adopted by the organizations

In the work of S. Lee & Y. Park [5] there is an emphasis on the need for having a technology roadmap that should be customized to align it to the purpose of roadmap. Authors have studies common roadmaps being practiced in the industry and analysed them from managerial usages and proposed a customization framework for roadmaps. However, the frameworks proposed by the authors are incomplete on account of not considering some of the important market-related variables. In the work of V. Kamtsiou, [6], an attempt has been made to advocate use of roadmap as a tool for knowledge creation process, but this study is very specific and limited to the PROLEARN Roadmap, which can't be generalized to other roadmaps on the basis of this study alone.

In work of Z. Cai [7], it is argued that knowledge innovation should be a focus area for businesses as a strategic business tool to meet competition and an attempt has been made to propose a framework for knowledge



innovation but, this framework is yet to be validated by putting it into practice.

In work of R.G. Cooper et.al.[8], it is argued that businesses document & published a product innovation strategy and relate it to technology adoption through a technology roadmap, in order to gain competitive advantages in business. Also an attempt been made to present a framework that may be useful, but there is limited evidence that business organizations are willing to take pain of defining and maintaining a technology roadmap for the same.

In work of W. Guo [9], it is argued that there is a close relationship between technology roadmap and strategic planning as well as between knowledge management and technology roadmap and the discussion is limited to semi-conductor industry and the findings can't be generalized to other domains.

In the work of J. Hou et.al [10], an attempt is made to identify some important factors for technology roadmap which are considered critical in the context of Chinese companies forming the scope of study. A framework with relationships of these identified factors is also presented, but the same has not yet been validated. It needs to be put into practice to validate and refine the framework. Also, the findings are limited to Chinese context and can't be generalized for other geographies, on the basis of this study alone.

In the research work of P.M. Khan et.al.[11], it has been argued that CoQ measurements are essential for ensuring effective quality assurance of technology based projects but the study is limited to software development projects only.

In the research work of P.M. Khan et.al.[12], it has been argued that organizations should set-up PMOs for effective management of technology based projects and the steps required to be ensured for sustaining PMOs during cycles of global recession. However, this study is limited to handling recession cycle and attributes of technology roadmap are not factored in detail.

Several lines of research have evolved in the growing body of literature to help improve technology adoption for better operational performance of business organizations, but there is limited evidence that technology adoption (solutions based on technology

options available) are being employed effectively for addressing the bottlenecks and improving the operational performance and effectiveness of business. This has been the trigger for this research work. Outcome of this research is envisaged to benefit Small & Medium Businesses (SMBs) in effective technology adoption, enabling them to use technology based solutions as a strategic business tool for meeting the global challenges of business performance.

5. RESEARCH METHODOLOGY

Grounded theory research methods were adopted for this research for two reasons. First, the research was aimed at the extension of existing theory. Grounded theory is generally deemed appropriate for such efforts as it allows theory to emerge from interview transcripts and organization artifacts. Second, the methodology is reputed to help separate researcher biases from interpretation of the data.

A total of 44-individuals (project managers and business executives associated with PMOs who supported this study) were interviewed over a period of 9-months. The project managers as well as business executives chosen for the interview were generally very experienced in their position with average experience of more than 8-years and had managed project budgets of multimillion-dollars. Four of the executives were retirees, having left the organization within the preceding 18-months.

The interviews were facilitated via open-ended questions intended to encourage individuals to describe those PMO processes that were related to Technology Roadmap and had either facilitated business success during good times or inhibited success during bad times. The resulting pages of interview transcripts were analysed to identify recurrent themes and concepts associated with good and bad times in the business. Those themes and concepts were then tested against archived data including survey results, periodic reports etc. with an eye to find evidence reinforcing or challenging the themes and concepts. Preliminary conclusions were then tested via follow-up interviews with a subset of original 44-individuals. This iterative process (interviews, concepts identification, concepts



aggregation, theme analysis, testing against organizational artifacts, review with interviewees, adaption, repeat) led to the identification of key concepts and vital lessons learnt, for Technology Roadmap maintenance. These findings are articulated in the following sections VI and VII.

6. DISCUSSION ON OUR RESEARCH FINDINGS

During this research, it was learnt that all the professionally managed organizations were having PMOs and an organizational mandate for maintaining a technology roadmap, but the more matured PMOs had more effective processes for maintaining a technology roadmap that were kept aligned with business strategy. These technology roadmaps were published, maintained and revised from time to time by Technology Managers / CIOs under the aegis of PMOs. A template of such a documented Technology Roadmap, aligned with product roadmap of business is shown in figure-2.

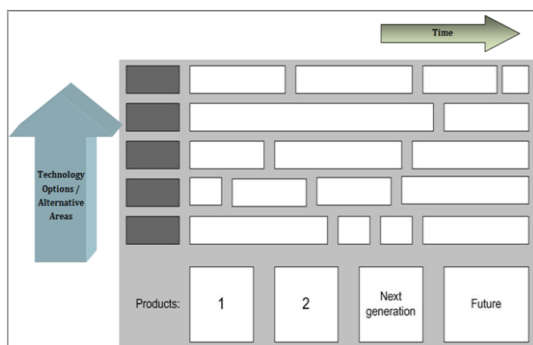


Figure-2: Template of A Detailed Technology Roadmap

Key findings from this study are as follows:

A. Key Finding # 1:

ROI-justifications made prior to technology investments are rarely revisited during or after technology based projects - to measure true benefits.

Businesses are dynamic and so is technology, but the changes are not in sync.

Business and IT, both have their respective KPIs (Key Performance Indicators) , but there is very little convergence between the two, except in those cases where there is a matured PMO with defined processes for the same.

B. Key Finding # 2:

It is clearly evident that in today's globally competitive business environment, organizations are looking forward to technology adoption for addressing key business issues and maintain an edge over competitors.

Technology investments are made by business leaders, but more often than not investments fail to deliver the business benefits perceived at proposal stage.

C. Key Finding # 3:

From this study, it is evident that lack of a clearly documented Technology Roadmap can be detrimental to technology investments of business organizations.

Justification for technology investments is very difficult in the absence of a pre-defined technology roadmap (which should be made public within the organizations) that can be referred to during various stages of investment justifications / decisions.

7. CONCLUSIONS

This study has identified possibility of inadequate understanding and its consequent impact on improper/partial/missing documentation of the Technology Roadmap of the organization.

This study has also identified the possibility of under-utilization of technology and possible impediments in technology adoption, due to lack of a well defined and documented technology roadmap.

We can therefore conclude that well-established Technology Roadmaps make a significant contribution to ROI-justifications of technology investments and effective adoption of technology as business enabler. It should, therefore, continue to be the object of further research.

8. IMPLICATIONS FOR FURTHER RESEARCH

This research is a step towards further understanding of the value propositions of Technology Roadmaps in helping the organizations to achieve strategic business objectives.

This research has focused on convenient sample of organizations that have undertaken technology based projects (under the aegis of PMOs) to attempt use of technology as a business enabler. Planned extensions of the work in this field could be: Undertaking



industry case-studies for project not managed under the accountability of PMOs to nullify the impact of PMO processes on Technology Roadmap Further studies with larger data-sets, to enable further validation and generalization of the findings.

REFERENCES

1. Deloitte report 2009–“Global economic slowdown and its impact on the Indian IT industry” , viewed on-line at <http://www.deloittemeet.com/files/IT%20Recession.pdf>, July, 2010.
2. R.Phaal, C.Farrukh, and D.Probert, “Technology Roadmapping: linking technology resources to business objectives” Centre for Technology Management, University of Cambridge, ISBN 978-1-902546-82-7 (2001).
3. T. A. Kappel, “Perspectives on roadmaps : how organizations talk about the future,” , The Journal of Product Innovation Management, vol. 18, no. August 2000, pp. 39–50, 2001.
4. R. N. Kostoff and R. R. Schaller, “Science and technology roadmaps,” IEEE Transactions on Engineering Management, vol. 48, no. 2, pp. 132–143, May 2001.
5. S. Lee and Y. Park, “Customization of Technology Roadmaps according to Roadmapping Purposes: Overall process and detailed modules,” Journal of Technological Forecasting & Social Change, vol. 72, no. 5, pp. 567–583, Jun. 2005.
6. V. Kamtsiou, “Roadmapping as a Knowledge Creation Process: The PROLEARN Roadmap The Proposed Roadmapping Process and its implementation” Journal of Universal Knowledge Management, vol. 1, no. 3 vol. 1, no. 3, pp. 163–173, 2006.
7. Z. Cai, “A Framework of Knowledge Innovation Based on Technology Roadmapping,” 2010 3rd Int. Conf. Inf. Manag. Innov. Manag. Ind. Eng., pp. 260–263, Nov. 2010.
8. B. R. G. Cooper, S. J. Edgett, and R. G. Cooper, “DEVELOPING A PRODUCT INNOVATION AND TECHNOLOGY STRATEGY FOR YOUR BUSINESS,” Research Technology Management, May-June 2010, vol. 53, no. 3, pp. 33-40, June, 2010.
9. W. Guo, “Technology roadmapping as a new tool of knowledge management,” 2010 Chinese Control Decis. Conf., pp. 1658–1661, May 2010.
10. J. Hou, Q. Lu, Y. Shi, K. Rong, and Q. Lei, “Critical factors for technology roadmapping: Case studies,” 2010 IEEE Int. Conf. Ind. Eng. Eng. Manag., pp. 2168–2172, Dec. 2010.
11. P.M. Khan, M.M.S. Beg, “Measuring Cost of Quality (CoQ) on SDLC Projects is Indispensible for Effective Software Quality Assurances” International Journal of Soft Computing and Software Engineering (JSCSE), vol. 2, no. 9, 2012, e-ISSN: 2251-7545
<http://www.jscse.com/papers/?vol=2&no=9&n=1>
12. PP. M. Khan, M. M. S. Beg, M. Ahmad, “Sustaining IT PMOs during Cycles of Global Recession”, European Journal of Scientific Research, ISSN 1450-216X / 1450-202X, vol. 114, no. 3, November 2013, pp.376-385.
http://www.europeanjournalofscientificresearch.com/issues/EJSR_114_3.html