

## **BENEFITS OF TECHNOLOGY ROADMAPPING AND THE NEED TO INVEST IN IT**

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### **ABSTRACT**

Technology Roadmapping gives a powerful insight for strategic planning. It is a consensus-based planning process that is driven by the projected needs of tomorrow's markets. A technology roadmap does not predict future breakthroughs in technology but it forecasts and articulates the elements required to address future technological needs. Technology roadmapping helps companies to identify, select, and develop technology options to satisfy future service, product or operational needs. It helps to reduce technology risk and hence, it can help companies to make better technology investment and development decisions. This paper will mainly focus on the benefits of technology roadmapping.

**Key words:** Technology roadmapping, management, planning.

### **INTRODUCTION**

Companies face tremendous business challenges today. All products, services and operations depend on rapidly changing technologies. Products are becoming more complex, consumers are becoming more demanding, product life cycles are shortening, and

product time-to-market is shrinking. High-caliber, innovative competition abounds, and the whole world is an open market. It is no secret that the companies with the greatest productivity and biggest market share know how to forecast, analyze and plan. To be competitive in the future, and ensure their long-term success, companies must focus on their future markets and apply a well-researched technology development strategy [1].

Technology roadmapping is a comprehensive tool to help firms better understand their markets and make informed technology investment decisions. It is a planning process, which can assist firms to identify their future product, service and technology needs and to evaluate and select the technology alternatives to meet them. It is a planning tool that can be used to support the development, implementation and communication of strategy and plans.

Technology roadmapping can ensure that an industry has access to the critical technologies needed to

seize opportunities from the major market developments projected to occur over a 10 to 20 year timeframe. By providing strategies to access those technologies and by when, a technology roadmap can help firms and industries to position themselves better for the future [2]. [rt. Nsf/vwopj/Trm guide]

A technology roadmap is the document that is generated by the technology Roadmapping process [9]. [Terbert and Bennett]. A technology roadmap does not predict future breakthroughs in science or technology; rather, it forecasts and articulates the elements required to address future technological needs. A roadmap describes a given future, based on the shared vision of the people developing the roadmap, and provides a framework for making that future happen technologically [3]. [Robert and Scholler]. However, this roadmap is only a high-level strategy for developing these technologies. A more detailed plan is needed to specify the actual projects and activities [2]. [rt. Nsf/vwopj/Trm guide]\_e.pdf]

#### **TECHNOLOGY ROADMAPPING**

Technology roadmapping is a high-level planning process that involves identifying and correlating variables that will impact future directions and uses of technologies.

A complete roadmap identifies these variables and their interrelationships and defines a future vision for the development of specific implementation plans. Not only does the roadmap identify the things that must be done successfully, it also pinpoints knowledge gaps so that scarce resources can be directed more effectively. By linking technology plans to business strategies and product plans, technology and product development information gathering is standardized across the corporation. This process of continuous update and renewal, along with a balance of strategic planning and calculated reaction is owned by the technology and business functions through joint technology and business leadership teams [2]. [rt. Nsf/vwopj/Trm guide]\_e.pdf] This communication sharing and linkage leads to more effective planning and future program development, and enables any participant the ability to see what might be possible in the company in the near future. It brings together a team of experts to develop a framework for organizing and presenting the information to make the right technology investment decisions and it provides a way to leverage those investments.

Thus, technology roadmapping is a compound process, requiring concurrent consideration of markets, products and technologies and their interactions.

**ELEMENTS OF ROADMAP**

There is no fixed format for describing or presenting roadmaps. Roadmaps are usually described using diagrams, charts, tables and text or a combination of these. However, there are a few basic elements that normally should be addressed when developing a roadmap. As depicted in Figure 1, these include the future needs or problems (business, market or societal) that the roadmap is to address; the applications (products or services) to meet those needs or to solve those problems; the various technologies (current and future) that could possibly be used to develop the applications identified; the R&D programs and projects to develop the technologies identified; and, the resources (human, financial, etc.) required to carry out the R&D programs and projects. All these are placed in perspective with respect to a timeframe of delivery, which could be from present to 10 years or more in future. Normally, timeframes are given in epochs, usually near-term, mid-term and long term [4] [<http://strategis.ic.gc.ca/>][5]. [Michael.P. 1990]

A generic format for a roadmap is shown in Figure 1.

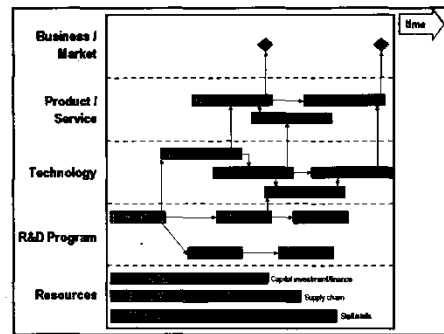


Figure 1. Generic format for a roadmap. [6]

As an example, Figure 2 illustrates the possible range of technology alternatives in future for Smart Homes.

SHE-ROADMAP				
	2003	2004	2006	Beyond
<b>Objectives and goals</b>	Embedded computing	Low-power wireless communication embedded in devices	Ubiquitous networks, rich overlays	Costs cutting, Ambient intelligence
<b>Context awareness</b>	Location-based services, position-based reactivity	Wearable embedded sensors, awareness of device context	Services using context-based information retrieval, environmental sensors	Awareness of social context
<b>Positioning</b>	GPS & GSM positioning-based services	Low-power RF-based indoor positioning (ICM), relative positioning (ultra-wide)	Indoor cm-resolution positioning	Absolute integrated indoor/outdoor positioning
<b>Personalization</b>	Electronic identification, Web-services using customer profiles	Profile-driven services with learning features	Trustful semantic classifications, Personalized context-driven services	Digital ink
<b>Multiple modalities</b>	WAP in HTML, PDA/phones, Voice control in consumer electronics	Pointing and voice combinations, Voice versatile devices	Shared user interfaces, interactive environments, gesture recognition, natural interaction, multimodal adaptive UI	Electronic paper

Figure 2. Source: VTT Technical Research Centre of Finland

**BENEFITS OF TECHNOLOGY ROADMAPMING**

Science and technology roadmaps plot the future development of a scientific or technical field, and industry/government-sponsored road-maps aim to

describe the future of an industry or sector, along with actions to move the industry or sector forward. For example, the technology roadmap for Semiconductors sets aggressive goals for the industry and its suppliers, defining the framework within which all participants contribute and compete [7]. [T-Plan]. Corporations use roadmaps for product, platform, and technology planning, as well as for functional planning in areas such as manufacturing or information technology.

The concise benefits of technology roadmapping are given below:

**1) Strategic planning:**

- provides a framework to help plan and coordinate developments within a company or an entire industry.
- provides information for reducing uncertainties for better technology investment decisions.
- builds consensus about the needs and the technology alternatives to address them.
- provides a mechanism to help experts forecast technology development in targeted areas.
- It assists in setting priorities for the allocation of resources.

**2) Market understanding:**

- links roadmaps between supplier, customer and competitors to help quickly visualize how other participants can affect a company's market.

- produces a 'big picture' view of the business by supporting composite roadmaps or 'roadmaps of roadmaps'.
- increases the probability for more robust economic performance.

**3) Technology development:**

- helps in identifying & selecting appropriate technology alternatives and driving implementation planning by specifying what levels of technology performance are needed.
- uses changes among competing technologies as opportunities.
- identifies critical technologies and gaps.
- helps coordinate research activities.
- accelerates the rates of both technology development and deployment [7]. [T-Plan]. [8] [<http://www.asdl.gotech.edu>] [9]. [Herbert and Bennett]

**NEED FOR TECHNOLOGY ROADMAPPING**

Rapid change in technology and frequently shifting requirements make it necessary to plan for the future. There has to be consensus within Malaysian industries as to the viable technology options from among the choices for future development. Individual companies within an industry sector, in general, lack the resources and skills needed to boost innovation, and would benefit from joint efforts in R&D, sourcing, or supply-chain arrangements [1]. [<http://strategis.ic.gc.ca>

Technological development is a key element in Malaysia's plans to achieve industrialized nation status by the year 2020. Development of industries such as automotive, textile, ICT, semiconductor, food etc. is seen as a means towards this end. The National Development Policy, outlines policy directions for Vision 2020 which include action plan for industrial technology development in the formulation of short, medium and long-term strategies; promoting the commercialization of research activities and potential technologies; modifying and restructuring public-sector R&D activities towards the establishment of close linkages and symbiosis with market needs; emphasizing on applied R&D and innovation in areas capable of providing high returns on national industrial development and competitiveness; and, developing expertise in technologies required by established and new industries [10]. [http://www.mint.gov.my] Technology roadmapping would help in building broad-based and well-defined roadmaps which will in turn help in developing action plan for industrial technology development.

What Malaysian industries need, are formal and well defined roadmaps as frameworks for business planning and coordinating technology developments both within a company or an entire industry or nationwide.

For example, Japanese firms seek to identify needs as the basis for developing and setting roadmaps for technological development. As shown in Figure 3,

Japanese firms have developed a systematic approach to long-term product development. Product development strategy begins with recognizing market needs, and moves through developing a product vision, initiating the R&D concept, and specifying quality and cost targets, to designing the product, process, and factory automation system and equipment [11][http://www.wtec.]. Tech-nology roadmapping plays a key role in the selection of appropriate technology alternatives among competing technologies and also helps in linking technology plans to business strategies and product plans.

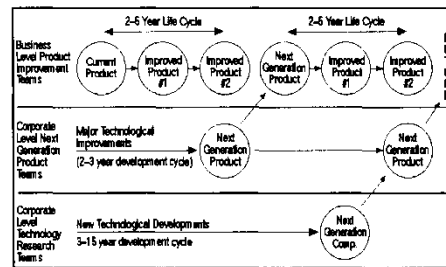


Figure 3: Product development strategies in Japan

Development of new technologies in ICT, MEMS, semiconductor industry etc. offer many opportunities for Malaysia to achieve the status of developed nation. Technology roadmaps can provide assistance for developing human capacity (knowledge, techniques and management skills), developing appropriate institutions and networks, and with acquiring, adapting and developing specific hardware. Roadmaps must therefore operate on a broad front covering human capital,

infrastructure and content challenges, and ideally within a framework.

The Malaysian Government has invested heavily in R&D in an effort to strengthen the technological capability of the nation. Since the country is limited in reserves (human capital, funds, infrastructure etc.), it needs to align and focus its R&D activities so as to optimize the usage of these resources. Technology roadmapping help in this by identifying the technological priority areas, when to take a lead and when to follow, where in the technology life-cycle to make an entry so that the investment decisions can be made. On its part, the Government can contribute to technology roadmapping by:

- providing data and analysis
- giving support via its various departments and agencies
- presenting the concept and benefits to industries
- helping industry in acquiring the requisite skills and knowledge
- acting as roadmap custodian
- providing funding and support services
- making policies and programs
- monitoring progress
- disseminating the results [1]

#### CONCLUSION

Technology and product planning presents a continuing challenge for many businesses, in terms of both the formulation and implementation of strategies. Technology roadmapping is certainly a fast and comprehensive way to envision the future implementation of a particular technology, since it is a compound process, requiring concurrent consideration of markets, products and technologies and their interactions. Thus, technology roadmapping is a good tool to help firms better understand their markets and make informed technology investment decisions. It therefore follows that the Malaysian government's focus on technological development to realize its vision 2020 would greatly benefit from carrying out technology roadmapping exercise for strategic decision making.

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