

Design and Measurement Technology Roadmap on the Balanced Scorecard

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ABSTRACT

In today's world technology plays a key role in enterprises competitive advantage, therefore, must be based on a strategic view of management. Flexible Technology Roadmap method is widely used in various industries and long-term strategic planning. This approach to planning, structured device (sometimes graphic) to explore the relationship between markets, products and technologies developed over time. This theory, first introduced by Motorola 25 years ago in order to support integrated planning and production technology was developed, then, in a broad and diverse field of industrial fields in which companies and sectors implemented and applied. Technology road maps can have many forms. But generally layered graphs when they are in conformity with the requirements and procedures that enable technology development market. Since the majority of Iranian organizations management tools, not in terms of integration with other management tools, implemented natively and so in this article we show. How the balanced scorecard and strategy map of the four main elements of technology (hardware, human ware, info ware, or ware) to design a technology roadmap. And went on to translate and implement the operational activities related to trade and integration model Balanced Scorecard Strategy Map to measure it.

KEYWORDS: Technology roadmap, strategy maps, balanced scorecard.

1. INTRODUCTION

Many of the many managers are aware of the strategic importance of technology in delivering value and competitive advantage to their companies. These issues are becoming more critical as the cost, complexity and rate of technology change increase, and competition and sources of technology globalize. The management of technology for business benefit requires effective processes and systems to be put in place to ensure that the technological resources within the organization are aligned with its needs, now and in the future.

Roadmapping is an established method for both Future oriented Technology Analysis (FTA) and innovation management. Roadmapping can be further used to integrate business planning and innovation or technology management in a way that the strategic and business objectives are met through controlled technology and new product development [1]

Due to the balanced scorecard system is established in our company (case study) and it was decided to technology Roadmapping through the logic of balanced scorecard draw. In this study, we are looking for design technology Roadmapping and make it operational. So another reason for implementing and using the balanced scorecard it was that many organizations have been successful in implementing the balanced scorecard. The objectives of this study in our company (case study) can be divided into three categories:

- Design technology roadmap through the Balanced Scorecard strategy map (with respect to the four perspectives of financial, customer, internal processes and learning and growth) in order to create an integrated system strategy
- Measurement technology roadmap by defining the indicators are consistent with the balanced scorecard strategy map

2. LITERATURE REVIEW

2.1. Background

Technology road mapping was originally developed by Motorola in the 1970s to support improved alignment between technology and product development. Since then the approach has been adopted widely by many organizations in different sectors around the world, at company, sector and national levels. The underlying concept is very flexible, and road mapping methods have been adapted to suit many different goals, supporting innovation, strategy and policy development and deployment. The most frequently cited benefit of the approach is communication. The process of roadmap development brings together the various key stakeholders and perspectives, building consensus. Once a roadmap has been developed it can be more widely disseminated, acting as reference point for ongoing dialogue and action.[2]

2.2. Four Main Elements of Technology

Technology is the collection of techniques, methods or processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation. Technology can be the knowledge of techniques,

processes, etc. or it can be embedded in machines, computers, devices and factories, which can be operated by individuals without detailed knowledge of the workings of such things.

Technology as the factor which turns production factors to the goods and services include four elements:

- Info ware
- Human ware
- Techno ware
- Orga ware

Four elements of technology interact with each other and mutual interaction and suitable and continuous progress of these elements develops the technology. Four elements of technology cause transformation of natural resources and mediatory goods to product and services and no transformation is possible without presence of these four elements. Technology does not have any property per se and everything depends on the way of utilizing technology [3]

2.3. Technology Road mapping

Technology Roadmaps were originally developed by MOTOROLA in the 70's in order to align the development of their products and their supporting technologies. The Technology Roadmaps (TRM) are part of a methodology that guarantees the alignment of investments in technology and the new development of capabilities, so that they are able to make capital out of future market needs. This is a tool that brings important support to the innovation manager, letting them define the firm's technological evolution in advance. The tool takes the relationship between technologies, their products and services as well as the relationship with the target markets into account. As a result, the firm's technological status can be maintained or improved. [4]

Roadmaps can have different applications. According to Phaal et al.[5], these can be classified into 8 areas(Fig1):

- a) Planning of products: This is the most common Technology Roadmap. In this case, the different generations of manufactured products are tied to the necessary technologies for their development.
- b) Planning of services and capabilities: The focus is on how the technologies foster the firm's development of capabilities that permit the rendering of the service.
- c) Strategic planning: This kind of Roadmap assesses the different opportunities that markets and business tendencies can offer, at strategic level.
- d) Long run planning: In this case, Roadmaps are often used at regional and national levels, where planning is projected long- term.
- e) Capabilities and knowledge planning: Here, Roadmaps let the firm align its knowledge capabilities and business goals.
- f) Project planning: The Roadmap can also align the different project activities, e.g. R&D projects with technologies development.
- g) Process planning: Road mapping permits managing knowledge, focusing on a particular area of the firm.
- h) Integration planning: Through this Roadmap, it is possible to have a vision about integration and evolution of the technology, and how they combine with products and systems in order to create new technologies.

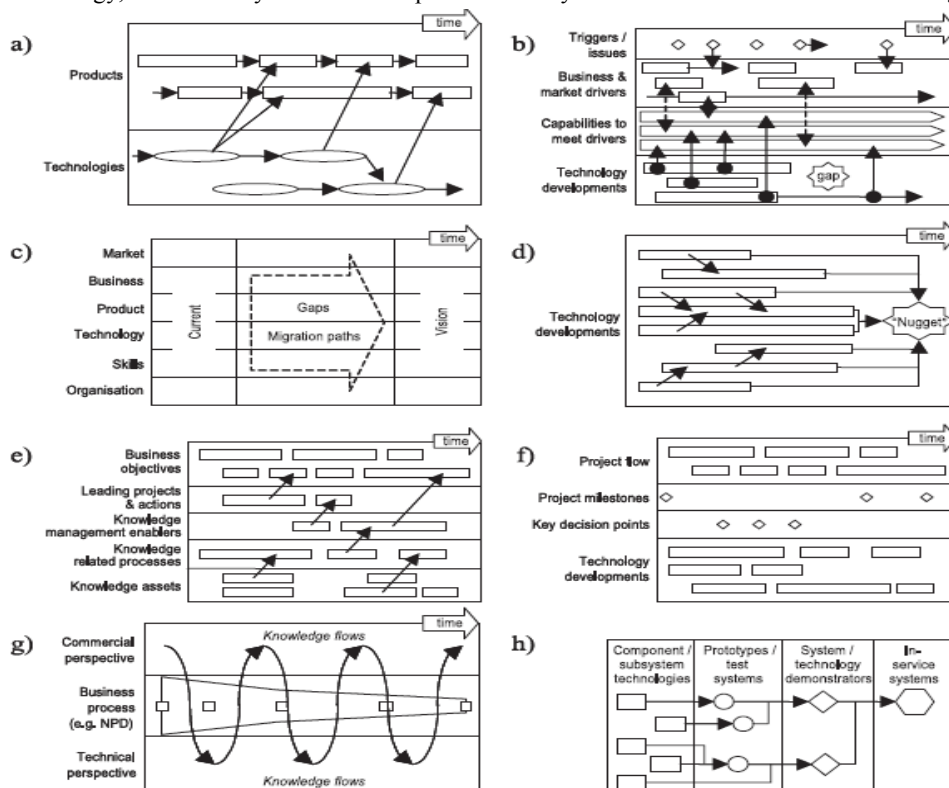


Fig. 1.Different Roadmaps

2.4. Balanced scorecard

The essential start of the Balanced Scorecard is that only measuring financial results is not appropriate for judging the overall performance of any organization. At the end of the day changes in financial output will be unable to locate the reasons for improvement or decline in profit. Kaplan and Norton recommended that organizations using only monetary measures are basically ignoring other important business activities that have a great significance on growth of the organization. They inferred that measure ought to be created to four perspectives of organization (Fig2). [6]

- The financial perspective; measures in this point of view may as well answer the inquiry, "How if we seem to our stakeholders?"
- The Customers Perspective. These measures may as well answer the inquiry, "How if we seem to our clients?"
- Internal Business Process Perspective. These measures may as well answer the inquiry, "What forms must we outperform at?"
- Learning and development Perspective. These measures may as well answer the inquiry. "By what means would we be able to maintain our capacity to change and improve?"

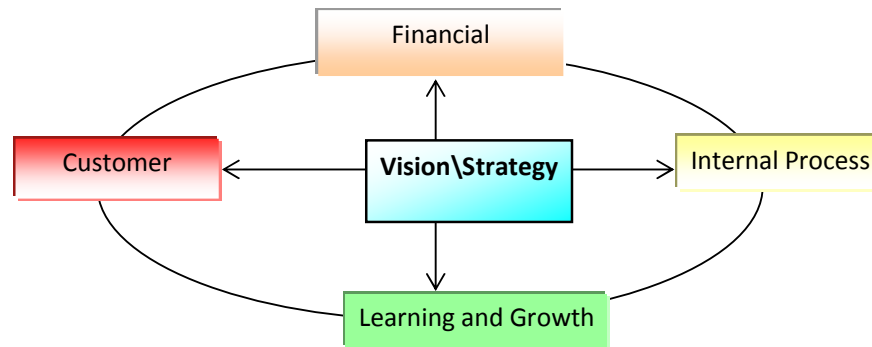


Fig. 2.Balanced scorecard framework

2.5.Strategy Maps

The strategy map is a visual framework of the cause and- effect relationships among the components of an organization's strategy, and it is used to integrate the four perspectives of a BSC — financial, customer, internal, and learning and growth. It provides a uniform and consistent way to describe strategy so the objectives and measures on the BSC can be established and managed. It illustrates the time-based dynamics of a strategy and the relationships that link desired outcomes in the customer and financial perspectives to outstanding performance in critical internal processes. These processes in turn create and deliver the organization's value proposition to targeted customers and promote productivity objectives in the financial perspective the strategy map also identifies the specific capabilities in the organizations

Intangible assets that is required for delivering exceptional performance in critical internal processes. The strategy map is based on several principles, including the following (Fig3):[7]

- Strategy balances the contradictory forces of short-term financial objectives for cost reduction and increased productivity, and the long-term objective of profitable revenue growth
- Strategy is based on a differentiated customer value proposition, because satisfying customers is the source of sustainable value creation.
- Value is created through internal business processes. Strategy maps and BSCs describe what the organization hopes to achieve, that is, strategic themes.
- Strategy consists of simultaneous, complementary themes or clusters of internal processes that deliver benefits at different points in time.
- Strategic alignment determines the value of intangible assets. The three components in the learning and growth perspective are human, information and organization capital

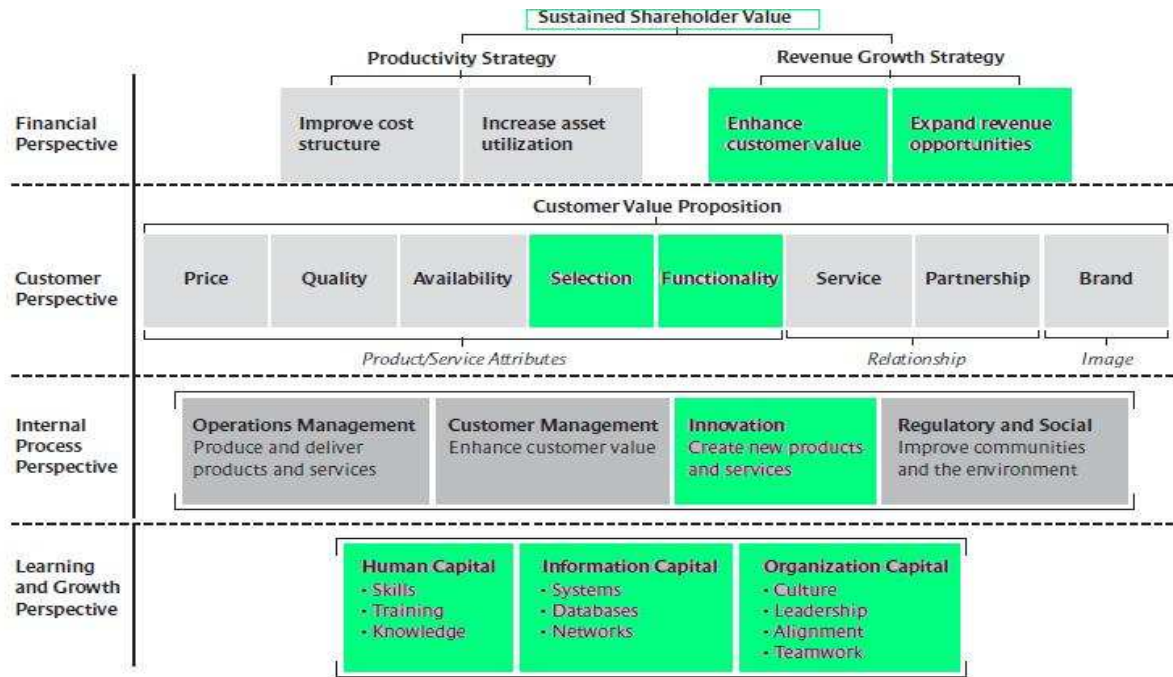


Fig. 3. Technology/ innovation strategy map

3. Drawing and measuring technology roadmap based on the Balanced Scorecard strategy map

The goals were considered in this study is that technology roadmap can be drawn using the balanced scorecard strategy maps. It should be noted, such as the balanced scorecard management systems, quality management systems, etc., often in developing countries, to create, deploy and run-in most cases Regardless of the level of maturity of the domestic industry as defined improvement projects to enhance productivity On the other hand, each of these management systems as isolated islands in the internal organizations, As a result, rather than managers, efficiency of these systems feel in productivity activities, contrary to the hands and feet become systems administrators lose confidence in them and Finally, the system as a ceremonial display in their industries. Industrial engineers and management experts agree that the main issue is to improve industry productivity enhancement and management systems are the only means of achieving productivity improvement. Therefore, the use of these tools to position their industries (IT platforms, knowledge workers, the current technology level, economic status, country, etc.) paid and then select the appropriate tools deployed integration with other models in the company noted. So what can the management systems to be integrated in a direction that can be more focused on achieving the goals?

An organization in which we studied, technology / innovation Management process as a core internal processes defined. As seen in Figure 3 is a bottom view map causal relations strategy to achieve the organization's goals, that point of view of learning in three core human capital, information capital and organizational capital in internal processes perspectives impressive. Part of the impact learning and growth perspective, according to the strategy adopted by an organization in the process of technology / innovation affects. Goals that technology / innovation Management process to deliver value to the customer in the customer's perspective and then provide long-term goals are the end beneficiaries.

As shown in Figure 3, the process of innovation is part of the overall strategy to achieve the vision and goals of an organization and, depending on an organization's strategy, which takes into account its weight change. An organization in which we studied, Almost 60% of the organization's strategy and is designed so that the bulk of the policies in the sights of the four strategic objectives of the strategy card technology / innovation goes. This means that based on the relationships in the balanced scorecard should be a major part of the three terms of learning and growth (human capital, information capital and organizational capital) of the technology / innovation Management process support. The learning and growth perspective to technology roadmap out the critical role plays.

Another issue is that the balanced scorecard model strategy in the form of a performance evaluation system translates into operational activities. So that in each of the four balanced scorecard perspectives, the strategic objectives defined then at least one indicator or measure is intended to quantify the strategic objectives. The current status of the company in any of the indicators determined for the months and years to come to be considered a target. Finally, to move from the current situation to achieve the intended purpose of a future strategic plans and Initiatives defined. The key point is based on the four elements of its technology strategy map, all programs and strategic Initiatives that can be associated with the technology / innovation and technology in the form of a map in two dimensions and relationships defined time.

3.1. The process of designing the technology road map (Figure 4)

- Developing programs and initiatives, including customer needs / ideas from the customer's perspective strategy map in customer's perspective technology roadmap in the dimension of time

- In production perspective, Definition products based on customer needs customer needs in the dimension of time
- Defining the technologies needed to achieve each of the products in technology perspective in the dimension of time
- Human capital is considered as a technology road map perspective that based on the strategic objectives of the strategy map as a key feature to increase staff, programs and measures should be proportionate to the technology roadmap for the achievement of defined technologies.
- Information capital considered as a technology road map perspective that based on the strategic objectives of the strategy map as objective knowledge management, programs and measures should be proportionate to the technology roadmap and time to achieve the defined technologies.
- organization capital considered as a technology road map perspective that based on the strategic objectives of the strategy map as to enhance leadership skills, programs and measures should be proportionate to the technology roadmap and technology to achieve the defined time

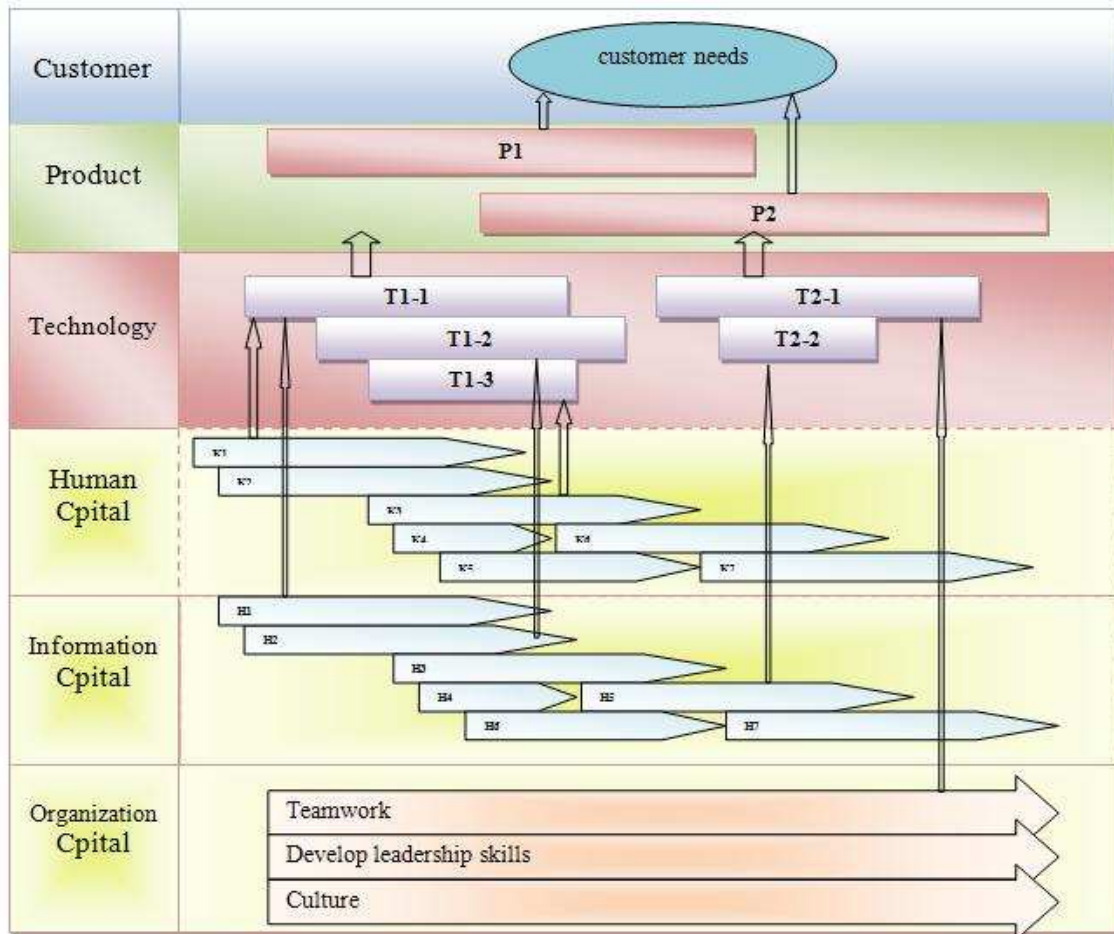


Fig. 4. Technology roadmap based on the strategy map

2.2. The process of Measurement the technology road map (Figure 5)

2.2.1. Customer perspective: As can be seen in Figure 5, According to the functionality (certain aspects of performance) strategic objective of customer needs (Figure 4) in the study was defined as the need may be offered by the customer or organization. With reference to the organization's strategy map can be Realized as of the index time spent with key customers and the index number of ideas raised in the meetings can be used just to evaluate customer's perspective technology road map.

2.2.2. Product perspective: As can be seen in Figure 5, Given the selection (products / projects, new projects) the product p1 and p2 (Figure 4)Technology Map of the study was defined by reference to the organization's strategy map can be Realized as an indicator of project or new projects for the development of indicators of progress in achieving the same product can be used in the evaluation mode of product perspective technology road map.

2.2.3. Technology perspective: As can be seen in Figure 5, With regard to process technology / innovation for product-related technologies in the technology road map of the study was defined. With reference to the organization's strategy map can be Realized as an indicator of progress in achieving the same technology can be used to evaluate technology perspective technology road map.

2.2.4. Human Capital perspective: As can be seen in Figure 5, According to the learning and growth perspective and human capital for each technology, Staff development programs related to technology roadmap was defined. With reference to the organization's strategy map can be downloaded that Key features staff development index can be used just to evaluate human capital perspective technology road map.

2.2.5. Information Capital perspective: As can be seen in Figure 5, According to the learning and growth perspective and Information capital for each technology, Required knowledge related to each technology was defined technology roadmap, With reference to the organization's strategy map can be Realized that Sharing of best practices and knowledge transfer rate outside of the organization index can be used just to evaluate Information capital perspective technology road map.

2.2.6. Organization Capital perspective: As can be seen in Figure 5, to the learning and growth perspective and Organization capital for each technology, Teams associated with each technology was defined on the technology road map. With reference to the organization's strategy map, Can be Realized that rate of development of leadership and strategic awareness rate index can be used just to evaluate Organization capital perspective technology road map.

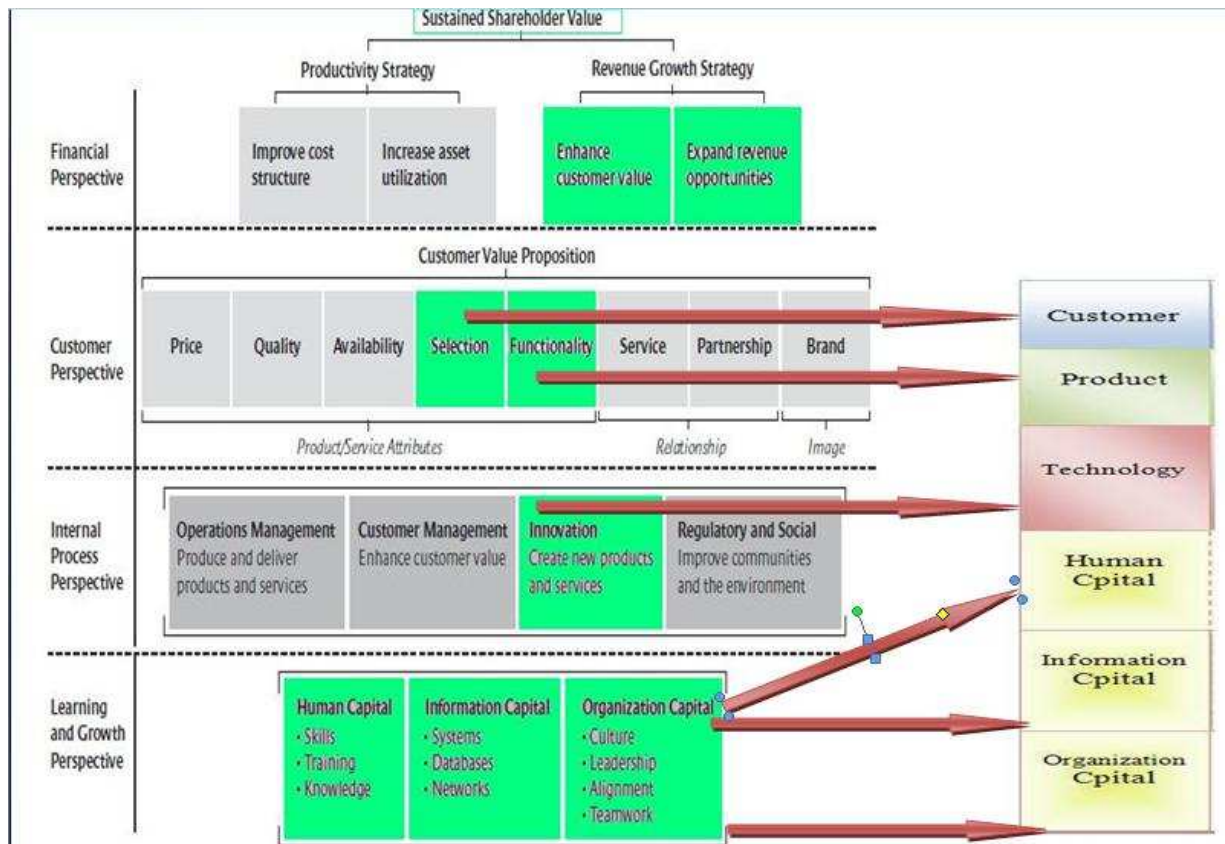


Fig. 5. Measurement technology roadmap based on the strategy map

4.RESULT

So far, efforts to develop frameworks and applications technology road map have taken place. One can develop a technology road map to be considered as strategic planning. Although some organizations prefer to use the method given for special situations. But the technology roadmap for the formation of organizations that utilize the main part of its strategy, the most concentrated and the most appropriate tool for the implementation of their business strategy. Since the strategy map of the balanced scorecard in four perspectives (financial, customer, internal processes and learning and growth), the conversion of intangible assets into tangible outcomes converts ,The study was intended to show How technology roadmap through the Balanced Scorecard strategy map (with respect to the four perspectives of financial, customer, internal processes and learning and growth) in order to create an integrated system that strategy And the technology roadmap for the operationalization of the indicators defined in accordance with the road map strategy Balanced Scorecard model was tested.

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Appendix

Bob Galvin, who was CEO of Motorola during the period when road mapping was established, provides the following definition3: “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 change in that field”. This definition emphasizes the importance that knowledge and expertise plays in the process, the forward-looking nature of the approach, and its flexibility. Many different approaches to road mapping have been developed, and roadmaps can take many forms, although generally the focus is a graphical representation that provides a high strategic view of the topic of interest. The most flexible and powerful framework for the creation of roadmaps is illustrated schematically in Fig6, comprising a multi-layered time based chart, bringing together various perspectives into a single visual diagram. This type of roadmap enables both ‘demand’ and ‘supply’ views to be represented, balancing ‘market pull’ and ‘technology push’.

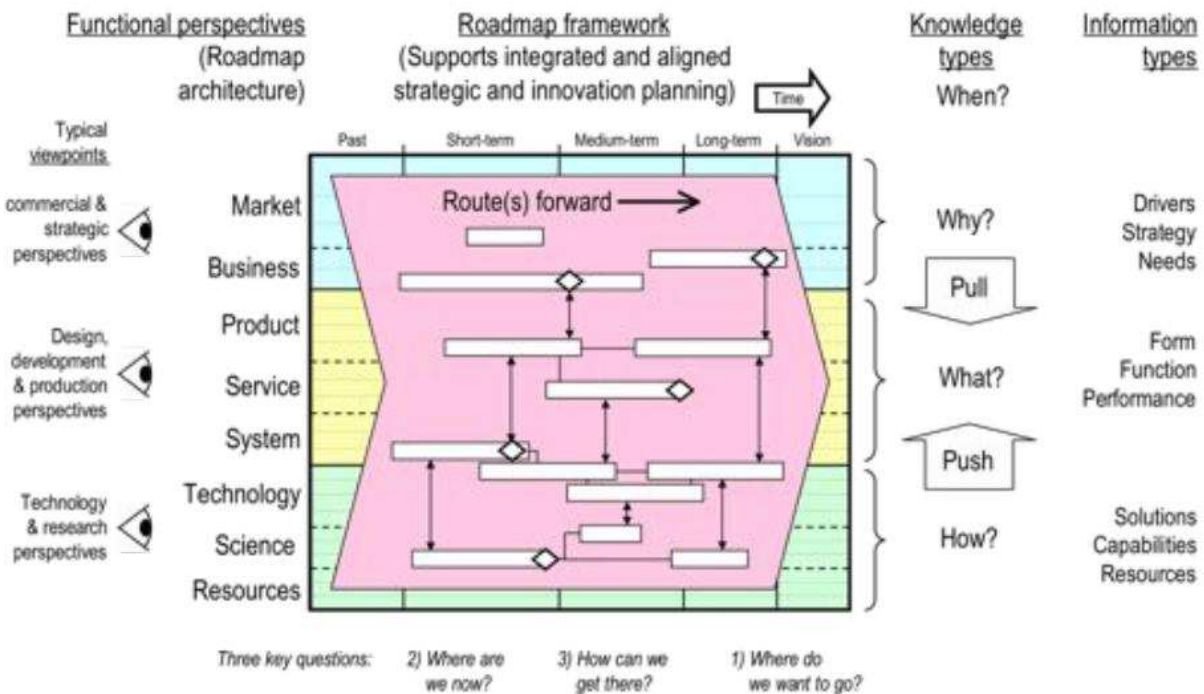


Fig. 6.Schematic multi-layered roadmap, aligning multiple perspectives

This holistic roadmap framework links directly to fundamental questions that apply in any strategic context:

1. Where do we want to go? Where are we now? How can we get there?
2. Why do we need to act? What should we do? How should we do it? By when?

The generic form of roadmap illustrated in Fig. 2 highlights the flexibility of the approach, which can be readily adapted to suit a wide range of goals and contexts. In essence, roadmaps are simple, adaptable ‘strategic lenses’ through which the evolution of complex systems can be viewed, supporting dialogue and communication.