

SOME METHODS TO SELECT REGIONAL STRATEGIC TECHNOLOGIES

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Abstract:

Each region of the country has its different geographical, cultural, economic characteristics and is appropriate for development of different technologies. On the basis of studying published reference materials of some countries on the selection of strategic technologies, this article tries to systemize theoretical basis for the selection of regional strategic technologies. The article also provides a model and an analysis and selection procedure to get the most appropriate technology. However, right selection of strategic technologies is a very complicated process; therefore, it is very hard for such a single article to express all of different aspects of the issue.

Keywords: Technology; Technology Development; Strategy; Region.

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1. Research Questions

Vigorous development of new technologies over the past few decades, along with the issue of technology application for socio-economic development, has attracted the attention of many policy makers, researchers in developed and developing countries. As a result, policy makers have really paid attention to high technology development issue as well as the application of this kind of technology for socio- economic development.

Strategic technology of an organization/enterprise or a nation as a whole is the technology which has possessed or will possess the potential to make contribution to the general development strategy, and it is also the objective that the organization or nation wishes to pursue and master it. On the other hand, technology strategy is a long-term plan where describes the objectives, itinerary to develop, use and master any specific technology [4]. Therefore, for a social entity, the two concepts of strategic technology and technology strategy are only different in terms of their expression. Strategic technology emphasizes on the objectives to be achieved and technology strategy focuses on the process to achieve the set goals. In some documents, these two concepts are interchangeably utilized.

Developing strategies for regional technology development covers a wide range of techniques and mechanisms which are considered as one of the aspects of "regional science and technology (S&T) policy" [4]. Regional

technology policy includes strategic technology planning, in which high technologies like nanotechnology, biotechnology, information technology,...[3] are received of high priority. However, these hi-technologies involve many other different fields, so with only a single policy it will not be optimal for all to apply. Accordingly, for each region, it needs a through analysis and a flexible application of a group of policies, whereby each policy has its certain objectives for a given group of technologies [7].

This article will analyze the technology development policies of some countries such as China, Israel, and Taiwan with a view to draw out some lessons learned as well as the selection procedure for regional technology strategies.

The success of strategic technology selection is evaluated by multiple parameters at many different angles. Therefore, the selection process includes not only the quantitative but also objectively qualitative assessment. Experiences in strategic technology selection in many countries show that the selection process is divided into two phases. The first phase is of qualitative assessment to get a short list of potential technologies while the second phase has the task of quantitative assessment. For quantitative assessment, it makes an assumption that there has a potential technology been applied in the first period, then start collecting relevant data to assess the ability to develop it with estimated cost and time... By doing so consecutively for potential technologies it will give us a comparative matching table which serves as a basis for more precise selection.

2. Enterprise technology strategy, regional and national technology strategy

In the literatures on technology management there have many definitions of enterprise technology strategy, regional and national technology strategy been launched. These definitions differ slightly but they can be summarized, as follows:

- Enterprise technology strategy is a management decision-making model relating to the use of technology to achieve the business goals, in which priority is given to plan of future technology development and future business plan, in general [1,2];
- Albadvi Amir, 2004 [6] defines "national technology policy is a series of government interventions that affect the production, reception, adaptation and diffusion of technology as well as the use of technological knowledge in a way that the administration think it would be better for community rather than for individual". In this context, it should be noted of two concepts "technology policy" and "technology strategy", they are

not exactly the same but in a few specific cases it can be used equally. In [4,5], technology policy is simply understood as the "priority" of the authorities given to a certain technology or a certain group of technologies, while technology strategy is understood as the selection of direction for technology development and feasible measures for the strategy to achieve its set out objectives;

- According to the Organization for Economic Cooperation and Development (OECD): National strategy for science, technology and innovation (STI) is a policy-making function of government. This function expresses the vision of the government on the contribution of S&T to the economic development, and serves as the basis for deciding on priorities for public investment in S&T, and it demonstrates the involvement/commitment of relevant stakeholders in the strategy planning and implementation process.

From these two concepts of enterprise technology strategy and national S&T strategy, we can generalize as below:

- Regional technology strategy is a portfolio of desired technologies to be developed and received support from government in the form of special goals for each technology component. This strategy assigns tasks for and enforcement responsibility of each agency responsible for implementation in each stage of technology development.

3. Methods of determining regional technology strategy

The models presented below, in the form of single or combined, are used to determine regional technology strategies.

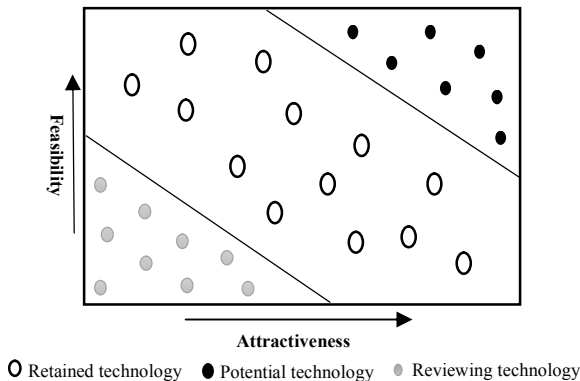
3.1. Method of listing potential technologies

Making a list of potential technologies to be selected for further development is one of the methods to develop regional technology strategy. The basic objective of making a list of potential technologies is to identify right technology policies to achieve the set out objectives. Potential technologies after being selected, they are classified accordingly based on their two fundamental characteristics, i.e. the level of attractiveness and feasibility and these are represented on the diagram "Attractiveness - Feasibility". The attractiveness of technology is determined by its potential socio-economic benefits, as well as the scientific and technological opportunities that it will bring about. The feasibility of a technology is determined by the possibility to conduct research and possibility that the society can effectively use that technology. Before formulating policy for a technology development, it needs to make a careful analysis and balance between the capacity of its

development in laboratory as well as the acceptance of the society with potential benefits and side effects of the technology.

Method of making a list of potential technologies that can be usefully utilized in case of need to give discrete, single recommendations when discussing at direction level. The process to identify technology priorities is shown in the Figure 1 (as suggested by the study of Stanford University) [3,7].

The chart is divided into three parts. Upper right corner is those technologies having feasibility and high attractiveness and should be selected to be goals for development. Middle zone is the technologies being relatively popular and the attractiveness is still worth to retain. Zone 3 at the bottom left corner is the technologies not only difficult to develop but having less attractiveness that should be removed from the priority list.



Source: D.Ford in "Developing your technology strategy"

Figure 1. Chart of technology classification by its feasibility and attractiveness

3.2. Planning method

In this method, technology is considered as a lever to enhance the competitiveness of the nation/region. This method has widely been used in strategic planning and the technological feasibility - attractiveness chart can also be used in this method.

There are several different versions of "feasibility - attractiveness" chart, out of which the version of Stanford University is basic and more widely used. The version proposed by Vernet and Arasti has some changes and it is called the "attractiveness - competitiveness" chart (Figure 2 and 4).

These charts allow many profit-making or non-profit organizations to shape the technology strategy and identify the modality as well as the priority order of their investment. Simultaneously, the diagrams serve as a tool for the selection process of strategic technology.

In general, the selection process consists of four basic steps, as follows:

- Identification of the technology group which is considered "important" for the region;
- Estimation on the attractiveness of each technology in the identified group;
- Estimation on the research capacity of the region in relation with the identified technology;
- Construction of the "feasibility - attractiveness" diagram and positioning identified technologies in the chart based on the estimated and surveyed data.

Attractiveness	High	Zone III Improvement options	Zone I Retainment / development
	Low	Zone IV Ignorance (reviewing)	Zone II Disposition by sale /Change
		Low	High
		Feasibility	

Figure 2. Technology strategic plan Chart

Combining Chart of Figure 1 and Chart of Figure 2, it will give a strategy for enterprise or region technology development. The basic difference between enterprise technology strategy and regional technology strategy is that if the enterprise finds it insufficient in terms of resources for development of a technology they are ready ignore it (zone IV). This means that when developing regional strategic technology, it should review potential resources available in the region or possible supports from central or other local authorities.

3.3. Procedures for technology strategy development

At present, there has not any method been published, widely recognized and regarded as guidelines for regional technology strategy planning. However, the need of development of strategic plans is widely acknowledged with the view that it must be associated with the overall development strategy of the region, supportive to socio-economic development in that region and based on existing research capacity of the region and the capacity mobilized from other sources. To meet the above requirements, scientists in some developed countries have launched a three-step model for technology strategy development, as follows:

Step 1: Strategy Pre-shaping

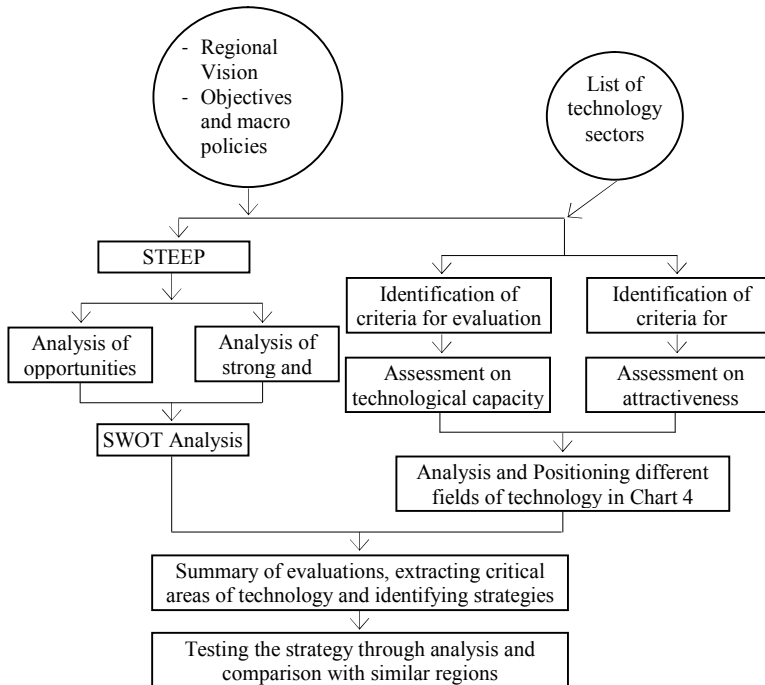
In this step, research was conducted on technology strategy of similar regions, localities. These may include in-country or foreign regions which have a similar position and achieved a certain reported successes or failures.

When studying similar localities, it needs to list all of components from general development strategy, vision, and development process. Advantages and disadvantages of each stage in the process must be scrutinized. Based on general strategic objectives, the vision and technology policies must be shaped in this step. The list of potential technologies as well as the priority technology sectors should be prepared by a Council of Technologists. And then, for the next step, the following information should be collected:

- Technology vision of regional leaders;
- National and regional policies and technology objectives;
- List of technology areas of priority.

Step 2: Input analysis and shaping strategy

This is a very important step and decisive to quality of the strategy. Two analytical processes are parallel undergone in this step, i.e. SWOT analysis and assessment of the capacity - attractiveness of technology.



Source: South Africa Department of S&T "National strategy on nanotechnology"

Figure 3. The process of technology strategy development

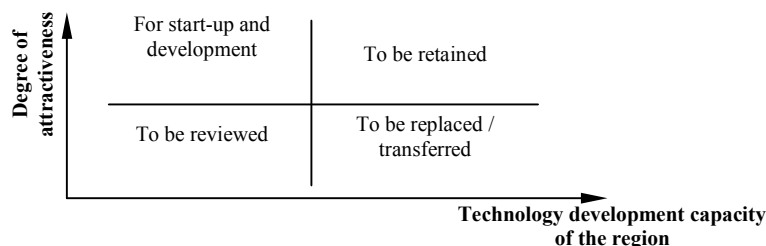
Firstly, the data on STEEP (Social - Technological - Economics - Environmental - Political) must be collected for STEEP analysis. The results

of this shall decide the strength - weakness points of the technology in question. Therefore, SWOT analysis results will bring about core technologies for further development. In the process of analysis, the national technology policy and objectives is referred as an orientation. The strategy must be analyzed in relation with the overall context and fair among technologies.

In the second analysis process, the national macro policies and objectives of technology and the socio-economic conditions should be taken into account. The analysis results shall show the degree of attractiveness, the development capacity as well as the possibility of application of the technology in the locality. In addition, the analysis process should provide general indicators for identifying follow-on studies.

Data obtained from these surveys are used to determine the attractiveness and implementation capacity indicators in each field of technology. The indicators in turn are plotted in the graph (Figure 4) where the strategy for each field is defined in four different zones of the chart.

- *Reviewing zone*: includes those technologies of low attractiveness meanwhile the region has also little capability to implement them. Technologies lying in this zone mean that they are unlikely to be commercialized. Nevertheless, instead of having them immediately eliminated, researchers, experts in this field of technology are encouraged, without additional large resources, to update the specialization with latest information;
- *Replacement or transfer zone*: In the case the technology having low attractiveness for the region, it should be transferred to other regions in the country or abroad where they are more attractive. It is noted that careful consideration must be taken into when transferring potential technologies which can bring about benefits in the future.



Source: M. Dodgson in "learning technology, technology strategy and competitive pressures"

Figure 4. Chart showing different zones of technology strategy

- *Start-up and development zone*: Technologies fall in this zone have high attractiveness, but if only using the research capacity in the region itself it may not be sufficient to explore the opportunity to develop them. In this situation, it should prepare a matrix table where all relevant factors causing shortcomings in technology development are analysed, accordingly a technology development plan to remedy such backwards, including research capacity building for the region, needs to be worked out.
- *Retaining zone*: Technologies in this specific zone is the platform technologies which support the local development and play a very important role in achieving the regional technology objectives. The strategy should be applied to this technology group is to increase investments to maintain the leadership position of the technology. However, the strategy needs to consider the balance between inside technology change and outside technology improvement in the same technology area so as to make stronger investment to achieve leap-frogs in local technology development.

Step 3: Completion of strategy

In this step, firstly, it should be done the combination of the results of SWOT analysis and attractiveness assessment in correlation with the technology development capacity. The result of this combination shall be formulated component strategies for each area of technology and strategy for each specific technology. These strategies should be compared again with strategies of other localities already referred in step one and make changes, if so needed. It should be noted that technology strategy is not a rigid plan, it needs update with changes, amendments to be in conformity with the local socio-economic development and their specific capacity.

4. Conclusions

The article presented a theoretical basis as well as the procedure for strategic technology selection relevant to different localities. In the paper, two basic methods were presented, in which the method of short-listing appropriate technologies is normally used when drafting strategies and policies. The result of this step is served as input for detailed planning in step two. For an effective detailed planning and closely linked to the actual conditions of the locality it needs to conduct a series of study, empirical investigation such as the survey on S&T level of the locality, the need for S&T, etc. The survey data obtained is then put into SWOT and STEEP analysis as mentioned in the article above. Furthermore, one locality can select various technologies with different requirements, resources and potentials for development. It is

recommended that each locality select one promising or the most appropriate technology to develop in order to focus resources on the issue. In this case, optimal models should be used to pick out the most optimal technologies. However, in this article with limited conditions, the extended content could not be presented. In addition, technology changes constantly, it makes strategy be adjusted accordingly to be suited with the local socio-economic strategy for each period./.

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