

# Gauging the Levels of Capacities in Power Plant Industries

Majid Farahani, Abbas Roshan Ardakani

Alborz Branch, Industries and Mines University, Karaj, Iran

## Abstract

Tarasht Power Plant Operations Company, which was commenced in full capacity in 1959, is the first Steam Power plant in the country. This power plant has become known as the symbol for endurance of power plant industries. The main operations of this complex include generation of electric power, serving as a simulation based training center, issuing technical certificates for small scale generators and offering of services related to sports. A prominent factor in lack of utilization of technology to acquire the advantage of competition in this company is a lack of awareness and insufficient knowledge of the levels of technological capacity and their use towards attainment of relative advantages. In this paper, authors have tried to gauge the levels of technological capacity of Tarasht Power Plant Operations Company using the technological requirements assessment model. The model utilizes nine criteria to gauge the company's capabilities, specifies the company's current status and finally clarifies the existing gaps with regard to each of those criteria.

**Keywords:** technology, technological assessment, technological requirements assessment model

## Introduction

Today's world is the world of fast and astonishing technological developments and success can only come with correct and robust use of those technologies. Implementation of the global village has pushed the pace of globalization in economics, social and cultural spheres in the third world countries where it plays a prominent role in their development especially in the area of modern technologies. [Thus local technological innovations find their way to international markets as technological solutions]. Efficient adaptation and utilization of new technologies, which have risen from

local economies and then transmitted through the global economic sphere, requires their reassessment based on global standards. [Although the profits generated by the absorbing economy and the profits of exportation of knowledge will benefit both economies]. It is evident that to develop a specific technology, a nation must first come in possession of that technology in its basic form and then refine it in steps. Thus technological developments are directly related to economic developments in an organization. Thus, the level of technological development of the organization is an indicator of its prowess. (Khamse, 2010)

Considering the importance of the technological development, senior management at Tarasht power plant must constantly act, guided with a realistic estimation of their company's capabilities, to implement new technologies.

## Definitions of key terms

*Technology:* Technology comprises all knowledge bases, products, tools and technics and also systems which are utilized to introduce a product or service. Technology is the process of development of resources into products through knowledge, experience, information and tools (Taregh Khalil, 2000).

*Technological requirement assessment:* Technological requirement assessment is a framework and a tool for identification and specification of required capabilities to implement technological priorities in developing countries (Unido, 2004).

*Technological capability assessment:* Technological capability assessment is a process by which the current level of technological capabilities of an organization is gauged so that its weaknesses and strengths can be identified and also to serve as estimation for the purpose of comparison with that of the rivals and also with the ideal state so that shortcomings can be compensated (Tabatabaian, 2005).

**Corresponding author:** Majid Farahani, Alborz Branch, Industries and Mines University, Karaj, Iran.  
E-Mail: Gf\_majid@yahoo.com

## Review of the literature

Choice of suitable technology and its correct assessment is essential for providing the required resources of the society and of the organization. Technologies are embedded within the fabric of society and thus they are in constant interaction with physical environment and man's economic, social, cultural and political structures. It can be said that different technologies affect man's social structures and vice versa. Thus technological assessments must be carried out within a wide perspective. In assessment of advantages and limitations of technologies, technical effectiveness and economic productivity must not be the only criteria, but its relation to human environment must also be taken into account. Thus, technological assessment is [minimization of the negative effects of technologies] and development of those that are compatible with human environment.

## Utilization of technology

Most organizations (especially those that are multinational) aim to profit from innovation in

technology related products and processes. It seems that their attempts at this goal constitute most technological related research and activity. As is evident from many patents and the rise of foreign trade, markets are becoming global with an increasing speed. This process, like the chaos in global markets, is much more pronounced than that which globalization analysts have defined in technological utilization (Gardner, Philip, 2002).

Inter-organization relations and cooperation is an effective mechanism for shaping networks of innovation. Such relations can include co-investments, agreement of devolution of rights, management agreements, co-production and cooperation in research and development (Tabatabaian, 2005).

### *Classification of various technological capability assessment models*

There are various models of technological capability assessment available that can be organized in three different classes as shown in table 1.

**Table1: classification of technological capability assessment**

Models of clarification of technological gaps	Models of assessment of the causes of technological gaps	Models of producing solutions for compensation of technological gap
<ul style="list-style-type: none"> <li>- Technology Atlas Model</li> <li>- Porter Model</li> <li>- Panda &amp; Ramanatan Model</li> <li>- Flouyd Model</li> <li>- Management of technological requirements model</li> <li>- Assessment of technological content Model</li> <li>- Assessment of technological level model</li> <li>- Economic value added Model</li> </ul>	<ul style="list-style-type: none"> <li>- Ford Model</li> <li>- Lyndsy Model</li> <li>- Technology Atlas Model</li> <li>- Flouyd Model</li> <li>- Management of technological requirements model</li> <li>- Assessment of technological capability Model</li> </ul>	<ul style="list-style-type: none"> <li>- Ford Model</li> <li>- Lyndsy Model</li> <li>- Fall Model</li> <li>- Garcia-Arola Model</li> <li>- Lyn Model</li> <li>- Assessment of technological requirements Model</li> <li>- Technology management information systems Model</li> <li>- Management of technological requirements model</li> </ul>

### *Description of the utilized model in this study*

To assess the technological capability of Tarasht Power Plant Operations Company, Assessment of Technological Requirements Model is utilized in this study. Based on this model, the company's capabilities are gauged using a questioner with nine criteria. Classification of the criteria is as follows:

- Awareness Capability: whether the management of the company is aware that it needs technological improvement.

- Search Capability: whether the company is capable of recognizing technological opportunities or threats.

- Making competence as core value: whether the company can make competence as the criterion of demarcation between rivals.

- Technology strategy capability: whether the company is capable of developing a suitable strategy to protect its income.

- Technology assessment and selecting capability: whether the company is capable of assessment and choice of a suitable technological solution.

- Technology acquisition capability: the capability of a company to acquire and implement a specific technology.
- Implementation and absorption of technology capability: whether the company is capable of implementation and effective use of technology.
- Learning capability: the ability of the company to learn from past experiences to improve the current products and technologies.
- Utilization of external relations capability: the ability of the company to take advantage of external

network of information and incentive resources (e.g. universities, consulting and research companies, government incentives etc.)

After the completion of the questioner by experts, the totals of points are calculated and are then compared with those that are described in table2. The affinities and contrasts with the values given in table 2 portray a view of the capabilities of the company. It must be noted that for added accuracy, the domain of points is multiplied by five and the points are assigned using a continuous spectrum (Khamse 2010).

**Table 2: Classification points for technological requirement assessment**

Results of the total audit	Total of points	Level of capability	classification of the company	micro classification	
your company is inefficient in important areas of acquisition, utilization and development of technology strategy and requires an urgent overhaul program	1-120	1	passive (A)	1-40	beginner
				41-80	with some experience
				81-120	advanced
your company is poorly developed in most areas of strategy, research, acquisition and development of technological capacity and it requires a lot of new abilities for compensation	121-240	2	reactive (B)	121-160	beginner
				161-200	with some experience
				201-240	advanced
Your company has the expertise to some degree in the area of internal capabilities and it has a single strategic approach to technology. But it lacks behind the national technological level in many areas	241-360	3	Strategic (C)	241-280	beginner
				281-320	with some experience
				321-360	advanced
Your company has a set of fully developed technological capabilities and it can set the limits of national technological abilities. In some areas it has an innovative and leading approach and it can utilize technology to its advantage in competition with rivals	381-480	4	innovative (D)	361-400	beginner
				401-440	with some experience
				441-480	advanced

According to this model and its classification system which is shown in table2, all companies fall in one of the following four categories:

Type one company (passive): it is not aware of its needs for technology transfer or its adaptation to the environment and doesn't know which technological capabilities to upgrade. It is far from clear that such company can stand its course in critical conditions.

Type two companies (Reactive): it understands the necessity for improvements of technological capabilities for reaching the goals of development. But because of limited internal resources (lack of key expertise and personal experiences) it can only react to environmental threats and is incapable of taking advantage of opportunities.

Type three companies (strategic): it is well aware of the necessary procedures to upgrade its techno-

logical capabilities; it has a strategic approach and is fairly capable of execution and completion of its projects.

Type four companies (innovative): most of these companies (e.g. Microsoft, Ford etc.) have a large amount of profit and are quick to upgrade their technological capabilities.

#### *Specification of the Indices used in this study*

Figure 1 shows the classification of the criteria of technological capabilities according to the technological requirements assessment model. The relation between the indexes used in this study and the criteria are shown in this figure. These indexes will be used to design questioners for gathering the required information for this study.

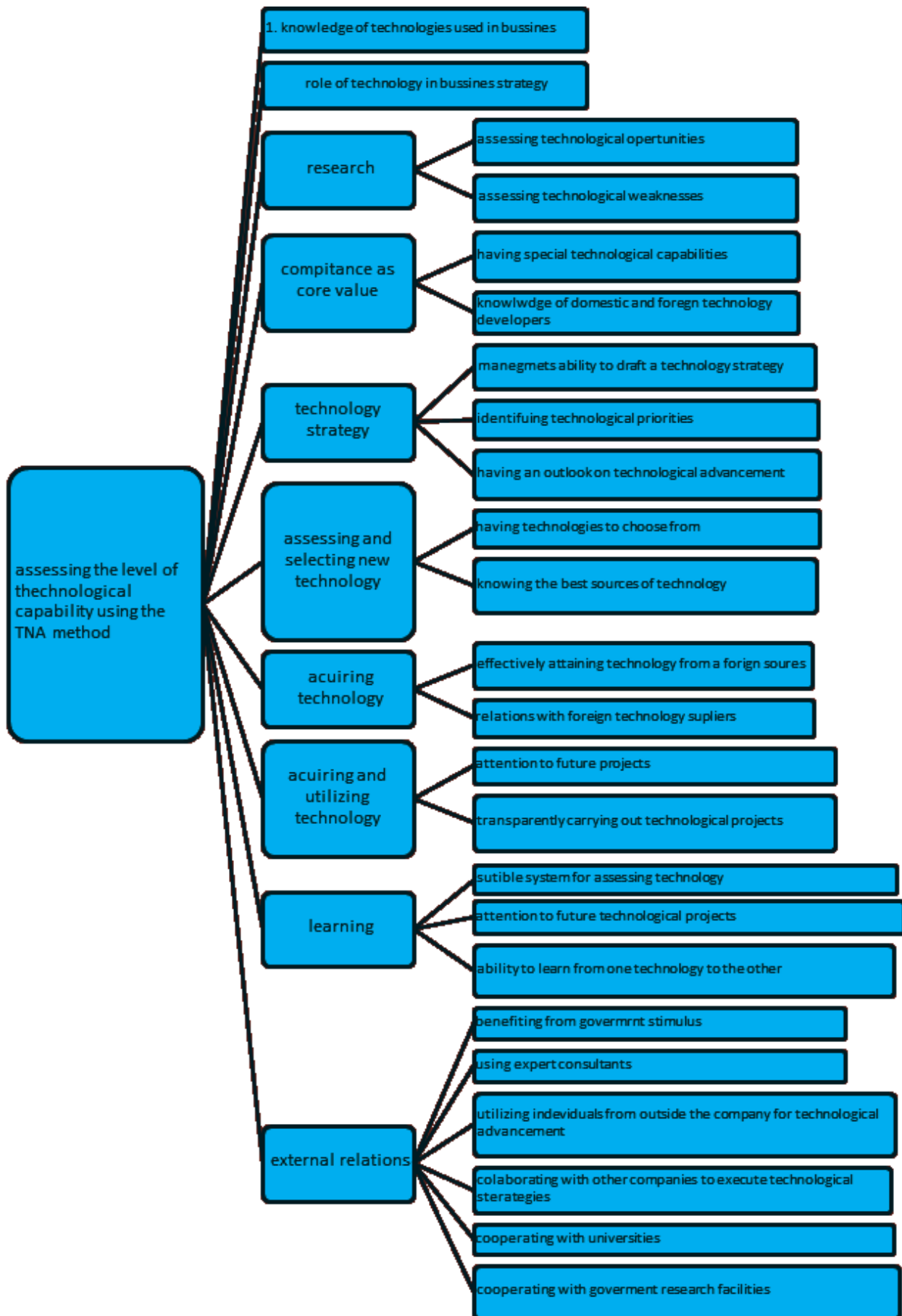


Figure 1. Classifying technological capabilities based on the technological needs model

## Purpose of this study and research questions

The purpose of this study is to clarify the levels of technological capabilities of Tarasht Power Plant Operations Company. The employed method is surveying.

The questions designed for this study are as follows:

- 1- At what level do the technological capabilities of Tarasht power plant stand?
- 2- Which category of companies does Tarasht power plant fall into according to the levels of technological capabilities?
- 3- At what level stand each of the nine criteria of technological capability of Tarasht power plant?

## A general description of Tarasht Power Plant Operations Company

Tarasht power plant [is a holding company]. The operations of this company falls under four

categories of: generation of electric power, serving as a power plant simulation based training center, issuing of technical certificates for small scale generators and offering of services related to sports and since it has consumers at the location of generation, it plays an important role in the stability of the network and the stability of the output voltage.

Top and middle ranking managers and experts working at Tarasht Power Plant Operations Company with degrees ranging from Associate Degree to M.Sc. and experiences of more than one year constitute the statistical population of this study.

The company's statistical population is determined based on the overall conditions of the company at the time of study. Plot 2 portrays the years of experience of the statistical population and plot 3 depicts the distribution of higher education degrees within that population.

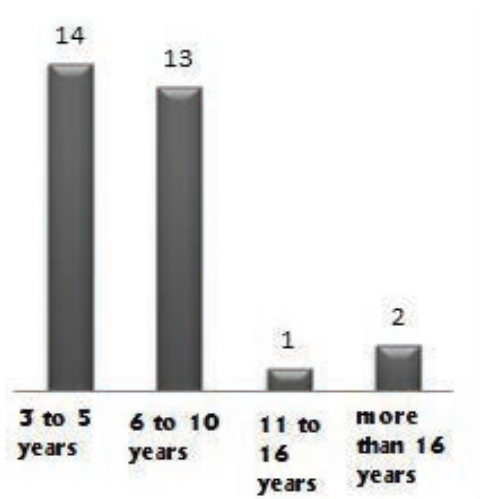


Figure 2. Job experience of the data set

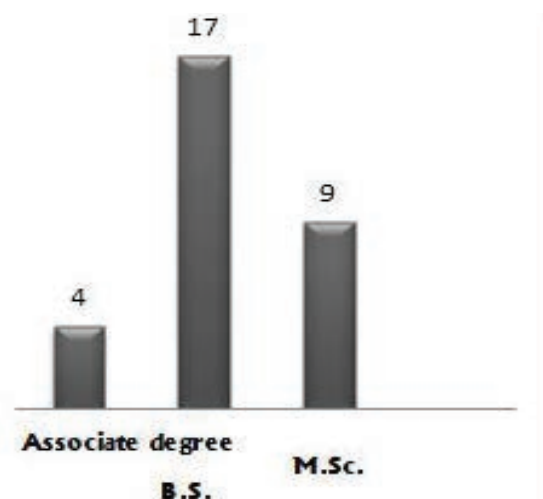


Figure 3. Education level of the data set

## Materials and Methods

Two methods are utilized for data analysis:

A). Statistical Analysis: in this method, gathered data are classified using statistical indexes.

B). Analysis based on the opinions of the experts: utilization of expert opinion to analyze data is one of the most important methods of decision making when the outcome is of very high value. Its merit arises from the fact that other methods of analysis might contain errors which will make their outcomes less dependable. This method of analysis based on expert opinion is chosen for processing of the data gathered by the questioners.

## Results

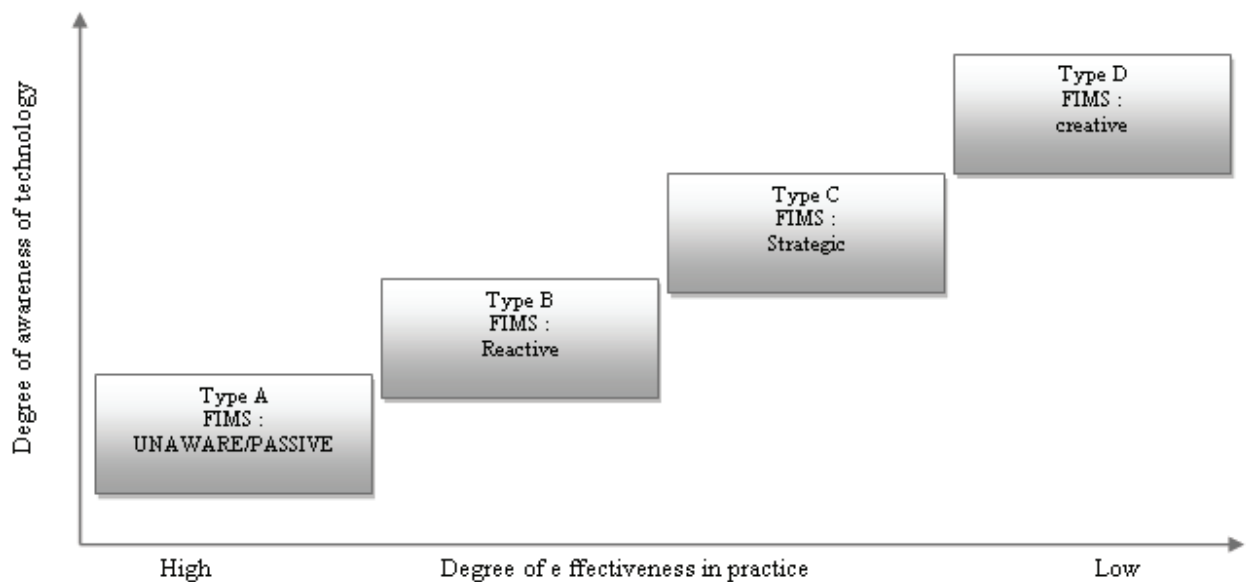
Table 3 shows the average level of technological capability given in percentage points.

Findings of the second question of the study: the sum of the points of the 24 questions has become 280.97. by reference to table2 and also plot 3 which shows the strategic classification of companies, Tarasht Power Plant Operations Company fall under the class "beginner company type C"; in other words it is a strategic company.

Findings of the third question of the study: table 4 lists the findings of the nine criteria technological capability level assessment.

**Table 3: Average of the points and the percentage of the criterion of the level of technological capabilities**

Criteria	Number of Indexes	Average Points of capabilities
Awareness	2	71.83
Search	2	61.25
Core Competence as value technological strategy	3	60.61
Assessment and Selection	2	58.42
Acquisition of technology	2	56.50
implementation and absorption	2	55.50
learning	3	55.50
external links	6	54.78
average of total points	24	59.43



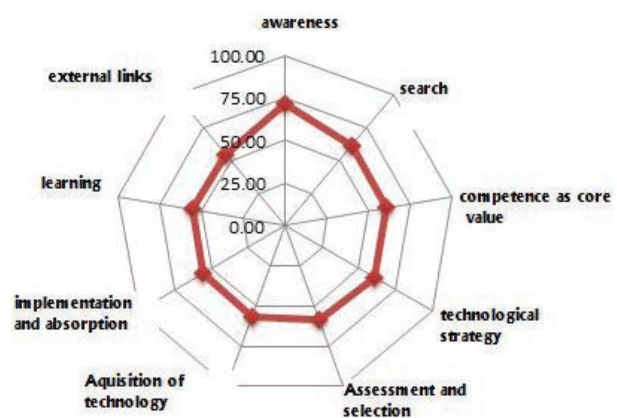
**Figure 4. Visualization of the classification scheme of technological capabilities of companies (Innosutra, 2007)**

Tarasht Power Plant Operations Company can be labeled as a C category company and it should be considered one of the companies that are “with some experience”. These companies usually have strong internal abilities and have one strategic approach to technology. But they lag behind national technological levels in many areas.

Of the type C companies, it must also be mentioned that, they have a clear view of the upgrading procedures of their technological capabilities and have a strategic approach. With a good knowledge of the cutting edge technologies, they seek to upgrade their capabilities so as to become an innovative company and take advantage of the rivalries.

On the other hand, there are gaps between the ideal level of technological capability (100%) and

the current state. The measure of the existing gap is shown in table 5 and plot 4.



**Figure 5. Plot of levels of technological capabilities for each criterion**

**Table 4: Level of technological capacity of the 9 criteria**

Average score	score	index	index	criteria	question
71.83	73.17	knowledge of technologies used in bussines	1	knowledge	one
	70.50	role of technology in bussines strategy	2		
61.25	60.67	assessing technological oportunities	3	research	two
	61.83	assessing technological weaknesses	4		
60.42	60.17	having special technological capabilities	5	Compitence as core value	three
	60.67	knowlwdge of domestic and foregn technology developers	6		
60.61	62.83	manegmets ability to draft a technology strategy	7	Technological strategy	four
	59.50	identifuing technological priorities	8		
	59.50	having an outlook on technological advancement	9		
58.42	58.50	having technologies to choose from	10	Assessing and selecting new technologies	five
	58.32	knowing the best sources of technology	11		
56.50	55.50	effectively attaining technology from a forign soures	12	Acuiring technology	six
	57.50	relations with foreign technology supliers	13		
55.50	55.67	Proper manegament of the company's technological endeavores	14	Acuiring and utilizing technology	seven
	55.33	transparently carrying out technological projects	15		
55.50	56.67	sutible system for assessing technology	16	learning	eight
	55.33	attention to future technological projects	17		
	54.50	ability to learn from one technology to the other	18		
54.78	55.33	benefiting from govermrnt stimulus	19	Utilizing external relations	nine
	55.17	using expert consultants	20		
	55.67	utilizing indeividuals from outside the company for tech- nological advancement	21		
	55.85	colaborating with other companies to execute techno- logical sterategies	22		
	53.33	cooperating with universities	23		
	53.33	cooperating with government research facilities	24		

**Table 5: Error in various aspects of technological capabilities**

Error	Average capability score	Number of index	criteria
28.17	71.83	2	knowledge
38.75	61.25	2	research
39.58	60.42	2	Compitence as core value
39.39	60.61	3	Technological strategy
41.58	58.42	2	Assessing and selecting
43.5	56.50	2	Acuiring technology
44.5	55.50	2	Acuiring and utilizing
44.5	55.50	3	learning
45.22	54.78	6	External relations
40.58	58.54	24	Average sum

Thus the top level management at Tarasht Power Plant Operations Company has decided to improve the current status and close the technological gap by pushing for improvement projects.

## References

---

- Gardner, P. (2002). The globalization of R & D and International Technology Transfer in the century.
- Jafar Nejhad, A. (2003). Modern Management of Technology. Tehran University Press.
- Khamse *et al.* (2002). A paper on assessment of levels of technological capabilities in lighting industry.
- Steenhuisain de B. (1998). The challenge of fifth generation R&D, Research technology management July – August 35
- Tabatabaian, S.H. (2005). Assessment of technological capability in businesses. Chape Aryan.
- Taregh, K. (2004). Management of Technology, Translated by Arabi and Izadi. Nashr Daftar Pajhooheshhaye Farhangi.
- UNIDO. (2004). Foresight Methodologies”, training modules.