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Measurement and Analysis of Technological Capabilities in High-Voltage Electrical Industry Case Study: Electrical Panels Company

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ABSTRACT

Today, we are witnessing tremendous growth in businesses that have put technology at the center of their movement; hence, considering the increased technological capability of industry manufacturers, remaining in the competitive environment of business is just possible by using the strategic approach and modern engineering and technological power; as a result, the main goal pursued by managers of the technology firms will be the acquisition and application of new and powerful technologies to march in the competitive environment. Assessment of technological needs not only identifies weak and problematic areas of the firm, but also causes to take into consideration and specify the relative merits of the firm. Electrical Panels Company as one of the most active companies in industrial power has been considered as the case of study in this paper; accordingly, the capability levels of this company, from 9 aspects, have been evaluated and analyzed using technology need assessment (TNA) model; also, in addition to identifying the technologic capability levels, the gaps existing between the capabilities and the desired level are assessed and analyzed using the Panda and Ramana than technology assessment model.

KEYWORDS: technology, technology assessment, Panda and Ramanathan technology assessment model, core competency.

1- INTRODUCTION

Due to the increasing rate of human progress in the field of technology, most businesses have become so agile that they not only have put technology at the core of their business, but also are strengthening their ability to quickly adapt to newer technologies; therefore, It is obvious that at the firm level, technology assessment and audits turned out to be one of the important and strategic goals of managers.

Mutations acquired by organizations using technology in the relevant industries are actually the same competitive advantage that can improve their strategic position among competitors. Therefore, monitoring the technological conditions of firms and companies is one of the requirements for today's strategic management; hence, the external face of the company's performance and position among competitors can have significant impact on management decisions and policies.

2- LITERATURE REVIEW

The comprehensive definition of technology is "a collection of information, tools and techniques that are derived from knowledge and practical experience and used in the development, design, production and deployment of products, processes, systems, and services" (Abetti, 1989).

Technology management is an interdisciplinary topic that connects science, engineering, and management to each other. From the perspective of technology management, technology is the main factor of wealth production and wealth is more than money and can include factors such as knowledge, intellectual capital, effective use of resources, preservation of natural resources, and other factors influencing the improvement of life quality and standards.

Technology management is actually the management of a system that makes the creation, acquisition and deployment of technology possible and applies the activities to serve humanity and meet client needs. Research, innovation, and development are the basic elements of creating technology and achieving technological advances; however, on the path of wealth production, there is another more important component, the use or commercialization of technology. In other words, technology benefits are realized when its results are available to

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the client who can be an individual, company, or a government agency. An invention that is placed on a shelf, does not produce wealth and an idea that is expressed but not applied, does not have financial returns even if to be registered as an invention. Technology leads to the production of wealth when it is commercialized or applied to achieve strategic or operational objectives of an organization (Booshehri, 2009).

Firm-level technological capabilities classification:

- **Investment capabilities**: including skills, knowledge and resources needed to search, identify, evaluate, select, design or acquire technology and manufacture, supply and launch new production facilities and equipment or expand existing facilities (modernization).
- **Production capabilities**: including skills and resources needed for the utilization of existing facilities and processes to produce fixed products in an efficient way. In other words, these capabilities include the firm's ability to monitor inputs from primary sources, production planning and scheduling, output quality control, and maintenance and replacement of machinery and generally deal with routine problems of production.
- **Communication skills**: including skills required for the transfer of information, skills and technology among suppliers of parts and raw materials, sub-contractors, consultants, service firms, and technology institutions.
- **Innovation capabilities**: including skills, knowledge and resources needed to attract, change and create technology through activities such as capital development, adaptive processes and products improvement.

The classification of firm-level technological capabilities from the perspective of Panda and Raman than:

- **Strategic technological capabilities**: including creation, development, design, engineering, and construction
- **Tactical technological capabilities**: including manufacturing, marketing, sales, and service capabilities
- **Complementary technological capabilities**: including acquisition and support consisting of training, planning, information and networking support, and the sale of technology and safety (Safarloo, 2010).

Technology components:

A) Hardware: physical structure and the logical settlement of all physical facilities necessary to perform the conversion or production operations such as tools, machinery and equipment, buildings and so on.

B) Software: the knowledge of using hardware and technology lies in documents, which includes all the information and data necessary to carry out productive activities such as the knowledge of using plans, maps, math calculations, and scientific theories of machinery.

C) Knowledge ware: technology lies in humans, such as expertise, skills, innovation, creativity, and so on.

D) Or aware: technology lies in organizations, such as systematizing the organization and management of tasks and processes (Khamseh, 2014).

3- The research objectives and questions

The present research aims to determine the levels of technological capabilities in Electrical Panels Company and the gaps existing in each level. Accordingly, the main questions of the research are as follows:

1- At what level are the technological capabilities of Electrical Panels Company for each index?

2- What type of company is Electrical Panels Company based on technological capabilities levels?

3- At what level are the technological capabilities of Electrical Panels Company in each dimension and what is the amount of technological gap in each dimension of technology?

4- THE RESEARCH METHODOLOGY

This study is an applied research in terms of its purpose and it is considered to be a survey research based on the methodology. The research data have been collected using the field method and the distribution of a 24-item questionnaire among 30 people based on the total counting method.

5-Introduction of the research model

In this study, the Panda and Raman than technology assessment model has been used to assess the technological capabilities of Electrical Panels Company. According to this model, the dimensions of technological capabilities are classified as follows (Innosutra, 2007):

A) Awareness: it means the capability of being aware of the need to improve technology in the company.

B) Search: it means the capability of finding the relationship of opportunities and external threats with the company's products.
C) Core competency: the capability of creating core competency in the company (the distinction between competitors).
D)Technology strategy: it means the capability of developing an appropriate strategy to support the business and profitability in the company.
E)Technology assessment and selection: it means the capability of assessing and selecting a specific technology.
F) Technology acquisition: it means the capability of acquiring and utilizing a technology in the company.
G)Utilization and absorption of technology: it means the capability of effectively implementing and using technology.
H) Learning: it means the capability of learning from past experiences and using it in new technology and products.
I) Utilization of external links: it means the capability of communicating with the network provisioning and utilizing external links (such as universities, consulting firms, etc.) and government incentives.
Figure 1 shows the conceptual model of the research.

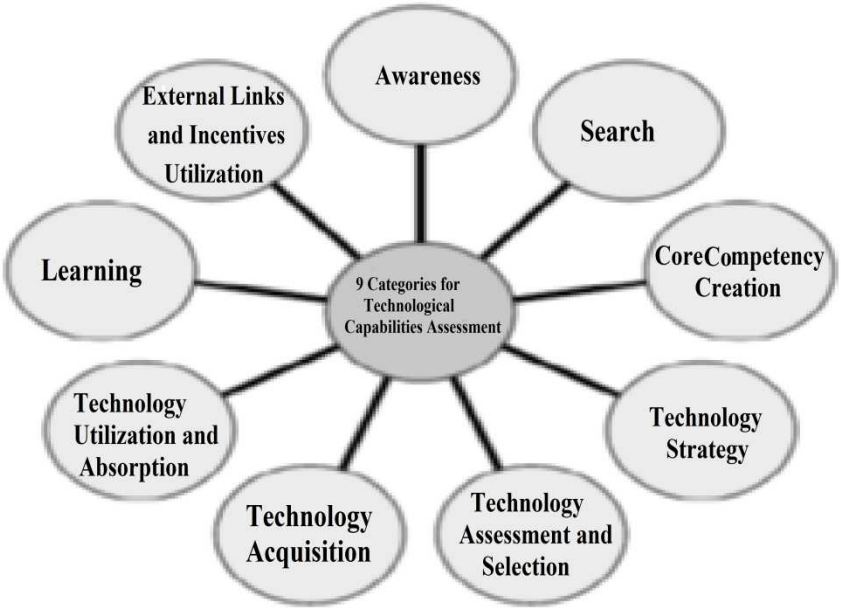

Figure 1: the conceptual model of the research

After completion of the questionnaires by experts, scores are summed and the total score is compared with the values in table 1; the final result of this assessment and comparison represents the level of company's capabilities.

Table 1: the form for determining the results of technology need assessment (Khamseh, 2013)

General Auditing Results	Scores	Firms Classification	Partial Classification	
Your firm is poor and inefficient in all major areas including utilization, acquisition and development of technology and needs a serious and urgent improvement plan.	1-120	Passive (A)	1-40	Beginner
			41-80	On the Middle Way
			81-120	Leading
Your firm is developed poorly in most areas including technology strategy, research, acquisition and capacity building and needs many capabilities for reconstruction of these areas.	121-240	Reactive (B)	121-160	Beginner
			161-200	On the Middle Way
			201-240	Leading
Your firm is relatively capable in internal capabilities and has a strategic approach to technology.	241-360	Strategic (C)	241-280	Beginner
			281-320	On the Middle Way
			321-360	Leading
Your firm has a set of fully developed technological capabilities and it is able to identify boundaries of national technology. In some areas, it has leading and creative approach and takes advantage of technology for gaining competitive advantages.	361-480	Creative (D)	361-400	Beginner
			401-440	On the Middle Way
			441-480	Leading

6- The research population

The research population consists of managers and experts of Electrical Panels Company who have master's, bachelor's, and associate degree and their work experience is higher than one year; hence, due to the limited number of experts, the total counting method has been used (table 2).

Table 2: descriptive parameters of the statistical population

Row	Education Level	Number	Mean of Work Experience (Year)
	Master	7	3
	Bachelor	15	5
	Associate	8	3
	Total	30	3.67

7- The research findings

The findings of the first question:

Table 3 shows the capabilities of the research indices based on the results obtained from questionnaires.

Table 3: the capability score of each index of the research

Dimensions	Index No.	Index Title	Available Technologic Capabilities (%)
Awareness	1	Awareness of Commercial Technologies	17.07
	2	Role of Technology in Commercial Strategy	16.70
Search	3	Technological Opportunities Assessment	15.93
	4	Technological Weaknesses Assessment	15.77
Core Competency Creation	5	Having Particular Technological Capabilities	16.13
	6	Awareness of Internal and External Technological resources	16.57
Technology Strategy	7	Management Skills in Developing Technology Strategy	17.70
	8	Identifying the Main Technological Priorities	16.63
	9	Having a Proper Perspective	15.93
Technology Assessment and Selection	10	Technology Selection Knowledge	15.77
	11	Awareness of the Best Technology Resources	15.90
Technology Acquisition	12	Effective Acquisition of Technology from External Sources	14.93
	13	Communication with External Suppliers of Technology	15.00
Utilization and Absorption of Technology	14	Appropriate Organization of Technological Activities of Firms	15.03
	15	Clarity of Technological Projects Implementation Process	15.50
Learning	16	Appropriate Technology Assessment System	15.33
	17	Take into Consideration Future Technological Projects	14.63
	18	Capability of Learning from One Technology to Another	16.07
Utilization of External Links	19	Using Government Incentive Policies	9.83
	20	Using Consultants for Technology Assessment	11.87
	21	Using Outsiders to Develop Technology	12.03
	22	Using Other Companies in Technology Strategy Implementation	11.67
	23	Using the Cooperation of Universities	6.97
	24	Using the Cooperation of Governmental Research Centers	5.40

The findings of the second question:

Since the total mean of 24 items of the questionnaire is reported equal to 344.37, according to table 1, it can be concluded that Electrical Panels Company is placed in the category of strategic-leading companies (C); hence, the company can be called a strategic one.

The findings of the third question:

Considering table 3, the capability level of each technology dimension and the technological gap between each dimension and the desired level are determined according to table 4 and figure 2.

Table 4: the capability level of each dimension and the existing gap between dimensions and the desired level

Dimensions	Weighted Average of Capability (%)	Percentage of the Gap to the Desired Level
Awareness	84.42	4.08
Search	79.25	9.25
Core Competency	81.75	6.75
Technology Strategy	83.78	4.72
Assessment and Selection	79.17	9.33
Technology Acquisition	74.83	13.67
Utilization and Absorption	76.33	12.17
Learning	76.72	11.78
External Links	48.14	40.36
Total Mean of Capability	71.74	

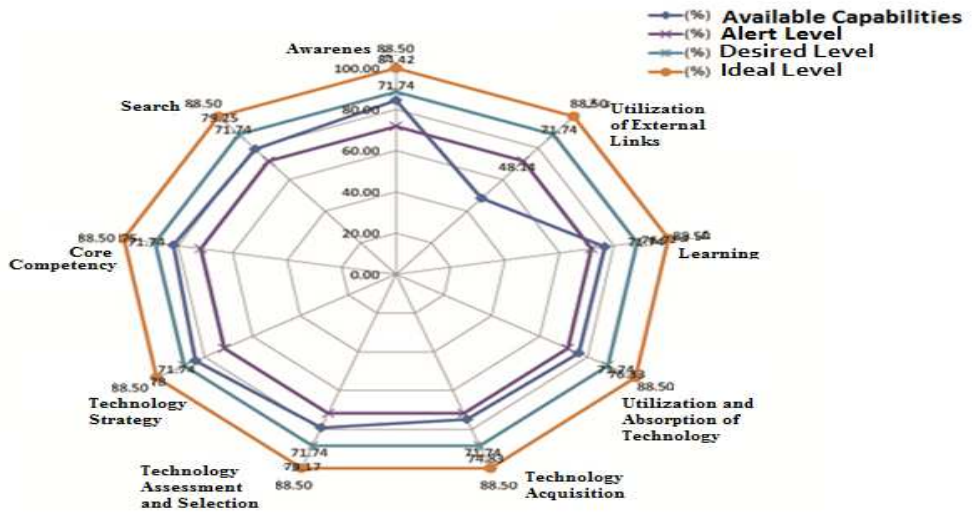

Figure 2: the capability level of each dimension and the existing gap

8- Conclusion

According to the results of this research, it was found that Electrical Panels Company is placed in the in the category of strategic-leading companies; namely, the company is relatively capable in internal capabilities and has a strategic approach to technology; thus, it can be said that the company has an appropriate vision of how to enhance the technological capabilities, so it can implement its projects with a high capacity. On the other hand, since there are gaps between the company's capabilities and the desired level of technological capabilities (table 4), it can be concluded that Electrical Panels Company is very close to the desired level in terms of being aware of its technological capability, but it is far from the desired level in terms of utilizing from external links; therefore, the company should take steps to strengthen this dimension and reduce the existing gaps.

9- Suggestions

Considering the results of this study, the following cases are suggested to Electrical Panels Company to strengthen its technological capability dimensions:

1- The greater use of the technological capability of research centers and universities.
2- Using the technology capability underlying in government research centers.
3- Signing a memorandum of understanding with technological companies to raise its technology level.
4- Implementing the technology management system in the company.
5- Holding training courses of technology management in the company.

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