Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at http:// http://www.cibtech.org/sp.ed/jls/2014/01/jls.htm
2014 Vol. 4 (S1) April-June, pp. 1029-1037/Dalvand and Nejad
Research Article

ASSESSMENT& ANALYSIS OF TECHNOLOGICAL CAPABILITIES IN WATER & POWER INDUSTRY (CASE STUDY: EXPLOITATION COMPANY OF IRRIGATION NETWORKS IN NORTH OF KHUZESTAN)

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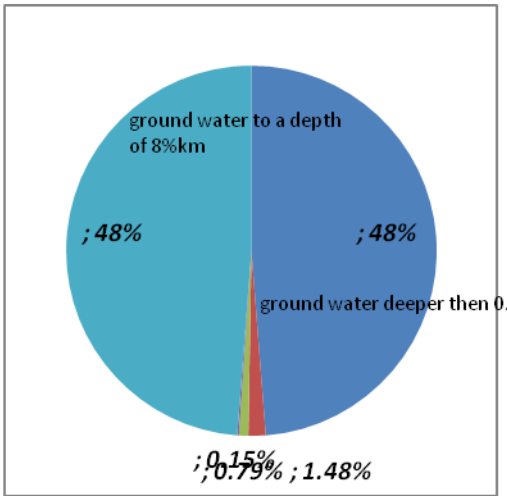
ABSTRACT

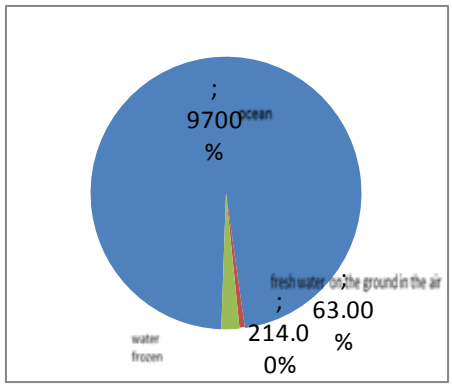
Considering the accelerating impact of technology in the present era, & the need to equip organizations with this important requirement, organizations are able to sustain & survive in competition that their managers are aware of the technologic capabilities of organization while trying to monitor rival firms & to update the technology used in their own company. In this practical paper with a quantitative approach, Panda & Ramanasn assessment model was used to assess & analyze the technological capabilities of Water & Power industry in 3 major & 9 minor aspects considering strategic, tactical technology capabilities & complementary technology as independent variable technological capability as the dependent variable. After assessment & analysis it was revealed that the current level of technological capabilities of the industry is 60.51%& compared to the desired level of 100% the gab between the surfaces is 39.49%.So it can be concluded that the industry is not at a desirable level of strategic capabilities. It is necessary for managers in the above mentioned industry & company to attempt to resolve this matter.

Keywords: *Technology, Assessment of Technology, Technological Compatibility, Water & Power Industry, Assessment Model of Panda & Ramansan*

INTRODUCTION

Water is the origin of life according to the Quran, the life of every creature is related to water (Surah Anbiya, Verse 30). Using Figure 1, we find that more than two-thirds of the Earth's surface is covered by water, however, fresh & potable water makes up less than three percent of water.& a significant portion of this little amount is currently unavailable due to geographic location such as being in the glacier, & so on (Hasheminia, 2004). Therefore, from a strategic perspective & with the help of the above mentioned figure can be said that In terms of water resources earth suffers from excessive deficit. Regardless of the above problem scarce water resources are not distributed in a balanced manner over the surface of the glob & there are many places like our country that is suffering from water shortage problems& this is one of the causes of lack of economic & industrial development of these areas. Besides this natural disaster another important in these countries, especially in Iran is lack of proper management of water resources.so it has been suggested that the World War III can be predicted in the Middle East & it will be due to disputes over water sources (Abdullahi & Abbasi, 2013) Therefore, careful evaluation of technology as a powerful tool for the management, optimal use and development of this vital matter besides education of the experts of this industry will be very important & useful. Experience has shown that the models & methods that are used in the industry should have two basic properties: First, they must be simple & untestable; secondly, they should result in a short and acceptable time (Nejadi et al, 2013).





Review of Literature

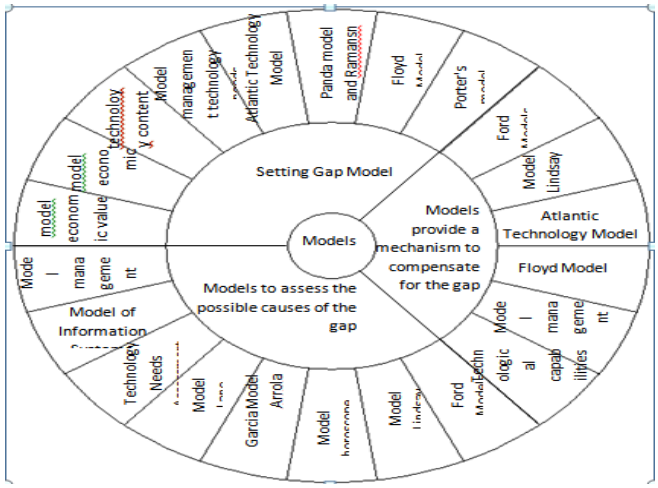
Definitions

Technology. Technology is defined as the scientific components of knowledge & experience in production of goods & services (Tarek Khalil, 2000).

Technology components. Technology consists of four elements, software, hardware, Scientific Instrument, & organizational instrument (wipo, 2010).

Assessment of technological capabilities. Assessment of technological capabilities is an analysis to identify the strengths & weaknesses of technological assets of the organization to evaluate the organization's technological position compared to the rivals, & the most advanced technologies (Porter, 1998).

Models of technology assessment & analysis. Different models associated with assessment, analysis & determination of technological gab in three general parts. Among the models of evaluating the organization's technological levels, is the Panda & Ramanasn model, & as mentioned in figure 2 it is used to identify & determine the technological capabilities of the technology to determine priorities to be implemented in the organization.



Power & Water Industry. An industry that is in charge of exploiting water resources, allocating it to agriculture, industrial & urban usage,& it also provides the power supply requirements of the major centers of consumption & industrial centers all over the country (Rashidi, 1999).

Technological Entrepreneurship. A process in which an entrepreneur, creates advanced technologies to create jobs (Mahnegar & Peykari Far, 2013)

A Premium Feature
It is a core competence that the organization has the capability to perform better in a competitive market (Velln& Hanger, 2010).

Review of Literature
Khamse et al, 2013, in their study titled Evaluation & analysis of technological capabilities in the oil & gas development company of Qeshm, by analyzing the strategic capabilities of this company they concluded that the company was not technologically desirable, and there is a huge gap between the existing and desired conditions. Nejadi et all, 2013, in their article titled assessment the level of technological capabilities in the wood & paper industry in a case study of Mazandaran Wood & Paper Company by analyzing technological capabilities of the company found that there is a considerable distance between the current technology used by the company, & the optimal technology. In another study done by Khamse and Darwish, 2013, By assessing technological innovation capabilities of power industry in case study in the Power Development Organization found that at all levels of the organization there is gap between existing & desired conditions. Mousa Pour 2013 in his article by assessing & analysis of technological capabilities Port & Maritime Organization concluded that because of the huge gap between existing & desired condition the organization needs urgent corrective by means of an appropriate model of gap compensation models. But Chalcers in his article titled Evaluation of technological innovation capability Metal Industry in Belgium found that the industry was at the average desired level.

Research question
Considering what was mentioned about the importance & need for efficient use of water & role of technological knowledge in fulfilling this important matter In addition to clarifying, strengthens the determination of human society, & forces administrators to implement competition -based technology in the industry. In Iran which is a vast & strategic country DOE is responsible for this important task. Therefore, by a case study in exploitation company of irrigation networks in north of Khuzestan the largest irrigation & drainage network in the Middle East& with a distinctive capability, by identify the technological strengths & weaknesses, processing & analysis of technological capabilities of this company we plan to decide if the currently used technology can guide the industry to the desired conditions or not?
Objectives & research questions
The purpose of this study was to determine the technological level of water & power industry by a case study in Dez irrigation network & to determine the technological gap at each level.

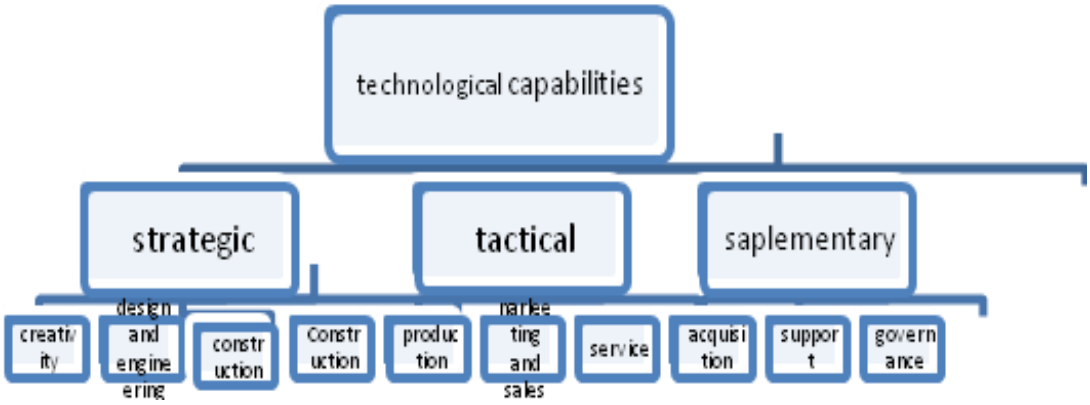
Main questions
1-What is the company's technological capability level?
2- How big is the company’s technological gap in three main dimensions?
Sub-questions
1- What is the company’s technological capabilities level?
2- What is the company’s tactical technological capabilities level?
2- What is the company’s complementary technological capabilities level?

Introducing the model used in this study

One of the models use to evaluate the technological level of an organization, is that of Panda & Ramanasn, which as shown in figure 3, is used for detection & determination of required capabilities to perform technologic priorities in three main & 9 sub dimensions& with 36 indicators will attempt to determine the company's levels of technological capabilities. Figure 3 - conceptual model of Panda & Ramanasn assessment model.

METHODOLOGY

This is a descriptive / survey study with an applied purpose and a quantitative approach. The population was all people working in expertise sectors of Exploitation Company of Irrigation networks in north of Khuzestan including managers' supervisors & experts with a bachelor's degree, & higher degrees that included a total number of 40people.



Sampling & Sample population

Since the company was the largest irrigation & drainage networks in the Middle East, & as it has been mentioned in figure-3 and table-1, it has a wide scope of activities. Therefore it was not possible to access all the experts. So from the total 73 experts working in the company40 subjects with an average of 19 years of experience were selected randomly, by means of Cochrane model according to formula (1). The population was determined according to the company's conditions during the study.

Table 1 - Specifications of Dez irrigation network

Dez irrigation network	
Gross land covered by the network	160,000hectares
Regulatory dam	2 units
Diversion Dam	1 unit
Large pumping stations	8devices
Installed pumps in the stations	96 devices
Railway overpass	2 units
Hydraulic structures	4969 units
Length of irrigation canals	845.6kilometers
Drain length	633.7kilometers
Length of maintenance & repair roads	1396.7kilometers
Number of irrigation valves	1070Units
Number of large bridges	2 units

The above equation has been calculated for the population size of N=73,& the values of *p*&*q* equal to 0.5 & Z value with a 5% error equal to 1.96,Accuracy of d=0.1.

$n=Nz^2pq/(Nd^2+Z^2pq)$

$n= 73\times (1.96)^2\times 0.5\times 0.5/ (0.1)^2 + (1.96)^2 0.5\times 0.5=40$

Research Tools

Considering the size of the population & the sample after interviewing & informing participants about the sensitivity of the task, data was collected using a standardized regional questionnaire distributed among participants in person. A questionnaire consisted of 36 scored questions (From strongly agree to strongly disagree ranging from0 to 20 scores) was used as a research tool. As Damon suggested in 1978 that the questionnaire be carried out for three groups before the experiment: A- A group of people that the research will be extended to them. B- Experts & specialists who have expertise in this field, and C-Those who benefit from the results of this study such as managers & experts in the area of research (Delavar, 2001). Using coordination & supervision of strategic management & statistics teachers from Ahwaz University of Technology, Industries & Mines, & obtaining the opinion of authorities of Dez Company, & some experts & professionals in power & water industry finally, the validity & reliability of questionnaire was confirmed by means of content validity method. Excel software was used for data analysis.

Table 2: Descriptive parameters of respondents

Education	Number of respondents	The average duration of experience (year)
BA	30	23
MA	10	15
Total/	40	19

Summarizing the findings

Summarizing the findings of the main research question

Main research question: What is the company's technological capability level? According to the results obtained from research dimensions, table 3 & Figure 1 shows the mean scores & the percentage of technological capabilities the company's capabilities is 60.51%.

Table 3-Meanoftechnologicalcapabilities of the company

The overall audit results	Total scores	Classification of firms
Your organization is poor and ineffective in all areas of acquisition, exploitation, development of technology strategy& requires an immediate major improvement program.	0-25	Strategic(C)Passive(A)
Your organization is poorly developed in most areas of strategy , research, acquisition ,capacity building technology, & innovation & needs a lot of capabilities to reconstruct in this field	26-50	Reactive
Your organization's internal capabilities are relatively strong, and have a strategic approach towards technology, & innovation but in most technology areas generally lags behind.	51-75	Strategic(C)
Your organization has a fully developed set of technological capabilities and can identify the boundaries of national technology. Ina number of areas it has an innovative and a pioneering approach & uses technology innovation to gain competitive advantage.	76-100	Creative & Innovative

Table 4-Classification of organizations with regard to innovative &technological capabilities

Main aspects	Sub aspects	Percentage of each Sub aspect c**apability**	Percentage of each main aspect c**apability**
Strategic capabilities	Creativity & innovation capability	65.28%	66.62%
	Design & engineering capability	67.18%	
	Construction capability	67.25%	
Tactical technological capabilities	Production capability	64.78%	56.28%
	Sales & Marketing Capability	52.08%	
	Service capability	50.94%	
Complementary technological capabilities	Acquisition Capability	56.03%	57.77%
	Support Capability	56.93%	
	Governance Capabilities	61.50%	
Total technological capabilities	60.51%		

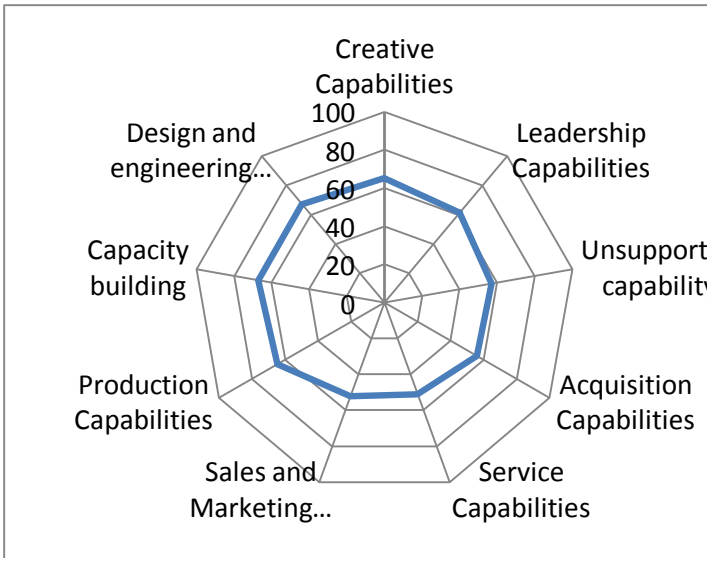


Diagram 1 - Technological capabilities in various aspects

According to the results of the evaluation of technological capabilities organizations can be classified in four categories according to Table 4(Khamse et al, 2013).

Since the overall level of technological capability of the firm is equal to 60.51 it is in Group C based on the classification results in the above table. & because one of the characteristics of companies in Group C is that they are strategic & are also aware of their capabilities & know how to upgrade their technological capabilities, based on knowledge-based manpower& high cap ability in project performance. With little attempt to improve the technological capabilities, the company will be able to pass Group C & reach Group D.

Second main question: How big is the company's technological gap in three main aspects?

Given the current level & the desired level (100%) it can be said that there is a difference between these two levels in three cases of technological capability. This difference has been shown in Table 5 & Diagram 2 in each of the main dimensions.

Table 5–Quantitative amount of the gap between current and desired levels

Technological capabilities	Current level	Desired level	The gap between current & desired levels
Strategic capabilities	66.62%	100%	33.38%
tactical capabilities	56.28%	100%	43.72%
Complementary capabilities	57.77%	100%	42.23%
Total technological	60.51%	100%	39.49%

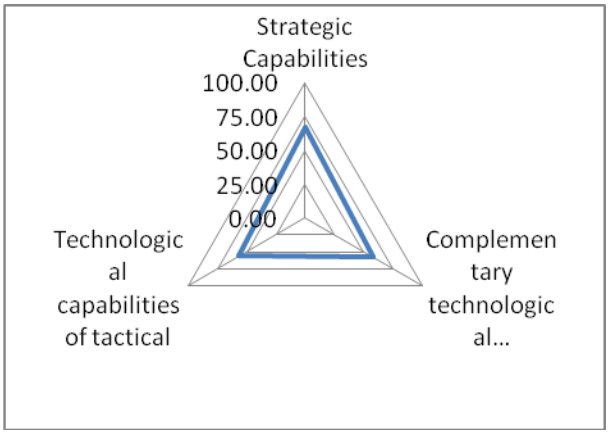


Diagram 2-Diagram of various levels of innovative & technological capabilities

Summarizing the findings of the research sub question.
What is the company's technological capabilities level?

Table 6- Total mean of strategic capabilities

Components	Percentage of success ofeachsub-capability
Creativity & innovation capability	65.28%
Design & engineering capability	67.25%
Construction capability	67.25%
Total mean of strategic capabilities	66.62%

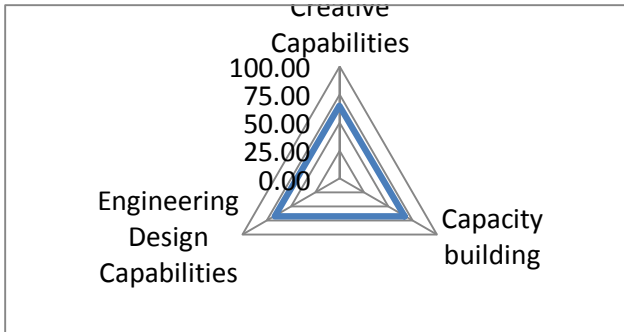


Diagram 3 - strategic capabilities

What is the company's tactical technological capabilities level?

Table 7–Total mean of tactical technological capabilities

Components	Percentage of success of each sub-capability
Production capability	64.78%
Sales & Marketing Capability	52.08%
Service capability	50.94%
Total mean of tactical technological capabilities	56.28%

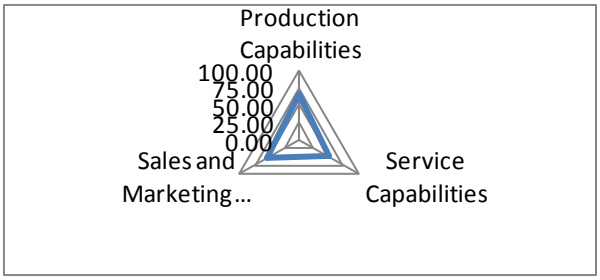


Diagram 4- Tactical technological capabilities

What is the company's complementary technological capabilities level?

Table 8–Total mean of complementary technological capabilities

Components	Percentage of success of each sub-capability
Acquisition Capability	56.03%
Support Capability	56.93%
Governance Capabilities	61.50%
Total mean of complementary technological capabilities	57.77%

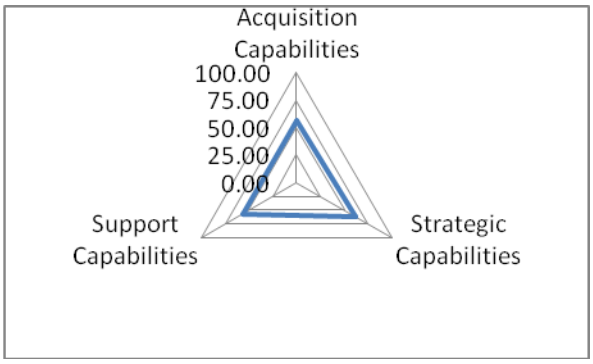


Diagram 5– Complementary technological capabilities

ANALYSIS & CONCLUSION

In the main dimension of strategic capabilities, sub aspect of service has the lowest percentage (50.94%), & sub dimension of construction capability has highest percentage (67.25%). Governance capability falls between these two (61.50%). In the main dimension of tactical technological capabilities, sub dimension of sell & marketing capability sell & marketing capability has the lowest percentage has the lowest percentage (52.80%), & sub aspect of production capability has the highest percentage (64.78%), & service sub dimension falls between these two(50.94%). In the main dimension of complementary technological capabilities, the sub dimension of acquisition has the lowest percentage (56.03%), & sub dimension of governance capability has the highest percentage (61.50%), & sub dimension of support

capability falls between these two (56.93%). Summarizing the results show that the company has the highest strategic capability with 66.62%, & the lowest tactical technological capability with56.28%. According to the results in Table 3, the company has the highest gap in the tactical capabilities among three main dimensions. Since in all levels, there is a gap between the existing & desired status, Therefore, it is necessary the company's top-level managers to take appropriate action to resolve the issue with proper planning & improvement projects. Considering the importance of upgrading strategic capabilities, & because the company has the biggest gap in this vital dimension, the following suggestions are offered.

Offers

Considering the average & higher than average age of the staff & their experiences, it is recommended to create a section called Technology Management in the company to remove the gap, & to stabilize the company in the field of sustainable competition by taking advantage of technologies related to the company's policy & requirements priorities. To motivate manpower absorb maximum required technology it is suggested to promote teamwork based on training led by experts in the company, provide effective productivity. In order to create new ideas& to implement them, it is suggested to find appropriate financing& make appropriate plans considering the time factor.

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