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THE IMPACT OF IT EMPOWERMENT EFFECT ON IMPROVING COMPETITIVE ADVANTAGE REGARDING INTERFERING MANUFACTURE VARIABLES IN OIL AND GAS INDUSTRY (CASE STUDY: SOUTH PARS GAS COMPLEX)

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Abstract:
A great part of the success and dynamism of organizations is due to the creation of competitive advantage and keeping its stability. This is possible through provision and alignment of the requirements of a stable competitive advantage by applying modern technologies. There are a great number of successful examples throughout the world that show how new technologies, particularly Information Technology, have changed the oil and gas industry of countries into a highly dynamic and effective one. Therefore, in order to be a pioneer in manufacturing field, considering the existence of many gas companies in Persian Gulf territory, presenting exact and comprehensive services in IT is essential. Developing technical and knowledge-based services in achieving the competitive advantage and the maximum amount of stable and high-quality production from common reservoirs is what makes IT a critical factor in companies' management policies.
This research attempts to study the effect of Information Technology on key manufacturing factors in South pars gas complex. In order to perform this task, a questionnaire was prepared and distributed among the staff and then, the results were analyzed. The outcomes show that Information Technology creates a positive effect on all effective manufacturing factors including quality, cost, production, and efficiency. There is also a meaningful relationship between IT and manufacture variables that lead to the improvement of the competitive advantage.

Key Words: competitive advantage, information technology, production, efficiency, quality, oil and gas industry.

1. INTRODUCTION

Nowadays the importance of information both as a tactical and strategic source and also a main source of added value is completely recognized in organizations. In business environments, information has always been considered as a competitive advantage; but the important point is that real changes which increase the potential value of information are related to the ability of organizations in using this important source through applying new technologies. Information Technology with such features as storage, processing, marketing and transmission helps managers improve the performance of their organizations. On the other hand, regarding the extension of competitive levels, technological complexity, taste diversity, shortage of resources, and data exchange rate, the significance of efficiency and its appraisal is crystal clear. Today, the effect of Information Technology on manufacturing efficiency is one of the important issues in economics. A lot of studies have been performed in developed and developing countries. Cost saving, human error prevention, and improving efficiency are some advantages that IT can bring about in organizations. Hence, today the IT per capita expenditure is presented as one of the countries' national development indexes. [1]
South pars gas complex is one of the ancillary branches of Iran's Gas National Company. It was founded in 1998 and became responsible for the exploitation of land facilities of South Pars gas field. This complex is the world's biggest gas field and produces 17 billion gas barrel equals to 8 percent of gas resources in the world. This fact has made this company a world-famous brand and an authentic model of technical knowledge among the whole industry of the country. The mission of the organization includes creation of the maximum value of gas resources in the area through natural gas refining and the production of accessory materials along with the development of knowledge-based technical services. Therefore, designing an incorporated management information system, privacy maintenance, integrity, and organizational data availability are the main policies of South pars gas complex. Hence, Information Technology is considered as a main facilitator in business activities of this organization.
This research has dealt with the role and the effect of Information Technology in gas industry and manufacturing management and the use of new techniques in fulfilling the organization's goals while presenting appropriate directions and guidelines to chief managers of Asaluyeh gas and oil manufacturing companies. IT and other related technologies confer valid criteria to certify the effects of Information Technology on manufacturing efficiency, which helps the organization improve its performance in its major future plans.

2. OBJECTIVES AND SIGNIFICANCE OF THE STUDY

The main goal of this research is to study and evaluate the effect of Information Technology on improving competitive advantage and efficiency in South pars gas complex. Besides, this study attempts to propose a standard framework of how IT affects manufacture efficiency, which shall increase managers' knowledge of the relationship between IT and manufacture efficiency. A systematic perspective on this subject provides groundwork to examine and analyze such a relationship.
Some questions that this study is about to challenge are:
Main question: What kind of relationship is there between Information Technology and competitive advantage and manufacture efficiency?
Subsidiary questions:
Has Information Technology level had a significant effect on increasing the amount of production in South Pars Gas Complex?

- Has Information Technology been effective in increasing the quality of products?
- Has Information Technology caused the decrease of production expenses in South Pars Gas complex?
- Is Information Technology level effective in increasing the efficiency?

3. RESEARCH HYPOTHESES

- Main Hypothesis: Competitive advantage is improved by Information Technology empowerment in South pars gas complex.

Subsidiary Hypotheses:

- Information Technology has had a significant effect on increasing the amount of production in South pars gas complex.

- Information Technology has been effective in increasing the quality of company products.
- Information Technology has caused the reduction of production expenses in South pars gas complex.
- Information Technology level is effective in increasing the manufacturing efficiency.

4. RESEARCH VARIABLES

In this study, Information Technology is considered as an independent variable and production amount, quality, expenses, and efficiency improvement are dependent variables.

5. DEFINITION OF CONCEPT

In today's hasty and complicated world, each revolution and new movement involves some requirements and problems that finding a solution or answer for them is impossible without new policies and advanced technologies or tools. One of the new technologies that have been increasingly significant in society, especially in organizations and agencies, is Information Technology. In recent years, IT has been the main element of organizations' empowerment. Moreover, the development of organizations in using Information Technology has become one of the main development indexes in organizational studies.

5.1. Information Technology:

Information Technology involves all shapes of technology that are applied for processing, storing, and transferring information (data) in electronic form. Physical equipment's used in this field are: computers, webs, communication devices, Fax and electronic software [2]. Generally, Information Technology refers to an extensive range of equipment's, computers, data storage tools, communication devices, applications and services that are used by organizations to create the knowledge and information [3].

5.2. Efficiency

Efficie**n**cy is defined as the relation between the output and the amount of the performed work and the input or the available resources to perform the work [4] the belief to improve efficiency means having a strong faith in humanity progress [5]. In fact, efficiency is the index of comparing the output with input or comparing the output with the goals [6].

5.3. Competitive Advantage

Competitive Advantage is the amount of the increased attractiveness of company's sale offers comparing with those of other rival companies form customers' viewpoint [7]. Competitive Advantage is the distinctiveness of each company's traits that enable that company to provide the customers with much better and more valuable service than its competitors [8]. Competitive Advantage is the capability of the company in presenting services and values much higher than customers' affordance and expectations [9**].**

Regarding these definitions, it is clear that the direct relationship between the customer's expected values and the proffered values by a company and its competitors signifies the requirements and the dimensions of competitive advantage. If the proffered values by a company satisfy customers' needs and attract him/her, one can say that this company has competitive advantage over its competitors.

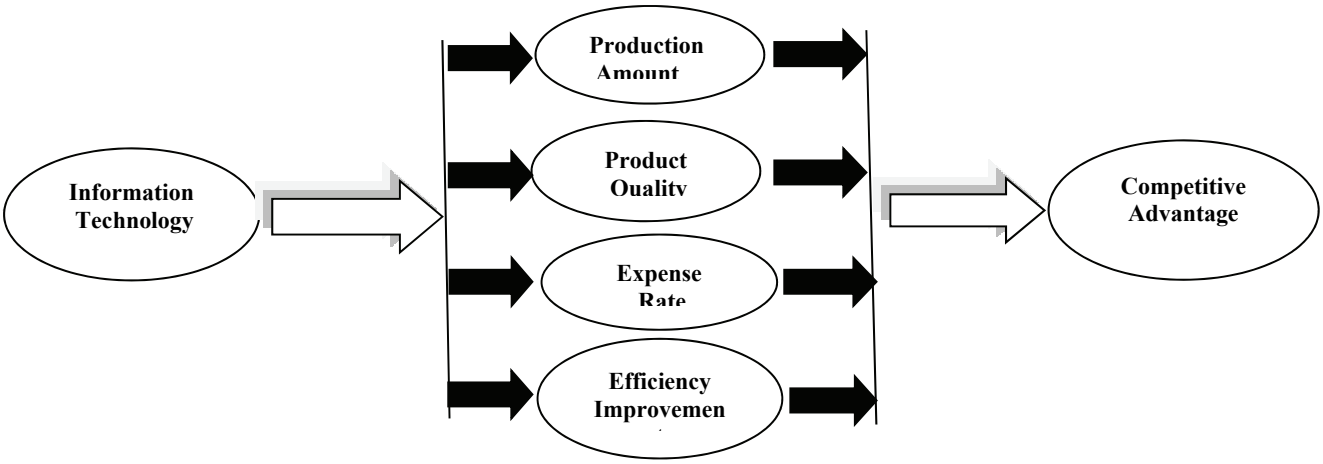
5.4. Relationship between Information Technology and Efficiency

Communication and Information Technology is considered as one of the new technologies that affects our organizational and industrial world to much extent. This technology has been developed into our daily life and the effect is undeniable. (31)Technology increases the whole efficiency, not necessarily work or asset efficiency. (27)

6. CONCEPTUAL MODEL OF THE STUDY

Regarding the theoretical studies and the review of literature, conceptual model of the research is designed as follows

Picture 1. Conceptual Model of the Study



7. RESEARCH TYPE

Based on the above descriptions, this research is an applied one, and through survey method deals with the effect of Information Technology level on manufacturing performance of South pars gas complex.

7.1. Questions Clarification

- Has Information Technology level had a significant effect on increasing the amount of production in South pars gas complex?
  Various factors which have been effective on production rate in manufacturing phases of South pars gas complex are analyzed in some studies and the relationship of Information Technology with these factors is evaluated by researchers. The effective factors on production rate are manufacturing process, raw materials, human resources, equipment's and facilities.
- Has Information Technology been effective in increasing the quality of products?
  The performed studies in manufacturing phases of South pars gas complex show various factors which have been effective on the quality of products and the relationship of Information Technology with these factors is evaluated. The effective factors on products quality are manufacturing process, raw materials, customers' satisfaction, and human resources management.
- Has Information Technology caused the decrease of production expenses in South pars gas complex?
  Various factors which have been effective on the amount of expenses in manufacturing phases of South pars gas complex are analyzed in some studies and the relationship of Information Technology with these factors is evaluated by researchers. The effective factors on expenses rate are manufacturing volume, current expenses, production expenses, sales and marketing expenses.
- Is Information Technology level effective in increasing the efficiency?
  The performed studies by researchers in different phases of South pars gas complex show various factors which have been effective on manufacturing efficiency and the relationship of Information Technology with these factors is evaluated by researchers. The effective factors on manufacturing efficiency are manufacturing method, technology, human resources and technical sections, offering new services, profitability and saving.

8. METHODOLOGY

This study, considering the goals, is an applied research and the target of its findings is solving common problems in the organization. This research follows a survey method. In these kinds of studies, the researchers try to know if there's any relationship between variables and if such a relationship exists, is it positive or negative?

In order to collect the data a questionnaire is designed. The questionnaire consists of two parts: the first section includes personal information and the second section contains questions related to measuring indexes of effective factors on competitive advantage such as the amount of production, manufacturing expenses, quality of the products and manufacturing efficiency. This questionnaire has content validity and reliability because questions are designed on conceptual basis, and by applying Choronbach's alpha, reliability is measured 0/88, which indicates consistency with survey questions. The statistical society of the research has been 200 hundred persons chosen in random from the staff of manufacturing phase of South pars gas complex. They were provided with the questionnaires of which 85 ones were returned. In fact, scaling random sampling was carried out. Research findings have been achieved using SPSS software.

9. SURVEY QUESTIONS

The questionnaire contains 27 five-choice questions based on Likert scale and accorded with research hypotheses. The first seven questions are related to determine the relationship between Information Technology as independent variable and Manufacture as dependent variable. The next seven questions are designed to assess the relationship between Information Technology as independent variable and Quality as dependent variable. The third 7 questions signify the relationship between Information Technology as independent variable and Production Expense as dependent variable. The last 6 questions consider the relationship between Information Technology as independent variable and Efficiency as dependent variable.

9.1. Qualitative Description of Population Variables

- **Gender Distribution**

Of 85 persons in the survey, 71 persons (82.6 %) have been male and 14 (16.3) have been female.

- **Education Level**

Of 85 persons in the survey, 43 (50.5 %) have B.A. degree, 40 (46.5 %) M.A. and 2 (2.3%) PhD.

- **Job Positions**

Of 85 persons in the survey, 42 (48.8 %) have been B.A., 22 (25.6 %) M.A., 10 (11.6%) managers, and 11 (12.8%) attendants.

9.2. Quantitative Description of Research Variables

In this part, the quantitative amounts of descriptive indexes of independent variable are being presented based on the gathered data of the questionnaire. In the following table, such indexes as Mean, Average, Mode, Standard Deviation, Minimum and Maximum for all components have been measured.

Table 1: Central Indexes and Distribution for Effective Guidelines

	Dimensions	Mean	Average	Mode	Standard Deviation	Variance	Minimum	Maximum
Variable	Production	3.87	3.86	4	0.53	0.28	2.29	5
	Expense	3.70	3.71	3.71	0.57	0.33	2	5
	Quality	3.48	3.43	3.29	0.54	0.30	2.29	5
	Efficiency	3.88	4	4	0.52	0.27	2.67	5
Information Technology	----------	3.73	3.70	3.70	0.43	0.18	2.70	4.63

9.3. Qualitative Description of Research Variables

Other than quantitative description indexes for research variables, the achieved amounts of the average questions related to these variables are divided into five categories as follows: very low (1-1.8), low (1.8-2.6), fair (2.6-3.4), high (3.4-4.2), and very high (4.2-5).

- **Production**

Of 85 persons who have assessed manufacturing as dependent variable, 3 persons (3.5 %) disagree, 8 (9.3 %) have no idea, 57 (66.3 %) agree, and 17 (19.8 %) completely agree.

- **Quality**

Of 85 persons who have assessed the quality of products as dependent variable, 3 persons (3.5 %) disagree, 14 (16.3 %) have no idea, 54 (62.8 %) agree, and 14 (16.3 %) completely agree.

- **Expense**

Of 85 persons who have assessed manufacturing expenses as dependent variable, 6 persons (7 %) disagree, 31 (36 %) have no idea, 42 (48.8 %) agree, and 6 (7 %) completely agree.

- **Efficiency**

Of 85 persons who have assessed manufacturing efficiency as dependent variable, 15 persons (17.4 %) have no idea, 52 (60.5 %) agree, and 18 (20.9 %) completely agree.

- **Information Technology**

Of 85 persons who have assessed Information Technology as independent variable, 18 ones (20.9 %) have no idea, 54 (62.8 %) agree, and 13 (15.1 %) completely agree.

10. Distribution Normality Test

After data descriptive evaluation, the researcher examines the research hypotheses by using hypothesis test which has an applied concept in academic texts. By choosing an appropriate analysis method and based on the achieved results, the researcher confirms or rejects the hypotheses and finds the answer to the research questions.

In order to use statistical techniques, first it should be made certain if the gathered data have normal distribution or not. In this study, one-sample Kolmogorov-Smironov test is used for Information Technology variable and its features. The results show that normality is only accepted for Technology and Expense and is rejected for the rest (P<0.05). Therefore, to study the variables relations, Spearman correlation coefficient is applied.

Table.2: The Results of Kolmogorov-Simonov Test for Data Distribution Normality

Variable	Dimensions	Sample Volume	Test Statistic	meaningfulness
Technology Variable Dimensions	Production	85	0.123	∗ 0.003
	Quality	85	0.118	∗ 0.005
	Expense	85	0.189	0.096
	Efficiency	85	0.129	∗ 0.001
Information Technology	----------	85	0.067	0.200

* In 0.05 significance level = lack of distribution normality

Hypotheses Test

1. Has Information Technology level had a significant effect on increasing the amount of production in South pars gas complex?

H_0: There's no significant relationship between Information Technology and the amount of production.

H1: There's a significant relationship between Information Technology and the amount of production.

In order to determine the relationship between Information Technology and the amount of production, Spearman correlation coefficient has been used. The following table shows the results of the test

Table 3: Correlation coefficient between Information Technology and the amount of production

Variable	Information Technology Variable			Relationship Existence	Kind of Relationship
	Spearman Correlation Coefficient	Significance	Number		
Production Amount	0/777	*<0/0005	85	Positive	Direct

* Significance level of 0.05

The correlation coefficient between Information Technology and the amount of production is 0.777 that indicates the positive effect of IT on production amount.

2. Has Information Technology been effective in increasing the quality of products?

H_0: There's no significant relationship between Information Technology and the quality of products.

H1: There's a significant relationship between Information Technology and the quality of products.

In order to determine the relationship between Information Technology and the quality of products, Spearman correlation coefficient has been used. The following table shows the results of the test:

Table 4: Correlation coefficient between Information Technology and the quality of products

Variable	Information Technology Variable			Relationship Existence	Kind of Relationship
	Spearman Correlation Coefficient	Significance	Number		
Products Quality	0/831	*<0/0005	85	Positive	Direct

* Significance level of 0.05

The correlation coefficient between Information Technology and the quality of products has been achieved 0.831 that indicates the positive effect of IT on the quality of products.

3. Has Information Technology caused the reduction of production expenses in South pars gas complex?

H_0: There's no significant relationship between Information Technology and manufacturing expenses.

H1: There's a significant relationship between Information Technology and manufacturing expenses.

In order to determine the relationship between Information Technology and manufacturing expenses, Spearman correlation coefficient has been used. The following table shows the results of the test:

Table 4: Correlation coefficient between Information Technology and manufacturing expenses

Variable	Information Technology Variable			Relationship Existence	Kind of Relationship
	Spearman Correlation Coefficient	significance	Number		
Manufacturing Expenses	0/809	*<0/0005	85	Positive	Direct

* Significance level of 0.05

The correlation coefficient between Information Technology and manufacturing expenses has been achieved 0.809 that indicates the positive effect of IT on manufacturing expenses.

4. Is Information Technology level effective in increasing the efficiency?

H_0: There's no significant relationship between Information Technology and manufacturing efficiency.

H1: There's a significant relationship between Information Technology and manufacturing efficiency.

In order to determine the relationship between Information Technology and manufacturing efficiency, Spearman correlation coefficient has been used. The following table shows the results of the test:

Correlation coefficient between Information Technology and manufacturing efficiency

Variable	Information Technology Variable			Relationship Existence	Kind of Relationship
	Spearman Correlation Coefficient	Significance	Number		
Manufacturing Efficiency	0/689	*<0/0005	85	Positive	Direct

* Significance level of 0.05

The correlation coefficient between Information Technology and manufacturing efficiency has been achieved 0.689 that indicates the positive effect of IT on manufacturing efficiency.

In order to examine this hypothesis that effective factors on production, quality, expense, and efficiency have significant difference on average or not, Nonparametric Friedman's test has been used.

- **Production**
  Four effective factors on production are: manufacturing process, raw material, human resources, and equipment. The results of Friedman's test indicate that there's a significant difference between these four factors (Significance level is less than 0.05). the highest point on average is related to equipment and the lowest point is related to human resources.
- **Quality**
  Four effective factors related to quality are: manufacturing process, customers' satisfaction, human resources management and product. The results of Friedman's test indicate that there's a significant difference between these four factors (Significance level is less than 0.05)., the highest point on average is related to quality process and the lowest point is related to human resources management.
- **Manufacturing Expense**
  Two factors related to manufacturing expenses are: Current Expenses and Production Expense. The results of Friedman's test indicate that there's no significant difference between these two factors (Significance level is more than 0.05). the highest point on average is related to quality process and the lowest point is related to human resources management. In this situation where there are only two elements, we can also use Wilcaxon Test. Of course, the result will be the same i.e. lack of significant difference.
- **Efficiency**
  Six effective factors related to efficiency are: manufacturing method, technology, human resources and technical sections, offering new services, saving, and profit making. The results of Friedman's test indicate that there's a significant difference between these six factors (Significance level is less than 0.05). the highest point on average is related to human resources and technical sections and the lowest point is related to profitability.

11. THE RESULTS OF THE STUDY

In today's world, Information Technology is a very important base in improving the competitive advantage in organizations and society. In Information Technology process, data are continually produced, processed, managed and distributed. Therefore, Information Technology shall solve many problems only when it is applied in the service of competitive advantage improvement. Then, it will integrate the abilities and lead to the development and efficiency. This study deals with the effect of Information Technology on improving the competitive advantage using intermediate manufacturing variables including the amount of production, cost, quality, performance and efficiency. The effect, in general, has been positive and has increased competitive advantage improvement. The performed tests in this study show that Information Technology has had the highest effect on the quality of products. Regarding the quality element, manufacturing process has the highest coefficient and human resource has the lowest. Hence, in such fields as controlling the quality of the product and its development, designing the production and quality process graph, and controlling quality improvement (SCADA), Information Technology has had a better performance. In such issues as employing talented and capable staff, increasing technical knowledge, and evaluating personnel's performance, more effort should be made.

The second effective factor has been the expense or the cost of the whole process. The scale of expense has 2 parts; current expenses and manufacturing expenses. The effect of IT has been the same on both of these units. Using Information Technology shall decrease all production expenses including storage costs, material transporting costs, equipment repair and maintenance costs, manufacturing simulation cost, and process improvement costs. It also reduces the current expenses as official expenses, service costs, and the expenses related to a certain number of staff in an organization or company.

The third effective factor is the amount or volume of production. In this section, equipment has the highest coefficient and human resource has the lowest. Information Technology has greatly affected manufacturing equipments (raw material, machinery …). It also has a significant effect on such key issues as controlling and supervising production lines, information and data feedback in production line, mechanization of production lines and increasing manufacturing efficiency. An ongoing advance is observed in decision making processes, production designing, manufacturing process improvement, and waste reduction; nevertheless, more decisive action is needed

The fourth and last effective factor of IT is efficiency. The results of efficiency analysis show that human resources and technical installment has the highest effect and the element of profitability has the lowest effect. Therefore, through innovation in designing and manufacturing methods, financial saving, investment, employing skilled human resources, and increasing the staff knowledge, one can imagine a proper and satisfactory efficiency for organizations and society.

12. SUGGESTIONS

Considering production significance in South pars gas complex and the ability and success of this company in developing technical and knowledge-based services in obtaining the competitive advantage and the maximum amount of stable and high-quality production from common reservoirs, one shall reach this firm conclusion that Information Technology plays a critical role in companies' management policies and competitive advantage attainment. The results indicate that Information Technology will surely be a basic and highly effective agent in oil and gas industry in order to achieve more production and also to obtain the competitive advantage. Therefore, much more effort should be made in improving and developing the current status of the organization. Prioritizing the effective factors on improving the competitive advantage can be one good resolution. The effective factors should be identified by multi-scale decision- making techniques such as AHP and ANP and be used in company's major decisions to create an improving trend. Because of using modern technologies, South pars gas complex is known as a leading company in oil and gas industry. Hence, this study can be used in other oil and gas refineries in order to measure and evaluate the effect of Information Technology. Then, a comprehensive and uniform structure can be designed to achieve more effectiveness in taking the hold of competitive advantage in the whole gas and oil industry which is one of the important profitable industries in the budget plan of the country.

Information Technology field is a knowledge-based one and every day wondrous changes occur in this domain. Consequently, with regard to the importance of human resources in IT, this knowledge must be developed and the staff's motivation in learning newer knowledge must be boosted. Planned investment is also essential in teaching IT knowledge to the personnel of organizations. By developing Information Technology knowledge and establishing meritocracy, competitive advantage supremacy is also increased, which finally leads to profitability that is the most important goal of manufacturing.

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