

Evaluating the Role of Joint Venture for Technology Transfer in Petrochemicals Industry at Jubail, KSA

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Abstract: In the petrochemical's sector, where the market evolves incessantly around new processes and functions, companies are forced to be continuously innovative by acquiring or developing technologies. This is a crucial element in the competitive strategy of any enterprise. The ongoing integration between the Saudi market and the international market liberalizes and enhances the competitive pressure within companies, in particular joint ventures and alliances. As well as, it increases technological development needs. This study was conducted to evaluate the role of Joint Venture for technology transfer in petrochemicals at Jubail Industrial City, Saudi Arabia. A questionnaire was developed to collect the necessary data from joint-ventures companies. Seventeenth companies completed and returned the questionnaire. The obtained data were analyzed using SPSS package. The results indicate that several Technologies including product, process, marketing, organizational, strategic, and systematic have been successfully transferred to the Petrochemical industry in Saudi Arabia. The majority of these technologies have been transferred mainly through joint venture companies. Joint venture companies consider and control many internal and external aspects to assure a successful technology transfer. Association with suitable partner, commitment of the top management, education and training, flexible organizational culture, intra-organization coordination and use of information and communication technology are essential ingredients of any technology transfer process. Also, the results show that patents play a main role in increasing profits for the joint venture companies. Language is considered as the major factor in creating a gap toward success in Joint Venture.

Key words: Product technology transfer, process technology transfer, strategic technology transfer, marketing technology transfer, top management, education and training, flexible organizational culture and barriers to technology transfer.

Introduction

Transfer of technology is more than just the moving of high-tech equipment from the developed to the developing world, or within the developing world. Moreover, it encompasses far more than equipment and other so-called "hard" technologies. It also includes total systems and their component parts, including know-how, goods and services, equipment, and organizational and managerial procedures. Thus, technology transfer is the suite of processes encompassing all dimensions of the origins, flows and uptake of know-how, experience and equipment amongst, across and within countries, stakeholder organizations and institutions (Gately, 2011). Multinational enterprises have a number of options for technology transfer. These include contractual arrangements, such as technology licensing agreements, joint ventures, technical assistance and management contracts, turnkey projects and direct foreign investment in wholly-owned subsidiaries or affiliates. Transfers also occur, for example, through education of students abroad and through trade in capital goods between unrelated parties. Technology transfer can be understood as the process by which technology moves from one physical or geographic location to another for the purpose of application towards an end product (Simon and Herman, 2001). Nevertheless, the transfer process can take place either domestically from one sector to another or from one country to another covering the required knowledge, experiences and skills.

Technology transfer may comprise some or all of the following: fabricated materials and capital goods such as machines, instruments, equipment and the rest of the technology and its necessities such as design and execution works; preparation of feasibility studies for projects, including technological experiences and skills

comprising knowledge relating to production, patents, documents, drawings, operation programs, maintenance instructions, training and education activities (Bresman, Birkinshaw, and Nobel, 2010).

A joint venture is a strategic alliance where two or more parties, usually businesses, form a partnership to share markets, intellectual property, assets, knowledge, and of course, profits (Patton and Rayan, 2009). This partnership can develop between two big parties in an industry. It can also occur between two small businesses, which believe partnering will help them successfully compete against their bigger competitors. Likewise, companies with identical products and services can also join forces, to penetrate markets they otherwise would not take on, without investing tremendous resources. Furthermore, due to local regulations, some markets can only be penetrated via joint venturing with other local businesses. In some cases, a large company will form a joint venture with a smaller business, empowering it to quickly acquire critical intellectual property, technology, or resources otherwise hard to obtain, despite adequate cash at their disposal (Raff and others, 2009).

Saudi Arabia is a pioneer in the field of petrochemicals in the Middle East region. Over the last two decades it has built itself from a modest beginning into a position of strength (Al Dabibi, 2003). One of the unique characteristics of the petrochemical industry is the great interaction between feedstock, technologies, products and by products. For the production of many petrochemicals, there may be more than one process of technology involving different combinations of feedstock and by products. To date, out of the distribution of foreign direct investment by major foreign companies in Saudi Arabia, it is mainly chemicals and petrochemical companies which have contributed 60% of the total. Wilson (2004) and others concluded that ExxonMobil is the largest foreign investor in Saudi Arabia, accounting for 23% of the total foreign direct investment, with a total cumulative investment exceeding \$14 billion. There exist giants such as the state owned Saudi Aramco and Saudi Basic Industries Corporation, ranking among the world's largest petrochemical products.

Literature Review

Technology transfer framework attempts to incorporate economic, social, and political influences that affect the ability of different corporations to both create new knowledge and deploy that knowledge in economically useful ways and thereby contribute to economic growth and prosperity. The objective mostly is to build a more general understanding of firm–industry relationships and their role in knowledge-based innovation systems (Bercovitz and Feldman, 2006). Olayan (2004) said that understanding technology may only be acquired by training, education, experimentation, research and previous experience. There are two main approaches with regard to the types of technology that need to be transferred: vertical and horizontal transfer. Vertical technology transfer is transference from general to specialized levels, or transference from the scientific level to the final product form. Whereas, horizontal technology transfer is transference from one country to another, or from one application to another, e. g. uses of warfare technology to the civilian sector.

Kogut (2006) said that joint ventures can be summarized as an instrument of organizational learning and movement of knowledge. In light of this, Muller and Schnitzer (2006) examined why multinational firms would prefer to enter joint venture agreements albeit the fear of spillovers. It was summarized with one phrase only: Knowledge Movement. Thus, the clear direct policies like taxation have always been taken into consideration, particularly for the new born international joint ventures companies. Furthermore, a joint venture company is set when a host country influences an international one to share its knowledge, development, objectives and existing technologies towards the achievement of both parties' benefits and success. (Roy and Oliver, 2009). An overlooked factor affecting the success or failure of international joint ventures is the effectiveness of the leadership. Obviously, the main feature of leadership teams in a joint venture, are in its demand to identify ways to improve the manpower's effectiveness. Blalock and Gerlter (2008) had identified five key elements of the joint venture leadership - team composition, process, structure, incentives, and the leader's behaviour which has important implications toward joint venture success. Their analysis was based on the literature regarding top management teams, cross-cultural behaviour, international joint ventures, and their own in-depth interviews with leadership teams, from international joint ventures. Hagedoorn and Schkaenraad (2006) studied the strategic technology partnering between firms, and it has become a growing subject of interest, to both companies experimenting with this mode of economic organization and researchers from a wide variety of academic disciplines. Also, the effort was made to measure the effect of strategic technology partnering on companies engaged in such joint efforts.

High-technology industries have led the way in the globalization of international business in recent years. Success often depends on how well a firm transfers technology to another firm or market in a foreign country (Keller, 2008). Abdul Wahab and others (2010) stated that the inter-firm technology transfers through international joint ventures, have significantly contributed to a higher degree of local innovation

performance/capabilities, technological capabilities, competitive advantage, organizational learning effectiveness, productivity, technological development of local industry, and the economic growth of the host country. Since the focus of inter-firm in developing countries has shifted to the degree of technology transfer, organizations in developing countries are attempting to assess not only the significant role of technology transfer in strengthening their corporate and human resource performance, but also to influence other critical variables. These variables include the size of the multinational company, age of joint ventures, country of origin, and the multinational company type of industries. Contractor and Woodly (2010) proved that the effective knowledge transfer process, monitoring the opportunity, maximizing the joint venture synergetic values, technology providers, and the share is equal with the net benefits; all these elements can be controlled systematically and implemented successfully, based on how tight or loose the relationship is between the joint venture's partners according to their own decision and the global and/or local market status.

Al Ghamdi (2008) said that the transfer of technology process aims to: reduce the country's dependence on oil and to utilize national resources more efficiently, and to investigate the factors affecting the transfer and the conditions related to the technology in question - the receiving entities are also analyzed. Keller (2008) stated that many of the important factors are ambiguous by nature and difficult to measure. For instance, the technology to be transferred and the target markets may be changing, estimating costs and prices can be difficult, and the competition may consist of only a small number of firms or governments. Several critical factors may be external to the firms involved, such as political, cultural, and economic conditions. It is important, under these conditions, for management to have a good understanding of the international technology transfer process and the barriers and bonds that determine success. The success of the technology transfer among joint venture companies is always been measured by the degree of the technology transferred to the local party. Furthermore, a joint venture is the most efficient mechanism to insert any new technologies, skills, or knowledge. However, to make this process occur smoothly and easily, the parties need to conform to the relationship quality and mutual trust and the degree of tacit explicit knowledge (Abdul-Wahab et al., 2011). Henrik and others (2010) concluded in their case study that the success of technological know-how occurs when it is facilitated by excellent communication, visits and meetings between the partners on a regular basis.

Caves (2003) stated that one way of viewing a multinational enterprise in Saudi Arabia, is as an economic institution that owns, in whole or in part, controls and manages income-generating assets in more than one country. However, normally multinational corporations (MNCs) possess some advantages enabling them to produce and compete successfully in an unfamiliar foreign environment. A number of technologies have been imported into the Kingdom of Saudi Arabia. This experience has affirmed the conviction that technology can make an invaluable contribution to the growth of the Kingdom of Saudi Arabia. However, in doing so the Kingdom of Saudi Arabia, like other nations, faces some questions of possible obstacles, trials and errors during the course of industrial development and technology transfer. These can be addressed by utilizing science and technology efficiently to develop many sectors, improving output of industry, developing standards and status of national manpower and its utilization. (Al Ankari, 2004)

Gately and others (2011) analyzed Saudi Arabia's growth in oil consumption, and they found that the oil consumption domestically is nearly 3 million barrels/day, which is one-fourth of the total production. Moreover, they concluded the rapid growth in consumption is 57% annually, which is 50% faster than the income growth, which in turn will challenge Saudi Arabia's abilities to increase its oil exports. Additionally, Jinagl and Chao (2010) supported the above statements by examining the Sahara oil reservoir in B Block of Saudi Arabia, and came up and said that it has very low porosity and permeability. However, Saudi is forming a three-way joint venture as a n-butanol plant in Jubail industrial city in the east of Saudi Arabia, as well as another JV between Saudi Aramco and Dow Chemicals being formed in the near future, in order to build the largest petrochemicals complex in the Middle East – this, will also be located in Jubail industrial city (Young, 2011). The Gulf Petrochemicals and Chemicals Association's annual report which was published in 2008, aimed to provide a comprehensive information source, which would cover developments in all countries of the Gulf. The report assured that Saudi Arabia continues to lead capacity development in the region with activity. As the Saudi government encourages economic diversification, the kingdom is now moving firmly upstream into refining and downstream to industrial development (Tracy and others, 2011). Over the past 10 years, there was a huge expansion of petrochemical production in the Middle East - two essential factors were responsible: (1) the availability of feedstock at low prices as a consequence of the large oil production, (2) the strategic location of the Middle East enabled the area to supply the Atlantic and Far East needs of petrochemicals, in particular the enormous demands from China. (Seddon and Duncan, 2010).

Saudi Arabia was the first country of the Gulf Cooperation Council, to implement an offset related investment program with foreign contractors, to help build its technological and human capital through technology transfer. Ramady (2005) examined the various offset programs undertaken and compares these with

private sector non-offset joint venture investments, to assess the effectiveness of technology transfer in the petrochemical sector using a model of technology transfer "packaging comprehensiveness". The results indicated a greater degree of technology transfer for the offset related programs, but the current Saudi educational structure needs to be directed towards science based subjects in order for such technology transfers to become self sustaining and high value job generating in the future. (Mathews, 2003).

Research Problem

With the exception of Saudi Basic Industries Corporation projects, about 70% of all the current petrochemical projects in Saudi Arabia are joint ventures with major chemical companies. Literature review based assessments of joint ventures in Saudi Arabia, indicated that these businesses are enjoying comfortable monetary benefits from economic endeavours in Saudi Arabia. Nevertheless, there seems to be insufficient information available on the impact of these joint ventures on technology transfer in terms of know-how, employment, and adoption. Lack of incentive or mandatory clauses may also act as an obstacle to joint venture agreements.

Research Significance

- The government desires to build strong and lasting industrial sectors to benefit from the country's available capital plants, which are considered major assets for the country. Assessing the problems facing this industry will help in eliminating them and syncing industrialization with advanced technology attainable through technology transfer.
- The success of the petrochemicals industry in the Kingdom of Saudi Arabia is very important to achieve the government's plan of diversifying the country's revenues.
- Transferring the petrochemicals technology into the Kingdom of Saudi Arabia is an attempt to promote Saudi development and training in this sector, as well as, the indigenous petrochemicals industry in the Kingdom. The creation of such a sector would give a boost to the Saudi economy as it would bring high value and high technology jobs to the region.
- Study the open door policy to further foreign direct investment into Saudi Arabia, from established global energy and petrochemicals firms. Examining joint ventures should allow considerable technology transfer, though their sheer size will also necessitate more diversified and imaginative financing solutions.

Research Objectives

The main objective of this research is to evaluate the role of joint venture for technology transfer in petrochemicals at Jubail industrial city, Saudi Arabia. To accomplish the main objectives, the following sub-objectives are to be met:

- Go over the current situation for technology transfer through joint venture in petrochemicals at Jubail industrial city, Saudi Arabia,
- Determine the causes and effects facing technology transfer processes within petrochemical joint venture companies in the Kingdom

Research Methodology

Based to the objectives of this work, the research methodology was descriptive using comprehensive survey of the literature. A quantitative research methodology was also used, with a questionnaire presented to and completed from top management, such as CEO's and whoever is involved in the decision-making process.

Tools for Data Collection and Statistical Analysis

Based on several previous studies related to the study area, a first draft of survey tool "Questionnaire" was developed. The questionnaire was e-mailed to a number of academics and experts with experience in technology

management. They were asked to evaluate the relevant contents of the questionnaire, its language, accuracy, completeness, clarity and reliability. The final form of questionnaires was distributed via E-mails in order to collect data from the respondents. The data were be collected from top management, such as CEO's and whoever is involved in the decision-making process of both representative of joint venture through a structured questionnaire and direct interviews as appropriate, whereas no significant difference between the two parties. The collected data were then analyzed and conclusions were delivered. Statistical Product and Service Solution (SPSS) version 16.0 for windows was used for the statistical analysis of the data collected by questionnaires. Microsoft Excel 2007 software was used to manage, process, and present the data.

Research Population

The population in this research consists of petrochemicals companies located in Jubail Industrial City in Saudi Arabia, which are listed on the Saudi Arabian General Investment Authority and Chamber of Commerce and Industry. The population was taken as companies located in Jubail Industrial City, which are 31 companies, and some of them operate in different locations yet they have representative and/or support office at Jubail Industrial City.

Research Sample

28 questionnaires were sent via E-mails to CEO's and planning directors, who were representing their joint ventures companies in Saudi Arabia. They were requested to participate by completing the questionnaire. However, the final retrieved number of responses was 17 out of 28 with percentage of (60.7%).

Statistical Test for the Tool

Reliability Analysis for Cause and Effect of Technology Transfer

A reliability analysis procedure was applied to make sure that the implemented tool was reliable in measuring the underlying elements. The reliability criterion (Cronbach alpha) of each section was calculated and presented in table (1). The analysis indicates that all factors have coefficients alpha ranged from (0.75) to (0.92). Therefore, values of calculated alpha in this research work indicate high levels of reliability.

Statistical Validity Analysis for Cause and Effect of Technology Transfer

To verify the validity of the study tool, the Pearson's Coefficient of Correlation between the main scale and the subscales are calculated as shown in table (2). Table (2) shows that the calculated Pearson's coefficient of correlation for the ten sub sections of this scale are between (0.499) for the fifth section and (0.910) for the ninth section. Since the correlation coefficient is ($r > 0$), it shows that correlation coefficient is positive and significantly different from zero. These results show that there is a statistically linear significant relation between the variables. This indicates that the study tool has the validity to meet the research objectives.

Table (1) Values of Cronbach's alpha for Cause and Effect of Technology Transfer

| Number | Sub Scale | Cronbach's alpha |
|--------|---|------------------|
| 1 | Technology(s) that the company has transferred to Saudi Arabia | 0.75 |
| 2 | How the company attained technology transfer | 0.79 |
| 3 | Abandoning or delaying projects due to non feasibility or lack of resources and information | 0.78 |
| 6 | Potential aspects that facilitate easiness in acceptance of Technology Transfer | 0.87 |
| 7 | Potential aspects that facilitate easiness in implementation of Technology Transfer | 0.92 |
| 8 | Potential sources of information which contribute in Technology Transfer process | 0.86 |
| 9 | Factors influencing the Technology Transfer success within the firm | 0.85 |
| 10 | Incentives that play a main role to increase the profit for the company | 0.88 |

Table (2) Pearson’s Coefficient Correlation for “Cause and Effect of Technology Transfer Process” and its subscales

| Number | Sub Scale | Pearson’s Correlation |
|--------|--|-----------------------|
| 1 | Technology(s) that the company has transferred to Saudi Arabia | 0.936(**) |
| 2 | How the company attained technology transfer | 0.708(**) |
| 3 | Abandoning or delaying projects due to non feasibility or lack of resources and information | 0.818(**) |
| 4 | Effectiveness in receiving transfer technology | 0.508(*) |
| 5 | Saudi government policies revolving around joint venture agreements favour technology transfer | 0.499(*) |
| 6 | Potential aspects that facilitate easiness in acceptance of Technology Transfer | 0.710(**) |
| 7 | Potential aspects that facilitate easiness in implementation of Technology Transfer | 0.596(*) |
| 8 | Potential sources of information which contribute in Technology Transfer process flow | 0.673(**) |
| 9 | Factors influencing the Technology Transfer success within the firm | 0.910(**) |
| 10 | Incentives that play a main role to increase the profit for the company | 0.695(**) |

Results and Discussion

Cause and Effect of Technology Transfer Process

Types of technologies that the joint venture company has transferred to Saudi Arabia

To determine the technologies that the joint venture company has transferred to Saudi Arabia, the frequencies and percentages for the responses of the sample on the question “What is (are) the technology(s) that the joint venture company has transferred to Saudi Arabia” are calculated as shown in table (3).

Table (3) Technologies that the Joint Venture Company has transferred to Saudi Arabia

| No | Technology | Yes | | No | | Chi-Square | Df | Sig. |
|----|------------------------------------|-------|---------|-------|---------|------------|----|-------|
| | | Freq. | Percent | Freq. | Percent | | | |
| 1 | Product Technology Transfer | 5 | 29.4% | 12 | 70.6% | 2.882 | 1 | 0.090 |
| 2 | Process Technology Transfer | 7 | 41.2% | 10 | 58.8% | .529 | 1 | 0.467 |
| 3 | Marketing Technology Transfer | 9 | 52.9% | 8 | 47.1% | .059 | 1 | 0.808 |
| 4 | Organizational Technology Transfer | 11 | 64.7% | 6 | 35.3% | 1.471 | 1 | 0.225 |
| 5 | Strategic Technology Transfer | 12 | 70.6% | 5 | 29.4% | 2.882 | 1 | 0.090 |
| 6 | Systematic Technology Transfer | 11 | 64.7% | 6 | 35.3% | 1.471 | 1 | 0.225 |

The results in table (3) show that the “Strategic Technology Transfer” is the most kind of technology that has been transferred to Saudi Arabia through the surveyed companies with a percentage of (70.6%) of the sample. Jabar and other (2011), said that this element usually get the highest percentage due to the direction that the companies have adopted, that help to modify the way of thinking from technology transfer philosophy into

organizational learning philosophy, which is an antecedent of technology transfer and new product development. This is followed by “Organizational Technology Transfer” and “Systematic Technology Transfer” with the same percentage (64.7%) of the sample. The researchers think that Joint Ventures companies are clearly targeting to transfer new management methods more than transferring processes, products or else, and that might be for the weakness in the training programs, research and development, or the ability to start producing new products and new processes.

The Mechanism of Attaining Technology Transfer in the Joint Venture Company

To define the mechanism of attaining technology transfer in the Joint Venture Company, the researchers calculated frequencies and percentages for the responses of the sample as shown in table (4). It can be concluded from the table that most of the companies investigated in the study have attained technology transfer in collaboration with another enterprise with a percentage of (70.6%). Lichtenthaler (2010), justified that most of the companies, especially who are in industrial market, always tend to head for open innovation and inter-organizational technology transfer, in other words alliances and licensing with technological firms. The results show significant differences at ($\alpha=0.05$) in the responses for the benefit of the companies who attained technology transfer by themselves as shown in table (4).

Table (4) Methods of technology transfer

| No | Phrase | Yes | | No | | Chi-Square | df | Sig. |
|----|--|-------|---------|-------|---------|------------|----|-------|
| | | Freq. | Percent | Freq. | Percent | | | |
| 1 | Mainly by your Organization | 1 | 5.9% | 16 | 94.1% | 13.235 | 1 | 0.000 |
| 2 | In collaboration with another enterprise | 12 | 70.6% | 5 | 29.4% | 2.882 | 1 | 0.090 |
| 3 | Mainly by another Organization | 5 | 29.4% | 12 | 70.6% | 2.882 | 1 | 0.090 |

Effectiveness of Saudi Manpower in Receiving Technology Transfer

The results show that six companies of the respondents said they are strongly agree that the Saudi technical manpower are effective in receiving transfer technology with the highest percentage (35.3%) and (23.5%) of the sample agreed with the statement. Ahmad (2007) said that the oil companies worldwide are looking for ways to improve operations in order to stimulating production increasing and costs reduction. Therefore, companies focused on addressing the technical quality of the local manpower and started to improve it through several English, American, Canadian, and Australian expertise. Then, by the end of 2004, the technical manpower efficiency in Saudi Aramco was improved up to 64% while the costs were reduced to 39%. Table (5) shows the results.

Table (5) The effectiveness of Saudi technical manpower in technology transfer

| Strongly Disagree | | Disagree | | Uncertain | | Agree | | Strongly Agree | | Chi-Square | df | Sig. |
|-------------------|---------|----------|---------|-----------|---------|-------|---------|----------------|---------|------------|----|------|
| Freq. | Percent | Freq. | Percent | Freq. | Percent | Freq. | Percent | Freq. | Percent | | | |
| 0 | 0 | 2 | 11.8 | 5 | 29.4 | 4 | 23.5 | 6 | 35.3 | 2.059 | 3 | .560 |

The Saudi Government policies around Joint Venture Agreements favor Technology Transfer

The results show that six companies said that the Saudi Government policies revolving around joint venture agreements favor technology transfer with a percentage of (35.3%) of the sample, whereas eleven companies (64.7%) didn't agree with this statement, as shown in table (6). Aldridge and Audrestch (2010) said that, several references since the 21st century began, Saudi Arabia had set many policies that concerning technology transfer mechanisms and processes, but it was obviously that those policies are not even closely related to oil, gas, and petrochemicals sectors. In addition, there were policies that control and confined the foreign investment in Saudi, which makes the Kingdom unhealthy environment to attract the investors to deploy new technologies and develop them.

Table (6) The Saudi Government’s policies revolving around joint venture agreements

| Yes | | No | | Chi-Square | df | Sig. |
|-------|---------|-------|---------|------------|----|------|
| Freq. | Percent | Freq. | Percent | | | |
| 6 | 35.3 | 11 | 64.7 | 1.471 | 1 | .225 |

The Potential Aspects that Facilitate Acceptance of Technology Transfer

To determine the potential aspects that facilitate acceptance of technology transfer, the means and standard deviations for the responses of sample on the question: “What are the potential aspects that facilitate acceptance of technology transfer?” are calculated as shown in table (7). The results revealed that the first potential aspect that facilitate acceptance of technology transfer is collaborating with suitable external partners (Means=4.824, SD=0.393). In fact, this factor came in the beginning due to the partnership parties most likely tend to understand each business philosophy and cultural perspectives, and these could be considered essential elements to achieve a successful cooperation, especially if both parties are from different cultural background; then the trust and transparency are playing very important role to make technology transfer process done successfully. In the second place came the aspect “Management Commitment and Support” (Means=4.353, SD=0.606) followed by the aspect “Education and training” (Means=4.235, SD=1.201). “Flexible Organizational Culture” came in the fourth potential aspect that facilitate acceptance of technology transfer (Means=4.176, SD=0.529).

Table (7) The potential aspects that facilitate acceptance of technology transfer

| No | Phrase | Means (5) | SD | Sort |
|----|--|-----------|-------|------|
| 1 | Management Commitment and Support | 4.353 | 0.606 | 2 |
| 2 | Flexible Organizational Culture | 4.176 | 0.529 | 4 |
| 3 | Focus on long term gains when compared to short term profits | 4.125 | 0.719 | 5r |
| 4 | Collaborating with suitable external partners. | 4.824 | 0.393 | 1 |
| 5 | Intra-Organization Coordination | 3.625 | 0.619 | 9 |
| 6 | Use of Information and Communication Technology ‘ICT’ | 3.438 | 1.031 | 10 |
| 7 | Having clear objectives and criteria for technology transfer. | 4.118 | 1.111 | 7 |
| 8 | Recruiting compatible talent and securing the required competencies. | 4.125 | 1.204 | 5r |
| 9 | Education and training. | 4.235 | 1.201 | 3 |
| 10 | Competitors and other Organizations in your sector. | 3.882 | 1.166 | 8 |
| | Total | 4.090 | | |

The Potential Aspects that Facilitate Implementation of Technology Transfer

To determine the potential aspects that facilitate implementation of Technology Transfer, the means and standard deviations for the response of sample are calculated as shown in table (8). The results show that three potential aspects “Focus on long term gains when compared to short term profits”, “Flexible Organizational Culture” and “Collaborating with suitable external partners” are chosen as the first aspect that facilitate implementation of technology transfer, and here we can see that both partners of the Joint Venture are looking for their long and short term benefits, considering that the culture they are going to deal with as a major factor, too. Where choosing the convenient partner is an essential factor to make the success for this process. These three aspects had the same means (M=4.353). In the fourth place came the aspect “Management Commitment and Support”.

Table (8) The potential aspects that facilitate implementation of technology transfer

| No | Phrase | Means (5) | SD | Sort |
|----|---|-----------|-------|------|
| 1 | Management Commitment and Support | 4.294 | 0.470 | 4 |
| 2 | Flexible Organizational Culture | 4.353 | 0.702 | 1r |
| 3 | Focus on long term gains when compared to short term profits. | 4.353 | 0.702 | 1r |
| 4 | Collaborating with suitable external partners. | 4.353 | 0.862 | 1r |
| 5 | Intra Organization Coordination | 3.588 | 1.004 | 5r |
| 6 | Use of Information and Communication Technology ‘ICT’ | 3.588 | 0.795 | 5r |
| | Total | 4.088 | | |

The Sources of Information which Contribute in Technology Transfer Process

Means and standard deviations for the responses of the sample are calculated to determine their opinion about the potential sources of information which contribute in technology transfer process as shown in table (9). The results show that the study sample thinks that the first potential source of information which contributes in Technology Transfer process is “Market sources such as Suppliers, Customers, Competitors, Consultants and Commercial lab/R&D canterers” (M= 4.353. SD=0.862). This is followed by two statements in the second place which are “Intra Organizational information and use of 'ICT'” and “Government or public research institutes” (M=4.235). The fourth source was “Universities and Higher education and institutions” (M=3.938, SD=1.237).

Table (9) The sources of information which contribute in technology transfer

| No | Phrase | Means (5) | SD | Sort |
|----|--|-----------|-------|------|
| 1 | Intra Organizational information and use of 'ICT'. | 4.235 | 0.437 | 2r |
| 2 | arket sources such as Suppliers, Customers, Competitors, Consultants and Commercial lab/R&D canterers. | 4.353 | 0.862 | 1 |
| 3 | Universities and Higher education and institutions. | 3.938 | 1.237 | 4 |
| 4 | Government or public research institutes. | 4.235 | 1.348 | 2r |
| 5 | Professional Conferences, Journals and Meetings. | 3.529 | 0.875 | 5 |
| 6 | Fairs and Exhibitions. | 3.412 | 0.939 | 6r |
| 7 | Professional or Industry Associations. | 3.412 | 0.939 | 6r |
| | Total | 3.873 | | |

The Factors Influencing the technology transfer success within the Joint Venture Company

To identify the level of the respondents agreement on some potential factors influencing the technology transfer success within the firm, means and standard deviations for the responses of the sample are calculated. As shown in table (10), “Training and development programs” is the first potential factor influencing the technology transfer success (M=4.235, SD=0.903). The training might be the most important element that influences technology transfer positively, only if it is been conducted continuously for constant improvement to the manpower and ongoing technology development opportunities. The second factor is “Market awareness of Technology Transfer” (M=4.188, SD=0.911). Two factors came in the third place with the same Means (4.176) and SD (0.883 and 1.015). These factors are “Inclination towards creative behaviour and idea generation.” and “Improvement of decision-making, communication, working environment, frame work”. This was followed by the factors “Value of the product and productivity efficiency” and “Emphasis on in-house and extramural research and development” with means of (4.133 and 4.059) respectively.

Table (10) The factors influencing the technology transfer success within the joint venture

| No | Phrase | Means (5) | SD | Sort |
|----|---|-----------|-------|------|
| 1 | Entrepreneur’s commitment. | 3.882 | 0.858 | 7 |
| 2 | Inclination towards creative behaviour and idea generation. | 4.176 | 0.883 | 3r |
| 3 | Improvement of decision-making/communication/working environment/tram work. | 4.176 | 1.015 | 3r |
| 4 | Competitive advantage. | 3.625 | 1.088 | 10 |
| 5 | Training and development programs. | 4.235 | 0.903 | 1 |
| 6 | Emphasis on in-house and extramural research and development. | 4.059 | 1.088 | 6 |
| 7 | Market awareness of Technology Transfer. | 4.188 | 0.911 | 2 |
| 8 | High sale potential. | 3.250 | 1.065 | 12 |
| 9 | Value of the product and productivity efficiency. | 4.133 | 0.990 | 5 |
| 10 | Effecting the development of the economy | 3.647 | 0.996 | 9 |
| 11 | Create new industries or expand the existing. | 3.706 | 0.772 | 8 |
| 12 | Investment returns increment. | 3.294 | 1.047 | 11 |
| 13 | Product quality increment. | 2.941 | 1.029 | 16 |
| 14 | Customer satisfaction increment. | 3.000 | 1.061 | 15 |
| 15 | Potential of learning. | 3.176 | 0.883 | 14 |
| 16 | Overcomes ownership restrictions and cultural distance. | 3.235 | 0.903 | 13 |
| | Total | 3.670 | | |

The Incentives for Increasing the Profit of the Joint Venture Company.

To determine these incentives, the means and standard deviations for the responses of the sample on the question about the role of these incentives in increasing the profit for the joint venture company are calculated as shown in table (11). The results show that “patents” came in the first place (M=4.353, SD=0.606) as an incentive that can play a main role in increasing the profit for the joint venture company. Ramady (2010) said that Saudi government is funding and supporting all the concerned institutions that have research and development or strategic alliances with technological providers. The government is also playing an essential role to commercialize new patents within the Kingdom, as this was one of the requirements for Saudi Arabia to join the trade world organization (WTO). The second place was taken by the incentive “Design Registration” (M=3.882, SD=0.993). “Trade Marks” came in the third place with a means of (3.875) and SD (1.204).

Table (11) The incentives for increasing the profit for the joint venture company

| No | Phrase | Means (5) | SD | Sort |
|----|------------------------------------|-----------|-------|------|
| 1 | Patents | 4.353 | 0.606 | 1 |
| 2 | Design Registration | 3.882 | 0.993 | 2 |
| 3 | Trade Marks | 3.875 | 1.204 | 3 |
| 4 | Copy Right | 2.400 | 0.986 | 7 |
| 5 | Secrecy/Confidentiality Agreements | 3.412 | 1.326 | 6 |
| 6 | First Mover Advantage | 3.588 | 0.795 | 4r |
| 7 | Complexity of Design | 3.588 | 0.795 | 4r |
| | Total | 3.585 | | |

Technology Transfer Barriers in The Kingdom of Saudi Arabia

The respondents were asked to indicate the level of their agreement on some factors that are considered barriers to technology transfer to Saudi Arabia. The means and standard deviations for the responses of the sample are calculated as shown in the table (12). The results show that amongst sixteen chosen factors, the respondents thought that the culture and language factors are the first potential factors that considered barriers to technology transfer to Saudi Arabia (Means= 4.647 SD= 0.606). The second factor is the “Differences in policies and procedures” with a means of (4.235) and SD (1.252). The factor “Lack of appropriate contractual terms and conditions” is categorized as the third barrier (M=4.118, SD=1.166). The two factors “Absence of National Plans for Science and Technology Development” and “Governmental Policies” came in the fourth place with the same means (4.059). This was followed by “Market Domination by Established Enterprises” and “Lack of Communications and Coordination” with the same means (M=4.000).

Table (12) Technology Transfer Barriers in The Kingdom of Saudi Arabia

| No | Phrase | Means (5) | SD | Sort |
|----|--|-----------|-------|------|
| 1 | Culture/Language Barriers | 4.647 | 0.606 | 1 |
| 2 | Lack of time | 3.353 | 1.057 | 13 |
| 3 | Inadequate training | 3.471 | 1.231 | 12 |
| 4 | Lack of funding provisions | 3.250 | 1.183 | 14 |
| 5 | Differences in policies and procedures | 4.235 | 1.252 | 2 |
| 6 | Market Domination by Established Enterprises | 4.000 | 1.323 | 6r |
| 7 | Geographical differences | 3.941 | 1.144 | 8 |
| 8 | Lack of appropriate contractual terms and conditions | 4.118 | 1.166 | 3 |
| 9 | Lack of Information and Technology | 3.235 | 1.252 | 15 |
| 10 | Weak and/or Lack of Infrastructure | 2.471 | 0.943 | 16 |
| 11 | Lack of Qualified Personnel | 3.500 | 1.095 | 11 |
| 12 | Lack of Communications and Coordination | 4.000 | 0.791 | 6r |
| 13 | Difficulty in Finding Suitable Partner for JV | 3.765 | 0.970 | 9 |
| 14 | Lack of Market Information | 3.529 | 1.125 | 10 |
| 15 | Absence of National Plans for Science And Technology Development | 4.059 | 0.966 | 4r |
| 16 | Governmental Policies | 4.059 | 1.249 | 4r |
| | Total | 3.727 | | |

Analysis of Variance and T-Test

Analysis of variance was carried out to identify any significant differences at ($\alpha=0.05$) in the role the role of joint venture for technology transfer in petrochemicals industry at Jubail Industrial City, Kingdom Of Saudi Arabia considering the six independent variables namely: the nature of business, the joint venture company's market, the capital of the company, the annual revenue, the total number of employees and the percentage of Saudi nationals working in the company.

The Nature of Business

According to the nature of business whether it is manufacturing or trading, the results show that there are significant differences at ($\alpha=0.05$) in the effectiveness in receiving technology transfer and in favouring technology transfer by the Saudi government policies revolving around joint venture agreements. It could be that the policies which facilitate transferring technologies need to be more discussed in terms of technology transfer in petrochemical sector. However, results didn't reveal any significant differences ($\alpha=0.05$) in the other causes that are assumed to affect the technology transfer process.

The Joint Venture Company's Market

The results show that there are significant differences at ($\alpha=0.05$) in the incentives that play a main role to increase the profit for the company ascribed to the joint venture company's market, and this might be because the patent is always an attractive factor to the investors for joint venture and to commercialize it into the international market. But there are no significant differences in the cause and effect of technology transfer process according to the other subscales.

The Capital of the Company

The results show that there are no significant differences at ($\alpha=0.05$) in the cause and effect of technology transfer process according to the capital of the company.

The annual revenue of the company.

The results show that there are no significant differences at ($\alpha=0.05$) in the cause and effect of technology transfer process according to the annual revenue of the company.

The Total Number of Employees

The results show that there are no significant differences at ($\alpha=0.05$) in the cause and effect of technology transfer process according to the total number of employees in the company.

The Percentage of Saudi Nationals Working in the Company

The results show that there are significant differences at ($\alpha=0.05$) in the potential aspects that facilitate implementation of technology transfer according to the percentage of Saudi Nationals working in the company, and this might be because setting plans and procedures is mostly more easier than executing them. But there are no significant differences in the cause and effect of technology transfer process according to the other subscales.

Conclusions

Technology transfer is a crucial and a dynamic factor in social and economic development. The industry's adopted business model, therefore, has entailed setting up joint ventures with leading global players. Al-Ghamdi (1987) illustrated that joint venture transfers more technology than direct foreign investment. With the exception of SABIC projects, almost all the current petrochemical projects in Saudi Arabia about 70% are joint ventures with major chemical companies (Al-Sa'doun, 2006). The technology transfer, as much as it seems to be simple in words, as much as it is quite complex and full of much opposition such as advantages, impacts, income, barriers, knowledge and difficulties. It might be because it is a rapidly changing process and may face several factors that block it or slow it down.

In the Petrochemical industry, several technologies including product, process, marketing, organizational, strategic, and systematic have been successfully transferred to Saudi Arabia mainly through joint venture companies. Joint venture companies consider and control many internal and external aspects to assure a successful technology transfer. The conclusion can be summarized in:

1. "Strategic Technology Transfer" is the most kind of technology that has been transferred to Saudi Arabia.
2. The majority of the petrochemical companies in Saudi Arabia have attained technology transfer in collaboration with another enterprise.
3. "Collaborating with suitable external partners", "Management Commitment and Support", "Education and training", "Flexible Organizational Culture", "Competitors and other organizations", "Intra-Organization Coordination" and "Use of Information and Communication Technology" sequentially ordered as the factors that facilitate in acceptance of technology transfer.
4. "Focus on long term gains when compared to short term profits", "Flexible Organizational Culture" and "Collaborating with suitable external partners", "Management Commitment and Support", "Organization Coordination" and "Use of Information and Communication Technology" are major factors that facilitate in implementation of technology transfer.
5. "Market sources such as Suppliers, Customers, Competitors, Consultants and Commercial lab/R&D centers", "Intra Organizational information and use of ICT", "Government or public research institutes", "Universities and Higher education and institutions" and "Professional Conferences, Journals and Meetings" are major sources of information which contribute to technology transfer process.
6. "Training and development programs", "Market awareness of Technology Transfer", "Inclination towards creative behavior and idea generation", "Improvement of decision-making, communication, working environment, frame work" and "Value of the product and productivity efficiency" are major factors in influencing the technology transfer success within a firm.
7. Patents, as an incentive, play a main role in increasing profits for the joint venture companies.
8. The majority of the joint ventures consider "Culture" "Language", "Differences in policies and procedures", "Lack of appropriate contractual terms and conditions", "Absence of National Plans for Science and Technology Development" as the top barriers to technology transfer to Saudi Arabia.

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