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Measuring Technology Transfer Success Empirical Evidence from Malaysian Firms

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Abstract
The research tries to answer the management question as to which mode of technology transfer leads to the maximum success among the Northern Malaysian manufacturing firms. The statistical tests employed included one-way ANOVA and multiple regression. One-Way ANOVA was used to test the differences in the mean degree of success for the various modes of transfer. Most significant finding from this study is different modes of technology transfer leads to different degrees of success. FDI would give rise to the highest degree of overall success. This is followed by co-production and lastly, by contractual agreements. Proper choice of technology transfer mode is key since a wrong choice would lead to the company loosing significant market share and could incur heavy losses. Malaysian managers are advised to look seriously into what mode suits their needs best based on the existing situation in the organization and also to ensure that good internal cooperation is maintained among the various functional areas of the firm to achieve high levels of success from the technology transfer. Main limitation is the study was limited only to the Northern Malaysia. Hence the results do not reflect the situation in entire Malaysia. Also, the inclusion of more MNCs, which are mostly FDI-based operations is another limitation. This study provides empirical evidence that will improve the understanding of the modes of technology transfer adopted among the Malaysian SMEs.

Keywords: Technology Transfer, Foreign Direct Investment, Absorptive Capacity, Internal Cooperation, Management Support, Partner Characteristics

Introduction

The global competitive environment is undergoing a drastic change and is becoming increasingly volatile. Further upheaval to the global manufacturing and the economy has occurred due to the Covid-19 outbreak. Hence the world is now witnessing an unprecedented situation due to its rapid spread. Thousands of people have died and millions have been infected. Technology to rapidly test and identify the virus infection and to cure patients has now been developed by many countries. The vaccines, its formulation and the related technology and equipment can be transferred to other countries. This type of transfer of technology from a country which has the technological know-how or capability to a country which does not have it is called technology transfer. Technology transfer happens in all industries. Chen et al. 2010, states technologytransfer is important both in research and in the development of new products or new technology service today. Research in technology transfer is important and according to them, has become a competitive advantage in business operational management and helps firms to keep cost down, enhance competitiveness and improve operational performance.

New product development, new technology transfer and new service procedures are better understood by the technology transfer process (Martinez and Jimenez, 2009). Stock & Tatikonda2000, define technology transfer as the tools or techniques, products or processes, the required equipment or the execution method.

Schon (1967), defines technology transfer as any tool or technique, any product or the manufacturing process, production equipment or method of doing or making, which results in the extension of human capability.

At the operational level, technology can be defined as technical knowledge and could also be associated with production machines, processes in the chemical, paper and refining industries, software development, patents, processes, techniques, etc Technological capabilities is not only the ability in using resources, but also capacities of resources, like training, research and development (R&D), and maintenance of resources (Cohen, 2004).

The transfer of skills along with it, the know-how of the technology and the required machinery and equipment is technology transfer (Wei, 2003). Putranto et al. (2003) also define technology transfer similarly. Tsang (1997) says technology transfer is the flow of knowledge, enabling the firm that receives the knowledge to produce a particular product or offer a specified service. It is also defined as the process of transferring know how required from one nation to another nation to successfully utilize a particular technology (Jegathesan/ Gunasekaran, 1997).

It is imperative to have an environment that is attractive to introduce new technology. It is also important to inculcate in in managers an entrepreneurial outlook and must be prepared to invest in R&D (Ratnam, 1985).

Nishimoto (1995) states that the journey towards 2020 has just begun and serious challenges will be encountered along the way and Malaysia must be ready at the outset to deal with them boldly with the right mix of strategies and action plans.

Technology Transfer in the Malaysian Manufacturing Sector

Malaysia has witnessed a rapid growth in the manufacturing sector and supported by a strong export performance in the last five decades. Significant Foreign Direct Investment is seen in Malaysia, especially in the manufacturing sector. This is very important not only for development, but also to the access to the modern technology (Ali, 1992).

Hamdan et al. (2018) states that the various supporting policies of the Malaysian government over the years have had a very desirable impact either directly or indirectly on the technology transfer process.

Mamat and Roslan (2012) reviewed effectiveness of the critical success factors of the effective transfer of technology, a process integrating the provider and receiver.

The free trade zone (FTZ) in Penang has become the most sought after location for semiconductor companies. consumer electronics and computer manufacturing and also the computer secondary storage medium industry (Witte, 2012). Business alliances with the multinational companies helped the local SMEsto improve the quality of their products and to offer services of better value (Witte, 2012).

The Technology Park Malaysia, formed by the Ministry of Science and Technology in 1988, was subsequently later privatised in 1996. It provided a platform for having technical collaborations and knowledge sharing among research organizations, the banks and other financial institutions, and the industry (Awang et al., 2008).

The Extent of Technology Transfer Practice in Malaysia

Technology Transfer is postulated to comprise three stages: adoption, rooting and innovation (Narayanan/ Lai, 1998). They say recipient economy benefits most when the three stages are achieved.

The First Step of Adoption is Complete when the Recipient Installs the Technology. The Second Stage Called Rooting is Made Up of Three Steps:

In the initial step purely operational skills are achieved. The second stage involves maintaining and repair capabilities. In the final step the recipient can do technological design and innovation independent of the technology supplier. The technology transfer process is deemed complete with the diffusion or spread of technology to the local economy.

Adoption of Technology

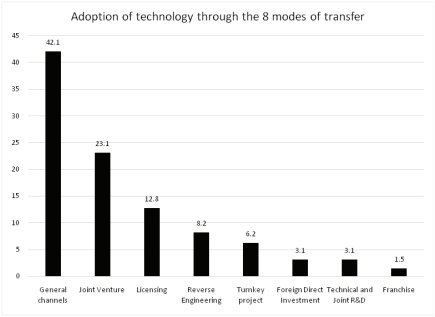

Figure 1 Adoption of technology through the different modes of transfer

National technology transfer projects have been undertaken like the PROTON national car project in collaboration with Mitsubishi Motors of Japan (Premachandra, 2014).

General channel with 42.1% recorded was the most popular method for transferring technology while the least was franchise, with 1.5%.

Boon (2006) identifies 8 modes of technology transfer, which are illustrated in the bar graph below. The eight modes are 1) General channels. (2) Joint Venture. (3) Licensing. (4) Reverse Engineering. (5) Turnkey Project. (6) Foreign Direct Investment. (7) Technical Consortium and Joint R&D. (8) Franchise

Some channels of transfer are considered effective while the others are not (Takim et al., 2009) A report in The Star newspaper (Jan 2017), the then Minister of International Trade states that FDI is imperative for the growth of the Malaysian economy and also for the creation of job opportunities.

According to the Malaysian Investment Development Authority (MIDA), Penang recorded RM13.3 billion in approved manufacturing investment inflows in the first nine months of 2019.

Table 1 Total investments received in 2019 and 2020 in the various sectors in Malaysia

Industry	2020		Total Proposed Capital Investment (USD Million)	2019		Total Proposed Capital Investment (USD Million)
	Domestic Investment (USD Million)	Foreign Investment (USD Million)		Domestic Investment (USD Million)	Foreign Investment (USD Million)	
Electrical & Electronics	518	3,362.50	3,880.50	945.3	5,328.50	6,273.80
Petroleum Products (Inc.Petrochemicals)	3,114.40	730.2	3,844.60	505.3	268.7	774
Basic Metal Products	82.2	3,487.30	3,569.40	64.4	105.4	169.8
Paper, Printing & Publishing	228	1,716.80	1,944.80	126.1	2,503.50	2,629.60
Machinery & Equipment	576.1	1,182.20	1,758.20	386.6	704.4	1,090.90
Chemicals & Chemical Products	406.1	1,149.80	1,555.90	514.3	647.6	1,161.80
Rubber Products	965.2	100.7	1,065.90	381.9	738	1,119.90

Source: Jegathesan, J and Gunasekaran, A, 1997

To sum up, we find that there is an impressive evidence of technology transfer within the Malaysian manufacturing sector.

Modes of Technology Transfer in Malaysia

Historically, the various modes of technology transfer agreements signed in Malaysian-manufacturing industries is shown below in the Table 2:

Table 2 Number of the different modes of technology transfer agreements signed from 1975-88 to Jan-May 1994

Type of Agreements	1975-1988	89	90	91	92	93	Jan - May 1994	Total
Joint Venture	162	15	15	11	7	7	1	218
Technical Assistance	688	64	72	93	80	85	19	1101
Licensing and Patent	142	35	17	28	14	44	13	293
Know-how	14	3	12	10	21	23	7	90
Turnkey and Engineering	26	0	1	1	0	1	0	29
Services	67	12	6	4	4	9	5	107
Sales, marketing/dist-ribution	31	6	5	0	0	0	0	42

Objective of the Investigation

The objective of the study is to determine how the different modes of technology transfer will lead to the different degrees of success and to answer the management question which mode of technology transfer leads to the maximum degree of success among the Northern Malaysian manufacturing firms.

Literature Review

Past work done on the topic of technology transfer and the factors that influence Technology Transfer are cited below.

Success of Technology Transfer

There can be important economic benefits, which accrue as a consequence of technologytransfer. Resources can be used for developing innovative technologies, which can lead to strategic advantages (Roman and Puett, Jr., 1983).

Measuring Success of Technology Transfer

A range of factors have to be considered for measuring the success of technology transfer. Technology Transfer can lead to the creation of new job opportunities, improve the skills of the workforce and increase the citizens' purchasing power (Roman and Puett, Jr., 1983). A firm's overall success may be characterized by sales, profit or market share growth; sales, profit or market share position; or financial position, which is returns to investors, or the extent to which owners' financial goals are met (Rhyne and Teagarden, 1997).

Noori Hamid, 1997 questioned what managers perceived to be most critical to the success of the company. The ranking of these factors on a scale of 1 (not important) to 6 (very important) reflects the importance of each to firm'ssuccess. The respondents ranked factors such as "quality," "manufacturing skill" and "prompt delivery" fairly high. At the other end of the scale they ranked "research and development," "product design," and "manufacturing skills" as less important.

Factors Influencing Success of Technology Transfer

Modes of transfer that is used in transferring the technology can be crucial to achieve a successful technology transfer exercise. In this study modes of transfer has been used as the independent variable in achieving a successful technology transfer process.

Modes of Transfer

The different modes oftechnology transfer a firm can choose are,contractual agreements such as licensing or franchising, strategic alliances and foreign direct investment including joint ventures and wholly owned subsidiaries (Terpstra 1987). Decision on the choice of transfer mode is important for a successful technology transfer exercise.Goodnow/ Hansz 1972, Erramilli/Rao 1993, and Woodcock/ Beamish/Makino 1994 have studied on the foreign marketentry mode. A number of mode choiceshave been suggested (Anderson and Gatignon,1986, Hill,Hwang&Kim1990, Agarwal & Ramaswami, 1992).Technology transfer is considered as one of the components of an entry strategy into a foreign market (Tsang, 1997).

The type of technology transfer agreement (mode of transfer) concluded could be utilized to gauge the extent of the rooting of the technology (UNDP Report). From Malaysian Industrial Development

Authority (MIDA) guidelines7 main types of modes of transfer are identified. These are:

- Joint Venture
- Foreign Direct Investment
- Technical Assistance Agreements
- Know-how agreements
- License Agreements
- Patent Agreements
- Sales/Purchase Agreements
- Turnkey contracts.

Moderating Variable Absorptive Capacity of the Firm

Hamel and Prahalad (1990) were of the view that firms will be able to strengthen their technological competence by importing external technologies, and then diffusing, assimilating, communicating and absorbing them into their organizations. Absorptive capacity is the ability of any firm in recognizing, assimilating, and applying knowledge which comes from sources which are external to the firm. Ultimately, this process is called technology transfer. Recipients would have to dedicate significant amount of time and money to embrace, modify and internalize the technology into its manufacturing process. According to Cohen and Levinthal (1990), a firm's capacity to assess and use external knowledge is by and large, a dependent on the extent of its earlier knowledge which is related to the technology being transferred. The important determinants of a firm's absorptive capacity are manufacturing experience, the firm size and the R&D (Teece 1977).. The level of efforts put in by the firm transferring the technology will depend on the absorptive capacity of the recipient firm and this process of technology transfer may be of a more extended time period than it usually requires (Tsang, 1997).

Absorptive Capacity Dimensions

Ahmad (2019) states that attributes (dimensions) of absorption capability are employee capability, knowledge sharing capability, working culture, R&D capability and communication capability There are different dimensions to measure absorptive capacity. These include the (a) Education level of the employees, (b) The training provided, (c) The willingness to learn, (d) R&D encouragement, (e) Management support and (f) Inter-departmental coordination etc. Based on the dimensions mentioned above, the absorptive capacity of the organization is measured.

Management Characteristics

Management characteristics include the management's level of technology orientation, risk taking attitudes, and encouraging the employees to learn.

Methodology

The methodology used for the study, the population of the study, the sampling frame, the sample, data collection techniques and the research model and the data analysis techniques are discussed.

Population of the Study

The population of the study consists of all the manufacturing firms operating in Northern Malaysia. The population incorporates both foreign and local companies (SMEs) in the Northern Malaysian region.

The unit of analysis for this studyis the individual manufacturing firm. The main respondent for the questionnaire will be the CEO or the production manager of the manufacturing firm since the CEO or the production manager is the person who is actively involved in the technology transfer process.

The sampling frame used for sampling was drawn from a list of all manufacturing firms in Northern Region of Peninsular Malaysia, which was obtained from the University Science Malaysia library. A total of 375 companies were included in the sampling frame.

The sampling technique used was probability sampling. In this method, stratified sampling technique was used. Stratified random sampling was used because, the manufacturing firms were divided by the respective industry such as Electronics/ semiconductors, Food Processing, Wood, Paper, Chemical, Hard disk, Telecommunication, Plantation, Polymer, etc.

Based on Roscoe's rule of thumb, 300 samples were drawn from the list. The proportion of sample/ category (samples targeted to be 75% to 85% of the total population).

The theoretical framework is shown in Figure 2. Success of technology transfer will depend on the modes of technology transfer adopted by the firm and also depends on the absorptive capacity of the firm, the management characteristics of the firm, the internal cooperation in the firm and the partner characteristics.

Independent variable (IV) is the modes of technology transfer and consist of Foreign Direct Investment, contractual agreements such as Licensing, Contracting and Franchising, (LCF) and Co-production (Strategic Alliances). This is the primary interest of study.

Moderating Variables (MV) are absorptive capacity, management characteristics internal cooperation and partnerc Characteristics. The moderating variables by themselves may be important in determining the success of technology transfer. They may also be considered to interact with the different modes of transfer in different ways to affect the success of technology transfer.

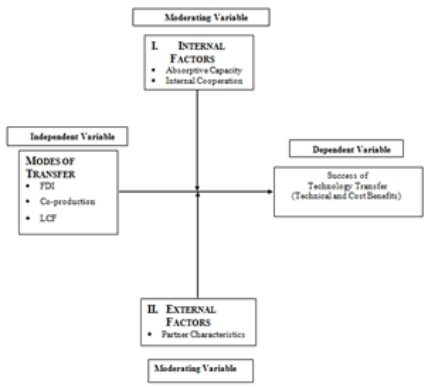

Figure 2 Theoretical Framework for the Factors affecting Success of Technology Transfer

Data Collection Method

Two types of data collection techniques were used: mail surveys and personal interviews.

Personal Interviews: The personal interviews were mainly conducted in Penang, Prai and Kulim regions of Northern Malaysia. For personal interviews, convenience sampling was used.

Questionnaire Design

The questionnaire contains mostly closed-ended questions even though there are a few open-ended responses.

Pilot Test

The purpose was to detect any weakness in term of ambiguous wordings, understanding, interpretation and appropriateness of questions before mailing it to the target respondents.

Questionnaire Administration

The questionnaire was either mailed or hand-carried to the target respondents.

Hypothesis

Based on the relationship of the variables described in the theoretical framework, the following hypotheses were developed.

According to the literature review there are 7 modes of technology transfer. The number of agreements under each will depend on the degree of success of the technology transfer under each mode. Hence the hypothesis can be stated as follows:

Hypothesis 1 (H1) The different modes of technology transfer lead to different degrees of success of technology transfer.

The level of R&D activity and technical change occurring in an industry are closely correlated (Rosenberg and Steinmueller, 1988)It can be considered that an organization's R&D as helping to discover new knowledge and also to contribute to the absorptive capacity of the firm.

Hypothesis 2 (H2) Absorptive capacity will enhance the success of technology transfer along with management support; however the rate of increase in success will be greater in organization with high absorptive capacity.

Hypothesis 3 (H3) Management support enhances Absorptive Capacity significantly, which in turn enhances Success of Technology Transfer

Preparing Data for Analysis

The questionnaires gathered were reviewed for validity. The use of coding is necessary, as most of the items were closed questions. Questionnaires that contained blank responses were discarded from the analysis.

Analysis of Data

Analysis on the responses from the valid questionnaires gathered from the samples was conducted using SPSS.

Data Analysis Technique

The systematic data analysis flow as suggested by Cooper and Schindler (1998) was used for this study. After the data had been gathered, analysis was done on it. This involved the following: preparing the data for analysis, statistical analysis and hypothesis testing. Strict compliance with these steps was necessary to ensure testability of the research hypotheses.

For the purpose of testing the differences in the dependent variable for the various modes of technology transfer, relevant inferential statistics were used. Parametric statistics were used since the data is assumed to be drawn from a normal distribution. The statistical tests employed included one-way ANOVA and multiple regression. One-Way ANOVA was used to test the differences in the mean degree of success for the various modes of transfer due to the nature of the data (interval) and the means had to be compared among three groups.

Experiment and Results

Next we discuss the results we obtained for this study, using the various statistical analysis

Responding Companies' Profile

A total of 70 responses were used in the study. This included 38 out of the 45 returned questionnaires from 300 mailed (i.e. a response rate of 12.67%) and 32 gathered through personal interviews. Seven questionnaires received were rejected due to incomplete data while around twenty were returned by post office due to unknown addresses. The details of the companies' profiles are given in Table 3 below.

Table 3 Descriptive Statistics for the Categorical Variables pertaining to Company Profile

Dimension	Group Number	Categories	Frequency	Percent
Business	1	Electronics	28	40.0
	2	Hard drives	8	11.4
	3	Food Processing	10	14.3
	4	Textiles	1	1.4
	5	Plywood/Paper	4	5.7
	6	Chemical	6	8.6
	7	Telecommunication	10	14.3
	8	Others	3	4.3
		Total	70	100.0
Revenue (Ringgit Malaysia) (Annual)	1	5 to 10 million	10	14.3
	2	10 to 100 million	17	24.3
	3	more than 100 million	42	60.0
		Total	69	98.6
		Missing	1	1.4
Number of Employees	1	<500	14	20.0
	2	500 to 999	10	14.3
	3	1000 to 2000	16	22.9
	4	>2000	30	42.9
		Total	70	100.0
Firm Status	1	MNC	48	68.6
	2	Malaysian	16	22.9
	3	Others	6	8.6
		Total	70	100.0

Test for Normality performed on the Dependent Variable Success of Technology Transfer

The dependent variable success of technology transfer was checked if the sample comprised of data that was normally distributed. For this the Lilliefor's test for normality was carried out. The results are shown in Table 4

Table 4 Lilliefor's Tests of Normality

Dependent Variable	Kolmogorov-Smirnov Statistic	d. f	Sig.
Success of Technology Transfer	.068	70	.200

It is clear that the p-value value of .200 is not significant at 5% level of significance and cannot reject the null hypothesis that the data comes from a normally distributed sample.

Factor Analysis for Success of Technology Transfer

KMO and Bartlett's shows that the data for success of technology transfer comes from a multivariate normal population. KMO value for sampling adequacy .746 suggests that factor analysis can be carried out.

Table 5 Factor Analysis for Success of Technology Transfer

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.746
Bartlett's Test of Sphericity	Sig.	.000
Success of Technology Transfer	Component 1	Component 2
Eigenvalues	4.806	3.075
Percent of Variance	34.328	21.966
Items	Technical & Cost Benefit (TCB)	Firm Benefits (FB)
Achievement of company objectives (TCB1)	.615	.354
No major technical problems (TCB2)	.792	-.0611
No frequent modification (TCB3)	.828	-.086
Increased firm's reputation (FB1)	.283	.552
No cost overruns (TCB4)	.781	-.102
Result in cost savings (TCB5)	.798	.0388
Increase company's global competitiveness (FB2)	.0802	.727
Increase in sales (TCB6)	.708	.319
Increase in market share (TCB7)	.554	.465
Commercialize new technology	.412	.588
Improvement of current manufacturing processes (FB3)	-.191	.826
Increased knowledge of employees (FB4)	-.118	.727
Increased user satisfaction (FB5)	.112	.782
Completed within planned time	.0392	.590

From the factor analysis shown in Table 5, only the significant factors have been identified and considered to measure the dependent variable, technical and cost benefits of technology transfer

Technical and Cost Benefits (Success of Technology Transfer)

Technical and Cost Benefits (Success of Technology Transfer): consists of benefits which are tangible in nature, such as:

- Increase in market Share.
- Increase in sales
- Result in Cost Savings
- No cost overruns
- No major technical problems etc.

The hypothesis 2 is restated as:

Hypothesis 2 (H2): Absorptive capacity will enhance the technical and cost benefit due to the

various modes of transfer; however the rate of increase in success will be greater in organization with high absorptive capacity.

Validity and Reliability Testing

Content validity of the instrument was established during the preliminary interviews and those variables and scales deemed irrelevant by the responding managers were not included in the final instrument.

Table 6 Inter-item Consistency Reliability Analysis (Scale: Alpha), of Moderating and Dependent Variables

Variables (Related items)	Number of Factor Items	Cronbach's Alpha
Absorptive Capacity	4	0.802
Technical and Cost Benefits	6	.864
Internal Cooperation	4	0.923
Management Support	6	0.876
Partner Characteristics	7	0.899

The Cronbach's alpha in Table 6, values were obtained by using SmartPLS 3.3 software

Descriptive Statistics for the Dependent Variable

(i) The descriptive statistics for the dependent variables (technical and cost benefits, firm benefits) are found for all the industries as a whole. The results are shown in Table 7

Table 7 Descriptive Statistics for Moderating Variables and Dependent Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Range
Absorptive Capacity	70	2.19	4.72	3.6965	.4423	1-5
Technical and Cost Benefits	70	1.57	5.00	3.4184	.7025	1-5

Descriptive Statistics for the Independent Variable

Table 8shows details of the IVvis-à-vis the categories, the number of cases under each category and the percentage under each category. Due to the smaller number of responses, the original modes of transfer were categorized into 3 groups.

Table 8 Descriptive Statistics for the Independent Variable (Modes of Transfer)

Modes of Transfer	Group Number	Categories	Frequency	Percent
	1	FDI	29	41.4
	2	Co-production	20	28.6
	3	LCF	21	30.0
		Total	70	100.0

The independent variable is the modes of transfer. Out of the firms, 29 companies (41.4%) adopted Foreign Direct Investment (FDI), 20 companies (28.6%) adopted co-production and 21 firms (30%) chose licensing, contracting or franchising (LCF). LCF consists of Licensing, Contracting and Franchising modes of transfer. These three modes were combined since at least one of them consists of less than five cases and as a result of which post hoc tests could not be conducted. Also, contractual Agreements are long term, non-equity associations between a company and another in a foreign market. Contractual agreements generally involve the transfer of technology, processes, trademarks or human skills (Cateora and Graham, 1999). Contractual agreements include licensing, franchising and joint ventures (contracting. Hence these three modes were combined together and named LCF

Testing of Hypotheses

The hypotheses that were formed were tested using several inferential statistics.

Modes of Transfer and Degree of Success – H1

The inferential statistics used for testing hypothesis 1 is one-way ANOVA since the independent variable consists of 3 categories. Hence in order to test whether the means for the 3 categories are equal, one-way ANOVA was used. The results of the one-way ANOVA tests are shown in Table 9

Table 9 Different Modes of Transfer leads to Different Degrees of Success of Technology Transfer

Dependent Variable	Modes of Technology Transfer Adopted			F	Sig.
	Foreign Direct Investment (FDI)	Co-production	Licensing, Contracting, Franchising		
Technical and Cost Benefits	3.7340	3.6429	2.7687	20.074	.000

From the results of the one-way ANOVA in Table, it is clear at 5% significance level there is a significant difference among the three group (FDI, co-production and LCF) means for the success of technology transfer. Hence we reject the null hypothesis that there is no difference among the three groups in the success of technology transfer. A firm that adopts FDI will attain the maximum level of overall success (mean = 4.04), followed by co-production (3.81). FDI will also lead to the highest level of technical and cost benefit (mean = 3.734) followed by co-production (mean = 3.643). LCF will give the least benefits.

Moderating Effect of Absorptive Capacity

The effects of Absorptive Capacity as a significant moderator(H2) to the Technical and Cost Benefits for the various modes of transfer are discussed below.

Table 10 DV: Technology Transfer Success MV: Absorptive Capacity

Treatment Variable	Zero-Order Model		First-Order Model	
	Regression Coefficient	p-value	Regression Coefficient	p-value
FDI	.818	.000	-2.852	.035
Co-production	.766	.000	.142	.926
Absorptive Capacity	.343	.041	-.0418	.860
Absorptive Capacity x FDI			.994	.007
Absorptive Capacity x Co-production			.199	.634
R2	.413		.479	
Durbin-Watson	1.461		1.445	

FDI = 1 if modes of transfer = FDI and 0 otherwise. FDI = 0 and Co-production = 0 when mode = LCF.

The moderating influences of absorptive capacity was analysed using a two-tier regression - with and without interaction terms. The results are summarized in Table 10. Absorptive capacity has a moderating influence on technology transfer success.Also, irrespective of the level of Absorptive Capacity, FDI ($\beta = 0.818$) gives rise to the highest degree of Technical and Cost Benefits, followed by co-production ($\beta = 0.766$) and then by LCF as stated in Table 10. Absorptive Capacity by itself plays a significant role (p-value = .041) in the technical and cost benefits of technology transfer. Hence we accept the Hypothesis 2. The presence of statistical interaction was determined by checking the F values in Table 10.

Table 11 Interaction regression between the independent variable and each of the moderating variables and the corresponding F-statistic for each equation

Moderating (MV) & Dependent Variables (DV)	R1 Square	R2 Square	K2	K1	N	F
ABSORPTIVE CAPACITY (MV)						
Technical & Cost Benefits (DV)	0.413	0.479	5	3	70	4.05374

Value in bold indicates significant F at 5% level of significance

Dummy variables D1 and D2 were created for the nominal variable modes of transfer (independent variable) in order to use them in the regression equation. D1 = 1 for FDI, D1 = 0 for Co-production and LCF. D2 = 1 for co-production, D2 = 0 for FDI and LCF

The F-value of 4.054 shown in the Table 11 indicates that the interaction effect is significant at 5% level. The strength of the interaction effect accounted for 6.6% of the variance in technical and cost benefits.

A line graph with DV technical and cost benefits on the Y-axis and independent variable modes of transfer on the X-axis was plotted as in Figure 3 to see the impact of the significant moderator, absorptive capacity at three different levels (low, medium and high),in Table 12, on the success of technology transfer (technical and cost benefits).

Table 12 Mean Technical and Cost Benefits for different modes of technology transfer at different levels of absorptive capacity

Absorptive Capacity	Modes of Technology Transfer Adopted		
	FDI	Co-production	LCF
Low	3.2857	3.5238	2.7429
Medium	3.5893	3.7143	2.7857
High	4.0220	3.6667	2.8095

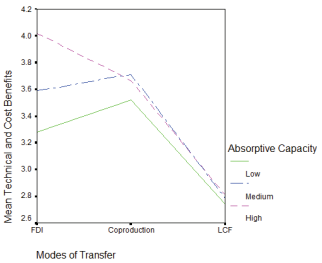

Figure 3 Graph Showing Interactions between Modes of Transfer and Absorptive Capacity

From the graph it is clear that for high absorptive capacities, FDI will give the maximum technical and cost benefits. For medium absorptive capacity, co-production gives rise to the maximum technical and cost benefits as seen from the graph. For low absorptive capacities also co-production gives the maximum technical and cost benefit.

Results and Discussions

The different modes of technology transferleads to different degrees of success of technology transfer. Foreign Direct Investment would give rise to the highest degree of overall success in terms of the technical and cost benefit. This is followed by co-production (strategic alliances) and lastly, by contractual agreements (Licensing, contracting and franchising), which leads to the lowest level of success. The results are in agreement with findings in the literature review. Absorptive capacity by itself is very important in order to bring about success of technology transfer (both technical and cost benefits (tangible) as well as firm benefits (intangible). This supports the literature which states firms that carry out their own R&D activities are in an advantageous position to use information that is available external to the firm according to Tilton (1971), as also Allen (1977) and finally Mowery (1983). Also thefindings are in agreement with the literature that says that competitive advantage can be obtained if new

technology is developed and participants are trained and have high absorptive capacity (Mirvis, Sales, & Hackett, 1991). Hence firms with high absorptive capacity could make better use of the technology that is acquired through the transfer. Management support significantly enhances absorptive capacity of the firm.

Conclusion

This study made a detailed analysis about how the different modes of transfer of technology would affect the degree of success got from the technology transfer. FDI is the best followed by co-production and then by LCF. Absorptive capacity is very important to achieve technical and cost benefits. The rate of enhancement of technical and cost benefit would be highest for a firm with high absorptive capacity and adopting FDI mode. A firm with medium absorptive capacity should adopt co-production since a combination of moderate absorptive capacity and co-production leads to the highest level of technical and cost benefit. High levels of internal cooperation must be maintained in order to get the maximum technical and cost benefit as well as firm benefit. Management needs to have a fairly good innovation and technology orientation and also moderate risk-taking attitude. Hence in order to attain the maximum benefits from the technology transfer, a firm should choose that mode of transfer depending upon the internal situation and the partner characteristics.

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