Journal of Agriculture and Sustainability
ISSN 2201-4357
Volume 6, Number 1, 2014, 1-13

Factors that Influenced the Effectiveness of Transfer of Technology (TOT) Programme among Rubber Small Holder in Malaysia

Nalini A.[1], Izah M.T.[2], Malik A.I.[1], and Wan Musa W.M.[1]

[1]School of Agribusiness and Extension, Faculty of Agriculture, Biotechnology and Food Science, Universiti Sultan ZainalAbidin (UniSZA), Gong Badak Kampus, 21300 Kuala Terengganu, Terengganu, Malaysia

[2]Research Institute for Islamic Products and Civilization (INSPIRE), Universiti Sultan ZainalAbidin (UniSZA), Gong BadakKampus, 21300 Kuala Terengganu, Terengganu, Malaysia

Corresponding Author: Nalini A., School of Agribusiness and Extension, Faculty of Agriculture, Biotechnology and Food Science, Universiti Sultan ZainalAbidin (UniSZA), Gong Badak Kampus, 21300 Kuala Terengganu, Terengganu, Malaysia

---

Abstract. This study aimed to determine the factors that influence the effectiveness of TOT programme among rubber small holders in Terengganu, Malaysia. 200 respondents were involved in the study from seven districts of Terengganu, namely Kuala Terengganu, Maran, Besut, Setiu, Hulu Terengganu, Dungun and Kemaman. Multiple regression was employed. Six factors were employed as independent variables: Understanding about technology, involvement in TOT programmes in group category, involvement in TOT programmes in individual category, effective of TOT programmes in group category, effective of TOT programmes in individual category and frequency of contacts between extension agents with smallholders. The results of the study revealed that all these variables had a positive significant relationship with the effectiveness of technology transfer. These findings could be used by relevant authorities and organizations to plan more comprehensive and strategic programmes in technology transfer activities to rubber smallholders in Malaysia.

Keywords: Effectiveness, Transfer of Technology (TOT), rubber small holders, multiple regression analysis, Malaysia.

Introduction

The Malaysian Natural Rubber (NR) Industry is currently being dominated by the smallholders sector. According to Department of Statistic 2011, the total area planted with rubber in Malaysia was 1.021 million hectares and it produced 939,241 tonnes of Natural Rubber (NR). Of these, smallholders contributed 883,000 tonnes of rubber (94%) from its land size of 960,440 hectares of land which was 94.02% of the total planted areas. The remaining areas, with very small percentage belong to the estate sector. According to the Smallholder Information System monitored by Rubber Industry Smallholder Development Authority (RISDA), in the year 2011 there were 265,274 smallholders operating on scattered and uneconomic-sized holdings averaging 2.22 hectares. These smallholder families livelihood are dependent on the rubber industry and this industry will continue to play a major role in the national economy. The rubber industry will remain buoyant as rubber is identified as one of the crops in the Government recognition of the importance of agriculture as the third engine of growth for the economy of Malaysia. In the year 2010, the integrated rubber industry contributed RM 33.85 billion (5.29%) in total export earnings. The export value of rubber products reached RM 12.85 billion, while the rubber wood products contributed RM 7.63 billion, the export of raw rubber earned RM 9.13 billion and other rubber products contributed another RM 4.24 billion. In the year 2010, the average yield of rubber by the smallholders and the estate sectors were 1480 kg/ha/year and 1620 kg/ha/year respectively. The substantial difference in productivity from the two sectors mentioned above had led the Malaysian Rubber Board (MRB) to continue its efforts in transfer of technologies to rubber related agencies such as RISDA and Federal Land Development Authority (FELDA).

The MRB had focused its Research & Development (R & D) activities to enhancing trees and land productivities. As smallholders account for 94% of natural rubber production, the transfer of technology to the smallholders continued to remain one of the main functions of MRB and extension agencies. For productivity improvement among rubber smallholders, efforts were also intensified to increase the adoption of latex harvesting technologies such as low intensity tapping systems (LITS) developed by MRB to reduce tapping days and increase tree productivity. MRB also focused on Hevea breeding and selection with the objective of developing new clones namely the RRIM 2000 series and the RRIM 3000 series, with high production potential and desirable secondary characteristics. These clones were claimed to have the capability of producing yield more than 2000 kg/ha/year. The amount of latex produced by different clones planted by smallholders however often varies depending on time of the year of tapping, age of trees, field maintenance with Good Agriculture Practices (GAP), field location, soil fertility and the technology applied or adopted.

The inclusion of rubber industry among the 12 sector of National Key Economic Area (NKEA) requires implementation of four Entry Point Projects (EPPs) i.e. increasing yield to 2,000 kg/ha/year by the year of 2020, to ensure the sustainability of the upstream sector, to increase world market share of latex gloves to 65% by 2020 and to commercialise Green Rubber. These measures will ensure sustainability of the industry and to enable the industry to contribute up to RM 52.9 billion to the Gross National Income by the year of 2020. Concerted efforts are needed to enhance domestic supply of raw materials up to 2.0 million tonnes by the year of 2020 for sustainability of the industry. Apparently, it is inevitable that in order to enhance national production to 2.0 million tonnes from the current level of about 1.0 million tonnes, diminishing planted hectarage needs to be arrested and minimum hectarage of 1.2 million hectares shall be maintained. If the average of the national rubber production can be raised to 2000 kg/ha/year and with current rubber prices, the average annual income of smallholders will increase up to RM 46000. With such level of productivity, a high income economy as envisaged under the New Economy Model (NEM) will be within the reach of the rubber smallholders.

The Malaysian Rubber Board (MRB) is the custodian of the rubber industry in Malaysia. It was established on 1st January 1998, as a result of the merger of the Rubber Research Institute of Malaysia (RRIM), the Malaysian Rubber Research and Development Board (MRRDB) and the Malaysian Rubber Exchange and

Licensing Board (MRELB). MRB is a government agency under the Ministry of Plantation Industries and Commodities, Malaysia. The primary objective of the MRB is to assist in the development and modernization of the Malaysian rubber industry in all aspects from cultivation of the rubber tree, the extraction and processing of its raw rubber, the manufacture of rubber goods and the marketing of rubber and rubber product. MRB as a custodian of rubber industry and research organization had since taken the vital step to transfer its technologies to the implementation agencies such as RISDA and the smallholders. Transfer of technology (TOT) is an important function of MRB where Research & Development (R&D) findings are promptly disseminated to the industry for adoption. New technologies in the rubber industries evolved from time to time as deliverables from R & D. Relevant technologies with specific objectives and output need to be transferred to the end users. The efforts are aimed at improving the socio-economic well-being of the smallholders especially to improve productivity and to increase incomes of the smallholders.

The mission in TOT programme is to enhance the productivity of NR, so as to improve the socio economic well-being of rubber smallholders and planters, through effective use of NR technologies. Swanson (2010) stated that technology transfer is the process of disseminating new technologies and other practical applications that largely result from R & D efforts in different fields of agriculture. In order to accomplish the mission in the TOT programme, various committees are formed involving the MRB and its implementing agencies such as RISDA, FELDA and FELCRA to ensure that new technologies are disseminated smoothly and in an efficient manner and as soon as possible to the end users. Various approaches were used to transfer new technologies derived from R & D to the industry. MRB through its publications and the electronic media regularly publicized its technologies and findings to create awareness to the public, particularly the rubber smallholders. In addition, conferences, seminars, and colloquia were often held for specific target audiences. Special attention was given to the smallholders ensuring good rapport and understanding, thus maximising the rate of transfer of technologies, and their correct adoption methods. A close interaction between MRB and implementing agencies such as RISDA, Federal Land Consolidation and Rehabilitation Authority (FELCRA) and Federal Land Development Authority (FELDA) were established, thus, further strengthening the efforts of the TOT as shown in Figure 1.

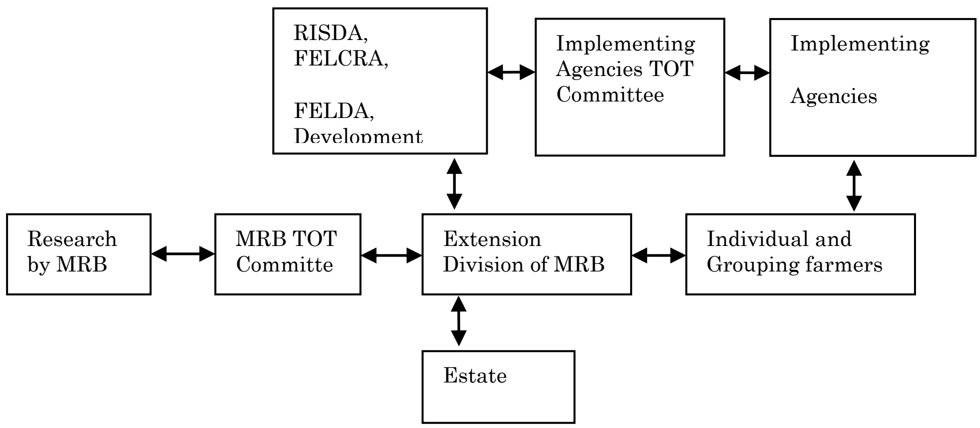

Figure 1: Transfer of Technology Flow Chart

Source: Extension and Development Division (EDD), MRB, 2010

In order to speed up the process of TOT, MRB had also created a division called the Extension and Development Division (EDD). The EDD housed eight units namely the Extension Research Unit, Malaysian Hevea Academy, the MRB Offices in the Northern Region, Central Region, Eastern Region, Southern Region, Sarawak Region, and Sabah Region. The regional offices are responsible to implement the recommended technologies and its TOT process. MRB had also established five Rubber Research Institute Mini Stations (RRIMINIS), two in the Eastern Region and one each in the Northern, Central and Sarawak Regions. The RRIMINIS are responsible to carry out training and demonstration activities besides being a reference centre in rubber technologies and agricultural practices to officers and staff of implementing agencies as well as the rubber smallholders. The transfer of technology to smallholders and related rubber agencies staff were carried out through courses, discussion, demonstrations, field visit, exhibition, visit to model holdings, study tours and special promotions of the technologies through the electronic and mass media. The extent of technology adoptions by smallholders is an impact which is measurable. Othman (2008) stated that the extension of the adopted technologies is seen as a mechanism to expand the use of the technology to a broad spectrum of users and this role is best handled by extension agents.

Therefore, this study aims to examine the influence of Understanding about technology, involvement in TOT programmes in group category, involvement in TOT programmes in individual category, effective of TOT programmes in group category, effective of TOT programmes in individual category and frequency of contacts between extension agents with smallholders, on the effectiveness of TOT programme.

Materials and Methods

Prokopenko, 1987 defined Effectiveness as "the degree to which goals are attained". Effectiveness is also a measure of programme impact as compared with the intended goal (Bentz, 2007). According to Misra (2007), agricultural extension has many goals such as social goals (e.g., farmer welfare) and economic goals (e.g., increased income). Among these, operational goals (e.g., physical and financial targets) are of special significance because their attainment makes realization of others goals possible (Misra, 2007). Bentz (2007) stated that an organization is said to be effective if it accomplishes its stated objectives. In order to measure effectiveness organization must collect programme impact data. The effectiveness of extension programme depends very much on how intensive the extension service is carried out by the relevant agencies (Aliasak, 2005). Effectiveness of a method depends upon selecting the right method, at the right time (Bukenya *et al*., 2008). Meanwhile Misra (2007) said that efficiency in extension is usually measured by the rates at which farmers adopt recommended practices. According to Ali Hassan *et al.* (2008) several studies in the agricultural extension contexts focused on evaluating the effectiveness of extension organizations from the economical prospective. Ali Hassan *et al.* (2008) focused on assessing the impact of agriculture extension on farm production and farmers' adoption rate of the new technologies disseminated by extension workers. Zainon *et al.* (2008) stated that to measure the results of the training means going beyond equipping people with the skills and knowledge necessary to carry out the assigned tasks and duties. Zainon *et al.* (2008) stated that training effectiveness refers to the evaluation of training immediately after the training is over and to judge its utility in achieving the goals of the organization on a long-term basis. According to Zainon *et al.* (2008) both these aspects are critical in assessing effectiveness of training programmes.

Adoption rates of varying degrees of complexity can be conceived. Impact in extension can be measured by a simple indicator, like yield of a crop per hectare, or by constructing simple productivity indices. Such indicators provide ultimate tests for the success of extension programmes (Misra, 2007). Misra (2007) stated that extension monitoring indicators can be grouped into two categories namely extension capability indicators and extension performance indicators. Extension capability indicators must be monitored regularly not only to know the status of extension's capability at a certain point in time, but also to determine changes in it over time and these indicators should be calculated annually (Misra, 2007). Extension performance indicators as stated by Misra (2007), can be grouped into two categories namely extension effectiveness indicators and extension efficiency indicators. Extension effectiveness indicators can be grouped into two subcategories namely single indicators and unitary or composite indicators. By definition, a single indicator will reflect an aspect of extension performance, while a unitary or composite indicator will reflect two or more aspects of extension performance. Extension efficiency indicators as stated by Misra (2007), are based on adoption rates of recommended practices and reflect extension's technical efficiency. Yield and productivity indices occupy the central position in the extension evaluation indicators and they are calculated on the basis of crop-cutting or economics and statistics departments (Misra, 2007). Misra (2007) further said that it may be useful to construct a unitary or composite indicator to provide a consolidated view of extension effectiveness to management, because management is often interested in having an overall view of extension effectiveness. The impact of the extension is measured by the indicators such as Performance Index, Penetration Index, Achievement Index, Yield, and Productivity Index. The methods to measure the impact are as follows: awareness, visit, field meetings, regularity, field day, demonstration, supervision, Research-Extension Linkage, Farmer Training, and Extension Effectiveness.

This study was based on extension effectiveness indicators by Misra (2007). The theoretical perspective in this study attempted to identify whether the independent variables has any influence or power over the effectiveness of technology transfer. The study used regression analysis to answer the objective which is to determine the best predictor of effectiveness of technology transfer programmes to the rubber smallholders. Field (2009) stated that regression analysis enables us to predict future outcomes based on the predictor variables. The multiple regression model used in this study is as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e$$

Where,

Y - Effectiveness in transfer of technology (dependent variable)

X_1 - Understanding about technology

X_2 - Involvement in TOT programmes in group category

X_3 - Involvement in TOT programmes in individual category

X_4 - Effective of TOT programmes in group extension

X_5 - Effective of TOT programmes in individual extension

X_6 - The frequency of contacts between extension agents with smallholders

a - the constant or intercept, b_1 - the slope (Beta coefficient) for X_1

b_2 - the slope (Beta coefficient) for X_2, b_3 -the slope (Beta coefficient) for X_3,

b_4 - the slope (Beta coefficient) for X_4, b_5 -the slope (Beta coefficient) for X_5,

b_6 - the slope (Beta coefficient) for X_6, e - standard error of coefficient.

Results and Discussion

Table 1 illustrates the results of the predictive variables in the multiple regression analysis.

Table 1: Results of the Multiple Regression Analysis

Model	Standardized Coefficients	*t*	Sig.	Collinearity Statistics	
	Beta			Tolerance	VIF
(Constant)		4.863	.000		
Understanding	.345	89.525	.000	.451	2.217
Effective of TOT programmes in group extension	.175	38.009	.000	.316	3.167
Effective of TOT programmes in individual extension	.194	35.109	.000	.219	4.566
Involvement in group extension	.209	39.176	.000	.235	4.260
Involvement in individual extension	.237	42.820	.000	.219	4.574
Frequency of contacts between extension agents and smallholders	.040	14.704	.000	.884	1.131

a. Predictors: (Constant), Total of contact, Understanding, Effective of TOT programmes in group extension, Effective of TOT programmes in individual extension, Involvement in group extension, Involvement in individual extension

b. Dependent Variable: Effectiveness of technology transfer

Table 1 showed the rank order of the most significant predictive variables relative to their beta weight and statistical significance to the outcome dependent variable, effectiveness in TOT was:

i) Understanding (Beta= 0.345, t= 89.525, p= 0.000)

The standardized regression beta coefficient for this variable was 0.345. The relative impact indicated that for every unit increase in understanding scores there was a 0.345 beta weight increase in the effectiveness in transfer of technology. In other words, if there is a target to increase rate of effectiveness in TOT by 3.45 per cent, the understanding also required to be increased by at least 10 per cent.

ii) Involvement in individual TOT programmes (Beta= 0.237, t= 42.820, p= 0.000)

The standardized regression beta coefficient for this variable was 0.237. It meant that for each additional point in the involvement of individual TOT value scores, there was a 0.237 beta weight increase in the effectiveness in the transfer of technology. In other words, if there was a target to increase the rate of effectiveness in TOT by 2.37 per cent, the involvement in individual TOT also required to be increased by at least 10 per cent.

iii) Involvement in group TOT programmes (Beta= 0.209, t= 39.176, p= 0.000)

The standardized regression beta coefficient for this variable was 0.209. It meant that for each additional point on involvement in group TOT value scores, there is a 0.209 beta weight increase in effectiveness in the transfer of technology. In other words, if there is a target to increase the rate of effectiveness in TOT by 2.09 per cent, the involvement in group TOT also required to be increased by at least 10 per cent.

iv) Effective of TOT programmes in individual extension (Beta= 0.194, t= 35.109, p= 0.000)

The standardized regression beta coefficient for this variable was 0.194. The relative impact indicated that for every unit increase in the effective of TOT programmes in individual extension scores there was a 0.194 beta weight increase in in the effectiveness in TOT. In other words, if there was a target to increase the rate of effectiveness in TOT by 1.94 per cent, the effective of TOT programmes in individual extension also required to be increased by at least 10 per cent.

v) Effective of TOT programmes in group extension (Beta= 0.175, t= 38.009, p= 0.000)

The standardized regression beta coefficient for this variable is 0.175. The relative impact indicated that for every unit increase in the effective of TOT programmes in group extension scores there was a 0.175 beta weight increase in the effectiveness in TOT. In other words, if there was a target to increase the rate of effectiveness in TOT by 1.75 per cent, the effective of TOT programmes in group extension also required to be increased by at least 10 per cent.

vi) The frequency of contacts between extension agents and smallholders (Beta= 0.040, t= 14.704, p= 0.000).

The standardized regression beta coefficient for this variable was 0.040. The relative impact indicated that for every unit increase in the frequency of contacts scores there was a 0.040 beta weight increase in the level of effectiveness in the transfer of technology. In other words, if there was a target to increase the rate of effectiveness in TOT by 0.40 per cent, the level of frequency of contacts also required to be increased by at least 10 per cent.

Conclusion

This study was based on extension effectiveness indicators by Misra (2007). The theoretical perspective in this study attempted to identify whether the independent variables has any influence or power over the effectiveness of technology transfer. The results showed that all six independents variables had significant influence in determining the effectiveness of technology transfer. Thus, when all these independents variables were combined in TOT programmes they showed to have greater influence. The hypothesis in this study states that “the trend of technology adoption among rubber smallholders seemed to decrease as the age of holdings increased”. The results of the data analysis in Table 1 showed to support this hypothesis.

References

[1] Bentz, R.P. 2007. *Acquiring and Managing Financial Resources.* http://www.fao.org/docrep/w5830e0m.htm#TopOfPa Assessed on 30 December 2007.

[2] Bukenya, M., Bale, W. & Buyinza, M. 2008. *Assessment of the Effectiveness of Individual and Group Extension Methods: A Case Study of Vi-Agroforestry Project in Uganda.* Research Journal of Applied Sciences. 3(3): 250-256.

[3] Field, A. (2009). *Discovering Statistic Using SPSS (3rd Edition).* London. SAGE Publications Ltd.

[4] Malaysian Rubber Board. 2009. *Rubber Plantation & Processing Technologies.* MRB. Kuala Lumpur.

[5] Malaysian Rubber Board. 2010. *Annual Report 2009.* MRB. Kuala Lumpur.

[6] Malaysian Rubber Board. 2011. *Malaysian Rubber Industry Statistics 2010.* MRB. Kuala Lumpur.

[7] Malaysian Rubber Board. 1999. *Revised Rubber Strategy, Key Areas For Action.* MRB. Kuala Lumpur.

[8] Malaysian Rubber Board. 2010. *Strategies for Malaysian Rubber Board and Malaysian Rubber Industry 2010-2020.* MRB. Kuala Lumpur.

[9] Malaysian Rubber Board. 2005. *The Evolution of the Rubber Industry in Malaysia*: *Navigating and Re-inventing the Industry*. MRB. Kuala Lumpur.

[10] Misra, D.C., 2007. *Monitoring Extension Programmes and Resourses.* http://www.fao.org/docrep/w5830e0m.htm#TopOfPa Assessed on 30 December 2007.

[11] Ministry Of Plantation Industries and Commodities, Malaysia. 2009. *Commodities Handbook 2009 Latest Edition.* MPIC. Kuala Lumpur.

[12] Musa Abu Hassan, Basri Bakar, Junainah A. Manan, Ainul Mardhiyyah Mohamed Ghazali, Jamaliyah Mohd Yassin & Zaidi Tajuddin. 2010. *Towards the Development of Agricultural Extension Service Policy: Initial Inputs from Agricultural Agencies.* Proceedings of the International Conference on Agricultural

[13] Othman Hashim. 2008. Transfer of Exploitation Technology. *IRRDB Latex Harvesting Technologies Workshop 2008.* MRB. May 5 – 8, 2008. Sungai Buloh, Selangor.

[14] Prokopenko, J. 1987. *Productivity Management: A Practical Handbook.* Geneva International Labour Office (ILO).

[15] RISDA Negeri Terengganu. 2011. Laporan Tahunan RISDA Negeri Terengganu 2010.

[16] RISDA Negeri Terengganu. 2010. Laporan Tahunan RISDA Negeri Terengganu 2009.

[17] RISDA. 2011. *Sistem Maklumat Pekebun Kecil (SMPK)* RISDA Kuala Lumpur.

[18] Swanson, B.E. 2010. *Strengthening and Transforming Agricultural Extension Systems to Achieve National Food Security and Improve Rural Livelihoods.* [Abstract]. Proceedings of the

International Conference on Agricultural Extension 2010. UPM. October 26 – 28, 2010. Putrajaya.

[19] Zainon Mat Sharif, Aminah Ahmad, Rahim Md Sail & Jamilah Othman. 2008. Individual, Situational and Training Design Factors as the Determinants for Transfer of Training in the Workplace. *Proceedings of International Conference on Agricultural Extension 2008.* June 15-19, 2008. Putrajaya Malaysia.