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Transfer of Technology and Its Relationship towards Work Performance among Extension Agents in Malaysian Cocoa Board (East Malaysia)

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Abstract*: Transfer of technology (ToT) refers to the process where the technology is transferred from the pioneer to the middlemen, and to the recipients. In the Malaysian Cocoa Board (MCB), the researcher has developed a new technology and has transferred the new technology to the extension agents; thus, extension agents are responsible to deliver it to farmers. To enhance the productivity of cocoa, the technology should be fully utilised by farmers. This study, hence, determined the level of ToT towards work performance. This study used the technique of stratified random sampling. A total of 315 productive cocoa farmers were sampled to evaluate the work performance of extension agents by using structured questions to gain responses from the farmers. The findings showed that technical skill has a significant value towards work performance. This concludes that good technical skill for both extension agents and farmers can enhance work performance. This ascertains a boost in farm productivity.*

Keywords*: Transfer of technology; extension agents; work performance; farm productivity*

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I. Introduction

Technology transfer is the process of learning; in terms of knowledge, materials, and services related to the theory and the experiences of extension agents and farmers. Technology transfer includes both informal and formal relationships in delivering technology in charge and receiver of the technology. Furthermore, transferring technology also involves knowledge and skills from both technologies' delivery and receiver.

The term "transfer of technology" is used to explain the process of technology transfer from a new technology discovery to the practices in the field. Agricultural extension is the main power that derives the technology from the researcher to be utilised by the farmers for better productivity in their farms. Thus, they serve as the middlemen between researchers and farmers. Moreover, agricultural extension service develops the necessary skills for farmers to adapt to the new technology in order to suit their level of literacy, knowledge, and skills in the disseminated technology.

The provision of agricultural extension is made to enhance farmers' knowledge and skills to improve farm productivity. Hence, extension agents need to master the knowledge and skills possessed by farmers in the first place. Thus, this study investigated the level of ToT and its relationship with work performance. The concern is whether extension agents can achieve the explicit objective. Therefore, this study only focused on the area of ToT, particularly on variables that are important in the process of transferring technology to farmers.
In MCB, the researcher and several extension agents were supervised under the same agency. This could bridge the gap in ToT. As MCB faces a problem concerning cocoa yield production, this study looked into the extension development in the skill of ToT.

Research objectives

This study has outlined the following objectives:
1. Determine the level of ToT component and work performance,
2. Determine the relationship of ToT with work performance, and
3. Identify the most important factor that contributes to work performance.

Significance of study: This study is grounded on the basis that ToT is important for extension agents to better understand and use it as a guide or information to increase their knowledge and skill. The study should, acknowledge the significance and contribute to the body of knowledge on the subject. It should provide knowledge to policymakers and practitioners to come up with a policy and knowledge that will benefit all players of development, which is important in improving farmers, extension agents, and MCB as a whole. Hence, it enables extension agents to identify the major factors to be used to retain their work performance through better knowledge of the ToT to the farmers.

The use of Iceberg Model in this research had strengthened the components in the model by adding three characteristics for the skills in extension agents. This study offers knowledge about skills of extension agents in MCB that can be used to identify the factors that influence work performance of extension agents. In fact, the study outcomes serve as input for the MCB to improve extension service in training cocoa farmers. In addition, the knowledge and skill can help improve cocoa farmers to increase their productivity by using the right technique and skill of the technology in their farms.

II. Literature Review

ToT is an important process that needs to be considered in the development of agricultural extension. In MCB especially, technology transfer is believed to increase the skill and knowledge of extension agents. Agricultural extension is also known to guide in technical area, information provider, help farmers to identify their problems in field, and organise themselves among the farmers groups (Baig, 2013).

Agricultural extension is an organisation that introduces suitable agricultural skills and techniques, give ideas or concepts to farmers and brings them to come out with the better farming strategies.The services in extension will not only influence farmers to enhance their lands and increase the yield, however also encourage them into better farming practices and adopt the better technology in agricultural practices according to their socioeconomic status (Khurshid, 2015).

A study by Rahim (2010) stated that agricultural extension is classified as a process of getting valuable info to farmers and support them by increase their knowledge, skills, and attitudes. Hence, can effectively use the information and technology to increase farm productivity. Instead of knowing their roles and being competent, the efficiency of extension services is also highly dependent on the capability of extension agents itself who are capable as the whole extension development is dependent on them to transfer technology to farmers. The services of extension basically organised based on a few of principles. For example, in some areas or organisations, extension plans are developed to help or spread information to rural areas.

Apart from this, agricultural extension agents become responsible for providing awareness, to solve farmers' problems and ToT.

Model

For model in reference, the Iceberg model (Spencer & Spencer, 1993), depicts the concept of competency. This research used this model to connect with the competency of extension agents in transferring technology mostly in terms of knowledge and skill from extension agents to the farmers. One of the most important characteristics in competency is the capability to predict work performance or behaviour in a specific characteristics or standards. They stood the Iceberg Model, which is composed of two elements; one visible (including knowledge and skills), and the other, hidden (including motives, traits, self-concepts). This study involved the first part, which is knowledge and skill of extension agents in ToT. Knowledge is information or ideas that one has in specific areas, while skills are the ability in performing a certain task.

III. Materials and Methods

The current study was conducted in East Malaysia; Sabah and Sarawak. The target population was selected based on productive cocoa farmers who have been exposed to the extension activities facilitated by the extension agents of MCB at a minimum of five years and two training sessions, at least. This study used the method of geographical stratified sampling. East Malaysia is separated into two states: Sabah and Sarawak. Sabah has 1095 productive cocoa farmers, while Sarawak has 265 productive cocoa farmers. The total number of productive cocoa farmers in these two regions is 1360. The list of productive cocoa farmers in each region was obtained from MCB. A total of 315 productive cocoa farmers were selected based on distributed questionnaires (Krejcie and Morgan, 1990).

Research design: This study combined both descriptive and correlative approaches. ToT consists of three components, which are technology skill, technology delivering skill, and technology evaluation skill, that serve as the independent variables, whereas work performance functions as the dependent variable.

Instrument and measurement: An established questionnaire was used as the instrument to collect data from the respondents. The questionnaire contained of three parts. First, this part of the questionnaire gathered respondents' demographic profile. Second, this part looked intoToT skills, and the last part of the questionnaire measured work performance of extension agents. Six-point Likert-scale option (1 = strongly disagree, to 6 = strongly agree) was used to measure the respondents' perception towards the given statements in questionnaire. The items were constructed based on the objectives and research questions of the study. The pre-test analysis was conducted, wherein the reliability (alpha > 0.7) was tested in the final stage of questionnaire development.

Data analysis: SPSS statistics version 23.0 was used for data analysis. A descriptive analysis of respondents' profile was finalized using mean, frequency and percentage values.ToT and work performance level were described by using the range level (low, moderate and high) based on mean, frequency and percentage values. Pearson's correlation coefficients were used to analyse the correlations of ToT with work performance. Multiple regression analysis was completed to prove the most contributing factors on the relationship between ToT and work performance.

IV. Results and Discussions

Demographic characteristics of the farmers, such as age, education level, farming background, and source of information, were considered crucial in their responses and mindfulness towards improved agricultural innovations.

Demographic Profile of Respondents

Race, gender, and age group

Data regarding respondents' demographic characteristics are shown in Table 3.

Race: Most dominant race in this research was Kadazan (40%), followed by Iban (21.9%) and Malay (17.5%). The other respondents were Murut (5.1%), Others (4.8%), Sungai (3.2%), Bidayuh (2.9%), Chinese (2.5%), Orang Asli (1.3%), Idahan (0.6%), and Bajau (0.3%).

Gender: The majority of the farmers were males (85.4%) and followed by females (14.6%).

Age group: The data showed that 4.8% of respondents were below 30 years of age, while 14% fell in the group of age 31−40 years. For group of age 41−50 years, there were 21% of respondents, whereas 33% of respondents were distributed for group of age 51−60 years old. 27.3% fell in the group of age above 61 years old.

Incomeand Type of Work

Income: The level of household income of the respondents showed that the majority of the respondents had income below RM1, 000 (69.8%). Approximately (23.2%) had income between RM1, 000-RM1, 999, while (7%) of farmers earned from RM2, 000 and above.

Types of Work: There was only a slight difference between the types of work of the respondents, which were (51.7%), between those who involved in cocoa plantation on full-time basis, while (48.3%) were on part-time basis.

Farm Profile

Clone/Farm, and Hectarage

Clone/Farm: The data also showed that (58.1%) used below 3 clones for their plantation, (37.5%) used 3 to 5 clones, and (4.4%) used more than 5 clones on their farm land.

Hectarage: The farm size of the respondents was also inquired during the field survey and the results are as shown in Table 3b. Farm size was measured in hectares and 87.9% of the respondents owned 1−3 hectares of land holding, 9.2% respondents had less than 1 hectare, while 2.2% of the respondents had 3.1−5 hectares. Only (0.6%) had cultivated 5.1−7 hectares of farmland for cocoa plantation.

Source of Information on Cocoa Technology:

The agricultural extension services are responsible for dissemination and transferring of agricultural technologies among the farming community. This research was conducted to discover the role of extension agents in transferring the technology in cocoa study area. In this regard, it is important to know the knowledge and awareness of respondents about the extension services. Most of the respondents (41.4%) received information on cocoa technology through MCB extension agents, (21.8%) received information from friends, while (15%), (8.1%), and (5.2%) gained information from family, brochures, and via television (TV), respectively.

All the information was analysed based on 315 respondents and detail of the profile shown at Table 3.

Table 3a: Respondents' Profile

Profile	Frequency	Percent (%)
Race		
Malay	55	17.5
Chinese	8	2.5
Orang Asli	4	1.3
Kadazan	126	40
Murut	16	5.1
Bajau	1	0.3
Iban	69	21.9
Bidayuh	9	2.9
Sungai	10	3.2
Idahan	2	0.6
Others	15	4.8
Gender		
Male	269	85.4
Female	46	14.6
Age		
≤30	15	4.8
31-40	44	14
41-50	66	21
51-60	104	33
≥ 61	86	27.3
Income		
< RM1000	220	69.8
RM1000 - RM1999	73	23.2
RM2000 - 2999	14	4.4
RM3000 - 3999	5	1.6
≥ RM4000	3	1
Types of Work		
Full time	163	51.7
Part time	152	48.3

Table 3b: Farm Profile

Clone/Farm		
< 3 clones	183	58.1
3-5 clones	118	37.5
≥ 5 clones	14	4.4
Hectarage		
< 1	29	9.2
1-3.	277	87.9
3.1-5	7	2.2
5.1-7	2	0.6
Source of Cocoa Information		
MCB Officers	292	41.4
Family	106	15
Friends	154	21.8
Brochure	57	8.1
Radio	13	1.8
TV	37	5.2
Newspaper	14	2
Internet	26	3.7
Others	6	0.9

Transfer of technology (ToT)

The distributions of level of technical skill, technology delivering skill, and technology evaluation skill are listed in Tables 4 (A), 4 (B), and 4 (C). For technical skill, 91.7% showed high level technical skill, 25% medium, and only 0.3% at a low level. It means; a majority (91.7%) of the farmers mentioned that extension agents did have knowledge and skills about the technology. Extension agents are required to have knowledge in technical skill because it is an important component of the extension agents' work. A study by Jasmin (2013) stated that in order to become an extension agent that competent, they need to have the knowledge, skills, and internal quality that lead to outstanding work performance. Extension agents must be excellent in the techniques area of their work especially in knowledge and skills of the latest technology (Neda, 2010).

Next, for technology delivery skill, 89.2% showed high level, 10.2% medium, and 0.6% had low level (Table 4B). In the process of delivering the technology to the farmers, extension agents need to convince the farmers to implement the suitable technology on their field (Altalb, 2015). The transferring of agricultural technologies process and influence farmers to practice them in field need to take over by agricultural extension specialists with experienced in the distribution of agricultural technologies and are able to contact with farmers. Thus, extension agents need to have certain skills in the technology delivery.

The level of technology evaluation skill displayed the same trend with technical skill and technology delivery skill (see Table 4C). About 88.6% showed high level of technology evaluation skill, while medium level at (11.1%), and low level at (0.3%). The role of extension agents is to teach and explain to the farmers before using the new technologies. With adequate knowledge and skill of application of the principles in extension, the extension agents assist a lot in shaping the opportunities, limitations, priorities, and needs for farmers. Extension agents help and teach farmers the important of improved agriculture, recommend suitable cropping plan, encourage them to adopt the most suitable and appropriate technologies, as well as evaluate farmers' reactions and also attitudes towards productivity of the farm. Extension workers also help farmers by encouraging them to get involved in project start-up, planning, operation, and assessment, along with to support practicable projects (Aremu, 2015).

Table 4. Transfer of technology (n=315)

(A) Technical skill	**Frequency**	**Percent**
Low	1	0.3
Medium	25	7.9
High	289	91.7
Total	315	100
Mean = 5.318	**SD** = 0.827	

(B) Technology delivery skill	**Frequency**	**Percent**
Low	2	0.6
Medium	32	10.2
High	281	89.2
Total	315	100
Mean = 5.323	**SD =** 0.854	

(C) Technology evaluation skill	**Frequency**	**Percent**
Low	1	0.3
Medium	35	11.1
High	279	88.6
Total	315	100
Mean = 5.191	SD = 0.852	

Work performance

The level of extension agents' work performance was high (91.1%), while the rest were only medium (8.6%) and low (0.3%) (see Table 5). The extension agents' performance will reflect the performance of farmers in increasing productivity. Indeed, the extension agents' performance is predictable to increase when involved in competency development programs that can improve their performance, wherein continuous evaluation of the competency of extension agents and performance is suggested (Tiraieyari et al., 2010). The efficiency of extension services is also depending on the capability of competent extension agents as the entire extension process is depending on them to transfer technology from extension organisations to the farmers or clients.

Table 5: Work performance

Work Performance	**Frequency**	**Percent**
Low	1	0.3
Medium	27	8.6
High	287	91.1
Total	315	100
Mean = 5.244	SD = 0.879	

Relationship of transfer of technology with work performance

The second objective of this research was to determine the relationship between ToT and extension agents' work performance. The Pearson correlation coefficient was used to achieve this objective. As represented in Table 6, performance is positively related to technical skill (r = 0.65), technology delivery skill (r = 0.63) and technology evaluation skill (r = 0.53). Thus, the relationships between ToT competencies and performance are positive. This study is supported by Mustafa (2017), who asserted that technical skill, technology delivery skill, and technology evaluation skill showed positive relationship towards work performance.

This is also in line with the study by Khalil et al. (2008) that revealed a positively moderate relationship between extension agents' work performance and their development program competency. In this research, ToT competency was divided into three sub-competencies; technical skill, technology delivery skill, and technology evaluation skill. Khalil et al. (2008) stated that evaluation program is a predictor of work performance in agricultural extension agents. This research hypothesised that ToT competencies are positively correlated to work performance of extension agents.

Table 6: Relationship between sub-variable of ToT with work performance.

		X1	X2	X3	X4	X5	X6	Y
X1	Technical Skill	1	.788**	.639**	.640**	.680**	.574**	.652**
X2	Technology Delivery Skill		1	.695**	.690**	.708**	.625**	.633**
X3	Technology Delivery Skill			1	.638**	.646**	.586**	.528**
Y	Work Performance							1

** Correlation is significant at the 0.01 level (2-tailed).

Analysis of coefficient for work performance

As depicted in Table 7, the largest Beta coefficient is for technical skill which is 0.377. This means that technical skill exhibits the highest contribution to explain the performance of extension agents, when the variance explained by other predictors in the model is controlled. It recommends that one standard deviation increase in technical skill leads to 0.377 standard deviation increase in performance. The second largest is 0.264 for technology delivery skill. This skill also contributed to the extension agents' work performance. Other skills have Beta values that are too small to be included in the calculation that determines work performance. The adjusted R^2 value of 0.463 implies that the three predictors explain that 46.3% of the variance/variation in extension agents' performance or the variability of agricultural extension agents' performance is accounted for by the competencies in the model. This means that technical skill and technology delivery skillare able to explain 46.3% (R^2 value adjusted) of the performance exerted by the extension agents. Besides, from the regression analysis, variables that are significant towards work performance had been determined. Technical skill and technology delivery skill showed significant differences ($\alpha < 0.05$), in which both technical skill and technology delivery skill scored ($\alpha = .000$).

Table 7: Estimated coefficient for work performance model

	Unstandardized Coefficients		Standardized Coefficients		
Performance dimension	B	Std. Error	Beta	t	Sig.
Constant	1.103	.254		4.344	.000
Technical Skill	.409	.074	.377	5.498	.000
Technology Delivery Skill	.265	.074	.264	3.597	.000
Technology Evaluation Skill	.108	.061	.104	1.766	.078

$R = 0.684$, $R^2 = 0.468$, Adjusted $R^2 = 0.463$, Std. Error of the Estimate = 0.491

V. Conclusion

This study concludes that, role of agricultural extension is the base for the development of the agricultural sector. Lacking the services in agricultural extension, modern agricultural techniques and information become useless. Agricultural extension is body of agriculture that responsible for the transferring of technologies to farmers, and to influence farmers to practice the right techniques and skills in agriculture. Hence, agricultural extension is the connection and catalysts that links farmers with agriculture research centres to transfer information and agricultural techniques and teach them how to practice in their field. This study has proven that ToT contributes towards work performance of extension agents. Based on the findings and discussion, several conclusions have been drawn, as follows:

Level of ToT for extension agents in East MCB seems to be at a high level. All three variables; technical skill, technology delivery skill, technology evaluating skill, showed positive and moderate relationships towards work performance. Technical skill had the highest Beta value, and followed by technology delivery skill, which contributed most to the work performance of extension agents in East MCB. Thus, we know that ToT is important for enhancing work performance.

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