Planning and Governance of Transfer Technology Activities in Polytechnic Institutions

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Abstract

Technical and Vocational Education and Training (TVET) institutions are urged to promote transfer technology activities, especially to foster the culture of innovation and commercialisation. Technology transfer enables the technology to be retrieved and manipulated for further usage according to the industrial needs. Although several technology transfer frameworks developed in past research, those frameworks cannot be applied to the TVET institutions because of the different organisational environment. Therefore, this study aims to identify the relationship between organisational factors, particularly the governance and planning with transfer technology activities in polytechnic. This research used a quantitative approach with a questionnaire as the instrument to test two hypotheses. 150 lecturers were selected as samples for the study involving three Polytechnics in Selangor. The hypotheses were tested based on Structural Equation Modelling (SEM) using the SmartPLS software. The study found a significant positive relationship between planning and governance with transfer technology practices. TVET institutions could benefit from the results in implementing consistent transfer technology activities by giving more priority to planning and governance.

Keywords:

Transfer technology, planning, governance, polytechnic

INTRODUCTION

The modern organisation shows a strong dependency on knowledge and technology to sustain their businesses as an inimitable strategic resource. Similarly, educational institutions including Technical and Vocational Education and Training (TVET) institutions rely on new information, knowledge, and technology as a competitive advantage for research, innovation, teaching and learning, and publication (Njiraine, 2019; Sigdel, 2019). The fourth industrial revolution magnifies the importance of technology, thus driving the world towards widespread internet of things and big data. Technology transfer means transferring technologies, skills, methods and facilities among institutions like universities and polytechnics to ensure that scientific and technological discoveries would be applied by the industry (Mendoza & Sanchez, 2019). The transfer of technology to developing countries has been one of the most discussed research areas in the past thirty years. Technology transfer can introduce new technologies, products, and services to increase productivity and values of industries, organisations and communities.

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Although several frameworks had been developed in past studies to promote technology transfer, those frameworks cannot be applied to the TVET institutions because of the different organisational environments (Kilbrink & Bjurulf 2013). Mendoza and Sanchez (2018) bolstered that argument as they found multiple realities and regional contexts where a university is residing, influence the technology transfer models being developed. Organisational factors influenced transfer technology activities from higher education institutions to the industries (Schoen, Potterie & Henkel, 2018) due to the complex interplay between skills, organisations, institutions, culture, and policies. Unanticipated changes in any of these other factors, or their interaction, could lead to severe disruption in the transfer technology activities.

Previous studies suggest that empirical research focused on management as a determinant of technology transfer activities (Guerrero & Urbano, 2019), including planning and governance. According to Mazurkiewicz and Poteralska (2016), the lack of clear policy limited the transfer technology activities (Arenas & González, 2018). Successful transfer technology activities need careful strategic planning and implementation to ensure its effectiveness. Transfer technology activities from education sectors to the industries involved many challenges that can get complicated. In particular, frequent technological change is one of the challenges of the TVET institutions in Malaysia to ensure that all planning and governance of technology transfer activities are in line with the country's requirements (Graham & Dean, 2018). By aligning the planning and governance of transfer technology activities at the polytechnics, new and cutting-edge technologies are supposed to be introduced to the industry faster to drive excellence and competitive advantage. Therefore, the paper aims to identify the relationship between governance and planning factors and transfer technology in polytechnic.

LITERATURE REVIEW

Transfer technology

Transfer technology is the mechanism by which technology and knowledge developed by a specific entity are transferred wholly to another party to allow the receiver to gain the corresponding benefit (Juan Jesus Arenas & Domingo González, 2018). According to Rahman Hamdan, Syazli Fathi and Zainai Mohamed (2018), technology transfer initiated innovation in the existing techniques, products and services in the industries. Innovation is also a strategic resource that determines the success and increases the qualities of TVET institutions. The need to stay relevant and current, encourage the TVET lecturers to be more productive, creative and knowledgeable. Accordingly, technology transfer emerged as a main approach to exchange expertise and knowledge between academics and industry that later can be translated and applied into innovative creation, driving both parties' effectiveness and sustainability. Consequently, technology transfer can increase quality innovation and organisational performance (Mendoza & Sanchez, 2019). In this research, transfer technology activities can be regarded as the flow of knowledge, innovative products and services from TVET lecturers to the industry and community.

Technical Vocational Education and Training Institutions

Technical Vocational Education and Training (TVET) system plays a pivotal role in skills development and technical training in Malaysia to produce a skilled workforce, in line with the national development requirements (Wei & Hazri Jamil, 2019). For that reason, TVET delivery must embed continuous quality improvement practices to ensure high quality in areas of the course and program provision and management, teaching and learning including competency of lecturers, research, development and innovation to align with industry standards (Zuraidah Abdullah, Kazi Enamul Hoque, Nor Hayati Ramlan & Salwati Shafee, 2019). Thus, TVET institutions in Malaysia are required to stay relevant along with the technological and economic developments, and the quality of TVET education needs to be reevaluated from time to time (Irdayanti, Ramlee, Nazirah Iman & Rui, 2020).

In Malaysia, the polytechnic is a public higher education institution that offers technical and vocational programs. The first polytechnic was established in 1969 is the Ungku Omar Polytechnic, and until now, 36 polytechnics have been established in Malaysia. The mission of the polytechnic is to lead a successful TVET institution. Accordingly, four goals are developed; (1) providing broad access to quality and recognising TVET programs, (2) empowering the community through lifelong learning, (3) producing holistic, innovative entrepreneurship and balance graduates, and (4) leveraging smart partnerships with stakeholders. Polytechnics can be divided into three categories which are premier, conventional and metro. These Polytechnics provide semi-professionals engineering, technology, commerce, and hospitality skills by offering special certificate, diploma, and degree programmes.

Planning

Planning is preparing a detailed document on the planned activities to achieve the organisation's objectives and creating a comprehensive strategy to integrate and coordinate an organisation's activities (Ndzoyiya, 2019). Planning is an organisation's process of defining direction, strategy, and decisions related to allocating resources to implement activities (Elbanna, Andrews & Pollanen, 2016). The purpose of the planning is to provide guidance on the direction, reduce waste of resources, avoid duplication of activities and establish standards in the control process. Strategic planning is a strategic management element to formulate and create a long-term plan to achieve the transfer technology vision. It involves planning a technology transfer ecosystem that comprises technology transfer offices, incubators, science parks, and university venture funds (Good, Knockaert, Soppe & Wright, 2019). Although no particular formula of resource consumption was identified in a prior study that can lead to a predictable transfer technology results (Berbegal-Mirabent, Gil-Doménech & de la Torre, 2020), gearing towards a single dominant technology transfer objective which aligned with technology transfer activities would be an effective plan for institutions in developing countries (Fai, de Beer & Schutte, 2018). Simultaneously, the planning of transfer technology activities requires strong coordination and management championed by an organisation's top management.

Governance

Governance is a mechanism where actions and rules are structured and regulated, and accountability is established. Governance plays a vital role in securing stakeholders' trust towards the management and compliance towards standards that determine the improvement and sustainability of the TVET institutions. Governance may take many forms and driven by many different motivations that result in varying outcomes. For example, non-profit governance focuses on achieving the organisation's social mission. This study stressed on governance as an essential aspect in enabling TVET institutions to perform transfer technology activities. Past studies showed that governance is one factor that could influence employees' behaviour towards transfer technology activities. In addition, Kirby and Hadidi (2019) emphasised that national coordinating policy should be established to promote technology transfer between universities and industry. Nevertheless, some of these transfer technology activities had also been implemented without organisation support in the past (Guerrero & Urbano 2019). University governance also negatively influence technology transfer (Kaushik, 2014). Despite that, a recent study suggested that the governance of transfer technology activities matters in education organisations (Schoen, Potterie & Henkel 2018).

CONCEPTUAL FRAMEWORK OF TRANSFER TECHNOLOGY

The conceptual framework of this study is based on Technology, Organization and Environment (TOE) framework. Contingency Theory is the underlying theory in developing the TOE framework, which aims to coordinate and plan organisational activities. The TOE framework is appropriate for organisational studies that focus on planning and governance (Dwivedi, Wade & Schneberger, 2012). The organisational context includes centralisation, scope, official function, decision-making, management structure, quality of human resources, communication, planning and governance to depict the organisational characteristics. In contrast, the industries, suppliers, employees, customers, and government agencies represented the environmental context (Tornatzky & Fleischer, 1990).

Moreover, TOE framework also investigates planning (Zhang & Meng, 2009) and governance (Tsou & Hsu, 2013). Innovation is one of the main objectives of the TOE framework guided past researchers to produce new findings. Figure 1 is the proposed conceptual framework for transfer technology developed by this study. The planning construct was measured by (1) planning consistent transfer technology activities, (2) planning transfer technology activities in formal and informal activities, and (3) planning technology transfer methods. In contrast, the governance was measured by (1) governance that guides transfer technology activities, (2) governance that has rules, and (3) governance that has an assessment of transfer technology.

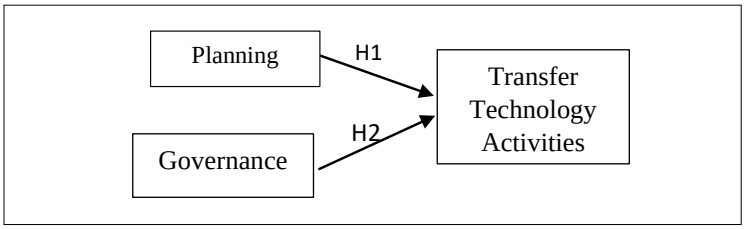

Figure 1: Framework for Transfer Technology

H_1: The planning has a significant positive relationship with transfer technology activities
H_2: The governance has a significant positive relationship with transfer technology activities

METHODOLOGY

Quantitative method was utilised in this research to find out the relationships between planning and governance, and technology transfer activities in TVET institutions. The respondents consisted of 150 lecturers from the polytechnics in Selangor, namely Sultan Salahuddin Abdul Aziz Shah Polytechnic, Banting Polytechnic and Sultan Idris Shah Polytechnic. The questionnaire was developed based on Lazarsfeld Scheme technique (Katz & Lazarsfeld, 1955), and a pilot study was carried out to test the validity. The questionnaire consisted of close and open questions. In Part A of the questionnaire, respondents were asked to fill in their demographic profiles, while in Part B they are required to provide their responses to the items representing the research constructs. All items were measured using 5-point Likert scale: (1) Strongly disagree, (2) Disagree, (3) Neither agree nor disagree, (4) Agree and (5) Strongly Agree. The data were analysed using SmartPLS. Two hypotheses were tested based on structural equation modeling (SEM).

FINDINGS

Assessment of the measurement model

PLS based on SEM was adopted for the data analysis using Smart PLS version 2.0 software. The measurement model demonstrated adequate convergent validity and discriminant validity. First, the measurement model of all constructs was checked for convergent validity. Convergent validity is the degree to which multiple items measuring the same concept are in agreement (Ramayah & Rahbar, 2013). The convergence validity of the measurement is usually ascertained by examining the loadings, average variance extracted, and also the composite reliability (Hair, Hult, Ringle & Sarstedt, 2014). The research model posited in Figure 2 linked planning, governance and transfer technology activities. Based on Table 1, it can be seen that all loadings were higher than 0.50, which is the threshold suggested by Hair et al. (2014). The average variance extracted (AVE) of all constructs exceeded 0.5, while the composite reliability scores (CR) were all higher than 0.7 (Hair et al., 2014). Hence, convergent validity is achieved.

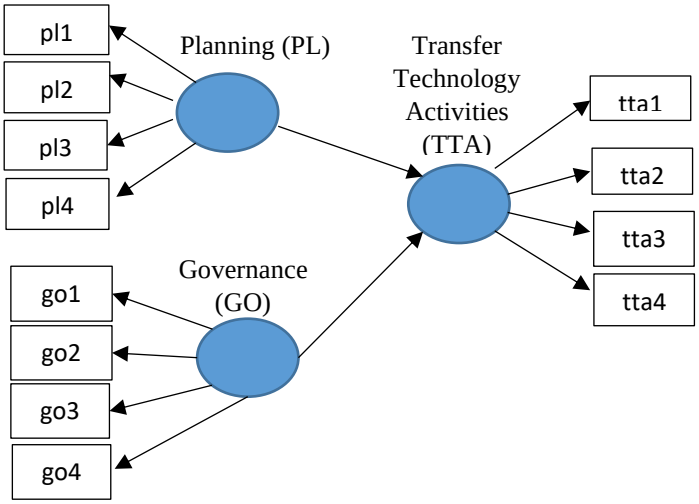

Figure 2: Structural model

Table 1: Result of the measurement model

Construct	Item	Loadings	Average Variance Extracted (AVE)	Composite Reliability (CR)
Transfer Technology Activities (TTA)	tta1	0.89	0.76	0.81
	tta2	0.78		
	tta3	0.76		
	tta4	0.63		
Planning (PL)	pl1	0.80	0.82	0.73
	pl2	0.51		
	pl3	0.78		
	pl4	0.73		
Governance (GO)	go1	0.79	0.79	0.84
	go2	0.81		
	go3	0.75		
	go4	0.73		

The next step was analysing the measurement model of all constructs to determine the discriminant validity. The discriminant validity measures the degree to which items differentiate among constructs or measure distinct concepts (Ramayah & Rahbar, 2013). It compared the correlations between constructs and the square root of the average variance extracted for that construct. As shown in Table 1, the square root of the AVE is greater than the correlation with other constructs indicating adequate discriminant validity. Discriminant validity can be examined by comparing the squared correlations between constructs and the average variance extracted for a construct (Fornell & Larcker, 1981). The squared correlations for each construct were less than the average variance extracted by the indicators measuring that construct indicating adequate discriminant validity in Table 2.

Table 2: Result of the Discriminant Validity

	PL	GO	TTA
Planning (PL)	**0.79**		
Governance (GO)	0.71	**0.83**	
Transfer Technology Activities (TTA)	0.72	0.68	**0.76**

Assessment of the structural model

Based on the assessment of the measurement model, the structural model was then analysed. The structural model comprised the hypothesised relationship between exogenous and endogenous construct. The structural model showed the causal relationships among the constructs (path coefficients and the R^2 value). The R^2 and the path coefficients (beta and significance) indicate how well the data support and hypothesised the model (Chin, 1998). A total of 300 research samples were used for the bootstrapping procedure to generate the path coefficients. The t-values were determined by determining the statistical significance of each path coefficient. Two hypotheses were supported and significant, with t-value larger than 2.33 ($p < 0.01$). Table 3 presents the results of the hypotheses testing. The first hypothesis showed that planning had a significant relationship with transfer technology activities (TTA) ($\beta = 0.791$, $p < 0.01$). The second hypothesis indicated that governance had significant relationship with transfer technology activities (TTA) ($\beta = 0.712$, $p < 0.01$). The findings concluded that H_1 and H_2 are supported.

Table 3: Results of hypotheses testing

Hypothesis	Relationship	Beta	Standard Error	T-Value	Result
H1	Planning (PL)-> Transfer Technology Activities (TTA)	0.791	0.03	6.37	Supported
H2	Governance (GO)->Transfer Technology Activities (TTA)	0.712	0.03	7.05	Supported

DISCUSSION AND CONCLUSION

The objective of this study is to identify the relationship between planning and governance with transfer technology activities. The findings revealed that planning has a significant relationship with transfer technology activities (β = 0791, p <0.01), and governance has a significant relationship with the transfer technology activities (β = 0.712, p <0.01). The findings are well supported by previous studies conducted by Good, Knockaert, Soppe and Wright (2019), Berbegal-Mirabent, Gil-Doménech and de la Torre (2020), and Kirby and Hadidi (2019). Thus, polytechnic management should provide technology transfer activity planning consistently for short-term and long-term activities. Consistent planning is important for the sustainability of implementation and monitoring of technology transfer activities and the need for smart collaboration with industry, agencies and communities.

It further indicates that polytechnic should give priority to developing good governance so that technology transfer activities can happen systematically. One of the problems in transfer technology activities at a polytechnic is the lack of governance aspect. Therefore, good governance elements such as leadership, organisational structure, policy, regulation, finance, and systems should be given attention to positively impact technology transfer activities.

Besides, this study relied on the TOE framework that underscores the direction of planning and governance. Thus, the findings confirmed that the TOE framework would help organisations coordinate, plan, monitor and evaluate technology transfer activities at the polytechnic. TVET institutions such as polytechnic need to have clear direction on transfer technology to ensure new products and services can be commercialised to the industry. The expertise of lecturers in business, engineering and technology can be used in applied research and development of products and services to help the industry and community.

REFERENCE

Abdul Rahman Hamdan, Mohamad Syazli Fathi & Zainai Mohamed. (2018). Evolution of Malaysia's technology transfer model facilitated by national policies. *International Journal of Engineering & Technology 7*(2), 96-202.

Berbegal-Mirabent, J., Gil-Doménech, D. and de la Torre, E.M. (2020). Examining strategies behind universities' technology transfer portfolio: How different patterns of resource consumption can lead to similar technology transfer profiles. *Competitiveness Review*, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/CR-01-2020-0013

Chin, W. W. (1998). *The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), Modern methods for business research*. Mahwah, NJ: Lawrence Erlbaum Associates.

Dwivedi, Y. K., Wade, M. R. & Schneberger, S. L. (2012). Integrated series in information systems. *Explaining and predicting Our Digital Society, (12),* 131-142.

Elbanna, S., Andrews, R. & Pollanen, R. (2016). Strategic planning and implementation success in public service organisations: Evidence from Canada. *Public Management Review, 18*(7), 1017-1042.

Fai, F. M., de Beer, C., & Schutte, C. S. (2018). Towards a novel technology transfer office typology and recommendations for developing countries. *Industry and Higher Education, 32*(4), 213-225.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 48*, 39–50.

Good, M., Knockaert, M., Soppe, B., & Wright, M. (2019). The technology transfer ecosystem in academia: An organisational design perspective. *Technovation, 82*, 35-50.

Guerrero, M**.** & Urbano, D. (2019). Effectiveness of technology transfer policies and legislation in fostering entrepreneurial innovations across continents: an overview, *The Journal of Technology Transfer, 44*, 1347–1366.

Hair, J. F., Hult, G. T. M., Ringle, C. M. & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS- SEM)*. London: Sage Publication.

Irdayanti Mat Nashir, Ramlee Mustapha, Nurul Nazirah Mohd Iman Ma'arof & Rui, T. J. (2020). Modified delphi technique: The development of measurement model for innovative instructional leadership in technical and vocational education systems. *Journal of Technical Education and Training, (12)*1, 24-37.

Katz, E. & Lazarsfeld, P. F. (1955). *Personal influence: The part played by people in the flow of mass communications*. New York: Free Press.

Kaushik, A.S. (2014). Technology transfer: enablers and barriers: A review. *International Journal of Technology, Policy and Management, 14*(2), 133–159

Kilbrink, N. & Bjurulf, V. (2013). Transfer of knowledge in technical vocational education: A narrative study in Swedish upper secondary school. *International Journal of Technology and Design Education, 23(3),* 519-535.

Kirby, D. A., & El Hadidi, H. H. (2019). University technology transfer efficiency in a factor driven economy: the need for a coherent policy in Egypt. *The Journal of Technology Transfer, 44*(5), 1367-1395.

Mazurkiewicz, A. & Poteralska, B. (2016). Technology transfer barriers and challenges faced by R & D organisations. *7th International Conference on Engineering, Project, and Production Management Procedia Engineering, Poland, 182*, 457-465.

Mendoza, X. P. L., & Sanchez, D. S. M. (2018). A systematic literature review on technology transfer from university to industry. *International Journal of Business and Systems Research*, *12*(2), 197-225.

Ndzoyiya, L. C. (2019). Analysis and evaluation of strategic planning and implementation at TVET colleges. A case study of Lovedale College. *Master Thesis.* Durban University of Technology.

Njiraine, D. (2019). Enabling knowledge sharing practices for academic and research in higher education institutions. *Information and Knowledge Management*, *9*(3), 82-89.

Ramayah, T. & Rahbar, E. (2013). Greening the environment through recycling: An empirical study management of environmental quality. *An International Journal, 24*(6), 782–801.

Schoen, A., Potterie, B. P. & Henkel, J. (2018). Governance typology of universities' technology transfer processes. *The Journal of Technology Transfer, 39*(3), 1-16.

Tornatzky, L. & Fleischer, M. (1990). *The processes of technological innovation*. Lexington, MA: Lexington Books.

Tsou, H-T. & Hsu, S. H. Y. (2013). Assessing the importance of TOE openness for firm performance: Does co-production matter? In *The 2013 International DSI and Asia Pacific DSI Conference*. Bali, Indonesia.

Wei, F. J. & Hazri Jamil. (2019). TVET educational choice of Malaysian polytechnic students. *Jurnal Pendidikan Malaysia, 44*(1), 65-76.

Zhang, N. & Meng, Q. (2009). Innovation 2.0 as a paradigm shift : Comparative analysis of three innovation modes. In *International Conference on IEEE Management and Service Science, 2009 Chicago*, 1–5.

Zuraidah Abdullah, Kazi Enamul Hoque, Nor Hayati Ramlan & Salwati Shafee (2019). Designing the structural model of TVET lecturers' professionalism and generic skills based on an empirical study in Malaysia. *Sage Open, 9*(3),1-18.