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Developing Effective Workforce via Industrial Based Project Supervision: A Case in Malaysian Technical and Vocational Education and Training Institutions

ABSTRACT: *The industrial based project has become a compulsory assessment for those who enrol in the TVET (Technical and Vocational Education and Training). The attributes in TVET require a student to be competent in the field to ensure it is comply with the industry's demands of skilled workforce. During the industrial based project development, an effective supervision that involves the both student and supervisor are greatly needed. Thus, this paper will discuss the implementation of industrial based project in Malaysian TVET and explains the importance of effective supervision in project completion. The content is based on the literature review of previous researches from several sources, including documents, papers, and journals, which aimed to explore the best concept of effective supervision. The main concern is regarding the implementation of industrial based project in Malaysian TVET system, as well as clarifying the importance of effective supervision in students' industrial based project completion. An EFA (Exploratory Factor Analysis) was conducted over 360 respondents to discover the factors in SIS (Supervisory Input Support). Then, CFA (Confirmatory Factor Analysis) was conducted to determine the AVE (Average Variance Extracted) and GoF (Goodness of Fit) model. The data regarding supervisory input is also discussed. It is hoped to provide a holistic view of effective supervision in developing skilled workforce. The ability to develop effective supervision in TVET should be catered in many ways which reflect the needs of students, for example by providing training to new supervisors.*

KEY WORDS: *Industrial Based Project; Technical and Vocational Education and Training; Student; Skilled Workforce; Effective Supervision.*

INTRODUCTION

Investment in developing human is very vital in order to achieve organizations' aim. The demands for effective workforce keep increasing. Currently, the government has put in focus to technical and vocational education to develop knowledge workforce. It is common

to hear that the terms education, training, and learning are used interchangeably (Hashim, 1993); although the common practice is to use the term training.

In this paper, training can be interpreted as the process of learning in student's studies. Supervision can be categorized as one of

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Table 1:
 Skills Certificates and Diplomas Registrations and Awards

Skills Levels	2005		2006		2007		2008	
	Register	Award	Register	Award	Register	Award	Register	Award
SKM 1	42,869	41,332	29,364	39,311	45,692	40,906	38,163	49,438
SKM 2	38,855	37,737	24,928	32,863	33,087	32,078	32,741	40,934
SKM 3	17,247	14,958	7,627	8,255	11,800	9,124	11,789	11,664
Dip	1,386	1,386	1,149	2,133	1,611	2,789	2,244	2,041
Total	100,357	95,413	63,068	82,562	92,208	84,904	84,953	104,104

the important elements in student's learning activity. To improve students' performance, there are crucial needs for effective supervision.

In Malaysia, including in Indonesia, the numbers of registered students for vocational education keep growing by years, although the increment numbers are not very impressive (*cf* Feigenbaum, 1994; PMD Malaysia, 2012; and ADB, 2015). This is a good sign for the future as the community has started to accept the TVET (Technical and Vocational Education and Training). The problem has raised here, where the capability of the institution to cater these large number of participants is questionable.

These years, the government in Malaysia is cutting the budget towards employment in the government sector and minimizes expenditures in the annual budget. This will affect the process of teaching and learning. The total of students graduated for each level in Malaysia is clearly described in table 1.

There are many factors affecting the successful of supervision activity that can be concluded in two: (1) Individual Differences; and (2) External Factors. According to F. Ohiwerei & B. Nwosu (2009), individual differences are the factors that are resident in the individual (Ohiwerei & Nwosu, 2009). They are those personal characteristics of the individual that determine his/her decision. They include: intellectual ability, aptitudes, interest, his/her value system, low motivation, self-esteem, sex, attitude towards various occupations, his/her personal, mental, and emotional disposition (Ohiwerei & Nwosu, 2009; and Ayub, 2015).

This factor will be continuity in the development of students' progress and even the successful of students' project. Meanwhile, external factors are coming comes from: teachers' influence; parental

pressure or influence; economic and political condition of the country; peer groups' pressure or influence; adequate information; and subject studies/combination (Smith *et al.*, 1993; and Jacobs, 1994).

TVET (Technical and Vocational Education and Training) institutions, in this context, need to play their roles by providing and maintaining a vibrant excellent resource to develop the students as independent workers. Collaboration between students and supervisors need to be clearly identified as a component of effective training. During this process, the students will learn many things outside of their formal class. Besides, the bond that develops between them will teach the student in various aspects, such as interpersonal, research, and problem solving skill. This effort will realize the institution's mission of becoming a sanctuary for skilled workforce.

Objectives. The main objective of this paper is to highlight the implementation of project supervision in Malaysian TVET (Technical and Vocational Education and Training) based on government policies for MQF (Malaysian Qualification Framework). Afterwards, the aspect of supervision as the pillar of the training is discussed with the required inputs needed by students.

Based on the analysis, the paper will discuss on how developing effective supervision is very important to the students' progress. The details of the will be further explained in this paper.

METHOD

This paper discusses the effective supervision for industrial based project. The content is based on the literature review of previous researches from several sources, including documents, papers, and journals, which aimed to explore the best concept of

effective supervision (Katz, 1997). The main concern is regarding the implementation of industrial based project in Malaysian TVET (Technical and Vocational Education and Training) system, as well as clarifying the importance of effective supervision in students' industrial based project completion.

An EFA (Exploratory Factor Analysis) was conducted over 360 respondents to discover the factors in SIS (Supervisory Input Support). Then, CFA (Confirmatory Factor Analysis) was conducted to determine the AVE (Average Variance Extracted) and GoF (Goodness of Fit)'s model.

LITERATURE REVIEW

Overview of Industrial Based Project Process.

At the end year of Level 4 or Diploma program in Malaysian Skill Certificate, students have to complete an industrial based project to ensure their qualification for a degree. According to SFSU (San Francisco State University), in 2012, an industrial based project must redesign of existing product leading to user improvements (SFSU, 2012). The product innovation must be based on: (1) New and emerging technologies; (2) Societal developments; (3) Environmental concerns; (4) Design and incorporation of unique visual languages; (5) Solving a problem through the innovative use of materials; and (6) Development of innovative manufacturing methods (Whitaker & Moses, 1994; and SFSU, 2012).

The project employed must be working directly with an industrial partner. Some of the institutions, such as Polytechnic University of Tokyo in Japan, encourage the student to collaborate with industry for relevant input during their project (Hatakenaka, 2008). It has a detailed employment support system, which supports student career development through this partnership with industry (Green *et al.*, 2012). This determines the level of the project.

The purpose of final year project for Malaysian TVET (Technical and Vocational Education and Training) Diploma is to test students' skill in applying their skills learned during their courses. The project can be performed by individual or group not more than 3 persons (ADTEC, 2006). This project must be referred to the solution of the problem

that might be existed in institute or industry. All projects must be complied with industry needs and can be commercialized if necessary.

One of the requirements needed in the report is the budget estimates through out the process. This part is so important to predict the value of commercialize. Before a project being approved, a proposal has to be presented to the panel. After the panels agreed upon the topic, with reference to the technology applied and the significant to the real situation, students may proceed with their project.

According to ICE WaRM (International Centre of Excellence in Water Resources Management), in 2012, industry based project is where the student completes project in the work place with a Workplace Supervisor. And the supervisor is the student's contact person at their home university, who is responsible for guiding the student and ensuring they undertake the required academic assessment (ICE WaRM, 2012).

On completion enable a student to be able to: (1) Understand the structure, operation and responsibilities and business culture of a company or organization; (2) Contribute to technical projects as an individual or team member; and (3) Critically describe the influences of financial, technical, institutional, social, and environmental issues on the business operations (ICE WaRM, 2012).

Students undertaking this program will gain many benefits, such as links to a company to gain valuable real work industry experience; enhanced understanding of the work place, including culture, practices, and the nature of work; development of technical skills and operational procedures; and development of personal skills, including communication, team working, and interpersonal relations (ICE WaRM, 2012).

The industrial based project also supported by private organization and industries. One of the traits, which distinguish the German dual system of VET (Vocational Education and Training) from most training systems in the world, is the voluntary contribution of many companies towards it, in both practical and financial terms (Mohamad, 2011). This is one of the challenges that should be faced by TVET providers in collaborating with industries.

We need these resources to ensure that the quality of the project is recognized by the

industries and can be commercialized. As the ability for innovation are to become key competences in TVET Malaysian government has allocated an amount of budget for innovation practice, such as MySkills and I3TEX (International Invention, Innovation, and Technology Exhibitions); and in Europe, the year 2009, had been declared as the European Year of Creativity and Innovation (Keevy, Chakroun & Deij, 2011).

Creativity is made visible only upon searching for specific solutions. The best solution in each case is selected in accordance with the standard of values applied. The qualification barometer published by the AES (Austrian Employment Services) for all occupations defines creativity as an interdisciplinary qualification, i.e. the capacity to think and act in associative, imaginative, and constructive ways (Keevy, Chakroun & Deij, 2011). Creative talent, the ability to shape, formative abilities, artistic creativity, imagination, and technical creativity are used as synonyms for creativity, amongst others.

It is already clear at this point that creativity is a skill developed under specific favourable conditions; and, therefore, not attributable to a group of artistically active people only, a fact made obvious by the efforts to establish a EQF (European Qualification Framework) and which we consider of vital significance for the subject matter (*cf* Shannon, 1995; and Keevy, Chakroun & Deij, 2011).

The relationship between student and supervisor, while powerful, is not independent of the departmental-disciplinary context. Four variables influencing retention collectively contribute to this environment for both students and supervisors. Two particularly affect students: *selection/admission* (Kezar, 1999); and *program requirements* (Yeates, 2003).

Traditional admission requirements often do not provide evidence of the kinds of learning that will be required of doctoral students and thus cannot foretell the potential to learn what will be expected (Hagedorn & Nora, 1996). Interestingly, non-traditional procedures have proven to be more effective than traditional ones (Lindblom-Ylanne, Lonka & Leskinen, 1996). Thus, there are needs for information about these requirements, so that the students can be prepared.

Supervision as the Key Factor in Effective Students. Institutions of higher learning incorporate many methods to attract candidates and to produce quality students in the given time frame. However, there is less action taken for this effort (Elgar, 2003). One of the main factors that constrain the institution's management from offering quality training is insufficient public funding that causes them to increase tuition fee to supplement the budget (Alexander, 2001). Completion rates are increased 34% to 68%, when the admission is limited according to the ratio (Smallwood, 2004).

O. Zuber-Skerrit & Y. Ryan (1994) summarizes the main problems in supervision as: (1) *Inadequate supervision*: supervisors' lack of experience, commitment, and/or time; (2) *Emotional and psychological problems*: students' intellectual and social isolation, their insecurity to fulfill the standards, and lack of confidence in their ability to complete their theses within the specified time or not at all; (3) *Lack of understanding and communication* between supervisor and student; and (4) *Students' lack of knowledge, skills, training or experience* in research methods (Zuber-Skerrit & Ryan, 1994). Other aspects that influence the student progress are accessibility of information, supervisor, good management, and problem solving skill (Lessing & Lessing, 2004).

Another problem is that the role of supervision and the motive for supervision also seems to be unclear. In the first instance, the role of supervision is being described as the most advanced level of *teaching* (Connell, 1985); *critical conversation* (Knowles, 1999); and *mentorship* (Taylor, 1995); and in the second case, supervisor motives may incorporate knowledge attainment, joint publications, and recognition (self-esteem), each motive carrying different expectations of students (Hockey, 1996).

R.H. Spear (2000) concludes that one of the most common complaints from research students concerns infrequent or erratic contact with supervisors, who may be too busy with administrative or teaching responsibilities, have too many students or be away from the university too often (Spear, 2000). Therefore, the supervisor should make equal information, time, and energy available to all students (Brown & Krager, 1985); and should also meet

Table 2:
The Dimensions and Items After EFA (Exploratory Factor Analysis)

Dimension	Items
Management Input (MI)	Organizing: arranges follow-up meetings with me. Directing: provides me with information on relevant sources. Monitoring: checks my progress.
Project Input (PI)	Literature review: tutors me on how to access information. Project proposal: provides me with criteria for my project proposal. Project development: shares his/her knowledge with me or refers me to an expert.
Academic Input (AI)	Discipline/subject field expertise: shares the knowledge and experience with me. Assessing: assesses my progress continuously. Evaluation: provides input on the quality of my project.
Technical and Innovation Input (TII)	Alert me on new and emerging technologies. Advises me to solve problems by the innovative use of materials. Monitors me in design and incorporation of innovative manufacturing methods. Develop competitive new technological products.

regularly with students (Hockey, 1996; and Russell, 1996). Research has shown that constant, thoughtful supervision and availability, is the key to successful graduate program completion (Donald, Saroyan & Denison, 1995; and Holdaway, Deblois & Winchester, 1995).

A further focus in ensuring smooth operation of knowledge transfer is to provide the students with adequate innovation and creativity input. The European Council conclusions of May 2009, on a strategic framework for European cooperation in education and training, formulate four primary strategic goals for educational policy. One of these is enhancing innovation and creativity, including entrepreneurship, at all levels of education and training (Weib, 2009). Therefore, to overcome the problems mentioned earlier is to facilitate these students with proper support and relevant input. Supervisor needs to act accordingly at every stage of student's progress (Lee & Green, 1998).

Needs on Supervisory Input Support.

Supervision is a complicated social interaction, which involves two parties multiple interests. The importance of interpersonal relationships between students and their supervisors, as a determinant of student success, is being discussed by many scholars (Lessing & Schulze, 2002; Ives & Rowley, 2005; and Lin

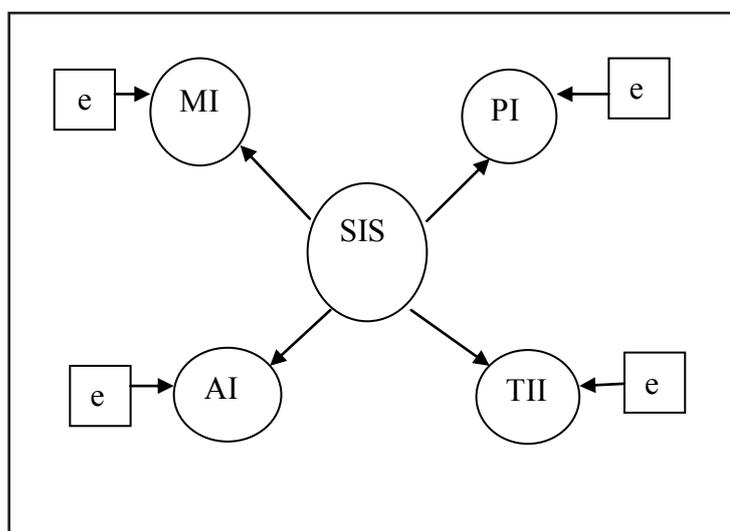


Figure 1:
The Final Dimensions of SIS (Supervisory Input Support)

& Cranton, 2005). Sometimes, students feel frustrated as a result of lack of support from their supervisor (Malfroy, 2005).

This is due to the fact that students are not homogenous, but highly diverse in terms of academic ability, personality attributes, motivation, and attitude. Hence, how supervisors respond to students will, in part, be conditioned by these different factors and applying the same rigid strategy for each student may not always work effectively (McQueeney, 1996).

In this context, R.G. Burgess, C.J. Pole & J. Hockey (1994) also pick up the theme of changing research stages and the need for a supervisor to be flexible in an attempt to meet the needs of individual students (Burgess, Pole

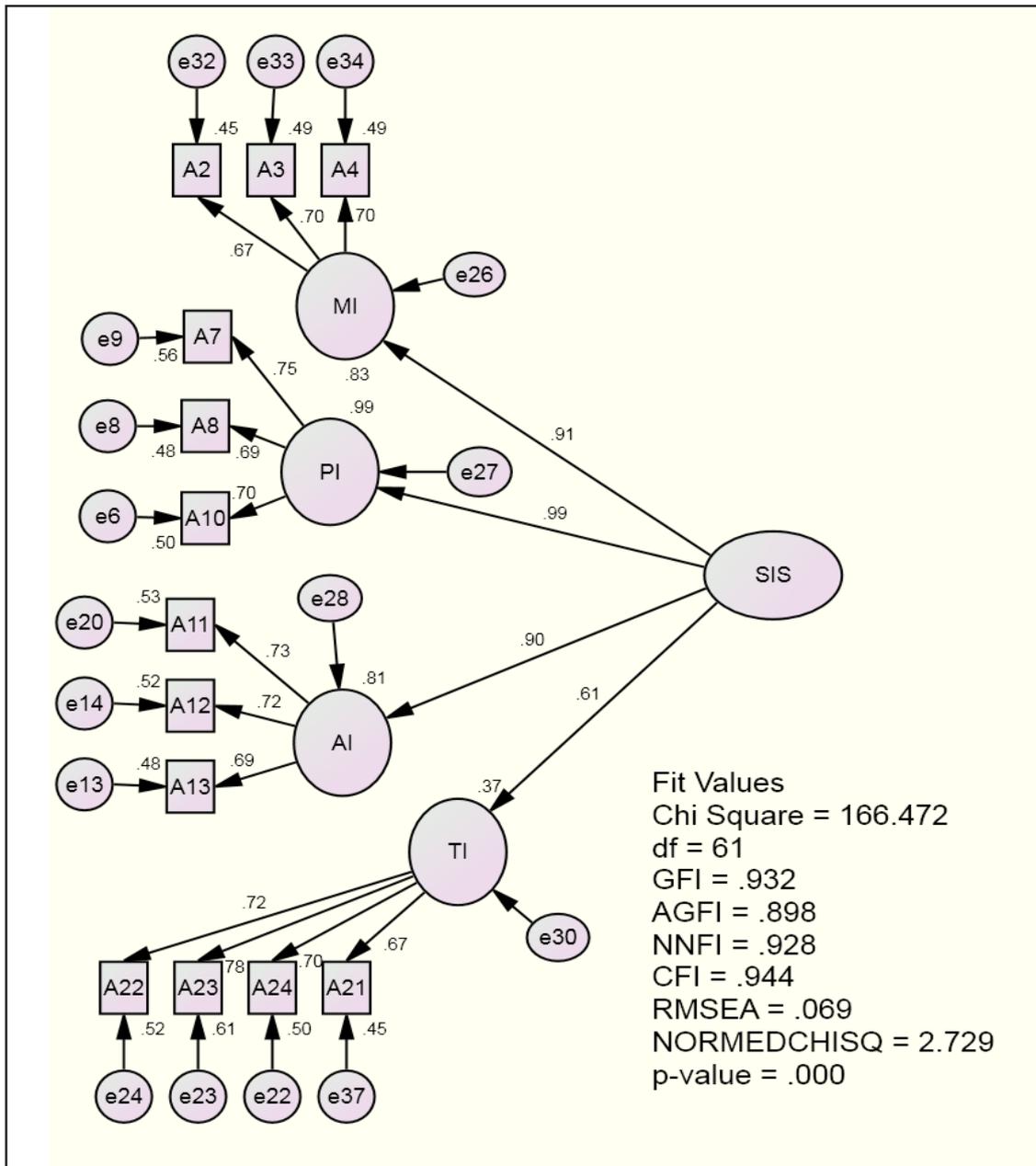


Figure 2:
 Confirmatory Factor Analysis for SIS (Supervisory Input Support)

& Hockey, 1994). Supervisors who have this flexibility can be more helpful to their research students (Johnston, 1996; and Haksever & Manisali, 2000).

J. Hockey (1996) agrees with this statement and suggests that supervisors initiate a tight structure of control solely with the students whom they consider to be weak (Hockey, 1996). However, research has found that strong and highly motivated students also demand such a structure. Conversely, with

this kind of student, supervisors might need considerable latitude in order to express themselves intellectually. In this case, a relatively unstructured strategy might develop with supervisors being primarily reactive to students' demands.

DATA ANALYSIS

An EFA (Exploratory Factor Analysis) was conducted to 360 respondents to find the factors that influenced SIS (Supervisory

Input Support). From table 2, the items were grouped into 4 components and thus explain the factors that contribute to SIS. Therefore, to examine the level of SIS, these 4 factors were deemed as significant in analyzing this construct thoroughly in this research context (Ismail, Hassan & Masek, 2013).

The most important support needed by the students, as reported in the research, are Project Input ($\mu = 4.198$) and Academic Input ($\mu = 4.142$). It is followed by Managerial Input ($\mu = 4.089$), Technical and Innovation Input ($\mu = 4.073$), and Interpersonal Input ($\mu = 4.033$). Aspects where improvement may be required include the provision of technical support, financial support, and computing resources.

Supervisor that agrees upon supervision must be prepared with uncertainty journey (Salmon, 1992). Students that committed and highly motivated will succeed in this process even the supervisors are not competent (Cryer, 2000). Good relationship and mutual understanding is the remedy for weak supervision experience (Ismail, Abiddin & Hassan, 2011).

Figure 1 explains the final dimension of SIS (Supervisory Input Support) that consists of 4 main elements, which are MI (Management Input), PI (Project Input), AI (Academic Input), and TII (Technical and Innovation Input). Implementations of these elements into supervision will enhance students' progress. In this context, A. Ismail *et al.* (2014) propose that good supervision contribute to the prominent of institutions' image.

Later on, CFA (Confirmatory Factor Analysis) was conducted to this model to determine whether it meets met the AVE (Average Variance Extracted) and GoF (Goodness of Fit)'s model. The results indicated that the CFA model for SIS (Supervisory Input Support) has sufficient and significant GoF at 0.05 level with AVE = 0.504 and CR (Credit Register) = 0.929, as shown in figure 2.

The data from EFA (Exploratory Factor Analysis) and CFA (Confirmatory Factor Analysis) clearly explains the final outcome of the analysis. In order to come out with supports that are needed by a students, the items was factorized and categorized into 4 main elements. It if later confirmed by CFA to ensure that the findings is in good fit. This

is considered a new contribution to the body of knowledge as it verifies the elements for supervisory support for TVET (Technical and Vocational Education and Training).

CONCLUSION

The ability to develop effective supervision in TVET (Technical and Vocational Education and Training) should be catered in many ways, which reflect the needs of students, for example by providing training to new supervisors. With the variety of backgrounds, the needs of supervision might be different. Students need different input at the different stage of student's progress. The main prerequisites for the successful supervision are openness, listening, and inquiry, or a reflective approach to dealing with the matters at hand.

In other words, the key issues are comprehension, understanding, and creative further development, all of which ultimately result in productive supervision practice. TVET policy measures and programs should be structured in such a way so as to render processes and results transferable. The benefit of this effort should be sustainable.¹

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¹**Statement:** Herewith, we have declared that this paper is our original work; so, it is not product of plagiarism and not yet be reviewed as well as be published by other scholarly journals.

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**Convocation Ceremony in One of the Technical and Vocational Education
and Training Institutions in Malaysia**

(Source: <http://jpkmalaysia.com>, 9/10/2015)

The ability to develop effective supervision in TVET (Technical and Vocational Education and Training) should be catered in many ways, which reflect the needs of students, for example by providing training to new supervisors. With the variety of backgrounds, the needs of supervision might be different. Students need different input at the different stage of student's progress. The main prerequisites for the successful supervision