Towards a Sustainable Continuing Technical and Vocational Education (TVE) Programmes in Higher Education Institution (HEI) in Malaysia

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Abstract

Continuing education is increasing its importance as part of university education. Technical and Vocational Education is one of the disciplines under the scope of Continuing Education (CE) programmes offered by CE centers in Higher Education Institution (HEI) in Malaysia. The main objective of continuing technical education (CTE) is to help practicing engineers, technologists or technicians stay current with technological advances relevant to their current or future jobs and indirectly they are also involved in the country development. However, continuing technical education faces some classic and some new challenges. One of the critical challenges common to all technical/engineering disciplines is the need for sustainable development of the programme. Although there are programmes that have successfully implemented skills into their curriculum, there are many factors that serve to hinder the philosophy of sustainability which may be contributed due to the non existence of guideline in CE centers. Hence the purpose of this research is to (i) determine the current level(status) of sustainable development orientation in CTE centers and (ii) develop a framework of sustainable CTE programmes. This quantitative-designed research is carried out using modified Delphi method which involves participation from 33 experts in relevant fields that purposively chose regarding their positions. This methodology required two cycles of instrument distribution to get a consensus from the experts by using questionnaire form and supported by interview. The findings showed that the framework consists of eight components such as quality assurance (mean=4.3212), instructional method (mean=4.2987), learning outcome (mean=4.2970), curriculum design (mean=4.2606), staff (mean=4.2242), facilities and support (mean=4.2000), assessment (mean=4.1465), and program needs (mean=4.1152). All components comprise 43 characteristics of sustainable development. Overall, the framework can be used as guideline to design and implement CTE programme to better equip the students to introduce and teach others with respect to sustainable development value and practices.
Introduction

Kofi Annan (2001) was, in fact, correct to say that the biggest challenge in the twenty-first century is to transform sustainable development from abstract to real for all the people in the planet (Bulmahn, 2004:25; and Velazquez, Munguia and Sanchez, 2005:383). For McKeown (2002), it is curious to note that it is still so difficult to envision a sustainable world to many parts of the world. Nevertheless, we can rapidly create a laundry list of problems to identify what is unsustainable in our societies such inefficient use of energy, lack of water conservation, increased pollution, abuses of human rights, overuse of personal transportation, consumerism, etc. Thus many experts and researchers concluded that TVET, as an integral component of lifelong learning, has a crucial role to play in this new era as an effective tool to realize the objectives of an environmentally sound sustainable development. Similarly, Wehrmeyer and Chenoweth (2006) also concluded that the implementation of sustainable development by society in part depends upon individuals being informed and educated about the interaction of environmental, social and economic issues, together with their relevance to individuals’ every day activities and work. Higher Education Institution (HEI) such universities and polytechnics have a major role to play by introducing sustainable development teaching into the curriculum across the spectrum of courses offered. However, McKeown argued that most of the time, education for sustainable development (ESD) was initiated by people outside of the education community. In many countries including Malaysia, ESD is still being shaped by those outside the education community. For example, the concept and content of ‘Sekolah Lestar’ are developed by ministries, such as those of environment and health, and then given to educators to deliver.

Paradigm Shift towards Sustainable Education in HEIs in Malaysia

There has been an increasing recognition of the role of universities in Malaysia like Universiti Sains Malaysia. There is applauding effort in USM in developing a sustainable development organization so called, Bahagian ‘Pembangunan Lestari dan Korporat’ - BPLK (http://healthycampus.usm.my). In 2006, BPLK has organized an international conference regarding ‘Education for Sustainable Development’ which participated by 120 experts of various field to identify practical solutions to current environmental, economic, social and cultural issues. Likewise, Universiti Kebangsaan Malaysia - UKM has also positive efforts towards sustainable development in campus in that, it introduced ‘Pelan Induk Kampus Lestari’, in addition to the existing Institut Alam Sekitar dan Pembangunan - LESTARI (http://lestari.ukm.my). According to UKM’s Vice Chancellor, in order for the university to be more effective under the rubric of sustainable development, it has to reorganize its structure and administration to establish specific portfolios to better interact with the community. Parallel to that, the ‘National Strategic Plan of Higher Education’, it highlights a vision to achieve sustainability in education. This is vital because the HEIs are being viewed as producers of skilled workers for country development. Therefore this area of research should be critical for Continuing Education (CE) centers(or providers) in HEIs because the centers have major concern to retrain or upgrade the human resource who are directly involve in the country development.

But the question is how to achieve greater relevance for current and future needs? According to McKeown (2002) and Nicolaides (2006), in order for a HEI especially CE center to become environmentally friendly, paradigm shift is required. As a primary concern, the importance of the environment should be integrated across all disciplines and perhaps even be the core of all education. The way CE centers conduct their programs operation will serve as a role model to students and will demonstrate to all the stakeholders in society that HEIs do care. CE centers also need to constantly monitor their performance as well as that of industry and make their findings accessible to the public. Hence, the aim is to lay the framework of a sustainable CE programs in HEI through links to the real world.
Continuing Technical and Vocational programs for Sustainable Development
As mentioned earlier, TVET is increasing its importance as part of leading innovation and change in higher education. The main objective of continuing Technical and vocational education is to help practicing engineers, technologists or technicians stay current with technological advances relevant to their current or future jobs and indirectly they are also involved in the country development. However, continuing Technical and vocational education faces some new challenges. One of the critical challenges common to all technical and vocational disciplines is the need for developing sustainable futures by not only introducing sustainable development into the curriculum across the spectrum of courses offered but also the programme itself must be sustainable. Although there are programmes that have successfully implemented skills into their curriculum, there are many factors that serve to hinder the philosophy of sustainability which may be contributed due to the non-existence of guideline in continuing education centers.

Industrial Skill Enhancement Program (INSEP) at UTHM: A Testimony of a Sustainable Continuing Technical Education
INSEP program is an innovative technical and vocational training offered to unemployed graduates for industrial skill enhancement where the activities is much more than students working through problems to come up with an excellent and successful project. The training goals of the INSEP was to prepare sustainable engineers, technologists and technicians with human, methodological, technical and lifelong learning skills. The INSEP program has dedicated itself to “reorienting continuing technical education” in order to produce engineers, technologists and technicians that not only “appreciate and understand the human condition” but also “proactive” and “competent problem solvers”. They are accomplishing their goals by using a multi-approach of training which integrates the ‘Project Oriented Problem Based learning’ (POPBL) and the spirit of the ‘Dual Training System’. This training innovation is very much developing their hands-on and generic skills through ‘learn by doing’ and ‘experiential learning’. The programme also empowers its students and encourages them to take charge of their own learning, by allowing them to direct learning experiences (e.g. homework, assessment) that best meet their needs. With the support of CEC, The INSEP students have successfully, manage and run few conferences and forum related to the sustainable development of the program and community. These activities educate and give awareness to all stakeholders with the goal for sustainable practices and to generate a sustainable community.

As a whole, INSEP has successfully enhanced graduates with the skills most lacking in them, ie. critical thinking skills and the ability to collect, evaluate, and utilize information, dealing with uncertainty and ambiguity in problem solving. All these are the very attributes of a sustainable employees and it has become a legacy of INSEP UTHM graduates.

Problem Statement
There was a worrying phenomena recently where quite a large number of graduates are entering the market place ill-equipped to deal with the problems of society and industries are facing (Noraini 2007). Thus, the modern engineers need to be equipped with the knowledge and skills to manage uncertainty and make judgments about the best course of action based on the available evidence which requires them to have strong problem-solving skills and to be able to evaluate the implications of their solutions beyond their immediate technical context (Huntzinger, Hutchins, Gierke and Sutherland, 2005). Change and innovations is required in universities to deliver sustainable programmes. However, a framework to guide for sustainable programme development is not available in most CE providers/centres especially in Malaysia. As a primary concern, the vital importance of the environment should be integrated across all disciplines and perhaps even to the core of all education. CE centers also need to constantly monitor their performance as well as that of industry and make their
findings accessible to the public. Hence, the aim is to lay a framework of a sustainable CE programmes in HEI through links to the real world. This paper offers a new paradigm for continuing technical education programs and proposes a framework for CE centers where sustainability is embedded in the curriculum. It will explore in the aspects of its outcomes, operational processes and structures, and its evolutionary processes which comprises of quality assurance, instructional methods, Learning Outcome, Curriculum design, staff, facilities, assessment and program needs. Further, this paper proceeds on the assumption that the core elements of the engineers’ role in modern society are project management, problem solving and solution development.

Research Objectives
The objectives of this research were:

(i) to determine the current level of sustainable program implemented in CE centers/providers in Malaysia
(ii) to develop a framework of sustainable CE programs

Conceptual Framework
The conceptual framework, as shown in Figure 1 (refer also Appendix 1), has been developed based on the major concern of CE centers to retrain or upgrade the people who are at works. The main idea of developing the appropriate framework came from the non existence of guideline in the local CE centers/providers about characteristics of a sustainable program oriented in HE organizations. After the analysis of program structures with respect to sustainable development, eight main components of the desirable framework were determined, i.e. quality assurance, instructional method, learning outcome, curriculum design, staff, facilities and support, assessment, and program needs (Malaysian Quality Assurance Division, 2005; National Accreditation Council, MoHE, 2005; Engineering Accreditation Commission-EAC, 2007; Hong Kong Council for Academic Accreditation-HKCAA, 2007; International Association for Continuing Education and Training-IACET, 2005; and Continuing Education Centre, UTHM, 2007). The main components consisted of dimensions of environmental, economic, social, and cultural (Ahmed, Hadj, Joseph and Mohamed Elzain.; Posch and Steiner, 2006; and Sammalisto and Lindhqvist, 2008).

Research Design and Methodology
The quantitative descriptive research design used in the present study involved questionnaires, interviews and document analysis. It was necessary to engage in both qualitative and quantitative data in this study to obtain the desired findings. The preliminary ‘main components of program structure’ of sustainable technical/engineering programme is discussed at several meetings and interview with
stakeholders of CE and validated by several experts of TVET. Further and extensive literature search provide with preliminary criteria of each component which were then again validated by experts.

**The Sample and Sampling of the Study**

The selection of the institutions was made on the basis of their being representative of the technical oriented institutions in Malaysia. The institutions were also being selected because of their involvement and key stakeholders in continuing technical programmes. The respondents in the study which were selected through purposive sampling, were staff and / lecturers/ directors or managers of CE at each of the selected higher education institutions in Malaysia. The researcher believe that this purposive sampling technique is useful for selecting a sample in relation to some criteria which are considered important for this study, i.e. the use of the best available knowledge of the sample with respect to TVET teacher training and programme accreditation (research in curriculum development, 1991). The sampling for the purpose of developing the subject recognition system concept was appropriate considering that the respondents are deeply involved either as teachers/ lecturers or managers. A total of thirty three (33) respondents were selected in this study.

**Modified Delphi Study**

A Modified Delphi Technique was used to answer the research questions. A key step in using the Delphi Technique is the identification and selection of the panel, since it is the panel’s opinions and judgments that determine the outcomes of the study. Individuals who are recognized as experts in the area being studied should be selected for panel membership in Delphi research (Helmer, 1983; Dobbins, 1999). Identifying individuals considered experts in the Sustainable Continuing Engineering/Technical Education (CEE) comprised the first step in the selection process. In dealing with experts, there are basically three rules that should be followed: select your experts wisely; create the proper conditions under which they can perform most ably; and if you have several experts on a particular issue available, use considerable caution in deriving from their various opinions a single combined position. In an effort to increase the validity of this study, experts from a cross-section of the continuing education practitioner who are actively involved in managing and defining the needs for effective continuing technical education development in Malaysia, were utilized. A basic criterion for selecting experts is that they should be extremely knowledgeable in the area they represent.

Three instruments were used in this study (Refer Table 2, Appendix 2. In Phase 1 of the Modified Delphi Study, the first instrument identified as Delphi Probe will be open-ended. The other two instruments is identified as Delphi Round I (Phase 2) and Round II (Phase 3). In this study, the Delphi Probe will be developed as an open-ended questionnaire to promote thoughtful and creative responses from the panel. After this step, based on the responses by the experts, appropriate changes will be made in the statements based on suggestions of the review panel.

In Phase 1, research instruments were developed from the analysis results of those related literatures and also inputs from experts through the Delphi probe. The experts were then asked to check the validity and reliability of the questionnaires which consist of eight components and 43 items. This resulted in the initial instrument for Round I of the study. Further to that, Panel members’ responses to Round I will be used to construct the Round II instrument. To assist in the development of sound conclusions and recommendations for the study, a criterion for consensus will be pre-established for the data. In the second round, the researcher delivered or e-mailed the panel of experts, materials that consisted of a cover letter thanking them for their support and continued participation, and the Round II instrument.

The Round II instrument consisted of the statements for which there is no consensus among the panel members in Round I. In order that comparisons could be made between the respondents personal ratings and the mean ratings of the panel, the rating scale included the individual’s prior ratings. Panel members will be asked to reconsider their previous answers and revised them if they desired.
Respondents will also be asked to state the reasons for any changes in their ratings. Panel members will be asked to return the instrument within a certain time (i.e. one week). The researcher will make personal or phone contacts with participants to clarify unclear or incomplete comments made on the questionnaires that might prove useful in data analysis. Since most Delphi studies have analyzed data by using a combination of means, median scores, and standard deviations (Dalkey, 1969; Uhl, 1983), for this study, the mean scores and standard deviations will be used to analyze the findings.

This ‘Modified Delphi Study’ was divided into three phases as follows:

**Phase I: Identification of main components of sustainable program structures through literature review, benchmarking and experts advice**

Components of program structures in six institutions such as Quality Assurance Division, Public Higher Institutions; National Accreditation Council, Ministry of Higher Learning, Malaysia; Engineering Accreditation Commission-EAC; Hong Kong Council for Academic Accreditation-HKCAA; International Association for Continuing Education and Training-IACET were purposively reviewed in the context of their experiences in CE or TVET. Research instruments were then developed from the analysis results of those related literatures. The experts were asked to check the validity and reliability of the questionnaires form conducted in eight components and 43 items.

**Phase 2: Development of the preliminary framework**

The sample consists of 33 experts consisted of high ranking administrators of the CE centers/providers and academic experts in TVET and sustainable development fields were purposively selected to verify and discuss the main components program structures with respect to sustainable development including their comments and suggestions. Besides, the experts were asked to rate the current level of ‘sustainable’ practices in their centers. Data in this phase was collected by Delphi technique. Qualitative data were analyzed using content analysis, and SPSS was used to analyze quantitative data. Descriptive statistic, mean and standard deviation were used in finding consensus among the experts.

**Phase 3: Evaluation of the appropriateness and the validity of the preliminary developed framework**

The sample was 25 experts from those who involved in the second phase. The sample was asked to evaluate the appropriateness, viability and validity of the preliminary developed framework, using the same questionnaire in the second phase.

**Findings and Discussion**

The data gathered were analysed and shown as in Table 1 and 2 (Appendix 1). The analysis showed that the current status of sustainable development practices in almost HEIs are at moderate level. Although there are programs that have successfully implemented skills into their curriculum, there are many factors that serve to hinder the philosophy of sustainability where there is little exposure and awareness towards sustainable development. This happens due to the non existence of guideline in the local CE centers. Perhaps this framework could help in the awareness and motivates for sustainable programme development. The findings also indicates that community colleges perceived that they are relatively sustainable as compared to polytechnics and universities (refer Table 1)

The analysis of the questionnaires and interviews of experts involved in Malaysian CE, converges into the following seven main components of program structures as follows:

(i) **Quality assurance** – the analysis indicate that the quality assurance contributes significantly towards reorienting undergraduate education towards sustainable development. As claimed by Wijeyaratne (2006), the Panels also agreed that the quality in continuing education has been identified as a multi-dimensional concept which embraces teaching,
academic programs, research, scholarships, staff, students, services provided to the community and the academic environment as a whole.

(ii) **Instructional method** - the panel claimed that the desirable instructional method include a combination of classroom lecturing, problem-based learning, field-based learning or experiences, some sort of integrated project, and interdisciplinary understandings of sustainability and environmental issues. Consequently, according to Farrel and Ollervides (2005), there is a need for people trained to work in an international setting, with a sound understanding of sustainability issues and the mechanisms for tackling them; or in a local setting with an international perspective. But, at CE level, sustainability education is often embedded within single-discipline subjects, rather than being taught per se as a separate subject (Leal Filho, 2002 in Buchan, Spellerberg and Blum, 2007).

(iii) **Learning outcome** - panels claimed that at the end of the lesson, students will be able to bring all the learning in the program into application in their work practice. Therefore, it must be noted that this research focuses on providing a necessary framework to guide the transformation from unsustainable to a sustainable CE program.

(iv) **Curriculum design** – As noted by Buchan, GD et al. (2007), the panels also claimed that employability skills is very important to be included in CE curriculum. While emphasizing the need for the students to master the subject matter, there is also a need to exposed or immerse the students in the reality of the work fields.

(v) **Staff** - the findings obtained show that education plays an important role in affecting how sustainable development can be achieved. Panels claimed that the effective way is promoting lifelong learning to the staff.

(vi) **Assessment** – In line with Buchan, GD et al. (2007), the panels noted that the students became too preoccupied with assessment, and they were not given the incentive to read widely around the subject. Therefore, they preferred assessment to be conducted in continuous rather than examination-oriented.

(vi) **Facilities** - in addressing the challenges to productive use of energy, panels claimed that is important for CE programs to be conducted in appropriate rooms according to the capacity of students.

(viii) **Program needs** - as education can increase productivity, empower women and change their status, decrease population growth rates, promote environmental protection, and positively influence the standard of living (McKeown, 2002), panels claimed that it is important to ensure CE program could reoriented education for better lifestyle.

The analysis of the data showed that the criteria of the eight components are of important (Refer to Table 2, Appendix 1).

The framework developed is shown in Table 3.

<table>
<thead>
<tr>
<th>TITLE</th>
<th>A Framework of Sustainable Continuing Education Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBJECTIVE</td>
<td>This framework is developed as guideline for executing sustainable CE programs in HEI</td>
</tr>
<tr>
<td>Components of CE program according to sustainable development priority</td>
<td>Characteristics of CE programs with respect to sustainable development dimensions such as environmental, economic, social and cultural</td>
</tr>
</tbody>
</table>
Quality Assurance
- Continuing education and training is provided to staff.
- CE program syllabus is revised for certain areas, for compatibility to fulfill the current market.
- CE program is audited by authorized unit.
- CE center has the sustainable development policy.
- CE program is observed based on sustainable development specification.
- Generate employability skills.

Instructional Method
- Integrate the human values.
- Practice health and safety procedures.
- Practice the ethical procedures in R&D.
- Practice the waste management procedures.
- Practice the student-centered method.
- Practice the problem-based learning method.
- Student will obtain employability skills.

Learning Outcome
- Student will be more concern on future needs.
- Student will practice critical thinking.
- Student will recognize the culture of every ethnic.
- Student will practice healthy lifestyle.
- CE curriculum consists of employability skills.

Curriculum Design
- CE curriculum consists of employability skills.
- CE curriculum infused certain topic regarding sustainable development within various subjects.
- CE curriculum offers a specific subject regarding sustainable development.
- CE curriculum is research-based.
- CE curriculum includes community services.
- CE staff practices life long learning.

Staff
- CE staff has education background in sustainable development fields.
- CE staff is motivated to do research on global problems.
- CE staff practices paperless campaign.
- CE staff put an effort to promote the social campaigns.
- Assessment is conducted continuously.

Assessment
- Assessment is based on employability skills.
- Assessment is based on ethical aspects.
- Assessment is based on social skills.
- Assessment is based on multi approach method which includes projects and examination.
- CE programs are conducted in appropriate rooms depending to the capacity of students.

Facilities
- Instructional resources are accessible to student.
- Consultancy services are provided without prejudice.
- Facilities used in CE center established environmental friendly products.
- Offer international level research opportunities.
- Aim of CE program is to reoriented education for better lifestyle.

Program Needs
- Aim of CE program is to provide life long learning.
- Objective of CE program is to enhance knowledge on sustainable development.
- Objective of CE program is to enhance the public awareness regarding future needs.
Conclusion
Current ‘sustainable’ level of CE programs have been recognized as a global priority although several barriers have been noted, including the difficulty implementing sustainability at the universities, polytechnics and community colleges level. However, these programs may represent a good alternative or otherwise help to supplement sustainable development education within higher education. More importantly, the flexibility of CE programs might facilitate the integration of environmental, economic, social and cultural issues; all of which are important dimensions of sustainable development. The research affirmed that the time has come for the other CE centers/providers to adapt and implement sustainable development value and practices.

Successful integration of sustainability into engineering curricula requires a change in the approach to education. Learner-centered environments are a prerequisite to the redesign of continuing technical education for sustainability. Because moving towards sustainability requires open-mindedness and collaboration with a broad range of stakeholders, including industry, government, students, and educators, a top-down approach to reform may not work. Therefore, incorporating sustainability into higher education requires a new “vision of possibilities” and an evolution in our way of thinking.

Recommendations to policy-makers and stakeholders of HEI, the voice from the academic experts must be heard concerning this very crucial issue includes creating an institutional framework or similar mechanism to develop a system or approach for community integration and involvement, and direct management activities towards sustainable development goals.
Appendix 1

Table 1: The Perceived Current Level of Sustainable Practice in CE Programs

<table>
<thead>
<tr>
<th>Components of Program Structures</th>
<th>Current Level of Sustainable Practice in CE Programs by Type of Institution</th>
<th>Overall Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>University</td>
<td>Polytechnic</td>
</tr>
<tr>
<td>Program Needs</td>
<td>3.3053 (Moderate)</td>
<td>3.6286 (Moderate)</td>
</tr>
<tr>
<td>Learning Outcome</td>
<td>3.4842 (Moderate)</td>
<td>3.6000 (Moderate)</td>
</tr>
<tr>
<td>Curriculum Design</td>
<td>3.4316 (Moderate)</td>
<td>3.2286 (Moderate)</td>
</tr>
<tr>
<td>Instructional Method</td>
<td>3.6992 (Moderate)</td>
<td>3.7551 (Moderate)</td>
</tr>
<tr>
<td>Assessment</td>
<td>3.4211 (Moderate)</td>
<td>3.5714 (Moderate)</td>
</tr>
<tr>
<td>Staff</td>
<td>3.4211 (Moderate)</td>
<td>3.6571 (Moderate)</td>
</tr>
<tr>
<td>Facilities</td>
<td>3.2947 (Moderate)</td>
<td>3.1429 (Moderate)</td>
</tr>
<tr>
<td>Quality Assurance</td>
<td>3.1053 (Moderate)</td>
<td>3.3143 (Moderate)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.3953 (Moderate)</strong></td>
<td><strong>3.4872 (Moderate)</strong></td>
</tr>
</tbody>
</table>

Table 2: The Main Components of Program Structures with Respect to Sustainable Programs

<table>
<thead>
<tr>
<th>Main Components of Sustainable Program Structures</th>
<th>Mean Score</th>
<th>Standard Deviation</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Score</td>
<td>Importance</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------</td>
<td>------------</td>
<td></td>
</tr>
</tbody>
</table>
| Quality Assurance     | 4.3212|明星
| Instructional Method  | 4.2987|明星
| Learning Outcome      | 4.2970|明星
| Curriculum Design     | 4.2606|明星
| Staff                 | 4.2242|明星
| Facilities            | 4.2000|明星
| Assessment            | 4.1465|明星
| Program Needs         | 4.1152|明星
Figure 2: Research Design (Adapted from Wiersma and Jurs, 2000; and Seehanath, Kanjanawasee and Pitiyanuwat, 2006)
References


