Development of MSc. in Nuclear Engineering via Knowledge Sharing and Transfer Mechanism: A UTHM-ANM Collaboration

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ABSTRACT

The design and delivery of an academic programme have always been perceived as the sole responsibility of an institution of higher learning. The ease and speed of internet access coupled with the seemingly limitless communication powers has perhaps made obsolete the cliché of a world without boundaries. To attempt to create competitive yet timely relevant academic programmes within the solitary confines of a university is an uphill, if not impossible task these days. The expertise stemming from specific knowledge and skills cannot always be found in the university, and to expend in an in-house talent pool would incur exorbitant costs barely justifiable in these era of tightened purse strings. An alternative to continuously develop and offer quality and relevant academic programmes within these limitations is with the share-and-transfer mechanism established between the university and an expert research institution. UTHM has joint effort with Agensi Nuklear Malaysia (ANM) using this strategy to develop the MSc. in Nuclear Engineering programme. The complementary and symbiotic partnership have enabled the development of a programme which is simultaneously offering forefront technological and knowledge advancement in nuclear engineering, bridging the expertise gap in the University and enriching the in-house talent pool with external connections. This paper describes the programme’s developmental processes, challenges and greater vision for nation building.

Keywords: university, academic programme, industry, knowledge sharing and transfer.

I INTRODUCTION

The very existence of a university is substantiated by the need for a place of higher learning, to acquire advanced knowledge and skills for self betterment and most likely, career advancement. Hence the academic programmes offered by a university is in a way ‘market-driven’, with the industries serving as a sounding board for identifying gaps in highly trained personnel and workforce. The industrial needs, on the other hand, are driven by the blueprint for nation building and economic sustainability. This unique inter-relationship (Figure 1) has placed universities in a critical, if not pivotal position, as these institutions of higher learning are the very place where the nation’s talents are nurtured and skilled workforce is cultivated. Without institutional support to accommodate and enable the creation and enrichment of our talent pool en masse, especially in advanced technology and knowledge, the chasm between expectations and results will only grow larger.

In today’s world of minimization due to both the depleting natural resources and a growing conscience for austerity, it is almost unthinkable for a university to assemble an expert team in-house for every other academic programme required. Yet there is a multitude of existing highly qualified and experienced professionals in administrative offices, agencies and research establishments throughout the country with an untapped wealth of knowledge. These people are not unlike live repository of expert knowledge and knowhow, waiting to be roped into the graduate education system where their brains could be, literally, picked.

After all, knowledge management is propounded to be a continuous process of managing knowledge in anticipation of current and future needs (Carrillo et al. 2004), involving the processes of creation, acquisition and utilization of the pooled knowledge (Laurie 1997). By involving experts from outside the university could kill two birds with one stone, i.e. (1) to fill in the lecturing positions of certain knowledge area in academic programme required. Yet there is a need for institutional support to accommodate and enable the creation and enrichment of our talent pool en masse, especially in advanced technology and knowledge, the chasm between expectations and results will only grow larger.

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Figure 1. A Market-Driven Higher Education For Nation Building

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It is perhaps not wrong to add the term ‘optimisation’ in the definition of the management philosophy, when sharing and leveraging what we know as a whole instead of separate standalone entities (Gurteen 1999) actually sets in motion a mechanism of coordination to convert the pooled resources into capabilities (Darroch 2005). The university, housing students, providing facilities and amenities as well as administering the academic records, is most apt to play the role of coordinator in a university-industry collaboration to maintain the programmes after their first inception.

Knowledge untapped and unused remain useless and non-beneficial, where they need to be converted to tangible and rewarding outputs with the aid of suitable infrastructure and delivery system (Duta et al. 2005). As such, one should not overlook the importance of the proper management of knowledge in preventing the stagnation and deterioration of intellectual assets, where a good knowledge management system could effectively enhance the collective intelligence and organizational adaptability of a university by providing it with a competitive edge (Grant 1996).

It is with this pretext that the University has initiated collaboration with Agensi Nuklear Malaysia (ANM) to develop a graduate programme in Nuclear Engineering, which does not cater only for the power industry, but a larger economic prospect for Malaysia and the region. The following discourse puts the programme development process into the context of knowledge management, with a knowledge sharing and transfer perspective.

II MECHANISM: HOW DID IT WORK?
In order for the knowledge residing outside the University to be channeled into the system, some form of robust connection needs to be established. The connecting corridor has to enable a 2-way flow of ideas, actions and responses. The extent of the accessibility of the transfer mechanism will ensure effective sharing of knowledge between organizations, such as highlighted by Cohendet and Meyer-Krahmer (2001).

Figure 2 illustrates the general programme development pathway between UTHM and ANM to facilitate knowledge sharing and transfer. It is apparent that the 2-way interaction encompasses all the inherent characteristics of both organizations, i.e. the good and the bad, and bound by certain shared limitations as both are public organizations. The communications between the organizations were arguably the determining success factor of the joint effort, in the entire process of knowledge transfer: initiation, implementation, ramp-up and integration (Szulanski 2000). On-going exchanges, adoptions and adaptations of ideas involve high levels of accommodation, motivated by the growing sense of belonging in a team as well as the reward awaiting at the end of the endeavour. Regular face-to-face meetings and other forms of communication help to ensure multiple iterations and feedback, creating a strategic collaborative mechanism for the free flow of ideas in both directions (e.g. Inkpen & Dinur 1998, Nobeoka 1995). A number of workshops and meetings were organized between UTHM and ANM throughout the development process, with invaluable bartering of information and ideas, friendly arguments and decision-making, leading to the final product mutually agreed upon.

III COMPONENTS: WHAT WERE INVOLVED?
Depending on the ultimate aim of collaboration, the output from a knowledge sharing and transfer exercise may vary from case to case. So are the components involved. For instance, Tai et al. (2012) proposed a framework which links the learning organization and performance with knowledge management to gauge the performance of public learning organisations in Dubai. For the Multimedia Super Corridor initiatives in Malaysia, Tasmin & Yap (2010) reported that the effectiveness of knowledge management depend on culture, information technology, organizational structure and people. Deriving from case studies of the global trend in knowledge management, Bhojaraju (2005) categorised the components of knowledge management into classes of people, process and technology.

From these examples, it can be noted that the frequently mentioned key component is the ‘people’ (Figure 3). In the case of the UTHM-ANM partnership, this could not have been more true. It ought to be reminded that the industrial expertise lies with the ANM scientists, who have been immersed in scientific investigations and research works for years, with a vast reservoir of knowhow and experience to be shared. While the output of their superb work has no doubt made significant contributions and advancement in various applied areas, the invaluable insights and knowledge behind the discoveries would remain...
In an academic programme, with an extensive knowledge repository for both institutional and public support, it helps spur novelty in research. An organized platform for cooperation between the institutions provides a sturdy and robust foundation for both institutional and public support. This cycle continues, with the income generated used for further research, making new findings and creating state-of-the-art discoveries, enriching the knowledge repository for both enhancement of the programme and expansion of the useful applications.

IV STRUCTURE OF PARTNERSHIP

Figure 5 summarizes the partnership between the two organizations. Essentially, it takes into account the factors and components common to both parties and these can be generally seen as the organizational and human aspects. The pyramidal model indicates a foundation lain by both the combined effort of both institutions, providing a sturdy and robust support for the programme as built from scratch. Referring to Figure 3 and discourse in the previous section, it is apparent that the most valuable and crucial component of ‘people’ would be relying on this foundation to ensure the success of the collaboration. Included in the figure are the sub-components or factors.

The people of both institutions are experts in their respective fields, with the scientists from ANM transferring the knowledge and expertise to the programme, and the academic staff from UTHM transforming and acclimatizing the body of knowledge into an organized standard deliverable format, with aligned educational objectives and learning outcomes (section V). In order to optimize on the talents and expertise of the human resources, the organization is obliged to take into consideration the expectations and cultural diversity of the people. These include the personal characteristics and collective traits borne of the diverse background they hail from.

As the people reside in the respective institutions with respective inherent features, the collaboration effectively merges these sub-components in a shared environment for co-existence. Differences of the organizational culture, working climate, technical support, IT services and infrastructure between the organizations are homogenized and optimized to suit the needs of the joint endeavour. The strengths of one organization are utilized to compensate for the lack of the other, thus avoiding duplications by enabling more leverage in the available resources with minimal additions. This inculcates the culture of sharing, adapting and assimilating of resources between the organizations which are both public funded. This is documented but not promulgated or bequeathed to the next generation.

With an academic programme, that is assiduously designed and structured in a methodical manner, continuously improved and refined while being delivered to the public, the deposited knowledge would be assured a formal channel for transfer to greater good. Moreover, a university, entrusted with the task as the custodian of academic excellence, is granted the legitimate authority to award degrees. It follows that a partnership as such would make the knowledge transfer exercise even more attractive, if not lucrative to all involved.

As illustrated in Figure 4, the jointly developed academic programme has positive repercussions to both institutions in the long run. A vibrant academic environment would help spur novelty in research, breaking new grounds for further expanded work. The exemplary teaching and learning as well as research activities would win accolades as due recognition of the quality and relevance of the programme offered. A good academic programme, appropriately delivered, would also help assuage the often misplaced concerns on the danger of nuclear power and related studies. If knowledge is power, then people would be moved to enrol for the distinguished programme and to obtain such noteworthy knowledge, resulting in monetary gain for the programme providers, i.e., the university and its partner. The cycle continues, with the income generated used for further research, making new findings and creating state-of-the-art discoveries, enriching the knowledge repository for both enhancement of the programme and expansion of the useful applications.

Figure 3. Components In Knowledge Management (Adapted From Various Authors)

Figure 4. Greater Good Generated From The Partnership

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achieved with much coordination between the management team of both organizations, to consolidate the resources for drawing out the best performance from the staff.

Management aside, it is also of importance to introduce a fair and accessible motivation and reward system. This allows for self reflection and assessment space for the staff, especially in the face of rising work pressure, for instance. It is of comfort to know that there is a place to turn to for advice and motivation, simultaneously creating a work environment which portrays institutional support for the wellbeing of the staff. Such a caring atmosphere would instill a strong sense of belonging among the workers, invariably leading to improved productivity and performance. The reward system, on the other hand, is aimed at making public recognition of the staff’s achievements. Knowing that one’s work is appreciated and recognized is a significant driving force to maintain and enhance the performance level of an organization. Of course, the satisfaction of transferring one’s knowledge and experience into physically deliverable forms, such as the curriculum and syllabus of the programme, surely is a reward on its own. The long term rewards would be reaped by many others, far and wide, unforeseeable for now but of certainty in time to come.

V PUTTING INTO CONTEXT: MSC. IN NUCLEAR ENGINEERING

Certain standards and qualifications must be attained before a master’s degree can be awarded. The Malaysian Qualification Agency (2012) clearly stipulates that in the relevant standards. Essentially, a qualified graduate should be able to demonstrate the mastery of knowledge of the field of study. The practical skills gained in the study should be applicable in the respective fields with creativity and innovation. A keen awareness of societal needs and the ability to response accordingly is expected of the graduate too. The programme should also groom the students to be law-abiding citizens, always conscientious and self regulating, and able to perform his or her duties in accordance with the ethical and professional codes of practice with minimal supervision. Leadership among peers as well as the community at large in formulating effective solutions to problems in various disciplines is within the expectations of a graduate too. In addition, the thirst and quest for knowledge should be a lifelong indulgence, a realization gained while in the programme and practiced throughout the graduate’s life.

The programme educational objectives, as envisaged after half a decade of completing the study, are as follows:

1. To contribute to the development of knowledge and nuclear engineering technology via research, consultation, writing and publication- knowledge and skills.
2. To recommend effective solutions to problems associated with nuclear engineering- humanity skills.
3. To implement knowledge and technological transfer to the community in an ethical and effective manner- humanity skills.

As for the learning outcomes to be attained immediately upon completion of study, i.e. programme learning outcomes, 8 targets have been identified to reflect the overall achievement and competencies of the graduate. A well trained graduate should be able to:

1. elaborate on the principles of nuclear engineering via the teaching and learning processes (knowledge).
2. identify and analyze problems, develop solutions and improve nuclear plant operations (technical skills).
3. deliver advanced technical concepts in oral and written forms (communication skills).
4. analyze and resolve issues on the operations and maintenance of nuclear plant infrastructure in a creative, innovative and effective way (critical thinking).
5. effectively play the roles of both member and leader in teamwork (teamworking).
6. practice lifelong learning and information management effectively (lifelong learning and information management).
7. study and resolve safety as well as environmental issues in a responsible and ethical manner based on standards and best practice recommendations (professional ethics and moral values).
8. incorporate and implement leadership qualities in the management of project and work teams (leadership).
Job prospect for the graduates does not lie within the narrow confines of nuclear power industry alone. As shown in Figure 6, there is more to nuclear engineering than commonly perceived. The World Nuclear Association (2013) highlighted the inter-dependency of the global energy and environment development, where a sustainable energy system is feasible with wide benefits, but advanced technology is slow in development for the clean energy sector, hindered primarily by the high costs incurred. Nonetheless investment in clean energy makes economic sense, for every additional USD dollar spent in the respect would generate 3 USD in future fuel savings by year 2050. Hence energy security and the mitigation of climate change are inseparable issues, though they are often regarded as contesting matters on opposite sides of a coin, with emphasis on one resulting in the inevitable negligence of the other. The programme may not solve such complicated issues, but it certainly helps to educate people from various disciplines and areas of expertise, with direct or indirect contact with nuclear engineering, to at least eliminate the sometimes irrational fear and resistance towards the very likely power source for man’s survival in the foreseeable future. In a way, it would make a success story of transferring knowledge of rocket science level to layman’s terms, a real democratization and popularization of expert knowledge.

VI CONCLUSION

Driven by the nation’s economic needs, UTHM has collaborated with ANM to develop a master’s programme in nuclear engineering. The process depicts a remarkable knowledge sharing and transfer mechanism, though not without glitches. The result was a competitive and relevant academic programme, with a feasible curriculum design and delivery system. The mechanism and components of knowledge sharing and transfer involved were elaborated in the paper, within the unique merged organizational platform with shared facilities and human resources. Finally a summary of the programme developed was given, in line with the requirements of the latest educational standards. In a nutshell, the UTHM-ANM joint programme exemplifies an unconventional form of knowledge transfer mechanism, which optimizes physical and human resources by complementing the strengths and weaknesses of one another. It may be a strategic solution to overcome the impedance of academic development and expansion in local varsities due to financial constraints in today’s challenging economic conditions.

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