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Investing in Higher Education, and Its Potential Impact on Research and Development for Technological Upgrading, Innovation, and Competitiveness

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Abstract: The aim of this paper is to review the state of higher education development in ASEAN and formulate how research and development should proceed post 2015 to ensure technological upgrading, innovation and competitiveness.

Keywords: Higher Education, Research and Development, Innovation

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1. Introduction

Investment in higher education has long been viewed as a means for ensuring economic stability for future generations. With the advent of the ASEAN Community in 2015, opportunities abound for technological upgrading, innovation and the opportunity to compete with other regions on a global scale. Alas, all the ASEAN Member States (AMS) except Singapore currently invest far less than the UNESCO-recommended level of 1 percent gross expenditure on research and development. Therefore, it is paramount to establish a strategic initiative to ensure that appropriate revenues are earmarked for research and development within the region to create a knowledge-based economy that is globally competitive.

This paper begins by reviewing higher education in various regions in order to determine specific lessons to be learned as the ASEAN Community moves towards higher levels of enrolment. From there, using the goals and objectives outlined in the ASEAN Socio-cultural Community Blueprint, specific targets to pursue are discussed. Finally, the paper addresses ways in which an excellence initiative post 2015 could contribute greatly to the development of not only the ASEAN University Network but also the six flagship programmes currently in place. It is hoped that the ideas expressed here will be an aid in advancing the ASEAN Community as an integral member of the global marketplace.

2. Leapfrogging to a New Model of Higher Education

According to the University of Minnesota's leapfrog initiatives website, leapfrogging 'means to develop long-term goals to get ahead of the competition or the present state of the art through innovative, time-and-cost-saving means. Leapfrog denotes leadership created by looking and acting over the horizon. Leapfrog first acts to create proximal futures, and then solidly grounds the most promising futures within the present' (Harkins, 2009). There is no need for the ASEAN Community to establish a higher education system that replicates the one currently in existence. Rather, the ASEAN Community has the unique opportunity to leapfrog to a new vision of higher

education utilizing the lessons learned from other higher education systems to create a promising future post 2015. Just as in Japan where the mobile-phone industry leapfrogged the PC market by creating innovative products that could compete in the global marketplace, so the ASEAN Community has the ability to leapfrog to a new system of higher education. This system will provide the region with a people-centred and socially responsible education framework to narrow the development gap and allow the welfare of all people to be enhanced.

Higher Education in the United States and the United Kingdom

A cursory glance at 'The Times Higher Education World University Rankings 2014–2015' shows that the top 11 universities are all situated in the United States or the United Kingdom. While these universities have much to praise, the cost of higher education takes a heavy toll on the students and their families. Upon graduation in 2012, the median student debt for a graduate of a private university in the United States was USD 24,460 and USD 18,680 for a student from a public university. With a price tag of USD 68,050 for just one academic year at Harvard University, it is obvious that this system of higher education can only benefit an elite few.

With increases in enrolment fees comes student frustration and scepticism. According to The Higher Education Policy Institute, 33.1 percent of first and second-year British university students felt that their course was very poor or poor value for the money in 2014, compared with a figure of just 18.3 percent in 2012 prior to the increase in fees (HEPI 2014, 6). With the stated goal of needing to narrow the development gap in the ASEAN Community, an overpriced higher education system makes no sense. Thus the lesson learned from higher education in the United States and the United Kingdom is that it is paramount for ASEAN to find a way to offer students a quality education that is affordable and allows them to enter the workforce without a millstone of debt.

Higher Education in Oman

Oman is a relatively new higher education system in which 'enrolment in private higher education went from none in 1995 to 20,353 in 2007' (Al-Barwani, *et al.* 2011, 135). With an annual output of 40,000 higher education graduates, this number is far

greater than the number of jobs currently available. In fact, unemployment is actually lower for people without higher levels of education although their wage levels and conditions are substantially lower. A further problem for Oman is to ensure the longer-term sustainability of its higher education system as it moves from a system that was largely supported by oil revenues to one with a 50/50 ratio of support from the Government and the private sector.

Oman thus provides two very important lessons. First and most importantly is the necessity to develop higher education in tandem with employment opportunities. Investment in higher education, whether by government, parent or individual, stems from the belief that upon graduation better opportunities will exist. This must be the cornerstone for investment in higher education. The second lesson is to approach funding with a strategic initiative. Within the ASEAN Community, the source of funding for GERD (Gross domestic spending on research and development) varies greatly from 91 percent government funding in Brunei to 84.5 percent funding from business enterprises in Malaysia. Lao PDR receives over half its funds from abroad, while Cambodia receives 43 percent from private non-profit organizations. One question that needs to be addressed post 2015 is whether there is a need for a united approach to securing sustainable GERD funds and, if so, how this funding will remain sustainable.

Higher Education in Europe

Europe has seen the development of two vast intracontinental opportunities for students of higher education within the past 30 years. The first launched in 1987, is the Erasmus Programme in which students are encouraged to study abroad for anywhere from three months to an entire year in one of 37 participating countries. The second is the Bologna Process, which began with 29 Ministers of Education signing a declaration in 1999, creating the European Higher Education Area and the European Credit Transfer and Accumulation System (ECTS). The Bologna Process allows not only Europeans to be able to study and work easily from one European country to another, but also encourages those outside Europe to consider the attractiveness of studying and/or working in Europe.

It is important however to realize that these two initiatives have a different philosophical and political focus. The Erasmus Programme involves two institutions trusting one another to provide a student with a unique opportunity to learn about another culture and then be accepted upon return to their home university to continue studying. The Bologna Process is more focused on ensuring quality assurance for an accepted system of credit transfer between institutions. According to Nørgaard (2014, 106), 'Erasmic integration celebrates diversity. Bolognian integration superficially tolerates diversity, at best, but really undermines it. Both forms of integration promote peace in Europe, one may say, but they are different forms of peace. Whereas the Erasmic peace is quite trustful and pluralistic, the Bolognian peace is more bureaucratic and monotonous.' With the development of the ASEAN Credit Transfer Systems (ACTS) and 'sandwiching' opportunities for students to study throughout the ASEAN Community, it is imperative to go forward with a philosophy that matches the goals and objectives states in the ASCC Blueprint.

Summary

The task post 2015 for investment in higher education is clear. Examining lessons that can be learned from various higher education systems, it is most advantageous for the ASEAN Community to leapfrog to its own system of higher education based on the ideals stated in the ASCC Blueprint. This proximal future is one in which 1) higher education is affordable and considered to be of high value to its students; 2) graduates are assured job placement in a career that merits the investment made in higher education; and 3) opportunities to study and/or work within the ASEAN Community are consistent with the philosophy of building a strong foundation for greater understanding, good neighbourliness, and a shared sense of responsibility. By imaging this future, the path forward can now be constructed with specific references to the ASCC Blueprint on meeting stated goals and objectives by providing designated targets to meet for technological upgrading, innovation and competitiveness.

3. Unity in Diversity—The ASEAN Approach to Higher Education

There is little doubt that recent technological advances have forever changed the way education is viewed. Many noted educationalists such as Cathy N. Davidson (2011) and Sir Ken Robinson (2011) lecture internationally on the need for a paradigm shift in the way we view education in general and higher education in particular. Entrepreneur Ben Nelson is trying to challenge legacy institutions with his university entitled Minerva, which uses an online platform to teach a student body in the most scientifically proven means to learn. Classes are interactive without lectures and students reside in a different international city each of their four years of study. In its first year of operation, Minerva has 'no faculty offices, research labs, community spaces for students, or professors paid to do scholarly work' (Wood 2014, 54) nor plans to develop them. It is characterized by stripping education down to the very essence of what higher education should be.

This then begs the question: what is the essence of higher education for the ASEAN Community? According to the ASCC Blueprint, innovation and entrepreneurship are to be encouraged. In addition English language, as well as ICT and applied science and technology, is to be promoted through socio-economic development activities resulting in human-resources training and capacity building. Through the strategic objective of an ASEAN identity based on friendship and cooperation, activities include technical assistance programmes for teaching staff, education networking through creating research clusters, exchange of cultural performers, semester or year abroad programmes, promoting life-long learning, enhancing IT skills of the workforce, and developing gender-responsive skills training programmes.

In order to realise the goals and objectives stated in the ASCC Blueprint, a model for higher education in ASEAN is suggested in Figure 1. It consists of four interconnecting modules for learning: academic foundation; community service; regional placement; and incubation. The following section defines each of the four modules, giving specific country examples to pursue in the establishment of this ASEAN approach to higher education.

Academic Foundation

No matter in which ASEAN Member State a student pursues his/her higher education, there needs to be a core foundation of academic integrity. Significant progress has already been made in this area through the work of the University of the Philippines Open University ASEAN Studies Graduate Program. As explained on the website, the framework for this program 'was jointly developed by five Open Universities in the ASEAN region, namely, Hanoi Open University (Viet Nam), Open University of Malaysia (Malaysia), Sukhothair Thammatirat Open University (Thailand), Universitas Terbuka (Indonesia) and University of the Philippines Open University (Philippines). In the spirit of the One ASEAN, students are given the opportunity to take courses in any of the collaborating ASEAN Open Universities following the UP Policy for cross enrolment' (UPOU, 2014).

All coursework is conducted in English and the first semester for enrolment was in May of 2014.

Figure 1: The ASEAN Approach to Higher Education

This form of collaboration is exactly what is needed for the academic foundation of undergraduate higher education in ASEAN. Working together, universities can

establish a core section of courses to be offered in English to the entire student body. To encourage non-native English speaking faculty to enthusiastically pursue development of this course of study, incentives could be either financial or a reduction in course load during the development and teaching of the English curriculum. Once an English core curriculum is established, students not only from ASEAN but also other international students could then be recruited. For the successful development of research clusters, it will be necessary to nurture an international student body and maintain contact with these students in the form of international alumni associations.

Community Service

While the importance of a strong academic foundation cannot be underestimated, innovation and entrepreneurship cannot be taught within classroom walls. It is only through experiential learning that a student can develop the skills necessary to think outside the box and meet the needs of a potential global marketplace. This approach has been defined by Paul Polak and Mal Warwick (2013) as Zero-Based Design. In order to create innovative products, it is first necessary to listen to what is really needed by going and speaking to the people who may potentially use those products and/or services. Starting from zero—not knowing what is wanted or needed—potential designers can learn by listening. In this way, Polak's International Development Enterprises (IDE) has developed products such as treadle pumps and small farm drip–irrigation systems at prices that are affordable even to the very poor.

Universities in the Philippines have as a cornerstone community service. Students adopt a community for one semester. Starting from zero, they go in faculty led teams to listen to people in the community. Then they return to the university to conduct research and devise a plan of service for the specified community. Once they have devised a faculty-approved plan, they return to the community and live there while completing their term of service. Accommodation may be as simple as a gymnasium floor. However, through living in the community, and listening to the people there, students are able to develop the necessary basic skills of entrepreneurship.

If the ASEAN Community is serious about trying to narrow the development gap, this learning experience should be required of each university student. By bringing university students into the community as dedicated volunteers, communities will

develop an appreciation for the role of universities in building a caring and sharing society. Students will be rewarded with not only the skills to think outside the classroom walls but also an understanding of how to create products and/or services that are necessary and applicable in furthering the development of their adopted community.

ICT training programmes would also prosper under a canopy of student-community service. When it comes to technology, at times the younger generation far excels their instructors in how to adopt new systems of knowledge creation through designing software, applications and infiltrating technology for daily use. Richardson (2007) worked on Establishing the Effective Use of ICTs in Education for All in Cambodia. One of his findings was the necessity for Khmer software support and a Khmer keyboard in order for first-time users to learn how to effectively use ICT. University students could be charged with the creation of such software and hardware as part of their community service. In this way, students would be able to learn entrepreneurial skills of creating a product and formatting the design while the designated community would learn the benefits of ICT without the additional hurdle of having to do so in a second language. While just one example, this illustrates the vast potential available for creating win-win opportunities from requiring university students to complete a semester of community service within their required curriculum.

Regional Placement

After a university student has completed at least two semesters in an academic foundation course and one semester of community service, the student is now ready for regional placement. This can be realised in the form of anywhere from a semester to a year of study in a second ASEAN country. Whenever possible, arrangements should be made for a student to attend a program in the second country that will allow for future research collaboration.

A JICA Research Institute Working Paper (2010) on Cross-Border Higher Education for Regional Integration found that 'within the setting of ASEAN+3, the issue of integration (or harmonisation) in higher education has not yet been prioritised' (Kuroda, *et al.*, 2010, 32). Northeast Asia has developed an Asian version of Erasmus but the scale is still very small with the aim of exchanging only 120 graduate students

within four years of FY2012. The program is called CAMPUS Asia (Collective Action for Mobility Program of University Students in Asia) and is funded by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). Significant work has been done to establish double degree programmes and credit transfers between universities in Japan, China, and South Korea. With CAMPUS Asia the groundwork has been done to establish an ASEAN+3 regional placement system and this should be a high priority post 2015.

There is also increasing support in the region for triangular relationships that utilise the know-how and technology of one/several developing countries with the financial support from one/several developed countries to provide assistance to transfer technology and knowledge. The China Medical Board Myanmar Fellowship Program for Myanmar Scholars to study at Mahidol University is one such example. These programmes are more cost effective and provide the added benefits of strengthening the notion of self-reliance in southern countries (Mahaisavariya 2014). They are also an avenue to expand the already occurring 'Sandwich' programmes in ASEAN.

In any case, regional placement should be a key component of undergraduate education whenever possible. With universities forming partnerships, such as Yale-NUS, that guarantee an opportunity to study abroad or have an overseas internship, there are ample lessons to be learned from AMS universities already offering such programmes. Furthermore the extensive work of the AUN in establishing an ASEAN Credit Transfer System (AUN–ACTS) and the provision of multiple scholarships make regional placement a valid option for all post 2015.

Incubation

The cornerstone for an undergraduate post 2015 education should be the ability to participate in an incubation programme. Students who gained basic entrepreneurial skills through community service and a greater appreciation of the region through a semester or year of study abroad, are now ready to hone these skills in incubator programmes. University-based incubators allow students an environment in which 'access to innovation programmes and startup resources fosters entrepreneurial spirit

distinct from many post-secondary programmes that are geared toward helping graduates land their first job' (Johnson, 2012).

Focusing on tech entrepreneurship, the Digital Media Zone of Ryerson University in Canada is open to not only Ryerson students but also to any start up that cares to apply. It is just one of many university-affiliated incubator programmes in Canada, with others being the University of Waterloo's VeloCity, as well as their Communitech Hub, Memorial University of Newfoundland's Genesis Centre, Simon Fraser University's Time Ventures and OCAD's Mobile Experience Innovation Centre. As each incubator draws a different clientele, establishing such a network of university-affiliated incubator programmes across the ASEAN Community would propel technological upgrading, innovation and entrepreneurship so that graduates would be able to design start-ups and products that would increase ASEAN's competitiveness as a contributing member of the global marketplace.

Summary

In examining the goals and objectives stated in the ASCC Blueprint, it is important to rethink the essence of higher education by incorporating lessons learned from other university systems. The current practices of 'chalk-and-talk' and rote learning will not result in graduates capable of being competitive on a global scale. Rather, students need to be supplied with not only an academic foundation but also the opportunity to develop entrepreneurial skills, which can only be acquired through a variety of learning experiences. This need can be met by providing each student the opportunity to participate in community service, regional placement and incubation.

While this may seem to be a vigorous undertaking, the AUN is already in position to address this challenge. Working together, AUN could incorporate an ASEAN Approach to Higher Education at each of its member institutions, utilising the modules it has already developed as the academic foundation and the AUN–ACTS for regional placement. These universities would then be charged with the task of teaching at least two other universities within their individual countries how to incorporate the new curriculum. Once a university in this second tier of implementation has adopted the new curriculum, it would then continue the learning process by reaching out to at least two other universities within the country. By incorporating this kind of cascade

approach, the number of universities able to adopt an ASEAN approach to higher education will increase exponentially within a very short time span.

Investing in higher education through a unified ASEAN approach post 2015 will supply the workforce with capable individuals confident in their ASEAN identity and able to serve as contributing competitive members on a global scale. It will strengthen the collaboration between universities and thus lead to the realisation of an ASEAN R&D Institution Network as the above stated programmes are put into operation across the region. This will in turn guarantee collaboration on securing the necessary R&D funding by each of the AMS. Having a unified vision of the outcomes for higher education, strategic initiatives will solidify into concrete avenues to develop rather than reside as lofty inspirations on paper.

4. Recommendations for Post 2015

The ASCC Scorecard outlines the current status of achievement on the stated goals and outcomes for the ASEAN Community which includes six flagship programmes that are on-going and contributing towards the development of a regional implementation mechanism. The following section discusses how incorporating excellence initiatives for higher education institutions post 2015 could implement not only the ASEAN Approach to Higher Education but also further develop the current flagship programmes and contribute to the 'Open Innovation' scheme through shared R&D facilities and information across ASEAN.

An important question to ask moving post 2015 is what is the cost of higher education in the ASEAN Community and how does it compare with other countries? Higher education is expensive. While 94 percent of total expenditure per student is devoted to core educational services at the primary and secondary levels of education, much greater differences are seen at the higher education level because of expenditure on R&D, which represents an average of 31 percent of total expenditure in OECD countries (OECD, 2013). When R&D expenditure is included, higher education costs nearly twice as much per student than at the primary level. Removing R&D expenditure, the expenditure per student on core educational services is USD 8,889 on

average and still 10 percent higher than other levels of education. In the United States this amounts to USD 19,000.

Table 1 shows the public expenditure per student on higher education as a percentage of a country's GDP per capita, in PPP US dollars, and as a percentage of public expenditure on total education. The United Kingdom and the United States have been included for reference in regards to the earlier section on lessons learned. Brunei Darussalam spends more in PPP US dollars than the United Kingdom on higher education, although, Brunei Darussalam's enrolment rate of 24 percent is considered relatively low and far less than the United Kingdom's 62 percent (World Bank, 2015). Singapore spends slightly less than the United Kingdom but this solid investment accounts for its being home to two top-ranked universities, NTU and NUS. With the recently established Singapore University of Technology and Design, the number of researchers and engineers has grown significantly resulting in the largest number of registered patents as well as scientific publications, in the ASEAN region.

Table 1: Expenditure per Student on Tertiary Education

Country	% of GDP per capita	In PPP US dollars	as % of total education
Brunei Darussalam	32.2	15,905	
Cambodia	27.8	606	14.5
Indonesia	23.8	1,088	18.9
Lao PDR			
Malaysia	60.9	9,753	37.0
Myanmar	11.8		19.1
Philippines	9.7	366	12.0
Singapore	27.9	14,232	35.6
Thailand	21.3	1,909	13.8
Viet Nam	39.8	1,353	14.7
United Kingdom	25.6	15,862	44.0
United States	20.9	25,576	52.0

Sources: OECD (2013); UNESCO (2014).

The least amount spent is USD366 at PPP in the Philippines which is almost half the amount spent by Cambodia. The Philippines recognizes the need to invest more in higher education, which is being addressed under the national innovation strategy of 'Filipinovation' and aims to achieve a competitive and multidisciplinary work force.

Yet the national R&D expenditure level stood at only 0.14 percent in 2009 with the vast majority (72 percent) of funding coming from the private sector and only 28 percent from public institutions. Due to the R&D underinvestment in the health and social work sectors, productivity enhancement is not at the level where it could be.

Due to the expectation of high private returns after completing higher education, it may seem reasonable that individuals or the private sector contribute more to the costs. According to OECD (2013) private expenditure in all countries for higher education averages out to be 32 percent. The amount covered by individuals, business and other private sources varies greatly from five percent or less in Denmark, Finland and Norway, to over 70 percent in South Korea and the United Kingdom where most of the expenditure is covered by tuition fees. Regardless, the cost of higher education is far higher than at the primary and secondary level and thus requires that there must be a way to ensure that higher education is available to all despite socio-economic background. One way to meet this need is through excellence initiatives and it is highly recommended that the ASEAN Community consider such an approach post 2015.

4.1. Excellence Initiatives

The past few years have seen enormous growth in governmental support of higher education through the use of excellence initiatives. Universities are asked to prepare a strategic plan that shows how funding can provide them with the opportunity to develop as an institution and reach higher status—hopefully achieving the rank of a world-class university. Initially begun in 1995 with the China 211 Project, the past 10 years have seen 33 such initiatives in 30 different countries (Siwinska, 2013).

The China 211 Project selected 100 universities to receive special funding to increase overall quality. This was largely due to the great increase in the number of institutions offering a higher education curriculum and concerns about overall quality. The subsequent 985 Project more specifically stated a goal of having 10 universities in the global rankings in the 21st century. A total of USD10 billion was allocated to 39 universities to reach this goal in two phases—the first from 1998–2003 and the second from 2004–2007 (Hou *et al*., 2013).

Similar concerns about quality of higher education led South Korea to develop its Brain Korea 21 Programme in 1999. This initiative focused on universities offering doctoral programmes and provided USD3.5 billion to 67 universities in order to cultivate global leaders. The first phase ran from 1999–2005 and the second phase from 2006–12 (Hou *et al*., 2013).

Japan has undergone a series of excellence initiatives beginning in 2001 with the 'Global Centre of Excellence Project'. This initiate ran from 2002–2007 and awarded research units not the universities themselves. This developed into a second phase from 2008 named the Global 30 Project. Although 30 universities were to be selected to internationalise higher education through the means of recruiting 300,000 international students by 2020, only 13 universities were selected for the project in 2009, with each receiving between USD22 million to USD44 million. Further developments to the project have included 34 university departments receiving funding under the 'Project for the Promotion of Global Human Resource Development', which concluded in 2014 so that the next phase, 'The Super Global Universities Program' could begin. This final programme will continue until 2023 awarding USD77 million to universities to achieve the potential to be placed in the top 100 world-class rankings within the next 10 years (MEXT, 2014).

Placement in the world-class rankings appears to be a high motivator for these excellence initiatives. When France realised that none of its universities were ranked above 50 in the world class rankings of 2003, it began vast reforms including autonomy for higher education institutions in 2007 and 'The 2010 excellence initiative, which brought USD10 billion investment for French research and development through direct competition between institutions for larger funding' (Myklebust, 2011).

Germany and Russia also are in the midst of excellence initiatives. The German Excellence Initiative was launched in 2005 with the first phase allocating €1.9 billion (USD2.2 billion) increasing to €2.7 billion (USD3.38 billion) for the second phase from 2012–2017. Of this funding, 75 percent comes from the German Federal Government and 25 percent from the states to promote top level research in Germany (DFG, 2012). On 7 May 2012, President Vladimir Putin announced the goal of having at least five Russian universities in the top 100 of the world-class rankings. This

resulted in the ‘Raising the Competitiveness of Top Russian Universities among the World's Leading Research and Education Centres Project’ (ITMO, 2015).

It would thus appear that many governments have recognised that the cost of higher education needs additional funding to remain competitive. As the ASEAN Community puts forth a new blueprint for post 2015, it would be advantageous to create an excellence initiative for higher education in the region. This initiative could provide adequate funding for the implementation of the ASEAN Approach to Higher Education to selected universities throughout the region. In this way, the ASEAN Community would be able to ensure high quality education through programmes built upon excellence. However, as seen in the above-stated projects, not all universities are able to create a strategic plan on such a large scale. Therefore, a second use of an excellence initiative would be to develop North–South capacity-building to promote the six ASEAN flagship programmes.

4.2. North-South Capacity-Building

The recently released International Association of Universities (IAU) 4th Global Survey (Egron-Polak and Hudson, 2014) collected responses from 1,336 higher education institutions world-wide. Of the 131 countries represented, 12 percent of the respondents came from 164 higher education institutes in Asia and the Pacific. In many ways, their responses reflect that issues surrounding the internationalisation of higher education are valued differently in Asia and the Pacific compared with those in the rest of the world.

While all respondents except those in Europe rank the highest risk of including international activities to be that opportunities will only be available to those students who possess financial resources to participate, Asia and the Pacific are unique in ranking the following two risks in second place: excessive competition among higher education institutions and over-emphasis on internationalisation at the expense of other priorities (Egron-Polak and Hudson 2014, 11). A similarly unique concern for Asia and the Pacific is the increase in ‘degree mills’ or low quality providers, which ranks as the third-highest societal risk of internationalisation.

When asked to define the most important internationalisation activity for universities, Asia and the Pacific along with Africa and the Middle East stated that it

was international research collaboration. The number-one response in other regions was student mobility (Egron-Polak and Hudson 2014, 14). These responses illustrate that in Asia internationalisation focuses on collaboration with others, not competition.

Regarding the benefits incurred from internationalisation, Asia and the Pacific ranked increased student awareness of international issues as number one followed by improved quality of teaching and learning. The only other region that placed student awareness first was North America. Another unique response in Asia and the Pacific was the third-ranked benefit as North–South capacity-building. It would thus appear that there is strong support in the Asia and Pacific region for providing students with international opportunities that are built upon collaborative efforts that in turn create stronger capacity-building through improved quality of teaching and learning.

The findings from the IAU Global Survey suggest that the ASEAN Community should consider providing excellence initiatives for all students regardless of socio-economic background to give them the opportunity to become involved in international activities. This could be accomplished through North–South capacity-building focusing on the six ASEAN flagship programmes currently in operation. Universities could collaboratively develop a strategic plan for North–South capacity-building focusing on a specific flagship programme and thus remove the risk of excessive competition among universities. In order to illustrate how this would be possible, each flagship programme will be introduced along with current projects around the world that could be approached to collaborate in North–South capacity-building.

4.3. ASEAN Flagship Programmes

The six ASEAN Flagship Programmes are on Biofuels, Climate Change, Development and Application of Open Source, Early Warning System for Disaster and Risk Reduction, Functional Food, and Health. Each is led by a county within ASEAN and thus a collaborative approach among ASEAN universities could result in not only North–South capacity-building but rather North–South–South capacity-building as explained earlier in this paper. This would thus provide students with the opportunity for international activities either as a form of regional placement or incubation. In the post 2015 Blueprint,

specific benchmarks to meet in these collaborations should be set and excellence initiatives to meet the financial needs secured.

4.3.1. Biofuels

Over the past six years, five programmes in Africa have been awarded SEED initiative money to recognise their contribution to biofuel research. ALMODO in Niger is looking for support in developing a network of contacts that develop technologies in waste management and recovery. The remaining four projects, two in Uganda, one in Ethiopia and another in Gambia, are all creating unique briquettes as a substitute to charcoal use. These briquettes are made from corn husks, coffee husks, groundnut shells and other forms of waste. Malaysia, as the country leader for the Biofuels Flagship Programme, could be charged with investigating the possibilities for South–South capacity-building among these initiatives and put forth a strategic plan for an excellence initiative as a part of the post 2015 Blueprint.

4.3.2. Climate Change

The Philippines is the leader for the Climate Change Flagship Programme and could easily be encouraged to explore North–South–South collaboration working with Thailand and its already-developed Plant A Tree Today (PATT) Foundation. This Foundation is both a UK registered charity, as well as a Thai foundation and has offices in Bangkok as well as the UK. Lessons learned from this North–South collaboration could be explored and then applied to any of the following programmes working on climate change.

Exploring alternative energy sources, the Barefoot University in India spread over eight acres, runs entirely on solar energy maintained by the Barefoot solar engineers who are mostly women sometimes as old as grandmothers, taught how to build solar panels (Bhowmick, 2011). Since the solar course was launched in 2005, more than 300 Barefoot engineers have brought power to more than 13,000 homes across India. A further 6,000 households in more than 120 villages in 24 countries from Afghanistan to Uganda, have been powered using the same model. As the current project proposal on electrification of remote villages in ASEAN countries using solar energy is pending, a South–South collaboration with the Barefoot University could

play a leading role in realising this objective as well as gaining valuable expertise to expand programmes to empower local communities

Brunei Darussalam's Kuala Belalong Field Studies Centre as well as the 'Heart of Borneo' initiative provides ample opportunities for biodiversity research for students worldwide. Recognised programmes established elsewhere in Asia, such as Last Forest Enterprises in India, the 2014 recipient of the SEED Low Carbon Award, should be approached about establishing research opportunities for students, internships and joint projects to result in academic publications.

Another possibility for North–South–South collaboration would be for another AMS to join the current partnership with Viet Nam's Southeast Asia Renewable & Adaptive Energy (SEA-RAE). This organisation supplies remote communities in Viet Nam with hydro-energy harvesters that are adapted to the needs of local communities with a US-based research hub at Berkeley.

Specific networking opportunities to consider in conjunction with Malaysia's National Oceanography Directorate are with Coveñas and the Instituto Morrosquillo located in Columbia. Their initiative to preserve the Gulf of Morrosquillo through sustainable shrimp farming is in need of support in networking with international partners and support with market research. Lessons learned from Malaysia's work with Blue Venture in Fiji and Madagascar using the Velondriake model could help establish a similar technique for working with local communities in Columbia.

4.3.3. Development and Application of Open Source

Indonesia, as the lead country for the Development and Application of Open Source Flagship Programme, could collaborate with Brunei Darussalam as it tries to reach its priority research agenda for ICT. Brunei Darussalam is home to the first IBM Blue Gene supercomputer in the ASEAN region as well as an established e-Government Innovation Centre. As Brunei explores implementation of e-government, these findings should be shared with the already on-going 'e-Network Project' sponsored by TELSOM. Although the e-Network Project is focused on tele-education and tele-medicine, there would be ample opportunities for joint initiatives to explore the overall needs for ICT training in the region and to develop the infrastructure to allow these needs to be met.

A further suggestion for the development and application of open source is to create a research partnership with Bauman Moscow State Technical University's Joint Resource Centres for Remote Access Space Robotics Laboratory. Registered researchers are able to scan radiophysical objects, run experiments, edit raw data and use the data in post-processing. In these ways the Internet Laboratory can be used as a tool for training operators for space robot manipulator control (Ivanov, 2014) and is an exemplar in the application of open source.

Viet Nam has also identified ICT as one of its R&D priorities, and hence should be encouraged to work with TELSOM on its pending 'Networked Multimedia for Education System'. This system would create ICT related trainings for ASEAN countries especially in Cambodia, Lao PDR, Myanmar and Viet Nam with possible funding support from the Japan–ASEAN Integration Fund. As TELSOM is also responsible for an ongoing 'e-Network Project' aimed at providing tele-education and tele-medicine, it would appear that Viet Nam is uniquely matched to this area.

4.3.4. Early Warning System for Disaster and Risk Reduction

Indonesia is also the lead country for the Early Warning System for Disaster and Risk Reduction Flagship Programme. North–South capacity-building is already occurring in the region between Japan and the Philippines in this area. In 2012, the Japan International Cooperation Agency (JICA) provided Doppler radar in Virac, Catanduanes for the early detection of tropical cyclones. In 2013, Japan announced its Emergency Warning System sponsored by the Japan Meteorological Agency and, as a member of ASEAN+3, it would seem that strategic plans for AMS to collaborate with Japan abound in this area.

4.3.5. Functional Food

Thailand is the lead country for the ASEAN Flagship Programme in Functional Food and North–South–South capacity-building could be encouraged along with the development of tourism activities. For example, a recent nationwide speech contest in Japan had as one of its themes 'Introduction to ASEAN countries: The new *Omotenashi* campaign' in which students were encouraged to develop a plan for encouraging tourists from ASEAN to come to Japan. A research network could easily be set up with the SOAS Centre for Islamic Studies at the University of Brunei Darussalam and the already established AIMS programme housed at Prince of Songkla

University's Phuket Campus. Eight full scholarships that are currently offered for students to study tourism and hospitality in Indonesia, Malaysia or Viet Nam and Japan could be invited to share in this network by providing financial backing and opportunities for students to contribute to programmes that encourage ASEAN tourism in Japan.

One stellar example of how Cambodia can move forward in the development of functional food is by emulating the work already being done by the Cambodian Agricultural Research and Development Institute (CARDI), which has 30 on-going projects. Within its first decade of existence, CARDI was able to release 38 rice varieties and develop four mung bean varieties. It would be advantageous for CARDI to encourage research networking utilising recent technological advances being used in agricultural production. One such avenue to pursue would be the use of Digitally Assisted Diagnosis through North–South–South partnerships. For example, the Kouchi Plant Protection Office Japan provides an online diagnosis query with sample images that can be accessed for precise and rapid diagnosis of plant disease. There has also been the development of a user-friendly web-based plant diagnosis system that links rural farmers in Nepal with an agricultural university in Japan. Instant diagnosis by academic faculty is provided via text messages after viewing a photo of the disease stricken plant through a mobile phone sensory image (Maharjan and Sakamoto, 2011).

4.3.6. Health

Singapore is the lead country for the ASEAN Flagship Programme on Health with Research Centres of Excellence focusing on cancer science, mechanobiology and life sciences engineering through the mission-oriented programmes of A*STAR. Additionally, the Campus for Research Excellence and Technological Enterprise (CREATE) houses a Regenerative Medicine Initiative in Cardiac Restoration Therapy between Technion-Israel Institute of Technology and NTU and NUS. The Duke–NUS Medical School was established focusing on five research programmes: cancer and stem cell biology; cardiovascular and metabolic disorders; emerging infectious diseases; health services and systems research; and neuroscience and behavioural disorders.

Many further opportunities for collaboration around health issues also exist throughout the ASEAN region. For example, the Myanmar Scientific and

Technological Research Department's development of anti-malaria herbal medicine allows for North–South–South networking relationships. This year marks the end of the first four-year project funded by the Shanghai Traditional Medicine University and the Medicines for Malaria Venture (Geneva) to publish a handbook in Chinese and English, which will be the first longitudinal analysis of a medical drug in English. Myanmar could become an active partner in furthering projects of this nature as its own anti-malaria products clear clinical trials.

A further example would be to establish a partnership with Taipei Medical University of Taiwan in order to work together on its teledermatology service. This service allows for the patients in rural areas to receive medical care via smart phone diagnosis. A cluster-randomised trial was conducted from last year at 20 rural health clinics in Mongolia. Findings revealed that the patients in the intervention group saved 19,829 km and 269 hours in travel time in addition to USD 2,854 for medical care (Shabbir, 2014). An even more significant finding was that as the trial progressed, health care workers in Mongolia who originally began merely supplying medical experts in Taipei with the images and data via smart phone transmission by the end of the project became competent and able to conduct a proper diagnosis without consulting the expert pool. Such a project would meet the challenge of directing scarce public funds to highly socially profitable R&D programmes whose socio-economic outcomes would immediately serve the poor in remote areas.

4.4. Summary

This paper has attempted to provide recommendations regarding investment in higher education for the ASEAN Community post 2015. It began with a brief look at higher education systems in various regions to extrapolate lessons learned. This would help the ASEAN Community to leapfrog into a higher education system which will provide affordable education and assure job placement to its graduates and thus secure the region's competitiveness in the global marketplace.

Investment in technological upgrading and innovation requires not only a necessary financial commitment but also a synergised approach to higher education. The second section of this paper examined how AMS could create an ASEAN Approach to Higher Education combining the elements of community service, regional

placement and incubation in addition to a strong academic foundation. Through collaboration on establishing courses in English, international students will also be drawn to the region. The core component of community service will help students to develop entrepreneurial skills by listening to the needs of a community and designing a plan to meet those needs. The opportunity to study abroad in another AMS will help students appreciate unity in diversity through the formation of their own ASEAN identity. The cornerstone of an undergraduate education would then be the opportunity to experience incubation either in the student's home country or yet another AMS.

The AUN already has a committed network of universities that have designed modules for implementation and the above proposal could be further enhanced by incorporating lessons learned from the significant work already begun by a consortium of open universities in the creation of the ASEAN Studies Graduate Program. Beginning with the AUN network, universities would collectively contribute to building a region-wide innovative approach to human resource development.

The final section examined ways in which Science and Technology development could be pursued by encouraging university development through ASEAN sponsored excellence initiatives. These initiatives could be awarded either to universities implementing the ASEAN Approach to Higher Education or to universities involved in North—South capacity-building supporting one of the six ASEAN Flagship Programmes. By pursuing these goals the overall objective of an ASEAN Community characterised by innovation can be realised and perhaps lead to a Regional Research Indexing Hub Project or an ASEAN RDI Network for R&D Cooperation post 2015.

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