the
APEX
University
Universiti Sains Malaysia
in support of the New Economic Model

TRANSFORMING HIGHER EDUCATION FOR A SUSTAINABLE TOMORROW

2009 Laying The Foundation

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ROYAL PATRON FOR THE APEX UNIVERSITY
(UNIVERSITI SAINS MALAYSIA)

(commencing 2009)

TRANSFORMING HIGHER EDUCATION FOR A SUSTAINABLE TOMORROW

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UNIVERSITI SAINS MALAYSIA

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Transforming Higher Education for a Sustainable Tomorrow
Quality • Equity • Availability • Accessibility • Affordability • Appropriateness
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USM UNIVERSITI SAINS MALAYSIA
USM is a pioneering, transdisciplinary research intensive university that empowers future talent and enables the bottom billion to transform their socio-economic well-being
UNIVERSITI SAINS MALAYSIA

Laying The Foundation

Since its inception, USM (the then Universiti Pulau Pinang) has always been built on a very strong foundation of being unique, bold and forward looking thanks to the creative vision of its founders and leaders, as well as the community of scholars whose lives have been touched by the university.

The first Prime Minister of Malaysia, Tunku Abdul Rahman Putra Al-Haj
laying the foundation stone of the university on 7 August 1967

TRANSFORMING
HIGHER EDUCATION
FOR A SUSTAINABLE
TOMORROW
2009 Laying The Foundation

CONTENTS

The Lead

This publication is an annual follow up to the now famously dubbed "Black Book" that was published as part of the APEX (Accelerated Programme for Excellence) submission in May 2008. The aim is to compile and document the accomplishments of Universiti Sains Malaysia (USM) since it was emplaced under the APEX programme by the Ministry of Higher Education beginning 3 September 2008. For the next two years until the end of 2010, USM was to lay the foundation to jump start an APEX university. For this, it proposed, succinctly, a two-pronged transformational goal under the APEX framework, namely, transforming higher education for a sustainable tomorrow and becoming world-renowned for sustainability and a sustainability-led university.

For the goal of transforming higher education for a sustainable tomorrow, USM believes that it will be more assertive in moving forward the sustainability agenda by reinvigorating and transforming its teaching and learning programmes, R&D activities and various services to produce more meaningful quality outcomes that embrace the values of equity, accessibility, availability, appropriateness and affordability. Ultimately, it aims to support the drive to improve the well-being of humanity, the bottom billion, in particular. In other words, these efforts are geared to contribute toward the attainment of global visions as endorsed universally since the Rio Summit in 1992.

For the goal of being a sustainability-led university, USM proposed to continue the effort implemented in early 2001, that is, to rigorously pursue and expand the nurturing of human beings (not just human capital) as the "seed" of sustainable social transformation amongst its staff and students. This is with the conscious awareness and understanding that education is the key to change unsustainable lifestyles and mindsets that are being uncritically promoted currently. Instead, students and staff must be provided with learning opportunities in the real world environment so as to integrate relevant knowledge and concepts of sustainability across thinking, practices, applications and solutions. In turn, outreach programmes by the university will introduce sustainability as an overarching principle to the glocal and global communities.

Dzulkifli Abdul Razak,
Professor Tan Sri Dato'
Vice-Chancellor,
Universiti Sains Malaysia

In the short period of the past 15 months, the university has taken great strides and earnestly initiated numerous dialogues, programmes and activities in order to reinvent itself to become a global institution of higher learning of tomorrow. In so doing, USM has adopted five critical agenda as its guiding principles and these are: (a) transforming higher education for a sustainable tomorrow, (b) creating cutting edge, high value innovative flagships, (c) reaching out toward the bottom billion, (d) translating sustainability into action beyond the classroom, and (e) leveraging on the experiences of scenario planning (2005) through the Blue Ocean (BOS) and Change Management strategies. Putting these agendas into context, it is obvious that USM's APEX agenda is congruent to, and supportive of, the National Mission and Key Result Areas (KRA) (see table below) and the recently released New Economic Model as discussed below.

In celebrating its 40th anniversary in 2009 and in aspiring to achieve the APEX status in 2013, USM has re-examined the core foundation of its being, and takes cognition of the need to amalgamate the vital elements of economy, society and the environment, or simply put prosperity, people and planet. One conscious approach is to rebrand its mission in order to clearly indicate what USM represents and where it wants to be as an APEX university. There is also a need to identify a single value proposition which could be recognised and experienced by its internal and external stakeholders alike. Thus began the branding journey.

The big picture to this process focuses on the transformation of at least three key areas, namely, changes in talent, resources and governance that would in turn transform higher education for the 21st century moving us towards a sustainable tomorrow. In that we focus our energies to reach out to enable the bottom billion to transform their socio-economic well-being. In essence, USM took leadership in reshaping the landscape of university education which has direct impact on sustainability and the future of the bottom billion.

The transformational journey towards the creation of an APEX university is one that is premised on seven key characteristics. They are focused on (i) the future, (ii) uniqueness, (iii) sustainability, (iv) humanity, (v) universality, (vi) change and (vii) sacrifice. It is about writing the rules of the game to meet the demands of the 21st century and beyond, recognising that all things are fast changing, and education, including higher education, cannot remain status quo.

In ensuring this, USM has conceptually interpreted its APEX vision as one which will position the university to take stewardship by adopting seven principles of APEX that would characterise the institution. These are principles relating to: the future, uniqueness, sustainability, humanity, universality, change and sacrifice. In operational terms, these principles will push for mindset (intangible) changes with the view to put in place "business unusual" practices and affect real (tangible) changes at all levels. In the words of the Chief Secretary to the Government, Tan Sri Mohd Sidek Hassan (during his visit to USM on 24 January 2008), we must "challenge the status quo" in our commitment to excellence. In the context of USM, "failure is not an option at all".

In this report, we enumerate and elaborate the numerous cumulative changes achieved since 3 September 2008 in the period of the last 15 months when USM was audited again. Among them are what we term as high value flagships precisely because each of them, in its own right, is a potential knowledge and wealth creator supporting the aspiration of an advanced economy and socio well-being for Malaysia and Malaysians. They include several firsts, not just for USM and Malaysia, but also the world. For example:

- Archaeologists from USM have unveiled a series of important artefacts to the world with the discovery of stone tools dating as far back as 1.83 million years and scriptural structures dated at 110 CE, as well as providing proof that humans have lived in Malaysia for at least as far back as that. This contributes significantly to our current understanding of the prehistoric environment and culture of early humans. Once verified, the discovery will send shockwaves throughout the archaeological community and have astounding implications on theories of prehistoric human development, migration and culture, not to mention debunking or bringing into question at least, the *Out-of-Africa* and the *Movius Line* theories.

- USM, through its Centre for Chemical Biology (CCB@USM), has made historic breakthrough by being the first university in Malaysia and in the world to produce a draft genome of the rubber tree *Hevea brasieliensis*. This instantly creates the potential of remaking Malaysia, once the largest rubber producer in the world, of becoming a leader yet again. Moreover, given the larger and greater contribution to the income of small rubber holders, the breakthrough will benefit the bottom billion as a whole. In the near future it entails the creation of spin-off companies which will be created to expedite further collaborative research efforts and the handling of even more potential intellectual property rights. Concomitantly, the university has forged an agreement with several organisations worldwide to expand this work beyond rubber into other crops like oil palm, jute, dates, rice and many more indigenous flora.

- USM has put into motion guiding principles for sustainable development which will make it a world class institution

“APEX is about the future. We are not talking about the position of the universities. We are identifying one that can go leaps and bounds into excellence with government help.”

Minister of Higher Education
Datuk Seri Mohamed Khaled Nordin
when announcing the selection of USM for the APEX status
New Straits Times, 4 September 2008, page 1 & 6

that provides excellent education in the broadest sense, integrating the principles of sustainability throughout the university's mission via its teaching and learning, research, and *kampus sejahtera* and green initiatives. This will pave the way to nurturing global citizens with the capacity to address the pressing sustainability challenges facing humankind, the bottom billion in particular.

- The Vector Control Research Unit (VCRU) of USM has made numerous discoveries in tropical insect biology and sustainable urban pest management in Southeast Asia. This unit has been active in conducting research on urban insect pests in Malaysia, Singapore, Indonesia and Thailand funded entirely by multinational chemical and household insecticide companies. Over the years the researchers of VCRU have published more than 50 peer-reviewed journal articles.

- USM, through the newly established Centre of Engineering Excellence (CEE), has forged stronger tripartite collaborative research platforms between the industry and academia through its cooperation with Khazanah Nasional Sdn. Bhd. and the Indian Institute of Technology (IIT) Kanpur, India. This is a unique approach to enrich the local ecosystem with engineering talent, new product development, processes and materials and access for local companies to global experts for product and technology development across geographical boundaries.

- At the Engineering Campus too, USM researchers have successfully completed the first Malaysian prototype and hybrid electric motorcycle (e-Bike) enabling the university to forge commercial agreements with Modenas (Motosikal dan Enjin Nasional Sdn. Bhd.) and Petronas Research to mass produce and market the vehicle scheduled for 2011.

- More recently, USM established IXC (Innovation Exchange) Malaysia Berhad (one of three centres of its kind in the world), which is fast becoming a platform for knowledge and innovation exchange networks at the global level. The centre provides professional support for the innovation of third parties encompassing both academic and research institutions as well as private companies. Innovation interests, ranging from commercialisation of research to social purposes, within and outside Malaysia, are being handled by the IXC. Together with the other centres in Australia and the UK, the centre acts as a global knowledge exchange hub, creating new opportunities for growth through the powerful combination of technology and people.

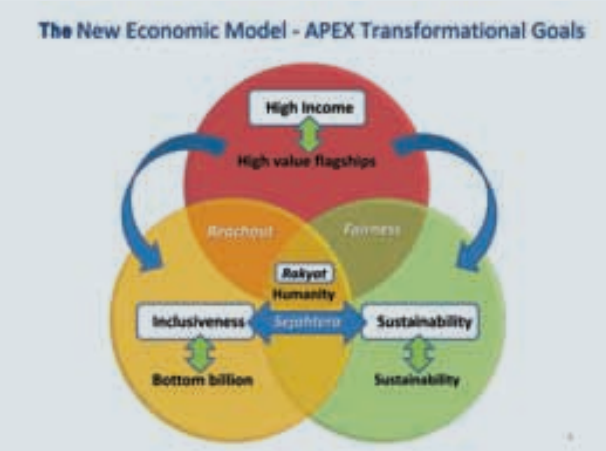
- In addition, the university's relentless pursuit to improve and enhance the quality and sustainability of life of the bottom billion also takes the form of direct social intervention. One of the significant steps taken is the establishment of the Mindanao Peace Programme within the Research and Education for Peace Unit (REPUSM) at the School of Social Sciences in support of the peace process in Mindanao island of the Philippines. This has been done through the publication of research findings; disseminating information about the process to the public both in the Philippines and Malaysia; conducting workshops, seminars and forums to

not only create public awareness of the issues but also to engage the stakeholders in discussion about potential solutions to the issues; enhancing the capacity of all actors through capacity building programmes, as well as bringing all the stakeholders, including the major conflict actors, together in a series of talks to consolidate their various positions. Over the last three years, two specific activities have been carried out by REPUSM to help in this transformation process. The first is the Consolidation for Peace (COP) project (2007-2009), and more recently, the Mindanao Educators Peace Summit (2010).

Although the Mindanao Peace Programme was started in 2004, peace studies and research had been conducted at USM since 1995 with the establishment of REPUSM. This effort was given the impetus through the Taiping Peace Initiative (TPI) in which USM entered into a partnership in 2000 with the United Nations, alongside the Taiping Tourist Association and the Taiping Municipal Council as local custodians. TPI had its 10th anniversary celebration recently.

Indeed, reaching out to the bottom billion has become a key driver and an evaluation tool to measure and gauge outputs and outcomes (beyond just numbers, for which we have introduced the concept of Key Intangible Performances) for most activities of the university. In other words, efforts are not only assessed in terms of their "numerical" commercial potential but equally important, is whether they address the welfare of the people at the bottom of the economic pyramid in an inclusive way. Since the past 15 months, many of the programmes at USM have been gradually refocused toward engaging the larger community as a mark of collegiality and inclusiveness.

This is of particular relevance since of late, the Right Honourable Prime Minister has unveiled the New Economic Model as a new document that would propel Malaysia into an advanced economy status. We are indeed very elated to see how the New Economic Model is being constructed based on the three elements of (a) high income, (b) inclusiveness, and (c) sustainability. This is because these three elements mirror very closely those of the USM-APEX agenda, albeit in different words, (a) high value flagships, (b) the bottom billion, and (c) sustainability, respectively. This means that the New Economic Model and the USM-APEX agenda share common grounds as I have argued in my weekly column recently (NST, 4 April 2010).



Looking ahead, we have barely three years to realise the APEX goals of the Ministry of Higher Education. Alhamdullilah, the two independent audit exercises conducted by MoHE to monitor the implementation of this programme by USM have been very encouraging and positive.

In addition, USM is also engaging a high-level OECD team to review the state of higher education in the region vis-a-vis USM's position, and so far the outcome is positive. The process is still on-going.

> **“There are now calls to protect the status quo.**
> **Do not be fooled. We need a new way of doing things.**
> **. . . we must act now to position Malaysia for the future.”**
>
> Prime Minister of Malaysia, Dato’ Seri Mohd Najib bin Tun Abdul Razak
> when announcing the New Economic Model at
> Invest Malaysia 2010, 30 March 2010

The feedback received from the regular visits by the Minister of Higher Education, the Honourable Dato’ Seri Mohamed Khaled Nordin, as well as key officials of the ministry has been supportive and motivating. During his latest official visit to USM, the Minister reaffirmed yet again that the USM APEX journey is “on the right track”. Despite the inadvertent minor glitch during the first direct admission of the undergraduate students (see Managing intakes - a learning curve, page 47), we are blessed by the rapport between the Minister and the Ministry in general, the APEX Committee and the USM community.

To this end, USM has set up a Centre for National APEX Development Indicators (NADI) to act as a window for anyone interested in the progress of APEX since its inception. The Centre houses new and regularly updated information about APEX, and also invites input as well as feedback from the community within and out of USM. NADI will be a one-stop centre for USM’s APEX journey.

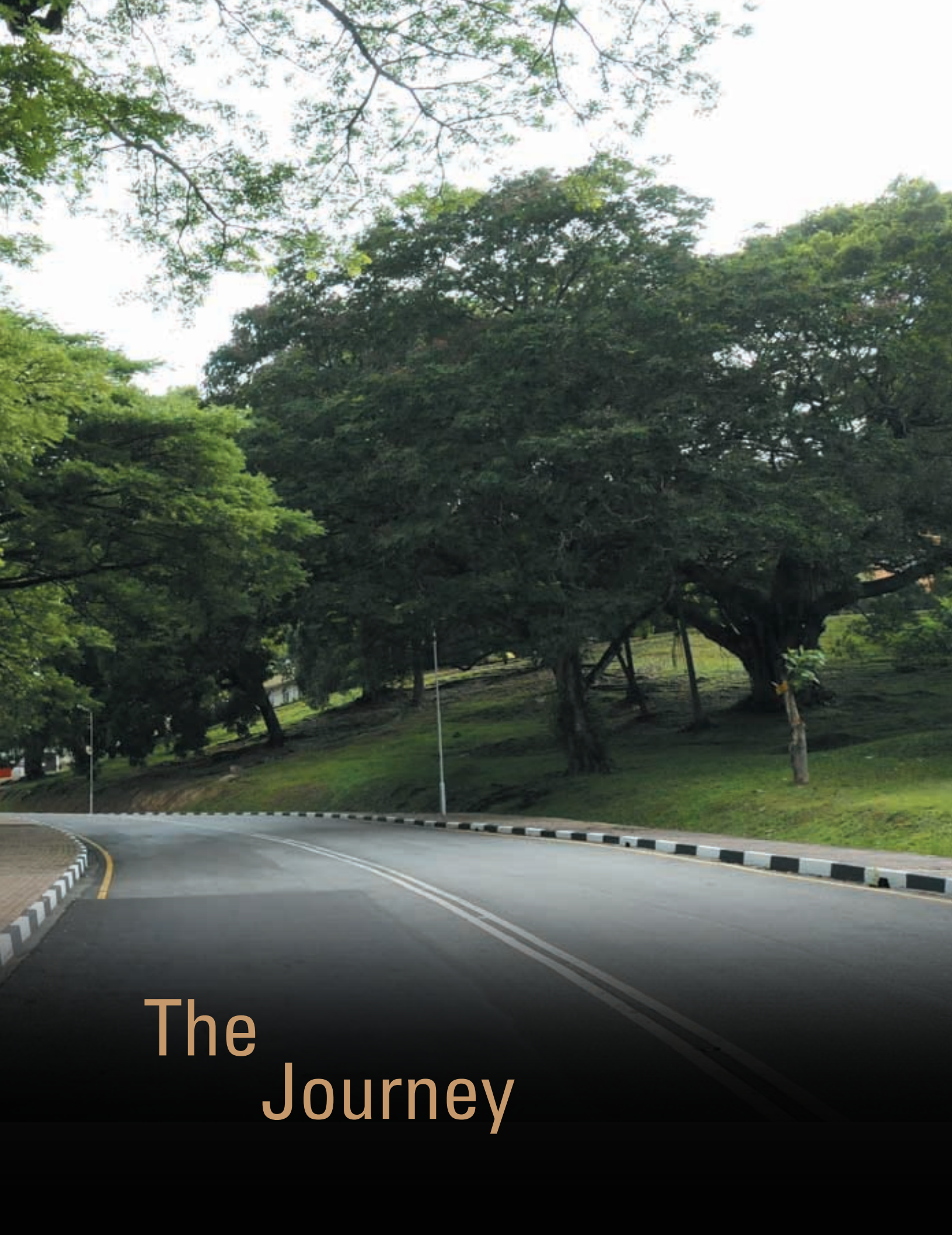
Invariably, the road ahead toward 2013 is certainly not going to be smooth and easy but we have braced ourselves for more hard work, dedication and perseverance. The most immediate task is to set into motion a new paradigm and mindset of the staff and students (and eventually decision makers and the public) in order to prod them to discontinue activities and values that are deemed unconducive and counter-productive to the need to adopt new work ethics which can deliver true excellence and promote innovation. We need to be agile in our daily activities and fast in our actions. We need to take the risks and be fearless in order to test the limits of excellence and innovation. In the process, we have to avoid the situation of paradigm paralysis and adopt the BOS strategy of continuously practising value innovation in order to find unknown market space which is untainted by competition and unexplored by competitors. To do this we need to change the rules of the game (“challenge the status quo”) which will render competition irrelevant and enable us to sail on the new blue ocean of tomorrow.

I would be failing in my duty if I do not acknowledge the sweat and toil that have gone into making this compilation what it is, and more importantly, the aches and pains that the USM community endured as the next breed of “game changer” in the higher education sector.

Hereby we humbly submit.

Dzulkifli Abdul Razak, Professor Tan Sri Dato’
Vice-Chancellor
Universiti Sains Malaysia
vc@usm.my
7 May 2010

Uphill from the Minden Green



The Journey

Transforming higher education for a sustainable tomorrow

Laying the Foundation

Submitting for APEX consideration - the BIG picture

01

02

01 The visit of Professor Emeritus Dato' Mohamad Zawawi Ismail and his APEX Audit Committee
02 Visit to CCB@USM

In March 2008, the Ministry of Higher Education requested all local universities to submit their proposal for consideration to be emplaced under its Accelerated Programme for Excellence or APEX. This is a fast track development programme for institutions of higher learning to achieve and to be recognised as world class institutions. After going through a rigorous selection process, including a presentation to the selection panel and its subsequent on-site validation visits, USM was selected as an APEX-status university under the APEX programme by the Minister of Higher Education begining 3 September 2008.

For the submission, USM had proposed a two-pronged transformational goal within the APEX framework, transforming higher education for a sustainable tomorrow and becoming world-renowned for sustainability and a sustainability-led university.

For the goal of transforming higher education for a sustainable tomorrow, USM believes that it will be more assertive in moving forward the sustainability agenda by reinvigorating and transforming its teaching and learning programmes, R&D activities and various services to produce more meaningful quality outcomes that embrace the values of equity, accessibility, availability, appropriateness and affordability. Ultimately, it aims to support the drive to improve the well-being of humanity, the bottom billion, in particular. In other words, these efforts are geared to contribute toward the attainment of global visions as endorsed universally since the Rio Summit in 1992.

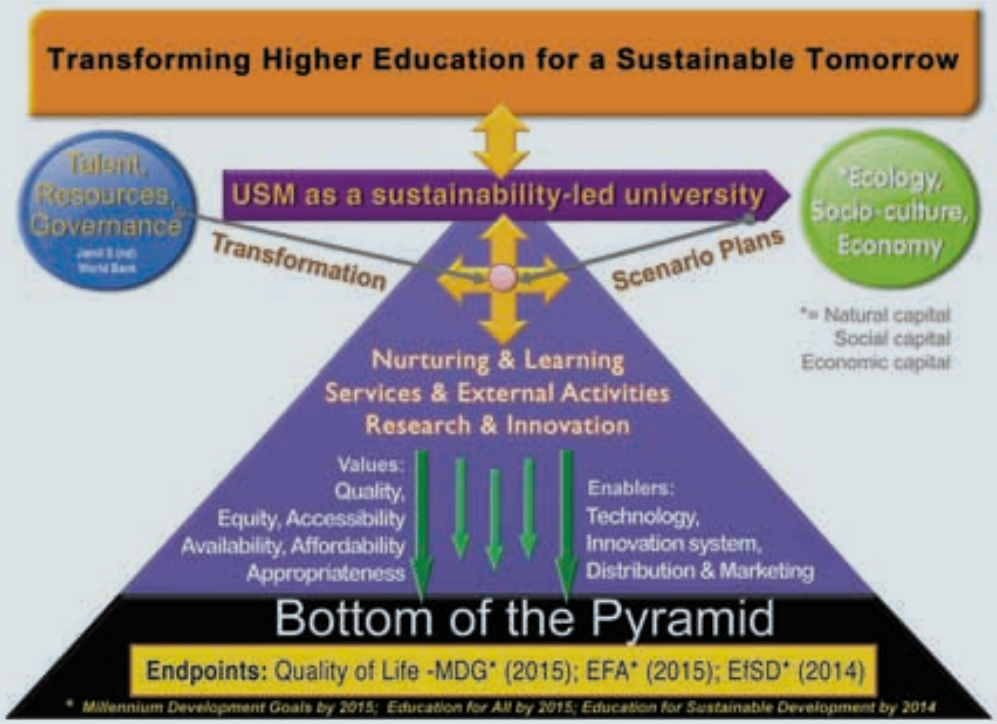


Figure 1: The USM's APEX university framework

For the goal of being a sustainability-led university, USM proposed to continue the effort implemented in early 2001, that is, to rigorously pursue and expand the nurturing of human beings (not just human capital) as the "seed" of sustainable social transformation amongst its staff and students. This is with the conscious awareness and understanding that education is the key to change unsustainable lifestyles and mindsets that are being uncritically promoted currently. Instead, students and staff must be provided with learning opportunities in the real world environment so as to integrate relevant knowledge and concepts of sustainability across thinking, practices, applications and solutions. In turn, outreach programmes by the university will introduce sustainability as an overarching principle to the glocal and global communities.

To accomplish these two goals, USM has integrated sustainable development into its education ecosystem so that future generations can be nurtured and imbued with the need to embrace ecological protection, conservation of resources and human development based on the virtues of equity, accessibility, availability, affordability and appropriateness so as to give greater insights to quality.

> **"During our first committee meeting, we deliberated on the purposes and objectives of the APEX initiative. It was important to us that the proposed APEX initiative will have a long-term positive impact on our higher education. Would APEX create different classes of universities, for example? It would be different if the committee is merely to select only one university for the APEX title. We would simply decide on some criteria and put the issue to vote. We thought that APEX must represent a long-term strategy and not just a contest. And therefore APEX should be more of a programme of initiatives."**
>
> Professor Emeritus Dato' Mohamad Zawawi Ismail
> APEX University Selection Committee Chairperson
> in *Bulletin of Higher Education Research*,
> No. 12, December 2008, page 1-2

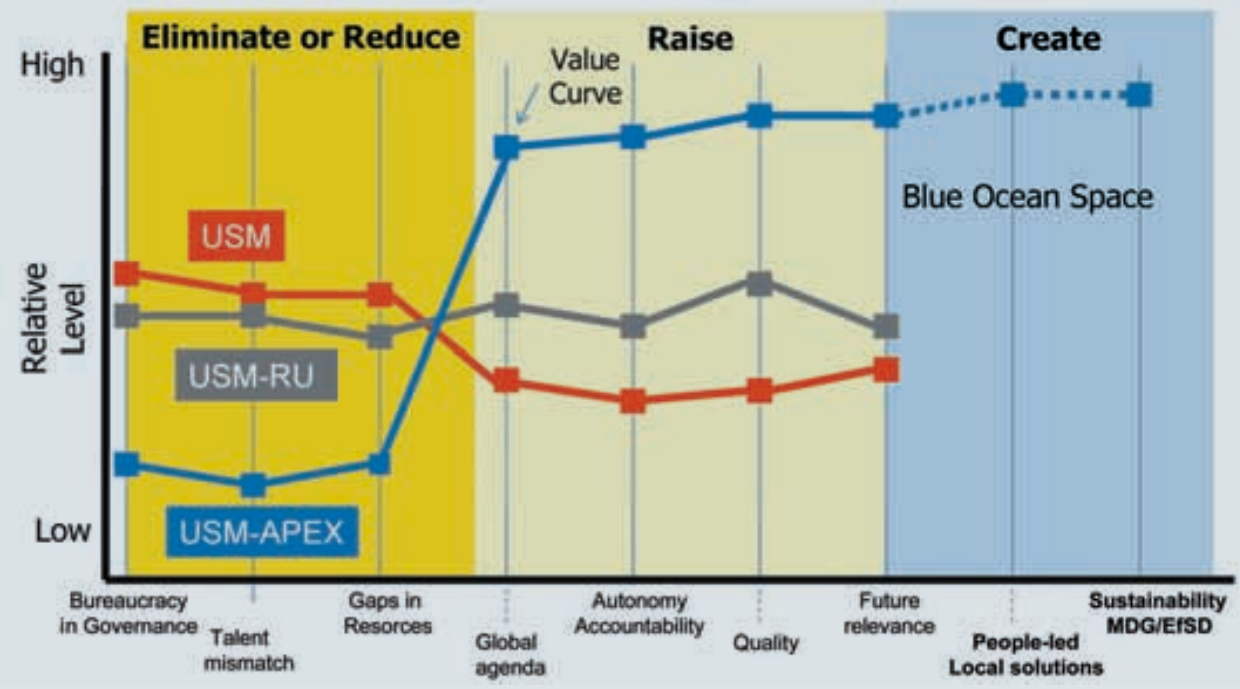


Figure 2: The General Strategy Canvas for USM
(Adapted from Kim and Mauborgne, 2005:87)[1]

Another strategy to realise these goals is to adopt Kim and Mauborgne's (2005) Blue Ocean Strategy (BOS). In so doing, USM proposed then to embark on numerous transformational journeys, including transforming most of its activities pertaining to nurturing and learning, research and innovation, services, students and alumni development and the governance of the university as a whole. The university also proposed to take steps to improve the core pillars of its strengths, i.e., concentration of talent, resources and acculturation of supportive governance.

The transformation plan also included the revamping of other activities and programmes of the university including postgraduate studies, students' and self-development services and alumni initiatives. By the same token, many changes were also proposed to other elements of the university, such as the concentration of talent, resources and supportive governance to act as catalysts for the accomplishment of the transformation of nurturing and learning, research and innovation and services.

Since its declaration as a university under the APEX programme on 3 September 2008, USM has carried out and implemented numerous changes to fulfil the promises made in the proposal submitted to the Ministry of Higher Education. At the philosophical level, USM has marked five main agendas as its APEX thrusts. These are,

(a) transforming higher education
(b) creating high-value flagships
(c) reaching out to the bottom billion
(d) translating sustainability into action
(e) leveraging scenario planning through BOS and change management

These agendas are contextualised within the principles and values of the future, uniqueness, sustainability, humanity, universality, change and sacrifice which are realigned to support Malaysia's New Economic Model (NEM) of high income, sustainability and inclusiveness espoused recently by the Prime Minister on 30 March 2010.

1 Kim, W.C. and Mauborgne, R. (2005). Blue ocean strategy: how to create uncontested market space and make the competition irrelevant. Cambridge, Mass: Harvard Business School Press.

We believe the foregoing agenda and the ongoing transformation of USM under the APEX programme are in line with the global picture. As reported by IMF in *Finance and Development* (March 2010, Vol. 47, No.1), the number of hungry people worldwide in 2009 tops one billion, which is 10 percent more than the previous year. The article attributed the rise to people's inability to afford the food that is produced as well as the corollary consequences of the global economic crisis.

Beginning in 2008, USM has also made numerous changes to the management of the university, including a new Key Performance Indicator (KPI) and Key Intangible Performance (KIP) formula for its staff and students including the creation of the National APEX Development Index (NADI) resource centre to monitor and highlight USM's APEX journey. In terms of management practices, USM has embarked on the rebranding exercise, advocacy work, change management and implementing the 13 critical agenda projects (CAPS). With the above mentioned changes, USM is proud that within this initial period of 15 months, the university community is able to record and document impressive successes in every endeavour including teaching and nurturing, research and innovation, staff and student development, community and industry outreach, undergraduate and postgraduate studies.

Overall, USM is also mindful of the Strategic Plan of MoHE (2007) that sets the Roadmap of Transformation for the higher education landscape in Malaysia.

This publication therefore, is an attempt at recording and documenting the accomplishments achieved by the university since it was declared as an institution under the APEX programme of the Ministry of Higher Education. This however is the beginning of laying the foundation as envisaged by the MoHE transformation roadmap (MoHE, 2007).

03

03 Visit of the Minister of Higher Education to NADI in February 2009

> **". . . there was a sense of excitement . . . USM was well prepared . . . [the committee] saw a synergy of thoughts, ideas and themes, sustained ability and imagination. . . It is the coherency in terms of ideas that we could easily relate to and the kind of leadership that USM has right now."**
>
> Professor Emeritus Dato' Mohamad Zawawi Ismail
> APEX University Selection Committee Chairperson

04

04 The Minister of Higher Education's announcement of USM's selection under the APEX programme and signing of the "Black Book" at Dewan Tuanku Syed Putra, USM, 4 September 2008

Tasked to implement APEX

Since the university was identified and emplaced under the APEX programme in September 2008, the Vice-Chancellor created a Steering Committee to draw up the strategic plan for the APEX agenda, to monitor its implementation, to appoint several task forces and to meet quarterly to assess its progress. In a similar vein, the Committee has focused on USM being "world renowned for sustainability" with the tagline "transforming higher education for a sustainable tomorrow".

Based on the Blue Ocean Strategy (BOS), the formation of the task forces highlighted the need to eliminate and/or reduce those practices and regulations which are deemed as impediments and obstacles for the accomplishment of the APEX goals, whilst raising and creating practices and ideas which can enhance and become catalysts for change in making competition irrelevant. As shown in Figure 1, the task forces are:

- Talent management
- Resources
- Bureaucracy in governance
- Autonomy and accountability
- Quality of services
- Global agenda and future relevance
- Sustainability agenda
- People-led solution agenda

The formation of the task forces is also to widen participation and involvement of the university community in charting the future of USM as an APEX university.

The Talent Management Task Force

This task force is responsible to identify issues related to human capital, namely the academic, students and administrative human talent and strategise to enhance the quality and quantity of human resources necessary to drive the APEX agenda. More specifically, it looks at how the university can develop a more innovative and creative human talent by assessing several specific issues. In doing so, it focuses on the aspects of service schemes, multitasking work, promotion exercises and the nurturing of continuous learning and professional development.

To reinforce the streamlining of human resource practices with the changes and aspirations of USM's APEX programme, 13 sub-committees were created to recruit and nurture the best talents and to groom talent for growth. Some major thrusts that are being attended to are the issues of postdoctoral fellowship development, the APEX leadership programme, the enhancement of academic staff recruitment "head hunting" nationally and internationally, improving the process of student intake and the improvement of academic and nonacademic staff profiling "Human Capital Management System".

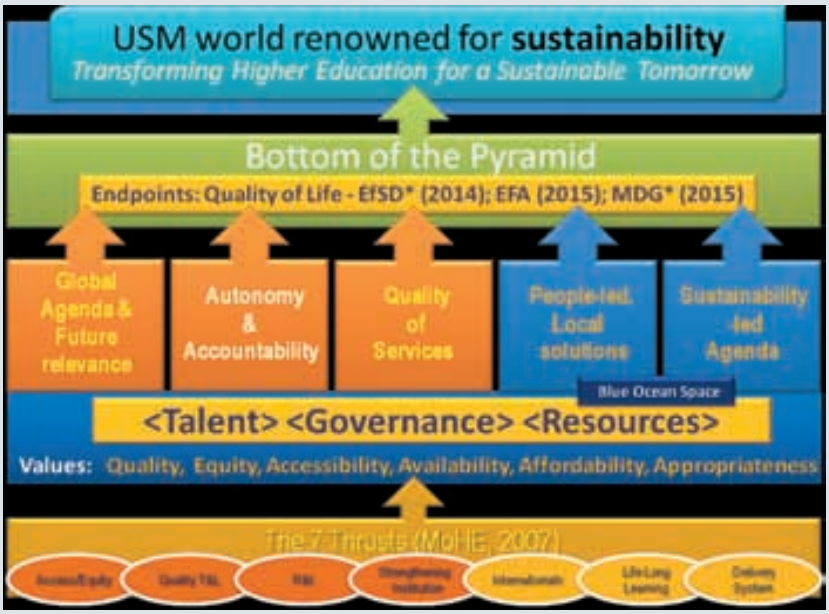


Figure 1: USM's Transformation Initiatives

The Resources Task Force

Resources, whether in the form of monetary, assets, data and even the well-being of the working environment, are critical to the development of every organisation. In order to meet these needs, it is important to (1) enhance the quantity and quality of various university facilities to meet the needs of the APEX agenda, (2) diversify potential resources; and (3) optimise the sustainable utilisation of available resources.

Under this task force, four major university resources and their related issues were scrutinised, namely (a) financial resources, (b) physical resources, (c) data/knowledge, and (d) ecosystem. The purpose is to identify the wastages in these four aspects of resources and propose strategies to reduce and eliminate them as well as raise and create new opportunities to further enhance the availability and sustainability of these resources.

- **Financial resources** have a direct bearing on the Key Performance Indicators (KPIs) as well as to provide the inputs into the planned activities that will produce these KPIs. These resources need to be transformed in terms of their quantity, quality, diversity and sustainability. The issues and strategies that need to be addressed include (a) sources of funding-enlarged, diversified, quality and sustainable sources, and (b) optimisation of the utilisation of available resources. For this, the task force intends to generate at least 30% of the financial resources by 2020. Thus, USM needs to consider all possible sources of financial resources. Strategies for resources focus on two broad complementary approaches, namely the resources generation approach and the resource optimisation/reduction approach.

- **Physical resources**, especially basic infrastructures, are a prerequisite for conducting sustainable world class cutting edge research, up-to-date academic programmes, and services. For researchers to excel, they require an environment conducive to stimulate creativity in their workplace.

  USM's physical expansion has not kept up with the increasing numbers of students (especially the postgraduates), academic programmes, research activities and consultancies. There are approximately 1,800 academic staff and 7,000 postgraduate students conducting research in various disciplines. In the APEX transformation plan, USM plans to increase its postgraduate enrolment from 7,000 to 20,000 by 2020, attract postdoctoral candidates and world class scientists. In recognition of these objectives and as part of APEX transformation plan, it is proposed that USM should prioritise investment in infrastructure vital for facilitating and accelerating research as well as providing suitable environment for nurturing, teaching and learning. USM should deliver infrastructure that supports priority research areas. As the main campus has limited land for physical expansion, a centralised high-rise laboratory complex equipped with the state-of-the-art equipment and integrated with office space is proposed for post- graduates/ researchers/academicians. In addition, supporting services such as student housing, transportation, recreational facilities, ICT facilities are also proposed. It is believed that the realisation of all these proposals will be a catalyst to the increase in the number of postgraduates, attract postdoctoral fellows and world class renowned scholars that will enhance quality learning and research at USM.

- **Data** alone have little value unless there are properly structured or organised. Processing organised data generates information, and effective use of that information, in turn, leads to knowledge and wisdom. The implementation of a Central Information and Communication Technology (ICT) system together with a cohesive ICT Policy are crucial for realising USM's APEX agenda and the KPI monitoring and delivery system.

The new extension of Hamzah Sendut Library which will house the research references

From 2009 onwards, there is an opportunity to integrate all these databases to form a cohesive USM Campus-Wide Information System (IS) that is fully integrated, or to replace all current legacy systems with a new central IS. It is proposed that this new IS should be service-oriented (client-centred) rather than 'corporate' structured. There must be a shift toward greater integration of information systems that is APEX-oriented with:

- all asset information to be totally digital and accessible via databases
- a single USM Campus-wide Electronic Data Management System
- emphasis on paperless management

Finally, we must learn from past failures, and take the bold step to implement a third-party monitoring system for key IS in USM. Between the executives that commission the information system and the stakeholder that is responsible for implementation of the systems (either in-house development or purchase), there should now be a third-party of stakeholders committee that evaluates the effectiveness of such systems. They must be given the authority to monitor a 'return-on-investment' of the IS implemented to ensure better accountability.

A Campus-Wide ICT System is no longer a "nice to have" facade. It is a strategic priority for USM to deliver higher quality and more cost-effective services, in our quest to stay competitive in the APEX agenda. In today's economically challenging environment, some ICT experts see this as the time to invest in IT initiatives and utilisation of the large pool of unemployed ICT personnel to develop effective ICT systems using Open Source systems for USM. The skills, procedures or software developed from the management of data/knowledge resources in USM is, in itself, as asset for USM, which can be marketed in the form of consultancies or software licensing to the private sector.

Lastly, in the midst of pursuing academic and research excellence, the changing landscapes of the campus ecosystem must be monitored. At this stage, USM faces the challenges in the aspect of sustainable ecosystem and strategies to achieve a real 'University in a Garden' concept. To achieve the APEX status, USM is committed to the development of a holistic higher education system that transforms and rejuvenates not only the mind but also the body; the internal characters as well as the external environment. In order to achieve this, major changes are needed not only in academic, research and management aspects but also in our attitude towards the campus ecosystem. It is nature that inspires creativity in human. Therefore, various strategies have been identified in order to make USM a real 'University in a Garden' that truly inspires its community and visitors. These include establishing parking zones, inculcating a walking campus community, work-from-home option, solar initiatives, LEO building, improved trash and chemical waste management, eco-friendly pest management approaches, waste-water recycling programme, etc.

At present, a total of 23 sub-committees have been tasked to oversee the implementations of the various strategies that have been identified by the task force on resources. Challenges remain at sight, especially the difficult to change the mindsets of the stakeholders. Many of the issues that were identified have either been reduced or eliminated by the stakeholders. Among them include simplifying financial procedures, annual fund raising efforts from the alumni, parents and staff, exploring tuition fee revisions for post-graduate students, establishment of Human Capital Management System (HCMS), etc. All the other strategies will be implemented in the near future.

The Bureaucracy in Governance Task Force

This task force was formed to identify and analyse issues pertaining to supportive governance, focusing in particular on internal governance issues. The primary principle guiding the restructuring of USM's internal governance would be the cascading of as much autonomy as possible, at the institutional level to the lowest possible units-schools/centres (or PTJs) and the individuals. The aims of this task force is to improve internal accountability, academic audits, peer review systems, decentralisation, participation in the development of strategic directions, policies, plans, the performance management system of KPIs and satisfaction of the stakeholders.

The key task is to review various internal processes to identify barriers that hinder efficient work flows and to recommend a more coherent and efficient work structure to manage all the functions within the university. To address these issues, five subcommittees were formed to review the following:

- finance
- human resource
- structure and function
- the Health Campus and
- the Engineering Campus

Their primary functions are to collect data on red tape and barriers and subsequently review the processes in the PTJs. They will eventually recommend a more coherent and efficient structure to manage all the functions within the university in an APEX environment.

Several recommendations were proposed by the task force, namely:

- **Red tape and bureaucratic practices:** PTJs should continue to look for ways to reduce and eventually eliminate red tape and bureaucratic practices. Each arising issue should be dealt with judiciously as it contributes towards achieving USM's KPIs and KIPs.

- **Ratio of non-academics to academics:** The current nonacademic to academic ratio of 4.5:1 should be further reduced to a level closer to the ratios being practised by most world-class universities. A lower ratio can be achieved in several ways such as by encouraging non-academic staff to multi-task and pursue higher degrees, recruiting more academic staff and reducing academic staff involvement in nonacademic positions and activities such as becoming a *penggawa* (hostel warden).
- **Science teachers:** They should be encouraged to get directly involved in research and publications. Practical classes that are now being taught by science teachers should be taken over by graduate assistants to give the latter some experience in teaching while at the same time providing them with financial support throughout their studies.
- **Technicians and laboratory assistants:** They should have at least the minimum of a first degree. This will create more opportunities for postgraduate students to work as part-time technicians under research grants.
- **Redundancies:** A special committee should be formed to review overlapping structures and functions in the university to ensure the optimisation of funds and manpower. PTJs must continue to formulate and implement the most suitable structure, function and system of governance to push USM towards higher KPIs and KIPs.
- **Roles and functions of the University Board:** Several issues pertinent to the University Board need to be addressed. For example, the Vice-Chancellor's function and job descriptions should be reviewed to resemble those of presidents of highly-ranked universities worldwide. Some of the job functions should be taken over by the Deputy Vice-Chancellors to allow the Vice-Chancellor ample opportunity to communicate, deal and "rub shoulders" with alumni, donors, sponsors, funding agencies and relevant authorities. Concurrently, the roles and functions of the Deputy Vice-Chancellors need to be reviewed to eliminate overlapping roles and functions. Many support the idea of having a Provost for each branch campus to allow wider autonomy and reduce dependency on the main campus.
- **Governance of the PTJs:** It is proposed that the management and individuals at each PTJ be given more autonomy in deciding its own management team. It is suggested that the top management gets to select the management team based on names (which can be internal or external to the PTJ or USM) that have been nominated by the staff. Additionally, each PTJ should have the flexibility to develop its own business plans that are directly linked to the KPIs and KIPs and negotiate a budget with the top institutional management.
- **Staff performance:** A comprehensive system must be developed to monitor and evaluate staff performance at the individual level, which when aggregated will contribute towards the PTJ's level performance and subsequently, the institutional level performance. Every staff should adhere and follow the guidelines that have been provided in preparing his/her own KPIs and KIPs at the beginning of the year that reflect the requirements of USM as an APEX university. USM should emulate the more transparent system in "hiring and firing" of academic staff that is being practised at top-ranking universities where the faculty board members have the right (vote) to hire and fire their own faculty members.
- **A paperless university:** USM must seriously pioneer and continue to achieve the status of "a paperless university" where ICT and online systems are widely used. The current face-to-face meetings should be reduced. Virtual groups, teams and research clusters should also be encouraged to flourish. As such, USM must continue to improve its infrastructure, skills and capabilities in ICT. USM must quickly shift from "blackboard and overhead projector teaching" to more computer-based and online teaching and assessment. All teaching materials must be made available online.
- **Research and Innovations:** More supporting academic positions should be created under the Deputy Vice-Chancellor (Research & Innovation) to enhance USM's network at the national and international levels.

The Autonomy and Accountability Task Force

This task force focuses on the external relations between the university and central agencies (government). Specifically, it looks at the issues of Amendments to the Universities and University Colleges Act (AUKU) (February, 2009) in transition, full USM APEX Constitution by 2011 (including legal, recruitment, financial, institutional), creation of "Ombudsman" and strengthening of "Internal Auditors" and advocacy of autonomy: legal, financial, institutional, and academic issues. The task force has reviewed the amended AUKU and has drafted some amendments and possible exemptions to be requested. At the same time, the first draft of the USM APEX Constitution has been discussed and further amendments made.

Also, autonomy in Student Intake has been accomplished and USM had its first intake independent of MoHE's *Unit Pusat Universiti* (UPU) and has managed to incorporate various selection criteria to reflect its aspirations in terms of student intake. Further, in November 2009, in lieu of the end of the term of the present Deans and Deputy Deans of the PTJ, elections for these posts were held for the first time in the history of USM.

Separate write-ups on the draft of the USM APEX Constitution (see page 17) and the amended AUKU (see page 23) are available in this publication.

Figure 2: Conceptualisation of COLLIGENCE

The Quality of Services Task Force

The primary task of this task force is to enhance the quality of services provided by the various units within the university. Its responsibilities include addressing issues related to quality certification and accreditation for professional services, sustainability-led quality standards and the creation of "new" standards, synergising with MQA leading to self auditing and strengthening of "Internal Auditing" through the "Ombudsman" system.

Since September 2008, this task force has carried various activities, including vying for various national quality awards, accreditation and certifications and quality assurance. The year 2009 witnessed the entire Health Campus being accorded various Quality Accreditations nationally and internationally. This is to be followed by the other campuses in due course.

The Global Agenda and Future Relevance Task Force

The task entrusted to this task force is to develop strategies and concrete plans of action to transform and nurture activities (nurturing and learning, research and innovation, consultancies, and community services as well as talents and resources) conforming to the global agenda of higher education while at the same time become the catalyst for transformation.

The task force has developed four major initiatives that are ready to be implemented. They are as follows:

- **Bottom Billion Initiative: Global BB Communities** - This is a multidisciplinary initiative to utilise staff and students through their talents, skills and expertise to transform BB communities globally through several mechanisms, such as the Sejahtera Corp, working with identified champions from the community, and so forth.

- **COLLIGENCE (Collective Intelligence and Scanning Engine Database)** - This project addresses issues of people-computer connection so that collectively they act more intelligently than any individuals, groups or computers have ever done before. As can be seen in Figure 2 above, the idea here is to gather accurate, meaningful and on-time information speedily and efficiently. It will also address the issue of empowering individuals and groups to make instant, well-informed and up-to-date decisions. This project enables heads of organisations to monitor, in real time, overall progress of the organisation's processes and machinery and tackle problems in their infancy, instead of having to constantly initiate a long and tiresome data gathering process before only then starting to address problems.

- **Global and Regional Networking** - This project aims at leveraging on the strength of member partners (university and industry), and share expertise, to be the primary information, knowledge, and advice centre on academic, research, consultation, and training in the region. It will also provide an avenue where academicians, researchers, consultants, trainers, and practitioners can jointly work together. A successful network will provide strength and visibility to the member partners. An example of one already practised in USM is the proposal modelled on a successful network between ASEAN universities and the Japan Graduate School of Engineering Consortium, as seen in Figure 3 below.

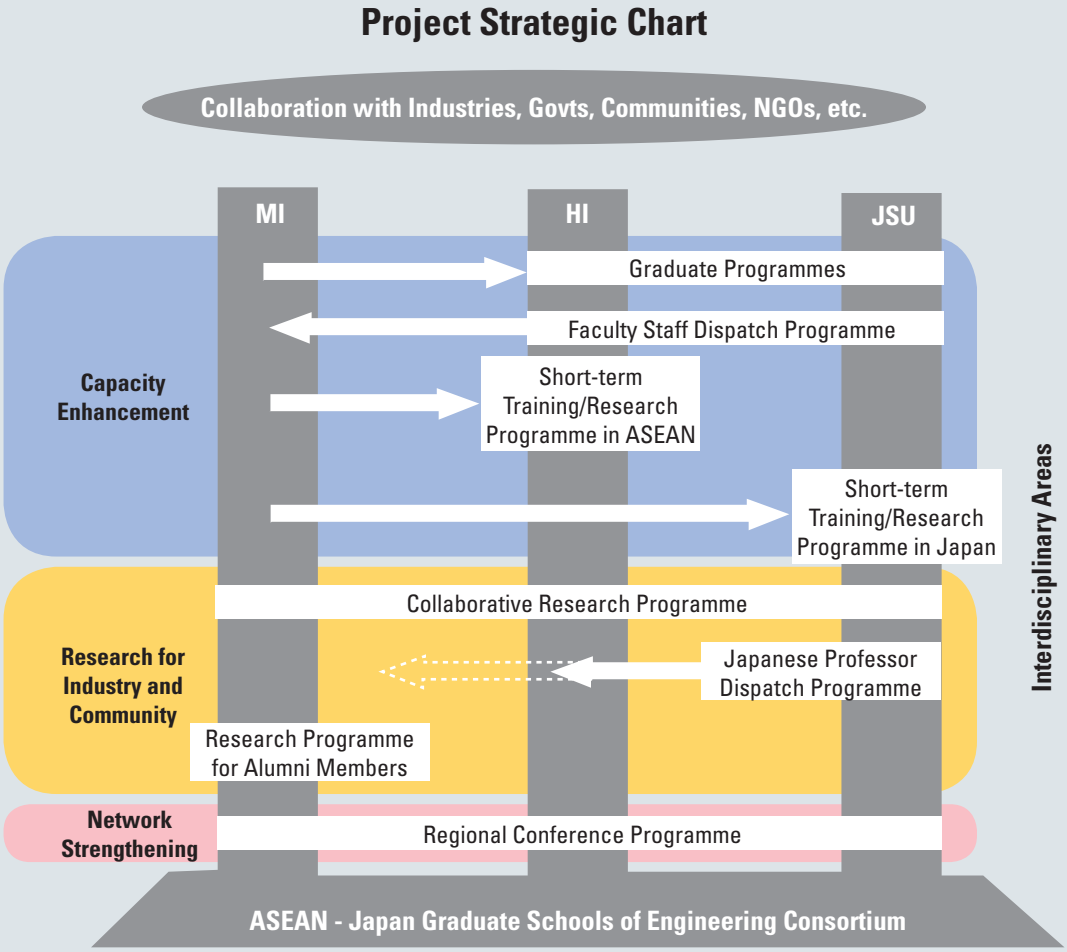


Figure 3: ASEAN – Japan Graduate Schools of Engineering Consortium (Source: AUNSEED.net JICA secretariat)

This project seeks to design and develop a generic template of a successful regional business networking model for USM that minimises the chances of failure and produce guidelines and recommendations for USM on how to enable success, growth, and sustainability of a global/regional network. By the same token, it will also initiate training sessions and furnish the necessary advisory support to PTJs to plan, organise, manage and sustain networks with esteemed academic organisations at the regional and global levels.

- **The Future Global Curriculum Programme** - This curricular transformation programme was initiated to develop a new framework as a template for the development of National Curriculums and for the transformations of Institutions of Higher Learning. The process will be carried out in several phases, including the development of transformation framework, review of previous studies and the conduct of a general public poll and workshop sessions.

The Sustainability Agenda Task Force

This task force plays the role of facilitating the realisation of the two-tiered approach of the USM APEX framework, namely aspiring to be world-renowned in sustainability and to be a sustainability-led institution of higher learning. In this regard, USM can play a pivotal role in promoting the sustainability agenda as stewards of large public institutions, as educators of future leaders, and as active participants in the search for ideas and solutions that will shape its common future. A worthwhile modality to achieve this is to subscribe to the principles of the Taillores Declaration which include striving for increased awareness of sustainable development; creating an institutional culture of sustainability and fostering sustainability literacy for all.

This task force therefore focuses on identifying framework(s) of sustainability, identifying programmes of sustainability awareness, research and outreach projects and in the settting up of a Centre for Global Sustainability Studies (CGSS).

- **The USM-APEX Sustainability Roadmap** - under the leadership of the Chair of the Sustainability Task Force, Prof. A. H. Zakri, a multidisciplinary Sustainability Team was involved in the development of the Roadmap. The Roadmap (see Figure 3) presents the university's case, state of readiness and action plans for rolling out a systemic adoption of the principles and practices of Education for Sustainable Development (ESD). The Roadmap assesses the current status of sustainability across the university's missions as well as by Water, Energy, Health, Agriculture and Biodiversity (WEHAB) and related cross-sectoral issues. Teaching methods and curriculum, research areas, methods and output, and networking as well as green campus initiatives are reviewed in terms of their alignment with ESD objectives.

  The major objectives are to mainstream principles of sustainability into teaching, research and community missions; promote teaching and training which will produce graduates who can think and act with a holistic understanding of the economy, environment and society; build human resource and technical capacity for research to produce innovative products or ideas to address real-world sustainability issues and develop new or strengthen existing research and other relevant networks to enhance USM's reach and capacity.

- **Centre for Global Sustainability Studies** - detailed description of CGSS (see page 125) is available as a separate article in this publication.

People-led Solution Task Force

The primary focus of this task force is to realise the second tier of the sustainability agenda, namely ensuring USM becomes a sustainability-led campus involving its community and the community at large in sustainability issues. A major task at hand is to promote and imbue sustainability as the Core Value in USM, which stems from the university's inside out approach in promoting sustainable development.

This internalisation approach (as opposed to outside-in), augurs well for sustainability or sustainable development since it promotes the existing internal strength based on the principle of contextualisation. Manipulation and optimisation of internal strengths will ensure the sustainability of the programme. The USM model of the inside-out approach can be understood from the framework of (a) the *Kampus Sejahtera* (Healthy Campus) programme, (b) the University in a Garden concept, (c) the transdisciplinary approach in promoting teaching and research activities, (d) community action, and eventually, (e) as an RCE (Regional Centre of Excellence).

One of the recommendations is to turn the Engineering Campus to become a model of sustainable community. Essentially, it is small (and manageable), not fully built-up yet (provides opportunities for experimentation with new ideas especially in terms of green buildings and spatial planning), there is a lot of support (from deans, staff and students); and there are already efforts underway (e.g. bicycle project; a proposal to curtail movement of cars on campus-only allowed to drive in, park, and drive out; proposal to house lecturers from different Schools under the same roof; electric motorcycles). Engineering students can also be mobilised to create technological solutions.

The newly established *Sejahtera* Centre

To see through the numerous recommendations, it is proposed that USM set up a Sustainability Office (SO) with overall charge on all matters related to sustainability under the APEX umbrella. The SO's role will be one of leadership, initiating, managing and implementing projects and policies. It will also play coordinating roles between the numerous departments and units which must all be working on relevant aspects of sustainability. It can perform advisory functions but will not be an approving authority (for instance in approval of construction projects). In the longer term, it will be tasked with facilitating compliance with university policies. One major responsibility will be to generate a sustainability report for the university.

It is also recommended that USM creates an advisory panel on sustainability consisting of prominent individuals within and outside of USM from diverse backgrounds. It serves as an independent body which advises on policies and actions, monitors, validates and critiques USM's sustainability efforts.

The USM's Guest House

At the threshold of a new era - USM's new APEX Constitution

In the enactment of all laws, the gestation period is always long and painful. The same is true for the APEX Constitution of USM. After a process of extensive discussion and consultation, our final draft was submitted to MoHE in February 2009. MoHE processes were completed by June 2009. Preparation of the Bahasa Malaysia draft was completed in November 2009.

The Constitution now awaits approval by the drafting unit of the Attorney General's Chamber after which it will be submitted to the Yang di-Pertuan Agong for his assent under Section 26(b) of the Universities and University Colleges Act 1971 (AUKU). As this is a piece of subsidiary legislation, there is no need for parliamentary debate and approval.

The APEX Constitution seeks to replace the existing USM Constitution and the First Schedule of AUKU, substituting them with a new APEX Constitution that contains many of our hopes and aspirations for a more autonomous state of affairs.

Below is an executive summary of the main differences between USM's proposed "APEX Constitution" and the First Schedule of AUKU.

University autonomy: a historical note

From 1957 to 1971, the government permitted the universities in the country a fair degree of autonomy even though the universities then, as now, were largely funded by the taxpayers. In the seventies due to disruptive student activism, bureaucratic control over university appointments and the core activities of universities became the norm. The instrument for this control was AUKU (Act 30).

In 1996, "corporatisation powers" were conferred by an amendment to Act 30. In practice, however, the bureaucracy retained its control and the 1996 amendments made no impact whatsoever.

The spirals of history are in motion again. In the last few years, we have begun to dream dreams of becoming the regional hub of education, to achieve world class status, to produce Nobel Laureates, to emphasise research and innovation, to develop links with industries and to commercialise our findings.

A realisation is growing that universities must be allowed more leeway to experiment and to innovate. The conferments of "research university" and "APEX status" are two steps in that direction. However, nothing is likely to change on the education front unless legal changes are accompanied by fresher administrative and psychological thinking.

Existing powers and possibilities

Despite the severe controls of AUKU, the universities are nevertheless recipients of many unrealised and un-utilised powers that confer a fair amount of operational independence in educational, administrative and financial matters.

Under Section 3 of the First Schedule, the university is a body corporate with all the powers of a corporation or company.

Under Section 4 of the First Schedule, the university has extensive powers to regulate its educational, administrative and internal affairs. For instance, the university has the power to:

- enter into contracts
- appoint staff and to establish trust
- appoint, promote and discipline staff
- regulate the conditions of service of staff including schemes of service, salary scales, leave and discipline
- establish pension and provident fund schemes

The university was also granted some commercial powers in the matter of investing in land or securities, granting loans to staff and students, conducting commercial research and promoting and utilising its commercial findings.

The university - with the approval of the Minister of Finance - could enter into equity participation, partnership and joint venture with the public or private sector.

The university is also permitted to set up corporations to manage any property, project, scheme or enterprise of the university. The corporation will be under the control of the university's Board of Directors and not of the Companies Commission. The Board of Directors - with the permission of the Minister of Finance - can float companies under the Companies Act 1965. There is considerable potential for academic and commercial autonomy here as the experience of Universiti Islam Antarabangsa Malaysia indicates.

The university is allowed to acquire private land and to register it in the name of the university.

Section 17 permits the university to set up a provident fund scheme. The funds of the scheme cannot be garnished, attached, sequestered or levied.

Section 24D regards university officers and employees to be "public servants" within the meaning of the Penal Code. However, for all other purposes, university employees are not public servants under Article 132 of the Constitution but servants of a statutory body. They are not subject to the disciplinary rules applicable to public servants, nor to the General Orders, schemes, directives, circulars to which public servants are subject to.

Financial autonomy: legal obstacles

Despite the above theoretical powers, there are also many legal and practical obstacles.

For example, "additional powers of the university" to venture into commercial and "corporatisation" activities require the consent of the Finance Minister.

The Minister also exercises a wide range of financial powers over the university, from approving estimates to assigning additional money to the university.

The Minister has power to grant or withhold permission to the university to engage in trade, business, investment or joint ventures.

In addition to the above laws, there is the reality that most universities have very little income of their own and rely mostly on the Ministry and the Treasury for operational and development expenses. Money comes with strings attached.

Section 3 of AUKU empowers the Minister to give "general direction(s)" on higher education to the universities. This power can be deployed by the Minister (and Ministry) to compel universities to conform to ministerial policies. The power can be used to block innovativeness and initiative on the part of universities.

Section 3 further subjects universities to "national policies, strategies and guidelines … formulated … by an authority established under any written law…". This means that not only the Minister but also other authorities and institutions existing under any law may claim the right to advise and guide universities and may pose potential obstacles in the way of initiative and enterprise.

Under Schedule 1, Section 37, the Board of Directors of the university has no power to transfer any balance of annual recurrent expenditure to the annual recurrent expenditure of the following year. Likewise, the Board has no power to transfer any balance of capital expenditure for one year to the capital expenditure of the following year.

Financial autonomy: administrative obstacles

Despite the theoretical possibility of some autonomy, in actual practice, universities remain severely regulated by the government. Legal and commercial independence has not been practised or has not been allowed to be practised for a number of non-legal, financial, administrative, historical and psychological reasons.

As a matter of the administrative traditions of a "bureaucratic state", the Cabinet, the Prime Minister's Department, the Public Services Department (JPA), Ministry of Finance (MOF), Malaysian Administrative Modernisation and Management Planning Unit (MAMPU), the Ministry of Home Affairs and the Ministry of Higher Education issue periodic circulars, directives and instructions to all institutions of higher learning. Universities tamely comply. A few examples can be illustrative:

- There is a Ministry order to all universities to send their MoUs and MoAs to the Ministry for approval
- There is an instruction on the need for Ministry's approval for staff to go on leave abroad
- The Ministry and JPA exercise power over many university appointments and promotions
- Sometime ago, there was an instruction to UPM on the contents of its ethnic course manual
- There are instructions that purchase of land by a university must be in the name of the Federal Land Commissioner
- Despite the university's legal autonomy, admission of students has been taken over by the Ministry
- There is very tight control by the JPA over the creation of staff posts
- The date for student elections is determined by MoHE and not by the university
- Many Treasury Circulars pose immense practical problems for universities. For example, SPP Bil 10, 1993 forbids Government agencies from establishing printing units. This violates Schedule 1, Section 4 (1) (i)
- SPP Bil 5 (2009) states that a tender's validity cannot last beyond 90 days. As an APEX-status university, USM would like more flexibility

Hundreds of similar examples of administrative obstacles can be pointed out. In law, the university is not bound by most of these circulars and can exercise its own mind to accept, reject or modify them.

This is especially so because many circulars pose problems of unconstitutionality; they force the universities to pay higher costs; they resort to micro-management; they impose pre-decisional obstacles instead

of post-decisional accountability; they treat the universities as if they are mere departments of the Ministry of Higher Education when in fact and in law, the universities are a separate, autonomous legal persona.

There is a misunderstanding that university employees are "public servants" and, therefore, subject to Government Circulars and General Orders. In law, "public services" are only confined to those listed in Article 132 of the Federal Constitution.

Under Section 3 of Act 30, the Minister has been given responsibility "for the general direction of higher education". The Ministry uses this section to exercise close supervision over all or most aspects of university administration. From a purely legal perspective, Section 3 authorises only general direction, not specific decision-making power. Further, Section 3 qualifies the Minister's (and Ministry's) powers with the words "subject to the provisions of this Act". This means that in whatever area Act 30 has conferred autonomy, the universities are entitled to exercise their powers in accordance with the law and the Ministry's prior permission is not needed.

It appears therefore, that in law there is no barrier to university autonomy. There is no barrier to permitting university managers to manage. There is no need for drastic changes made to Act 30 to devolve or delegate power from the Ministry to the universities. The power already resides in the universities although it is gathering much dust.

What has happened is that a dissonance has developed between the law in the book and the ground realities.

Vice-Chancellors have no security of tenure. They are therefore, vulnerable to government pressures to comply and are open to risks if they act out of line.

What is required, therefore, is that legal and structural changes must be accompanied by a psychological shift and a new way of thinking on the part of MOHE, MOF, JPA, MAMPU and the university leadership.

The government "loves" the universities too much and trusts them too little! It must be prepared to let go, to take calculated risks and to let managers manage. It must stop at broad policy guidelines. It must give up some of the prior restraints that it has no legal power to impose but imposes nevertheless administratively. It must, instead, ensure post-decisional accountability and answerability.

New provisions for financial autonomy

A number of significant changes has been proposed which should strengthen our autonomy.

USM is to have the power to determine fees in accordance with any general directions on higher education. The matter of fees is complex. Fees vary from undergraduate to postgraduate students, local to foreign students. Special courses for target groups and for professional groups may have different fee structures. It is inconvenient to obtain prior permission each time. However, USM will obey any general directions issued by the Minister on higher education. As such, social responsibility will accompany freedom.

USM shall register and maintain patents, trademarks and other intellectual property rights.

Under "the powers of the university", USM is to have the power to regulate and control its income other than grants-in-aid. All income and earnings other than grants-in-aid from Parliament that the university creates, generates, earns or receives by its own efforts, initiative and enterprise, shall be assigned to one or more special accounts managed and administered by the university in accordance with any rules prescribed by the Board of Directors. This section is at the heart of USM's effort to seek financial autonomy. Money not given by Parliament and earned by our own effort should be managed and controlled by the university itself. This is in accordance with the constitutional right to property in Article 13.

Allowances of the Board are determined by the Minister. It is proposed that subject to subsection 19 (7), the Board should determine the allowances for other members of the Authorities. A person invited by any authority may be paid such allowances as the Board may determine. Under AUKU, allowances to other members of the Authorities and to any invitees are mandatory. It is proposed that they be optional and be determined by the Board.

Accountability, answerability and good governance

In addition to the legal provisions for accountability that are already existing, the following new mechanisms have been introduced. For example:

- an internal auditor shall be appointed by the Board in addition to the external auditor appointed by the Board
- a complaints officer to investigate complaints of maladministration shall be appointed by the Board
- the USM Constitution shall have a "whistle-blowers clause" to protect staff and students who report abuse of power
- the Board may order other audits on any matter deemed necessary

Governance issues relating to the board of directors

- The Board of Directors shall be renamed the Board of Governors. This is in line with the practice of most foreign universities. The terminology of Board of Directors is suitable for companies and was not used for universities before 1996
- There shall be two professors on the Board elected by the Senate
- The appointment by the Minister of members shall be after "consultation" with the Chairman of the Board. Consultation with affected persons

increases the legitimacy of the process but does not impose a duty to obey. Consultation does not mean consent The Minister may reject the advice
- The Board may invite representatives of administrative staff or of students to attend its meetings
- Under AUKU, the Minister has no power to dismiss a Board member. Under the USM APEX Constitution, members of the Board shall be appointed for three years but may be terminated by the Minister following the assigning of reason for the termination
- The Board is required to establish committees related to: management of properties, assets and trusts; intellectual property; the environment; the well-being of the community; employee performance and the APEX programme

Governance issues relating to the Vice-Chancellor

The Vice-Chancellor, like other members of the Board, shall be appointed by the Minister for a term of three years. However, the Minister may remove him by assigning reasons for the termination.

Governance issues relating to the University Senate

- The Senate may invite any person, including a student, to its meeting and to give him/her access to parts of the minutes
- The number of professors who are to be elected to the Senate by their peers shall equal the number of deans. For the purpose of election to the Senate of professors, the Vice-Chancellor may create "clusters" of faculties and allocate a number of professorial seats to each cluster
- In addition to any committees it may wish to establish, the Senate shall set up some committees in areas such as enhancement of pedagogy and training; evaluation of courses; research and publication; links with industry, community and institutions and franchise programmes

Governance issues relating to head of campus

The head of a local branch campus shall be appointed by the Board after consultation with the Minister. Heads of foreign campuses shall be appointed by the Minister after consultation with the Vice-Chancellor.

Other governance issues

- The clause on "powers of the university" is amended to include the power to make, revoke or amend any statutes, rules or regulations
- The Management Committee of the university under AUKU leaves out heads of branch campuses and the Chief Librarian. USM includes both in the Management Committee of the university
- In addition to the Management Committee of the university, there shall be a Management Committee for each branch campus; an Academic Council for each faculty and a Management Committee for each faculty
- The Yang di-Pertuan Agong shall be the Patron of the APEX university. The Patron is not an authority of the university. His role is to keep himself informed on the university's vision and mission
- There shall be an advisory group of eminent persons

Regulations, circulars, etc.

The Board of Governors may adopt, with such modifications as it deems fit, any regulations, rules, circulars or directives issued by the Federal Government. Such regulations, circulars etc., may be amended or revoked by the Board. Being the law of the university, they may be amended or repealed by the university without any prior permission.The purpose of this section is to remove, once and for all, the uncertainty surrounding government circulars. Legally, they have no status of law unless derived from a specific provision of an Act of Parliament. The university is not bound by them.The purpose of this section is to reiterate the supremacy of law over policy; to reiterate that whatever powers are conferred by Act 30 cannot be taken away by administrative directives and to affirm the university's powers to accept, reject or modify a circular.

Academic autonomy and academic matters

- As under AUKU, twinning or franchise programmes and conduct of study in association with any university or organisation require approval of the Minister. However, approval of the Minister shall not apply to any short-term course or training programme not leading to the award of a degree or diploma
- Besides faculties, schools, academic centres etc., there shall be research centres.

Staff matters

- Post-doctoral fellows are recognised as a special category of persons.
- Trainee lecturers under the academic staff training scheme (ASTS) are a special category of persons.
- USM is empowered to consider applications for review from any employees aggrieved by the exercise of power to appoint and promote.
- Subject to other written laws, USM is empowered to regulate the discipline of employees and students.

Student affairs and development

- USM proposes to separate "student affairs and development" from student discipline. The former shall be in the hands of a Deputy Vice-Chancellor. Student discipline shall be in the hands of the Vice-Chancellor who shall delegate it to any employer or to a committee.
- The Vice-Chancellor may delegate his powers to any Deputy Vice-Chancellor, any employee or any committee of persons of the university including students.
- In addition to the SRC, USM shall have a Students' Consultative Assembly consisting of the SRC plus representatives of

other student bodies. Meetings of the Students' Consultative Assembly shall be open to all registered students. In this way, there shall be a democratic forum for consultation, discussion and debate between student electors and all student representatives. The Students' Consultative Assembly shall have a speaker and a secretary. It shall meet at least twice in a year. It may have extraordinary meetings if requested by at least 2,000 registered students.

- The detailed qualifications and disqualifications of persons who may seek election under AUKU have been removed. The Board shall prescribe the qualifications. Those facing disciplinary charges or convicted of such charges are disqualified. First semester students will now be qualified to contest.
- SRC elections shall now be held annually and no later than 45 days after the commencement of the academic year. A fixed election schedule will provide a level playing field and will remove uncertainty about the tenure of each SRC.
- Under the proposed USM Constitution, the Vice-Chancellor may remove a student, after giving him/her an opportunity to make a written representation, suspend a misbehaving member of the SRC or a student body from his/her post and institute disciplinary proceedings.
- The USM Constitution provides for the Minister to refer students for admission to the university for the university's consideration. We believe that in line with the quest for autonomy, the university should not be obliged to admit students who have secured scholarships and who are referred to the university.
- Despite mandatory annual student elections, transition period members of the present SRC shall continue to hold office till the date on which new elections are held.

Autonomy with answerability

In seeking the above powers, USM is aware of the need for autonomy to go hand in hand with accountability. To ensure answerability and accountability for all decisions, financial and non-financial, the university is proposing the following new offices or institutions:

- a legal adviser
- an ombudsman
- an internal auditor
- Board committees to manage properties, assets, trusts and IP
- protection for whistle blowers
- other audits

Conclusion

In seeking the above powers, USM is inspired by the liberating spirit of AUKU (2009).

USM is asking for the restoration of legal powers that exist under AUKU but which have become eclipsed by administrative and extra-legal restraints.

USM is seeking revival of the theory that statutory bodies are semi-autonomous legal persons that stand in between government departments and private sector enterprises.

USM is requesting that administrative policy should not be used to frustrate the explicit provisions of AUKU on autonomy. USM is requesting a chance to experiment and to innovate.

USM is proposing that instead of pre-decisional fetters, the government should enforce post-decisional accountability.

In seeking more autonomy, USM is conscious that if things go wrong, the law of surcharge, the Penal Code and anti-corruption laws may be invoked against its officers.

USM is not seeking autonomy for its own sake but to achieve the vision and mission of its APEX status. USM is deeply committed to remaining accountable to the broader society (both local and international), to USM's own community, to the MoHE and our financiers (Parliament, the Government and the Ministry of Finance). ◢

"We have the confidence that USM can do it, but there is always fear. Ours (the Malaysian setting) is not an ideal environment to exert change. So long as universities are part of some misguided political agenda then it is not going to be easy to have the kind of change we are looking for. Change can happen only if we have the right notion about academic freedom and about institutional autonomy. . . . we don't want to hear, "We can't do it because we are bound by the Universities and University Colleges Act"."

Professor Emeritus Dato' Mohamad Zawawi Ismail
APEX University Selection Committee Chairperson

Q & A

Prof. Emeritus Dato' Shad Saleem Faruqi

Visiting Professor

Q ***Why do we need a new Constitution?***

A The essay tried to explain that there are many legal and non-legal obstacles in the path of independent and innovative action. If the Government wishes to have universities that can become the hub of regional education, can excel in research and can blaze their own trails, then some bureaucratic hurdles need to be removed. The APEX Constitution will not provide a magic wand but will lay the legal basis for autonomy with responsibility. In sum the new Constitution seeks to fulfill the need for autonomy with accountability.

Q ***You wrote, "There is a misunderstanding that university employees are "public servants" and, therefore, subject to Government Circulars and General Orders. In law "public services" are only confined to those listed in Article 132 of the Federal Constitution." Does that mean that university employees are not subject to Government Circulars and General Orders?***

A The second question about GO is based on prevailing practices and wrong perceptions. I reiterate that universities are separate legal entities not government departments. JPA and MOF Circulars are not binding on us. What is binding is "law" - law as found in our Act and in delegated legislation under our Act or under Acts applicable to us like Act 605 on staff discipline. Circulars etc. do not qualify as law under Article 160(2).

Q ***You wrote, "Under AUKU, the Minister has no power to dismiss a Board member. Under the USM Constitution, members of the Board shall be appointed for three years but may be terminated by the Minister by assigning reason for the termination: S. 19(1)." Does that mean that under the USM Constitution, the Minister expands his power while USM loses part of its autonomy?***

A This question is reasonable but we do not need to change our script. The previous position was that Act 30 explicitly provided for appointment of members of the Board but was silent on termination. The position was therefore uncertain. Was there no power to dismiss? Or could the Interpretation Acts be employed in that part which says that the power to appoint includes the implied power to terminate? We decided to make the law clearer.

As to the assertion that USM has lost autonomy and Minister has gained a power! With all due respect, this allegation is totally unfounded. USM never had any autonomy in this area. Board appointments were always made by the Minister, not by USM. There was implied power to dismiss. We made the power explicit and added a safeguard - reasons must be given. Prior to our law, the university was not even consulted.

Now a committee will advise the Minister. Further, the removal of a recalcitrant, obstructive member may well help, not hinder, autonomy. We heard plenty of evidence that there are Board members who seek to derail everything. Now, the university will have the opportunity to request the Minister to remove these uncooperative members under our Act. Further, our new Act seeks to provide for consistency. If VCs can be removed, why not Board members?

New era of APEX transformation for students

Amendments to the Universities and University Colleges (Amendment) Act 2009 (AUKU) were gazetted on 1 February 2009. In addition, USM's new APEX Constitution is awaiting the approval of the Yang di-Pertuan Agong. Together these two new laws seek to usher in an era of liberalisation of the USM campus in a number of areas of interest to students.

Among the important areas covered in the Amendments are:

- Freedom of association
- The Vice-Chancellor's power to suspend student organisations
- Freedom of speech
- De-criminalisation of AUKU
- No automatic suspension or dismissal
- Fundamental right to education
- Student democracy
- Fairer disciplinary procedures
- Participation in governance
- Other rights for students

1

FREEDOM OF ASSOCIATION

The amendment removes the need for students to seek the university's permission to join any organisation - national or international - outside the university.

However, this freedom does not include the permission to join any political party, any organisation declared illegal by any existing law, and any organisation specified by the Minister - and not the individual Student Affairs Departments - as being "unsuitable to the interest and well being" of the students.

Previously all association was prohibited unless clearly permitted. Now all association is permitted unless clearly prohibited.

2

VICE-CHANCELLOR'S POWER TO SUSPEND STUDENT ORGANISATIONS

The previous power of the Vice-Chancellor to suspend or dissolve a student organisation summarily has been subjected to procedural safeguards for students. Student organisations are given a chance to defend themselves through a prior hearing and are allowed to appeal to the Minister.

In curtailing the Vice-Chancellor's power to summarily suspend or dissolve a student organisation, the law has shifted focus towards the individual member or office bearer of the SRC who may be acting irresponsibly. After giving him a proper opportunity to make a written representation, the Vice-Chancellor may suspend him from his post or institute a disciplinary proceeding against him.

4

DE-CRIMINALISATION OF AUKU

Previously, for violation of university laws, criminal penalties including jail sentences up to six months and fines up to RM1,000 were in place. There were provisions for presumption of guilt, criminal liability even without conviction and collective criminal guilt. These have all been repealed. The amendment totally de-criminalises AUKU by removing all criminal penalties and substituting them with disciplinary measures by the university.

3

FREEDOM OF SPEECH

Students are still not allowed to show support for, sympathy with or opposition to political parties. However, students can now make public statements on any academic matter on which they are engaged in study or research. Students are also allowed to indulge in any academic comment or criticism on academic occasions provided that these occasions were not organised by political, illegal or any organisation deemed unsuitable for students by the Minister.

6

FUNDAMENTAL RIGHT TO EDUCATION

The new Act recognises that education is a citizen's fundamental right. Beside those discussed above, a student has a right to return to the university upon being acquitted of a charge in a court of law or has served out his sentence or has been released from a detention order.

His forced absence cannot be taken into account in calculating the maximum period he is allowed for completing his studies.

If a student was suspended from a public university, or ceases to be a student of a university under this Act, he has a right to enrol in a private institution and, with the permission of the Minister, in another public university subject to any condition the Minister may impose.

The Senate's right to revoke a degree or a diploma on the ground of "scandalous conduct" was previously very broad. The term "scandalous conduct" has now been narrowed down to false documentation. Even that is subjected to the procedural safeguard of a prior hearing for the student concerned.

> **"Student discipline has been separated from Student Affairs and Student Development. Hopefully this will exclude conflict of interest situations."**

5

NO AUTOMATIC SUSPENSION OR DISMISSAL

The Act removes all previous provisions for mandatory, automatic suspension or expulsion of a student who is charged with a criminal offence or who is convicted of an offence.

For criminal charges, no disciplinary action needs to be taken if the offence is a "non-registrable offence". For "registrable offence", the university is given the discretion to handle the case as it sees fit depending on whether the offence is related to academic matters. If convicted, the student may face further disciplinary action at which he will be allowed to defend himself.

If a student is detained or restricted under a preventive detention or restricted residence law, he is not automatically suspended or dismissed. He is allowed to retain his status as a student. The Senate may even permit him to take his examination at the detention centre. He may be subjected to a disciplinary proceeding at which he will be entitled to defend himself.

> **Attitudinal changes within the minds of all stakeholders are essential in order for these amendments to be truly meaningful.**

8 FAIRER DISCIPLINARY PROCEDURES

A student of the university may now be appointed by the Vice-Chancellor to sit as a member of the Disciplinary Board of first instance to try student disciplinary cases.

There is a right to a written notice of the grounds on which disciplinary proceedings are to be commenced, right to an oral or a written reply, and the right to be represented by an employee of the university or by another student of the university before the Disciplinary Board of first instance.

Once a decision is made, it must be communicated to the student within 14 days, and the student found guilty has a right to appeal within 14 days. The appeal must be heard and a decision pronounced within 60 days from the date the appeal was filed.

The Minister's power to dismiss an appeal summarily is repealed. The right to hear student appeals is transferred from the Minister to the Board. Adjudicators now have strict time limits (14 days) to communicate their decision to the accused.

7 STUDENT DEMOCRACY

The SRC shall be elected within 45 days of the commencement of each academic year. The university shall determine the rule of eligibility to contest.

In addition to SRC, a new Students' Consultative Assembly (SCA) for all registered students except "external students" has been created. The SCA will consist of members of the SRC as well as representatives of other elected student bodies. The SCA shall have a Speaker, a Deputy Speaker and a Secretary.

9 PARTICIPATION IN GOVERNANCE

The Board of the university shall have a Student Welfare Committee on which two student representatives elected by the SCA shall be entitled to sit. The Senate of the university is empowered to invite a student to attend its deliberations and to give him access to any minutes of the Senate.

The Academic Council of the Faculty may invite a student to attend its deliberations.

10

OTHER RIGHTS FOR STUDENTS

Student discipline has been separated from Student Affairs and Student Development. Hopefully this will exclude conflict of interest situations.

A Deputy Vice-Chancellor shall be in charge of student affairs and development. Student discipline shall be transferred to the Vice-Chancellor and his delegates.

Students who report abuse of power by university authorities are protected by a whistleblowers clause.

CONCLUSION

Attitudinal changes within the minds of all stakeholders are essential in order for these amendments to be truly meaningful. Students must remember that rights per se have no value. It is what rights are for; it is the sense of responsibility and restraint with which they are exercised that is the mark of a mature mind.

However it must be remembered that good governance is not in legislation but in fair administration. The provisions of the law need to be backed by necessary psychological and attitudinal changes on the part of all concerned.

Students of various ethnicity showing the 1Malaysia sign at the October 2009 *Perkampungan 1Siswa 1Malaysia* at USM

APEX Eminent Persons Advisory Committee

The Eminent Persons Advisory Committee was established to create a forum to receive continuous feedback and discussion at the global level. It will also serve as a tracking mechanism to guide USM to undertake some of the changes that have widespread impact not only for the higher education in Malaysia, but also globally.

For this purpose, the university is indeed very proud to welcome the following eminent personalities in the wider world of education as members of the USM Eminent Persons Advisory Committee.

Tan Sri Razali Ismail

An eminent Malaysian diplomat and leader. He was the President of United Nations 51st General Assembly and also a passionate environmentalist; received the first Elizabeth Haub Prize for environment diplomacy by Peace University, New York in 1999. He has been the university Pro-Chancellor since 2001. He was a recipient of USM Honorary Doctoral Degree in Law in 1998.

Chair

Professor Muhammad Yunus, 2007 Nobel Laureate for Peace

The founder and Managing Director of Grameen Bank, Bangladesh. He was awarded the Nobel Prize for Peace in 2006, an award which he shares with the Grameen Bank. He was associated closely with USM in the early 1970s in an advisory capacity to set up Malaysia's nascent microcredit system. He was the recipient of USM Honorary Doctoral Degree in Economics in 2007.

International Member

Professor R. Noyori, 2001 Nobel Laureate for Chemistry

He is currently President of the Institute of Physical and Chemical Research (RIKEN), Japan. Professor Noyori has also served as the Science Advisor and Member of the Scientific Council with the Japan Ministry of Education, Culture, Sports, Science and Technology.

International Member

Sir Brian Smith, former Vice-Chancellor, University of Cardiff, Wales

He was the Vice-Chancellor of Cardiff University from 1993 to 2001, currently serves as the University's International Ambassador. He has also served in various capacities in the academic field and consults widely in Britain and abroad, among which he advises the Malaysian and Chinese governments on the development of research within their higher education systems.

International Member

Ms Eva Egron-Polak

She is the Secretary General and Executive Director of IAU, an international non-governmental organisation based at UNESCO, Paris. Prior to joining the IAU, she was Vice President (international) of the Association of Universities and Colleges of Canada.

International Member

Prof. Yoshiharu Doi, Executive Director, Institute of Physical and Chemical Research (RIKEN), Japan

He was appointed Executive Director in charge of research management at RIKEN in 2004. In the same year, he was also appointed Emeritus Professor at the Tokyo Institute of Technology. For his contribution to polymer science, he has received the Society Award of Polymer Science, Japan and the Houkou Award, Japan. He was a recipient of the USM Doctoral Degree in Science in 2006.

Alternate International Member

Tan Sri Dato Dr Lin See-Yan, Pro-Chancellor, USM

He is an independent strategic and financial consultant and the Chairman, Harvard Graduate School Alumni Association Council at Harvard University in Cambridge (USA) as well as Regional Director for Asia and President, Harvard Club of Malaysia; a member of Eisenhower Fellowships' International Advisory Council, Philadelphia.

National Member

Prof Dato' R. Ratnalingam, former Dean and Professor of the School of Physics, USM

He is the founding principal of the Penang Medical College and the first Malaysian Rhodes Scholar. He has served USM in various capacities, including the Dean, School of Physics and founder-director of USM Centre for Innovation and Consultation prior to his retirement.

National Member

Prof Datuk Dr. Mazlan Othman, Director of United Nations Office for Outer Space Affairs

She was formerly the Director General of the Space Science Studies Division in Malaysia. She initiated the National Microsatellite Programme and spearheaded initiatives to identify space R&D priorities and strategise the national space policy. She was a recipient of USM Honorary Doctoral Degree in Science in 2008.

National Member

A metamorphosis: Alumni USM guides change management

USM has produced more than 100,000 alumni - over a span of forty years, representing a huge pool of talents - who would be more than proud to give back to their *alma mater*. Their experience and expertise in the private and public sectors, both domestic and international, in various capacities is invaluable to USM. An area that USM believes the alumni could contribute the most is in change management. USM has committed itself not to just any kind of change but rather a transformation that requires out-of-the box thinking as its unusual modus operandi. An outside perspective and expertise from the alumni would, therefore, be extremely valuable in completing USM's metamorphosis into the APEX status.

Heeding the call, Alumni USM has stepped up its dialogue with the relevant authorities and has engaged in a meaningful way to support USM in its journey towards attaining the APEX status by 2013. The exchange of ideas and perspectives drawn from corporate best practices, such as information and communication technology, human capital development and management of financial resources, are some areas where many of the USM alumni have vast experiences; they have returned to give back service to the university where they cherished many unforgettable learning experiences as young men and women.

The Alumni Caucus Group

The alumni members began their formal engagement with the university through the Alumni Liaison Office, the Alumni Association of USM and the Caucus Group, the latter being a loose group made up of prominent alumni who have served, or are serving, at senior positions in the public and private sectors. This "think tank" serves as a sounding board for the Vice-Chancellor and his ideas and provides feedback based on the experiences of the caucus. Through the caucus, the alumni gauge the areas where they can offer valuable contributions.

When the APEX agenda was announced by the Ministry of Higher Education, two members of the alumni, namely, Mohd Zulkifli Itam (Social Science, 1974) and Shaifubahrim Saleh (Computer Science, 1983) who have been with the caucus since 2007 were included in several initiatives to make this a reality. They were involved in initial discussions on various aspects of change management with the Vice-Chancellor and other senior officials of USM. This led to their participation in various initiatives, such as:

- key Performance Indicator/Key Intangible Performance workshops where the key parameters for each school/ department were established.
- scenario planning sessions and workshops in preparing for the "Transforming higher education for a sustainable tomorrow" publication, also called the Black Book, which forms the strategic roadmap for USM's application and implementation for the APEX status.

Upon USM being accorded the APEX status, Alumni USM again offered its expertise in recommending specific aspects of the change management process and also participated extensively in this programme. In pursuance of the common objective, Alumni USM proposed the exercise in branding, recognising that the key staff of USM would have to undergo a paradigm shift under the APEX regime. The practices which have evolved over the forty years since the inception of USM cannot be left unchecked and "business as usual" will not lead USM to success in achieving the APEX goals. Another key component is to assist the group in charge of support functions cope with the transformation as most initiatives seem to focus on the academia.

Change management - what is it?

Change management simply means managing the changes that would take place in an organisation in a structured manner when it undergoes a transformation. However, a transformation from an IPTA to a research university then to an APEX university is a complex transformation, and the rapid changes required can be daunting, to say the least, as they affect all levels of the organisation. Complex changes require sophisticated tools to manage the change process. Therefore, the proactive Creating Positive Change model adopted by Alumni USM, in contrast to the reactive Problem Solving and Fire-fighting approach, focuses on identifying areas which may require changes such as systems,

Figure 1: Outlining the Business Unusual programme

policies and procedures, guidelines, processes, human resource requirements and in USM's case, even certain provisions of the legislation governing it. Three initiatives were proposed:

- the USM Branding Exercise
- *Business Unusual* Change Management Workshops
- USM Support Function Strategy Workshops

The above are focused exercises initiated by Alumni USM to provide a framework whereby the changes are managed in a structured and professional way to ensure that the supporting units are in alignment with the organisational aspirations and to create "Centres of Excellence for Execution", enhancing execution capabilities to achieve results expected from the intended mission successfully.

The USM Branding Exercise

To underscore the milestone in being accorded the APEX status, Alumni USM studied how several successful universities operated and came up with a proposal to undertake a branding exercise as a critical step to support USM's transformation plan.

In any branding initiative, the most important task is to identify the brand's unique value proposition. The change management process started with the branding exercise as USM had to reposition the value proposition it offered to its stakeholders. Alumni USM felt that the entire staff of the university at all levels ought to be apprised of the mission that USM is embarking on and should be thinking in harmony with the top officials. It is imperative that this value proposition is communicated to all citizens of USM from the Vice-Chancellor right down to the industrial and manual groups. The objectives of the branding exercise are:

- to create an emotional attachment to USM which promotes loyalty
- to make the brand a valuable intangible asset
- to create an invaluable change in the perception and experience of the stakeholders towards the university

The deliverables are to get everyone thinking on "how can I contribute towards achieving these goals?" together with the rest of USM to make the APEX status a reality. This can only be achieved if the staff of USM understand the journey, what it means to them and how it is undertaken in tandem with the stakeholders' expectations.

Alumni USM, in collaboration with professional branding external consultants, participated in the branding exercise with the participation of additional members including Abdul Rais Abdul Majid (Social Science, 1974) and Zaini Rahmat (Humanities, 1974).

Business Unusual Workshops

Transformation involves a series of changes in the processes, systems and the human resource capabilities to be aligned to the objectives of the organisation. The *Business Unusual* workshops will equip the participants with tools required to manage critical priorities during the change process, namely, communication, productivity and resistance.The objectives of the workshops are:

- to recognise the predictable dynamics of change
- to acquire tools to manage the challenges of change around communication, productivity and resistance
- to identify and capitalise on individual "change management strengths" that is, flexibility, innovativeness, risk tolerance and stress management
- to understand the importance of creating energy and emotion in the team
- to plan the desired future support based on talent and capability gaps

A workshop held on the 10-11 September 2009 with the attendance by 36 participants from a wide spectrum of support departments was conducted by Zulkifli Itam and Shaifubahrim Saleh, the latter being the President of Alumni USM and also a consultant at Pritchett Rummler-Brache.

The results from this workshop, whilst disseminating the intricacies of the change process, also provided inputs for further refinement to the change management framework for customised workshops to specific groups in the future.

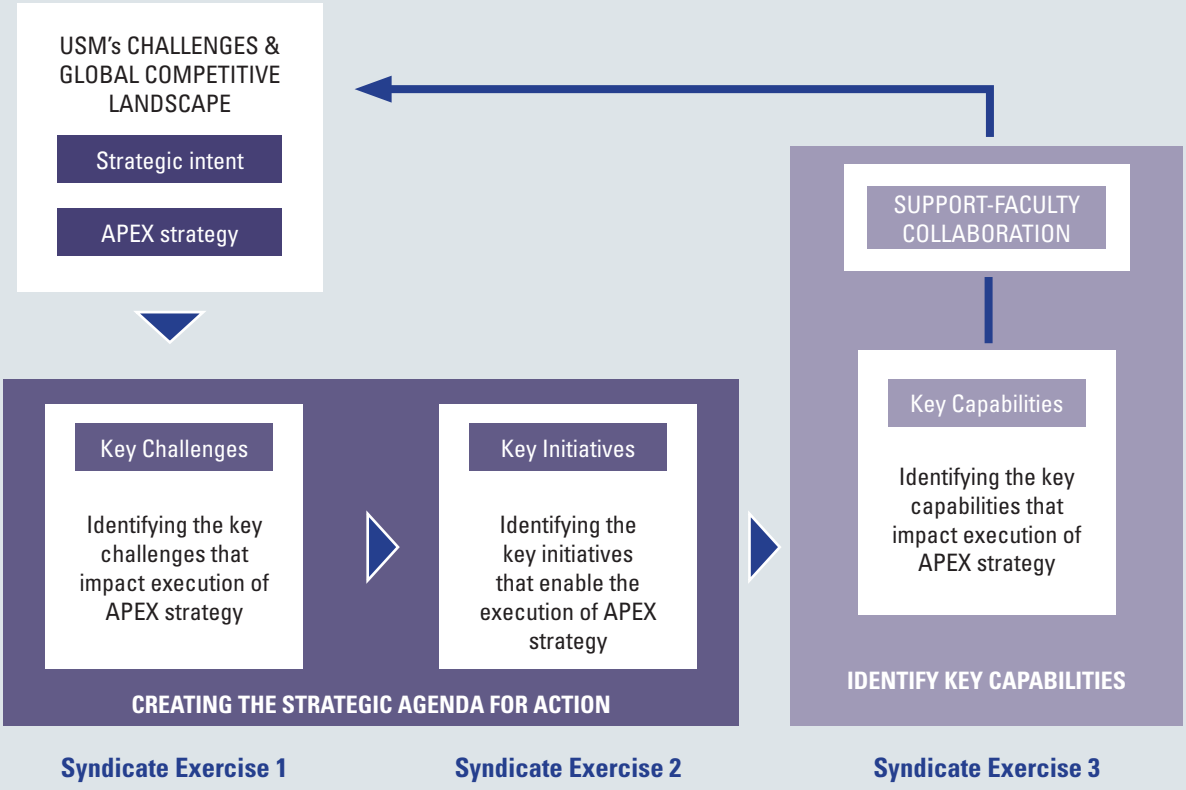


Figure 2: Alignment of USM Support Functions Strategy to APEX's Vision - The "Strategic Fit"

The USM Support Functions Strategy Workshop

The change management process for the support services involved functions such as the offices of the Registrar and the Bursar, the Chief Information Officer, engineering services, the library and other related services which form critical cogs in the wheel of the university. Recognising the demanding order for changes in student intake, the student mix, the emphasis on research and recognition at international level, autonomy and self-funding, the sustainability agenda and others that come with the APEX status, the functions of the university's support functions group have to undergo a major transformation in their activities in tandem with expected changes or activities at schools/faculties and other departments.

With the support and confidence shown by the Vice-Chancellor who requested for further intervention, Alumni USM submitted a proposal to assist the group in information communication technology, human resources and financial management. The scope was later expanded to include other relevant departments such as the library, engineering and sports departments.

The USM Support Functions Strategy Workshop for 37 key support function staff members was held at the USM campus on 6-7 March 2010. Participants were provided with specific tools to manage the change:

- identify key challenges they face in supporting the execution of the APEX vision
- identify the key initiatives needed to be undertaken to achieve the vision
- identify the key capabilities and resources that should be developed and strengthened to successfully execute the key initiatives.

For this specialised workshop, in addition to Zulkifli Itam and Shaifulbahrim Saleh, the Alumni USM team was strengthened with three highly experienced members, namely, Datin Huzaimah Mohd Yusoff (Humanities, 1973), Abdul Rais Abdul Majid (Social Science, 1974), and Ahmad Ghazali Kassim (Social Science, 1975). Together, their combined experience is about 150 years centred around human resource management in public listed companies, information and communication technology in multinational environments, public service, investment banking and financial services industries.

While further initiatives need to be conducted, the above results will form the springboard for the transformation of the functions of the support services to be aligned to the APEX objectives, to synergise the initiatives as strategic partners to the academic and other departments in USM.

The institutional impact

In coming out with solutions for the support group, there are several true and tested models, or variation of these models that USM can adopt. Ultimately, the model would take into account all external and internal developments, controllable and uncontrollable factors that will evolve when the APEX infrastructure is in place. It is expected that the proposed changes would have a profound impact on the way the university is managed as it would result in a lean and financially efficient organisation with minimal bureaucracy. Key capabilities of each support function will be enhanced. Ideally, many of the current processes would be re-engineered, functions would be decentralised at the responsibility centres with clearly defined lines of responsibility and accountability, and policies and procedures be revised. Concurrent with the proposed revisions to the legislation governing APEX universities, the university would be given autonomy which comes with financial independence and reduced dependence on government funding to run the university. This translates into the necessity to adopt industry's best practices and professionalism to manage financial and other resources.

The way forward

The findings from the Support Functions Strategy Workshop will be compiled and analysed for presentation to the Vice-Chancellor at the Caucus Group meeting with perspectives of Alumni USM to discuss the way forward. A quality check will be conducted to ensure that the strategies identified are aligned to the strategies adopted in line with the APEX vision. To avoid duplication of efforts, further analyses will be conducted to ensure consistencies between all other initiatives undertaken currently.

The resulting solutions will enhance the capabilities of the support functions group in responding to the challenges its members face to be in alignment with the rest of the strategies adopted by the academic group within the university to ensure the success of the APEX journey.

USM has an exciting journey ahead, and the journey has been made even more meaningful with the participation of people from its past in this metamorphosis. Indeed, Alumni USM represents USM's proudest investment - exceptional human capital development.

USM Alumni President Saiful Bahrim Saleh elucidating his point at the Support Functions Strategy Workshop

The Brand

pre-1969

1969

1999

2009

The Crest

The crest of USM, featuring the crescent and the moon, the two tigers, the shield and the motto, reflects the Malaysian identity from which the university draws its inspiration and support. The role of the university as a national institution is reflected in the other symbols in the crest.

The crescent symbolises the universality of Islam, the official religion. The fourteen pointed star signifies the unity of the thirteen states and the Malaysian government.

The two tigers, the national symbols of Malaysia, embody the qualities of strength. The two golden palm fronds with golden studs signify economic prosperity.

The shield, a universal reflection of protection , held by the tigers, is a traditional instrument of the indigenous people of Malaysia to symbolise the relevance and importance of traditional and indigenous knowledge and wisdom. Purple, signifying high rank, is the official colour of the university.

The open book in the shield represents knowledge associated with the university. The two keris, signifying the authority and power of royalty, are the traditional arms of the Malays. The hibiscus on the shield is the national flower.

Overall, the crest is underpinned by the motto "KAMI MEMIMPIN" (WE LEAD) that reflects the role of the university in the fields of knowledge, teaching, research and community service.

Colour Reproduction of USM Crest

The USM crest is reproduced using the colour breakdown as specified below. It is essential that reproducing the crest follows these specifications in order to maintain consistency in its appearance across all the various media.

1 Pantone 7404C CMYK Values 2% Cyan 9% Magenta 80% Yellow 1% Black	**2** Pantone 143C CMYK Values 0% Cyan 41% Magenta 100% Yellow 0% Black	**3** Pantone 144C CMYK Values 0% Cyan 58% Magenta 100% Yellow 0% Black
4 Pantone 485C CMYK Values 0% Cyan 100% Magenta 97% Yellow 0% Black	**5** Pantone 7516C CMYK Values 24% Cyan 76% Magenta 100% Yellow 15% Black	**6** Pantone 362C CMYK Values 79% Cyan 0% Magenta 100% Yellow 0% Black
7 Pantone 2617C CMYK Values 87% Cyan 100% Magenta 24% Yellow 12% Black	**8** Black CMYK Values 50% Cyan 50% Magenta 0% Yellow 100% Black	**9** White

The Logotype

The official USM logotype is designed in the form of a string of three letters signifying the cohesiveness of USM as an organisation. The letter S is in white and is flanked by the letters U and M on either side in purple, the official colour of the University.

The use of the letter S in white symbolises the state of *Sejahtera* (well-being) prevailing within the campus as well as soundness of thought and the keenness of its citizenry.

The letter S, also signifies the *Sains* (Sciences) and *Sastera* (Arts), in the form of a symmetrical S, symbolising a sense of balance and harmony in the quest for knowledge.

The letter S with an opening at the top and the bottom represents our "out-of-the-box" trait, in line with the innovative and pioneering aspirations of USM as stated in our mission statement.

The letter S, which is connected to the letters U and M, signifies the close ties between the university and the *masyarakat* (masses), unified by knowledge and widely disseminated.

The colour orange

The colour orange is taken from the colour of the tiger in the official USM crest to signify the dynamic and active nature of USM as a knowledge enterprise at both national and international levels.

The triangle in orange

The triangle in orange symbolises the stability of USM, which has its basis in three core values - *Unggul, Sejahtera, Mesra* (excellence, well-being and cordiality). The placing of the triangle on the base of the letter S signifies the importance of these three core values in support of the USM motto 'We Lead'.

The four vertical bars in orange

The four vertical bars in orange signify the four guiding principles of USM which function as the main pillars in the overall development of the university, namely:

- to enhance a rigorous intellectual culture with a worldview that creates a "oneness" of knowledge through a transdisciplinary approach
- to serve societal needs without comprising its socio-cultural integrity and sensitivities based on appropriate and relevant knowledge
- to demonstrate excellence in leadership premised on strong principles, scholarly pursuits and wisdom of thoughts
- to measure up to international norms and best practices while taking on a glocal outlook firmly rooted in basic values, both the tangibles and intangibles, of the Malaysian traditions

UNIVERSITI SAINS MALAYSIA

2003

UNIVERSITI SAINS MALAYSIA

2009 - vertical version

UNIVERSITI SAINS MALAYSIA

2009 - horizontal version

The Brand Signature

The USM Brand Signature is the very heart of the USM brand identity and as such must always appear in exactly the same manner wherever it is seen.

The Brand Signature is a combination of the crest, the logotype and the descriptor. These are locked together as a single entity.

The Brand Signature can appear in two formats - horizontal and vertical - to maximise its visual impact dependent on the space available.

Brand Signature in Full Colour - Four-Colour Reproduction

The Brand Signature should ideally be reproduced in a four-colour version. It is preferable that the Brand Signature should appear in colour on a white background wherever possible but, in some instances, it may be necessary for other versions to be used.

The Ceremonial Seal - the new look

As the name suggests, the Ceremonial Seal is reserved to mark our special ceremonial occasions such as awarding certificates and honourable recognition and acknowledgement to specialists in various fields. Its usage is limited to a restricted range of official insignia, documents, papers and medallions.

The Seal comprises a special version of the USM crest within a circle with the words "Universiti Sains Malaysia" written around it in a circular form - the only occasion on which this format is to be used.

The new ceremonial seal has been devised to reflect the updated USM brand image and this will be used on all degree certificates.

The 40th anniversary symbol represents a bamboo shoot noted for its fast rate of growth into a sustainable plant with a myriad of well-documented uses, including as food. It is segmented into four portions to symbolise the 40 years of productive periods between 1969 and 2009.

The bamboo shoot is pliable in that it can be shaped before it becomes a bamboo plant, as traditionally recognised in the Malay saying: *Melentur buluh biarlah semasa rebungnya* [To bend a bamboo, is best done as a shoot]. The overall shape that resembles a stylised alphabet "A" is to signify the APEX status of Universiti Sains Malaysia, which was announced on the eve of the 40th anniversary. The continuous zig-zagging white line from the base to the apex signifies the on going journey towards excellence.

Source: USM (2009). *Upacara Konvokesyen ke-40*, page 193

The transformation has begun

01

02

03

01 The Batu Uban entrance to USM in the early days
02 . . . prior to rebranding
03 . . . today

The journey

Have you seen the sign? A transformation has begun at USM and if you have not realised it as yet, you need to jump on board and become part of the change. For USM has gone through a year of self-discovery. The new USM brand has been crafted and is now being adopted as part of our daily lives.

The journey began in October 2008. The branding project has resulted in a new look and feel for USM. The new brand positioning is driving all our endeavours towards achieving USM's vision of "Transforming Higher Education for a Sustainable Tomorrow".

Once USM received the APEX status, it became necessary to identify clearly where USM was and where it wanted to be. There was a need to identify a single brand proposition that could be owned by internal and external stakeholders alike. Thus the branding journey began.

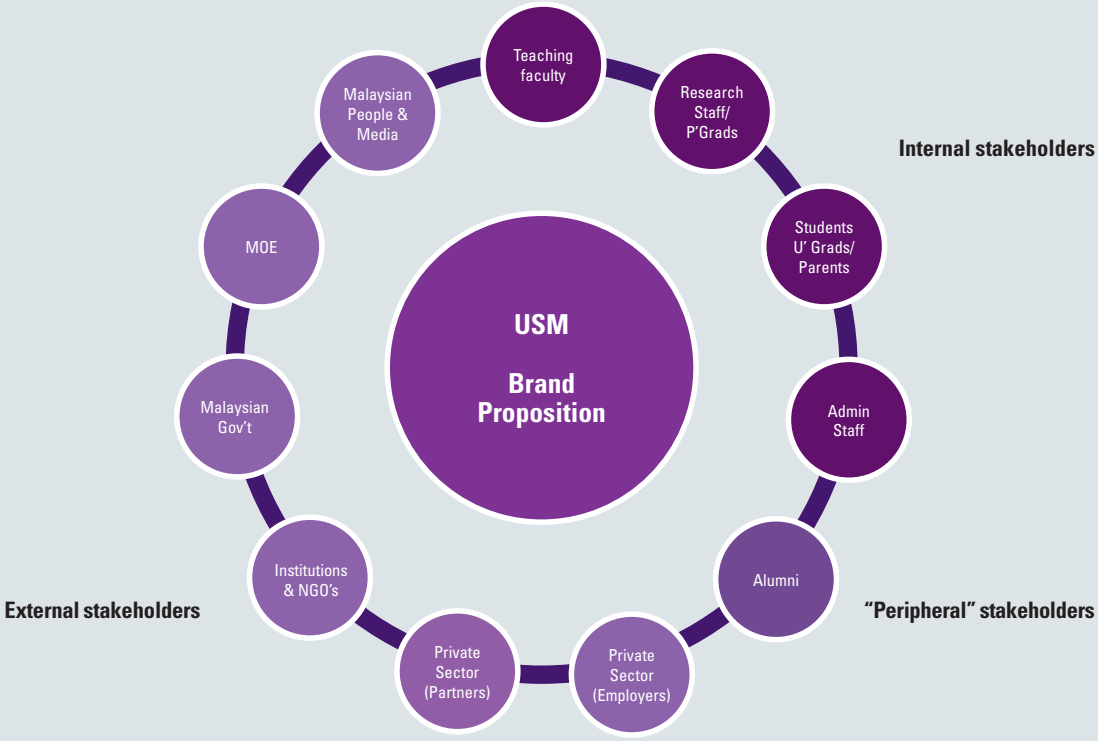
This journey involved three phases of brand development. In the first phase - Discover - stakeholders were interviewed in groups, online surveys were carried out to validate the findings of these interviews and discussions were then conducted to refine the brand position hypothesis.

In the second phase - Develop - focus was on the design concepts, website and application designs as well as signages. This is to ensure a unified feel and projection of the brand.

In the final phase - Deliver - master artwork templates have been finalised and a brand manual published. Advocacy workshops have also been held to internalise the brand position to the stakeholders.

We have almost reached the end of the project and now the ownership of the brand is in the hands of everyone at USM.

The question you must be asking is, why bother to brand? The simple answer is people make their choices based on brands in each and every walk of life and a strong brand gives so many advantages.



The best way to understand what a brand is all about is to think of all the brands of things in your life and ask the question, "How do I feel about each of them?" The answer is an emotional attachment that you have developed over a period of time with each brand and this relationship makes sense to you so you want to continue with it. Imagine if you could not have your favourite food or your favourite radio station was taken off the air - how much would you miss not having them as part of your life?

But remember that a brand is not just a logo or a name - it is the experience every consumer and stakeholder have each time they come into contact with the brand.

Our job therefore is to deliver the brand promise consistently, every time we come into contact with either internal or external stakeholders so that their faith in us becomes stronger and stronger until they become truly loyal.

Internal stakeholders include teaching faculties, research staff, students and their parents, as well as the administrative staff. External stakeholders are all Malaysians, the media, the Ministry of Higher Education, institutions and non-governmental organisations (NGOs), private sectors and the Malaysian government.

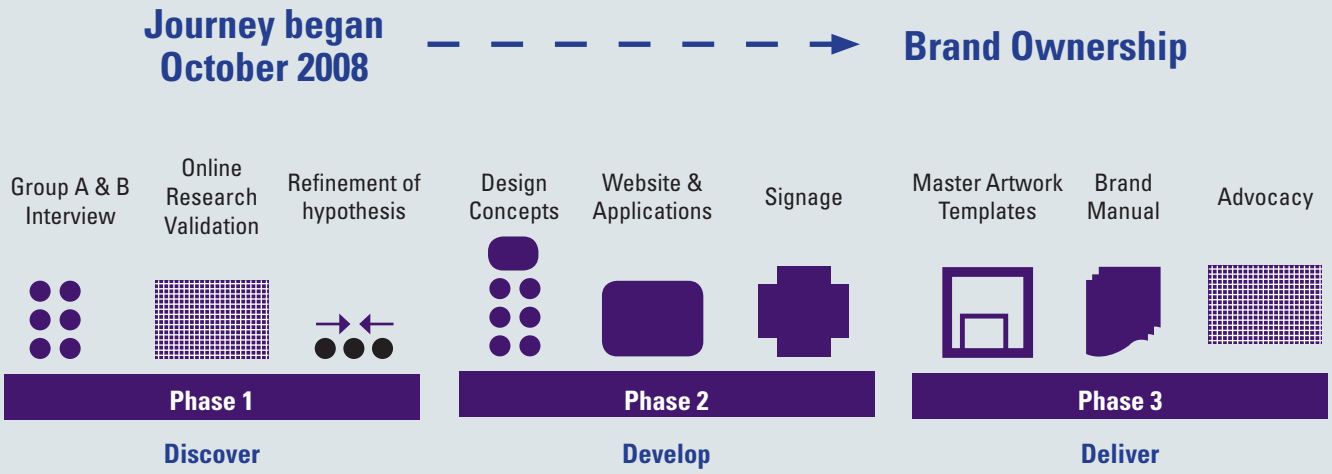
The value of a brand can be measured in many ways, including financial. For example, the value of a leading brand of cola drink is estimated to be around USD70 billion.

One of the key reasons for building a strong brand is to enable our potential stakeholders to make a choice in our favour when faced with options. This is particularly important in education as there is a huge number of options to choose from.

A strong brand clearly dominates space in the minds of the "consumers". They know what you stand for and why they choose you. Over a period of time, the belief gets deeper and deeper as each positive, touch-point experience reinforces the belief.

Brand advocacy

The ownership of the brand lies in the hands of everyone associated with USM. The aim of the Brand Advocacy rollout was to enable groups of our key stakeholders ranging from students, faculty staff, administrative staff and alumni to become the brand advocates for USM.



In order to reach the total population of internal customers, we have identified a group of Brand Ambassadors whose job is to cascade the message throughout the entire university. They have attended brand advocacy workshops where among the tools used were the USM brand proposition, the USM passport to excellence (see below), the change circuit, viewing of the USM brand video and sharing of USM Vice-Chancellor's branding viewpoint.

These brand advocacy workshops have been conducted at the USM Main Campus, Engineering Campus and the Health Campus. Approximately 5,000 people so far have become proud owners of the USM brand. More will join.

The Brand message - the vision

USM's vision is to transform higher education for a sustainable tomorrow. The end goal of all our efforts is for USM to become world renowned for sustainability. The vision is a university that is pushing the performance curve from every angle. It leads by example as it has done for so long.

The total picture of the USM transformation focuses on key change areas. Major shifts in talent, resources and governance will transform higher education forever and this will have a real impact on ecology, socio-culture and the economy, moving us towards a sustainable tomorrow. All our energies will be directed towards helping the bottom billion to be able to transform their socio-economic well-being.

In essence, USM becomes the leader in university education that has direct impact on sustainability and the bottom billion.

USM's transformation plan

Eight areas of transformation will enable USM to make remarkable strides towards the unique position of leading the world of higher education.

Each of the transformation thrusts has a detailed strategy canvas: what to eliminate or reduce, which areas to raise and the potential Blue Ocean space. The details of the full transformation plan can be found in the "Black Book" (USM, 2008[1]).

This detailed approach to each thrust of the transformation jigsaw tells us of the serious nature of the commitment to change - there are real plans and a real effort leading to real measurable outcomes. The message is clear that this journey is not for the faint hearted.

Depending on which group attended the brand advocacy workshop, the relevant areas of change were highlighted. For example, for students the focus was on nurturing and learning and postgraduate studies.

The vision - sustainability

At the heart of the USM brand lies sustainability. It is essential that everyone understand what this means because sustainability must become the key focus for all our activities.

Sustainability consists of managing the relationship between the needs of the environment, the needs of people in the social context and the need for viable economic activities. It is important that all these three aspects are in harmony in order to have a sustainable future for the planet.

The goal for USM is to be world famous for sustainability initiatives. So everything that we do must be sustainability-led.

This mean real action with real outcomes. Sustainability must be driven by everyone and owned by everyone.

[1] Universiti Sains Malaysia (2008). *Transforming higher education for a sustainable tomorrow.* Penang: USM.

The Brand

After extensive consultations with internal and external stakeholders, this brand positioning statement was derived.

"*USM is a pioneering, transdisciplinary research intensive university that empowers future talent and enables the bottom billion to transform their socio-economic well-being*".

It spells out what USM stands for and what it aspires to be. This will now drive the brand effort in all key areas.

Everyone associated with USM needs to understand the significance of the words and what they personally need to contribute to make this new brand a living reality.

The way we enable the participants at the workshops to take ownership of the brand was to help them have a clear understanding of the meaning of the words and the significance of each part to the whole expression. Then we got them to focus on how they can make a significant contribution to making this brand strong. The examples they put forward gave us a clear indication that so many aspects of this brand are already very much alive!

The Brand visual language

The final part of the brand project was the development of the visual brand identity.

The brand identity manual gives clear instructions in depth and covers what we can and cannot do with every aspect of the visual language. This means all forms of print must follow the guidelines for the use of the crest, the logo, the colour scheme, the font type and size and the layout.

In short, without strict control on the use of the various brand visuals, we will create confusion and the most important thing is that we will miss out on the opportunity to build a strong relationship with the stakeholders. So consistency is the key word.

The Brand ownership

The last part of the brand advocacy workshop focused on the ways in which individuals can take ownership of the brand. Clear plans of the ways in which they will put in real effort to make a difference were shared. By focusing on the simple formula of Attitude, Knowledge, and Action, the participants generated many ideas which they planned to act on immediately.

In essence, the true test of the success of the branding project will become visible when our community generates simple ideas that can be implemented to create great solutions to overcome challenges faced at USM, challenges faced in our *desa* and challenges facing our nation. Everyone agreed that our capacity to be creative is unlimited. We simply must want to do it.

As a student, a member of faculty staff or as the provider of valuable support services, we all have an opportunity to be part of something remarkable - Universiti Sains Malaysia.

Passport to Excellence - USM's gateway to APEX

"The introduction of the USM's passport leading towards execellence provides new educational challenges and experiences to USM's staff and students. The passport is very imaginative and the panel *commends* USM for this innovative and constructive approach."

Academic Performance Audit (APA) Exit Report

Keying into performing for APEX

In 2009, USM attained a score of 116.8, a remarkable KPI (Key Performance Indicator) accomplishment considering that the maximum score set by the Ministry of Higher Education (MoHE) is 100. This accomplishment is also significant because it is the highest ever attained by the university since this KPI measurement was adopted by MoHE under its Research University (RU) programme. As shown in Figure 1, the overall score for the university has gradually improved from 77.90 in 2005, to 87.3 in 2007, 104.1 in 2008 and 116.8 in 2009.

This reflects a sterling accomplishment of the APEX goals and objectives. Using the eight performance indicators of RU issued by MoHE, the university has over exceeded the target for the quantity and quality of research conducted during this period as well as the indicator for quantity of its postgraduates. The university also attained the maximum score needed in the areas of the quality of postgraduates and professional services and gifts.

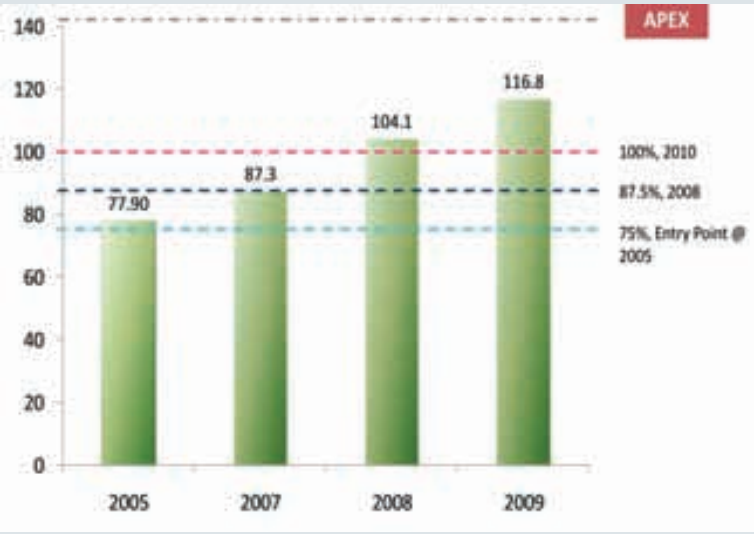


Figure 1: USM Overall Performance, 2005-2009

As can be seen in Figure 2 below, the achievements for quantity and quality of research were 41.7 in 2008 and 51.1 in 2009, beyond the maximum score of 30 for this criterion. According to MoHE, this criterion is measured in terms of four factors and these are the number of publications, the amount of research grants secured, research expenditure made and the appointments of post-doctoral candidates.

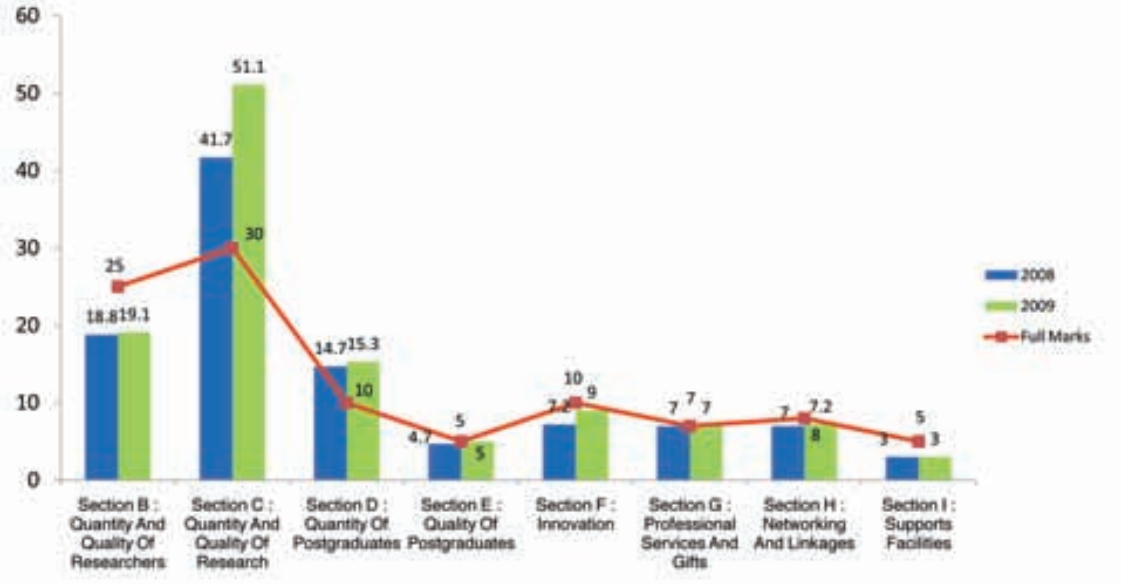


Figure 2: USM Overall Performance 2008-2009 by RU Criteria

Similarly, USM also attained a score of 14.7 in 2008 and 15.3 for the postgraduate (PG) quantity criterion whilst the maximum score for this indicator was 10. This criterion was measured based on four factors and these were, the ratio of doctoral candidates who graduated to the number of academic staff (1:16 academic staff of which 60% will be from S&T), the ratio of PG currently enrolled to academic staff (3 PG: 1 staff), the ratio of PG (excluding coursework mode candidates) to undergraduates (1 PG: 4 undergraduates), and the percentage of international post-doctoral candidates recruited (i.e., 10%).

As for the quality of PGs, the university attained the desired score of 5 in 2009 as compared to 2008 (4.7). The maximum score for this criterion was 5. Quality of PGs was measured in terms of two factors and they were percentage of graduate intake (50% of PGs with CGPA ≥ 3.0) amd percentage of PG fellowships/ grants from prestigious bodies awarded to research-mode PGs (not less than 10%).

The university attained the required score of 7 under professional services and gifts. This criterion was measured in terms of income generated from training courses/services/ consultancy and PG students fees/endowments/gifts (RM20 million).

The KPIs also suggested that the university should also attain the target for three other criteria in the next year or so. These are innovation, networking and linkages and support facilities. For innovation, USM attained a score of 9 out of 10 in 2009, 7.2 out of 8 in 2009 for networking and linkages, and 3 out of 5 in 2009 for support facilities.

Perhaps the achievement for the last criterion of quantity and quality of researchers may be attained with greater resolve and determination by the academic community. For this criterion, the university only attained 18.8 and 19.1 in 2008 and 2009 respectively while the maximum score was 25. This criteria was measured against four factors and they were critical mass (60% of academic staff should be involved as Principal Investigators), percentage of academic staff with Ph.D. or equivalent (60%), research experience of academic staff (with balanced distribution of staff with >20 years of experience, 10-12 years and <10 years experience), and the number of recognitions/awards/stewardship conferred by national and international learned and professional bodies.

Based on the performance of the university as a whole, the accomplishments have indeed been encouraging and motivating. Globally, the exposure of USM's products and outputs to the academic community is steadily gaining momentum as can be seen in figure below. According to Hans-Dieter Evers (2010) of the University of Bonn, the global spread of publications of USM staff between 2000 and 2010 has spread exponentially compared to the period prior to that. According to Evers, USM has become a major catalyst in turning Malaysia as a major knowledge hub in the world.

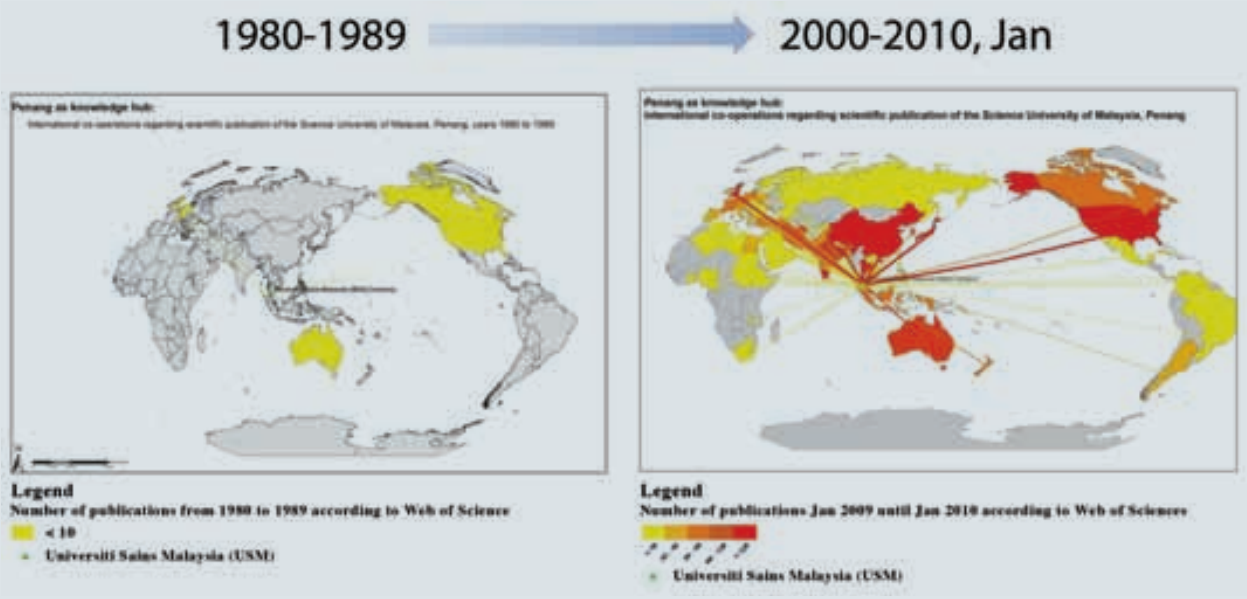


Figure 3: USM as Trans-Oceanic K-hub
(Publications of USM staff 1980-2010 (Jan) with international co-authors in ISI Web of Science)
Source: Prof. Dr. Hans-Dieter Evers (2010) Center for Development Research, Universitat Bonn

The meticulously manicured Minden Green

Managing intakes - a learning curve

Under the APEX programme, USM was given the autonomy by the Ministry of Higher Education (MoHE) to conduct its own student intake as part of the effort to ensure that students were matched with the right undergraduate programmes. The current practice is that the *Bahagian Pengurusan Kemasukan Pelajar* (UPU) of the MoHE acts as a central unit conducting admissions into all Malaysian public universities.

From the beginning, the USM community had understood that it would be a difficult but necessary step to ensure that bright students would be matched with the right programmes in order to maximise their potential when they entered university.

The USM's Division of Academic Management was charged with the task of the student selection, with USM's Centre for Knowledge, Communication and Technology (PPKT) providing the technical support. The time constraint was PPKT's main challenge as the centre had to develop the necessary software from nothing to facilitate the intake process within a month. Software with that level of function would normally take six months to write.

The intake was also staggered over six months. It began when USM received applications with matriculation results in December 2008, those with diploma or STPM results in February 2009 and ending with the second round of applications with matriculation results at the end of May 2009.

The software to handle the applications was developed in November 2008 and was adjusted during the application process as more features were added into it from time to time. New information was continuously added into the system.

The intake was a learning process for all involved, considering the level of details and public scrutiny as well as expectations. Over 22,000 applications were received for the first intake conducted by USM. From these, 8,174 applicants were short-listed for the selection process as they had met the regular minimum criteria to enter USM in accordance with the prerequisites of the programmes at USM.

These pre-qualified short-listed applicants were later put through a series of tests and interviews. Applicants were required to sit for the Malaysian University Selection Yearly Inventory (MUnSYI) test in order to assist USM to match the right student to the right programme.

USM is the first Malaysian university that requires its applicants to sit for the placement cum aptitude test. On this occasion, the test was independently conducted at 116 centres across Malaysia with the assistance of the Malaysian Examination Council. Some programmes in the university also require applicants to attend an interview that was held in four regional centres. Both the MUnSYI test and interview sessions were conducted smoothly despite the fact that they represented new elements in the selection process.

The selection process also involved other steps and interaction with relevant agencies including obtaining matriculation and public examination results from the MoHE, requesting source codes for the application software, etc.

Despite the volume of the applications, time constraints and technical challenges faced by a team of dedicated personnel, for the first time, almost all the stages in the application process proceeded smoothly. The personnel had to manage a myriad of tasks that would normally take an entire division within a ministry to handle. It was a long journey with high expectations on the results from this selection process.

In the final three-day selection process from 26 to 28 May 2009, only 3,599 applicants were selected from those short-listed to be the pioneer batch of the APEX-status undergraduate students of USM.

During the selection process, the personnel of USM's Division of Academic Management and PPKT had been working under tremendous pressure and tight deadlines to compile the list of unsuccessful applications to be passed to MoHE to be considered under the ministry's intake procedure. This list of unsuccessful applications consisted of the remaining 4,575 applicants who were pre-qualified and short-listed at the beginning.

However, instead of uploading only the names of the 3,599 successful applicants, there was an unfortunate mix-up in the process resulting in all short-listed students' list was uploaded. (The uploading accordingly also included the names of the pre-qualified but unsuccessful applicants.)

Twenty-four hours passed before USM realised the "glitch" and the error was rectified within two hours. The rest is history!

Since then, USM has revamped the Admission Unit. A standard operating procedure (SOP) has also been developed to ensure that each section/unit within USM understands and play its role to better coordinate the application process. PPKT further decided to administer the User Acceptance Test (UAT) on the software before releasing it for actual usage.

Overall, the selection process went smoothly if we take into consideration the number of tasks and challenges faced by the personnel involved and the duration of the selection process itself.

Despite the traumatic experience, it was an invaluable learning process for the personnel involved and for the entire USM community in general. It is, however, not because of the lack of dedication among personnel or their readiness to meet the challenges meted out by the new demands of APEX.

01

02

01 For the first batch of APEX intake, USM received over 22,000 applications. Only 3,599 were accepted
02 Oath taking ceremony at USM, in June 2009

Q & A

Zulham Hamdan
Chief Information Officer PPKT

Q ***Were we technically equipped to handle the surge in Internet traffic back in 2009? How about now?***

A Technically, we were equipped to handle the volume. We support 1 gigabyte (GB) traffic internally and have a 155Mbps Internet access. There was excitement when we browsed the website for the first time. About 1,000 applicants had accessed the website as soon as it was launched. The system was slow at the beginning but it started to cope with the situation after some fine-tuning.

From the previous experience, we learned that in a public access online system, we should never start "on the dot", as the queue would be very long. For the current intake process, we started six hours earlier than the scheduled time and we experienced a constant and steady traffic flow.

In 2009, we handled about 22,000 applications. For 2010, we are currently handling 21,000 applications.

Q ***What is the difference (in terms of percentage) of Internet traffic between ordinary weeks and during application week(s)?***

A Internet traffic is constant, with peak hours between 9 a.m. to 6 p.m. throughout the period.

Q ***What are the modifications that you have made since the "glitch" ?***

A We had seconded three IT staff to the "new" Unit Kemasukan dan Pengambilan. A replication server has also been installed to handle the possibility of the main server crashing due to heavy Internet traffic or being hacked. We have also purchased high-end servers and upgraded our bandwidth. Most importantly, we have developed a standard operating procedure (SOP) to coordinate better each section/unit within USM when handling the application process.

Tidak patut hukum USM keterlaluan – Musa

PULAU PINANG 9 Jun – Kesilapan ketika mengumumkan senarai akhir kemasukan pelajar ke Universiti Sains Malaysia (USM) bagi sesi 2009/2010 tidak sepatutnya membawa kepada peletakan jawatan individu di bahagian pentadbiran universiti tersebut.

Sebaliknya, kesilapan seperti itu boleh dijadikan iktibar supaya pihak universiti dapat memperbaiki segala kelemahan selain memulihkan kembali imej dan kredibiliti pada masa akan datang.

Bekas Menteri Pendidikan, Tan Sri Musa Mohamad berkata, tidak perlulah mana-mana individu dihukum, didesak ataupun diberi tekanan berhubung isu tersebut.

Segala kesilapan yang berlaku, jelas beliau, bukan disengajakan tetapi merupakan kesilapan teknikal yang boleh terjadi kepada universiti lain.

"Kita perlu memberi peluang dan ruang kepada pihak universiti agar dapat memperbaiki kelemahan serta membuktikan kredibiliti mereka sebagai peneraju Program Pemacuan Untuk Kecemerlangan (Apex).

"Justeru, semua pihak perlu menerima kesilapan berkenaan secara terbuka dan memberi galakan kepada USM untuk terus mencapai kecemerlangan, bukannya mematahkan semangat pihak universiti," katanya.

Beliau diminta mengulas desakan beberapa pihak yang mahukan status Universiti Apex yang diberikan kepada USM ditarik balik.

Ahli Dewan Undangan Negeri (ADUN) Komtar, Ng Wei Aik pula mahu individu bertanggungjawab meletakkan jawatan.

Musa berkata demikian selepas menghadiri persidangan dan rumusan tahunan Persatuan Penyelidik Pengurusan Dalam Pembinaan Malaysia (MiCRA 2009) di USM hari ini.

Beliau berkata, apabila berlaku sesuatu kesilapan ia juga merupakan salah satu proses pembelajaran.

Pada 29 Mei lalu, USM melakukan kesilapan berhubung pengumuman senarai akhir kemasukan pelajar ke USM bagi sesi 2009/2010 apabila menyenaraikan nama semua pelajar yang layak iaitu kira-kira 8,173 calon sedangkan jumlah pengambilan sebenar 3,599 orang sahaja.

Kesilapan yang dilakukan menyebabkan lebih 4,574 calon yang tidak ditawarkan juga terpapar dalam laman web USM dan ia hanya disedari selepas lebih 1,300 calon diarahkan menerima tawaran ini.

MUSA MOHAMAD

Utusan Malaysia, 10 Jun 2009

"Mistakes will happen. In order for USM to excel, allowance for mistakes must be made. Furthermore, this was a technical glitch - a small mistake to me . . . This was not done deliberately. Even Ivy League universities make mistakes."

Tan Sri Musa Mohamad, former Minister of Education at the MiCRA conference in USM as quoted in *The Star,* 10 June 2009

MUnSYI - leading the way to a more accurate and fair selection process

With the selection of USM into the APEX programme, the university has taken measures to enhance its student selection process. Students' selection is no longer solely focused on academic achievements and co-curricular activities, but would also take into consideration other intrinsic and affective aspects of the candidates. This approach is in line with the philosophy of national education and the direction of the Ministry of Higher Education.

MUnSYI is the Malaysian University Selection Yearly Inventory. It is an inventory to record the intrinsic quality of a candidate, which includes:

- career interest
- personality
- integrity
- emotional agility, in addition to the candidate's academic performance

It is developed by a group of independent experts under the supervision of the Malaysia Examination Council (MPM) using the MEdSI experience as a template.

A team from USM started gathering data on the norm for career interest, personality, emotional intelligence and integrity for each programme that was offered in USM before embarking on a pilot test on the students to examine their 'fit' to the programmes they were in. The result of the pilot test revealed a high reliability of the instrument as it was able to show consistency between the candidate, the programmes they were in and their academic performance.

Specifically, MUnSYI aims to:

- assist the university in getting the most suitable candidates based on the "right individual for the right programme" concept. Information from MUnSyI would be used to ensure that the intrinsic character of the candidates suits the programmes they have applied for.
- increase the success rate of candidates registered in the appropriate programme.
- help reduce internal conflicts at the university due to an inappropriate choice of programmes, which often result in request for change of programmes, poor academic performance, emotional stress and dropouts.

MUnSYI was and will be administered and analysed by the Malaysian Examination Council. Candidates sit for the test at a date decided by the Council. These data would then be used by USM in the undergraduate students' selection process. A working committee was set up to coordinate the implementation between USM and MPM.

When candidates applied for a place in USM they were given eight options to select the programmes of their choice. The USM Admission Division would then process the selection based on the choice of programmes of the candidates (in descending order), their academic cumulative group point average (CGPA), co-curricular strength and their best 'fit' to the programmes (based on MUnSYI scores). Some programmes also conduct interviews as part of the selection process.

In the words of the

1 Aishah Mohd Marsin
Johor
Technology Industry
"I want to help people identify halal food, as well as nutritious food."

2 Farah Hain Misnon
Selangor
Pharmaceutical Science
"I want to find a way to produce medicine from halal and organic sources."

3 Dahrani Chandran
Kedah
Biological Sciences
"It is crucial to raise public awareness about the importance of flora and fauna and we must make space for them in our inclusive society."

4 Rahmatiah Al Faruqy M Sujuthi
Sabah
Industrial Technology
"We must be able to apply our knowledge to ensure a sustainable development."

5 Dwi Indah Natalia Santosa
Indonesia
Communication
"I want to help children charity organisations because it is important for us to help children reach their true potentials."

6 Veraneeta Dumat
Sabah
Languages, Literacies & Translations
"Language teachers are crucial for students, especially those in rural areas, or what we now term as the bottom billion community, as language is the tool to acquire knowledge."

pioneer APEX students

7
Shankar Kandasamy
Selangor
Management
"Being ethical and having integrity are important in conducting business."

9
Kumanan Kandasamy
Penang
Social Sciences
"I want to change public perception regarding politics, and bring about positive transformations to society through politics."

8
Mohammad Faiz Omar
Johor
Communication
"What sets USM apart from other universities is our clear vision and conviction on 'kelestarian.'"

10
Ng Ze Shen
Penang
Management
"Short-term mentality in business would not sustain long-term business growth."

11
Goh Eng Keat
Kedah
Computer Science
"Research in ICT is very crucial in improving the current state of technology in order to facilitate greater exchange of information."

12
Muhamad Syaffiq Syazwan
Negeri Sembilan
Biological Sciences
"There is still so much for us to explore in the ocean. The possibilities are endless."

13
Muhamad Hafiz Abu Kasim
Kuala Lumpur
Physics
"It is in USM that I started to be captivated by the beauty of physics."

1

Empowering students to grow with the APEX university

Since the inception of Universiti Sains Malaysia (USM) for the larger part of 40 years, the Division of Student Affairs and Development (better known with its Malay acronym BHEPP) has now grown into an important centre of responsibility charged with the task of not just looking after the welfare, but also nurturing the development of students.

The BHEPP is committed to provide the best guidance and encouragement to students in its efforts to mould quality students to become future leaders. In order to achieve this, BHEPP is always receptive and responsive to the needs and requirements of students. BHEPP would provide effective character and leadership development programmes for students and guide student organisation in carrying out their activities.

As outlined in its newly developed Client Charter, the BHEPP would:

- provide efficient and quality services by improving the quality of management, administration and services
- provide friendly and courteous services, in keeping with the motto "Student-Friendly"
- ensure that the BHEPP is always attentive and responsive to the needs of the students
- provide effective leadership and self-development programmes in line with the motto "We Lead"
- monitor and advise the Student Council to ensure that the objectives of its activities and the mission of the BHEPP are achieved

Our main national assets are talents and human capital in which each is individually unique. Thus, development of such talents and human capital is an important step in ensuring that each talent is developed and honed in order that students reach their true potential as human beings. These talents would empower students to explore new frontiers of knowledge, design new technologies, create new career path, enhance the economy, guarantee social-economic well-being and elevate Malaysia's leadership in various arenas.

The BHEPP invites students to participate in drafting policies and planning development programmes as these would have direct impact on them.

Students have an important part to play in the university's aspiration of becoming an APEX university and pushing for an intellectual sensitive culture in society.

The following articles would illustrate some of the programmes initiated by students with support from the BHEPP.

Dasar Pembangunan Siswa

The DPS or Student Development Policy was developed as an overarching policy on students' development in order to strengthen their development as APEX student at Universiti Sains Malaysia. It was approved for implementation at the end of 2008 by the Minister of Higher Education.

The policy acts as a framework for the implementation of development programmes in USM in line with the needs of students and the mission and direction of the university. However, the policy needs to be flexible and adaptable to the changing demands in the society, as espoused in the recently announced New Economic Model.

The DPS was drafted with the following objectives:

- to complement the direction of the university in assisting current and future students' development.
- to establish a basic framework which can be modified to be used to guide the university management, staff and students.
- to position the students' development agenda as the main thrust in the university's mission as an APEX and research university.
- to give focus to the various components in students' development, namely, objectives, core values, framework, components, rights, ownerships and management.

The DPS focuses on four frameworks and five main components that act as the foundation for the implementation. They are:

- vision and mission of the university
- administration and management
- stakeholders and networking
- development and welfare of students

The five main components of the DPS are:

- the academic component
- academic support
- students' well-being
- students
- external relationships and community

The BHEPP was restructured in 2009 with the emphasis on four new sectors, namely:

- students' services
- students' development
- students' well-being
- character building

Overall, the DPS is the basis for the terms of reference (ToR) and standard operation procedure (SOP) in the development programmes for all students. In its operations, the DPS involves all centres of responsibility, including the schools and hostels, in the implementation of the students' development agenda.

2

The National Research and Innovation Competition

Better known as NRIC, it provides a platform for the best final year research projects for local and private universities to compete under a single banner besides being exhibited to the public. NRIC, organised by the Student Representative Council of Universiti Sains Malaysia, is now into its third year and has become a much awaited event for budding researchers. It has expanded from a national to a regional premier yearly event. It supports the APEX agenda well.

The project focuses on developing a young generation of researchers who are aware and appreciate the importance of research and innovation for the nation's future. It encourages healthy competition among students, pushing them to the limit to develop good and creative research projects. NRIC has proved to be a thriving ground for innovation and new discoveries in the field of science and technology as well as literature and arts. In 2009, winning projects included "Mathematic Educational Kits Multiplication Made Easy" (Universiti Perguruan Sultan Idris), "The Formulation of High Guava Cookies from Different Parts of Pink Guava Fruits" (Universiti Sains Malaysia) and "The Blind Man's Navigation Robot" (Universiti Malaysia Perlis). At NRIC, young researchers from various higher learning institutions come together to share their opinions and experiences. Students return to their respective institutions not only with new knowledge and experience, but also renewed interest in research and innovations.

3

PIMPIN Siswa

USM through its Students Affairs and Development Division has decided to extend its existing staff development programme - PIMPIN - to students of USM by introducing a similar programme called PIMPIN SISWA.

PIMPIN (*Program Intensif Meningkatkan Pengupayaan Insan*) Siswa is one of the three main components under the Continuous Student Development (myCSD) framework. The other two components are Academic Development and Generic Development, which cover sports, culture, leadership, entrepreneurship, volunteerism, debate and public speaking, social service, and invention and innovation.

The PIMPIN Siswa programme focuses on eight main core elements in student's development as aspired by the university, which are:

- love for the university
- love for the country/patriotism/respect for the country
- identity/branding
- self-discipline
- sustainability
- acquisition of soft skills and leadership
- spirituality and inclusiveness/teamwork
- intellectual prowess

PIMPIN Siswa is a 3-day training programme consisting of physical, mental, intellectual and spiritual components; the activities in the training programme are carried out at selected training camps outside the campus and conducted by qualified facilitators.

For each camp, seven preparatory stages are carried out to ensure smooth implementation of the programme. These seven stages are:

- planning, idea and policy workshop
- module drafting workshop
- module confirmation workshop
- selection of panel members, training camps and evaluation
- speaker, trainer and facilitator Training of Trainers (TOT) course
- basic emergency assistance course
- pilot project launching

The objectives of NRIC are:

- to consolidate Universiti Sains Malaysia's APEX agenda as a research university that focuses on research and development in all disciplines.
- to advocate sustainability in research and development by providing a platform to feature and recognise innovative research projects at the undergraduate and diploma levels.
- to showcase the products and innovations resulting from the research and development by students in all higher learning institutions from Malaysia and abroad, at the same time encouraging students to chart their own career path as researchers.

The competition is divided into six categories: life sciences, medical and health sciences, fundamental sciences, engineering and technology, information technologies and communications, social transformation and creative art. The students' presentations and their research projects were evaluated by a panel of judges selected from higher learning institutions and the industry from local and abroad.

In 2009, some NRIC award winning projects were entered into the British Invention Show 2009 in London. At the competition, USM won three major awards:

- the World Invention Award for the "Development of New Synthetic Composite for Injectable Bone Replacement Material",
- the Gold Medal for "A Novel Route for the Conversion of Waste Polymer into Fuels and Chemical Foodstocks"
- the Gold Award for "A Novel Malaria Vaccine Containing Blood Stage Specific Epitopes"

Among the activities carried out during PIMPIN Siswa are:

- camping sessions
- discussion on the university's vision and mission
- extreme activities and physical training sessions
- personal skills training
- programmes on morale inclusiveness and spirituality
- group-based training and discussion
- programmes on discipline and patriotism

The curriculum in the programme is based on five important aspects, which are:

- belief in God
- inter-racial integration
- sequential activities
- experiential learning
- sustainability-based activities

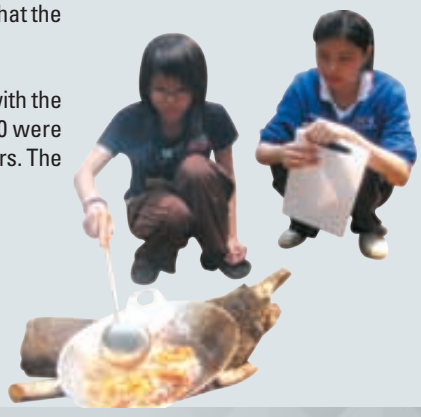
Eight training sessions were carried out between 2 July to 25 October 2009 to train all the APEX students, including international students. The nine training camps involved in the PIMPIN Siswa programme spread out throughout Peninsular Malaysia were:

- Lata Perangin Camp, Kuala Kangsar, Perak
- Batu Ampar Camp, Lubuk Merbau, Perak
- D'Risa Impiana Camp, Gerik, Perak
- Cinta Alam Kelimat Camp, Sungai Siput, Perak
- Belantara Elit Camp, Kuala Nerang, Kedah
- PJ Sentosa Camp, Kuala Nerang, Kedah
- D'Puncak Bris Camp, Sik, Kedah
- Jeram Mengaji Camp, Pasir Puteh, Kelantan
- Belatan Camp, Jerteh, Terengganu

The total number of first year students registered for the academic session 2009/2010 was 3,459. Of these, 3,088 students (89.3 percent), including international students, participated in this programme. Others were given official exemptions.

A survey to gauge the effectiveness of the programme found that 90.6 percent of the students agreed that the programme was beneficial.

The programme was successfully conducted with the assistance of 275 people. Among these, only 90 were USM administrative and academic staff members. The rest were USM students.



4

SEDIA@USM - from the laboratories to the public

Over the years, USM researchers have developed several products with great commercial value. The true potential of innovative products, such as the banana trunk derived paper and vermicompost, could not have been tapped if they had remained in laboratories. Researchers who are experts in the laboratories would often be handicapped when it comes to marketing and developing business plans to commercialise their products.

Realising the daunting challenges faced by researchers in commercialising their products, the Student Entrepreneurship Development Initiatives Agenda (SEDIA) was developed to nurture USM graduates in commercialising the products developed by USM researchers. The SEDIA programme provides assistance in several areas such as in extending initial capital outlay, setting up incubators and providing training in business management. It also looks into new and innovative ideas in marketing and commercialising services and products in collaboration with various business partners.

The objectives of SEDIA are:

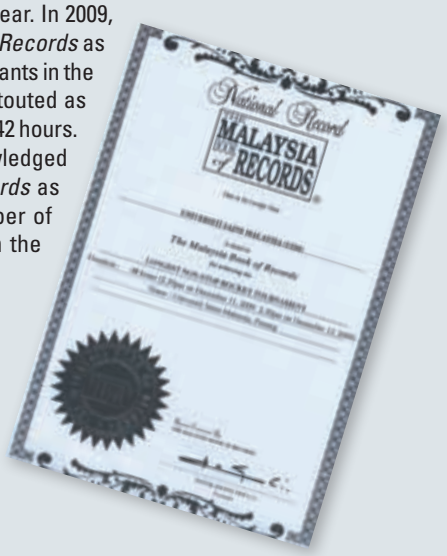
- to nurture interest and talents in businesses among USM students and to encourage them to become entrepreneurs
- to provide knowledge and skills in entrepreneurship to USM students
- to foster a network between student entrepreneurs and successful entrepreneurs in the industry

5

Pesta Hoki Antarabangsa USM

Tens of thousands of people have converged annually for the past 36 years at the USM main campus for one reason - to play hockey. The Pesta Hoki Antarabangsa USM or the USM International Hockey Festival attracts participations from about 400 local and international teams, consisting of different age groups ranging from students to veterans, to play in 12 categories. Of late, about 50 international teams take part including those from Australia, India, Sri Lanka, England, Singapore, Hong Kong, Thailand, Indonesia and Brunei Darussalam.

The crowd and participants have grown from year to year. In 2009, the Pesta was acknowledged in the *Guinness Book of Records* as a hockey tournament with the highest number of participants in the world. In the *Malaysian Book of Records*, the event is touted as the longest non-stop sports tournament over a period of 42 hours. Pesta Hoki Antarabangsa USM has also been acknowledged for five years running in the *Malaysian Book of Records* as the biggest sports tournament with the highest number of participants in Malaysia. It is also a marked event in the nation's sports diary.



- to increase the number of USM entrepreneurs and new products and services that are commercialised and marketed by them
- to cultivate businesses that emphasise economic, social and environment sustainability, and at the same time serving the interest of the bottom billion

This is also in line with the USM APEX agenda to create high value flagships. Students who are interested to be part of the SEDIA programme apply by submitting a New Business Venture Concept (NBVC). The SEDIA team of advisors will evaluate these applications and subsequently short-lists 10 to 20 business projects that it believes can be successfully commercialised. These projects will then go through a process of incubation and be registered as companies within six to nine months. The Innovation Office and Sanggar Sanjung (a commercial arm of USM) will monitor the progress of the SEDIA programme from time to time. Competitive projects will then be undertaken by Sanggar Sains Sdn. Bhd. to fully operationalise it in accordance with USM policies.

To date, the companies that have been established under the SEDIA programme include: My Agro Tech (organic products manufactured using the vermicomposting process and technology), Tropicoast Biotech Enterprise (product development for the banana tree trunk), and Utransport (an asset-based community development module).

The hockey festival is organised by approximately 250 USM students in collaboration with the Ministry of Higher Education, Ministry of Youth and Sports, the National Sports Committee, the Malaysian Hockey Federation and various government agencies. In 2009, the event was mainly sponsored by Nestle Products Sdn. Bhd. and New Straits Times Sdn.Bhd. as it had been for a long time.

USM is proud that the festival is recognised throughout the Asia Pacific region as a leading sports event and one that encourages cultural diversity, inclusiveness and friendship.

Pesta Hoki Antarabangsa USM is also a platform for students to develop knowledge and skills in sports management and science. Participants to the tournament have the opportunity to attend various workshops and seminars conducted by professionals and experts. Students organising the tournament get hands-on experience in various areas such as in promoting the event, getting sponsorships, managing teams and participants, and organising the schedules throughout the tournament.

The key missions of the tournament are to promote the game of hockey in this region among students and to scout for talents for the national hockey team. Indeed, each year many young talents have been uncovered in the tournament. For the past 36 years, the Pesta Hoki Antarabangsa USM has helped USM to produce graduates who are not only knowledgeable but also adept at executing their responsibilities effectively, giving due attention to the sharing of ideas and collaboration with others.

Strengthening industry and community engagement

As a public institution, USM has social responsibilities to fulfil its obligations to the outside world, particularly to the community in which it exists and the industry that surrounds it. It has to serve as a one-stop centre to provide leadership to the community for social and cultural promotions and expertise to the industry. In turn, it allows the community to take ownership of issues of concern to, and affecting, it.

The Division of Industry and Community Network (or Bahagian Jaringan Industry and Masyarakat, BJIM) was created in September 2007 to spearhead and accelerate USM's engagement with the community and industry. The vision is to contribute towards, and lead in, the sustainability of the social and economic development, advancement and transformation of the nation.

The mission is to engage closely with the industry and the community, especially of the North and North Eastern Regions of Peninsular Malaysia, in as many areas as possible so as to achieve the vision. The function of BJIM is to match the knowledge/expertise, facilities and resources of the university to the needs, aspirations and expectations of the industry and the community to result in a win-win situation.

The engagement with industry and the community will involve not only the science and technology based schools but also the humanities and social sciences as well. Since its inception, BJIM has progressed extensively in its direction, programmes and accomplishments, aligning itself to championing and crystallising the university's mission and vision under the APEX agenda.

Engagement and partnership with the industry

Towards this end, BJIM has engaged and developed partnerships with the industry through academic staff attachments and collaborations, as an example, with the Northern Corridor Implementation Authority (NCIA). This programme enables USM staff to obtain exposure to the environment and the latest trends and future of the industry. It also enhances their respective skills and hands-on exposure to the expertise, technology and state-of-the-art equipment. Academic staff can then bring this exposure to the classroom and improve their teaching curricula, making them more updated, dynamic and industry relevant.

USM, through its commercial arm, USAINS Holding Sdn. Bhd., signed an MoA with NCIA in July 2009. A subsidiary company of USAINS Holdings, USAINS Info Tech Sdn. Bhd. was appointed to manage the new Centre of Excellence (CoE) for the Electrical and Electronics Integrated Circuit (IC) Design Industry. The centre would provide consultation services such as research and development in microelectronics design, pay-per-use of IC design tools and facilities, training, development programmes in microelectronics systems and design consultation and engineering resources for projects.

The CoE has initiated the Northern Corridor Analogue and Digitial Design (NCADD) Programme. The first batch of 25 trainees started their course in Digital Design in January 2010. The candidates were selected through Intel Technology. In a similar vein, USAINS Holdings purchased electronic design automation (EDA) software from Synopsys (Singapore) Pte. Ltd. in February 2010 in order to provide shared-tool services to the industry.

The centre will also be launching its Master of Science programme in microelectronics in collaboration with USM School of Electrical and Electronic Engineering. In order to support the tourism initiatives of NCIA, on-going discussions are being held to establish collaboration activities involving the Centre for Global Archaeological Research Malaysia, the Centre of Marine & Coastal Studies (CEMACS) and the Muzium & Galeri Tuanku Fauziah on edutourism projects.

Engagement and partnership with the community

To cultivate closer and more meaningful relations with the world outside, USM aims to play a strong leadership role in the country's development policy and a proactive role in catalysing the participation of all stakeholders in the development process, hence the need for engagement.

Chairman USM Board of Directors, Tan Sri Ani Arope, officiating an OKU-friendly van

Engagement implies working together with shared understanding, evolving shared solutions, shared governance, shared assets and shared advantages in mind. USM has created an environment that is conducive for this engagement to take place and to flourish (to allow for both giving and receiving from society at large). This is instilled within the university community so that service to, and interaction with, the community and industry will not be seen as an additional burden. There is therefore a need to change the mindset not only of faculty members but of students as well so that they are aware of, and sensitive to the needs, expectations and aspirations of the community around them and of society at large, that is, to result in a truly engaged institution.

Since its establishment in 1969, USM has been active in engaging industries in their teaching and research programmes. It will now focus on community service and community-based participatory projects/research. To realise this, BJIM encourages USM schools and centres to conduct community projects at various levels, from service to outreach and engagement types of projects. Funded by BJIM, approximately 60 community projects were conducted from 2008-2009. These projects covered issues such as drug and tobacco abuse, family health, culture and heritage, environmental conservation, efficient utilisation of resources and community empowerment. Many major projects are ongoing and many more new projects will be initiated in 2010.

To further enhance the social responsibilities and changing roles of universities and to explore methods, experiences and strategies of community development, the University-Community Engagement Conference (UCEC) 2009, the first of its kind in Malaysia and perhaps in Asia, was organised by BJIM in collaboration with the Global Alliance for Community Engaged Research (GACER) and UNESCO-APEID in November 2009. Besides revisiting the missions of universities, this conference also aimed at exploring ways to create an environment within universities that is conducive for serious, meaningful, inclusive and sustainable university-community engagement to take place.

The way forward

Networking necessitates the sharing of perceptions, missions, goals and roles of the university with society in order to achieve end results. Since its establishment, BJIM has continued its proactive approaches in industry and community partnerships. It aims to be the agent that brings industry, government agencies and NGOs together to empower local communities besides intensifying industrial collaboration, as universities are expected to be both the nation's economic and intellectual engines. Since 2010, with a focus on transforming the "bottom billion" and bridging the rich-poor gap, as well as playing a pivotal role to effectively assist the SMEs with the university's expertise, technology and innovations, BJIM has set up four clusters to work towards the various goals of sustainable industry-community development. These are:

- **The SME Development and Transformation Cluster**
  The engagement with industry is one of the core responsibilities and commitments of USM. The significance of the local SMEs as a major component in the Malaysian economy is being taken seriously by the division. The SME Development and Transformation Cluster was set up with the realisation that in order to compete effectively in the local and international markets, local SME capabilities in the supply chains and the maintenance of the operations of MNCs in Malaysia with world class support must be strengthened. The cluster's functions are to utilise the knowledge, specialisation and resources of the university to strengthen the local SMEs through the active involvement of academic staff, students and experienced retirees (from SMEs) in consultancy services, research, training and hands-on support. The strategy is to change the work culture of local SME and their culture, mindset and capabilities in order to achieve continuous development and improvement in their operations. The involvement of students will also increase their employability in the job market as well as provide a training ground for graduates to set up their own SMEs.




- **The Corporate Conscience Circle (3C-BJIM)**
  Besides playing an active research and advisory role to organisations, businesses and the community at large on the significance and strategies of corporate social responsibilities (CSR), 3C-BJIM will engage businesses and community-based organisations to promote CSR agendas as well as use CSR to build a network to serve a larger community. It also aims to repurpose the corporate sector towards engaged social responsibility and sustainability. Other than the production of websites, publication materials and brochures on CSR matters, activities planned under this cluster are seminars, workshops, forums as well as training and internship programmes, all of which are aimed at building networks and organisational capacities as well as exposure to "corporate conscience" practices.
- **The OKU Referral Hub**
  For the past two years, BJIM has focused on the equalisation of opportunities for all, including those with special needs or the "Orang Kurang Upaya" (OKU), which in USM is termed as "Orang Kelainan Upaya", a more central term. The OKU Referral Hub was set up with a strong commitment to correct the perception of society at large towards the OKUs and to provide them with equal opportunities academically and professionally. Under this cluster, USM will be the Referral Centre for "Universal Design" as well as the Centre for Interaction and Information on OKU culture. Besides conducting awareness campaigns on the rights and needs of the OKUs for the campus community, schools, local authorities and the industrial sector, the cluster will also provide training facilities and modules for organisations that need to cater for, or work with, the OKUs.
- **Secretariat for University-Community Engagement Champions/ Conferences**
  Due to the success of the University-Community Engagement Conference (UCEC) 2009, a plan was put forward for the setting up of a permanent UCEC Secretariat at USM. The Secretariat's function are to co-organise future UCECs with universities in various parts of the world and to encourage active university-community partnerships as well as implement, manage, facilitate and monitor USM community projects. The "second" C (in UCEC) thus stands for both "Conference" and "Champions" (of university-community engagement), hence placing USM at the forefront of community development and engagement.

Programmes and activities undertaken by BJIM have certainly greatly expanded the network of university-community partnerships and collaborations since 2007. Due to the proactive and "overdrive" pace of these activities and USM's reputation as a research university as well as its APEX status, the public and private sectors alike are beginning to initiate collaborations or partnerships with USM in various ways. The consolidation of BJIM's functions, focus and blueprints for immediate and future actions will ascertain a place for USM as a university with an engaged emphasis that can contribute towards more employable graduates, wealth creation, social inclusion and cultural enrichment, a greater awareness and care for the environment and a healthy and safe society.

Selected partners of USM in industry

Source: USM (2009). *Journeying with industry: 40 years . . . an unwavering commitment.* Penang: Penerbit USM

Leveraging scenario planning to APEX programme

The vision to transform USM as a higher education institution for a sustainable tomorrow and becoming world renowned for sustainability as a sustainability-led university was first mooted during a workshop held in May 2005 on the Futures of Higher Education. This is the point where USM embarked on the futures path with lectures by a well-known futurist named Sohail Inayatullah. The rationale for conducting a workshop such as this at the time was to conceptualise a future of tertiary education in order to ensure our survival and map out where we are heading and what spiritual, mental and physical preparations we need to equip ourselves in order to confront the challenges ahead. The eventual aim is to choose the best possible alternative or model in order to move ahead and become globally renowned and relevant.

The group of about 25 lecturers and senior administrators, including the Vice-Chancellor, attended this workshop facilitated by Sohail Inayatullah at a hotel in Batu Ferringhi, Penang. At the end of the workshop, five (5) possible scenarios for the future of USM were envisaged (for detailed descriptions of these scenarios, see USM, 2007[1]). They ranged from dining metaphors to enchanting garden concepts, hard-nosed business models and even an invisible university thrown in for good measure. Eventually, we conceptualised several fascinating scenarios that could be the basis for the future direction of the university.

Figure 1: The five possible future scenarios of USM

[1]Universiti Sains Malaysia (2007). Constructing future higher education scenarios: insights from Universiti Sains Malaysia. Penang: USM Press

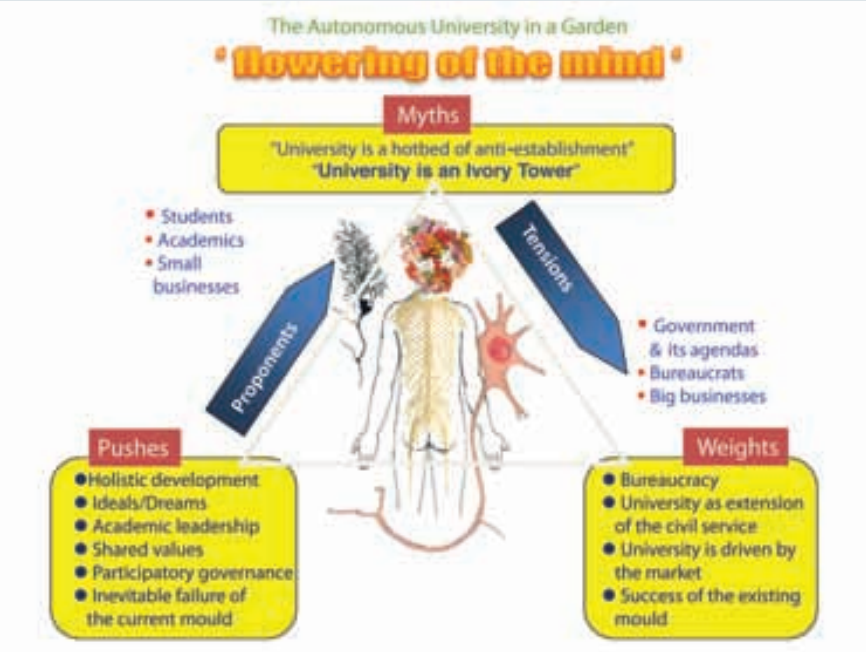


Figure 2: The University in a Garden Scenario

A special mention should be made on one of the five scenarios, i.e., the University in a Garden, as it has significant bearing and influence on how the university will be transformed under the APEX programme.

To be sure, the idea of a University in a Garden started in earnest in 2001 when the Vice-Chancellor started talking about turning the campus into a "village" to halt the relentless physical developments which were threatening the heritage and habitats. Then in 2004, a group of lecturers took it one step further to conceptualise "The University in a Garden".

The scenario envisaged USM as a university of the intellectual which allows for the flowering of the minds in a garden environment that recognises that the individual is unique and has talents that must be allowed to develop with a minimum of constraints. The university is likened to a big tree of knowledge whose roots are continuously being nurtured by dedicated and committed academic, administration and support staff and whose branches represent the holistic development of young minds without abandoning their interconnectedness with nature in a sustainable way.

This scenario envisioned USM to have an intellectual environment which is in a state of deep ferment, characterised by a decline (deemphasised) in educational leadership, to think the unthinkable, wider and greater participatory governance, a return to shared values and the introduction of a holistic-based education system. Eventually, the objective is to make the university once again an institution of higher learning that is autonomous, accountable and sustainable. It will be an institution of learning valued for its own sake to endow the individual with maximum intellectual, spiritual and humanistic faculties.

These scenarios were designed three years before USM was selected to be emplaced under the APEX programme. When we were invited by the Ministry of Higher Education (MoHE) in 2008 to submit our nomination for the APEX programme, we used this exercise to leverage for the selection. For this purpose, we felt that the scenario planning project really prepared us with a coherent framework to structure the university's successful bid to become the APEX university under MoHE's strategic plan. USM's vision is to "transform higher education for a sustainable tomorrow" while its stated mission is "to become a sustainability-led institution of higher learning".

The scenario planning project provided USM with a distinct edge over the other universities' bid to become the APEX university because USM's transformation plan displayed sustained efforts to become "*business unusual*" dating back to the early years of its establishment. Numerous other initiatives have, over the last 20 years, put USM where it is now - a university world renowned for its sustainability efforts in research, in learning and in practice. The journey has not been without hiccups but with foresight and the willingness to explore alternative futures, we have managed to stay a few steps ahead, not only of our competitors but with the emerging trends and ethics driven by youths disillusioned with the excesses of the past. We have stayed ahead.

USM's Tuanku Fauziah Museum and Gallery leading the way in sharing living knowledge with the world

Her Royal Highness Tuanku Fauziah Binti Al-Marhum Tengku Abdul Rashid

What is the similarity between a dagger *(keris)*, a kite *(wau)* and a shadow puppet *(wayang kulit)*? All three are living evidence of the synergy between science and arts. These "knowledge artefacts" are already part of our civilisations for thousands of years representing the amalgamation of knowledge in science and arts.

USM's Tuanku Fauziah Museum and Gallery's vision is to raise awareness among the public that a museum is not merely a storehouse for static artefacts, but rather a window to the richness and diversity of our past knowledge heritage and has continuing relevance in the contemporary world as we grapple to strike a balance in our daily lives.

Visitors, especially USM alumni, would have noticed the obvious physical transformations of the museum. However, these physical transformations are merely the manifestations of the more crucial, clear and confident mindset transformation among the museum staff in particular, and among the USM community in general.

Among the physical changes implemented in the museum are the modifications to the front portion of the building. Small extensions with glass walls have been added to both sides of the main entrance to allow sunlight and the surrounding greenery to reach the interior of the museum.

Efforts are made to present a more inviting atmosphere to the museum. Among measures taken is the generous use of the more vibrant colour of orange. Fabrics are also draped at strategic locations to soften the internal space of the museum.

For visitors with children, a puzzle section is set up for the children to keep themselves occupied with learning experience. The central area in the museum is also kept fairly empty as it is often used as an active space for experiential learning programmes involving visitors especially school children. Educational programmes such as storytelling and motivational talks are carried out using shadow play (*wayang kulit*) on the shadow play stage - complete with shadow puppets and traditional musical instruments - that is set up in the central active area.

The museum also conducts audience studies as an effort to understand its visitors. This understanding is important as the museum strives to put

the visitors at ease and become more inquisitive. Audience research shows that visitors, especially children, are not comfortable with the realistic figures used in the exhibits. Thus, the museum replaced some of these too-realistic figures with *manga*-style cutouts to allow visitors to better relate to the exhibits.

Another interesting finding in the audience studies is that visitors generally do not read the typical formal description cards accompanying an exhibit, but would react positively to the less formal, handwritten description presented in speech bubbles. Again, the popularity of manga among the younger visitors might be reflected through these findings. The museum believes that these real-life data provide a better understanding of their visitors and allow it to tailor the programmes and approaches accordingly.

The museum is also firm in featuring people as the public face of the museum. Museum publicity materials like brochures, vehicle decals and posters are now filled with faces of its staff and visitors. It deliberately avoids using the exhibits as the visual elements in the publicity materials as it believes that the museum is about human experiences, not artefacts.

In its effort to return the museum space to the public, changes are made in the way exhibits are presented. Among the interactive elements included in most of the exhibits are elements that will encourage audience participations. Visitors are often invited to participate in drawing or origami activities, and their "artwork" would be given space amongst the other exhibits in the museum. This is part of the museum's effort to shed its "elitist" image. Community outreach programmes such as exhibitions, talks and astronomical activities are also carried out in public spaces like shopping complexes, schools and community halls.

The museum recognises that these physical transformations are the easier part of the transformation envisaged. The trickier transformation would involve the transformation of mindsets among its staff and the general public.

The museum hopes to offer visitors an experiential learning experience in order for them to appreciate the richness of our heritage and the natural co-existence of science and arts within our civilisations. Knowledge in science and arts does not compete, but they complement each other in our quest to find the equilibrium in our life. The current practice of classifying knowledge into separate parts is not only artificial but also discourages natural cross-pollinations of knowledge.

Knowledge artefacts such as the daggers, shadow puppets and kites best illustrate the rich application of knowledge in our daily life and USM's Tuanku Fauziah Museum and Gallery is leading the way in sharing this with the world. The production of a dagger would require knowledge in material science, physics, chemistry and carving and other artistic skills. Similarly, the art of flying a kite would require someone with vast experience in various "compartments of knowledge" such as geography, material science, physics and definitely, aesthetic skills.

Of late, the museum has embarked on a Toy Museum with the focus on traditional toys. This is expected to be completed in the near future.

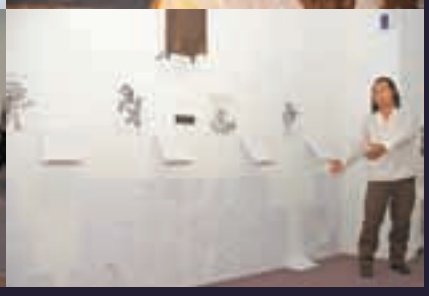
More importantly, these knowledge artefacts usually represent a way of life that is at peace with the self, the higher being and with nature. Materials for the production of these knowledge artefacts are usually locally sourced without jeopardising the environment. This is a life style that is natural to us. It is our way of life that is at peace with nature, the very essence of the now-fashionable concept of sustainability.

We have already got it, since thousands of years ago.

Croation Art . . . Penang Governor TYT Dato' Seri Utama (Dr.) Hj Abdul Rahman Abbas and Toh Puan Dato' Seri Utama Majimor bt Shariff (far right) viewing one of the exhibits on display and listening to the Republic of Croatia's Minister Counsellor, Tatyana Carev-Maruna.

These items are part of the museum community outreach programmes to the people. The museum is actively bringing these items to public spaces like shopping malls, community halls and public schools.

Studies show that visitors are uncomfortable with figures that look too realistic. The museum had since used *manga*-style cutouts for their diorama, thus, injecting more colour and youthfulness into their diorama.



'Knowledge artefacts' like the wayang kulit puppets are good examples of living knowledge combining arts and science that is part of our traditions.

Museum Technician, Rosli Hamzah, pointing out a 260kg meteorite from Russia to a group of visiting pre-schoolers.

Artworks from visitors are also displayed in the museum as an effort to return these "elite" spaces to the people.

One of the exhibition halls at the
Tuanku Fauziah Museum & Gallery

Living with nature, inclusiveness in action

The spirit of inclusiveness is alive in USM true to the concept of The University in a Garden. USM reasoned that a university, as a scaled-down model of the world that we live, can only thrive with the inclusive participations of all and when all are considered in any form of development. USM has vouched since its inception 40 years ago that inclusiveness be part of its tradition and upheld to its truest form. Inclusiveness is practised when all communities, regardless of race, creed, age or even species are included in every plan and action. Each organism has a role in the community. Each has something to contribute. Each has a story to tell. USM listens, and it listens well.

USM's flourishing garden presents the best testament to inclusiveness in action. Lakes, valleys, hills, streams and buildings roll before the eye seamlessly. Plants, animals and humans co-exist in faith that each is imperative for a sustainable world. A walk around the garden campus, therefore, is never dull as one will often comes across interesting flora and fauna such as wild orchids blooming on lush big trees, birds in vibrant plumes and the water lizards feeding on the fish in the lakes. Some even claim the presence of beings from the "other" realm, but of course that has yet to be confirmed!

Rules in place and on-going programmes to protect and conserve the environment proved to work well as USM continues to be a sanctuary to wild-life and most proudly to animals rarely seen in other parts of Penang and even Malaysia. Though small, the 252.7 hectares of the USM garden houses an amazingly rich ecosystem that sustains many living things. Rows of big, tall trees, numerous fig trees (*Ficus sp.*) naturally replacing old and dead trees, the undisturbed and naturally enriched secondary forest of Durian Valley, the lakes, monsoon drain, streams and hills provide variety and favourable habitat for different species. USM's meticulous maintenance of the habitat and the ecosystem ensures that the animals are happy to call the campus their home too. For example, 114 species of birds have been recorded in USM, including eight first-time recorded species which may have been there for some time but probably had escaped notice. Undoubtedly, the animals are rejoicing in the sustainable environment in the university. Rare animals like the Brahminy kites (*helang merah*), the Malayan Night heron (*pucung rimau*) and the white frogs are examples of the most recent additions to the big USM family.

The Brahminy kite

A lunch at the Anjung Budi, a garden cafeteria in USM is often accompanied by the sight of the Brahminy kite (*Haliastur Indus*) or also known as helang merah, soaring majestically across the campus. In Penang, this species can be found both on the mainland and the island. It was assumed, however, that the Penang National Park was the last refuge for this species. To USM's pleasant surprise, this very selective species has chosen the campus to nest. Four nests were spotted in 2009; three nests on *Araucaria sp* trees, and another on a *Casuarina sp* tree. In early 2010 another three active new nests were spotted; two on Angsana (*Pterocarpus indicus*) trees, and another on an *Araucaria sp* tree. USM is priviledged to play host to this majestic bird.

To nest, birds of prey need a safe and secure environment with adequate water, food, shelter and cover. USM unquestionably has fulfilled these nesting requirements. The abundant tall trees giving them a bird's eye view around the campus allow them to monitor and protect their nest from harm. Food and water are easily accessible in and around USM and Penang Island, including Pulau Jerejak.

Brahminy kites are facing an increasingly challenging environment with the biggest threat coming from pollution. Penang, an industrial state, has high amounts of harmful chemical pollutants in its land, water and air. Persisting chemicals contribute to the bioaccumulation and bioamplification of harmful pollutants in the birds that can eventually lead to mutation and death. Eating contaminated sea organisms will cause mutations or render them impotent or other problems that reduce their chances of survival. Moreover, pollutants from agriculture, industrial, mining and urban development often end up in wetlands. As wetlands are important habitats for Brahminy kites, they are particularly susceptible to pollutants. As scavengers Brahminy kites can easily get entangled while scavenging solid waste. Consequently they are often found choked to death or incapacitated for flying. In addition, plastic solids that end up in their stomachs may block their digestive systems and lead them to starvation.

Birds are excellent indicators to the health of our environment as their disappearance indicates that the environment is not healthy enough to sustain its population, and could possibly pose a threat to humans. Since they are at the apex in the food pyramid Brahminy kites maintains the balance in nature by keeping a check on the population of their prey. Having chosen as a nesting site, USM now has the unique opportunity to provide them an alternative refuge in the campus.

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01 Abundance of food brings Brahminy kites to USM
02 One of three active nests discovered in 2009
03 A Brahminy kite on guard

Fast Facts	
Scientific name:	*Haliastur indus*
Common name:	Red eagle kite
Malay name:	Helang merah
Size:	About 47 cm in length
Appearance:	Striking and contrasting chestnut and white plumage. The head, nape, throat and breast of an adult are white with narrow black streaks. Their back, wings, belly and tail are bright chestnut. Flight feathers are light on the basal third and blackish at the apical wingtips. Juvenile birds are darker with pale brown flight feathers and their heads and breasts are streaked with fawn.
Life history, abundance, activity and special behaviours:	Brahminy kites are resident birds of prey. They are widely distributed throughout tropical Asia from India to South China including Malaysia, Indonesia, Thailand, Bangladesh, the Philippines, the islands of the East Indies to New Guinea, the Solomon Islands and the coasts of northern Australia. They are coastal species which prefer wet areas. Habitats best suited for Brahminy kites are broad natural mudflats such as mangroves, estuaries and coasts. In Malaysia, they are the most common birds of prey of manmade wetlands especially near the paddy fields or fishermen villages. They are excellent diurnal hunters and effective fishers that hunt for small prey such as fish, crabs, shellfish, frogs, rodents, reptiles and even insects. They forage both over water and land, soaring 20 to 50 metres above the surface and snatch prey on water surfaces with their talons. Nearer to civilisation, they become cleaner feeder scavengers that scavenge from food scraps at harbours and coastal fish processing sites. However, their survival is very much dependant on wetland areas as they require mangrove habitats for nesting sites and better breeding success. Brahminy kites prefer to nest on tall, emergent trees, especially near the water. Nests are small and concealed, most are from 30 to 50 feet up trees like perepat or casuarinas. On swampy sites that are more secure from land predators, they may nest as low as 16 feet up mangrove trees. The nesting season is from December to April, nests are compact and made out of twigs and sticks and often lined with dried mud. A first time nest is usually thin but as pairs reuse the nest, it thickens. Both parents share domestic duties and raise the young together. Pairs do not share nest or nesting trees.
Protection status:	Brahminy kites are nationally endangered in many countries including Indonesia, the Philippines and Bangladesh. Although they may not be endangered in the world, their population is drastically declining in certain countries to the point of local extinction. In Malaysia, they can be seen soaring high in mangrove areas in the states of Perlis, Kedah, Penang, Perak, Selangor, Negeri Sembilan and Melaka. They may not be highly threatened but as mangrove areas decline dramatically, more studies are needed to evaluate their actual status.

The Malayan Night heron

The thick secondary forest of the Durian Valley is valued much less for its durians than for its rich eco-system that attracts diverse creatures. For instance, the Malayan Night heron (*Gorsachius melanolophus*) has been spotted occasionally roosting in the area. The Malayan Night heron is a wading bird with long legs, long neck and a pointed dagger-like bill. It is also known as the Tiger Bittern and Pucung Rimau.

Since February 2009, the elusive heron has been spotted four times in USM and all sightings were inside the Durian Valley. During two years of monitoring, the heron was seen seasonally in February and March which coincide with spring migration. Thus, it is concluded that the heron is a spring vagrant that uses USM as its stopover site during the migration. Long distance migration requires enormous amounts of energy, hence, stopover habitats provide opportunities for migrants to rest and refuel.

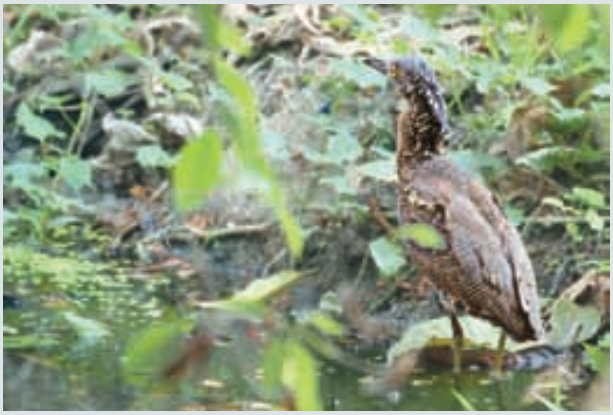
This species was first identified in Sumatra. According to the Asian Waterbirds Sensor Committee, the sighting of the Malayan Night Heron is uncommon in Malaysia. It was last reported in the Templer Park in year 2008 while in Penang, the last time it was seen was about six or seven years ago in Penaga. In Malaysia, the Malayan Night heron is not endemic, a rare migrant and very difficult to see. Thus, its sightings in USM are considered very important, proving that the campus is part of an important route of Far-Eastern-Australasian migration flyway for wading birds. The bird is generally rare and currently considered near-threatened. Very little is known of its movements and breeding habits because of its scarcity and secretive behaviours. There has been little study on its ecology and distribution, though such information is crucial for its conservation.

For waders like the Malayan Night heron, wetlands, especially mangroves, are extremely important because they are rich with wading bird food especially crustacean and small fish. Mangroves, however, are much more important for juvenile waders as they will stay in the stopover habitat for about a year since they do not have to return to breeding grounds like the adults.

The Malayan Night herons face both ecological and physiological challenges while en route from one location to another. They require periodic stopovers to rest and refuel and must cope with the uncertainties of food, competition with other migrant and local species, predation and other pressures in unfamiliar environments. In addition, their size may place large constraint on fuel storage, flight speed and ultimately the distance they are able to travel. These challenges in concert with the extensive landscape changes by human civilisation along historical migratory pathways suggest that the migration period poses formidable hardships to the birds. Any event at any state while en route in the annual migration cycle can have a powerful influence over a bird's survival and productivity.

Since the Malayan Night heron is a species of conservation concern, the maintenance of bushes and wetland ecology is imperative to ensure the survival of this species and continuous visits. Also, more research is necessary to study this species in Malaysia and within its range especially in Taiwan and Japan.

Habitats lost in terms of destruction of mangrove forests to make way for aquaculture, logging and development are the main cause of the Malayan Night heron's global population decline. As such USM has been aggressively promoting the conservation of wetland areas in Malaysia especially in Penang Island. The aim is to provide a corridor of natural and safe habitats for species like the Malayan Night heron thus guaranteeing their survival not only in the USM campus but throughout the region.



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06 The Malayan Night heron's clever camouflage often makes it difficult to track

07 Resting on the migratory trail en route to East Asia

Fast Facts	
Scientific name:	*Gorsachius melanolophus*
Common names:	Malayan Night Heron, Tiger Bittern
Malay name:	Pucung Rimau
Size:	About 47 cm in length
Appearance:	Adults have black crowns, with beautiful black crests extending to the napes. The upper parts are dark reddish-brown with fine streaks. The eye rings are light blue. Wings are black, fading outward to reddish-brown. Primary feather tips are white. The face is reddish-brown; the chin and upper breast are paler. The yellowish-brown breast has a central row of black streaks. The immature is greyish-brown above with black and white spots while its underparts are buff with brown spots and bars.
Life history, abundance, activity and special behaviours:	As a migratory bird, it ranges from India and Sri Lanka to Indo-China, Southern China, Thailand, Taiwan, Indonesia, Philippines and Japan. This very skittish species prefer tropical and subtropical wet forest as breeding habitats mainly found in Japan and Taiwan. A very secretive and nocturnal or crepuscular bird, it forages food during dusk and dawn, usually in the dark or shady areas in the parks, gardens or open fields. Its main diets are ground worms, insects, small reptiles and amphibians. As a nocturnal bird, the Malayan Night heron often migrates at night and is broadly and unpredictably dispersed during the day. When disturbed, it may raise its crest. Predation, starvation, infertile or addled eggs and inclement weather-caused deaths were identified to be the major causes of the mortality during incubation and nestling stages. The main factors that affect the reproductive success of the heron are: the age of the breeding pairs, nest predation and reuse of old nests.
Protection status:	This species has a large global range and does not approach the vulnerable thresholds. It has survived from Near Threatened in 1988 to Lower Risk in 1994 and Least Concern in 2008's IUCN Red List of Threatened Species.

The "white" frog

In January 2009, USM researchers came across "white" frogs from the *Polypedates leucomystax* species in the Durian Valley. Although the *Polypedates leucomystax* is a common species, a white/pale form/morph of the species is quite rare, occurring only in one out of 10,000 specimens. The *Polypedates leucomystax* species that has been found in the Durian Valley is about two inches long and an inch wide. It is off-white in colour and has dark brown eyes. There are small dark brown dots - but no stripes - on the body. Individuals can modify skin coloration according to temperature and humidity. These frogs are an important part of the ecosystem in USM as they help to control insects and the tadpoles are known to eat mosquito larvae thus helping to reduce the mosquito population near human habitation.

Studies are now being conducted to learn more about the "white" frogs. Importantly, toads and frogs are like canaries in a coal mine because they are the first to detect any pollution or degradation in the environment. The presence of the *Polypedates leucomystax* is often used as a biological indicator that an area has been disturbed by human activities as humans have built settlements or have agricultural activities. To understand more about this species and the significance of its presence in the Durian Valley, studies are being carried out to elucidate the genetic properties of this wide ranging species in addition to population studies to the phylogenetic relationships of populations from various areas and localities.

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01 & 02 A rare "white" frog spotted at the Durian Valley, USM
03 & 04 The changing colour of the frog depending on the temperature and humidity

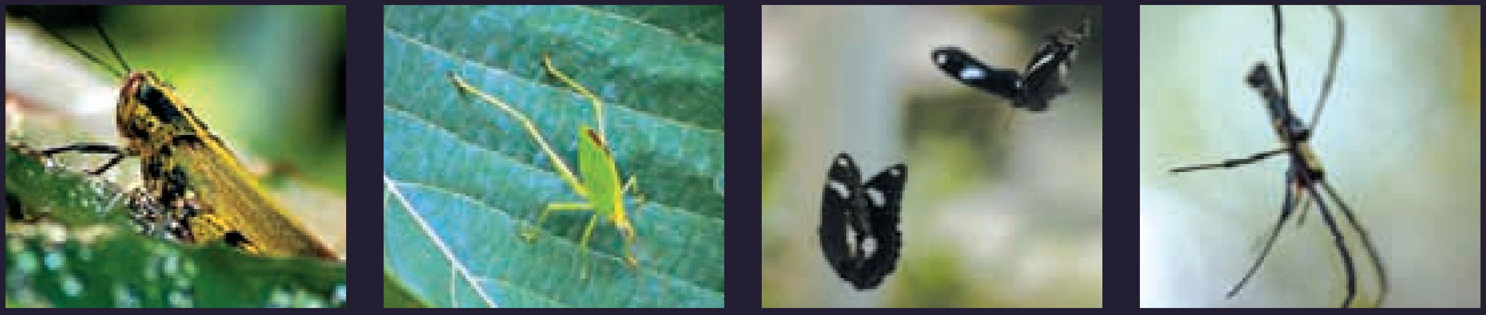
Fast Facts	
Scientific name:	*Polypedates leucomystax*
Common names:	Common Tree frog, Four-lined Tree frog, Golden Tree frog, Asian Brown Tree frog, Banana Tree Frog
Malay name:	Katak Pokok Biasa
Typical locality:	Java, Indonesia
Holotype:	Breslau Mus. (presumably MNHHWU).
Size:	Small to medium-sized common tree frog (males averaging 50 mm in total length and females averaging 80 mm in total length)
Appearance:	A variable shade of brown, ranging from pale brown to yellow-brown, reddish brown, gray-brown, or dark brown[1]. Patterning is prevalent, varying from spotted to longitudinal stripes. Plain forms are also seen but not as commonly[1,2]. However, in Bali, the most common form is plain, without pattern[1]. Capable of metachrosis (colour change), from pale beige during the day to dark brown with dark stripes at night. Different morphological forms include dull brown and lightly speckled; mottled, orange brown; plain pale; plain light brown; four-lined light brown; beige with spots; plain tan; gray with stripes. Can be found either in the same area or in different and far away areas.
Life history, abundance, activity and special behaviours:	Breeding is year-round in wetter areas, and restricted to the start of the wet season in drier areas[1]. Males congregate at still or slow-moving water, or puddles, and call from the edges or elevated positions on vegetation (described as a "widely spaced nasal quack, and occasionally a low throaty chuckle"[1]). Females deposit from 100-400 eggs in oval-shaped foam nests measuring about 10cm in length constructed on vegetation above ephemeral pools[3] or attached to a surface by the water's edge[1]. Hatching takes place after three to four days, occurring at the external gill stage[1,3] at which point the larvae wriggle free of the foam nest and drop into the water below[1]. The larvae are opportunistic predators, attacking and consuming nearly anything they can, including both live and dead tadpoles and decaying vegetation[3]. Hatching to metamorphosis takes approximately seven weeks[3]. This species is very wide spread, occurring in India, South east Asia right across to China and Japan.
Protection status:	Least concern (International Union for Conservation of Nature and Natural Resources Red List of Threatened Species). It is currently not threatened, due to its tolerance for various environmental conditions and is abundant throughout its range.

1. Frith, D. W. (1977). "A preliminary list of the amphibia of Phuket Island and adjacent mainland Peninsular Thailand." *Natural History Bulletin of the Siam Society*, 26(3-4), 189-199.
2. McKay, J.L. (2006). *A field guide to the amphibians and reptiles of Bali*. Malabar, Florida, Krieger Publishing Company.
3. Yorke, C. (1983). "Survival of embryos and larvae of the frog Polypedates leucomystax in Malaysia." *Journal of Herpetology*, 17(3), 235-241.

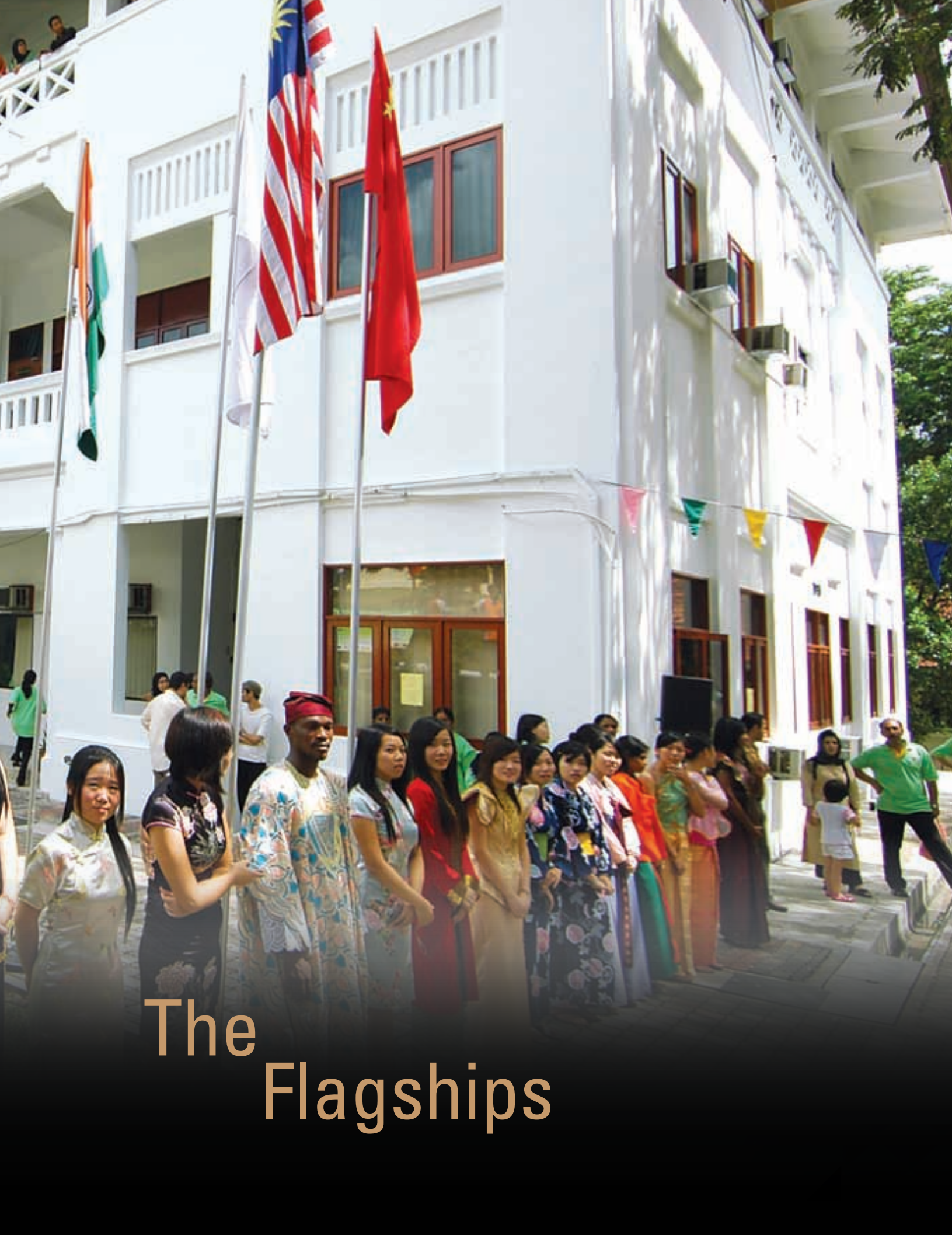
A challenge for the next generation

Today, USM stands proud of its firm stand on inclusiveness that has contributed to its sustainable environment. Each inhabitant recognises and acknowledges each other's contribution towards the state of *sejahtera* in the campus. The present USM community has kept the campus in the most pristine condition. Importantly, the spirit of inclusiveness is not only embodied in USM's relations with the natural environment, but also in all of its programmes and activities. The benchmark has been set. It is now up to the next generations to uphold the values and proud traditions of the present USM community.

The “other” inhabitants of USM



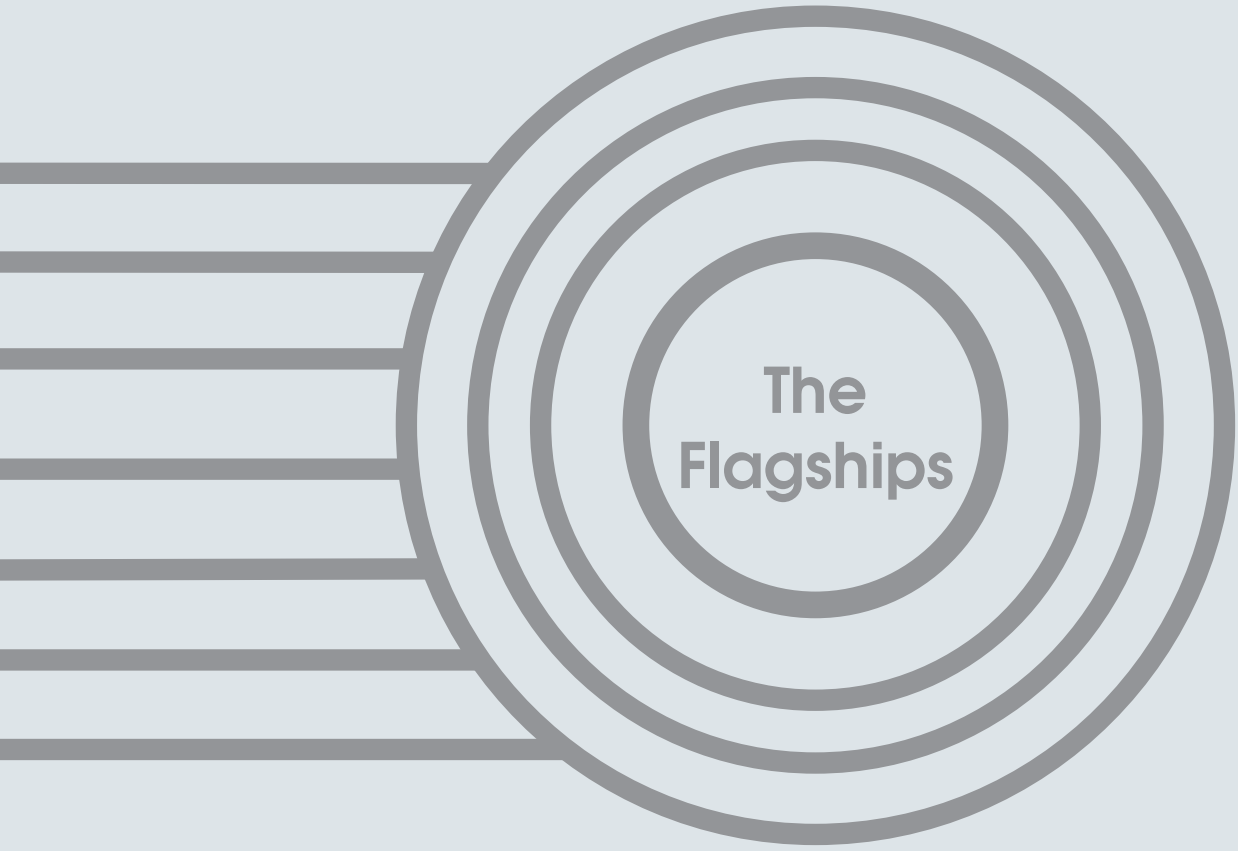
The diversity of ideas and minds at USM



The Flagships

Transforming higher education for a sustainable tomorrow

Laying the Foundation



Out-of-Malaysia: putting Malaysia on the map of human development

Archaeologists are keeping a keen eye on Malaysia following the discovery by USM team of archaeologists of the oldest evidence of human presence. Stone tools over 1.83 million years old have been found in Bukit Bunuh, Perak, (please refer to Figure 1: Location of Bukit Bunuh) making them far older than the 1.5 million year old handaxe previously found in Africa, long held to be the oldest handaxe ever discovered. At stake is more than just bragging rights, the discovery is postulated to lead to an *Out-of- Malaysia* theory as an alternative to the widely accepted *Out-of-Africa* theory which suggests that *Homo erectus*, our distant ancestors, originated in Africa. USM archaeologists are now anxiously holding their breath, waiting for final verification from a handful of professional dating laboratories such as the Hiruzen Institute for Geology and Chronology Co. Ltd., Japan and the College of Oceanic and Atmospheric Sciences, Oregon State University, United States. Once verified, the discovery will send shockwaves throughout the archaeological community and have astounding implications on theories of prehistoric human development, migration and culture, not to mention debunking or bringing into question at least, the *Out-of-Africa* and the *Movius Line* theories.

The Bukit Bunuh discoveries

As the name suggests, Bukit Bunuh is a place of mysteries, mysteries of our ancient origins to be exact. After a decade of efforts to piece together the mysteries of Bukit Bunuh, a dedicated team of archaeologists from USM, headed by Associate Professor Mokhtar Saidin, has unveiled a series of important artefacts to the world of archaeology. Most significant is the discovery of stone tools dating as far back as 1.83 million years, proving that humans have lived in Malaysia for at least as far back as that. The excavations at Bukit Bunuh were carried out in two phases, each contributing significantly to our current understanding of the prehistoric environment and culture of early humans.

Phase 1: of ancient workshops and secrets of the meteorite

The first phase of the excavations, commencing in 2001 in the southern region of Bukit Bunuh, was significant in its contributions to our understanding of the old stone-age, or Paleolithic, technology in Southeast Asia. The excavations revealed a 40,000[1] year old stone tool-making workshop that produced pebble tools such as handaxes, and flake tools. The discovery of the handaxes, in particular, has significant implications for our understanding of Paleolithic technology in Southeast Asia and our interpretation of other Southeast Asia Palaeolithic sites. Contrary to the *Movius Line* theory suggesting that peoples to the east of India never developed necessary technology for the

[1] The dating was obtained using the Optically Stimulated Luminescence technique with the cooperation of a dating expert from the Wollongong University, Australia, Professor Richard Robert. The results have been published under "Bukit Bunuh, Lenggong, Perak: New Evidence of Late Pleistocene Culture in Malaysia and Southeast Asia" in *Uncovering Southeast Asia's Past* (NUS Press).

01 A panoramic view showing the impact crater of the meteorite, estimated around 1.83 million years ago

construction of handaxes (see Figure 2: *Movius Line* Map), the Bukit Bunuh findings demonstrate that the community in that area had, in fact, been making and utilising sophisticated handaxes on a massive scale. The handaxes had been constructed from various materials such as quartzite, quartz, chert, flint and from a rare type of rock known as *suevite*. Suevites are rocks that have been transformed due to the high temperature and pressure from a meteorite impact. Suevites are extremely hard rocks, and to be chosen specifically for making handaxes indicates that the humans in the Bukit Bunuh area were advanced in their thinking and tool-making technology. Moreover, the discovery of handaxes ranging from the 40,000 years stratum to the 29,000 years stratum in Bukit Bunuh suggests that handaxes in the region were being continuously produced and used into the Late Pleistocene period. The discovery of handaxes from the same period in Chongokni, South Korea further supports the idea that people in the region had been using handaxes since at least 40,000 years. This begs the question, however, when did the technology of the handaxe first appear in the region? The second phase of the excavations gives a surprising insight, one that challenges the widely accepted *Out-of-Africa* theory.

Another significant discovery is the thousands of suevite boulders found scattered around Bukit Bunuh. Suevites have only been found in a few areas around the world, namely, Canada, Germany, Mexico, Spain and Russia, all with different datings. The suevites found in Bukit Bunuh have been dated to be approximately 1.74-1.84 million years old[2], indicating that the area had been hit by a meteorite around that time. From the geological perspective, the discovery of suevite rocks in Bukit Bunuh is important in that they are the first to be discovered in East Asia and provide the only evidence of a dated meteorite impact in the region. New minerals have also been found inside the suevites, thus arousing the attention of geologists from around the world. The suevites of Bukit Bunuh, however, have far more secrets to reveal.

[2] The dating was obtained using the fission-track dating method under the supervision of Professor Mashiro Daishi from the Japan Geochronology Lab, and the suevite has been substantiated by Professor Emeritus Tjia Hong Djin from Universiti Kebangsaan Malaysia and Professor Ir. Yahdi Zaim from the Institut Teknologi Bandung.

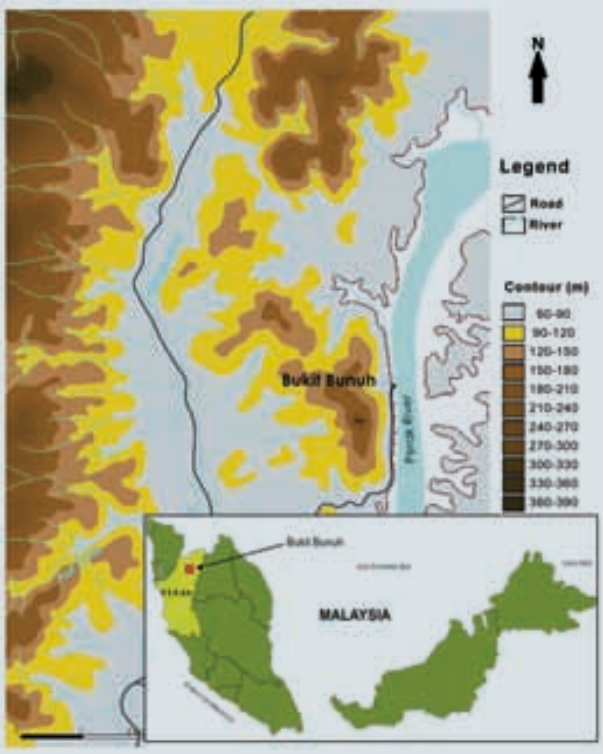
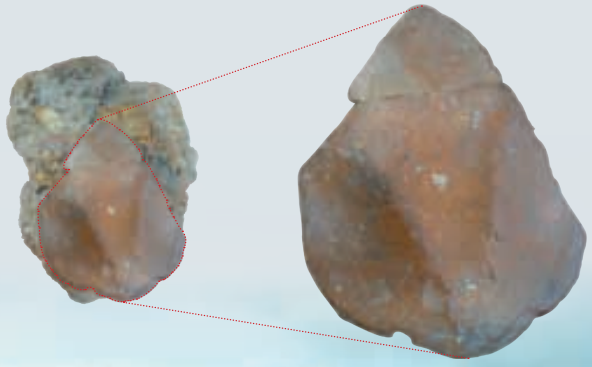


Figure 1: Location of Bukit Bunuh



02 Handaxe embedded in suevite which was dated 1.83 million years old

Phase 2: *Homo erectus* Out-of-Malaysia?

The second phase of the Bukit Bunuh excavations led USM archaeologists to the discovery of thousands upon thousands of stone tools which had become embedded in the suevites. The sheer number of stone tools found in the suevites suggests that humans had lived in and made tools in the Bukit Bunuh area long before the meteorite impact some 1.83 million years ago. Furthermore, the tools that were found suggest that the tool-makers were technologically more advanced than their contemporaries as evidenced by findings from elsewhere along the same stratum, suggesting that the Bukit Bunuh humans might not have been *Homo erectus* at all! These findings pose a direct challenge to the widely held *Out-of-Africa* theory on the spread of early man. The theory posits that the first human, *Homo erectus*, travelled *Out-of-Africa* and migrated to various parts of the world. Traces of *Homo erectus* have been found in Georgia (1.8 million years old), in China (1.7 million years old), and in Indonesia (1.7 million years old) (Please refer to Figure 3: *Out-of-Africa* map). The similarity of these dates poses an intriguing question. If the *Out-of-Africa* theory is held to be accurate, should we not find earlier evidence of *Homo erectus* closer to the African continent?

Moreover, given Malaysia's central location to Georgia, China and Indonesia, it would have been an ancient route to the south and therefore any traces of *Homo erectus* in Malaysia should be dated similarly to the other three areas. Instead, the traces of human evidence found in Bukit Bunuh were dated much earlier, 1.83 million years old, compared to the traces in Georgia and China towards the north of Peninsular Malaysia, and Indonesia towards the south. These observations suggest that it is plausible that the *Homo erectus* dispersed out of Malaysia, thus suggesting the theory of *Out-of-Malaysia* (Please refer Figure 4: *Out-of-Malaysia* map). It is also important to note that if the handaxes found in Bukit Bunuh are indeed 1.83 million years old then the humans and civilisation of Bukit Bunuh prior to the meteorite impact would be much older than 1.83 million years.

The discovery of handaxes[3] among the 1.83 million year old tools in Bukit Bunuh lends further weight to the *Out-of-Malaysia* theory. The handaxe is a tool particularly associated with *Homo erectus*. The general consensus among scholars is that handaxes are typical of the Acheulean industries of *Homo erectus*. It is widely held that these industries emerged in Africa 1.4-1.5 million years ago based on a handaxe previously found and dated from around that period. The presence of handaxes earlier than 1.5 million years old in Bukit Bunuh indicates that handaxe technology spread across the region and not *Out-of-Africa* as the dominant theory has suggested. The Bukit Bunuh handaxes, along with other recent discoveries in Southeast Asia, also challenge the *Movius Line* theory positing that handaxe making technology only existed west of India; thereby relegating the "non-handaxe east" (including Southeast Asia) to the backwater of civilisation. On the contrary, USM archaeologists found not only handaxes but evidence of an entire tool making workshop engaged in mass production suggesting that Bukit Bunuh had been home to a thriving civilisation with highly advanced technology.

Summary

Taken together, the discoveries in the first and second phase of the Bukit Bunuh excavations suggest that the area had been not simply inhabited but permanently settled since at least 1.83 million years ago. Hence, humans living there were not nomads. Communities of 29,000 years old and 40,000 years old have been found, proving that Bukit Bunuh was a suitable site for living due to the abundance of raw materials for stone tool making as well as providing food sources and fresh water for sustenance. Bukit Bunuh is unique among archaeological sites in Southeast Asia, having evidence of human inhabitation from the Lower to Upper Palaeolithic periods. These findings warrant a re-evaluation of the misconception of Palaeolithic era populations as being nomadic bands of wanderers following the food and resource trails. What the USM team of archaeologists found in the Bukit Bunuh site seems to suggest that this particular pre-historic community did not feel the need to relocate given the abundance of food and natural resources.

The discoveries at Bukit Bunuh have earth-shattering implications for the world of archaeology and geology, and will, if confirmed, re-write the history book as far as human civilisation is concerned. Once the estimated date of 1.83 million years for the stone tools has been verified, archaeologists will likely consider the *Out-of-Africa* theory old hat, *Out-of-Malaysia* becoming the dominant theory explaining prehistoric human migration. What is more, these discoveries will likely put Bukit Bunuh under the spotlight as the Palaeolithic Development Centre and the Handaxe Technology Development Centre of the world. Work is now underway with the USM team racing to be the first to find prehistoric skeletal remains and most important a tooth to confirm the exact species of the Bukit Bunuh inhabitants. Further work is also underway to develop the world's first suevite rock classification chart (please refer to Figure 5: Suevite Rock Classification Chart).

[3] The discovery of the handaxes was confirmed by prominent archaeologists, Dato' Professor Emeritus Zuraina Majid (Universiti Sains Malaysia), Professor Stephen Oppenheimer (University of Oxford) and Professor Keith Chang (PennState University, USA). Further studies with the CT-Scan method, conducted with the assistance from Professor Ibrahim Shuib and Professor Wan Kamil from the USM Health Campus substantiates the claim.

Q & A

Assoc. Prof. Mokhtar Saidin

Director of Centre for Global Archaeological Research

Q ***When did you first come across the 1.83 million year old handaxes?***

A We had actually come across pieces of stone tools as early as 2001 but it did not occur to us then that they were actually artefacts. It was not until 2007 that we came across one handaxe embedded in a suevite boulder that really stood out. Still sceptical at the time, we took the boulder back to USM and took samples from it for dating purposes. As the dating process took a long time, we did not pay much attention to it and carried on with our work at Bukit Bunuh. It was not until late 2008 that the results were returned. The first result dated the suevite as 1.74 million years old. We thought it could not be right because it would mean that the handaxe would be at least that old. We asked for a retest, and the results point to circa 1.74 to 1.83 million. We could not believe our eyes; we unofficially have in our hands the oldest handaxe in the world.

Q ***Could you describe some of the first reactions from around the globe?***

A I think the reaction from Prof. Stephen Oppenheimer, a renowned Oxford palaeoanthropologist, best illustrates the magnitude of the discovery in Bukit Bunuh - "Oh my God!", that was his first reaction. Of course, many like him were astounded by the discovery. We not only found one handaxe, but thousands of tools embedded in 1.83 million old suevites, *in-situ*. One hour after the press conference announcing the discovery, I was flooded with calls from all over the world, asking if it is true and asking for details of the discovery.

Q ***How would you describe their respones?***

A What I noticed was that people tend to be more sceptical when a major finding is announced by an Asian. I would not blame them, maybe because it was such a major finding that organisations such as the BBC wanted to be doubly sure. It was only upon several cross-checks, such as the dating laboratory and with my colleagues at my *alma mater* Harvard University, that people began to take our words seriously. I hope in some ways USM archaeologists have contributed in endorsing the quality of work of archaeologists from the region.

Q ***What is the significance of Bukit Bunuh to you and your team?***

A From the archaeological perspective, most important and obvious is that we are now working on a major revision on theories of human development and migration, specifically the *Out-of-Africa* and the *Movius Line* theories. The findings in Bukit Bunuh have provided us ample evidence to discount those theories. We believe that we can now position Malaysia and USM as a focal point for research in human development.

What is not obvious, and often forgotten, is the impact that our project in Lenggong and Bukit Bunuh had on the community. Our work in the Lenggong area that has been ongoing since 1986 has helped bring development to the area. When we first started, the area was practically dead in the evening, but now you can see thriving businesses late into the night catering to visitors to the archaeological sites and the museum. While it is easy to be pre-occupied with our work at the sites, we are well-aware and grateful that that we have been able to help the community to lead a better life. For instance, since 1986, 17 *green badge* (given to tourist guides with specialist local knowledge) tourist guides have been trained to explain the findings at the area and the exhibitions in the '*Muzium Arkeologi Lenggong*'. We are now anticipating the Lenggong area to further flourish with its possible inclusion on the UNESCO's World Heritage List.

All in all, working on the Bukit Bunuh project has been very much a fulfilling endeavour for all team members. I'm proud that I have a dedicated team in which everybody, including the clerk, security guard and stenographer, has comprehensive knowledge and contributed greatly to the archaeological research conducted by the team, not just at Bukit Bunuh but also those in Sabah, Sarawak and Kedah. I believe the team is the very example of inclusiveness and teamwork much talked about in USM.

World impact of Bukit Bunuh

Bukit Bunuh has brought an entourage of academics to Malaysia, not just archaeologists; but geologists, geneticists, palaeontologists and the list goes on. Similarly, the world's media along with documentary makers, the BBC, Discovery Channel and National Geographic, have expressed great interest (one even offering to take over the entire research from USM). Experts anticipate that Bukit Bunuh will result in new knowledge and theories concerning human development, migration and culture. Key findings from Bukit Bunuh include:

- the handaxes found in Bukit Bunuh are the oldest known evidence of a human presence having been dated to at least 1.83 years, making them far older than the previous record holder from Africa which is a mere 1.5 million years old
- it is estimated that humans may have inhabited the Bukit Bunuh area over 2.0 million years ago. For comparison, "Perak Man" is 11 thousand years old. The discovery of fossilised bone and tooth fragments will prove beyond any doubt that Bukit Bunuh is home to the oldest human remains in the world that are outside of Africa. USM archaeologists are quietly preparing to astonish the scientific community once again with another bombshell
- discoveries at Bukit Bunuh suggest an emerging *Out-of-Malaysia* theory as a more accurate explanation for the origins of our human ancestors, debunking the long-held *Out-of-Africa* theory. An *Out-of-Malaysia* theory will position Malaysia as the epicentre of academic research into human development, migration and culture
- the Bukit Bunuh discoveries dispute the *Movius Line* theory - east of India is not the backwater of civilisation as scientists had previously claimed. The people of Bukit Bunuh, having used handaxes long before their human counterparts in Europe and other areas to the west of India, have effectively rewritten the history book for what is known about the spread of handaxe making technologies
- more than a hundred thousand ancient stone hand tools, some dated as far as 1.83 million, have been found in the Bukit Bunuh area alone. The anvils used in making these tools and the debitage (i.e., stone chip waste) found along with the hand tools in the area indicate that Bukit Bunuh was actually a Palaeolithic workshop for stone tools production. This demonstrates that humans had developed the capacity for organised large scale production as far back as 1.83 million years ago
- tools found in Bukit Bunuh are of a similar technology to those found in Europe constructed at a much later date. This indicates that the Bukit Bunuh humans 2.0 million years ago had as an advanced technology as the later European ancestors. This suggests that a different species of humans, rather than *Homo erectus*, may have inhabited the Bukit Bunuh area 2.0 million years ago
- Bukit Bunuh also represents the only archaeological area in the world that has evidence of an ancient human population across different strata; namely from the 29 thousand, 40 thousand and 1.83 million year strata
- USM archaeologists have discovered at least 6 new minerals compounds in the suevites of Bukit Bunuh and anticipate assigning these newly discovered minerals names of a uniquely Malaysian flavour
- USM archaeologists have developed the world's first suevite rock classification system thereby creating a taxonomy for use by geologists and archaeologists around the world
- Bukit Bunuh holds the only evidence of suevite in South East Asia. The only other evidence of suevite is mostly found in Europe and the Americas, and
- it is expected that Bukit Bunuh will become a mandatory subject in the curriculum of archaeology, palaeoanthropology and archaeogeology. To date, USM have received visits from professors and students from various world renowned universities such as Cambridge

The USM archaeology team has an exciting and challenging time ahead. These discoveries are just the tip of the iceberg; the ultimate goal is the discovery of a human tooth which can be used to establish the genetic identity of the hominid at Bukit Bunuh. While the enormity of the archaeological site at Bukit Bunuh has not gone unnoticed by the international scientific community, the local story is an altogether different situation.

Beyond the groundbreaking scientific endeavours, perhaps the greatest challenge for the USM archaeology team is to generate a local (i.e. Malaysian) interest and appreciation for these discoveries. The reality is, for the USM archaeology team to continue its indispensible work it requires the support of both the government and private sectors to ensure that Malaysia remains in the lead of prehistoric archaeological sciences.

USM and the archaeology team are sincerely indebted to the owner of the oil palm plantation on which this major archaeological find was discovered and who has been exceedingly accommodating and supportive of the group's research. The site warrants recognition as a National Heritage site affording Bukit Bunuh its due recognition owing its importance to not just Malaysia but to the entire human race. This extraordinary work and findings elucidated thus far entitle it to be one of high value flagships for the APEX programme at USM.

03

04

05

03 Scrape tools found in Bukit Bunuh, Malaysia
04 Sharp edges of the cut tool found in Bukit Bunuh, Malaysia
05 Suevite boulders found scattered around the oil palm plantation in Bukit Bunuh, Malaysia

Figure 2: The *Movius Line* Map

Figure 3: The *Out-of-Africa* Map

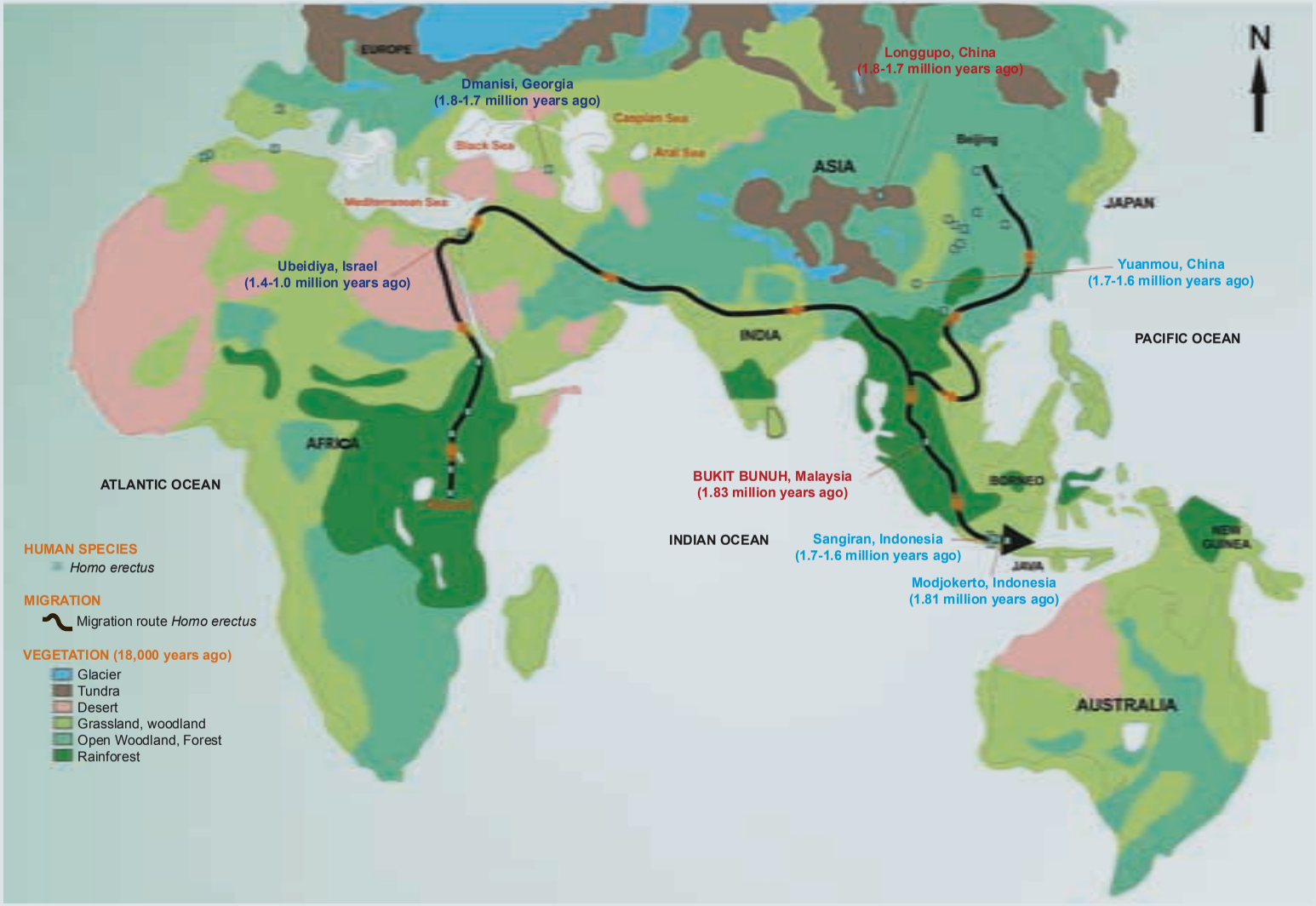


Figure 4: The *Out-of-Malaysia* Map

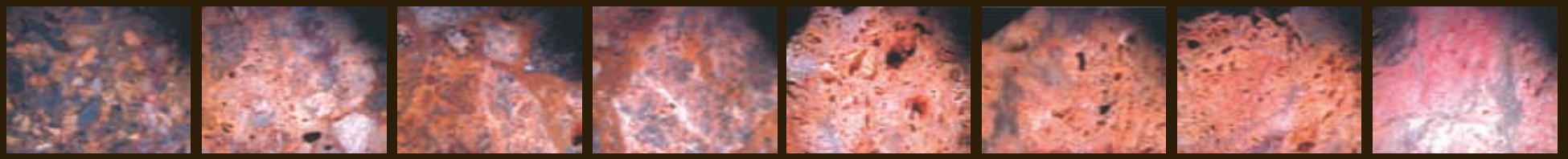


Figure 5: Suevite Rock Classification Chart

Collaborative research the CCB@USM way

The vast array of research topics makes it difficult to have all the necessary expertise under one roof. The Centre for Chemical Biology (CCB@USM) overcomes this challenge by understanding the value of collaboration and seeking the best in the world (both locally and abroad), making it truly an international research centre.

What is within the walls of the centre does not limit the science in terms of ideas, knowledge or resources. As part of those collaborations, CCB@USM has initiated an exchange programme for its researchers to get training from the experts and bring back those skills to be developed and shared.

Thus far, CCB@USM has over 30 collaborative partners located throughout Malaysia, the Asia-Pacific, Europe, South Africa and the United States (see related article).

Rubber Genome Research

A prime example of such collaborative efforts is the decoding of the rubber tree genome (*Hevea brasiliensis*), which was announced on 27 October 2009 by the Minister of Higher Education Dato' Seri Mohamed Khaled Nordin. Rubber is Malaysia's second most important cash crop, contributing to a multi-billion dollar global industry. In the interest of keeping Malaysia as the leader in rubber research and be at the forefront in the global rubber industry, CCB@USM undertook this major project and brought together the people, technologies and resources to move it in an expedited manner.

Contributions in the areas of rubber production, timber, disease resistance, pharmaceuticals and other biotechnological applications are all possible from knowing the genome. Decoding the genome is only the first step in a long journey of discovery, and will allow for the filing of intellectual property rights to protect the information before others can exploit and make claims.

In a short span of time since early 2008, CCB@USM has strategically positioned itself as the conduit for transforming fundamental academic research into applied research and development initiatives of significant interest and benefit to private enterprises.

Mission

CCB@USM's mission is to develop a leading platform for fundamental research in chemical biology and generate a creative, conducive, innovative and flexible transdisciplinary international research culture. In this way, the centre can develop a generation of international young scientists as well as to develop and transfer innovative technology through smart partnership.

The centre has launched a journey to create a new paradigm (culture, platform, dreams and implementation). The motto, Driving Inspirations into Reality, has truly shaped every aspect of CCB@USM. It places emphasis on the dreams and aspirations of each researcher, no matter what level they may be. This "bottom-up" approach is to allow the individual researchers to use their passion and creativity to drive the science and make discoveries without the research outcome being dictated by the supervisor. This instills greater interest and responsibility, while cultivating them to be independent, innovative and open-minded young scientists.

Creating the research environment with state-of-the-art facilities (see related article) was greatly influenced by those who would be using it - the students. Their involvement in the planning and design of the functionality, atmosphere and comfort of the lab space has certainly made it conducive to great "get-go" research infrastructure.

Research clusters

CCB@USM believes that there are no boundaries or limits to what can be done. It all starts with a dream. Based on the interests of each researcher, it has led to the formation of six research clusters at CCB@USM (see related article). In keeping with the bottom-up approach, the members of each cluster are responsible for developing their research roadmap and "big picture", budget and determining their curriculum in terms of courses, books, resources and expertise needed. CCB@USM's goal is to eliminate the gap between the supervisor and the student, in favour of treating everyone as colleagues that openly share and discuss their ideas. CCB@USM encourages out-of-the-box thinking, so as not to settle for mediocrity.

Facilities at CCB@USM

State-of-the-art facilities include:

- Malaysia's first 3-D visualisation lab equipped for immersive 3-D visualisation and structural design, multi-site audio/video teleconferencing, multiple screen separation for collaborative work and data curation between researchers and viewing online lectures and web-seminars
- Altix 450 supercomputer and Dell servers to accommodate computationally demanding processes and share information with collaborators around the world
- X-ray diffraction system for protein structure determination
- Liquid chromatography systems for high-throughput protein purification
- High-throughput DNA sequencer to meet the needs of CCB@USM researchers, as well as provide affordable, reliable and timely service to both the USM and non-USM research community
- Flow cytometer for cell and chromosome sorting and analysis

First genome discovery for global benefits

Universiti Sains Malaysia (USM) through CCB@USM has made historic breakthrough by being the first university in Malaysia and in the world to produce a draft genome of rubber tree *Hevea brasieliensis* with the potential of remaking Malaysia the largest rubber producer in the world.

CCB@USM has successfully decoded the draft of the rubber tree *Hevea brasieliensis* genome using its Seamless Genome-Based Discovery Platform applying the next generation high throughput sequencing platforms (454, Illumina/ Solexa, and SOLiD), BAC library and transcriptome. This project is the result of international collaboration led by CCB@USM and it has become the basis of a larger and greater contribution to the income of small rubber holders who often are the bottom billion in the society as a whole.

This discovery has enabled USM researchers to discover specific features of functional genomics of the rubber tree that can be used from breeding to biotechnology applications.

Through this fundamental discovery and gathered knowledge, Malaysia can increase its level of competitiveness in the rubber-related research and production. In the long run, it will form solid foundation to advance the research and development as well as to strengthen the country's position in the rubber industry at the global level. CCB@USM researchers are also expanding this discovery in diverse applications such as pharmaceuticals and health.

Some of the economic and social benefits envisaged include:

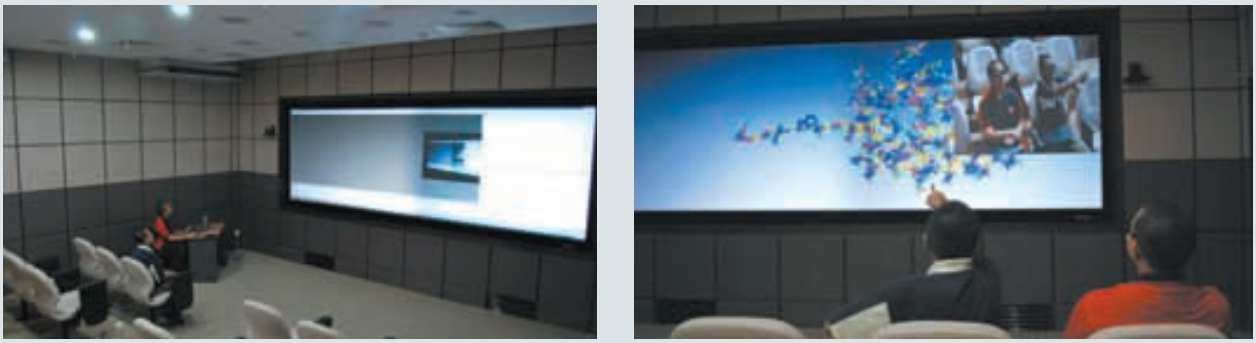
- as part of 1Malaysia, the New Economic Model (NEM), it has the potential to become a biotechnology research hub for rubber trees in the Asian region (sustainable future technology platform) and can produce and train local scientists - building highly qualified human resource
- as part of CCB@USM's Technology Transfer Platform and in close collaboration with RISDA, Malaysian Biotech Corporation and Malaysian Rubber Industry in upcoming years it has the potential to generate revenues worth billions of ringgit
- through CCB@USM's Functional Genomics Platform and Tissue Culture, USM can lead to develop a better quality rubber tree for fine quality Rubber Wood and resistance to against various pathogens, including the South American Leaf Blight disease
- the Genome Platform has enabled CCB@USM to consult with organisations world wide to undertake similar discoveries of various flora

Announcement by the Minister of Higher Education on the world's first discovery of the rubber tree genome

Murals on the laboratory walls of CCB@USM

Research clusters at CCB@USM

- The Extremophile cluster aims to explore extreme environments around Malaysia, and has started with a hot spring in Ulu Slim, Perak. They have isolated microbes and plan to understand life at these extremes through genomic, transcriptomic and proteomic approaches, as well as mine for useful secondary metabolites and novel enzymes.
- The Virology cluster is interested in viral infectious diseases, particularly dengue and chikungunya. Fundamental knowledge of viral replication and virus-vector-host genome co-evolution is being combined with applied research such as the identification of antiviral compounds and production of diagnostic kits. This will ultimately lead to ways for prevention, diagnosis and treatment.
- The Herbal and Drug Discovery cluster will study local plants and herbs for active compounds that can be used for anti-aging, treatment of diseases and ailments, and prevention/control of pathogens. This not only entails the identification and testing of active compounds, but also to understand the mechanism of their action at the molecular level.
- The Signal Transduction cluster is focused on understanding the language of the cell and how communication occurs within and between cells. Signalling occurs in every type of cell and controls/regulates a multitude of processes such as gene expression, metabolism, survival, virulence and development.
- The Synthetic Biology cluster is concerned with building and developing new biological functions and systems by understanding, dissecting and reassembling the existing cellular networks. Major emphasis will be on bioenergy, vitamins, antibiotics and the regulation of RNA, proteins and small molecules.
- The Bioinformatics and 3-D Visualisation cluster uses computational approaches to answer biological phenomena and crack the code of life. Computational tools are indispensible for any type of research in this age of science, and are a core component of every cluster. Areas of research include genome analysis, metabolic pathway reconstruction, biomarker discovery, molecular modelling and simulation and in silico drug design.



Visualisation laboratory at CCB@USM

Sharing knowledge with the world

Other collaborative endeavours:

- USM's Doping Control Centre and Centre for Drug Research: These two centres of excellence are a perfect complement to the research goals of CCB@USM. Their world class facilities and expertise have enhanced and pushed forward many of CCB@USM's research problems involving proteomic analysis, small molecule separation and identification and in vitro drug/chemical testing.
- Malaysian Agricultural Research and Development Institute (MARDI): Partnership began as part of a tripartite Memorandum of Understanding between CCB@USM, MARDI and Malaysian Biotechnology Corporation on 17 November 2009. The aim of the Memorandum is to develop a scientific and technical collaboration on agricultural, food and other agro-based industries. Among others, the collaboration will look into enhancing research regarding food and herbal natural resources and plants frequently used in traditional medicine.
- Durban University of Technology (DUT), South Africa: Drawn to its similar research philosophy and enthusiasm, CCB@USM initiated collaboration with DUT in late 2009. This not only included the contributions of DUT members to CCB@USM projects, but also to share CCB@USM's knowledge and experience to help with infrastructure and capacity building of DUT's genome biology programme. To get this started, CCB@USM hosted two postgraduate students for two months. One of the major outcomes of this collaboration will be to sequence the genomes of South African indigenous plants.
- Vietnam Medical Military University (VMMU): Initiated and led by CCB@USM's postgraduate students, this collaboration combines fundamental science with research done in a clinical setting. This ambitious programme is focused on investigating chikungunya, tackling areas such as diagnostic kit development, genome sequencing and genotyping of isolates, virus database creation, biomarker identification and validation and drug discovery. CCB@USM aims to make this into a sustainable research programme, with future possibilities in branching out to other medically-oriented topics.

What is next?

An e-Management System

CCB@USM has spearheaded a programme by implementing an e-Management System in early 2010 to do cutting-edge research, without having to worry about administrative/fiscal obstacles and bottlenecks brought about by cumbersome manual processes. Authorised users will have access to this online system with portals for procurement, payment, accounting/reporting, property management, travel and human resources. CCB@USM will work together with the relevant administrative departments to set forth the appropriate policies and procedures, improve and develop the system and integrate it with other existing systems at USM. The e-Management System streamlines the administrative/fiscal process while allowing full transparency and efficient and real-time reporting. Upon successful completion of the testing phase at CCB@USM, it is planned for USM system-wide application.

A seamless genome-based discovery platform

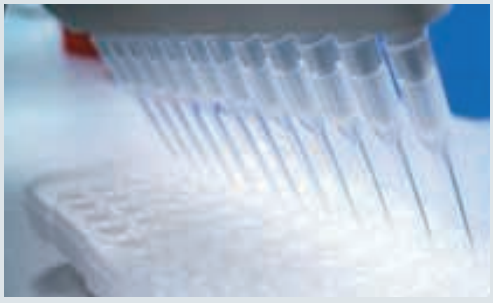
In the fall of 2009, CCB@USM put together a pipeline capable of offering a complete solution to contemporary genomic challenges, from raw material acquisition to metabolic profiling. Through academic and corporate partnerships, this "Seamless Genome-based Discovery Platform" combines powerful techniques and products to explore any type of microbial, plant or mammalian genome. The base pipeline consists of the sorting of individual chromosomes, genome and transcriptome sequencing using a combination of next-generation sequencing technologies, assembly and annotation of the data generated, metabolic pathway reconstruction and proteomic validation. Proteins of interest can be further investigated using high-throughput molecular modelling, crystal structure determination and in silico drug design. CCB@USM is positioned to provide sophisticated solutions as a single package in a rapid and efficient manner to a global clientele. As proof-of-concept, CCB@USM has already managed to attract RM2.5 million in extramural funding.

The future

George Whitesides recently wrote that "biology is - now and probably for the foreseeable future - the area of fundamental science in which the growth of knowledge is the most rapid". The molecular revolution in biosciences has propelled chemical biology to its status as one of the most important areas of science today.

CCB@USM in coming weeks, months and years will continue to pursue the "bottom-up" approach by connecting dreams of individual researchers to the rich intellectual transdisciplinary international research culture. This will be accomplished by using powerful emerging technologies from visualising the interactions of individual molecules to profiling thousands of genes simultaneously in the areas of healthcare, agriculture and biotechnology.

The extraordinary discovery shown by CCB@USM in a relatively short period of time entitles it to be one of the high value flagships that would turn USM around to be an APEX university.



Business Unusual - the USM-KLEC Academic Park

USM is paving new grounds in higher education by becoming the only local anchor university at the Kuala Lumpur Education City (KLEC) Academic Park as approved by MoHE. The KLEC Academic Park features an innovative and futuristic approach in higher education, offering academic programmes from various top-ranked international universities all in one campus. As a strategic partner, USM acts as a catalyst to attract other international partners, providing an academic platform to put together the cluster application for a license to operate university undergraduate and postgraduate programmes. In a business unusual modus operandi, USM will facilitate KLEC in bringing various local and international universities to work together, non-competitively, as clusters towards mutual benefits.

The cluster approach in higher education is envisaged to encourage the sustainability of knowledge. The cluster collaborations at the KLEC Academic Park aim at creating dynamic relationships that allow each anchor cluster institution, both local and international, to leverage on each other's strength. Collectively, the institutions will build on each other's brand to promote the KLEC Academic Park as an eminent education hub in the Southeast Asian region. The scope of international collaborations encompasses joint-academic programmes, faculty exchanges, sharing of resources as well as trans-cluster research collaborations.

KLEC is keen to promote key research collaborations by establishing national centres of research excellence within the KLEC Research and Innovation Park. USM will work with key cluster anchors to develop centres to run research programmes and offer research-based postgraduate joint programmes with international anchor institutions. USM and the international anchor institutions will benefit in realising the vision of establishing Malaysia as a regional hub for education and research.

From a more operational perspective, the KLEC project presents an opportunity for USM to expand its undergraduate student population and extend its reach to the large local and international groups of students in the Klang Valley. International collaborations with anchor institutions within various clusters will expose USM KLEC undergraduates to global community that will enrich their experiences and broaden their horizons. USM KLEC will also nurture world class graduates who may then proceed to the USM postgraduate programmes. The undergraduate academic programmes will commence in 2011 at a temporary campus whilst the permanent campus is expected to be ready in 2013. In

01 The KLEC Medical Park concept master plan

addition to the undergraduate programmes, USM at the KLEC City Campus will also cater for popular postgraduate, part-time and continuing professional development (CPD) programmes, targeted at working professionals in Kuala Lumpur.

USM and KLEC Sdn. Bhd. have formalised the collaborative intent with the signing of the Memorandum of Agreement on 21 November 2009. Both parties will join forces to bring a number of international universities on board and establish the academic cluster application to be submitted to the Ministry of Higher Education by the third quarter of 2010. The health cluster application is expected to be submitted by the end of 2010 with the subsequent research cluster application being submitted in 2011.

The inaugural undergraduate programmes to be offered by USM are as follows:

- School of Management: Bachelor of Management
- School of Health Sciences: Bachelor of Science in Nursing, Diploma in Nursing
- School of Housing Building and Planning: Bachelor of Science in Quantity Surveying and Bachelor of Science in Construction Management
- School of Arts: Bachelor of Fine Arts in Performing Arts, Bachelor of Fine Arts in Product Design, Bachelor of Fine Arts in Design and Media, Bachelor of Fine Arts in Graphic Communications, Bachelor of Music
- School of Computer Sciences: Bachelor of Computer Science
- School of Social Sciences: Bachelor of Arts in Economics, Bachelor of Arts in Social Work and Bachelor of Arts in Social Sciences

02

02 A meeting in Westmister, London to discuss the first KLEC cluster

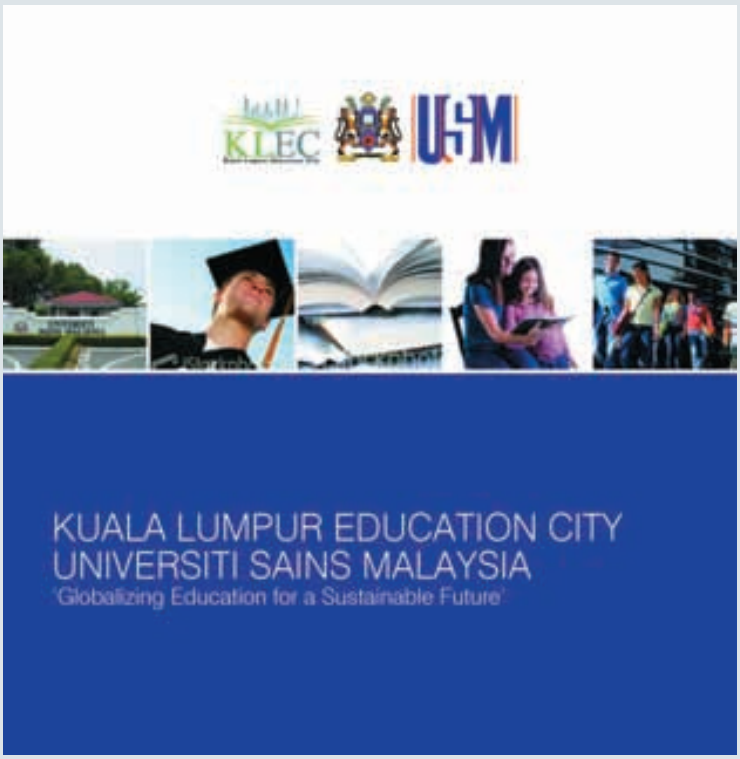
The KLEC Medical Park

One of the key attractions of the KLEC Academic Park is the KLEC Medical Park, a health cluster currently being promoted by KLEC with USM. Encompassing an estimated 40 acres of land within the KLEC Academic Park, the KLEC Medical Park will be modelled on the successful UK/US Academic Health Service Centre (AHSC). The KLEC Medical Park will have a strong research focus supported by a strong academic presence for the clinical provision of services.

The KLEC Medical Park will feature a 600-bed teaching hospital that incorporates a 100-bed private wing. The hospital will feature a common shared International Medical Centre, teaching facilities, medical library and medical museum with an integrated Clinical Skills Centre to be used by all KLEC anchors, ranging from medical, dental, pharmacy, nursing, allied health to biomedical sciences, for pre-clinical training.

Research is a critical motivation factor for the international anchors to be part of the KLEC Medical Park. The KLEC Medical Park will be extremely attractive to participating faculties if they have the opportunity to participate in new and exciting research, particularly those related to the biodiversity and disease spectrum in Malaysia. At the KLEC Medical Park, they will not only be able to tap into the expertise and interests of the participating partners but also into the partner's homebase research facilities and expertise. As such, the intellectual property generated and shared among these partners will have an extensive exposure and present increased opportunity for further development. The research cluster, in turn, will become an attraction for related industries to explore opportunities for R&D collaborations and nurture lateral relations.

Potentially, the management of this hospital will include USM and a UK anchor medical school. TH Properties Sdn. Bhd. will develop the hospital via a property special purpose vehicle company. The funding will be based on a public-private partnership model with subsidies from the government to all local patients registered under the teaching hospital, and other sources of income from private patients as well as research and academic initiatives. The main aim is to reduce the government funding and capital ownership yet providing critical healthcare services to the general public on subsidised rates while at the same time focusing on research.



The KLEC Academic Park business model

The KLEC Academic Park will be located in Bandar Enstek, a 5,116 acre township situated next to the Kuala Lumpur International Airport (KLIA). The physical infrastructure of the park will be developed through a private investment mechanism to ensure that the partner institutions will incur minimal capital outlay in the initial stages. The project is designed and managed by Kuala Lumpur Education City Sdn. Bhd., a company with extensive experience in international education collaboration.

The business model of the KLEC Academic Park leverages on a model of sharing, ensuring that USM is able to run a campus without a huge capital investment. The shared facility and services model diverts investments away from costly capital infrastructural development to operational expenditures. USM may then focus its investments on its core business - offering academic programmes. The business model requires less financial support from the government in terms of setting up a campus and the campus can be sustained in the long run through a student-based voucher system.

Two levels of investments are required in turning this concept of the KLEC Academic Park into reality. At the first level, huge capital investment is required to develop the land, infrastructure and buildings for the participating universities. The investment is raised via the developer partner KLEC–TH Properties Sdn. Bhd. This approach relieves the potential participating universities from the massive initial capital outlay in exchange for a long-term lease of buildings and facilities by the joint-venture KLEC-university holding company. At the second level, investments for operational requirements are injected by KLEC and its pool of institutional and private equity investors, via a joint venture-holding company with the participating universities. Coupled with the unique shared service model, efficiencies within this two-level financing model not only ensure the viability of the institution, but also its sustainability over the years in support of institutional growth and aspirations for excellence in both teaching and research. This model allows the institution to channel its strengths to its core business of providing educational services, whilst enjoying a strong financial foundation.

The timeline for development is broken up into phases of five years each. The first cluster of universities including USM, is planned for 2013, with a primary focus on undergraduate teaching. The second cluster is focused on enhancing value to the education hub, with the addition of strategic partners involved in the KLEC Research and Innovation Park. The structured development is to allow for a more integrated development by TH Properties Sdn. Bhd.

The Universiti Sains Malaysia-Karnataka Lingayat Education collaboration

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01 & 02 Karnataka Lingayat Education University campus

The USM's School of Medical Sciences has become the first public medical school in Malaysia to provide a medical curriculum to the Karnataka Lingayat Education (KLE) University, Belgaum, that houses the prestigious Jawarharlal Nehru Medical College (JNMC). USM's problem-based and integrated approach in teaching medicine, as compared to the more traditional approach of JNMC, was one of the key factors in consolidating the collaboration as it will contribute to the richness of the medical curriculum offered at KLE University. USM will benefit immensely not only from the KLE University's commitment to provide the infrastructure and educational resources, but also from the opportunity to promote its medical programme at the international level. Through this collaboration, USM will now be able to send more of its medical students to study in India alongside world renowned physicians and be exposed to different medical environments and cultural diversity that will enhance their development in becoming global physicians. Students in this programme will be awarded with a Doctor of Medicine degree from USM.

The USM-KLE University collaboration was officially established in November 2009 with the signing of a Memorandum of Agreement (MoA) between the two parties. Under the MoA, KLE University will provide the infrastructure and educational resources for the delivery of a medical undergraduate programme in Belgaum, India, utilising USM medical curriculum. USM's key motivation in this collaboration is to increase the quality and number of its graduates in medicine to fulfil the current and future needs of Malaysia. Unlike the JNMC medical programme, no quota will be imposed on foreign students under the USM-KLE programme, hence allowing more Malaysians to study in India, tap into the enormous educational resources and benefit from vastly experienced teachers at one of the top medical colleges in India. In this programme, medical students will have access to some of the best medical facilities and resources in the world. For instance, students in this programme will be able to practise their medical skills on human cadavers, a rare opportunity for medical students anywhere else in the world. USM is also looking forward to the opportunities for collaborations in research and exchange of staff and students in the future.

The inaugural class will commence with the intake of about 100 medical students from Malaysia in July 2010. Students will be selected through the existing process practised by the USM School of Medical Sciences. Selection will be based on both their academic and non-academic achievements and an interview. The programme will also adopt the system of governance of the School. A Deputy Dean has been appointed to organise and monitor the medical programme in KLE University and all academic matters will be subject to the deliberations and approval of the Faculty Board of the USM School of Medical Sciences and the USM Senate.

The USM-KLE University collaboration signifies an achievement for the School of Medical Sciences in marking its name at the global level. In line with USM's vision to transform education for a sustainable tomorrow, one of the future goals of the USM-KLE medical programme is to recruit students from less developed countries, such as Bangladesh and the Maldives, to allow them to obtain superior medical training at affordable fees.

About the USM School of Medical Sciences

The USM's School of Medical Sciences was established in June 1979 as the country's first integrated medical education, and among the handful world wide then. At the beginning, the pre-clinical years were carried out in the Penang campus while the clinical years were carried out at the Kelantan campus. The school was fully operational at Kubang Kerian, Kelantan by June 1990. The Kubang Kerian, Health Campus, was established on 220 acres of land and encompasses the School of Medical Sciences and the USM Teaching Hospital. The move to the Kelantan campus further consolidated the academic, service and research activities of the School. More recently two new schools have been established, the School of Dental Sciences and Allied Health Sciences.

About the KLE Society

The Karnataka Lingayat Education (KLE) Society, located in Belgaum, Karnataka, India, was set up by seven selfless dedicated teachers (fondly known as the Saptarishis) and three patrons (Founders) who identified the immense need to create a strong educational base in the neglected areas of North Karnataka and South Maharashthra, India. The Society has grown tremendously in the last nine decades in the field of education. The KLE University and Jawaharlal Nehru Medical College are now part of the Society consortium which has been endorsed by the Ministry of Human Resource Development of India.

The Jawaharlal Nehru Medical College, a constituent college of KLE University recognised by the Medical Council of India, is also recognised by the Malaysian Medical Council and is listed in the WHO directory of World Medical Institutions. JNMC has more than 520 qualified and experienced faculty members, respected in numerous areas. Overall, the college boasts of having a committed faculty of eminence and is highly reputed both in India and abroad.

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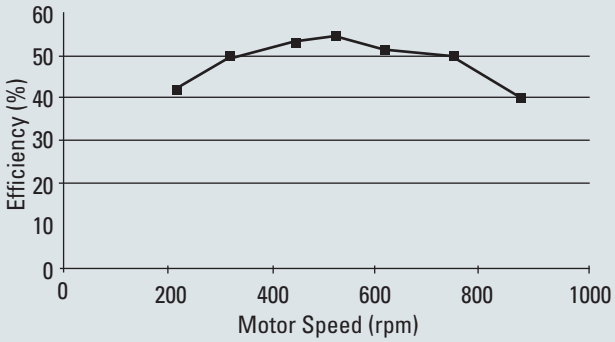
03, 04, 05 & 06 Picture taken during USM delegates' visit to Karnataka Lingayat Education University campus

USM e-motorcycles towards sustainable mobility

Motorcycles have become part and parcel of life in Malaysia. They make commuting easy and affordable and to some, more interesting with manoeuvres rivaling Evil Knievel. If motorcycles are here to stay, would it not make sense to make them more sustainable and at the same time, affordable to Malaysians? In answering that question, USM in collaboration with DRB Hicom (via Modenas) is expected to begin the commercialisation of a clean, convenient, efficient electric motorcycle (e-motorcycle) by late 2010. The e-motorcycle will be capable of medium range (100km) trips and can be recharged from any standard 240VAC wall outlet. It is designed to emit no pollution and will cost much less to operate than a conventional motorcycle. If its introduction is successful in Malaysia, e-motorcycles could become an export product to countries which also charge high petroleum prices.

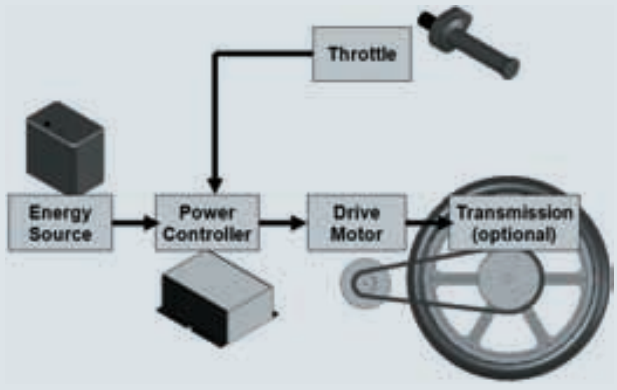
Future transportation will feature a much greater percentage of hybrid and electric vehicles. In Malaysia, light weight electric bicycles have already become a common site in urban and rural settings alike due to their low cost of operation. While these vehicles are very convenient for short trips they do not, however, significantly reduce the number of automobile or motorcycle trips; rather, they tend to displace foot or bicycle travel. To make a significant impact on reducing fuel consumption, emissions and transportation costs, USM Engines Laboratory has been developing a more powerful electric vehicle, the Malaysian first e-motorcycle.

Motorcycle	Cost (sen/km)
Gasoline	1.5
Electricity	0.5
E-motorcycles cost approximately 1/3 of what a conventional motorcycle cost per kilometre.	



The efficiency of e-motorcycles average around 50%. Conventional gasoline motorcycles average less than 20% (tank to wheels)

One of the key advantages of electrical vehicles is the modular design. Components can easily be interchangeable for various vehicle configurations. The same vehicle can be equipped with a larger battery capacity for longer range applications or a more powerful motor for higher top speeds.



DRB Hicom (via Modenas) has indicated interest in the commercialisation of the e-motorcycle being designed at USM. Modenas has been supporting this project via the donation of motorcycle frames which USM uses in its e-motorcycles. USM has also furnished units to Modenas for testing. Currently, USM and Modenas are working together to produce a motorcycle capable of 70kph top speed with a range of 100km.

Modenas is targeting prices approximately equivalent to current models. Dr. Horizon Gitano, director of USM Engines Laboratory, had this to say about the project: "We are working very closely with Modenas on this project. Electrical propulsion has been identified as a key technology for the future. Getting into this market today will allow us to lead in sustainable transportation system designs in the future. This will become increasingly important as fossil fuel resources are depleted and emissions take their toll on the environment. Whoever wins the race for transportation technology will be the big winner economically in the long run".

USM's first e-motorcycle; current version is faster and more powerful

The electric motorcycle development plan

Phase	Milestones	Duration (months)
1.	Determine on basis of vehicle design Motor, gearing, batteries, controller	Completed
2.	Deploy five e-motorcycles for guard duty at USM Engineering Campus	3
3.	Expand to USM Main campus with 10 more e-motorcycles Modenas to support with frames	4
4.	Programme evaluation and commercialisation plan JPJ approval for e-motorcycles Modenas frames for prime motorcycles Prime motorcycle assembly plant	4
5.	Pre-production run of 50 e-motorcycles	8

The USM Engines Laboratory team is now working at Phase 2. It expects to have all five motorcycles ready for deployment to the Engineering Campus by June 2010, to be used by the security guards during their rounds. The security guards, currently using their own vehicles and being only partially reimbursed for expenses, welcome dedicated duty motorcycles to conduct their on-campus rounds.

During this phase, the vehicles will be assessed for long-term viability, battery life and range and customer satisfaction. Any changes or modifications will be carried over at the Phase 3 deployment, which will include more power and greater range. This phase will see the completion of perhaps 10 vehicles used on the USM Main Campus for guard duty. At the end of this phase, the team should have sufficient data and accumulated test time to justify further commercial development. This will require capital from a commercial partner (e.g., Modenas or a similar motorcycle assembly plant such as Armstrong Assemblers) for frames and running gear. The necessary factory space for assembly could be within the partner's existing facility or may include a separate facility. The proposed pre-production run of 50 units for Modenas can begin as Phase 3 is in progress, carrying over all the learning from any issues that the team has with the Main Campus deployment. The initial three phases are expected to be completed by mid-to late 2010. After that, the team will seek the approval of the Road Transport Department (JPJ) for further development.

Team dynamics

The initial phases of this project are organised according to the structure previously used with great success on several Engines Laboratory projects. A professor leads the effort and acts as the project's spokesman when dealing with any technical partners. Directly reporting to the professor will be several graduate students in charge of the various areas (design, testing, assembly, logistics). These graduate students have direct supervision over undergraduate students and perform the highly skilled work with the various technicians. This type of organisational structure provides direct lines of responsibility while allowing students at all levels to contribute and gain vital experience.

Making a difference

While the USM Engines Laboratory team will leverage off this work for academic purposes (i.e., paper publishing), it will also be using the data gathered to help form an environmental policy together with the United Nation's Clean Air Initiative Asia. As such, this high profile study is expected to enhance USM's international reputation. Any university can assemble and test an electric vehicle but very few can deploy a fleet of them for track performance on a long-term basis. Importantly, this study will result in a production ready e-motorcyle design and render an excellent idea of the costs and challenges associated with fleet deployment. The remaining commercialisation will depend strongly on the market, especially the price of gasoline as well as volume prices of the various components and terms negotiated with the commercialisation partner. Efforts are underway to negotiate with potential interested partners to ensure that the team will be able to speed production to a viable commercial volume for both domestic and export markets. The USM Engines Laboratory team is proud that it is doing its part in preserving petroleum resources, reducing environmental degradation as well as saving money for some of the poorest members of society.

Modenas, the national motorcyle maker Motosikal dan Enjin Nasional Sdn Bhd, is looking at commercialising and mass-producing its electric motorcyles by 2011. The company's chairman Datuk Syed Mohamad Aidid Syed Murtaza said a sample model of the environmentally-friendly scooter will be ready by late next year and Modenas is looking at selling the motorcyles here and abroad.

"Modenas and **Universiti Sains Malaysia** (USM) are collaborating to manufacture the motorcyle," he told Business Times.

He said a prototype of the vehicle is currently being tested at USM's engineering campus in Nibong Tebal on mainland Penang.

"We are likely to embark on this after 2010, since we aim to develop an indigenous engine.

"Our long-term plan is to come up with a motorcyle which is fully made in Malaysia," he added.

Business Times
Mon. Nov. 23, 2009
By Marina Emmanuel

DRB-HICOM in talks to manufacture hybrid vehicles

- SHAH ALAM, Dec 30 (Bernama) -- Malaysian automotive conglomerate, DRB-HICOM Bhd, aims to introduce its own hybrid car by 2012 in line with the government's objective to promote hybrid and electric vehicles and development of related infrastructure.
- Group director of automotive, Datuk Nik Hamdam Nik Hassan, said the company was currently in talks with three potential partners to manufacture the car and hoped to finalise the deal next year. "Besides the assemble, we want to have our own hybrid car that we can call it HICOM hybrid.
- It will take 18 to 24 months to have this car to come on stream," he told a media briefing on the company's automotive business update here today. Nik Hamdam, who declined to name the parties, however, said one of them was DRB-HICOM's existing partner.
- **It is targeted for commercialisation by 2011**, he said. DRB-HICOM, through its unit Modenas (Motosikal Dan Enjin Nasional Sdn Bhd), is already in joint development works with Petronas and Universiti Sains Malaysia to build hybrid/electric motorcycles.
- The Star Dec 31, 2009

The USMElectricBike Team at work

Sustainable urban insect pest management

Today, approximately 3.3 billion people live in urban areas. This figure is expected to rise to 4.9 billion by 2030, but a tremendous growth is predicted in East Asia with an average of 1% growth in urban populations per year. Although rapid urbanisation due to accelerating socio-economic growth has led to a comfortable and better quality of life for the people, it has also brought many social and health issues to urban dwellers.

In particular, the urban insect pest problems (such as cockroaches, ants, termites, bed bugs, mosquitoes, etc.) are also on the rise, owing to the rising human population, food storages, improper waste disposal facilities, limited pest-proof structures and development of numerous former plantation lands. These problems can be in the form of building and structural damages, vector-borne diseases (e.g., dengue and chikungunya), food contamination and even lack of peace of mind. Despite the importance of insect pests to the urban environment, information on tropical pest biology is scarce. The lack of this information can hamper the development of effective and sustainable pest management strategies.

At the Vector Control Research Unit (VCRU), Universiti Sains Malaysia, the urban pest management research led by Prof. Lee Chow Yang has made numerous inroads into tropical insect pest biology and sustainable urban pest management in Southeast Asia. He and his graduate students have been actively carrying out research on urban insect pests in Malaysia and in other neighbouring countries such as Singapore, Indonesia and Thailand, entirely funded by multinational chemical and household insecticide companies.

Over the past five years, more than 50 peer-reviewed journal papers have been published. In addition, between 2008 and 2010, a number of invitations has been received for keynote and plenary presentations on sustainable urban insect pest management at international conferences and conventions, amongst them, FAOPMA 2008 in Tokyo, the Pest Summit 2008 in Bangkok, Pest World 2010 in Honolulu and Pest Summit 2010 in Bali. The outcome of the research has also assisted and supported the pest management professionals in Southeast Asia in their business and better management of urban insect pests through sustainable and ecologically-acceptable approaches.

Managing cockroaches

Surveys carried out in Malaysia and Singapore revealed a total of nine domiciliary cockroach species, namely, *Periplaneta americana* (American cockroach), *Periplaneta brunnea* (Brown cockroach), *Periplaneta australasiae* (Australian cockroach), *Nauphoeta cinerea* (Lobster cockroach), *Neostylopyga rhombifolia* (Harlequin cockroach), *Supella longipalpa* (Brown-banded cockroach), *Blattella germanica* (German cockroach) and the recently discovered smooth cockroach, *Symploce pallens*.

> “Recently, a new species of scuttle fly that parasitises termite soldiers of M. gilvus was found in the Minden campus of Universiti Sains Malaysia. The fly was named *Misotermes mindeni* after the location where it was discovered.”

Misotermes mindeni found in USM Main Campus

01 A kitchen cabinet badly infested with termites

02 Baits are highly attractive against German cockroaches

03 *Coptotermes gestroi*

Cockroaches are an obnoxious group of insects that are potential mechanical vectors of many pathogenic organisms. Among them, the German cockroach is an extremely destructive pest species to the hotel and food preparative industries in Malaysia, Singapore, Thailand, Indonesia and the Philippines. German cockroach populations that are resistant to insecticides show a much lower biotic potential compared to that of the susceptible ones. Better sanitary conditions must be emphasised during the control operation, because food- and water-deprived cockroaches forage more frequently and tend to have a higher susceptibility to insecticides compared to the normal individuals.

Sanitation levels are positively correlated with cockroach reduction of treated houses with lower bait placement numbers; however, when higher bait placement numbers are executed, the role of sanitation on the reduction of cockroaches can be negated. Good sanitary practice has also been shown to impact the intrinsic rate of an increase of German cockroach populations in the presence of insecticidal baits. Other factors also influence insecticide susceptibility in cockroaches including age and circadian rhythms. To manage cockroaches well, the efficacy of conventional and novel insecticides has been studied and it has been found that the low toxicity pyrethroid is the most effective group. However, insecticides should only be used when pest populations exceed aesthetic injury levels. This requires reliable and unbiased monitoring tools such as traps.

While insecticides remain the most effective tool against cockroaches, their performance can be greatly reduced with the development of insecticide resistance in cockroaches. Studies on various field-collected populations of the German cockroach have demonstrated that insecticide resistance is a prevalent problem to the pest control industry in Malaysia and Singapore, with most populations showing broad-spectrum resistance.

In order to better understand how to manage insecticide resistance, characterisation of the underlying resistance mechanisms, using both biochemical and synergism studies, was executed. It was revealed that monooxygenase (particularly P450 monooxygenase) and esterases, glutathione S-transferase, altered acetylcholinesterase and kdr-type mutation were involved in the resistance.

To manage insecticide resistance effectively against German cockroaches as well as infestation of other cockroach species, several sustainable and ecologically-acceptable strategies have been tested including the use of insecticidal baits and insect growth regulators.

Baiting is an effective method; however, it is not a silver bullet to all cockroach infestations, as the presence of bait-aversion characteristic in the German cockroach to bait products has recently been detected. Besides insecticide resistance, control failure may also arise from sublethal concentration treatments that affect the biology and behaviour of cockroaches and other insect pests.

Managing termites

Being located in the tropics, Malaysia is blessed with a rich termite diversity. A total of 175 species of Malaysian termites has been described, compared to only 141 species for the entire North American continent.

Among those species found in Malaysia, only three species are commonly known to attack buildings and structures in the region; they are *Coptotermes gestroi, Coptotermes curvignathus and Coptotermes kalshoveni. C. gestroi* is the most destructive species. Known as the Asian subterranean termite, this species is believed to have originated from this region (Assam through Burma and Thailand to Malaysia and the Indonesia archipelago). However, it has been brought into new geographical regions including Turks and Caicos Islands in the Caribbean, Florida (USA), Brazil and was even intercepted recently in continental USA (Ohio) and Puerto Rico.

> “There are two types of houses - one that has termites and the other that will.”

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04 The Asian subterranean termite, *Coptotermes gestroi*
05 Window frame infested with termites
06 Collecting termites for phylogenetic analysis from Tainan city in Taiwan

Recently, three *Coptotermes* species *(Coptotermes havilandi, Coptotermes vastator and Coptotermes heimi)* were concluded to be junior synonyms of *C. gestroi.*

It is important to have an accurate termite taxonomy in pest management. This will prevent or reduce duplicative testing of termite management strategies; information generated from different countries may be applied, adapted or shared, therefore saving time, resources and money. If there are taxonomic confusions or application of wrong names to particular pest species, pest management decisions may be made based on misleading or wrong information.

The use of the molecular technique in phylogeography has also aided in illuminating the maternal origins of *C. gestroi* that were found in USA and Australia. For the first time, in collaboration with the University of Georgia, Athens, we have tracked the origin of new-found *C. gestroi* in Puerto Rico, Ohio, Florida and Brisbane. Three mitochondrial genes were used, namely, 16S, COII and ITS. It was found that the *C. gestroi* samples from Singapore and Ohio had a close genetic relationship, while samples from Australia, Puerto Rico and Key West Florida were more closely related to those from Malaysia. Shipping records further substantiated that Singapore and Malaysia were the likely origins of Ohio and Australia *C. gestroi*, respectively.

Foraging populations of subterranean termites can be estimated via mark-recapture and direct counting techniques. Although both methods need more verifications, the mark-recapture technique is a generally more acceptable method because of its practicality.

More recent studies, however, found mark-recapture population estimates to be unrealistic and unreliable and the accuracy of the estimates has also been widely questioned. However, this method is highly effectively in mapping the geographical locations of a colony and can be used to estimate the foraging territory of termite colonies.

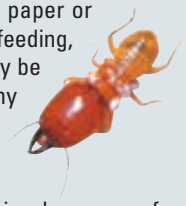
In most situations, termite infestations can be prevented or detected at an early stage. Based on surveys carried out in Malaysia on premises that were infested by termites, we reported the most common locations of infestations by subterranean termites in buildings and structures in Malaysia. The results obtained did not differ much from those found in Thailand and Singapore. Doors, window frames and wooden floorings were found to be most prone to termite infestations.

Buildings and structures are protected with a chemical barrier between the building and the soil. Soil treatment is carried out before the construction of the building. After chlordane was banned in Malaysia in 1998 due to environmental issues, a few chemicals, namely chlorpyrifos, imidacloprid, fipronil, cypermethrin, etc., are used for soil treatment. These chemicals, however, do not last as long as chlordane in the soil. More recently, the use of non-repellent termiticides is becoming popular.

These compounds showed a delayed mode of action that continues to allow termites to forage freely in and out of a treated zone, thus promising a greater impact to the whole colony. It was reported that a laboratory evaluation of six new termiticides (bifenthrin, chlorfenapyr, chlorantraniliprole, fipronil,

imidacloprid and indoxacarb) against *C. gestroi* had found that all, except bifenthrin, demonstrated non-repellent insecticide characteristics. Based on the results obtained, it was concluded that termite mortality caused by the evaluated termiticides were concentration dependent.

Baiting manages termites by allowing them to feed on baits containing insecticides (or insect growth regulators). The bait normally consists of toxicant-impregnated cellulosic material (e.g., paper or cellulose powder). Upon feeding, the bait will subsequently be shared with other colony members through trophallaxis.



This method has minimal usage of insecticides and it is less intrusive compared to corrective soil treatment that requires drilling of floors in order to inject a relatively larger amount of termiticides into the ground. It took between 49 and 62 days to eliminate three colonies of *C. gestroi* after consumption of 0.92 - 1.46g of hexaflumuron.

More recently, the performance of a 0.5 and 1.0% above-ground bistrifluron bait evaluated against *C. gestroi* in northern Peninsular Malaysia showed that colony eliminations can be achieved within four- five weeks for baits containing 1% bistrifluron and six - eight weeks for baits containing 0.5% bistrifluron. To kill a termite population via baiting, less than 5g of toxicant is required! This method "saves" many tons of insecticides from being injected into the soil each year for termite management.

Although baits are effective, they are only effective against lower termites from the genus of *Coptotermes and Schedorhinotermes* (family Rhinotermitidae). Higher termites from the family Termitidae, such as *Macrotermes gilvus* and *Macrotermes carbonarius*, are normally not responsive to baits.

This situation is not unique to Malaysia as it is also similarly observed in Thailand, Singapore, Indonesia and Australia. In addition, when baiting reduces or eliminates populations of lower termites such as *Coptotermes*, other species that are normally considered as secondary pest species or non-pest species could forage into the "broken foraging territories" and enter the buildings.

Recently, a new species of scuttle fly that parasitises termite soldiers of *M. gilvus* was found in the Minden campus of Universiti Sains Malaysia. The fly was named *Misotermes mindeni* after the location where it was discovered in the Minden campus. The potential of this species in managing termite infestation remains unexplored, but it certainly warrants more studies in the future.

Managing pest ants

Ants are a nuisance group of insects in buildings and structures but they have also been recently shown to be capable of transmitting pathogenic microorganisms.

There are a total of 30 species of pest ants infesting buildings and structures in Malaysia and Singapore. Similar to subterranean termites, ant management has relied on the use of residual insecticide treatment which only affects foraging worker ants. On the other hand, baiting has been shown to eliminate ant colonies in the field. Some ant species, such as the ghost ant *(Tapinoma melanocephalum)*, can be managed by modifying environmental conditions such as reducing moisture in infested locations.

Several aspects of the foraging behaviour of household ants have been explored, particularly the *Monomorium* species. It was recently reported for the first time that behavioural plasticity exists in polyethism of *Monomorium* species, particularly in terms of forager and nurse ratios.

It was also found that among the three common species of *Monomorium (M. pharaonis, M. floricola and M. destructor)*, the *M. pharaonis* showed the highest colonial growth dynamics. In addition, colony growth can be affected by the number of sexuals in the colony due to the presence of queens or queen body parts. Colonies of *M. pharaonis* with live queens were reported to be the slowest in producing sexuals, indicating that a queen suppression chemical may be involved. The effects of various queen body parts (live queens, dead queens, queen thoraces, queen heads and queen gasters) were evaluated and it was proposed that the queen suppression pheromone could be stored in the queen's gaster.

The worker ants of *M. pharaonis* were found actively donating carbohydrate and proteinaceous food to all larval stages, while lipid was transferred only upon a lengthened period of starvation, especially to larval stage III. Food was more actively transferred at the latter stages when compared to the youngest larval stage (e.g., larval stage I).

The brood arrangement in the Pharaoh ant colonies was explored using dye markers.

Three distinct rings in the arrangement of brood piles of the *M. pharaonis* colonies were found. The outermost layer contained older broods (L2 and L3), while the centre pile consisted of the eggs and L1.

> "To kill a termite colony via baiting, less than 5g of toxicant is required! This method "saves" many tons of insecticides from being injected into the soil each year for termite management."

The pupae and pre-pupae were placed in the intermediate ring between the two. Different brood members are sorted to alleviate the particular type of care they beseech. Since the older (or largest) larvae required the most nutrients, they were placed in the boundary. This positioning would make them highly accessible to the worker ants.

Ant larvae are involved in regulating colony nutrient flow and distribution. Colony fecundity of *M. pharaonis* was found to be dependent on nutrient transfer from larvae to queens. Important storage proteins needed for colony development and metamorphosis have been isolated and identified from the larvae of several ant species. However, under field conditions, the protein resources and availability may change with time (or seasons) and location.

A study showed that larval storage protein profiles changed with dietary protein levels, as well as stages of larvae. The findings also indirectly suggest that different larval stages have different roles and responsibilities within a colony.

The use of residual insecticide sprays is a common practice for pest ant management. However, this method only targets foraging ants. As a foraging population only accounts for a small proportion of total nest members, colony elimination using this method is not possible unless the nest is located and directly treated. Residual spraying, particularly the use of pyrethroid insecticides, has several limitations in control, including unpredictable efficacy due to the heterogeneity of treatment surfaces, insecticide repellency and inability to eliminate the colony.

Numerous bait toxicants evaluated have shown excellent efficacy against several ant species such as the Argentine ant, odorous house ant, carpenter ant, pharaoh ant and fire ant. These toxicants are generally neurotoxic insecticides, stomach poisons, metabolic inhibitors and insect growth regulators such as juvenile hormone analogues.

Juvenile hormone analogues, such as pyriproxyfen and methoprene, are good toxicants in baits. In addition to causing mortality to the targeted pests, at low concentrations, pyriproxyfen also causes physical abnormalities (e.g., bulbous wings, decreased melanisation and shorter life) in sexual insects of *M. pharaonis*, as well as decreasing queen production in treated colonies. The affected queens are also unable to lay eggs. There are also situations where unusually large size workers are produced and are referred to as super workers.

Several field studies were conducted to evaluate the performance of some bait formulations against major pest ant species *(M. pharaonis, T. melanocephalum, P. longicornis* and *Pheidole sp.)* in Malaysia. All bait formulations containing neurotoxic agents (fipronil and imidacloprid), metabolic inhibitors (hydramethylnon) and stomach poison (boric acid, sodium borate) showed excellent efficacy against field colonies of household ants.

Studies on the efficacy of hydramethylnon and fipronil baits against *M. pharaonis, T. melanocephalum* and *P. longicornis* found more than 80% reduction in ant counts within a week of post-baiting. An evaluation of the boron-based bait containing 5.3% boric acid and 4.3% sodium borate against *M. pharaonis* showed a reduction of more than 75% of the field populations within a week of post-treatment and more than 90% after a two-week treatment. In laboratory experiments, the borate-based bait killed all broods and queens after a four-week post-treatment, leaving only 3% worker survivors.

Baits containing the juvenile hormone analogue, methoprene, were compared with 1% hydramethylnon baits and these baits were tested against field populations of *M. pharaonis*. The bait containing the juvenile hormone analogue performed poorly (51.9% reduction) after a week of introduction compared to the hydramethylnon bait (89.1% reduction) but it gradually eliminated the colonies after an eight-week post-treatment.

More recently, a study reported the field performance of a new bait formulation containing S-methoprene against *M. pharaonis*. It recorded 80 - 90% reduction in a population after four-five weeks, while colony elimination was achieved after 13 -15 weeks. Although a substantial reduction of household ants was recorded with most bait toxicants, limited success was registered when baiting crazy ants and ghost ants with paste and granular bait formulations.

The way forward

There are several important issues pertaining to sustainable urban insect pest management that warrant urgent investigations. First, the issue of bait performance against higher termites is currently being addressed. Second, we are investigating the mechanism of parasitism of *M. mindeni* on *M. gilvus*. Third, the bait palatability issue on the invasive long-legged ant and the crazy ant remains unresolved. We are currently exploring the use of virtual baiting to overcome the problem.

The outcome of the findings can propel sustainable urban pest management to be carried out in a more effective manner, while at the same time minimising the impact of pest management activities ecologically, economically and sociologically. Gone are the days where pest management should rely on the use of large amounts of pesticides. Pesticides should be used only as the last resort, and only as and when they are absolutely required!

> “Pesticides should be used only as the last resort, and only as and when they are absolutely required!”

Variety of pests in USM's collection

Partnering Mindanao through peace negotiations

In a conflict, more often than not, the victims are not the parties in the conflict but those caught in between. These are the groups of people without the resources to respond, retaliate or retreat from the ongoing conflict. They also usually consist of those from the bottom billion of that unfortunate region.

Realising that the bottom billion would usually be the unfortunate collateral damage from any conflict, USM has always put peace as a priority in its transformation. USM is the first (and currently, the only) institution of higher learning in Malaysia to set up a special unit that focuses on the issue of promoting peace to resolve conflict, especially in the Southeast Asia region.

The Research and Education for Peace Unit (REPUSM), at the School of Social Sciences, was set up in 1995 to research on the issues of peace and conflict, as well as to conduct educational programmes, both formal and informal, for peace.

REPUSM has also been very active in carrying out actual peace-building and conflict transformation activities on the ground, believing that with knowledge comes responsibility. It is our responsibility to ensure that we do everything that we can to create a more peaceful world through our actions as part of the sustainability concept.

An important component of REPUSM's peace-building and conflict transformation strategy is linking up with and enhancing local partnerships for peace. REPUSM believes strongly in the positive and necessary roles that local stakeholders can and should play in transforming and mitigating conflict situations. In peace-building, the "roots must be local", as they are the ones most affected by the conflict and have the most to lose if the conflict continues as well as the most to gain if the conflict is resolved.

The commitment is usually there but sometimes the capacity is not enough to ensure positive sustainable results. This is where REPUSM comes in, by way of playing a strong supporting role and linking up local and international partners to enhance peace-building efforts on the ground.

Since its inception, REPUSM has been involved in peace-building and conflict transformation activities in the whole region. As a recognition of its abilities and commitment, REPUSM was appointed in 2001 as the Regional Secretariat of the Southeast Asian Conflict Studies Network (SEACSN) with Associate Professor Kamarulzaman Askandar as SEACSN Regional Coordinator.

REPUSM and SEACSN can claim many successes in the region, including helping to transform conflicts in Aceh, Mindanao and Southern Thailand through the research and education for peace processes for peace-building and conflict transformation activities.

The Mindanao Peace Programme

The Mindanao Peace Programme at REPUSM was created in 2004 solely with the purpose of transforming the Mindanao conflict and supporting the peace process in Mindanao.This has been done through the following:

- publication of research findings
- disseminating information about the process to the public both in the Philippines and Malaysia
- conducting workshops, seminars and forums not only to create public awareness of the issues but also to engage the stakeholders in discussions about potential solutions to issues
- enhancing the capacity of all actors through capacity building programmes
- bringing all the stakeholders, including the major conflict actors, together in a series of talks to consolidate their various positions

Over the last three years, two specific activities have been carried out by the REPUSM to help in this transformation process. The first was the Consolidation for Peace (COP) project (2007-2009), and the second, the Mindanao Educators Peace Summit (2010).

The Consolidation for Peace (COP) Project 2007-2009

COP was a Japanese International Cooperation Agency (JICA)-funded peace-building activity that brought together almost 50 stakeholders to discuss the Mindanao conflict. They were from various sectors including the major actors-the Philippines government, the Moro Islamic Liberation Front (MILF), the Moro National Liberation Front (MNLF) as well as members of the civil society including the academics, *Ulamas*, the Church, non-governmental and grassroots organisations.

COP was successful in suggesting ideas to revive the peace process that collapsed in 2008 and these were then submitted to all the relevant players in the Mindanao conflict. The Mindanao Educators Peace Summit was a follow-up programme of the COP for Mindanao that was held in January 2009.

The Mindanao Educators Peace Summit 2010

This Mindanao Educators Peace Summit was proposed by the Mindanao Association of State Colleges and Universities Foundation (MASCUF) and REPUSM, with joint coordination support from the Western Mindanao State University President Dr. Grace J. Rebollos, representing MASCUF and Associate Professor Kamarulzaman Askandar, representing REPUSM and the Southeast Asian Conflict Studies Network (SEACSN).

The summit, held from 12-15 February 2010, aimed to help harness educational leadership for peace and development in Southern Philippines by providing a venue for conversation-analysis, visioning and action-towards peace education.

Specifically, the following objectives were posited:

- to review peace-oriented efforts in the context of history and current events vis-a-vis the mandates, functions and programmes of the State Universities and Colleges (SUCs).
- to identify and/or define the peace initiatives of SUCs on an individual or collective basis, and see how these are further pursued and enhanced through the Mindanao clusters of the Philippine Association of State Universities and Colleges (PASUC).
- to provide policy recommendations or alternatives for higher education to address the peace and development imperatives of Mindanao.
- to gain knowledge about the operations of the REPUSM in its work for regional peace.
- to learn ways of enhancing the quality of higher education in Mindanao through an observation of best practices in the academic functions of USM.

Well-known participants in the summit included:

- Dr. Annabele Abaya, the Presidential Adviser on the Peace Process (PAPP) of the Government of the Philippines.
- Dr. Hja Luningning Umar, a Commissioner with the Philippines Commission on Higher Education (CHED).
- Professor Rudy Rodil, Mindanao historian, peace advocate and former member of the Government of the Republic of the Philippines Peace Panel.
- Professor Abhoud Syed Lingga of the Cotabato City-based Institute of Bangsamoro Studies (IBS).
- Dr. Danda Juanday, Chair of the Bangsamoro Development Agency (BDA).
- Kazuhiko Shimizu, Deputy Director, Ministry of Foreign Affairs, Japan.

Also present were 28 other Presidents of the state colleges and universities in Mindanao, other representatives from JICA, the Japanese Foreign Ministry, USM presenters which included the Vice-Chancellor and Deputy Vice-Chancellors for Academic and International Affairs, and Research and Innovation, and members of the media from Malaysia and the Philippines.

This summit, with the theme Transforming the Conflict in Mindanao through Peace Education and Quality Higher Education, was organised to secure the involvement of a key component of the civil society in Mindanao, the scholars and institutions of higher learning, in strengthening peace-building and conflict transformation efforts in this difficult conflict area.

Participants at the Mindanao Educators Peace Summit

This group had been recognised as strategically positioned to contribute to the Mindanao peace efforts through their leadership in higher education and because their respective institutions are at the forefront of instruction, research, production and extension services in Mindanao.

More importantly, for the mandate and resources channelled to them as social investments in higher education, the Mindanao super-region's state institutions take on a special obligation to participate in the government-led peace and development efforts.

The group, comprising thirty state universities and colleges (SUCs) from Mindanao, is recognised as the Mindanao Association of State Colleges and 3 Universities Foundation, Inc. (MASCUF), its current president being Dr. Victor Barroso of the Bukidnon State University.

It is generously funded by the JICA under the leaderships of Noriko Suzuki, the Chief Representative of JICA in Kuala Lumpur and Sachiko Ishikawa, the Senior Advisor on Peace Building for JICA in Tokyo.

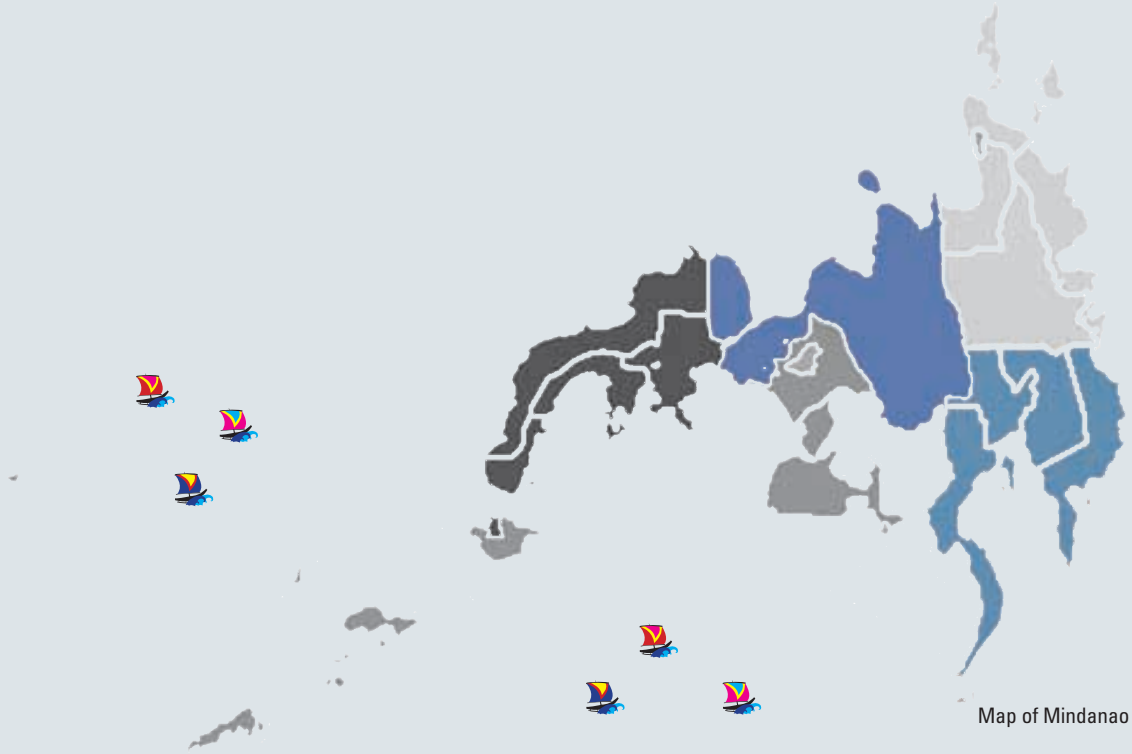
Results of the Mindanao Educators Peace Summit

At the start of the four-day summit, MASCUF and USM signed a Memorandum of Understanding (MoU) to "establish the framework for understanding and cooperation" in the areas of staff and student exchanges and the sharing of expertise, knowledge and information.The MoU was intended to promote cross-cultural exchanges between staff and students of USM and the members of MASCUF; enrich the academic and campus life of both institutions and support academic and non-academic activities as well provide opportunities for faculty staff at USM and MASCUF to undertake joint teaching and research and to promote the sharing of best practices and experiences.

Dr. Barroso of MASCUF signed the MoU with USM Vice-Chancellor, represented by USM Deputy Vice-Chancellor for Academic and International Affairs, Prof. Ahmad Shukri Mustapa Kamal. Signing, as witnesses, were Coordinator of REPUSM Associate Professor Kamarulzaman Askandar and the Philippines' CHED commissioner, Dr. Hja Luningning Umar.

MASCUF also promised to conduct training for teachers of Mindanao history in mid-2010. The Presidents of MASCUF also pledged to promote peace education and actively contribute to, and participate in, peace-building efforts as outlined in the MASCUF Penang Declaration for Peace 2010. It was the first time MASCUF had sat down together specifically to discuss the conflicts in Mindanao and the efforts for peace.

The issuance of the MASCUF Penang Declaration for Peace 2010 (see next page), was attested to by Dr. Hja Luningning Umar, Prof. Tan Sri Dato' Dzulkifli Abdul Razak and other representives from USM, JICA, the Ministry of Foreign Affairs Japan, BDA and IBS.



Map of Mindanao

The way forward

Plans are already being made to implement the proposals from both the USM-MASCUF MoU and the Penang Peace Declaration 2010. The University of Southern Mindanao (USM) in Kabacan, Mindanao, is looking forward to sign another MoU with USM in what is deemed to be a novel USM-USM partnership in higher education, especially in staff and student exchanges.

MASCUF will go ahead with the workshop on the teaching of history this year and have more meetings to discuss the development and promotion of peace for education in Mindanao. MASCUF members will also submit proposals for research funding to the Office of the Presidential Advisor on the Peace Process, Philippines.

Plans are being made to enhance collaborative efforts between MASCUF members and JICA, with the dissemination of JICA guidelines to MASCUF members. REPUSM would continue to play a supporting role in all these efforts through the Mindanao Peace Programme of the Unit.

The next major event will be the Consolidation for Peace programme - COP4 - at the end of 2010. Stakeholders from the Mindanao conflict will again be invited together with stakeholders from Southern Thailand and Aceh in an effort to create better understanding and promote peace-building activities in the three areas.

Thus far, qualified postgraduate students from Mindanao are already starting to study at USM as part of the long-term strategy of USM to transform the conflicts in the region by way of increasing the capabilities of people from these areas.

In view of its immense potential to support sustainability based on peace and harmony-building, the Mindanao Peace Programme has made it to be one of the high value flagships that would turn around USM to be an APEX university.

A MASCUF Penang Declaration for Peace 2010

Consists of a seven-point declaration and four-point action agenda. The Presidents of Mindanao's state universities and colleges (SUCs) agreed that they would:

- promote peace education
- implement Executive Order 570 by institutionalising peace education in SUCs in Mindanao
- collaborate among SUCs in undertaking peace education programmes in areas of instruction, research and community extension
- recommend to the Commission on Higher Education the identification of regional peace consortia, together with other civil society groups, and to appropriate funds
- strengthen MASCUF as a Peace Network working together for a common agenda and sharing its resources
- recommend to the Office of the President the (issuance of an executive order on the) observance of Muslim and Indigenous People's (Lumads) holidays all throughout Mindanao
- MASCUF as a Peace Network should be involved in the national agenda for peace process

B Brief history of the Mindanao region conflict

The Mindanao conflict has been going on for many turbulent years. It has resulted in social and economic fragmentation as well as inter-cultural and inter-religious hostility and poverty affecting the lives of the peoples of Mindanao and the surrounding islands.

In spite of initiatives to transform the conflict through socio-economic development packages and peace talks combined with military and police activity, there appears to be no abatement in the internecine strife and underdevelopment that have characterised life in the area.

It is also widely acknowledged that unless peace reigns in Mindanao, there will be no peace in the whole of the Philippines. In recent times, this situation has worsened due to the controversial aborted signing of the Memorandum of Agreement on Ancestral Domain (MOA-AD) between the Government of the Republic of the Philippines (GRP) and the Moro Islamic Liberation Front (MILF) on 5 August 2008.

The suspension of the peace talks and the violent events that followed have led various stakeholder communities of Mindanao to reflect on their respective roles and express their interest in having a greater involvement in the peace process.

Nearly a year later, renewed hope is seen in a resumption of the talks, albeit with the introduction of various conditions - with the establishment of a new peace panel, the conduct of a series of community dialogues that are carried out by national government, religious and academic leaders, and the continuing support of civil society groups for the many communities that have been displaced by the war.

01

03

02

04

Manila hargai USM bantu Mindanao

“The Philippines Government values any effort by neighbouring countries and we will be partners to ensure peace in Mindanao.”

Ms. Annabelle T Abaya
Advisor to the President for
the Philippines peace process,
on Mindanao Peace Negotiation at USM,
12-15 Jan 2010 in USM as quoted in
Utusan Malaysia, 14 Jan 2010

01 Discussing Mindanao in Penang
02 At the USM Conference Hall
03 WMSU president Grace Rebollos, also of Peace Advocates Zamboanga, and REPUSM's Assoc. Prof. Kamarulzaman Askandar
04 After the MOU signing. Dr. Victor Barroso in *barong*, Prof. Ahmad Shukri (right) and Dr. Hja Luningning Umar (left).

C The Taiping Peace Initiative - a university, city and community partnership

"Peace can only be achieved through our behaviour, attitudes and everyday acts. The Culture of Peace is the universal culture that is shared by all people. It is essential to our common humanity. Together, let us cultivate peace. Let us each ask ourselves "What can we do for peace today?"

Koichiro Matsuura
UNESCO Director General (1999-2009)

The Idea

The idea of promoting the town of Taiping, in the state of Perak in Malaysia, as a centre for peace was not arbitrary. Historically, Taiping has been associated with peace since its very inception.

In the mid-19th century, it was discovered that the area was rich in tin deposits. Tin had become a globally strategic material because of the discovery of canning to preserve and transport food. Chinese miners were brought in to mine the ore. In time, two rival clans emerged, the Hai San and the Ghee Hin, who competed for water and other resources.

This gave rise to various conflicts, which became known as the Larut wars. The disruption of harmony forced local leaders to seek the help of the British to quell the fighting. This invitation led to the signing of the Pangkor Treaty on 20 January 1874, signalling the start of the British Administration in the Malay States. To create a neutral place for business, residence and administration, it was decided to establish a new town to mark peace and to name it Taiping, which is the Chinese word meaning "everlasting peace".

The main initiators

To achieve its objectives of promoting Taiping as a peace centre, the key founder, the Taiping Tourist Association required partners capable of contributing specific expertise, experience and support. After careful consideration, it was decided that the Taiping Municipal Council, the United Nations and Universiti Sains Malaysia would provide the best foundation for its success. Thus, a unique partnership developed between a local community association, the municipal council, an institute of higher learning and a global organisation.

Collectively they hope to create a Peace Park and Promenade at the Taiping Lake Gardens.

The definition of peace

The Taiping Peace Initiative is based on a broad triple definition of peace to ensure a holistic view that is relevant to a widest possible range of groups and individuals, both local and international.

The three definitions of peace are:

- inner peace - peace with one's self
- social peace - peace with one's community
- environmental peace - peace with one's surroundings

Key partners

The Taiping Tourist Association (TTA)

The TTA has two main strengths. It has a deep understanding of local issues including the type of activities that the local residents would support. Since the TTA comprises residents and former residents, it is also further evidence that this is a local community commitment and not an externally based project.

The Taiping Municipal Council

Under the Memorandum of Understanding signed recently, the Council provides administrative support as well as relevant facilities as required. The Council will soon play a more involved role as the Initiative enters a new phase where it will require a permanent space to serve as the nerve centre for the activities. The President has already articulated the possibility of converting the historic old Town Council building into a Peace Centre. This is being restored with the assistance of the Ministry of Arts, Culture and Heritage as a multipurpose public space in which peace activities form an integral part.

The United Nations (UN)

The UN system was invited to become a partner because of its immense experience in peace activities. UN involvement is not restricted to one agency such as UNESCO or UNICEF, or even individual programmes such as the United Nations Development

The 10th Anniversary of the Taiping Peace Initiative

Programme (UNDP) but the system as a whole. This allows the expertise and experience of each agency and programme to be made available. The principal founder and initial chairperson of this initiative was Dato' (Dr.) Anwar Fazal, who grew up in Taiping and worked for many years with the United Nations.

The United Nations played a pioneering entrepreneurial role by awarding an initial grant of RM15,000 from its Malaysian Representatives Fund to get this initiative off the ground.

Universiti Sains Malaysia (USM)

USM was chosen as a partner as it has been "thinking-out-of-the box" in its outreach activities and also has a unit within the School of Social Sciences that is dedicated to peace issues. The Research and Education for Peace Unit was established in July 1995 with many of its objectives relevant to the Taiping Peace Initiative.

These objectives include carrying out research and education projects on peace and publishing and disseminating research findings for the academic community as well as the general public. Other objectives include the organising of seminars, workshops and providing training for professional peace building skills.

USM will provide support on two levels: to ensure that the Initiative's activities are based on solid academic research as well as to assist in the organising of workshops and other educational programmes that will be an important aspect of the Taiping Peace Initiative.

USM will also provide support in the form of technical advice for the Initiative's cyber activities such as website design and maintenance. The Vice-Chancellor of the university, Professor Tan Sri Dato' Dzulkifli Abdul Razak, has also pledged support from the other faculties and schools to ensure the success of the Initiative. The construction of a peace dome in the peace park is under discussion.

A part of its commitment to peace, USM has "planted" seven peace poles in the campus and renamed the road leading to it as Jalan Kedamaian.

More recently, programmes included:

- A 2-day workshop on "Youth for Peace" organised with funding from the United Nations Children's Fund (UNICEF). The workshop was organised in Taiping in April 2009. Dato' (Dr.) Anwar Fazal was a keynote speaker.
- The 10th anniversary of the Initiative was celebrated on 20 January 2010 with the launch of the publication "99 ways to promote the Culture of Peace" in Bahasa Malaysia, Mandarin and Tamil. The Bahasa Malaysia and Tamil versions were done with the support of USM.

Entitled *Transformation*, the sculpture was designed by Peter Gelencser, a former lecturer in fine art (1974), of the School of Humanities. The design was largely motivated by the experiences the lecturer had with his students in the studios and lecture theatres. The sculpture captures and immortalises the dynamic changes which take place within a student while studying in an institution of higher learning as well as the changes in the institution itself. It expresses how incomplete masses go through a transformation and react when they undergo higher education. These changes never end. Neither does the growth of the institution itself.

The Milestones

The Milestones

Transforming higher education for a sustainable tomorrow

Laying the Foundation

Enriching global sustainability studies: aspiring to meet global challenges

In conjunction with the APEX award that was conferred on the university, USM has begun to refocus and retool its teaching, research and community engagement areas to meet sustainability standards. These three missions form an integral part of Education for Sustainable Development (ESD), thus embodying the principles of a holistic education. In an effort to be more dynamic and competitive, USM is adapting ideas and approaches that have been successfully practised elsewhere. The major approach that has been adopted for USM's sustainability transition is the Blue Ocean Strategy (BOS). The BOS offers a powerful tool to keep abreast of value innovation for the integration of sustainability into all USM's missions. In order to facilitate and catalyse the APEX vision, USM was convinced that a dedicated centre was a necessity in transforming higher education for a sustainable tomorrow.

The Centre for Global Sustainability Studies

In response to this need, the Centre for Global Sustainability Studies (CGSS) was established. Since its inception as a "functional centre" from the beginning of 2009, CGSS has been involved in a number of activities aimed at promoting sustainability within the USM-APEX context.

The centre was officially launched by the Minister of Higher Education, Dato' Seri Mohamed Khalid Nordin on 14 December 2009.

The centre is expected to facilitate the mainstreaming of sustainability into the entire fabric of the university. In order to achieve this outcome, CGSS is designed to work with all other relevant sections of the university, regional and international sustainability organisations, national and regional governments, private sectors, civil society groups and non-governmental organisations (NGOs), paying particular attention to the disempowered and the disadvantaged through a transdisciplinary framework.

In this regard, CGSS has taken the first step to introduce sustainability at all levels of the university by developing the USM-APEX Sustainability Roadmap and in the context of awareness building, a set of Sustainability Fact Sheets.

Besides the Roadmap, CGSS efforts cover other areas like offering teaching and training programmes, involvement in research, cultivation of professional networks, participation in sustainability networks and meetings, the hosting of conferences and meetings, increasing awareness and establishment of a Sustainability Office.

Awareness Building Efforts: the Fact Sheets

CGSS has prepared a set of twelve Fact Sheets on a variety of topics ranging from sustainable development (historical development, principles, major challenges, practices, S&T), education for sustainable development (principles, mainstreaming SD in universities), USM-APEX, green growth and success stories to be used as awareness building materials within USM for the promotion of the sustainability agenda. The Fact Sheets are available in both English and Bahasa Malaysia.

Development of the USM-APEX Sustainability Roadmap

The Roadmap presents the university's situation, state of readiness and action plans for the systemic adoption of the principles and practices of ESD. (see Figure 3 on page 128).

The Roadmap assesses the current status of sustainability across the university's mission areas as well as Water, Energy, Health, Agriculture and Biodiversity (WEHAB) and intimately relates cross-sectoral issues such as "climate change/disaster risk management", "population/poverty" and "production/consumption". Teaching methods and curricula, research areas, methods, output and networking as well as green campus initiatives are reviewed in terms of their alignment with the objectives of ESD.

The major objectives of the Roadmap are to execute the following:

- introduce mainstream principles of sustainability into teaching, research and community missions
- promote teaching and training which will produce graduates who are able to think and act with a holistic understanding of the economy, environment and society
- build human resource and technical capacity for research to produce innovative products or ideas to address real-world sustainability issues

> **Sustainability, not only in our economic activities, but in considering the impact of economic development on our environment and precious natural resources. There is little value in pursuing a future based entirely on wealth creation. Pursuing growth that deplete resources and displace communities will have dire consequences for future generations. This is a false and futile choice.**
>
> Prime Minister of Malaysia,
> Dato' Seri Mohd Najib bin Tun Abdul Razak

- develop new or strengthen existing research and other relevant networks to enhance USM's reach and capacity

The Roadmap is expected to generate a variety of university-wide projects. A major monitoring and evaluation scheme was also developed, together with a condensed section on all the major gobal initiatives dealing with ESD.

Teaching and Training

The single most major initiative in this area is a Masters in Development Practice (MDP) programme to be offered in Semester II, 2010. This is part of a global network initiative involving Columbia University, New York and about twenty other universities across the world. This training will be tailored specifically for anyone planning to play a leadership role in the broad area of sustainability with a proper blend of theory and practice being the special feature of this programme.

The USM-MDP curriculum contains two groups of courses - interdisciplinary and transdisciplinary - which will cover all the four core competency areas, i.e., natural sciences, social sciences, health sciences and management sciences.

In the interdisciplinary context, the adoption of several discipline-based perspectives in developing necessary courses is implied. The transdisciplinary courses, on the other hand, would focus on cross-cutting issues such as global warming - without specific reference to any particular conventional academic discipline.

Both course groups will be strengthened with two practicums: internships and fieldwork. It is also of importance to mention that USM's strength lies in its fieldwork and internship programmes.

Research

The research profile of CGSS is planned to conform to action research that focuses specifically on targeted sustainability challenges of major concern to ordinary community dwellers. In preparation for this, the centre was involved, right from the beginning, in three process research projects as pre-requisites for future work.

These projects (in different stages of development) are:

- Building human capacity in science, technology and innovation for development
- Sustainability mainstreaming at USM
- Development of indicators for sustainability monitoring and evaluation.
- Design of a built environment
- Natural resources and climate change/ disaster risk management
- Culture and sustainable development.
- Sustainability communication

Fast facts

- Sustainability Office was established on 15 October 2009.
- Aims to facilitate the mainstreaming of sustainability onto the entire fabric of the university.
- Developed the USM-APEX Sustainability Roadmap and a set of Sustainability Fact Sheets.
- CGSS efforts covers nine major areas, namely - developing the USM-APEX Sustainability Roadmap, offering teaching and training programmes, involving in research, cultivating professional network, participating in sustainability networks and meetings, hosting conferences and meetings, building awareness and establishing a Sustainability Office.

Establishment of the Sustainability Office

Given the need to constantly promote, monitor and evaluate sustainability implementation at USM, a Sustainability Office was established on 15 October 2009. Based in CGSS, the office is primarily concerned with reducing the university's negative impact on the environment as well as reducing the university's operational costs.

Sustainability offices around the globe are working towards reducing energy consumption, limiting harmful emissions, developing "green" buildings, reducing wastes and increasing recycling efforts, as well as promoting renewable energy opportunities.

The role of the Sustainability Office at CGSS covers areas of 5Cs:

- Communications - Information clearinghouse, strategic communicator for the institution and promoting USM as a sustainability leader
- Connections - Linking individuals and organisations, connecting research and teaching with campus living and learning and engaging the larger USM community
- Coordination - Events and activities involving groups and individuals and pursuing goals through the knowledge, experience and activities of others
- Culture - Promoting changes in campus culture, building a sustainable community and building the momentum for a sense of shared ownership
- Credibility - Vocal champion of USM's sustainability commitment and efforts as well as providing transparency through involvement and reporting

Professional Network Development and Outreach

Following the Commonwealth Education Ministers' Meeting in Kuala Lumpur in June 2009, CGSS organised a Post Vice-Chancellors' Forum in Penang (20 June 2009) with a view of establishing a Commonwealth Vice-Chancellors' Network (CVCN) for sustainability mainstreaming at universities. CVCN agreed to a Policy on Sustainability Education and decided on a course of action to strengthen the network. A Penang Declaration is issued to this end.

Sustainability networks and meetings

In a relatively short period, CGSS has shown leadership internationally as explained below by the Director of CGSS:

- Plenary paper at the ASEAN Biodiversity Conference, Singapore, 21-23 October 2009.
- UNEP meeting for establishing the Intergovernmental Panel on Science Advice for Biodiversity and Ecosystem Services (IPBES), Nairobi, 5-9 October 2009. A paper on CGSS and its potential for collaboration was presented.
- Represented the Academy of Sciences of the Developing World (TWAS) and CGSS@USM at the A-IMBN conference, Penang, 27 October 2009.
- Co-chaired the review on the CBD Global Biodiversity Outlook 3, Montreal 4-5 November 2009.
- Represented CGSS in the DIVERSITAS Open Science Conference, Cape Town, South Africa, 13-15 October 2009.

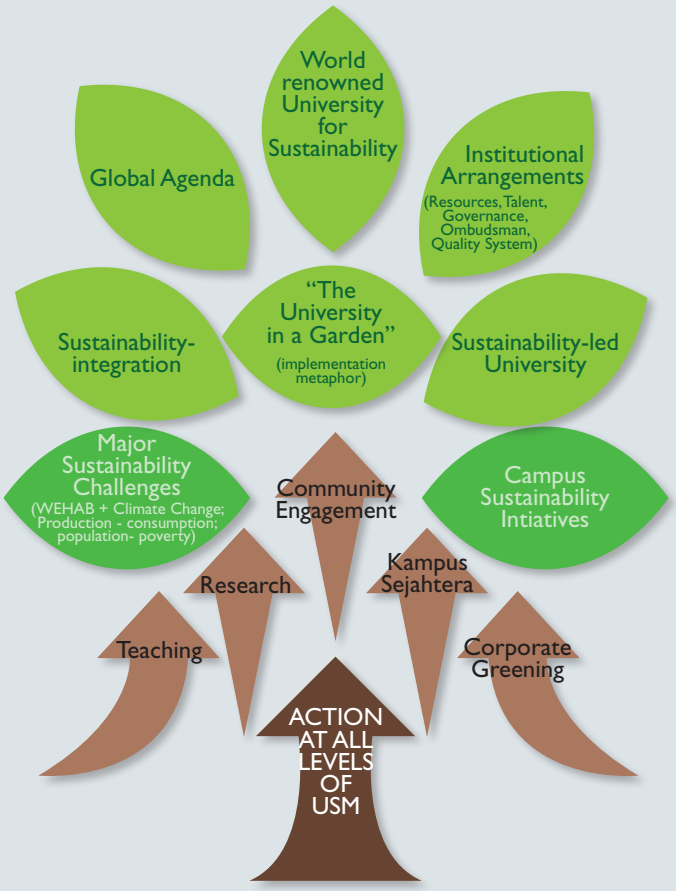


Figure 3: The USM-APEX Sustainability Roadmap

- Participated in the discussions on "Malaysia and the Commonwealth: A common future" Public Forum organised by the Royal Commonwealth Society and the British High Commission Kuala Lumpur, 26 October 2009.
- Provided one of the two training resource persons for the climate change and sustainability training workshop organised by the Asia Pacific Network for global change research during CSD15, UN Headquarters, New York, May 2009.
- One of the four centres invited to the scoping meeting for the development of a synthesis report and a book on climate change in the Asia Pacific region based on the findings of 53 research projects completed by APN.
- Discussions with the CSD Division of UNDESA, New York and Columbia University for the promotion of sustainability capacity building through collaborative initiatives, December 2009.

CGSS as the host of conferences/meetings

- Post Vice-Chancellor s' Forum 2009 Developing a Sustainability-led University Network in the British Commonwealth, 20 June 2009.
- Co-host, "International Satoyama Initiative" with ICSU Regional Office for Asia- Pacific, LESTARI, Ministry of Natural Resources, Malaysia with full funding from the Japanese Ministry of Environment, Penang, 1-3 October 2009.
- ICSU Asia-Pacific Regional Consultation on Science and Sustainability, participants from 17 countries from around the region, Penang, 13-14 October 2009.
- International Workshop on the "Quranic Botanical Garden" 18-19 December 2009.

Partnerships, networks and outreach

Partnerships, networks and outreach will be major activities of the centre and will be strategised in such a way that they will profile USM among key global change players internationally and secure for USM new and emerging initiatives from outside.

In order to make this happen, the centre has and plans to work closely with a number of UN system bodies and Government ministries and departments for policy issues, link up with IIED, ICSU, ISTS, TWAS, IGCI, CSIRO, Columbia University's Earth Institute for special training, UNU, IGES, START and APN for research project support and with the SIDS unit of UNDESA to support small island developing countries, particularly those in the Pacific Island region because of USM's existing MoU commitments.

Because of the relatively small size of CGSS and the fact that the knowledge needed for the understanding of earth systems is highly interdisciplinary, the centre's network needs will always be high.

What is next?

CGSS is set to become the coordinating and facilitating platform for mainstreaming the sustainability agenda under the APEX programme and develop further trajectories into making USM a world renowned university for sustainability.

The lush greenery of the Main Campus manifests USM's sustainability effort

IXC Malaysia Berhad - a hub for global knowledge exchange

USM has set up a centre known as the InnovationXchange or IXC Malaysia Berhad (IXC). It is one of three entities of its kind in the world, with sister offices in Australia and the United Kingdom. The centre provides support for the innovation interests of third parties encompassing both academic and research institutions as well as private companies. Innovation interests being dealt with range from commercialisation of research to social purposes, both within Malaysia and also globally.

IXC Malaysia Berhad acts as a global knowledge exchange hub, creating new opportunities for growth through the powerful combination of technology and people. The technology aspect is embodied by IXC's database or knowledge system, a secure internal online system called the "IXC Vault". The people aspect meanwhile, is represented by a worldwide network of specially trained "IXC Intermediaries". This powerful combination provides a secure model for the matching of capabilities and the transfer of knowledge between industry, research organisations, universities and government bodies. As a result, IXC is able to facilitate truly compatible and effective business and research collaborations.

Conception

The idea for establishing the centre was first raised in September 2008 at a meeting of the Technology Subcommittee at the Ministry of Science, Technology and Innovation (MOSTI). The Technology Subcommittee is one of six subcommittees under the national-level Committee for National Innovation Action Plan (Jawatankuasa Tindakan Pelan Inovasi Negara, JTPIN).

At that time, the subcommittee meeting was debating the issue of the lack of technology transfer from university laboratories to the market. Being familiar with the InnovationXchange model, Hasannudin Saidin from IBM, a subcommittee member (now CEO of IXC), explained its application and success elsewhere. After extensive discussion, it was decided at that same meeting that the implementation of InnovationXchange in Malaysia would be worth pursuing. The USM member of the subcommittee, Professor Zainul Fadziruddin Zainuddin, subsequently championed the cause and explored various funding options including the setting up of IXC Malaysia Berhad.

USM ultimately undertook the costs of funding and establishing the brand new company, IXC Malaysia Berhad. From USM's point of view, this company would benefit not only its parent university, but would also extend its international network to service Malaysia's industry members, the academic sector and government agencies. In other words, this new resource would be at the service not just of USM, but also of the whole nation.

Launch

IXC Malaysia Berhad was successfully incorporated at the Companies Commission of Malaysia (Suruhanjaya Syarikat Malaysia, SSM) on 1 July 2009. As per the Company Act of 1965, IXC Malaysia as a "Limited" or "Berhad" company is a "company limited by guarantee" (as opposed to "company limited by shares"). Thus, it is a non-profit company similar to Foundations and Institutes. Instead of operating with the motive of maximising profits to shareholders or owners, the InnovationXchange model for Malaysia is non-commercial in nature, consistent with its sister entities of the successful IXC Australia Limited and IXC UK Limited. Such a commercially neutral position helps IXC secure its clients' trust.

The principle of trust is very important for the success of IXC's services. In addition to the non-commercial nature of the IXC company, the core service called the "IXC Intermediary Service" is built upon procedures and processes that ensure the safeguarding of confidential information shared by clients with IXC.

Launching of IXC Malaysia by the Deputy Prime Minister of Malaysia, Tan Sri Muhyiddin Yassin, during PECIPTA 2009

Two months after incorporation, the second milestone of the setting up of IXC Malaysia Berhad was achieved - the Chief Executive Officer commenced work on 1 September 2009. For this important position, USM recruited and hired a highly accomplished and experienced individual. With 26 years of experience within the industry, Hasannudin Saidin is certainly qualified to lead at the helm of this young company that aspires to make a difference.

With the official launch of the company, a third milestone was achieved. Right Honourable Tan Sri Muhyiddin Yassin, Deputy Prime Minister of Malaysia, officially launched IXC Malaysia Berhad on 8 October 2009 at PECIPTA 2009. A biannual national-level conference and exhibition organised by the Ministry of Higher Education to showcase innovations and inventions by Malaysian institutions of higher learning, PECIPTA 2009 was indeed a fitting venue for the launch.

Open for Business

The CEO promptly proceeded with the staff recruitment process in September 2009. By November 2009, shortlisted candidates had been interviewed. The first IXC Intermediary joined IXC Malaysia Berhad on 4 January 2010. Two other Intermediaries joined later in January 2010 and the fourth Intermediary was employed on 1 March 2010. Also in January 2010, two management positions, firstly, the Director of Development and secondly, the Administration and Marketing Manager, were filled. Beyond 2010, IXC will recruit additional Intermediaries as the number of clients grows, with two Intermediaries assuming Senior Intermediary position in 2011. It is anticipated that by the year 2012, there will be up to twelve Intermediaries reporting to the two Senior Intermediaries.

The management personnel and first three Intermediaries underwent IXC training in January 2010, conducted in Australia by IXC Australia and IXC UK. At the time of writing, the training for the fourth Intermediary was planned for March 2010. The training that the IXC management team and Intermediaries undergo includes knowledge sharing on operations, methodologies and processes of the IXC model as successfully deployed in Australia since 2005 and the United Kingdom since 2007. IXC Malaysia Berhad then customises them for the Malaysian operations.

Since incorporation, IXC Malaysia Berhad has been operating from its main office located within USM's innovation park in Penang, known as "science and arts innovation space" or sains@usm (see next article on page 135). On 5 February 2010, the company commenced its Kuala Lumpur office operations at Kuala Lumpur Sentral. From these two offices, IXC Malaysia Berhad will serve clients from all over Malaysia.

Uniqueness

The IXC concept opens up greater opportunities for sharing of information and ideas across boundaries. Institutions of higher learning and other research institutions in the country will be able to promote their research products by engaging with IXC. Those that have a large number of high impact research products would need a platform for commercialisation. They would want to forge smart partnerships with groups that can provide the commitment, the funding and the know-how to do so. IXC would facilitate this introduction.

In addition to commercialisation-related intentions and connecting clients to the outside, IXC will also fulfil clients' intentions for other collaborative connections. These include collaborations for capability sharing. Another intention may be for partnerships to access different markets. Large and complex clients will have multiple intentions and thus will have the need for a dedicated IXC Intermediary to serve on an ongoing basis. Smaller clients may deploy more rapid, project-based services from IXC to find their needed external connections.

The networking created by IXC complements the clients' existing processes and methods for finding external connections, as IXC does not attempt to replace these. Rather, IXC fills the gaps where such networking is not achievable by the clients themselves. Organisations may have their own business development, technology transfer or technology licensing functions whose goals include seeking external partnerships. IXC adds value to these by expanding

their network and utilising the company's unique position. The international IXC network already spans eight countries with almost 100 clients, and this network grows by the day. An IXC Intermediary is embedded in each client organisation as if she or he is a member of the organisation. Through this regular presence, the Intermediary is able to create an intimate relationship with relevant individuals within the client organisation. The Intermediaries' spirit of enquiry and spirit to serve, coupled with a methodological line of questioning and information gathering, allow them to filter the cliens' needs and intentions. Being creative, highly specialised and trained in the IXC methodology further allow them to identify, confirm and service the strategic intentions of their clients as related to external party connections.

IXC adheres to strict information confidentiality principles. All information gathered through discussions with involved parties is stored in the confidential IXC Vault, which can only be accessed by IXC Intermediaries. By sharing via this central knowledge database, all Intermediaries are able to service logged intentions, thus maximising exposure of client intentions to potential connections. Intermediaries are then able to seek the most relevant connections by carrying out investigations for the clients. These include basic web searches, searching the Vault and talking to other Intermediaries within the international network. Any release of confidential client information goes through a permission-based, step-by-step disclosure process, thus guaranteeing the protection of client confidentiality.

Ideas leading to connections

IXC protects all client-related information in order to ensure the continued cooperation of client organisations, for the benefit of all parties involved. For business collaborations at both national and international levels, it would activate strategic communication for accurate and swift exchange of information.

Once the Intermediary identifies a potential connection for the client, it becomes an "opportunity" and the Intermediary goes through an "Opportunity Brief" process with the client. This includes the client giving permission to release any relevant confidential information to the other identified party. The Intermediary also approaches the party to be connected to gauge its interest in connecting with the client. If this second party is also a client of IXC, the Intermediary walks through the Opportunity Brief process with it. Even if it is not a client, the Intermediary still obtains consent from the party for the client meeting.

The Intermediary then arranges and chairs the meeting between the two parties. If the geographical location precludes a face-to-face meeting, remote videoconferencing technology is used. The opportunity now becomes an "engagement". Once the two parties are engaged, they decide on their next course of action. Rarely does the engagement stop at the first meeting, although it can happen for reasons related to either party. At this stage of engagement, the Intermediary withdraws from the discussion, because the intention of making the connection has been fulfilled. The Intermediary continues to serve the client's other intentions. Meanwhile, the two parties which have engaged continue working on the details of their collaboration.

In this model, IXC and the Intermediary do not take any commercial return from whatever financial gain that the two parties subsequently achieve from a positive engagement. As an example, if there is Intellectual Property licensing involved that necessitates payment between the parties, IXC does not take any commission or percentage from it. The role of IXC is to facilitate the creation of the connection. The business model is such that IXC is paid a flat fee by the client for seeking connections and not through any "success fees". Again, this helps engender client trust, as the IXC undertaking is non-commercial and neutral in nature.

The universe of IXC services

IXC Malaysia Berhad does not merely function as USM's Intermediary, but also offers its services to all institutions of higher learning in the country, other research institutions, multinational companies, small and medium enterprises and social organisations. Also in the universe that IXC serves are high technology startups, technology transfer companies, incubator networks and business support networks.

Any organisation that has research output or solid innovations can work towards further developing their products by enlisting IXC's services to network with strategic partners. This includes pre-patented ideas that require further research and development. On the flip side, organisations seeking to exploit ideas and innovation using their own capabilities and expertise would be able to increase their exposure to advantageous opportunities by becoming IXC clients.

Current clients include global giants such as Cochlear, Crown Packaging, Fonterra, Jaguar Land Rover, ResMed and Solvay Pharmaceuticals. Smaller technology firms representative of IXC's broad client base include Applimex Systems, Geotechnical Instruments and Teer Coatings.

The public and academic sectors are also well represented. Major research institutes, including Food Science Australia and the Walter and Eliza Hall Institute in Melbourne, feature within IXC's client base, as do a range of universities including the Australian National University and Birmingham, Nottingham, Northumbria and Wolverhampton Universities in the UK.

IXC UK's extensive networks are further strengthened through its numerous working relationships with technology networks such as St John's Innovation Centre in Cambridge, RTC North and CLIK Knowledge Transfer Limited, the commercial exploitation arm of the Rutherford Appleton Laboratories in Oxfordshire.

The IXC model covers multiple industries including Life and Health Science, Food and Agriculture, Advanced Manufacturing and Materials, Resources and Energy, Transport and Logistics and Information and Communications Technology.

The Intermediary Service not only focuses on technological applications, but has also been found to be suitable for social innovation. As an example, in Australia, IXC is working with the Australian Social Innovation Exchange (ASIX) within the social policy and practice field. The service aims to assist nonprofit agencies, public policy groups, research organisations and companies to collaborate in confidence. Through this collaboration, the Intermediary Service seeks out and identifies innovative solutions for a range of social challenges within these organisations. While the main engine for national growth was previously manufacturing, economies are currently placing more emphasis on services. Thus the IXC model is also moving into the services innovation space. Intermediaries are well equipped to create collaborative connections to enhance the design and delivery of service systems.

The USM connection

For large organisations within which barriers to open communication and knowledge sharing exist, a customised version of the IXC model, called "Client Connect" has been designed and implemented to address these issues. In the case of USM, this service is called "USM Connect". The USM Connect approach offers a way of systematising the process of making useful connections, thus no longer relying on serendipity for innovation.

An IXC Intermediary is embedded on-site at USM one day per week. In addition to this, an internal network is built up, consisting of USM members trained and mentored by IXC, called "USM Connectors". Under the guidance of the IXC Intermediary, USM Connectors work to analyse USM's strategic intentions, capabilities and gaps and look internally and externally for opportunities and connections. They are connected to the external network of organisations through their IXC Intermediary and all information collected is communicated and shared with other USM Connectors as well as the IXC Intermediary.

USM Connectors are models of innovative behaviour and thus would positively contribute to, and influence, the broader collaborative culture of USM. This would allow the development and improvement of capabilities for building external relationships and cooperative opportunities.

Conclusion

Innovation is the novel application of shared knowledge for social or economic value. It has always been about connecting ideas with the right technologies, resources and capabilities. In today's global economy, no one company, organisation or country can do things alone. We must look outside to find new technologies, new capabilities and new market opportunities - to collaborate. Linkages between business and research, between businesses and particularly international linkages, are critical.

The InnovationXchange model adds value because it creates collaborative and convergent business linkages, opens up new channels to market, finds new and emerging technologies, accelerates and improves internal and external research and development connections and improves exploitation of ideas and Intellectual Property. In the quest for innovative excellence, IXC Malaysia Berhad is well poised to accelerate the nation's capabilities by radically broadening its collaborative horizon.

Hasannudin Saidin, CEO of IXC My, and Grant Kearney, founder and former CEO of IXC Australia and currently the Executive Director of IXC International

sains@usm and Sanggar SAINS Sdn. Bhd.

Sometime in the early 2000s, USM, as part of its continuous effort in research, development and commercialisation (R-D-C), conceived the idea of a research and incubator park as a space for enterprise and entrepreneurship development, thus completing the chain of R-D-C to R-D-C-E. The location, formerly occupied by a private college, at Bukit Jambul was identified and acquired through funding from the 9th Malaysia Plan. The purchase of the land and existing buildings was completed in 2008 for the sum of RM59 million and marks the beginning of the Science & Arts Innovation Space, popularly known as sains@usm.

As part of the preparation, USM staff involved in laying the foundational concepts and philosophy of sains@usm studied and visited existing research and business parks, in 2007 and 2008, such as BioCity (Nottingham, UK), Surrey Research Park (Guildford, UK) and several North American and European research parks (as delegates in a MOHE-organised study tour).

A University Park Training Workshop in Boston, USA, organised and sponsored by the Malaysian Biotechnology Corporation and facilitated by the Association of University Research Parks (AURP) in February 2008 provided useful insights on best practices in developing and running university-based research and business parks. Brainstorming sessions were also held internally and provided more ideas from, and buy-in of, key individuals in USM's own community.

The concept

sains@usm was conceptualised as an integrated community, not just as a place for research and enterprise development but also as a place where its facilities, functions and activities integrate themselves with, and benefit, the various layers of communities to which it is linked. The general design include the architecture that encapsulates a contemporary design influenced by traditional indigenous Malay-Islamic architecture and design philosophy within the context of the tropical milieu. As a habitat that attempts to link the development of research and business, the architecture of sains@usm showcases a design that reflects sustainability as its main thrust, respectful of nature and the ecosystem whilst deeply radiating its universal cultural values.

Sustainability and space

Sustainability, which is epitomised through the use of energy efficient designs, will also embed features that have long been successful in tropical micro-climates such as large overhangs and well-ventilated spaces. sains@usm acts beyond just being an incubator. It is a space that fuses innovative ideas in a transdisciplinary way as emphasised in the layout plan of sains@usm. The design welcomes the visitors to venture into sains@usm through the provision of friendly and attractive public amenities such as the outdoor café and shaded open spaces. The intermediate space, which mediates between the public and private, allows for limited public access to the area for the more serious and discerning visitors or clientele.

Finally, located further inwards or upwards, sains@usm is the private customised space within a highly secured area where specialised activities and research are conducted.

One unique feature of sains@usm is the underlying acceptance that "arts is an integral part of science" and vice versa. Arts is thus recognised to contribute significantly to society in tandem with science and technology. sains@usm recognises this as the catalyst for balanced socio-cultural and knowledge growth. The understanding of science in the arts domain through patterns and design denotes the balance and unity of the cosmos.

Creativity and innovation

Being the cornerstone of innovation, it is only fitting that sains@usm is nestled in a verdant and inspiring landscape, where each habitable room faces a picturesque view of greenery and water elements so as to ignite the creative energy. Such a setting draws the inflow of nature indoors, into the interior. This intricate connectivity heightens the respect of humanity towards the environment it lives in exemplifying in essence the principle of sustainability, as underpinned by the metaphor of "The University in a Garden" - as USM is popularly known.

The objectives

sains@usm is envisaged as a nexus where people, ideas, science, technology and the arts as well as academia and business intersect and fuse to generate new ideas, products and solutions that can contribute to the enhancement of the nation's socio-economy. The motto "*Synergising Creativity, Nurturing Enterprise*" was crafted to encapsulate this vision of sains@usm.

Furthermore, a special focus will be given to support USM's vision of addressing the needs of global sustainability and communities at the bottom of the economic pyramid.

In essence, sains@usm will create an enviroment to support:

- acculturation and nurturing of entrepreneurship amongst staff
- nurturing USM's students as the next generation of entrepreneurs
- consolidation of USM's strengths and resources in sciences, technology and the arts
- retention of the best talents (staff & students) in USM
- attracting new talents to USM from all over the world
- showcasing the talents and creativity of USM's academic and research community
- creation of high-value jobs in sains@usm that in turn will result in a multiplier effect outside of it such as has been shown in a large North American study of research and incubator parks where on an average, each job in a research park creates 2.57 jobs outside of the park
- provision of resources of entrepreneurship, talent and economic competitiveness for the local, regional and national economies
- provision of infrastructure support for the knowledge and innovative economy, for example, by providing shared facilities that can be accessed by Biotech Corp's BioNexus or MDeC's MSC status companies respectively
- fostering of a closer relationship between academia and industry
- fostering creation of new intellectual property, innovations, technology transfer and commercialisation of technology
- the concept of inclusiveness and sustainability

Artist impression of sains@usm

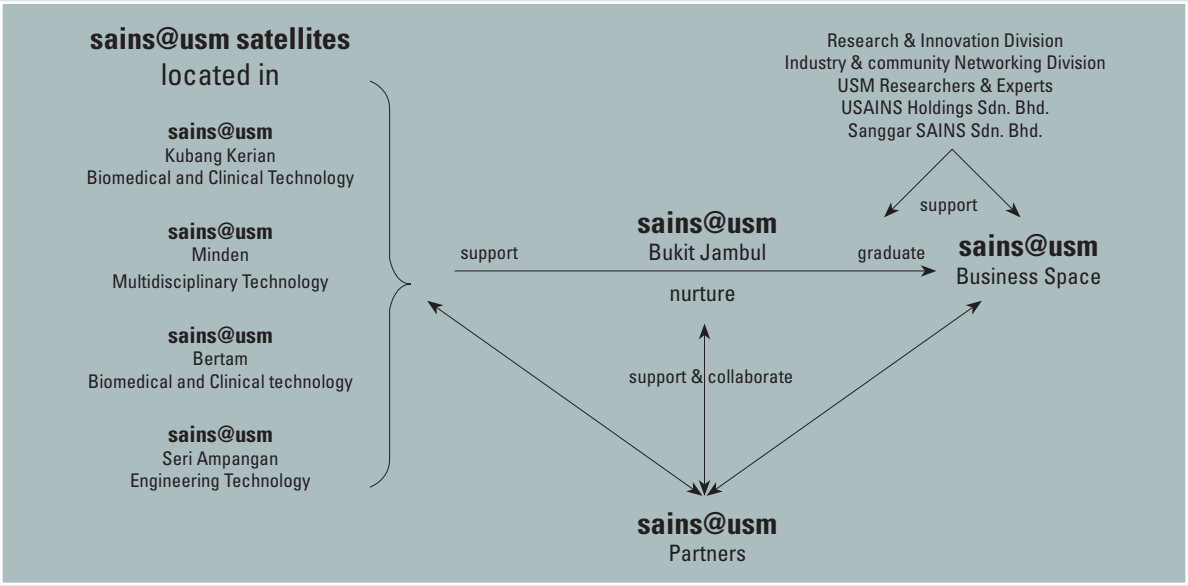


Figure 1: The various current and future components of sains@usm

Components of sains@usm

sains@usm was envisaged to be a multi-site, multi-component entity that serves different inter-linked functions. The key components of sains@usm are as follows:

Incubators

sains@usm Bukit Jambul (sains@usm BJ) is an integrated community for the incubation and nurturing of start-ups from USM's research community as well as others from any part of the world together with other supporting facilities and services. sains@usm has been planned to contain:

- incubator laboratories (Life Science, Engineering & Technology and Arts incubators)
- federal laboratories and facilities
- GLC and MNC-linked research centres
- selected USM centres of excellence
- USM's Graduate School of Business
- shared administrative and technical services & facilities
- a convention centre
- hotels & service apartments & long lease apartments
- leisure facilities
- retail space
- Fine Arts and Science Galleries
- Performing arts mini theatre
- an artist colony
- day-care centre, community-linked facilities and activities
- supporting services such as IP agents, patent lawyers, funding agencies and USM's consultancy offices
- an international school (Fairview International School that is already operating in one of the existing blocks in sains@usm)

Clusters

sains@usm Satellites are selected among existing USM's clusters, units and centres of excellence located in its four campuses that will provide supporting facilities and expertise to other components of sains@usm especially sains@usm BJ. The current sains@usm Satellites are:

- the Collaborative Microelectronic Design Centre (CEDEC)
- the Doping Control Centre (DCC)
- the Centre for Drug Research (CDR)
- the Institute for Research in Molecular Medicine (INFORMM)
- the Nano-Optoelectronics Research & Technology Laboratory (NORLAB)
- the Tuberculosis Research Group (TBRG)
- the Natural Product Research Group (NPRC)
- the Brain Mind Nexus (BMN)

Business Space

sains@usm Business Space (sains@usm BS) is a development for the future and is the space for incubatees from sains@usm BJ that have matured and are ready to "graduate" and start actual commercialisation activities. This space will also be used to attract other organisations looking for space to engage in knowledge-based businesses. The site for sains@usm BS will be determined in the future.

Partners

sains@usm Partners are organisations or other research parks located anywhere in the world that collaborate with sains@usm. This is also planned as a development for the future to create a network that will support sains@usm activities.

Creation of Sanggar SAINS Sdn. Bhd. and its role in the development of sains@usm

Sanggar SAINS Sdn. Bhd. (SSSB) was created to drive the physical development of sains@usm. Since its establishment on 8 August 2008, the SSSB team has been concentrating its efforts throughout 2009 on planning, obtaining approval from regulatory bodies and securing funding for the development of sains@usm.

Occupancy of sains@usm as of March 2010

When USM acquired the site, there were already three existing academic blocks designated as Blocks A, B and C. Block A (2 storeys) is currently fully occupied by the Institute for Pharmaceuticals and Nutraceuticals (IPNM) consisting of laboratories, offices and other support facilities. The upper (2nd floor) of Block B is taken up by USM's own Centre for Chemical Biology (CCB) whereas the ground floor has been renovated for use by the Centre for Herbal Standardisation (CHEST), a unit of the School of Pharmaceutical Sciences that was set up together with Biotropics Berhad (a subsidiary of Khazanah Nasional Berhad). The ground and first floor of Block C has the Fairview International School as the occupant whereas the 3rd and 4th floors are being renovated for other external clients and also for some units of USM.

Developing enterprises from USM's research: The Innovator Programme

Whilst the physical development of sains@usm is important, of equal importance is the development of the incubatees that will occupy the incubator space to be built in sains@usm. To nurture and to assist researchers in commercialising their innovations, Sanggar SAINS Sdn. Bhd. introduced the Innovator Programme in July 2009 consisting of the following:

- **i-Biz**
  A business clinic targeted at research products generated by USM researchers that have potential commercial values. The programme involves not only helping researchers to manage IP registration and licensing, but also to proactively build compelling business propositions for products that have commercial values. It also provides guidance and advisory services on further business developments, including application of grants, participation in trade exhibitions, etc.

- **i–Roadshow**
  This programme is aimed at educating researchers on commercialisation mechanisms and strategies. i-RoadShow is part of the plan to introduce the Innovator Programme to faculty members of USM. The team visits the various academic and research units of USM explaining how this programme works and how the team can support the innovations coming out from the university.

Since its introduction in 2009, the Enterprise Development team of Sanggar SAINS has conducted three road shows in three different localities of USM:

  - School of Management and the Graduate School of Business, USM Main Campus (11 September 2009)
  - School of Chemical Engineering, USM Engineering Campus, Nibong Tebal (3 November 2009)
  - Kubang Kerian Health Campus (18 November 2009)

- InnovationXchange Malaysia (IXC My), a new, not-for-profit international knowledge-exchange entity which facilitates business and research collaboration through its network of IXC Intermediaries, also introduced its programmes during the road shows.

- **i–Boot Camp**
  This programme provides hands-on training, nurturing and coaching for researchers or students from USM who wish to set up their own enterprises and to develop their ideas into commercial products. This service is open to selected incubatee companies.

- **i-Connect**
  This is an industry-focused networking forum to connect the innovations to the industries, and for the researchers to connect with each other. It is a forum for Sanggar SAINS to start assessing potential commercial partners and is open to all researchers and aspiring entrepreneurs.

- **i-Cradle POC/POV Forum**
  Under this programme, USM and Sanggar SAINS screen and channel start-up candidates who have proof of concept ("POC") or proof of value ("POV") to merit support from the Cradle Fund for pre-seed funding.

- **i-Pitch**
  The i-Pitch is a workshop to train researchers and aspiring entrepreneurs on how to present the effective pitch to potential investors or funding partners.

Progress of the Innovator Programme

The Enterprise Development unit of Sanggar SAINS has conducted a series of meetings and discussions with USM researchers in order to identify their needs and the opportunities that each project may represent.

Discussions with some SEDIA Programme (see page 57) members have also taken place and there are five projects that could benefit from sains@usm services.

Moving forward

Sanggar SAINS Sdn. Bhd. expects to finalise the detailed building design by the end of 2010 and the actual physical development to start in early 2011.

Stage of project readiness	Progress since July 2009
Start-up potential	14 projects/products (from various fields) that have proceeded past the proof-of-concept ("POC") stage. Sanggar SAINS is helping the researcher(s) to either develop the business plans or seek and assess commercialisation partners or secure funding.
Industry partnership	8 projects/products (from various fields) have been introduced to potential commercialisation partners involved in activities ranging from pharmaceuticals, water and waste management, construction to manufacture of cars. Negotiations on 3 projects (medical device, halal vaccine, engineering solutions for water and waste management) are currently in progress.
Keep-in-view	4 projects/products commercialised before the Innovator Programme was introduced. Sanggar SAINS will assist in further market expansions, if required.
Ideas	5 product ideas that have yet to go through POC / POV.

Chronology of progress
(August 2008 - March 2010)

August to December 2008
The appointed Project Management Consultant (Scientige Sdn. Bhd.) worked on the preparation of the Project Brief, Master Plan Layout and Development Proposal Report.

December 2008
The Board of Directors of USM approved the proposed Master Plan Layout of sains@usm for submission to Majlis Perbandaran Pulau Pinang (MPPP).

December 2008 to March 2009
After the approval of the proposed Master Plan Layout, the Project Management Consultant and Sanggar SAINS Sdn Bhd prepared the final application dossier and various submission reports as well as endorsement of supporting documents by USM, Director General of Land & Mines etc. (e.g., land titles, master plans, survey plans) to the authorities.

April to November 2009
The application for the Development Order for sains@usm was submitted to MPPP, via the Council's One-Stop Centre on 16 April 2009; since then, interactions with various regulatory departments at MPPP as well as Federal agencies such as JKR, Jabatan Alam Sekitar etc. have taken place.

August 2009
The Project Management Consultant (Scientige Sdn. Bhd.) was further appointed to prepare the preliminary building design.

October 2009
The first draft of the preliminary design proposal was submitted to SSSB and USM for review.

December 2009
Approval from MPPP for the Development Order for sains@usm was finally received on 11 December 2009.

February 2010
The final draft of the preliminary design proposal was submitted to SSSB and USM for review.

March 2010
The preliminary design proposal was finally approved by the Vice-Chancellor on 22 March 2010.

Preserving the natural heritage of USM

USM's CEE - IIT Kanpur for collaboration engineering leadership

USM's Centre of Engineering Excellence (CEE) is a committed effort on the part of Malaysia to provide an impetus for building the knowledge hub/nexus with the original ideas of moving up Penang's industry in the value chain through greater creative and innovative engineering inputs.

With the commitment towards this direction, Khazanah Nasional Berhad had approached USM with a concept note of CEE on January 2009 and reaffirmation with USM on May 2009. With the committed involvement from both multinational and Malaysian companies, this centre will be used as a bridge to forge closer and meaningful technology learning and development experiences for the region.

It is seen as an opportunity for leading institutions from India such as India Institute of Technology (IIT) Kanpur and other similar organisations to extend their learning experience to USM and the companies operating in Penang, through joint research projects, emplacement of academics and postgraduate students and other forms of collaboration which could yield significant creation and dissemination of knowledge.

A visit by IIT Kanpur delegates to USM, especially to the Engineering Campus on 5 May 2009, became the starting point of a strong collaboration between USM and IIT Kanpur. The journey continued with the visit of USM delegates to IIT Kanpur on 21 August 2009, capped by the signing of a MoU on 22 August 2009. The engagement has national and international impacts as follows:

- provide fertile ground for the development of human capital through students, academia and interaction with the industry
- develop a supportive framework for the development of incremental technologies, for the benefit of all to tap into the resource base of all participants for the development and dissemination of knowledge and technology
- provide a platform for the development and commercialisation of technology, through a partnership of academia, applied research centres and industry
- create a platform for the development of a greater mutual understanding and a forum for meaningful sharing of resources and knowledge

CEE plans to move forward the collaboration with continuous activities, namely through:

short-term activities such as:

- short courses, student exchanges, student internships, staff exchanges and emplacements and industrial attachments
- identification of the problems in the industry and to provide the solutions

long-term activities such as:

- joint research collaborations, matching grants, consulting, smart partnerships, joint ventures, research/clusters in the potential niche areas such as energy, environment and nanotechnology
- technology transfers, licensing and commercialisation

Aspirations to generate and nurture local engineers with strong world class leadership for the multinational and local industries will inspire CEE to be the best knowledge hub/nexus in Malaysia and the world.

In view of the critical need to support the existing electric and electronic industrial community in Penang, this collaboration is viewed as a key milestone under the APEX initiative.

> **"In the Electrical and Electronic sector, Malaysia can leverage its early mover advantage. Building on a strong foundation, Malaysia's future in this sector must be focused not only in manufacturing but in research and development and design, where Malaysian companies are driving innovation rather than simply importing it."**
>
> Prime Minister of Malaysia,
> Dato' Seri Mohd Najib bin Tun Abdul Razak

International collaborations have always been a strength of USM

USM leading the *halal* way

Despite being one of the largest religious groups in the world, Muslims often find their requirements for halal products ignored by mainstream producers. Tides of change, however, are coming our way with Malaysia's commitment in developing itself as a halal hub. In support of the move, two initiatives at USM, the halal detection project and the halal collagen hub lead the way in ensuring that Muslims' needs become increasingly relevant and important in global production and marketing. With transformation as one of the key guiding principles, USM hopes to contribute in making the world a more conducive place for Muslims to lead the life that they want.

Halal detection

In pharmaceutical products, the halal issue, especially in the use of halal gelatine, is a concern of the Muslim community. It has been reported that gelatine from pig sources occupy greater than 50% of the world's gelatine market. Porcine gelatine or gelatine from pig sources is preferred over bovine gelatine or gelatine from cattle sources in most non-Muslim countries because it is cheaper and because of the fear of bovine spongiform encephalopathy (BSE or mad cow disease) that can be contracted through cow-based proteins.

Gelatine is made up of a mixture of proteins that are derived from the collagen of animals' skin and bones. Gelatine is produced by the partial hydrolysis of the collagen. It is a tasteless and colourless solid substance that is use as a gelling agent in food and pharmaceutical products. In the capsule form, gelatine derived from both the mentioned sources looks, tastes and produces the same result. Therefore, it is not possible to differentiate the source of gelatine in these capsules simply from their physical appearances.

Absence of a reliable method of analysis A few methods are available for the determination of whether a gelatine capsule is produced with a porcine or bovine source. These methods include principal component analysis (PCA) and calcium phosphate precipitation (CCP).

PCA involves a lengthy and costly procedure, where gelatine is subjected to acid hydrolysis to form amino acids. The amino acids will then be derivatised prior to HPLC separation. The whole procedure takes about 24 hours to complete. In addition, PCA reduces the dimensionality of the data set and this affects its effectiveness when being analysed.

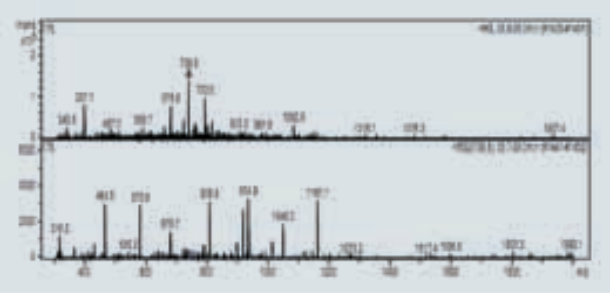
CCP is measured by the pH drop method, based on the formation of the precipitation. This technique depends solely on the known concentration of pure bovine or porcine gelatine; in a situation where the source of gelatine is not pure or where the concentration is not known, the method cannot be used to differentiate the source of the gelatine.

Due to the drawbacks of the mentioned methods that limit their usefulness and reliability, they have not been used and remain primarily at the theoretical and publication level.

Previously, the acid base method was used to differentiate the source of gelatine; however, this method has been found to be unreliable as it is dependent on the external properties of the gelatine, which can be altered during the preparation of the capsules.

More recently, there have been reports on the polymerase chain reaction (PCR) based method for the identification of gelatine from the porcine source. The drawback for this method is that DNA, the trace component of gelatine, is targeted for the identification of the gelatine source. As the composition of gelatine is protein, the DNA is considered a contaminant in its preparation.

Nevertheless, the usual way of gelatine preparation involves acid or base treatments; these processes also lead to the hydrolysis of DNA. Accordingly, the presence of DNA in gelatine capsules or gelatine powder is only via change. The absence of porcine DNA in the gelatine does not necessarily mean that the gelatine is not made from porcine sources.



01 An example of LC/MS/MS analysis for protein identification

(a) (b) (c) (d) (e) (f) (g)

02 Images of bands of bovine and porcine gelatine eafter gel electrophoresis: (a) and (g) porcine gelatine standard and (d) bovine gelatine standard purchased from Sigma; (b) and (c) bovine gelatine samples (softgel), and (e) and (f) bovine gelatine samples (hard gelatine)

The solution Realising that there is no reliable method for the analysis, Assoc. Prof. Gam Lay Harn from the School of Pharmaceutical Sciences has taken the initiative to develop a method with the assistance of two science officers, Siti Zuraidah Zorbi and Yap Beow Keat. The research was completed by June 2008.

In this method, respective protein markers for porcine and bovine gelatines were used for the gelatine source identification. The specificity of these biomarkers enabled the unambiguous identification of the gelatine source.

With the knowledge that gelatine is protein, they foresee the possibility of solving the task of gelatine source identification through the proteomics approach. This is because the true component of gelatine can be used reliably to identify its content and therefore indicate its source of origin.

The term "proteomics" was first used in 1996. There are four main branches of proteomics, namely, proteome mining, protein expression profiling, identification of protein-protein interactions in protein complexes and protein modification profiling. Since then, it has become the technique of choice for protein identifications.

In identifying unique protein markers to differentiate the sources of gelatine, researchers can apply the protein expression profiling in their study.

The main challenge however was the extraction method for the proteins from the gelatine. In the process of gelatine preparation starting from the extraction of the collagen from the skin or bones of animals, followed by the treatment of collagen to form gelatine, a series of heat, pressure and acid or base treatments were carried out. These processes denatured and hydrolysed the proteins. As a result, good protein profiles cannot be obtained. The high viscosity of solubilised gelatine also holds back the progress of the method development.

But the researchers have invented an extraction method that enables them to recover good proteins, leaving behind the fragmented proteins in the highly viscous gelatine solution. This is the innovation that leads to the successful method development.

The extracted proteins were subjected to electrophoresis protein separation. The protein profiles of the respective gelatine sources, namely bovine and porcine, were mapped and the differentially expressed proteins were subjected to in-gel protein digestion and mass spectrometry analysis for protein identification.

A few proteins were identified to be unique for porcine gelatine and the others were unique proteins for bovine gelatine. The consistent expressions of these proteins were tested against a pool of known bovine and porcine gelatines, where the presence of these proteins was found significant in all the gelatine sources tested. The uniqueness and consistent presence of these proteins in the respective source of gelatine render them to be useful biomarkers for the identification of the gelatine sources.

Using the identified biomarkers, a method was devised to differentiate the source of gelatine from the bovine and porcine sources. Unlike the PCR based method, which detects only the porcine DNA, the current method uses the specific biomarkers to identify the exact source of the gelatine.

This innovation is the first of its own kind in the world as this is the first protein based method for the identification of gelatine sources. Since it is identifying the true component of gelatine, the amount of gelatine required for this test is very little (half of a capsule). Furthermore, false positive or negative identification of a gelatine source is not likely to happen as both the bovine and porcine gelatines are presented with specific biomarkers.

A blind test was conducted on the method developed, where the researchers received blind samples from a pharmaceutical control unit in Malaysia. The results they reported on the capsules

sources matched exactly with what were sent. The researchers have patented this method in Malaysia (2009) and have also filed a Patent Cooperation Treaty (PCT) in preparation for international patent filling.

USM leading the way As the Muslim population increases, worldwide concern for the use of halal gelatine in capsule form is on the rise, and we are offering this solution.

Currently, this method is ready to be used for the determination of halal gelatine and the researchers have received local and international gelatine samples for identification of their gelatine sources.

Driven by the fast-growing Muslim population and that halal products are headed towards wider popularity, the needs for halal products in the future will also be on high demand. Although a non-porcine source of food may not be the sole factor to determine whether the food is halal, identification of the source of the raw material used can lower the "risk" of consuming food from porcine sources.

The halal issue in food, pharmaceutical and cosmetic products will continue to be a challenge especially when the demand for halal detection on processed food and cosmetic products has not been fully met currently.

The way forward Moving forward USM's future endeavours include:

- Detection of meat sources in canned meat
  Currently, the researchers are in the process of developing a method to differentiate the source of meat in canned food. This project presents great challenges as canned meat is well cooked and often garnished with all types of ingredients that hinder its identification. Nevertheless, the researchers believe that this problem can be solved in due course.
- Detection of fat sources in cosmetic products
  This project will involve the profiling of the fatty acid contents in fats from porcine sources. The profile of the fatty acids will be used to identify the source of fats used in cosmetic products.
- Detection of the porcine component in animal feeds
  This project will involve the method development for the identification of protein and fat based ingredients in animal feeds to ascertain whether they are from porcine sources or otherwise. The methods that will be developed in the above two projects may be applied in this study and also in other halal detection studies involving the identification of proteins and fats from porcine sources.

The Halal Collagen Hub

In line with Malaysia's effort in promoting halal initiatives, a biotechnology company, Holista-Colltech Sdn. Bhd. and Universiti Sains Malaysia have joined forces to make Malaysia the world's first halal collagen hub.

Managing Director of Holista Biotech Sdn. Bhd., Dato' Dr. M Rajen, said that the collaboration is vital for Malaysia to be able to play a more important role in the collagen market at the international level. If this initiative succeeds, it will enable Malaysia to become the pioneer in the setting up of a halal collagen hub worldwide. While European countries, China and India are well known for their highly developed collagen industry, their products have raised concerns among Muslims who question the ingredients used in the production of the collagen. The current production method involves the extraction of enzymes from sources of protein which currently only include animals such as cows and pigs. The issues raised by consumers pertaining to the ingredients used in manufacturing process of collagen have caused confusion and doubt especially among followers of a number of religions worldwide. Some of the consumers doubt the credibility of the halal certification while there are others who are against the use of animal products in the manufacturing process.

The joint venture between Holista-Colltech and USM will consolidate research on the potential production of the first halal collagen in the world. Both parties will be focusing on improving the essential skills and expertise required in the extraction of enzymes which can break the protein using non-animal ingredients. Another aim of the joint venture is to discover new uses of collagen produced through the combination of other elements in the experiments to be conducted.

A carpet of jacaranda flowers at your feet

"Challenge the status quo" - harnessing synergies for a positive future

Laureates of the Right Livelihood Award, popularly known as the "Alternative Nobel Prize", are people who have been recognised for their contributions towards achieving a global ecological balance, fighting to eliminate material and spiritual poverty and/or working towards lasting peace and justice in the world. Importantly, they think of solutions, act on their convictions and work tirelessly to solve problems of our time. To date there has been 137 laureates from more than 57 countries, including Dato' Anwar Fazal (1982 recipient) from USM. Their contributions have touched many lives in different parts of the world, and now, the Right Livelihood College (RLC), a global capacity building initiative of the Right Livelihood Award Foundation, is building the momentum so that their efforts can be harnessed, multiplied and spread across the globe.

The Right Livelihood College

The Right Livelihood College was established via a Memorandum of Understanding signed between the Right Livelihood Award Foundation, based in Stockholm and Universiti Sains Malaysia, based in Penang on 8 January 2009. The College, the first of its kind, is hosted by Universiti Sains Malaysia and its global secretariat is located at the USM's Centre for Policy Research and International Studies (CenPRIS).

The Steering Committee of the RLC consists of:

- Assoc. Prof. Azhari Abdul Karim, Director, Centre for Policy Research and International Studies (CenPRIS)
- Prof. Datin Rashidah Shuib, Director, Women Development Centre (KANITA), USM
- Ole von Uexkull, Executive Director, Right Livelihood Award Foundation
- Bijan Kafi, Project Developer, Right Livelihood Award Foundation
- Dato' (Dr.) Anwar Fazal, Director, Right Livelihood College

"The Right Livelihood Award is also called the Alternative Nobel Prize. It was founded in 1980 to honour and encourage people who fight for a solution to the great problems of our time and for a better future. These people threw off the straitjacket, think the "unthinkable" and inspire us with their courage, their compassion and their hope. They often take great personal risks while fighting for their convictions: they face prosecution, imprisonment, even torture, and yet they continue. Of course, not everyone of us can be a hero, but at least we can learn about those who are."

Vice-President of the European Commission, Margot Wallstrom

The RLC aims to have the following impact at the national and international levels:

- ensure that the knowledge of laureates is accessible to the general public, individuals and selected groups to realise the true potential of the "winning ideas" of laureates and let them multiply
- foster the injection of external know-how into Award Recipients' projects that need it the most so that they will develop and flourish effectively and sustainably for experimental learning
- connect the global community of award recipients to help release synergies, multiply tested know-how and create the critical mass to help bring their common goals forward
- provide a 'hub' and an incubator for promoting and multiplying the most successful solutions to urgent global problems through the development of information, communications and education activities including web based learning materials, meetings, networking and an internship and research scholarship programme, and
- actively link with the most excellent like-minded institutions that foster programmes that resonate with the goals of the Right Livelihood Award Foundation as well as with other top educational institutions.

The RLC aims to achieve this impact by carrying out a number of activities including lectures, fellowships, internships, international courses, publications, films and "days of action" series.

Fellowships and Research Grants

It was envisaged that fellowships and research grants will be given to outstanding students and researchers to collaborate with the laureates to help realise the vision and mission of their initiatives. In 2009, the "Right Livelihood Fellowships" were announced and two Ph.D. candidates have been identified.

Interns and International Courses

In 2009, three interns/research assistants, one from Myanmar and two from Malaysia, were mentored at the Right Livelihood College. Their work revolves primarily on global civil society organisations and is overseen by the Director.

Two workshops were organised by the RLC in 2009:

- "Making a Better World - Small actions, Big changes". This workshop was attended by 21 representatives from six international civil society organisations based in four countries.
- "Transformational Leadership in Civil Society Organisations". This workshop was attended by 20 participants from seven international and local organisations and was co-organised with Gill Emslie of Findhorn College based at the Findhorn Eco-village.

"The Right Livelihood Laureates are living libraries and especially unique and valuable resources, whose skills, wisdom, vision and passion must be harnessed, documented and multiplied all over the world. The Right Livelihood College aims to do just that, systematically and progressively spreading out as energising ripples across the globe!"

Vice-Chancellor,
Universiti Sains Malaysia,
Professor Tan Sri Dzulkifli Abdul Razak

Initial meeting in Berlin, 2008 with Jakob von Uexkull

Forging forward

USM and the RLC are currently working together to extend the activities to other campuses throughout the world. Lund University in Sweden is now the second campus of the RLC and discussions are underway with the Addis Ababa University in Ethiopia, Center for Development Research (ZEF), University of Bonn and the Indian Institute of Administrative Services (IIAS). Discussions are also being held with possible partners in Latin America, including the Avina Foundation.

Two pioneering international workshops, one on "Environmental Justice," and the other on "Migrant Workers" are being organised in association with local partners, and various United Nation Agencies. Additionally, in the coming years the Right Livelihood College hopes to bring out a series of publications and films on the laureates and their work. The RLC will be specially featured at the 30th Anniversary of the Right Livelihood Award to be hosted by The City of Bonn in Germany .

Dato' (Dr.) Anwar Fazal, the Director of the College, describes the future of the College as "a creative journey of academics and activists that will multiply ideas and actions for a better world. One hundred and thirty seven global pioneers of social, economic and ecological change from some 60 countries will work with this hub based at USM in Penang - a great honour as well as a great responsibility."

About the Right Livelihood Award Foundation

The Right Livelihood Award Foundation was established in 1980 in Sweden by the journalist and professional philatelist Jakob von Uexkull who felt that the Nobel Prize categories were too narrow in scope and too concentrated on the interests of the industrialised countries to be an adequate answer to the challenges now facing humanity. Popularly known as the "Alternative Nobel Prize", the Right Livelihood Award is widely recognised as the world's premier award for personal courage and social transformation. It honours and supports people who offer workable solutions to the most urgent challenges of our time.

About the Centre for Policy Research and International Studies

The centre is a research hub, serving as the focus of USM's efforts in consultancy services, research and graduate supervision related to public policy and international studies. It was established in 2007 from the amalgamation of two existing research centres: the Centre for Policy Research (CPR), established in 1974, and the Centre for International Studies (CIS), established in 2004. Focus on research in policy are public-private sector collaboration, socio-political development and rural modernisation; for the international arena focus areas will include globalisation and regionalism, global international reform, international political economy, and cultural communication and ethnic studies. The Noordin Sopiee Chair in Global Studies, established in 2007, is also housed at CenPRIS.

"When I founded the Right Livelihood Awards in 1980, I wondered why we are living with problems we can solve. I still haven't found the answer. It is not due to a lack of solutions, for they exist - 133 Award Recipients from more than 57 countries have shown what can be accomplished when we have a vision and follow it. They are all examples of courage, wisdom and action. They give us hope that our children can live in peace, in a healthy environment and healthy societies with values beyond material wealth."

Jakob von Uexkull,
Founder and Chairman,
Right Livelihood Award Foundation

Right Livelihood Laureates

. . . for his courage in confronting the forces that are destroying the Congo's rainforests and building political support for their conservation and sustainable use.

- René Ngongo (Democratic Republic of Congo)

2009

. . . for his lifetime advocacy of the socially responsible use of science, and for his massive contribution to raising awareness about the perils of climate change and building public support for policies to address it.

- David Suzuki (Canada, Honorary Award)

2009

. . . for her tireless commitment to working with women who have experienced the most horrific sexual violence in some of the most dangerous countries in the world, and campaigning for them to receive social recognition and compensation.

- Monika Hauser (Germany)

2008

. . . for showing in diverse ethnic and cultural situations how religious and other differences can be reconciled, even after violent conflict, and knitted together through a cooperative process that leads to peace and development.

- Dekha Ibrahim Abdi (Kenya)

2007

. . . for her dedicated commitment and campaigning for human rights, social justice and environmental protection.

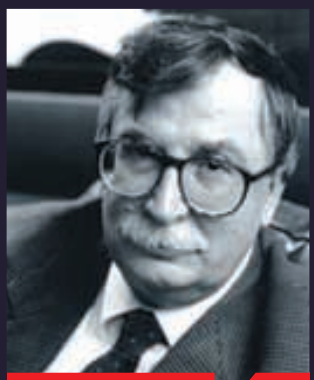
- Bianca Jagger (Nicaragua)

2004

. . . for a 21st century business model which combines commercial success with social and cultural development.

- Sekem / Ibrahim Abouleish (Egypt)

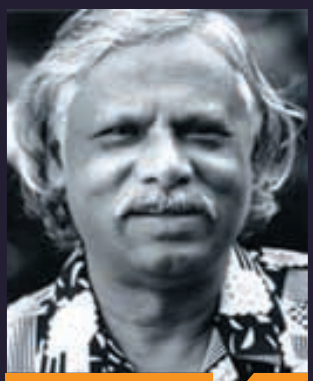
2003



. . . for his long-standing efforts to end the impunity of dictators.

- Juan Garcés (Spain)

1999



. . . for his outstanding record of promoting health and human development.

- Gonoshasthaya Kendra / Zafrullah Chowdhury (Bangladesh)

1992

. . . for converting the Kenyan ecological debate into mass action for reforestation.

- Wangari Maathai (Kenya)

1984

. . . for showing the direction in which the Western economy must develop to promote the well-being of humanity.

- Alice Tepper Marlin (USA, Honorary Award)

1990

. . . for fighting for the rights of consumers and helping them to do the same.

- Anwar Fazal (Malaysia)

1982

A mix between the urban and rural - the HBP enclave

Radio frequency identification (RFID) for a digital smart community

Radio Frequency Identification (RFID) for a Smart Community System has been developed by the Auto-ID Laboratory (AIDL), at USM's School of Electrical & Electronic Engineering. It is the first Malaysian-made RFID reader product while the active RFID is the first world invention to have better performance for an indoor positioning system.

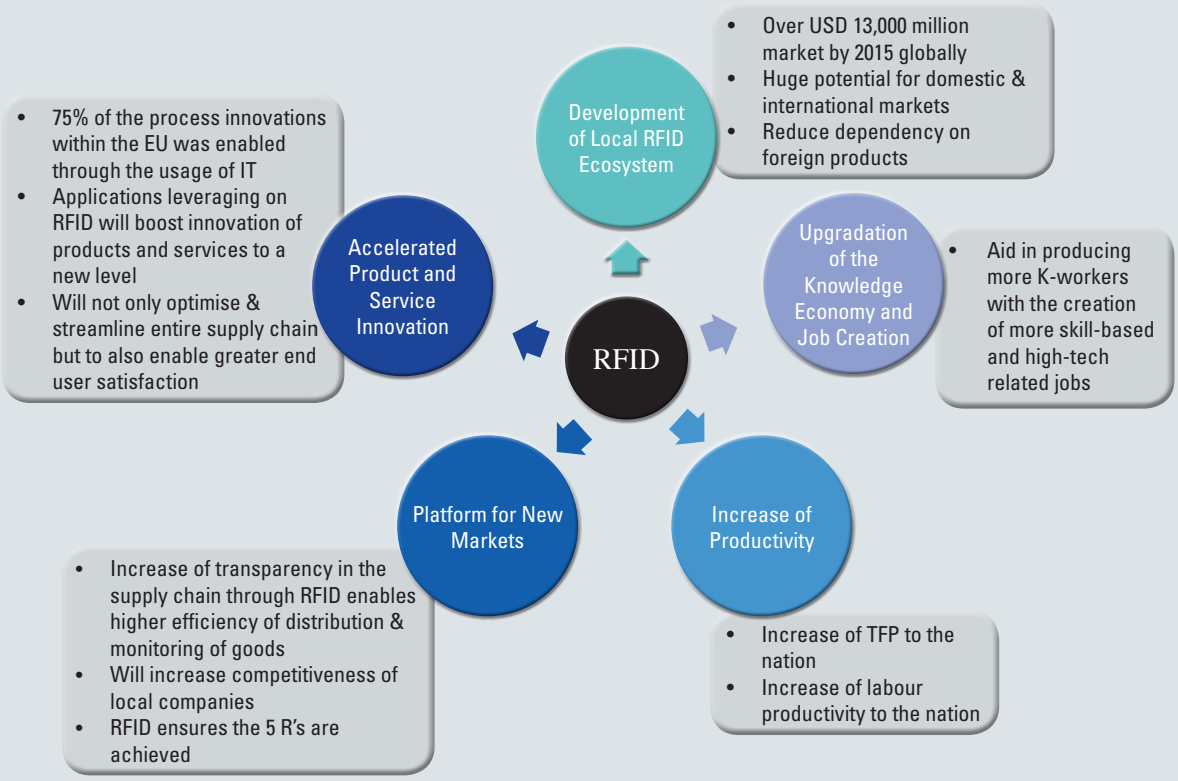
The RFID system is an area in the field of automatic identification that uses radio waves to automatically identify and track people, animals, objects or items. RFID is a simple wireless system with only two basic components - an interrogator (reader) and a transponder (tag).

An identification or serial number identifies a specific product along with other information that is stored on a tag, which is a small microchip attached to an antenna. The antenna enables the chip to transmit whatever identification information it contains to a reader. The reader converts the radio waves from the RFID tag into digital information that software systems can use for processing.

The AIDL was started in January 2008 by Dr. Widad Ismail as the Coordinator and four other lecturers, Dr. Zaini Abd. Halim, Dr. Kamal Zuhairi Zamli, Assoc. Prof. Nor Ashidi Mat Isa and Dr. Shahrel Azmin Suandi. The AIDL's main objective is to be an international hub for research and commercial activities. Other partners of the AIDL include Aliya Technologies Sdn. Bhd. and 15 qualified engineers. Some of them are pursuing M.Sc. and Ph.D. studies.

The AIDL has successfully produced three commercial products – the 2.45GHz Contactless Active Integrated RFID (CAIRFID), the Gen2 Passive RFID Reader (PRAID) and the RFID Tracking and Monitoring Module (RFIDTM). Six patents have also been filed.

Both passive and active RFID products have already been subject to the testing for certification in the Standards and Industrial Research Institute of Malaysia (SIRIM) and in the



Socio-economic benefits of RFID to Malaysia, 2005-2015
Source: Frost & Sullivan, 2009

near future, the passive RFID product will be sent to EPC global for international certification. The developed RFID system is reliable with low redundancy and high reusability and therefore is sustainable. It is a centralised system that can be used for many applications with only minor changes being necessarily made, if required, to the middleware system to meet the requirements of any given application.

The system has already been put to use for various applications at the university, and eventually public places, such as:

- students and staff attendance systems
- tracking and monitoring systems for missing items
- car park systems
- door lock systems
- convocation events
- reward card systems for recycling items
- integrated smart library systems

At the RFID Markets - ASEAN Growth Trends, Thailand RFID Summit 2006, Frost & Sullivan (see above graphic) commented that security and access control is the largest application for the system in Malaysia. The system is predicted to have a great impact in Asia Pacific as well as in Malaysia by the year 2012 where it is believed to have value on import substitution, market share and export value.

Transportation (Electronic Toll Collection by Touch'N Go and Smart Tags, payments for monorails, etc.) is the second largest growing application. Manufacturing and logistics (including movements of containers at Port Klang) are still at a nascent stage with very limited retail projects.

Other key applications include RFID in hospitals, baggage handling at airports, tagging people at amusement parks and document tracking.

Environment-friendly plastics

Non-biodegradable fuel-based synthetic plastics have become a plague to the environment. Plastics have become so ubiquitous that it is hard for many to give up their use despite the continuous calls to use green bags. We produce and use 20 times more plastics today than we did 50 years ago, resulting in increasing pressure for better waste management. The shortage of landfill space, the depletion of petroleum resources, the increasing price of petroleum and concerns over emissions during incinerations have spurred efforts to produce degradable plastics.

Two research teams from USM have invented distinctive solutions in producing degradable plastics, one utilising PHA (polyhydroxyalkanoates) and the other incorporating a chemical compound called DegraChem (a USM invention). Although there have been various efforts in producing degradable plastics, these plastics tend to be costly, non-durable and take a long time to degrade. Therefore, USM researchers have taken great care to ensure that their degradable plastics are cost-efficient so that they can be widely adopted in everyday life; durable so that they are reusable and degrades within a short period of time so that they do not congest the environment. The solutions by USM researchers allow us to continue to use plastics without posing a threat to the environment.

PHA bio-based and biodegradable plastics

Degradable plastics can be categorised into two types: bio-based plastics that are produced using polymers from renewable biological resources and biodegradable plastics which are plastics that can be degraded by microbial activities. There are several types of bio-based and biodegradable plastics such as polyhydroxyalkanoates (PHAs), aliphatic polylactic acid (PLA), polysaccharides, polythioesters, polyanhydrides, polyisoprenoids and polyphenols.

PHAs in particular have gained the key interest of researchers around the globe because of their complete biodegradability, along with similarities to synthetic thermoplastics. Today, the work on PHAs at USM is being carried in a total of five research laboratories, making USM the most active PHA research centre in Malaysia.

PHAs are a family of linear polyesters of biological origin with desirable properties of biocompatibility, insolubility in water, non-toxicity, complete biodegradability and ease of generation from renewable sources. The polymerisation of PHAs takes place within the microbial cells.

PHAs are synthesised by PHA-producing bacteria, such as *Cupriavidus necator, Pseudomonas oleovorans, Aeromonas caviae, Bacillus megaterium* and many more. PHAs are naturally produced as carbon and energy storage compounds by PHA-producing bacteria during undesirable growth conditions. They are usually synthesised by the fermentation of sugars or lipids. In nature, only 1-30 wt % (of dry cell weight) of PHAs are accumulated in PHA producers.

However, with laboratory optimisation, more than 90 wt% PHAs can be produced. The production of the PHAs can be carried out by fermentation using a suitable carbon source, namely, glucose, fructose, jatropha oil, crude palm oil, crude palm kernel oil and even used cooking oil. PHAs with desired properties can be obtained by genetically modifying the genes involved in PHA biosynthesis and by the addition of precursors for the desired incorporation of selected monomers.

PHAs can be either homopolymers or copolymers. The mechanical properties of PHAs are comparable to polypropylene. PHA copolymers can also be custom made to meet desired biocompatibility, thermoplastic range, elastomeric property and mechanical structures. These tailor-made PHAs can cater to the needs of various fields, from home use containers to medical applications.

PHAs are a promising alternative to petrol-based synthetic plastics as they possess advantages such as:

- **Complete biodegradability**: Can be fully decomposed in both aerobic and anaerobic conditions.
- **Elastomeric property**: Possess the elastic properties of natural rubber.
- **Thermoplastic ability**: Become soft when heated and retain hardness when cooled.
- **Biocompatible**: Non-toxic and non-injurious to biological systems.
- **Bioabsorbable**: Able to dissolve and be absorbed by the body. Suitable material for orthopedic implants and tissue engineering.
- **Wide range of melting points**: 40°C to 180°C, enabling industrial processing of the PHAs.
- **Biosustainable**: Derived from renewable biological resources.

- **Research @ USM** Over the past 20 years of research, the USM's PHA researchers have identified various bacterial species of PHA producers, produced several types of PHA copolymers and terpolymers, received many awards of innovation and filed patents for their novel products.

  To date, USM's PHA team members have published more than 100 scientific papers in both local and international journals such as the Journal of Biomedical Materials Research; Progress in Polymer Science; Biomaterials; Applied Environmental Microbiology and Tropical Life Sciences Research (formerly, Journal of Bioscience). The total citations received by all these papers are at least 650 as of March 2010.

  One of the critical success factors for the USM's PHA team is the numerous collaborations with various national and international research institutes to further boost the PHA research carried out in the USM laboratories. Some examples are the RIKEN Institute (Japan), the Tokyo University (Japan), the Tokyo Institute of Technology (Japan), the Hokkaido University (Japan), the Massachusetts Institute of Technology (USA), the State University of New York (USA) and the Max-Planck Institute for Marine Microbiology (Germany) along with national collaborations with SIRIM Berhad, Forest Research Institute Malaysia (FRIM), Universiti Malaya (UM), Universiti Putra Malaysia (UPM) and Universiti Kebangsaan Malaysia (UKM). These collaborations have resulted in a great amount of knowledge sharing that has boosted paper publications at both the local and international levels.

  Years of studies and experiences in sustainable bioplastics by the USM's PHA team have earned it the honour of organising the 2nd International Conference on Bio-based Polymers (ICBP 2009), in Universiti Sains Malaysia, Penang from 11-13 November 2009.

The ICBP 2009 was successfully organised by Associate Professor Dr. K. Sudesh Kumar from Universiti Sains Malaysia in a joint collaboration with Associate Professor Dr. Tadahisa Iwata from Tokyo University and Associate Professor Dr. Hideki Abe from the RIKEN Institute, Japan. ICBP 2009 brought together a total of 123 scholars and industrialists from 13 different countries onto a single knowledge sharing platform.

The conference focused on the development of green processes and green products, to ensure a sustainable tomorrow. This conference covered the research on bio-based polymers (nucleic acids, polyamides, polysaccharides, polyesters, polyisoprenoids, and polyphenols) and synthetic polymers derived from renewable resources and CO^2; developments on the biosynthesis of various bio-based and biodegradable polymers and commercialisation of these green products.

- **Industry and community linkages** The research and development of PHAs is not restricted to knowledge sharing between research bodies alone; the USM's PHA team also provides industrial support to several local companies such as Basechem Sdn. Bhd., Plainexus Laboratories Sdn. Bhd. and Biogreen Sdn. Bhd.

In addition, educational support has also been given to several schools in Penang, namely, Penang Free School, SMJK Chung Hwa Confucian, SMK Convent Green Lane and SMJK Perempuan China. The students have been educated on the production of bioplastics and were given hands-on experience using relevant laboratory facilities.

Recently, the Teluk Awak Villagers Community Project 2010 was conducted with the objective of recycling waste cooking oil collected from villagers for the production of bioplastics (PHAs), treating batik dye waste water using bioplastic-TiO^2 composite films and creating awareness among the villagers of the importance of environmental conservation.

The future work on PHAs will focus on the fermentation scale, thus moving from the laboratory scale to the industrial scale, genetic manipulation of strains to improve production and developing new applications for PHAs such as the controlled release of fertilisers and herbicides as pharmaceutical applications and wastewater treatment.

EnviroPLAST

Realising that the current consumption trends are unsustainable, USM's School of Materials and Mineral Resources Engineering has taken the lead in researching for an environmental-friendly plastic, called EnviroPLAST. The research project is spearheaded by Professor Hanafi Ismail and his postgraduate student, Sam Sung Ting.

EnviroPLAST is a novel invention. The degradability of the plastic is due to the incorporation of natural based polymer and our own synthesised additive named DegraCHEM. It is a "ready to use" polymer and can be processed using conventional plastic equipment such as injection moulding, blow moulding, extrusion, compression moulding, etc. Besides, EnviroPLAST can be recycled and is easy to colour with many types of pigments. In terms of processing, EnviroPLAST is produced using optimised formulation and under optimised processing conditions.

EnviroPLAST offers many advantages and is useful in various applications. It is cost effective and a contemporary way to overcome the disposal of non-degradable petroleum derived polymers. With the invention, less labour skills in disposal management will be needed. The mechanical properties are comparable with commercial polymers and can be used to manufacture any commercial polymer products. From the cost aspect, it is about 10% cheaper than commercial available polymers.

The patent application has been submitted for patent search.

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06

01 Compounding - twin screw extruder
02 Extrusion
03 Pelletising
04 EnviroPLAST
05 Blown film
06 Products from EnviroPLAST

View of the academic offices at USM

Recycle it right! Bioenzymatic deinking in recycling printed waste paper

Recycling has been the mantra of our age. Poor recycling systems however can actually contribute to the degradation of the environment. A case in point is waste paper recycling. While the recycling of waste paper is highly recommended, the process itself could potentially introduce harmful chemicals to the environment. USM's Industrial Biotechnology Research Laboratory (IBRL) at the School of Biological Sciences has developed a system to ensure that waste paper is recycled sustainably.

The recycling of waste paper is indeed imperative in view of the ever-growing paper manufacturing industry. Each ton of paper processed requires 17-20 trees, 31,500 litres of water and 50-70kg. of chemicals, causing 27kg. of air pollution and creating 2.5 m^3 of landfill materials. The recycling of waste paper, therefore, has been recommended to alleviate the stress on the environment. However, recycling involves a difficult process of ink removing, or deinking, particularly when it involves non-impact ink that fuses with the paper on which it is printed. Professor Darah Ibrahim (together with Professor Ibrahim Che Omar now in Universiti Malaysia Kelantan) and students from IBRL have invented and developed an enzymatic deinking system of printed waste paper that makes the deinking process more environmentally friendly and cost-effective.

The deinking of used paper is a necessary step in obtaining brighter pulp. The printing on paper is generally carried out either by using impact or non-impact ink. Impact ink, generally used for newsprint, does not fuse with the paper, and therefore is easy to remove or disperse during the deinking process. The process is deployed in most paper mills where newsprint is recycled. On the contrary, non-impact ink, used in photocopying, ink-jets and laser printing, results in the ink fusing with the paper and making it non-dispersible, thus making the deinking process much more difficult. The toners used for printing generally contain carbon black as the colorant, resin (as a binder), water (as solvent), surfactants (to reduce surface tension), humifactants, buffering agents and fungicides.

Currently, the alkaline deinking process is widely utilised and generally considered to be efficient. However, the large amount of chemicals used in the process, such as sodium hydroxide, sodium silicate, hydrogen peroxide, flocculants, dispersants and surfactants, have several negative impacts on the environment. For instance, the alkaline deinking process increases the Chemical Oxygen Demand (COD) level and the concentration of chemicals in effluent caused by the dissolution of carbohydrates and organic activities present in the fibrous materials. The effluent will also contain a high level of chemical impurities used in the deinking process. Consequently, costly wastewater treatment processes are required to meet environmental regulations. Another downside is that alkaline deinking induces smeared pulps of low brightness or can yellow the treated pulps and consequently diminishes the strength of the pulp fibres.

Environmental friendly technology that exploits enzymes (biological molecules) has been the focus of research interested in reducing the operational cost and environmental impact of the paper deinking process. Enzymatic treatments can produce effects similar to chemical treatments. They can even improve the deinking results without affecting the physical properties of the final paper product. The application of enzymes stable in an alkaline environment has been shown to be effective in increasing the brightness and reducing the ink counts of recycled paper.

The enzymatic deinking system invented by IBRL utilises the bioenzymatic process to produce secondary pulps, which then can be used for making white paper. The IBRL team has worked on the project extensively since 2004 and has now developed a pilot scale system that is ready for use. The prototype for 10kg. capacity of waste paper is now available at IBRL and with the MTDC Cradle Fund, a prototype for 100kg. capacity of waste paper is being fabricated. The system consists of a stirred-tank enzyme hydrolysis coupled with a flotation vessel for ink removal and reuse. The process has been developed to be used as an effective large-scale recycling process of printed paper.

Figure 1: The pulp fibres obtained after the bioenzymatic deinking process

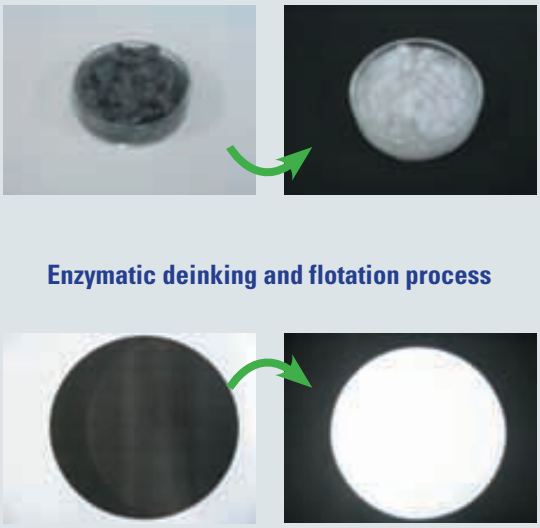


Figure 2: The bioenzymatic deinking of waste paper. Before (left) and after (right) the hydrolysis and flotation steps

In this deinking system, two steps are involved, (a) the detachment of ink from the surface of the disintegrated fibres, which is performed during the pulping process in the bioreactor for pulp hydrolysis, and (b) the removal of the detached ink particles from the pulp slurry by flotation (in the flotation vessel) based on the pneumatic approach. The end product of the system is the pulp as shown in Figure 1. Figure 2 shows the recycled laser printed waste paper before and after the enzymatic deinking and flotation processes.

The enzymatic deinking system developed by IBRL will significantly reduce environmental pollution by decreasing the flow of waste to landfills and reducing associated disposal costs. The system ensures that recycling and reuse of waste paper become an important and environmentally benign source of raw materials.

The next step for the project is to form a smart partnership with existing paper manufacturing companies that will utilise the bioenzymatic deinking system in recycling waste paper. Although the bioenzymatic approach is new in Malaysia, IBRL is confident that due to the increasing concern on the environment and together with enforcement from the government, the system will be widely adopted in the future.

Enzymatic deinking and flotation process

Awards and recognition

- the Gold Medal and the Special Henry Goh Environmental Innovation Award 2004 in the 15th International Invention, Innovation, Industrial Design and Technology Exhibition (ITEX) 2004, Kuala Lumpur, Malaysia (2004)
- the Gold Medal Award in the 33rd International Exhibition of Inventions New Techniques and Products, Geneva, Switzerland. (2005)
- the Gold Medal Award in the 19th International Invention, Innovation, Industrial Design and Technology Exhibition (ITEX) 2008, Kuala Lumpur, Malaysia (2008)
- the Gold Medal Award in BIOMALAYSIA 2008, Kuala Lumpur, Malaysia (2008)
- the Silver Medal and a Special Award of "IFIA ECO CUP" for the Best ECO invention in the 64th International Trade Fair "Ideas, Inventions, New Products" (IENA 2009), Nuremberg, Germany (2009)

The IBRL deinking project is an exemplary approach of how USM strives not only in doing the right thing, but also in doing it right. At USM, we transform the way we do things!

Biomaterials - changing lives through regenerative medicine

In response to the growing number of patients afflicted with traumatic and non-traumatic conditions, the USM Tissue Bank was established with the aim of improving and saving lives by promoting the safety, quality and availability of biomaterials. The country's only tissue bank, the USM Tissue Bank has been prolific in producing numerous biomaterials, such as freeze-dried bone allografts, amniotic membrane allografts and bovine bone xenografts, that are crucial in helping patients regain their health and in some cases, return to normal life.

The development of biomaterials is not a new area of science, having existed for more than half a century. Biomaterial science is a provocative field of science, having experienced a steady and strong growth over its history, with many companies investing large amounts of money into the development of new products.

Biomaterial applications and transplantations have become part of daily medical practice in Malaysia. However, medical professionals have been limited in their ability to find tissues and synthetic biomaterials for transplant patients because there is no facility or centre in Malaysia that provides biomaterials.

Biomaterial Research at USM

Research work on biomaterials started in the early 90s at the Tissue Bank in USM Health Campus. The initial work was on the development of amniotic membrane as wound dressing followed by the development of freeze-dried (demineralised) bone allografts.

The main purpose of the research was to develop safe, biocompatible, effective, readily available and economical biomaterials to treat diseased bones and wounds (Figure 1). This has lead to the preservation of the structure, function and aesthetic value of the human affected parts so that the disease is eradicated and the well-being of the subject is restored to health.

When bone is lost due to injury and/or disease, autogenous bone is the best grafting material as it contains the triggering factors necessary for bone formation in cases of bone defects.

The USM Tissue Bank has successfully produced several biological and synthetic biomaterials.

However, autografts have significant limitations, including donor site morbidity, inadequate amount and inappropriate form. Allografts have become alternatives to autografts. Nonetheless, allografts have disadvantages such as non-availability due to lack of donors. Therefore, many studies have been carried out in an attempt to find suitable substitutes for autogenous bone.

The USM Tissue Bank explored and conducted research on other natural resources such as bovine bone xenografts and natural corals that have close resemblances to human bones and subsequently developed halal good bone substitutes (Figure 2). With the advancement of science and technology, ceramics from these natural resources as bone substitutes have also been produced.

Collaborative synergy

Through efforts and intelligent collaboration between the Malaysian Nuclear Agency (now Nuclear Malaysia) and USM along with the International Atomic Energy Agency (IAEA), a project to develop a tissue bank for Malaysia was carried out in 1990.

This international project ran smoothly until mid-1991 when a group of pioneer researchers from Nuclear Malaysia and the USM Tissue Bank started the medical biotechnology-based research at the School of Medical Sciences, USM Health Campus. With the strong support of the Ministry of Science & Technology and Environment and the endless determination and commitment of the researchers, USM, Nuclear Malaysia and IAEA, the first processed tissue graft was produced and used on a patient for the first time in Malaysia in 1993.

Utilising state-of-the-art molecular biology, biotechnology knowledge and skills, the emphasis of the medical biotechnology-based research was to transform concepts to products. Biomaterial science encompasses elements of medicine, biology, chemistry, tissue engineering and material science. Thus, the development,

Figure 1: Bone graft suitable to treat bony defects

Figure 2: Bone substitutes and biological wound dressings produced by USM's Tissue Bank

Figure 3: Deep-frozen bone allograft

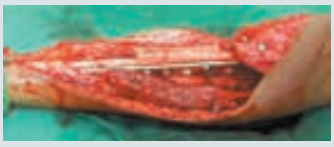


Figure 4: Bone grafting for the treatment of bone tumours

Figure 5: Freeze-dried human bones

design and testing of the biomaterials are interdisciplinary efforts involving scientists, engineers and physicians.

Pushing frontiers

Since its beginning, the USM Tissue Bank has been geared towards conducting research with sustainability and creativity as the focus when discovering new ideas and applications while being innovative in finding new and exciting uses for older theories and thoughts. Besides supplying deep-frozen allografts (Figure 3), the bank also provides processed tissue grafts and substitutes to repair and promote natural healing of human tissues. These biomaterials are biocompatible, inexpensive, easily available and can be stored at room temperature. In addition, the biomaterials are produced in a wide variety of shapes and sizes to meet many applications. They may be used alone as scaffolds or in combination with stem cells or differentiated cells and growth factors as in tissue engineering-based therapy.

Clearly, the economic and medical impact is very large. Treatment of damaged tissues (Figure 4) has improved both the quality and the length of life of many people. Today, implant procedures increasingly take into account not only pure functional but also aesthetic aspects.

As of today, over 40 government and private hospitals have received the services of the USM Tissue Bank. The tissue grafts have been used by medical specialists, surgeons in various fields and dental specialists to treat bone, skin and eye diseases. The bank distributes in excess of 15,000 grafts for more than 8,000 biomaterial applications and transplants performed in Malaysia.

In addition, halal xenografts are made available for medical applications as the bank processes halal bovine bone and pericardium. This is a valuable option to the imported biomaterials of non-halal bovine sources or of porcine origin xenografts.

The advancement of locally produced biomaterials by the USM Tissue Bank has encouraged progress in the field of biomaterials in all its aspects, including research, teaching and clinical applications, as well as has fostered related activities in a sustainable way.

The biomaterials

Today, being the only tissue bank in Malaysia, the USM Tissue Bank works together with the Ministry of Health in cadaveric human tissue procurement. Besides supplying deep-frozen allografts such as bone, tendon/ligament and skin, the bank produces other graft substitutes using various processing and preservation methods depending on the surgical disciplines to which they are directed. The biomaterials are sterilised by gamma irradiation at Nuclear Malaysia before they are used or transplanted into human beings.

- **Freeze-dried bone allografts**

In the process, the bones are demineralised followed by freeze drying. This demineralised bone matrix has osteoinductive capacity. The grafts are processed into various forms and sizes such as cancellous bone chips, cortical cortico-cancellous struts and cortical rings, to suit the surgeons' needs (Figure 5). These bone grafts are used mainly by the orthopaedic, plastic, maxillofacial and dental surgeons to correct bone defects or for bone augmentation.

Figure 6: Air-dried and glycerol preserved human amniotic membrane

Figure 7: Freeze-dried bovine bones

Figure 8: Lyophilised bovine pericardium

Figure 9: Corals as bone substitutes

- **Amniotic membrane allografts**

Amniotic membrane is produced by using the air-dried technique and is either glycerol preserved or glycerol cryopreserved (Figure 6). Wound coverings with amniotic tissue provide optimum physiological conditions for healing. The amniotic tissue adheres to the wounds to reduce pain and diminish infection, promoting reepithilisation. In addition, it allows exchange of water vapour and maintains an appropriate degree of humidity of the lesion to prevent dehydration.

Amniotic membrane is commonly used to treat open wounds including superficial burns (1st and 2nd degrees), diabetic ulcers, leprosy ulcers, post-traumatic wounds, skin graft donor sites and dermabrasions. In ophthalmic practices, it is used for corneal ulcer and ocular surface surgeries.

- **Bovine bone xenografts**

The halal bovine bones are demineralised and freeze dried. The grafts are processed into cancellous bone chips, cortical and cortico-cancellous struts, cortical rings and bone granules (Figure 7). The clinical application is similar to freeze-dried bone allografting. Ceramic bones have also been developed from the bovine source.

- **Bovine pericardium xenografts**

The halal bovine pericardium is freeze dried to provide ideal healing conditions after implantation. The membrane (Figure 8) is used in various oral surgical procedures, including guided tissue regeneration, to cover dura defects and as a wrapping material for hydroxyapatite implants in patients undergoing enucleation.

- **Corals as bone substitutes**

Corals made by marine invertebrates have skeletons with structures similar to human bones, with interconnecting porosity. The USM Tissue Bank produces coralline implants directly in calcium carbonate form and uses the hydrothermal process that converts calcium carbonate to hydroxyapatite (Figure 9).

Recognising the increasing use of tissue substitutes for transplants, the USM Tissue Bank wishes to uphold its leading position in biomaterial research and consolidate its presence by continuously making new regenerative therapies with innovative materials for practice and transplantation.

Forging ahead

Since the early 90s, the USM Tissue Bank has established a phenomenal record of developing safe and good quality biomaterials. As modern medicine finds newer and better uses for tissue substitutes to save and improve lives, the production of biologic alternatives that will enhance the functional capabilities of the graft substitute will continue to increase, as will the USM Tissue Bank's role in the development of ideal biomaterials and the creation of new carrier constructs that regenerate and restore the functional state.

The USM Tissue Bank is ISO 9001:2008 certified by SIRIM, however, it continues to upgrade the processing facility to comply with Good Manufacturing Practices. This ensures that the biomaterials gain worldwide acceptability.

Having gained eminence in global markets in recent years, the concept of halal products is being adopted by many countries. Halal is good not only for business but also in medicine. To USM, it is a form of social obligation that help boost patients' trust and confidence in biomaterial products. It provides tremendous export opportunities and although halal certification is not mandatory, those with this certification have a competitive advantage over other implant companies. Thus, the USM Tissue Bank is intent on getting our biomaterial products certified halal.

Culture immersion in action

Mobile learning to bridge the education divide

If the short message service (SMS) is a popular method of communication among the younger generation, why not use it for learning? The SMS has now become an indispensable communication medium, providing quick and cost-effective access to individuals anywhere and anytime. Consequently, the SMS offers an asynchronous form of communication with students, thus fostering a sense of connectivity between the lecturer and student and facilitating a supportive learning environment. Recognising the unique opportunity offered by the mobile technology, a group of researchers from the School of Distance Education, led by Professor Rozhan M. Idrus, has embarked on a research to investigate the potential of mobile technology in bridging the education divide among students and promoting life-long learning. Mobile technology is expected to complement other electronic learning (e-learning) resources. It is particularly beneficial to students in vocation as it will integrate learning in their everyday life within the limited time that they have hence, making learning less burdensome.

The idea for the project was inspired by the use of the mobile phone by the USM's School of Distance Education to alert and remind lecturers of videoconferencing-based classes for distance learners. The school has an in-house platform that sends an SMS to lecturers to remind them of their classes a day before, and again, a few hours before class begins. It was realised that the same technique can be used to reach distance learners and deliver content to them anytime, anywhere. It was initiated by Professor Rozhan and Dr. Issham Ismail from the School of Distance Education in the 2007/2008 academic session.

Pilot studies conducted on the use of the SMS to deliver learning materials to distance learning students can be summarised as follows:

- **M-Learning in Distance Education Physics Courses**

A Physics course was selected in a pilot study due to its highly structured and logic-based nature. Students of this course tend to study by making notes and breaking the content down into "chewable" pieces. This is akin to a short message. One short message can contain a complete definition of a certain phenomenon. As such, the subject lends itself very well to this SMS method. The course selected for the pilot study was the second year Physics optics course (JIF 212) taught in the 2007/2008 session to 17 students. The topic selected was "Dispersion", a topic that - according to the flow of the contents of the course - the students should normally be attending to in their self-study schedule.

One of the main thrusts of this project is to incorporate pacing by constructing the text message according to the sequence of topics in the learning materials. The students have been instructed to copy by hand each message into their note book to instil the habit of writing down facts and definitions as well as tips sent to them. More serious deliberations will be conducted via the forum in the electronic portal, the event being initiated via the SMS. This technique would lead to an optimisation of the forum and participation in discussions on relevant topics.

- **Acceptance of Mobile Learning via SMS in Distance Education, USM**

The study investigated whether mobile learning via the SMS was favourably accepted by the students enrolled in the distance learning academic programme in USM. The respondents consisted of 105 distance learning students, of 31 males and 74 females, ranging in age from 20 to above 50.

The study explored the impact of perceived usefulness, perceived ease of use and usability of the system. Results indicated that the usability of the system contributed to the effectiveness of the SMS in assisting students with their study.

Prior to the study, none of the participants had any experience in using the SMS in learning. The students volunteered to participate in the SMS-learning project in the second semester of the 2008/2009 academic session. The subjects that were included in this study were Financial Principles for second year students, Management and International Business for third year students as well as second year Mechanics and Optical Physics. In the Economics

discipline, the subjects involved were second year Money & Banking and third year Quantitative Economy.

The participants involved in this project had volunteered and agreed to use their own mobile phones. The students were permitted to use the SMS free of charge. The study was conducted for three months from February 2009 to April 2009, encompassing the related subjects in the semester. Students received learning materials via text messages once a day. Respondents in the study agreed that SMS-learning is easy, effective and useful to help them study. However, the results indicated that low interaction with lecturers could be a downside. Nevertheless, the study shows that students highly endorse this mode of communication and interaction in learning.

The study will be published in Issham Ismail, Rozhan Mohammed Idrus, Siti Sarah Mohd Johari (2010). "Acceptance on Mobile Learning via SMS: A Rasch Model Analysis," *International Journal of Interactive Mobile Technologies (iJIM)*, Vol. 4, No.2, pp. 10-16.

Bridging the education divide

The project is very much in line with the aspirations of the 9th Malaysia Plan which places an emphasis on human capital development to ensure the sustainable success of the country. The project can provide educational opportunities and equal access to education to all students including full-time learners and working adults. In addition, this project also contributes towards the growing recognition of the need to move towards lifelong learning as it focuses on formal, informal and non-formal learning by individuals through mobile-based learning programmes. This approach has the potential to impact individuals, groups and communities in the way the live, inform and educate themselves. Furthermore, this concept is also in tandem with USM's APEX status agenda of raising the bar in technology-enhanced learning through new forms of media and technology to enhance the learning experience.

This project recognises mobile learning as a unique element of education reform that will enhance our current educational environment. To university students, this project will allow them access to education via mobile phones anywhere and anytime, and in the most efficient manner as the SMS is the most affordable medium of communication in Malaysia.

The mobile learning platform enables organisations or institutions to securely deliver courses, surveys, assessments, podcasts and videos to handheld devices. The platform enables full progress tracking and reporting on all contents. In addition, it can be deployed as "standalone" or fully integrated with an organisation's learning management system, human resource or enterprise resource planning system and is available online or offline for maximum accessibility as long as the users have access to mobile phones.

In the pilot stage, the project subscribed to the Nanozone Web Control Panel (WCP) utilising the SMS notification system for a one-way message delivery to the students. Weekly segments of content-rich SMSes are loaded onto the system for a scheduled delivery over the period of the study. An in-house interactive system is currently being developed for a multi-application construct in the scalable mobile learning mode.

The work gained recognition when the paper entitled "Development of SMS Mobile Technology for MLearning for Distance Learners", published in the *Malaysian Journal of Educational Technology*, Vol. 8, No.1, pp. 33-41, was chosen as a recipient of the the Asia Pacific Mobile Learning & Edutainment Advisory Panel (APACMLEAP) Mobile Learning Initiatives Recognition 2009. The role of APACMLEAP is to bring together all agencies, both in the public and private sectors, so that they can develop the field of new media technology through inventions and innovations, thereby enabling it to grow more holistically.

Texting forward

Efforts to extend mobile learning into a wider combination of various disciplines involving information technology (IT), linguistics, education, education technology as well as communication is now on the way. The project aims to utilise the easiest and the cheapest technology, the SMS, at the initial stage to disseminate information and knowledge to students. This process involved the development of the IT system, the proficiency in language to broadcast the knowledge and information to students and to monitor how well the students interact and adopt the technology in their routine communication apart from conventional learning.

The research will also contribute towards the mobile learning applications as it will involve different areas and fields such as Islamic knowledge, special education, environmental issues to secondary schools science courses. In addition, the research will also look into the possibility of using advances in mobile technology and its integration with digital network systems in mapping environmental issues. In this part of the study, waste rangers will be recruited among schoolchildren to record indiscriminate waste disposal occurrences and communicate using SMSes from their handphones to the m-technology enhanced digital network.

In all, the research team believes that the use of the SMS as an innovative learning tool to share knowledge will pave way for greater collaborative ventures among teachers, learners and all related institutions.

WINNER of the Asia Pacific Mobile Learning & Edutainment Advisory Panel (APACMLEAP) Mobile Learning Initiatives Recognition 2009 for Universiti Sains Malaysia.

River of life - River Engineering and Urban Drainage Research Centre (REDAC)

Rivers are often taken for granted in modern living - until they run wild. Yet, rivers and drainage are an essential part of modern life, without which civilisations will falter as exemplified in Angkor Wat. Urbanisation, industrialisation and population growth are increasingly stretching the capacity of rivers and our drainage systems in sustaining the immediate biosphere. It is crucial therefore that sustainability becomes an integral part of any development project.

The River Engineering and Urban Drainage Research Centre (REDAC), at the Engineering Campus USM, was established on 31 May 2001 to engage in research and consultancy projects in urban drainage management. The REDAC research and development scope is in the fields of river management, urban drainage management, hydro informatics and environmental hydraulics management. The objectives of the research activities conducted at REDAC are:

- To accelerate the realisation of urban drainage metamorphosis in order to transform the quality of life in urban areas
- To conduct holistic research and develop new technologies in river engineering and urban drainage
- To become a Centre of Excellence in River Engineering and Urban Drainage for engineers and scientists from Malaysia and the South East Asian region
- To promote research networks and international cooperation in river engineering and urban drainage research

One of REDAC's key achievements is an ecologically sustainable solution to the flooding and pollution problems using the "control at source" approach known as Bio-Ecological Drainage Systems (BIOECODS). BIOECODS is unique in the field of stormwater management and innovative urban development because it emphasises the importance of a holistic approach to environmental engineering, landscape architecture and development. Presently, the project has become a model for the development of new urban areas. The simultaneous implementation of several components of BIOECODS meets the new concept of the Stormwater Management Manual for Malaysia (MSMA) in managing and controlling stormwater runoff quantitively and qualitively at its source.

BIOECODS attempts to provide solutions to three major problems commonly encountered in Malaysia, namely, flash floods, river pollution and water scarcity during dry periods. Due to its novel approach in stormwater management in Malaysia, REDAC has received visitors from local and international agencies and universities thus affirming the BIOECODS status as a "World Class Research Programme" certified by the USM Vice-Chancellor's Advisory Committee in November 2001.

REDAC continuously strives to expand knowledge in river and drainage management. Currently, it offers postgraduate studies in specialised areas of urban drainage management, river management, hydro informatics and environmental hydraulics management. REDAC also organises seminars from time to time such as the seminar on the MSMA guidelines and another on erosion and sediment control.

River of life is a fitting description of REDAC. Since its inception in 2001, REDAC has provided a turning point to various communities in crisis with their river or drainage systems such as those in Tanah Merah, Sarawak and residences along several rivers in Peninsular Malaysia (see related articles on page 168 to 171). As with all the positive endeavours of REDAC, the sustainable river and drainage systems are always at the heart of its activities.

The River Inventory and Monitoring Programme (RIMP)

Funder/Client: Sarawak Rivers Board (SRB)
Status: Completed
Duration: December 2008 - November 2009

Rivers in Sarawak are appreciated for their natural features and abundant resources, including sand, water, food, for transportation, fisheries resources, wildlife and also aquatic and biotic biodiversity, tourism, recreation and increasingly, for their aesthetic values. The utilisation of river banks and riparian areas is necessary for the economic development of the state. Along many rivers in Sarawak, the timber and wood based industries, ship building, sand mining, food processing, agriculture products processing, need the river for transportation, water and other needs. However, these industries together with water from households and food outlets (e.g., markets, food centres, restaurants) introduce pollutants into the rivers and need to be monitored and regulated in order to control pollution.

With the inception of the Sarawak Rivers Board (SRB) in 1993, 35 rivers have been gazetted under the Sarawak Rivers Ordinance, 1993. The ordinance and accompanying regulations provide the guidelines for riverine transport systems, abstraction of natural resources, usage of the riparian and river bank reserves and prevention of river pollution from various sources like vessels, ship wreckages and river bank industries.

While the activities in and along the rivers are crucial for the development of the state, regulatory efforts to attain safe and clean waterways shall not stifle the economic development planned for the objective of attaining a developed country status by the year 2020. A holistic and pragmatic method is necessary for conserving and protecting the streams, rivers and the river banks. This is in alignment with the fourth trust of the Ninth Malaysia Plan: to improve the standard and sustainability of the quality of life for riverine communities within the state of Sarawak.

The River Inventory and Monitoring Programme (RIMP) that was carried out resulted in a depository of riverine information and a clearing house whereby the public can seek information and data on Sarawak's rivers. The river inventory facilitates the remuneration and monitoring of main riverine activities, the river profiles and morphology for the rivers included in the RIMP. The scope of the RIMP will include the set-up of a River Information Centre whereby the programme will be developed and linked with various systems such as continuous flood warning and telemetry systems, river hydrology and morphology, water quality surveillance systems, models of river improvement projects and river basin management and riparian auditing proposals. The objectives of the study were:

- To provide information on waterway traffic for passengers, cargo and cruising vessels
- To monitor and utilise facilities as accident prevention of river traffic and to provide information on waterway traffic accidents
- To prevent and reduce river polluting activities along Sungai Sarawak such as illegal dumping and other river related offences as provided in the Sarawak Rivers Ordinance, 1993
- To create a river profile for Sungai Sarawak for navigational and sediment control and connect it with a digital network at the SRB headquarters in Kuching
- To develop a network for advance warning in emergencies such as information on water levels and flood warnings

MoU signed between Sarawak Rivers Board (SRB) and USAINS Holding Sdn. Bhd.

Sg. Sarawak along the Kuching riverfront

Study on the River Sand Mining Capacity in Malaysia

Funder/Client: Department of Irrigation and Drainage (DID) Malaysia
Status: Completed
Duration: September 2007 - December 2009

In recent years, sand mining activities in Malaysian rivers have created several issues that need urgent attention. Among them are the deterioration of the river water quality, bank erosions, river bed degradation and buffer zone encroachment. These problems are mainly due to excessive sand extraction along river stretches. Typically, the pace of development without proper land use planning and management tools will result in tremendous pressure to obtain sand as a main component for the construction industry. Accordingly, as common practice, river sand mining is always considered a source of renewable resources. The Department of Irrigation and Drainage (DID) has to be prepared with the planning and management tools as well as the resources to systematically deal with these problems.

The study by REDAC covered three rivers, namely, Sungai Muda, Sungai Langat and Sungai Kurau that have different levels of sand mining activities. Sungai Muda has a long history of this activity along the upper reach. Sungai Langat has recently been a major source of sand for the construction development of Putrajaya. Fewer activities of sand mining are ongoing in Sungai Kurau at the upstream of the Bukit Merah reservoir.

The objective of the study was to develop a sand mining planning and management tool such that the DID would be able to make effective and timely decisions on sand mining applications and operations based on the following:

- To assess the current state of river morphology based on on-site data and determine the capacity of the rivers to act as a natural conveyance to carry both water and sediment
- To carry out hydraulic/sediment transport modelling studies incorporating both the rivers and their capacity to sustain sediment extraction according to the sediment balance within the catchment
- To formulate a long-term solution encompassing sand mining envelopes along the river stretches in terms of both river morphology and hydraulic/sediment transport modelling

Guidelines on river sand mining management were included in this study, emphasising the impacts of sand mining and several recommendations for sustainable sand extractions were forwarded including discussions on appropriate extraction methods and sites adopted from overseas experiences.

Flood plain mining is also proposed as an alternative to in-stream mining. Finally, the geographical information system (GIS) was utilised for the study for the development of the river register database.

A sand mining pit

A river morphology study

The Stormwater Management And Master Plan Study For The Town Of Tanah Merah, Kelantan

Funder/Client: Department of Irrigation and Drainage (DID) Malaysia
Status: Ongoing (90% progress)
Duration: August 2007 - June 2010

Tanah Merah town is located in the district of Tanah Merah with a total catchment of 64 km square. It is the second largest town in the state of Kelantan experiencing rapid growth and development. The town is situated on the west bank of Kelantan River with the railway line running across the middle of the town. The lack of a proper drainage system has led to floods in several areas during heavy rainstorms. The situation becomes even worse during the monsoon season when the overflow from Sungai Kelantan backflows into the lowland areas through several streams in Tanah Merah.

Therefore, a drainage and stormwater management master plan for the area of town Tanah Merah are needed to address these flooding problems. In Tanah Merah, REDAC has engaged in a study to minimise the impact of urbanisation on the stormwater environment and to strike a balance between social, economic and environmental concerns to achieve sustainable development. To achieve this, the study shall meet the specific objectives of urban stormwater management as follows:

- To formulate a long-term solution for stormwater related problems in existing built-up areas in order to reduce the adverse effects of flooding on people and property by the implementation of an integrated stormwater management plan
- To protect and enhance the natural water-dependent ecosystems and enhance community access to, and enjoyment of, water environments and to protect and maintain river environments to a high environmental and aesthetic quality while promoting sustainable recreational opportunities, community health, aesthetics amenities and a healthy environment

Presently, the study is near its completion with the finalisation of all analyses to formulate feasible solutions to the client.






The existing drainage system

The field works

Preparation of Design Guides for Erosion and Sediment Control in Malaysia

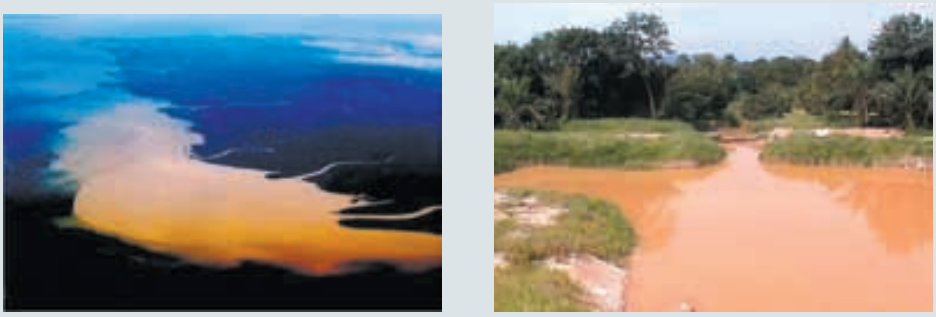
Funder/Client: Department of Irrigation and Drainage (DID) Malaysia
Status: Ongoing (80% progress)
Duration: September 2008 - July 2010

The estimation of the sediment yield for a specific site is vital for the design of sediment basins and other erosion control Best Management Practices (BMPs) at construction sites in Malaysia. Our heavy tropical rainfall and highly weathered soils, which are also highly erodible, have resulted in the severe sedimentation of rivers throughout the country as a result of extensive land clearing for construction purposes. Malaysia cannot prevent the occurrences of erosion and sedimentation problems as many parts of the country are experiencing rapid developments, such as land clearing for housing, logging and agriculture. While these activities are necessary for the development of the country, regulatory efforts to minimise erosion and sedimentation problems should not stifle the economic planning towards the objective of attaining a developed country status by the year 2020.

Erosion and sediment control (ESC) has become a popular topic in recent years, especially among developed countries, such as USA and UK, which have developed their own ESC procedures, guidelines and manuals. Generally, these manuals have similar objectives which are to monitor and reduce erosion and sediment problems at construction sites and new developing areas, with minor differences to cater to the requirements of the rules and regulations of each country. At present, the available data in Malaysia do not enable proper checks to be carried out on the suitability of the measures proposed to control erosion and sedimentation. Therefore, the country needs a standard procedure to derive sediment yields which will enable engineers planning earth works and inspections to implement routine BMPs for the future. The objectives of the study are:

- To enable engineers and planners to have access to a single standard procedure to calculate erosion and sedimentation rates at any site in the country, primarily for the purpose of controlling erosion and sedimentation during the earth works stage of construction
- To enable engineers to have expertise in designing control structures like sediment traps and basins using available historical records of rainfall for Peninsular Malaysia and soil series/type data

Large-scale earth works without erosion control BMPs



Sedimentation of waterways and coastal areas

The underground eco-drain system pioneered at the USM Engineering Campus

From waste to wealth: a new composite

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01 Most polystyrene will find its way into landfill sites
02 Dr. Issam Ahmed Mohammed explaining his product to USM Deputy Vice-Chancellor (Academic & International Affairs) Prof. Ahmad Shukri Mustapa Kamal and the Deputy Dean of the School of Industrial Technology Prof. Azhar Mat Easa

Polystyrene is a high molecular weight polymer prepared from styrene, a liquid hydrocarbon that is commercially manufactured from petroleum by the chemical industry. It is a clear, solid plastic that softens at about 85°C (185°F). Furthermore, polystyrene foam, commonly known as styrofoam, can be categorised as expanded polystyrene (EPS) and extruded polystyrene (XPS).

Polystyrene has been mainly used in our daily life as packaging material for over 50 years due to its properties, such as impact resistance, ability to be shaped and thermal insulating, which make it ideal to protect thousands of different products. Polystyrene plays an important role in packaging especially food packaging.

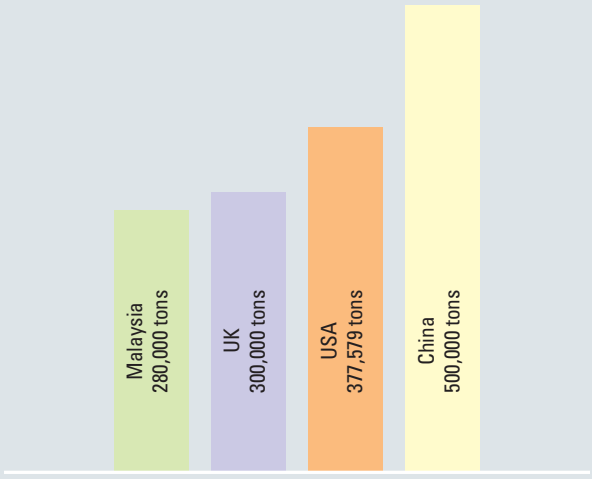
Apart from this, it protects valuable goods without adding significant weight and is an excellent low-cost and sanitary material for service packaging. Petri dishes and other containers such as test tubes, made of polystyrene, play an important role in biomedical research and science.

Polystyrene recycling

Recycling of waste polystyrene has been a topic of interest in the fields of environmental science and technology for some time. It is conservatively estimated that well over 280,000 tons of waste polystyrene are produced annually in Malaysia.

The question is what happens to all this packaging once the goods it protects have been delivered? Although some companies have a recycling policy for this material if they use large amounts, most polystyrene will, unfortunately, find its way into landfill sites around the world.

Once waste polystyrene is put into a mixed skip, it may be contaminated by other materials which makes recycling difficult or impossible. In the case of fish merchants and at supermarkets, the polystyrene boxes used will be contaminated with organic waste (such as blood) which may make them even more difficult to dispose of. After collection, these boxes usually end up in landfill sites where they occupy a significant volume of space and because of their lack of weight, they can be blown around and cause a nuisance to the surrounding areas.



Estimates of polystyrene produced annually

Recycling is one of the common, simple and economical processes for waste management. However, polystyrene presents a problem in degradation as well as in recycling. Degradation takes hundred of years due to the hydrophobic nature of the polystyrene. In the case of recycling, there are limitations as some of the polystyrene contain flame retardant material.

Several countries such as USA, UK, Australia, Japan and China have been making efforts to solve this problem. In USA, UK and Australia, the polystyrene is compacted by using special machines, while in Japan, attempts are being made to convert waste polystyrene into a polymer flocculant for treating wastewater.

Chinese and Japanese recover styrene monomers from waste polystyrene by supercritical solvents. Furthermore, the Styromelt machine from USA essentially melts styrofoam to form a dense block of material that is reduced in volume by over 95% of the original material. Among the techniques proposed for the recycling of waste polystyrene, the method with the most potential is chemical recycling as used in our technique.

Invention on waste polystyrene

The recycling of waste polystyrene to useful materials at a cheaper cost and via a simpler route help more countries to dispose and to convert polystyrene into value-added products - hence, "waste to wealth".

In this invention, Dr. Issam Ahmed Mohammed, Associate Professor Abdul Khalil Shawkataly and postgraduate student Putri Mur Syazwani binti Azizan, USM used a new technique of recycling by converting the waste polystyrene to a new resin. The research was carried out between September 2008 to August 2009.

The new resin is applied as a matrix material reinforced with oil palm empty fruit bunch (EFB) fibre to produce new composite materials. Excellent adhesion between the polystyrene resin and the EFB fibre exhibited promising results on tensile, flexural and impact properties. In addition, the new composite materials are low weight, have low water uptake and can be customised, for instance, for furniture making.

The new product exhibits excellent adhesion, physical and mechanical properties when applied to different materials, such as glass, wood, plastic and cardboard. It is the outcome of converting waste styrofoam to a new resin and applying it as a matrix reinforced with oil palm EFB fibre to produce a new composite material.

This invention of converting waste polystyrene to a new adhesive as well as a new composite will lead to the sustainability of the environment and of national industries to improve their products, thus generating more profitability.

Since polystyrene is pervasive in our society and is not biodegradable, this invention can protect the environment by converting polystyrene into value-added products. The merits of this invention are the following:

- **as adhesive** - low cost with excellent properties, low energy of production, cleaner and fresh environment and a solution to solid waste treatment
- **as composite** - light weight, excellent properties, low cost and can be customised (able to be shaped)

The way forward

The research team is currently exploring ways to prepare a new fire retardant composite using the new adhesive which may be used to prepare the composites by using other fibres such as kenaf.

Nanotechnology: a big future for the small world!

Nanotechnology is the sixth truly revolutionary technology introduced in the modern world following the Industrial Revolution of the mid-1700s, the Nuclear Energy Revolution of the 1940s, the Green Revolution of the 1960s, the Information Revolution of the 1980s and the Bio Technology Revolution of the 1990s. Nanotechnology offers the tools to control the production of materials and the function of devices at the atomic and molecular level. With this level of control, the possibilities of creating new materials and new devices are limitless.

In sync with the current advancements in technology, three research groups at USM have been exploring the boundless possibilities of nanotechnology. Advances in nanotechnology have led to the discovery of many new materials and inventions of novel applications. For example, the Carbon Nanotube Research Group, led by Professor Abdul Rahman Mohamed, has had a major breakthrough in methane catalytic vapour deposition (CVD) technology thus placing USM at the forefront of nanoscience and nanotechnology. Another group of researchers from the USM's School of Dental Sciences has invented NanoSeal Plus, the world's first endodontic or root canal sealer treatment using nanotechnology. At USM's Institute for Research in Molecular Medicine (INFORMM), a group called NanoBiotechnology Research and Innovation (NanoBRI) is focusing its energy on the design and development of nanoparticles, nanocolloids, reagents design, drugs and molecules carrier design and development, cellular imaging and diagnostic platforms. Unlike the rest of us, these researchers are unperturbed to be accused of living in a small world. The small world that they live in promises a big future to the rest of us.

Carbon nanotube technology

The Carbon Nanotube Research Group focuses on the technology to produce carbon nanotubes (CNTs) on a large scale and CNT applied products. CNTs have emerged as one of the most important components of nanotechnology. These tiny tubes have diameters as small as to 0.4 nm, while their lengths can extend up to a million times their diameter. CNTs have been said to be the most innovative materials of the 21st century due to their extraordinary properties and their enormous potential applications. Most fascinating is the fact that nanotubes could either be semiconducting or metallic depending on their structural orientation. In addition, CNTs are lighter than aluminum and 25 times stronger than steel alloys. CNTs can carry electric current 1,000 times better than that of copper and have a heat transmission of 1.8 times better than that of the diamond. Furthermore, CNTs can resist the thermal decomposition up to 2,800°C in vacuum and can be bent at a large angle without damage.

The unique structure and properties of CNTs have seen a wide range of potential applications in advanced technologies. New applications for these amazing nanotubes are being reported daily in electronics, chemistry, optics and biology. In this regard, their potential applications include the usage in flat panel displays, rechargeable batteries, memory chips, structural reinforcements, biomedical applications, supercapacitors and hydrogen storage. The total market value of the applied products of CNTs is estimated to be more than US$ 350 billion per year.

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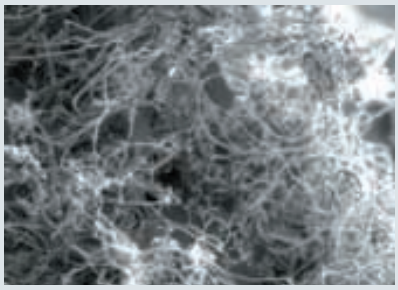

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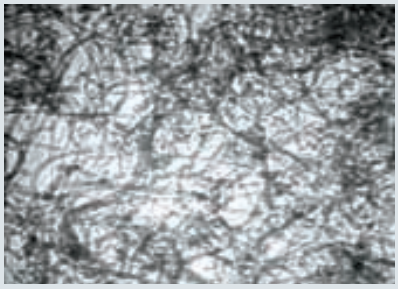

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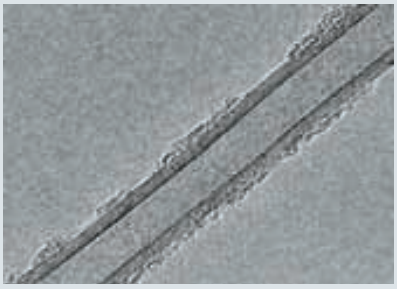

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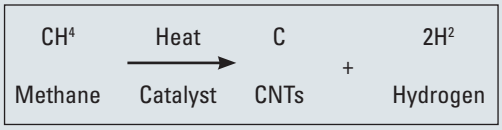
01 Batch type CNT production rigs
02 A rotary horizontal reactor installed in USM-MTDC funded laboratory
03 SEM image of CNTs
04 A low magnification TEM image shows dense as-produced CNTs
05 A high resolution TEM image shows the high graphitisation of the CNT wall structures

Central to the research strategy in USM is the idea that advancements in nanoscience and nanotechnology should be driven by innovations and applications. New materials synthesised by rational approaches are regarded as the key for success. Yet to be useful, these nanomaterials must be assembled and processed into complex and functional architectural elements that can be further assembled into applications and devices. As such, significant effort has been placed in developing a technology to produce CNTs on a large scale and to work on the development of CNT applied products. The group focuses on developing ultra-precise growth control at different length scales, morphology, size and structure because these will define and enable control over the physical and chemical properties of CNTs.

One of the group's core technologies is methane catalytic vapour deposition (CVD), an approach that the group has developed since 2001. It was found that the addition of a small and controlled amount of catalyst/support to the synthetic ambient dramatically increases the growth yield of CNTs. The finding represents a major breakthrough in the CNT field, simultaneously addressing many critical problems, such as scalability, purity and cost that have plagued the use of CNTs for real applications and opens up new opportunities ranging from biology to nanodevice and optical applications. Currently, the Carbon Nanotube Research Group is working on various projects that take advantage of controlled growth to develop exciting new research and application frontiers, as well as projects that pursue the ultimate syntheses that will grow CNTs with completely defined structures.

The technology of methane CVD involves a low cost process that utilises a specially designed catalyst as an enhancement agent to decompose methane gas, the primary composition of natural gas, into CNTs and hydrogen. The technology can be easily scaled up to produce CNTs in a bulk quantity. It is important to note that only a specifically designed catalyst is efficient in enhancing the formation of CNTs in this process. The carbon atoms, decomposed from methane gas, will deposit on the active site of a specially designed catalyst and self-assemble to form tubular carbon nanostructure, which are the CNTs.



The advantages of this process are listed as follows:

- provides a single-step process solution
- utilises cheaper and abundant methane gas as feedstock
- operates at atmospheric condition, which is more cost effective

- controllable/selective growth of CNTs
- produces hydrogen as a by-product, which in itself is of high value and is environmentally friendly
- can be operated by a single operator
- the technology is scalable to any production size
- low cost of production

In the intensely competitive CNT synthesis race, faster and more powerful technologies in addition to intellectual capital are imperative to maintain leadership. As the synthesis is central to the whole effort of the group, the group has developed several generations of controlled methane CVD systems that can grow samples and implement any sophisticated synthesis process. A dedicated research laboratory has been installed with four CVD systems designed for various purposes. With a full-automatic furnace, one can run 12 CVDs a day at a maximum, during which time one can focus on other aspects of research. Recently, the group also designed and fabricated a rotary production system that enables the production of CNTs continuously via methane CVD at a capacity of 1,000 kg/year. These advanced systems have been developed to significantly accelerate research while simultaneously enabling highly reproducible and precisely-controlled growth.

Mass production is a key factor in establishing a CNT industry. For CNTs to become a widely used industrial material, the cost must be reduced to the level of classic carbons, such as activated carbon or carbon fibres. This translates to a 100-fold to 1000-fold reduction in production cost in the future. The Carbon Nanotube Research Group has already solved this problem by using methane as the carbon source. The group is committed to, and actively engaged in, developing new approaches for the mass production of economical, pure and high quality CNTs based on controlled growth.

- **CNT applications**

The simple and cost effective process to produce CNTs at a large scale developed by the Carbon Nanotube Research Group has significantly reduced the price of CNTs. Consequently, it is expected to encourage the development of CNT applications that can be tagged at a more competitive price in the market. The technology developed by the group has been filed for patent and quoted in Frost & Sullivan's 2007 market survey report.

> *"Abdul Rahman Mohamed and his research group at the School of Chemical Engineering, Engineering Campus, Universiti Sains Malaysia, have synthesized CNTs and carbon nanofibers over supported-NiO catalysts by catalytic decomposition of methane at 550 degree C and 700 degree C. The researches characterized the catalytic activity by the conversion levels of methane and the amount of carbon accumulated on the catalysts. The researches then found the selectivity of CNTs and carbon nanofiber formation using transmission electron microscopy (TEM)."* - Frost & Sullivan: Carbon Nanotubes - Road to Commercialization.

The wide range of potential commercial applications of CNTs promises great commercial value for the invention by the Carbon Nanotube Research Group. Industry enthusiasts believe that CNTs will radically improve the performance of tiny sensors, electronic and optical devices, catalysts, batteries, fuel cells, solar cells and drug delivery vehicles. Owing to the huge applications of CNTs, the global market for nanotubes in 2002 has recorded approximately US$ 12 million. The global demand for CNTs is estimated at US$ 40 billion in 2020. The versatility of CNTs scales up their demand, pegging them at the current market price range from US$ 100 to US$ 2000 per gramme, depending on their purity and types. CNTs have an amazingly wide range of applications and these applications boost the electronic, chemical, mechanical, material, pharmaceutical and medical industries, with the revolutionary changes arising in these areas. Therefore, CNTs promise mankind a higher standard of living, better quality of life and healthier and richer lifestyles. In addition, hydrogen is produced as a side product of the methane CVD technology and hydrogen has been recognised as a future source of energy and is widely needed in the chemical and petrochemical industries.

- **The way forward**

For the past 10 years that the Carbon Nanotube Research Group has been researching on CNT synthesis, it has filed patents in multiple countries on the process and catalyst to produce CNTs. Marching forward, the group is now intent to commercialise the innovative production technology and market CNT products. To that end, a new company will be established as a subsidiary under Sanggar SAINS Sdn. Bhd. The company has the following visions:

- establishing its own production with wholesale/retail distributions
- contract manufacturing of high-value CNTs
- licensing technology to a current CNT manufacturer
- partnership/joint venture with a methane-producing company for large-scale production of CNTs
- partnership/joint ventures with companies interested in specific application areas

NanoSeal Plus - root canal sealer treatment using nanotechnology

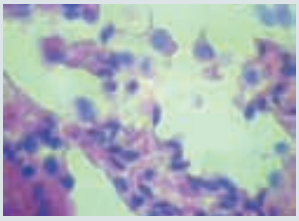
USM researchers at the School of Dental Sciences have invented NanoSeal Plus, the world's first endodontic or root canal sealer treatment using nanotechnology. NanoSeal Plus can greatly increase the success rates of root canal treatments and allow patients to keep their teeth. It is yet another example of how USM has successfully transformed a research discovery into an innovation that ensures the sustainability of the quality of life and one that can compete in the global market. From the economic point of view, the innovation is expected to generate new industries and consolidate existing industries in Malaysia. Additionally, NanoSeal Plus will reduce the dependence of Malaysian dentists on imported dental materials.

The three-year effort by the Nanoseal Plus research team resulted in a nanohybrid endodontic material suitable for root canal treatments. The sealar, developed using a simple and inexpensive technique, has a structure similar to the tooth. In root canal treatments, the pathologic pulp is removed from the root canal system. The canal is then cleaned, disinfected and obturated with root canal filling materials to prevent re-infection. The root canal filling materials are divided into the core material (gutta percha points) and root canal sealers. The functions of the sealers are to cement the core materials into the canal and to fill the discrepancies between the canal wall and core materials. A properly sealed canal will prevent bacteria from the mouth getting into the canal and infecting the tissue at the root of the tooth. The sealers also act as a lubricant to enhance the positioning of the core filling materials. Finally, the tooth will be restored to maintain its shape and function. Root canal treatments preserves teeth so that they continue to function and thus, the extraction of the affected teeth can be avoided.

The nano hybrid material is biocompatible, improves apical healing and produces hermetic apical seals. The material contains nanofillers that are more reactive and give better adaption of sealers to the tooth structures compared to other sealers in the market. Their similarity to the structure of dentine and/or enamel prevents leakage after treatment. The silica nano particle fillers are produced using the sol-gel process (10nm in size). These particles strengthen the physical properties of nano hybrid sealers and also fill the space between nano HA particles to prevent matrix from producing voids in the sealers.

- **The way forward**

NanoSeal Plus is now being patented under the guidance of the Innovation Office, USM. The third draft of the patent has been submitted and waiting for the next patent status. Prodental Sdn. Bhd. in Kuala Lumpur has agreed to produce and sell NanoSeal Plus to the domestic and export market; once the patent is received. The research team is currently working on the next product, a root canal sealer that can be injected into the root canal without the use of the gutta percha. The sealer uses resin and can be set chemically inside the canal.



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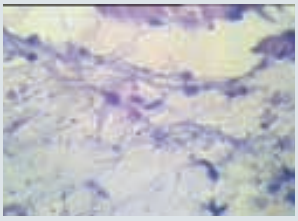

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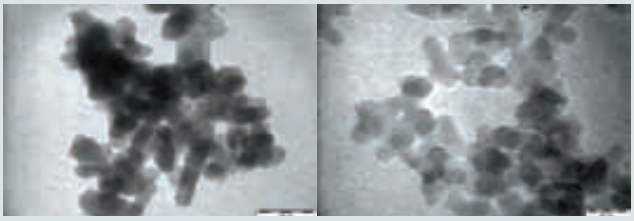

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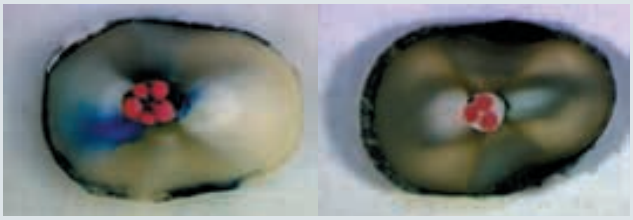

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06 Nano hybrid particles were synthesised at USM's School of Dental Sciences by the wet chemical method using calcium hydroxide $Ca(OH)^2$ and phosphoric acid (H^3PO^4) as Ca and P precursors, respectively

07 Subcutaneous area of mice on first week of evaluation at 400x of magnification, showed increases of lymphocytes and decreases of inflammatory cells

08 Subcutaneous area of mice on second week of evaluation at 400x of magnification. No inflammatory cells detected

09 The TEM micrograph of nano structured HA. The HA nano crystals were found to be rod-like with the size of 40 to 60 nm (left). The nano silica particles, 10 nm in size (right)

10 Root specimens showing dye penetration (left) filled with a commonly used sealer [AH 26] and no dye penetration (right) filled with NanoSeal Plus

NanoBiotechnology for Biomedical Applications

NanoBiotechnology Research and Innovation (NanoBRI), a multidisciplinary research team at USM's Institute for Research in Molecular Medicine (INFORMM), is formed subsequent to the signing of the Sub-License Agreement for Advancement of Nanotechnology between Universiti Sains Malaysia (USM) and BiotechCorp on 25 July 2008. Malaysian Biotechnology Corporation (BiotechCorp) has acquired an exclusive, global license from Nanobiotix S.A. Paris France for the manufacture of nanoparticles and development of related applications such as Drug Delivery Systems and Diagnostics for non-oncology applications.

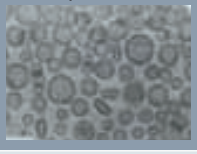
Three principal researchers from multidiciplinary backgrounds; Dr. Khairunisak Abdul Razak (School of Materials and Mineral Resources Engineering), Associate Professor Azlan Abdul Aziz and Associate Professor Shaharum Shamsuddin have taken up residence at Nanobiotix from September 2008-August 2009 to undergo a technology transfer training. In consideration for the training, USM is to develop a minimum of two new applications or products of substantial commercial value per year for a period of 4 years. Progress on products development is monitored by the Steering Committee composed of representatives from USM, BiotechCorp and Nanobiotix.

At NanoBRI, dedicated laboratories have been developed equipped with state-of-the-art facilities with funding from USM. The facilities include a nanomaterials synthesis laboratory, a nanomaterials characterisation laboratory, cell culture facilities, a dark room equipped with inverted fluorescence microscope facilities and a biological laboratory. NanoBRI focuses on the design and synthesis of multifunctional inorganic nanoparticles for the various molecular medicine and other biotechnology applications.

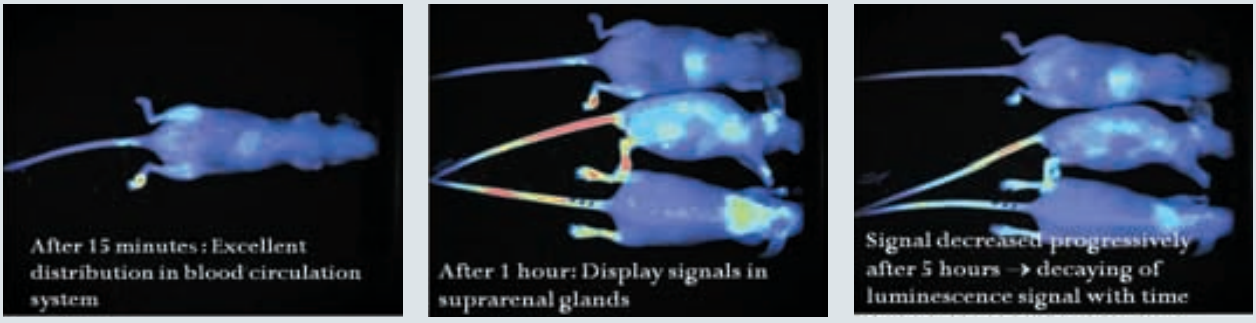
- **The research thrusts**

In essence, the research thrusts at NanoBRI are in the design and development of nanoparticles, nanocolloids, reagents design, drugs and molecules carrier design and development, cellular imaging and diagnostic platforms. To date, NanoBRI has the ability to produce at least four types of nanoparticles: NanoSilica, NanoMagnetic, NanoGold and Liposomes with potential applications in biomedical, agriculture and energy production.

Table 1: Potential applications of designed nanoparticles.

Nanoparticles	Potential applications
NanoSilica 	• Drug delivery system (DDS) • Molecules carrier
NanoMag 	• Therapy - DDS, hyperthermia, radio therapy combined with MRI etc. • Diagnosis - MRI, sensing, cell sorting, bioseparation, enzyme immobilisation, immunoassays, transfection, purification.
NanoGold 	• Immunosensors, X-ray contrast agent, DNA-AuNPs assemblies and sensors, AuNP enhanced immunosensing, AuNP sugar sensors, AuNPs bioconjugates (peptides, lipids, enzymes, drugs and viruses) and AuNP biosynthesis.
Liposomes 	• Biomedical field - DDS, protection against enzymatic degradation of drugs, drug targeting, gene transfer. • Food and nonfood applications - e.g., nutrient encapsulation & delivery, functional components encapsulation (proteins and enzymes, flavours, antimicrobials).

11 Laboratories at NanoBRI



12 Biodistribution in vivo of DDS with varying time

NanoBRI researchers have already started two research projects based on the transfer of technology.

- *Use in TB*

The first project is on a drug delivery system (DDS) for the treatment of tuberculosis based on silica nanocarriers. A conventional DDS for tuberculosis (TB) has major drawbacks including limited solubility, poor distribution, degradation in biological medium, lack of selectivity, unfavourable pharmacokinetics and accidental damage on healthy tissue.

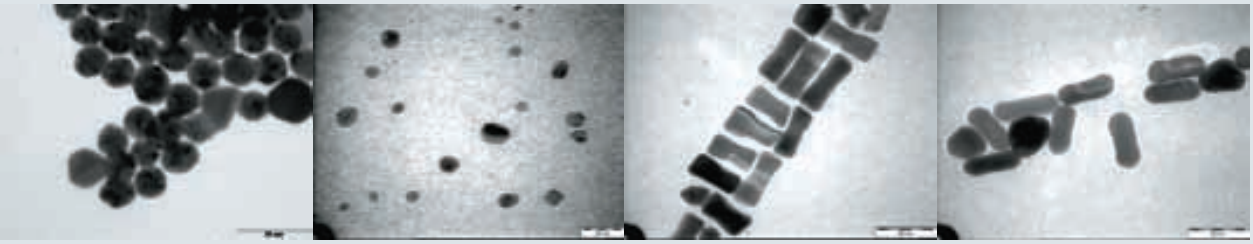
Adaption of nanotechnology in a DDS has advantages of improving delivery of poorly water-soluble drugs, allowing targeted delivery of drugs in a cell or tissue in a specific manner, permiting transcytosis of drugs across tight epithelial and endothelial barriers, enhancing delivery of large macromolecule drugs to intracellular sites of action, co-delivery of two or more drugs or therapeutic modality for combination therapy, allowing visualisation of sites of drug delivery by combining therapeutic agents with imaging modalities and improved real time read on the in vivo efficacy of a therapeutic agent.

NanoBRI has the capability to tune the size of a silica DDS by changing synthesis parameters from 18 nm to 150 nm. Physical and chemical analysis shows that nanocarriers in the range of 40-60 nm are promising for a DDS for TB. The DDS for TB developed has been tested for cytotoxicity in vitro and in vivo shows acceptable cytotoxicity. Preliminary toxicity and biodistribution in vivo of two sizes of drugs have been studied using SWISS nude mice using 50 nm and 80 nm nanocarriers. Toxicity in vivo shows no sign of toxicity on SWISS mice after 11 days treatment for both DDS particle size.

All mice started gaining weight after 7 days, which is similar to the control mice injected with glucose. The biodistribution study shows that smaller size (50 nm) nanoparticles had longer circulation time in blood compared to the larger ones (80 nm) by up to 1 hour. However, after 5 hours both samples showed a similar distribution pattern. Necropsy after 5 hours showed that the DDS for TB was observed in organs e.g., liver, suprarenal glands, ovaries and lungs.

- *Production of gold antibodies*

The second project approved by the Steering Committee is on the production of gold colloidal conjugated antibodies for diagnostic applications (reagents). This research will develop the know-how process to produce gold nanoparticles of various sizes and shapes as well as conjugation with antibodies for diagnostic applications. The know-how process will facilitate innovation in diagnostic devices with enhanced sensitivity at a reduced



13 Different size of gold nanoparticles and gold nanorods

cost that will encourage more research and innovation in diagnostic applications.

This research will assist the nation's capacity building on human resource with new expertise in gold conjugated antibodies which in turn contributes to the development of nanobiotechnology in Malaysia. The new scientific understanding in this project will also contribute to the current knowledge that will benefit Malaysia as one of the main players in the nanobiotechnology field in the Asian region.

It is known that when the size of gold nanoparticles decreases, surface area reactivity increases hence the ability to scatter light increases as well as enhances the sensitivity in diagnostic applications. Gold nanorods have recently attracted widespread attention due to their unique optical properties and facile synthesis. When the aspect ratio of gold nanorods increases, the extinction peak increases and separation between the two plasmon bands (transverse and longitudinal surface plasmon) becomes more obvious.

Hence, nanorods can be tuned to near infrared wavelength states by controlling the aspect ratio. The long-axis of gold nanorod conjugated antibodies provides higher sensitivity than nanosphere conjugated antibodies in diagnostic application. The long-axis of gold nanorod will enhance the absorption and scattering of light.

To date NanoBRI has the capability to produce various size gold nanoparticles and gold nanorods. The next step is on optimising the conjugation process of gold nanoparticles and gold nanorods with antibodies such as IgG, IgM and IgA to produce reagents for diagnostic application. The produced reagents will then be tested in available diagnostic kits at INFORMM.

Moving forward, NanoBRI will train interested researchers to use the acquired nanotechnology platform as well as provide contract research in the related area to sub-licensee approved by BiotechCorp. In research and innovation, NanoBRI will work towards enhancing properties of the DDS for tuberculosis as well as reagents for diagnostic application. In the next 3 years, NanoBRI is expected to develop six more nanotechnology-based products of substantial commercial value for biomedical applications.

Facilities available at NanoBRI	
Facilities	Applications
Nanomaterials synthesis facilities	Synthesis of designed nanomaterials e.g. silica nanocarriers, ferrofluids, magnetic nanoparticle and liposomes.
UV-Vis spectrophotometer	Determine solution absorption/transmission, compound concentration, conjugation quality.
Zeta sizer	Analysis of hydrodynamic size, zeta potential and molecular weight of particles in solution.
Florescence spectroscopy	Determine reactive single oxygen, quenching properties of materials, optical properties.
Florescence microscope	Observe cell penetration/uptake.
Microplate spectrophotometer	Analysis of cytoxicity level, optical density.
Cell culture facilities	Provide basic support services (preparation of numerous culture media and a source of culture supplies and sterile reagents), cell propagation services, establishing primary cultures from human and animal tissue samples, cell transformation services, screening services for detecting mycoplasma contamination in cultured cells and sterile workstations for researchers.

The “flowering of minds” in USM

USM leading the way in sustainable tourism research

Active tourism research activities in Universiti Sains Malaysia were initiated in 1998, by a group of academics from the School of Housing, Building & Planning led by Professor Badaruddin Mohamed who formed a virtual research group called the "Tourism Research Circle" (TRC).

Initially, this group received continuous funding from various sources, which included the IRPA grants, USM short-term grants as well as external funds, both from international bodies like the Sumitomo Foundation (Japan) as well as from the Ministry of Tourism (MOTOUR).

Besides active engagement in tourism related research, this group has also organised various seminars, conferences and workshops and is involved in many consultancy projects for clients like MOTOUR, various state governments, UNESCO, Tourism Malaysia as well as the Prime Minister's Department.

With the Research University (RU) set up, this group was further expanded into the Tourism Research Cluster (also called TRC) in 2007 under the umbrella of the Social Transformation Research Platform. The RU grant facilities further promote interdisciplinary and interschool collaborations, bringing more academics from various backgrounds into its fold.

2007-2009 Milestones

In response to the incessant global crises such as climate change, pandemic disease and natural disasters which affect the local and global tourism sector directly and indirectly, more practical and integrated approaches are required to sustain this sector. In an effort to fulfil the vacuum and the need of useful data for proper planning and development of tourism, TRC gathers fellow researchers both from USM and its counterparts from outside USM in tourism related research, especially in the fields of tourism planning, development and alternative tourism.

With main interests to promote research integration, TRC has been able to gather diverse researchers from 8 different schools/ centres of excellence, which include the School of Housing, Building and Planning, School of Management, School of Arts, School of Communication, School of Humanities and School of Social Sciences (Figure 1).

In line with the sustainability agenda of USM, many ongoing research projects are related to physical development, ecotourism, sustainability, trends, heritage and other issues pertaining to alternative tourism.

Figure 1: The growing participation of Schools and Centres in tourism research

The university had approved a total of 10 long-term grants and five short-term grants between 2007-2009, on tourism studies from the Research University funding mechanism. Another five short terms were allocated to graduate students under the Postgraduate Research Grant Scheme (PGRS) under the same period.

The Tourism Research Cluster has successfully organised two annual tourism symposiums at the national level in 2008 and 2009, held at Universiti Sains Malaysia. With the theme of "Designing tourism research towards practical applications", the first symposium provided a platform for discussion and sharing of tourism research topics, methodology and sharing of research findings for more than 50 participants from across Malaysia comprising of academicians, students, practitioners, and professionals on tourism. The second annual symposium was themed "Theories and Applications". Two peer-reviewed proceedings with ISBN numbers were produced. USM also receives a growing number of postgraduate students pursuing Masters and Ph.D. in the tourism field. While many schools and centres offer potential tourism research fields to prospective candidates, the School of Housing, Building and Planning (since 2005) has been offering a mixed mode Masters programme in Tourism Planning and Development. An average of 15 students from various nationalities enrol in this programme every year. Besides theoretical lectures in the classrooms, students are also brought to the field, to have first-hand experience in organising trips, conducting field research and understanding local issues and knowledge. At the same time, about 20 research students (mostly Ph.D.) are pursuing their degrees in tourism related research across USM. Again, the agenda of sustainability has been put at the forefront for the graduate students whenever they start the research journey.

Intensifying sustainable tourism research

Tourism research activities in USM locate sustainability as the main focus, which is also in line with the Ecotourism Master Plan of the country. While at present topics are well spread out across the schools and centres, TRC, with the careful guidance from the Social Transformation Committee, will prioritise all new topics toward sustainability focus.

Therefore, TRC will encourage more topics like pro-poor tourism, village tourism, green tourism, heritage tourism, interpretation and education. The community-based tourism will also be widened and developed. Again, research areas that would benefit and impact the local community would be given priority.

While the role of tourism in generating new jobs and businesses as well as increasing the national revenues cannot be denied, the concern of tourism research in USM would be more on the social, economics and environmental impacts of tourism development. More attention would be given to the conservation and preservation of the natural and cultural resources of the country, which require a multidisciplinary approach and participation.

As part of its collaborative approach, the Tourism Research Cluster will continue to forge networks with its local and international research groups from other institutions of higher learning, as well as with stakeholders such as MOTOUR, the NGOs, related industries and local communities.

Realising the importance of research in sustainable tourism development, TRC has set the target of becoming a Centre of Excellence for tourism research in Malaysia for the next three years which would further strengthen the networking between tourism experts, scholars and researchers from other institutions as well as practitioners and professionals from the tourism industry in Malaysia.

01

02

01 & 02 A field trip to Cambodia to understand heritage management issues

USM's research on mud crab helps Mother Nature and the community

Figure 1: Juvenile mud crab

Figure 2: Innovative compartment units designed to rear mud crab from juvenile until market size

Crabs belonging to the genus *Scylla*, commonly known as mud crabs (and locally known as ketam nipah), are found in tropical, subtropical and warm temperate areas where they inhabit brackish and saltwater estuaries or mangrove forests. The mud crab is considered a very hardy species and is quite resistant to diseases compared to the prawn or the shrimp.

In mangrove areas, the local fishermen use traps to catch the mud crab and sell them to the market while still alive. The most common species that has been cultured is *Scylla serrata* due to its preference for estuarine habitats, less aggressive behaviour and higher value[1].

Because of their large size, high meat contents and delicate flavour, mud crabs are in great demand and are commercially important in many Indo-Pacific nations[2]. The mud crabs fetch high prices depending on their size range. For example, a berried mud crab costs about RM30-40. Not surprisingly, there is a growing interest in mud crab farming in the Indo-Pacific region (Keenan, 1999). However, in Malaysia, the mud crab industry is still not making headway and is only carried out on a small scale by local fishermen.

Ecologically, the life cycle of a mud crab starts in the muddy mangrove area and during spawning time, a berried mud crab will swim to the sea and release its eggs. Each berried mud crab will release nearly three millions eggs per spawning season. During the process of larval and juvenile development, they eventually return back to their natural habitats until reaching maturity.

Generally, *Scylla serrata* is popular in demand as a protein food source by various communities in China, Vietnam, Singapore, Taiwan, Hong Kong and also in Malaysia. Due to its delicacy, there is an increasing demand for this species for food.

[1] Cowan, L. 1984. Crab Farming in Japan, Taiwan, and the Philippines. Information Service Q184009 QLD DPI pp 85.
[2] Keenan, C.P., 1999. Aquaculture of the mud crab, genus Scylla-past, present, future. In Keenan, C.P., Blackshaw, A Mud Crab Aquaculture and Biology. ACIAR Proceedings, vol. 78. ACIRA, Canberra, Australia, pp. 9-13.

Mud crabs are easily caught in traps or nets set in the mangrove estuary during low tide. Fishing of mud crabs in the wild can provide an important source of income to rural communities (Keenan 1999).

Potential mud crab aqua-farming industry

Currently, mud crab farming has been identified as an emerging aqua-farming industry. In Malaysia, the mud crab farming covers the breeding of crablets and rearing of crablets into marketable size.

Most juvenile mud crabs are collected from their natural habitat and placed in a pond and fattened until they are of marketable size. Continuous harvesting of the mud crab population in the wild will eventually reduce its population without giving a chance for the mud crabs to reach maturity and to breed.

Uncontrolled fishing of juvenile crabs and reliance on wild seed will lead to the decrease in the population and unavailability of wild stocks. With these challenges and in order to support the demand for mud crabs, the Centre for Marine and Coastal Studies (CEMACS) has initiated a small scale project on the seedling production of the *Scylla serrata* (ketam nipah).

The breeding of the mud crab from the larval to the juvenile stage in the hatchery will be one way to increase the population of mud crabs and also to support mud crab farming.

The process of seedling production of mud crabs usually takes place with millions of eggs being hatched into the larval stage known as the zoea stage. After a few days with enough food sources, the larvae will develop into the megalop stage and finally into crablets (juvenile stage) (Figure 1). This process of development takes about 30 days.

For grow-out, the young crablets will be placed in an enclosure such as ponds, cages and pens with frequent feeding of trash fish for a few months until they reach marketable size.

This kind of crab fattening by holding the crab and giving frequent feeding with trash fish is widely practised by fishermen. However, an innovative design of a compartmental unit with recycling brackish water system has been developed to make the rearing of the mud crabs very practical and without having to be near a mangrove area (Figure 2).

This innovative technique of rearing mud crabs can be carried out by the local community. A unit of this compartment system of mud crab rearing is mobile and can be set up at any household backyard. Subsequent feeding of mud crabs with trash fish to fatten them will take about 3-4 months before they can be harvested and sold to the market. This type of mud crab rearing will be one way to avoid cutting down mangrove areas for the grow-out ponds; thus the mangrove ecosystem is well preserved.

The mud crab resource is a natural gift to our tropical country and has the potential to change the socio-economic status of the coastal communities. The coastal poor fishermen and educated unemployed youths should realise this fact and take up crab culture or fattening in an eco-friendly way to raise their economic status.

FOR THE RECORD: The sustainability professional featured in Sustainability: The Journal of Records

Associate Professor Lee Lik Meng, coordinator of the Healthy Campus USM, gave an interview which was featured in Sustainability: The Journal of Records (Volume 3 (1), February 2010: pp 13-19).

He provided a succinct explanation on USM's transformation approach, "A future outlook or ability and willingness to examine alternative pathways and their implications are the key to modifying our behaviour so that we continue to be relevant in a changed world".

To USM, successful transformation requires more than an awareness of, or attitude to, change. It requires a visionary, out-of-the box and innovative outlook while at the same time ensuring that the changes are guided by the spirit of inclusiveness which will lead to a sustainable tomorrow.

Dr. Lee explained that USM's sustainable development initiatives are, and will always be, people-centred in what is described as a "blue ocean with a conscience" approach.

USM had resolved to leverage research and teaching to benefit the community and the world at large, particularly the bottom billion who survive on $1 (USD) dollar a day. He also pointed out that although other universities in Malaysia had developed academic and research programmes on sustainability long before USM did, it is USM's clear thinking and commitment to bring sustainability to the forefront that makes it stand apart.

In USM, sustainability is not just a buzz word but rather a part of life. Student-led initiatives, such as the "White Coffin" project, a project against the use of polystyrene foam containers, are good examples of how sustainability has become a core value for students.

USM is now working to ensure that the sustainability psyche permeates every level of the university, from top management, lecturers and students, all the way through to the support staff and with everyone taking ownership of USM's transformation plan. A deep understanding of sustainability is imperative to ensure meaningful lifestyle changes imbibed with planetist values.

Importantly, USM's efforts in promoting sustainable development must reverberate to the community at large. Several examples quoted by Dr. Lee provide proof of USM's success in leading the transformation of society. For instance, the "White Coffin" campaign has now been emulated in at least eight universities.

In addition, since the publication of USM's first APEX university "Black Book" that delineates USM's commitment to sustainable development in its transformation plan, a high ranking officer at the Ministry of Higher Education has reported that the Ministry now insists that universities seeking approval for courses must integrate sustainability into their curricula. According to Dr. Lee, with the APEX university agenda to transform higher education for a sustainable tomorrow, USM will now channel more energy into sustainable efforts.

"In USM, sustainability is not just a buzz word but rather a part of life. Student-led initiatives, such as the "White Coffin" project, a project against the use of polystyrene foam containers, are good examples of how sustainability has become a core value for students."

FOR THE RECORD:

NEW STRAITS TIMES TUESDAY, APRIL 20, 2010 BUSINESS TIMES **NEWS** I B7

Usains to pay 6pc maiden dividend

By Marina Emmanuel
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USAINS GROUP OF COMPANIES

UNIVERSITI Sains Malaysia's commercial arm — Usains Group of Companies — is set to pay out a 6 per cent maiden dividend after nine years in operation.

The Penang-based company, set up with an operational budget of RM100,000 a decade ago, has also reported revenue of RM23.6 million for 2009, more than a six-fold increase from RM3.6 million in 2000.

"Our success represents a major landmark in the efforts by USM, our sole shareholder, in generating revenue for USM and enabling its staff to supplement their salaries by commercialising their professional services through the Usains Group of Companies," group managing director Datuk Gan Ee-Kiang told Business Times.

Pre-tax profit increased from RM79,691 to RM1.084 million over the same period. Net profit of RM810,246, represents a return on equity of 10.5 per cent for 2009.

Usains' shareholders' fund currently stands at RM7.65 million and it has total assets of RM35.2 million.

"From our revenue last year," noted Gan, "almost RM3 million was paid out to USM for the purchase of its services and facilities."

A further RM6.7 million, meanwhile, was paid out to 2,054 staff of USM for their consultancy services.

"We have also generated an additional RM10.5 million for the university from USM projects that are managed by the Usains Group," said Gan.

From its origins as the Centre for Innovation and Consultancy of USM, Usains now comprises five subsidiary companies and a holding company.

Its client base ranges from government agencies, multinational companies to small and medium-sized entrepreneurs.

Its services range from those which tap into USM's intellectual properties such as archeology, environment, traffic management, marine and aqua culture to bio-medical and property construction.

The past decade has seen Usains acquire many badges of honour, including acquiring Multimedia Super Corridor (incubator) status for its operating premises, known as Kompleks Eureka.

"We continue to be a referral centre for other institutions of higher learning, both in Malaysia and overseas, in their efforts at commercialising their intellectual properties," he added.

In its bid to chart out newer business activities, the group has incorporated a special-purpose vehicle in the form of a fully-owned subsidiary, Usains Infotech Sdn Bhd, to operate and manage the Centre of Excellence for Electrical and Electronics (Integrated Circuit Design) established by the Northern Corridor Implementation Authority.

Gan said Usains is hoping to spawn spin-off companies on a joint-venture basis, based on its current operations.

"Our experience and performances over the past 10 years and the network developed gives us confidence to venture overseas and source for business opportunities which leverage on USM's intellectual properties and expertise."

Other plans on the drawing board, include collaboration with professional bodies in offering electronic-based courses which prepare students for examinations conducted by these bodies.

"We will also pursue plans to build (with the help of private sector consultants) and operate a private hospital at our health campus in Kelantan," Gan added.

FOR THE RECORD:

After toiling for years for the doctorate degree, Tan Yifen from the School of Biological Sciences can now smile upon receiving the 2010 UNESCO-L'Oreal Fellowship for Women In Science Award.
She will continue her research at the Department of Microbiology and Molecular Genetics, Harvard Medical School in September 2010.

FOR THE RECORD:

COMMERCIALISED PRODUCTS 2009			
No	Products	Researchers	Marketing Companies
1	Production of PHB/ PHBV Bioplastic Polymers	Assoc. Prof. Sudesh Kumar Kanapathi Pillai	Plainexus Research Laboratories Sdn. Bhd.
2	Banana-based Flour	Assoc. Prof. Noor Aziah Abdul Aziz	Bioterials Ventures Sdn. Bhd.
3	Digital Smart Community Using RFID Systems	Assoc. Prof. Widad Ismail	Cool Return Sdn. Bhd.
4	Titania Nanotube Arrays as a Novel Photocatalyzer	Dr. Srimala Sreekantan	Scientige Sdn. Bhd.
5	3G Streaming System (JMCS)	Prof. Sureswaran Ramadass	Inetmon Sdn. Bhd.
6	Graphic Design, Desk Top Publishing (DTP) Works and Printing Solutions to Clients in the Northern Region of Malaysia	Azizi Ibrahim	Meteor Doc. Sdn. Bhd.
7	Development of a Laser Measurement System for High Precision Callibration of CNC Machine Tools and CMM	Dr. Indra Putra Almanar	C.D. Measure Sdn. Bhd.

FOR THE RECORD:

TECHNOLOGY KNOW-HOW LICENSING 2009			
No	Products	Researchers	Marketing Companies
1	International Tobacco Policy (ITC)- Wave 3	Dr. Maizurah Omar	ITC-TTURC
2	Projek Jalan Gong Bongsu-Kampung Lobak	Dr. Indra Putra Almanar	Puncak Utara Sdn. Bhd.
3	Development of Laser Measurement System	Dr. Indra Putra Almanar	C.D. Measure (M) Sdn. Bhd.
4	Propagation of Abalone for MFI	Dr. Ailen Tan Shau-Hwai	RBAJ Enterprise Sdn. Bhd.
5	Upper Padas Hydroelectric	Assoc. Prof. Fauziah Ahmad	Ranhill Bersekutu Sdn. Bhd.
6	ISOC APIPV6TF	Selvakumar Manickam	Internet Society (ISOC)
7	RFID - Installation & Commissioning	Assoc. Prof. Widad Ismail 2009	Centre for Knowledge, Communication & Technology
8	Utilisation of Plant Ingredients through Application of Allyzyme SSF Enzyme Complex in Aqua Feeds	Prof. Ng Wing Keong	Alltech Inc., USA
9	Sungai Batu Archaeological Studies & Lembah Bujang Heritage Development in Kedah	Assoc. Prof. Mokhtar Saidin	Ministry of Unity, Culture, Arts and Heritage
10	Production of a High Definition Tele-Presence Set-Top Box Endpoint System	Prof. Sureswaran Ramadass	IP Convergence Sdn. Bhd.
11	Development of Prefabricated Fibre-Reinforced Plastic Industrial Wastewater Treatment System	Assoc. Prof. Ir Nik Fuaad Nik Abllah	Hijauan Tegas Sdn. Bhd.
12	Development of Solar Cell Electrical Tester	Prof. Hj Kamarulazizi Ibrahim	TT Innovation
13	Industry Research and Development Grant Scheme for Research and Development of Intelligent Network Monitoring (iNETMON) Tool for Linux Platform	Prof. Sureswaran Ramadass	School of Computer Sciences
14	Ipv6 Certification (Cne6 Level 1) Training for Telekom Malaysia Berhad's Personnel	Prof. Sureswaran Ramadass	Telekom (M) Bhd.
15	Development of Prefabricated Modular Super Low Cost Housing System	Assoc. Prof. Ir Nik Fuaad Nik Abllah	Tri Q Engineering Sdn. Bhd.
16	Operation Services for the Centre of Excellence for Electrical and Electronics-IC Design (COE-EE-IC Design)	Assoc. Prof. Othman Sidek	Northern Corridor Implementation Authority
17	Development of New Versions of the Multimedia Conference System	Prof. Sureswaran Ramadass	Multimedia Research Lab Sdn. Bhd.
18	Development of Low Cost High Grade Fishmeal Production	Assoc. Prof. Ir. Nik Fuaad Bin Nik Abllah	Aman A.R. Properties Sdn. Bhd.
19	Ingression of Jellyfish Thermal Power Plants at Coastal Area of Peninsular Malaysia	Assoc. Prof. Khairun Yahya	TNB Research Sdn. Bhd.
20	Training on Advanced Digital and Analogue Circuit Design in Accordance to Curriculum or Syllabus Developed by Buyer for the NCADD GT Programme	Universiti Sains Malaysia	Intel Microelectronics (M) Sdn. Bhd.

Commercialised products of USM

The transformational journey continues

The Conclusion

> **. . . No, we are not modelling ourselves on any university - local or foreign. We want to be unique, that is what innovation is all about. . .**
>
> Vice-Chancellor, USM
> Prof. Tan Sri Dato' Dzulkifli Abdul Razak
> New Sunday Times, 14 September 2009

The transformational journey continues

The past 15 months have been an intense but exciting time for the entire USM community. Demanded from us have been changes in the way we think, live and work in order to jump-start the APEX journey as we have envisaged it in our submission to the APEX committee in May 2008. In a way, this compilation celebrates the second anniversary of that historic event not only for the university but for the higher education sector as a whole. This exercise has never been attempted before and therefore "failure is not an option".

As we embarked on this unusual journey, the task to "challenge the status quo" - in the words of the Ketua Setiausaha Negara, YBhg Tan Sri Sidek Hassan[1] - became our guiding principle, although ever so often, the status quo came back to haunt us with a vengeance! Many a time, we felt alone but resigning to our fate would have been only for the faint-hearted. We are indeed a rebel with a cause as it were, and we must soldier on. It is the team spirit that has kept us alive despite the pain and agony. There were unanticipated glitches, difficulties and challenges along the way, accompanied by the harshest of words and unkind remarks from even the least unexpected persons, but these only served to increase our resolve and perseverance. We have come out stronger and more determined to embrace changes towards realising the university's - and indeed the nation's - goals of transforming higher education for a sustainable tomorrow and becoming globally renowned as a sustainably-led university.

This book captures, in a nutshell, the various changes attempted with a high degree of success to put in place a firm foundation for future challenges and an even greater transformational process. We have just begun learning the ropes to survive in a world where a multitude of changes is a must... Enumerated as well in this book are the fruits of some of the changes in the short 15 months, exemplified by the number of pioneering programmes and processes, discoveries and innovations. All these serve as a window for those interested in the progress to empathise, if not learn, from our experiences for USM expects nothing less for the coming year. Several plans are being put in place to continue efforts in laying the foundation for the establishment of Malaysia's first APEX university.

For instance, the initial work of the eight task forces has been put into motion over the past year and is undergoing fine tuning from time to time. We are optimistic that this work will come to fruition in the not too distant future as well as begin to be implemented in the next phase of laying the foundation in 2010. The initial planning for talent management, development of resources and reduction of bureaucracy in governance should produce signficant results which we are confident will start turning things around in improving the quantity and quality of social and intellectual capital where the staff and students are concerned, enhancing our teaching and research facilities and the related resources to execute them. Mostly, progress will depend on how much red tape we can eliminate so that we simplify the overwhelming complexities that have been over-crowding not only the workplace but equally important, our mental space.

Not least in this scheme of things is the improvement in the way we lead, govern and manage the university through a change management process which has also started to take shape, involving the administrative and support staff in the main. The branding and the advocacy processes are also running in parallel as a result of the exercise which has taken place over the past year, this engaging the entire community in small batches so that we can etch more prominently into their minds and persona the vision, mission and the brand experience of what it is that USM champions and its new *raison d'être*. A central theme in the branding and advocacy processes was the idea of brand ownership that emanates from a clear understanding and firm support of the brand's position and identity to a point that the brand reverberates in everything that one does. It is only through ownership that the brand promise can be delivered consistently to our stakeholders, hence ensuring that in their minds, we carve a strong image of USM as a university that transforms higher education for a sustainable tomorrow. Linked to the brand image are key brand associations such as "sustainable tomorrow,"

[1] Meeting of the Malaysian Statutory Bodies at USM, 24 January 2009.

"enabling the bottom billion" and "transdisciplinary" that help stakeholders identify how the USM brand resonates with their own situation, needs and aspirations. Ultimately, we want the USM brand to be on the top of their mind in a choice situation – be that for community projects, continuing studies, research collaborations or educational partnerships.

At the same time, we have also initiated the implementation of the Blue Ocean Strategy (BOS) in the management of the university as part of the learning curve promised in our submission to the Ministry of Education (MoHE) in 2008. This strategy will seek to change the university management system that will promote value innovations compelling us to explore new Blue Ocean space where competition is made irrelevant or maybe, to create demands in uncontested market space. For instance, through a series of BOS workshops conducted early this year, USM is currently exploring the uncharted territory and noncustomer market space to promote its research and consultancy resources, knowledge and innovation, postgraduate studies, talent management and many others. What we will do is to clearly create a better and richer perception in the minds of the stakeholders. We hope to report the accomplishments of these new explorations of the BOS in the next report.While all these are being put in place, USM will continue to unveil more exciting transfromational activities in breaking new ground. Some of the emerging themes that will unfold include:

The Bukit Bunuh mystery: Will the archaeologists at the Centre for Global Archaeological Studies uncover human remains that will allow them to identify the nature of community and origin of settlement species at Bukit Bunuh?

The alchemy of Tualang Honey: Honey bee, honey bee/You fly free from tree to tree/The sweet stuff that comes out from your belly/Not only it tastes good but is also a remedy… What prompts USM researchers to wax lyrical of the honey bee?

The journey of excellence: covering the innovative and creative endeavours that lead to USM research centres being benchmarked as pioneering Higher Institutions' Centres of Excellence (HICoE) by MoHE, namely, the Institute of Research for Molecular Medicine (INFORMM) and the Centre for Drugs Research.

Many more such endeavours, for example, in the areas of disaster management, tissue culture or plant cloning and Islamic development management, to name a few, will be part of the transformational APEX journey 2010.

In the final analysis, true to the submission to MoHE 15 months ago (USM, 2008[2]), this APEX journey which we are undertaking has blazed many new trails which would otherwise be impossible in the cloak of business-as-usual mindset. As such, it remains our fervent hope and desire to raise the flag of higher education by carving a niche as the Fourth Generation University in the new century based on a new metaphor beyond that of the worldwide accepted Industrial Age. This is certainly an ambitious journey but one that does not deviate too far from the aspiration of MoHE when it aspired to lay "the foundation for the revolution of Malaysian higher education - a revolution that is not merely desirable, but is necessary for our survival."(2007:492[3]).

On that note, the USM community would like to acknowlege all the support that it has received to make the APEX journey possible, notably that of the Honourable Minister Dato' Seri Mohamed Khaled Nordin who from the onset stood firm in seeing the programme through and also the APEX Committee members who became such strong supporters in ensuring that the APEX journey is on the right track from the word go!

For those who can and have the desire to contribute to the future transformational journey and to make USM's vision of transforming higher education for a sustainable tomorrow, we would welcome their involvement in this noble effort. Together, and by the Will of God, we shall prevail.

Could this boulder contain the fossilised skeletons which USM archaeologists are looking for?

Bee hives of the *Tualang* tree from where honey is extracted

You will be updated with INFORMM's progress and development

[2] Universiti Sains Malaysia (2008). *Transforming higher education for a sustainable tomorrow*. Penang: USM.
[3] Kementerian Pengajian Tinggi (2007). *National Higher Education Action Plan - 2007-2010*. Kuala Lumpur: KPT.

Flame of the Forest tree that adorns the USM campus

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