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**APEX**  
**University**  
Universiti Sains Malaysia

**Transforming**  
**Higher Education**  
**for a Sustainable**  
**T o m o r r o w**



# Transforming Higher Education for a Sustainable T o m o r r o w



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Y.B. Dato' Seri Mohamed Khaled Nordin, Minister of Higher Education Malaysia at the launching of "Transforming Higher Education for a Sustainable Tomorrow" held in conjunction with his official visit to announce the selection of USM for the APEX University programme, 4 September 2008, Dewan Tuanku Syed Putra, USM Penang







## THE ARTICULATION

...USM will set its vision of a sustainable tomorrow while keenly promoting values such as equity, accessibility, availability, affordability and quality as the optimal endpoints. Concomitantly, USM will embrace the protection of the ecosystem, the conservation and restoration of resources as well as the development of human and intellectual capitals for this purpose. USM will position itself to facilitate in meeting existing (e.g., Millennium Development Goals) and other future global aspirations towards the upliftment of the billions trapped at the bottom of the socioeconomic pyramid.

## TRANSFORMING HIGHER EDUCATION FOR A SUSTAINABLE TOMORROW

This truly team-effort represents a submission on behalf of Universiti Sains Malaysia (USM) to the Ministry of Higher Education for consideration to be emplaced as an APEX university, i.e., an institution to be accelerated for excellence and to be nurtured for *world-class* standing.

This submission is most timely because of several reasons. As Malaysia celebrates its 50 years of nationhood, and the accomplishments of an independent sovereign nation, likewise, USM looks forward to its impending 40th anniversary in 2009 as an autonomous university given its wide-ranging accomplishments since its establishment in 1969. Its coming of age was decisive when USM was recognised as Malaysia's premier research university, along with it being the only five-star institution of higher learning to date. Its most recent internationally acclaimed status as ASEAN's only Regional Centre of Expertise on Education for Sustainable Development accorded by the United Nations University in 2005, to coincide with the launching of UN Decade of Education for Sustainable Development, signals that USM is set to reinvent itself as a valued global institution, collaborating with the best in moving forward in the global arena.

Through this collective effort we seek to outline how USM has strategised as a potential APEX

university to enmesh itself in the challenges to solve global issues with the hope to make a lasting difference at all levels. In this regard, USM has chosen sustainability as a platform to create a new future. The term denotes an over-arching concept of meeting "the needs of the present without compromising the ability of future generations to meet their needs".

Sustainability, broadly defined thus, applies to many disciplines, including economic development, environmental and natural resources management, food production, energy, and socio-cultural dimensions and lifestyles engaged in a transdisciplinary mode. It is within this framework that USM focuses its vision of a sustainable tomorrow while keenly promoting values such as equity, accessibility, availability, affordability and quality as the universally accepted optimal endpoints. Concomitantly, USM will embrace the protection of the multiple ecosystems, the conservation and restoration of resources as well as the development of human and intellectual capitals for this purpose. USM will position itself to facilitate the meeting of existing (e.g., *Millennium Development Goals*) and other future global and universal aspirations towards the upliftment of the billions trapped at the bottom of the socio-economic pyramid.

To realise this ambition, several transformational and strategic plans have been laid out for the





university to accomplish within the foreseeable future. In the area of teaching and learning, for example, the university will provide and offer various programmes relating to a deeper understanding of “sustainability” so that the learning accrued by students and staff will compel them to be more involved, committed and dedicated for the sustainable wellness of the institution, community, and global environment. Though many attempts have been successfully carried out in the past, some are still on-going to engage and instil values which will further help to nurture ethically-responsible, and morally-sound adolescents of the school-going age. Their involvement in tertiary education and campus life will not only prepare them as employees with good corporate responsibility but also to be responsible global citizens with strong national-local commitments.

Since 2000, USM has taken various proactive and productive steps to transform itself as a reputable research-intensive university dedicated to the promotion of wellness and well-being of the human ecosystem. This will be further enhanced under the APEX programme based on plans to carve innovative inroads into diverse but cutting-edge



transdisciplinary fields that will bring about a better and sustainable Malaysia, if not the world. Teams of committed researchers will be empowered to venture beyond the Ivory Tower and immerse themselves with cross-sectoral partners be they public agencies, the industries and members of civil societies across the nation and beyond. The highlight of this effort will be the successful launch and implementation of USM’s Science and Arts Innovation Space or SAINS@USM as the unique nursery to sow the seed for a sustainable tomorrow.

Hence, this submission for the APEX university status aptly entitled “Transforming Higher Education for a Sustainable Tomorrow” summarily represents our collective views of what and who we are, and why as well as how we have nurtured ourselves to remain distinctively different from others, at least in the Malaysian context. In the true spirit of USM’s motto “Kami Memimpin” (We Lead), it is now time that the same distinction be further accelerated to the next level as a truly Malaysian icon in the world of higher education and beyond.

Hereby, we humbly submit.

Dzulfitri Abdul Razak, Professor Dato’  
Vice-Chancellor  
Universiti Sains Malaysia  
vc@usm.my  
30 April 2008



# THE SUMMATION

The Ministry of Higher Education (MoHE) has requested all local institutions of higher learning to submit their proposal for consideration to be selected as an APEX university. The Accelerated Programme for Excellence (APEX) is a fast track development programme for institutions of higher education to achieve and to be recognised as world-class institutions.

Universiti Sains Malaysia believes that it should be considered and selected to be an APEX university for several reasons. Since its establishment in June 1969, USM has registered such remarkable accomplishments in teaching and learning as well as research and innovation activities as to merit the institution with such a status. Furthermore, the university is in the best position to attain world-class status as it has built the basic infrastructure to become more competitive at the global level as well as being able to attract quality staff and students locally and from abroad. In 2007, the university was anointed as one of four research universities by MoHE through a rigorous evaluation process elevating its status to the top of more than 100 public and private universities and colleges in Malaysia. In the same year too, USM was rated as the only “excellent” (or 5-Star) university in the Academic Reputation Survey conducted by the Malaysian Qualification Agency (MQA).

Based on the above accomplishments, the university has set forth its mission to become a sustainability-led institution of higher education. Following the recommendations of OECD (2007), USM believes that it can play a role and contribute to sustainable development vis-à-vis

the generation of human capital, acting as a source of expertise through research and consultancy, by bringing together talents and elements for sustainability, adopting best practices through on-campus management and development activities to undertake strategic planning, building design, waste control and water and energy efficiency practices. In a similar vein, the university will also be prudent in its acquisition programmes and pursue good citizen-type initiatives like a “green campus” concept as well as offering recognition and reward incentives for staff to be involved in sustainable development leadership in the regional community.

The starting point is to integrate sustainable development into the educational system 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 quality. Following the compelling practices adopted by the European universities, USM is strategising itself to be more autonomous, accountable, and will provide incentives for partnership and business, the right mix of skills for the labour market and the community. The university will aim at reducing the funding gap and make funding work more effectively as well as enhance interdisciplinary and transdisciplinary learning and knowledge accumulation, facilitate interaction of knowledge and society and reward and recognise excellence.

Another strategy which USM will follow to realise this sustainability-led growth is the “Blue

Ocean Strategy” which is proposed by Kim and Mauborgne (2005) as entities to propel itself toward unknown market space (hence the blue ocean) which is untainted by competition. “Blue ocean” is analogised as the deeper potential of market space that is yet to be explored and this requires institutions to expand their existing boundaries and change the rules of the game which, in turn, will render competition irrelevant.

By choosing sustainability-led growth as its destination, USM will embark on numerous transformational journeys, including revamping most of its activities pertaining to nurturing and learning, research and innovation, services, students and alumni and the management of the university as a whole. The university will take steps to improve the three core pillars of its strengths, i.e., concentration of talent, resources and acculturation of supportive governance.

In the area of nurturing and learning, the university will enhance student-centred and sustainable development curricula, market relevance, technology learning, skills competency and linkage between research and learning. The university will also re-examine its entry requirements to include non-traditional entry modes, democratise knowledge education through the use of OpenCourseWare (OCW) and accelerate open learning. For research and innovation, efforts will be made to increase the presence of foreign students and staff, including towering personalities who can lend support to navigate USM’s research towards the blue ocean. In line with the theme of sustainable development and being a sustainability-led university, more research

programmes will be realigned in the areas of health biotechnology and molecular medicine, fundamental research, biodiversity and environment and engineering research. To help support the intensification of research during the APEX university period, USM will use its latest endeavour, that is, the establishment of Science and Arts Innovation Space (SAINS @ USM) that combines the talents of USM’s faculty members from all centres and schools to create an environmentally-friendly innovation space.

The transformation plan also includes 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 will be made to other elements of the university, such as the concentration of talent, resources and supportive governance to act as catalyst for the accomplishment of the transformation of nurturing and learning, research and innovation and services.

Eventually, the key performance indicators (KPIs) for USM in this APEX programme will be articulated and manifested in the sustainability-relevant issues for those at the bottom of the pyramid, in particular.

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# 1.0

INTRODUCTION





# 1.0 INTRODUCTION



## 1.1 The Context of APEX

On 27 August 2007, the Prime Minister of Malaysia launched the National Higher Education Action Plan (2007-2020) to kick-start the transformation process focussing on institutional excellence, a robust higher education ecosystem with diverse institutional missions and clear, coherent and aligned national policies to enable transformation.

In Phase I which spans 2007 to 2010, 15 initiatives were identified to be launched. The Accelerated Programme for Excellence (APEX) was identified as one of the most critical initiatives to help transform Malaysian higher education. APEX is a fast track development programme for institutions of higher education to achieve and to be recognised as world class institutions. The programme is aimed at facilitating selected institutions to become world class and to serve as a catalyst to help other institutions move up the value chain of higher education to the level of excellence.

By June 2008, one or two institutions of higher

education will be identified to be in the best position to become world-class in 5 to 10 years under the APEX programme. By so doing, lessons learned from this initial exercise can be used to accelerate the transformation of other institutions.<sup>1</sup>

## 1.2 The Request for Proposal

As a result of this initiative, the Ministry of Higher Education (MoHE) requested all local public and private institutions of higher learning to submit their proposal for consideration to be selected as an APEX university. The MoHE guideline suggests the following format for the proposal which must be submitted to them by 30 April 2008:

- a. An institutional profile
- b. A SWOT analysis
- c. A world-class vision
- d. A transformation plan
- e. Challenges and critical success factors
- f. Government support required to enable transformation

<sup>1</sup> Adapted from MoHE, "Transformation of Malaysian Higher Education – Accelerated Programme for Excellence (APEX), IPT Briefing, 14 March 2008.

This submission from USM for consideration as an APEX university by June 2008 is based on several documents produced and published by the university, including:

- USM (2003). *The University in a Garden*. Penang: Penerbit USM.
- Lee, M.N.N. (2005). *Research Assessment in Institutions of Higher Learning*. Penang: Penerbit USM
- USM (2007a). *Constructing Future Higher Education Scenarios – Insights from Universiti Sains Malaysia, Celebrating 50 Years of Nationhood*. Penang: Penerbit USM.
- USM (2007b). *Research Intensive University 2007 – 2009*. A strategic plan submitted to MoHE for consideration as a research university, January.
- USM (2007c). *A Handbook for Pejabat Sejahtera – Greening The Offices of USM*. Penang: Penerbit USM.
- Lee, L.M., Masrah, A. and Dzulkifli A.R. (2007d). *Kampus Sejahtera, Kampus Lestari – the genesis for a sustainable campus*. Universiti Sains Malaysia: Penang.
- USM Kampus Sejahtera Monograph Series (a series of 19 volumes on topics ranging from participatory planning process, community wellness, climate change survey, wildlife in Minden campus, etc.).
- USM's 9th Malaysia Plan (approved submission).
- USM's Strategic Plan for 2006 to 2010.

### 1.3 Why USM?<sup>2</sup>

Universiti Sains Malaysia was established 39 years ago. Since then it has grown from a university to the top university in Malaysia, with close to 30,000 undergraduates and postgraduates spread out over three campuses and 24 schools. Through a rigorous evaluation process, USM was selected as one of four pioneer research universities in Malaysia, elevating its status to the top of more than 100 public and private universities and colleges in the country. Like other universities, USM is faced with the challenges of industry-



market pressures and meeting its responsibilities to society.

The university operates on a budget of a little over half a billion ringgit a year with most of its income coming from government grants (about 91%) and a small portion from tuition fees (6%). About half of the expenditure goes towards paying the emolument of the staff while one-third is used for the purchase of services, supplies and capital assets.

In terms of land coverage, the main campus on Penang island has expanded to a size of 240 hectares in three phases. The university has acquired another piece of land on Penang Island to develop as a research park based on sustainable development principles. The other two campuses cover 86 hectares (Health Campus in Kubang Kerian, Kelantan) and 140 hectares (Engineering Campus in Sri Ampangan, Penang). Another campus on the mainland at Bertam is being developed to house the Advanced Medical and Dental Institute.

The university has come of age for it to be considered as an APEX university by the government because of the following reasons:

<sup>2</sup> Adapted from Lee, L.M., Masrah, A. and Dzulkifli, A.R. (2007d). *Kampus sejahtera, kampus lestari – the genesis for a sustainable campus*. Penang: Universiti Sains Malaysia.



- The remarkable accomplishments in teaching and learning as well as research and innovation activities merit the institution to be accorded such a status.
- It is in the best position to attain world class status as the university has built the basic infrastructure to become more competitive at the global level as well as is able to attract quality staff and students locally and from abroad.



**Figure 1**  
**Certification as RCE Penang @USM by UNU/UNESCO, 2005**

- It was rated as the only “Excellent” (or 5-Star) university in the Academic Reputation Survey of 2006 conducted by MQA. In this rating exercise, USM came out at the top for the best overall university and for its research contribution to the community.
- Since 2000, the university has established itself as one of the champions for sustainability and has gained recognition as the United Nation University’s Regional Centre of Expertise (UNU-RCE) in 2005 on Education for Sustainable Development (See Figure 1).
- The university has created research programmes which are structured and

organised along multi-disciplinary clusters (including integrating the arts and the sciences) with borderless facilities. Some clusters that have existed include social transformation (which clusters the social sciences and the humanities), medical, life sciences, health sciences, engineering & technology, IT and fundamental research.

- Since 2004, USM has evolved a scenario plan for the future of the institution up to 2025 which features global outreach and sustainability-led programmes (USM, 2007a).
  - In 2007, the university was anointed as one of four research universities by MoHE through a rigorous evaluation process elevating its status to the top of more than 100 public and private universities and colleges in Malaysia (see Figure 2).

Building on these major accomplishments, the time is now appropriate for the university to be nurtured and acculturated with quality human resources and talents, support facilities and appropriate governance to become world-class.



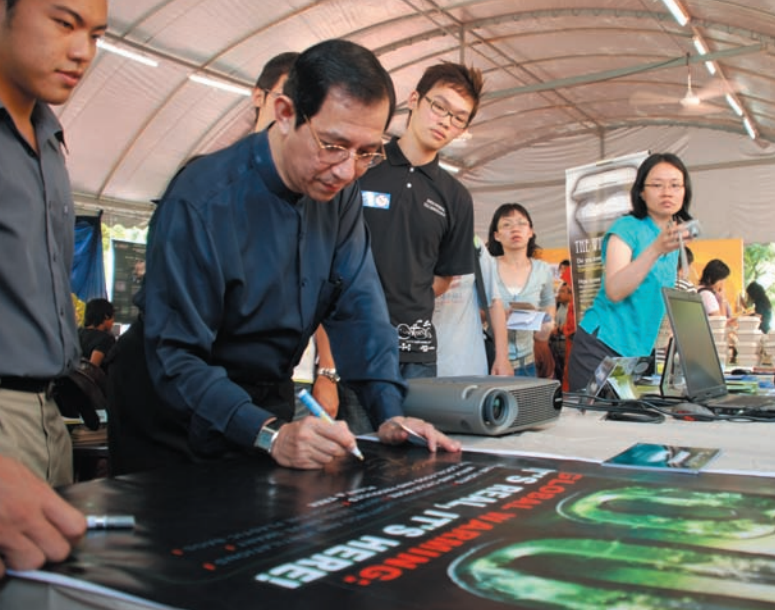
**Figure 2**  
**Certification as Research University by MoHE, 2007**

# 2.0

THE MAKING OF A  
SUSTAINABILITY-LED  
UNIVERSITY







## 2.0 THE MAKING OF A SUSTAINABILITY-LED UNIVERSITY



### 2.1 Current Global Issues

At the turn of the new millennium, global issues have spurred most countries and governments to take stock of their human resources and infrastructure in order to respond to those issues. At the top of the list is the issue of climate change and its corollary impact on biocapacity and environmental challenges, the breach on the global ecological footprint and the widening gap between developed and developing societies.

With regard to climate change, the concern is over global warming, the depletion of fish stocks and fossil fuel reserves and the irreversible loss of biodiversity. These were brought about by the depletion of the ozone layer in the atmosphere. It is said that climate change is due to the variation within the earth's climate which has impacted on glaciations, ocean variability and the climate as a whole. Climate change has also been affected by non-climate factors, such as greenhouse effects, plate tectonics, solar variations, orbital variations and volcanism. Human activities have also played a major role in climate change, including the high usage of fossil fuels and aerosols.

This is compounded by poor planning and resource utilisation in land use and livestock rearing.

The Intergovernmental Panel for Climate Change (IPCC) Report (2007) states that the impact of climate change will be most brutal on developing countries, including Malaysia. "Warming of the climate system is unequivocal, as it is now evident from observations of increase in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."

Besides climate change, the Rio Summit of 1992 also addressed the issue of poverty alleviation and economic development, incorporating the principles of equity among people, between countries and between generations. However, until the next summit meeting in Johannesburg in 2002, the promises of Rio did not materialise. This then gave birth to Local Agenda 21 and initial discussion of making a Decade of Education for Sustainable Development (DESD) which was finally launched on March 1, 2005. Subsequently, at the conference in 2007, Bali provided the

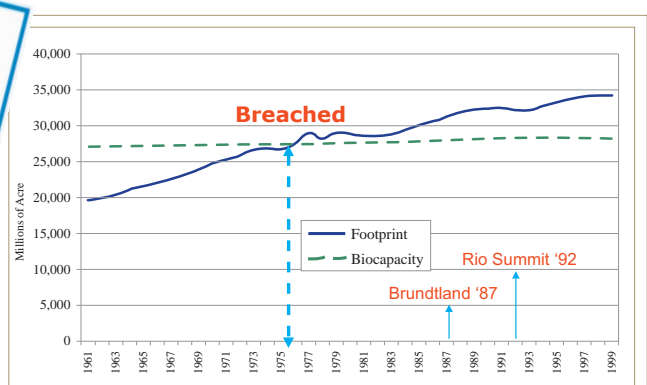


roadmap to address five major areas in terms of capacity building, awareness building, technology development, policy studies and talent cultivation. These areas were further detailed out at the IPCC conference in Bangkok in 2008.

From the standpoint of the ecological footprint, as shown in Figure 3 below, it was reported as early as in the mid-1970s that the demand on the earth's ecosystem and natural resources has breached human ability to regenerate them. The ecological footprint is an estimate of "the amount of biologically productive land and sea area needed to regenerate (if possible) the resources a human population consumes and to absorb and render harmless the corresponding waste, given prevailing technology and current understanding. Using this assessment, it is possible to estimate how many planet earths it would take to support humanity if everybody lived a given lifestyle".<sup>3</sup>

With regard to the distribution of world income, the gap between the rich and the poor is becoming wider and more visible. Almost 60 percent of humanity live on less than USD2.00 a day. Nearly 30 percent of the world's population suffer some form of malnutrition. The world's richest 50 million people consume as much as the 2.7 billion poorest people on the planet (UNDP, 1989).

According to Clark (2004)<sup>4</sup> (see Figure 4), the great divide, that is, the gap between developed and developing societies, is often characterised by the latter undertaking action-driven research, using traditional knowledge, being recipients of climate change and having resource shortages, young billions, poor "local people" and poverty. The developed societies, on the other hand, comprise "global people", possess affluence, aged-millions, rich resource surpluses, are the cause of climate change, have technological knowledge and undertake theory-driven research. While developed and developing nations continue to prosper, we also see "a world where over a billion people live on less than a dollar a day, more than 800 million are malnourished, and over two and a half billion lack access to adequate sanitation".<sup>5</sup> Increasing wealth has depleted our environmental resources but extreme poverty leaves the poor with no option but to deplete their local environment merely to survive. A world with two extremes of prosperity and poverty is unsustainable.



Source : Ecological Footprint Report (2004)

### Biocapacity breached in mid-1970s

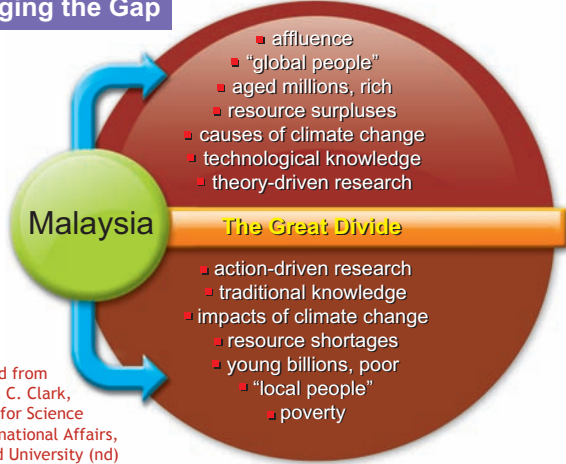
**Figure 3**  
World Ecological Footprint, 1961-1999

<sup>3</sup> Venetoulis, J., Chazan, D. and Gaudet, C. (2004) *Ecological footprint of nations*. Sustainability Indicators Program, March.

<sup>4</sup> Clark, W.C. (2004). "A global environmental divide?" *Environment*. 1.  
<sup>5</sup> DEFRA (UK), 2005. *Securing the future – delivering the UK sustainable development strategy*.



**Bridging the Gap**



Adapted from William C. Clark, Center for Science & International Affairs, Harvard University (nd)

**Figure 4**  
**A Global Environmental Divide**



In this great divide, Malaysia is saddled between the two components of affluence and poverty. It is therefore in the best position to be the convenor in balancing the two and optimise the positive aspects of the divide.

**2.2 Global Challenges: Linking Sustainability to Education**

Given the bleak global situation outlined above, it is imperative, therefore, for nations of the world to engage and partake in collaborative endeavours to address these views and issues. While steps have been taken to address them, for instance, the establishment of intergovernmental panels and initiatives such as the Brundtland Commission (1987), the IPCC (1988), the Rio Summit (1992), the Kyoto Protocol (1997) and so forth, the root causes of these issues have yet to be addressed. This is best done through education.

One of the challenges is to be involved in sustainable development and to turn it into reality rather than mere rhetoric. This was emphasised some years ago by the former UN Secretary General, Kofi Annan (2001)<sup>6</sup> who said that, “Our biggest challenge in this new century is to take an idea that sounds abstract -

sustainability development - and turn it into reality for the world’s people”.

To promote a more sustainable future, we need to change the system of our society. People must work together regardless of status and hierarchy to make their environment more sustainable by integrating sustainable operations, policy and practices for the long term in order to make the immediate environment a microcosm of the outside world.

The starting point is to integrate sustainable development into the educational system so that future generations can be nurtured and imbued with the need to embrace ecological protection, conservation of resources and human development. In addition and as aptly stated by the Brundtland Report (1987), “Sustainable development is meeting the needs of the present without compromising the ability of future generations to meet their own needs”.<sup>7</sup> The emphasis here should be to recognise that the many crises facing the planet are interrelated and are elements of a single crisis of the whole. Therefore, it is important that all sectors of the society consult and actively participate in decisions relating to sustainable development.

<sup>6</sup> Press release sc/sm/7739 (201), UN Secretary-General calls for break in political statement over environmental issues, 15 March 2001.

<sup>7</sup> Brundtland Report (1987). *Our common future*. Oxford: University of Oxford.



### 2.3 Education for Sustainable Development

Looking back at the progress of the Rio Summit which was held more than a decade ago, or rather its failure to set in motion processes that would lead to genuine sustainable development, it is incumbent now for the education system, higher education in particular, to be actively involved and to take steps in the promotion and acculturation of sustainable development. Since education is a major vehicle for, and contributor to, national and global development as well as the well-being of the community, it is strategic and appropriate for it to become the conduit for this promotion and nurturing.

It has been argued that education enables people to develop the knowledge, values and skills to participate in decisions about the way we do things, individually and collectively, locally and globally, that will improve the quality of life now without damaging the planet of the future.

The Organisation for Economic Cooperation and Development (OECD, 2007:173-174) suggested that institutions of higher learning can contribute to sustainable development in the following ways<sup>8</sup>:

- generating human capital in the region through their learning and further education

programmes in areas of sustainable development;

- acting as a source of expertise through research, consultancy and demonstration;
- playing a brokerage role in bringing together diverse regional actors and elements of capacity to the sustainability process;
- demonstrating good practice through on-campus management and development activities, strategic planning, building design, waste minimisation and water and energy efficiency practice, responsible purchasing programmes and pursuing good citizen type initiatives like the “green campus” concept; and
- offering recognition and reward incentive for staff to be involved in sustainable development leadership groups in the regional community.

The problem with the current higher education is that it is still living in the past. According to Ricardo Diez-Hogchleitner (1996), the President of the Club of Rome, the present social context is totally different from the situation for which education was designed. He said, “Education must not only be adapted to the needs of our age, it must also make real effort to look ahead some twenty-five years”. In his assessment of higher education many years ago, Rene Maheu (1974), the then Director-General of UNESCO has already acknowledged that it is necessary

<sup>8</sup> OECD (2007). *Higher education and regions: globally competitive, locally engaged*. Paris: OECD.





to regenerate education to cope with the changes affecting society. To do this, one has to transform higher education according to the new needs of the community and the individuals both economically, socially and culturally.

This transformation requires a re-examination on how we approach and plan education, especially at the tertiary level. We need to strategise higher education for the promotion of sustainable development and growth. To do that, we need to position higher education toward sustainability.

In order to meet the challenges, USM has developed several programmes and initiatives along the line of sustainability even before it was officially recognised as one of the pioneers for the UNU Regional Centre of Expertise (RCE) of Education for Sustainable Development since 2005. With this United Nations University (UNU) recognition, USM has intensified its efforts and increased the synergies among different programmes in line with the UNESCO DESD agenda.<sup>9</sup>

The university's approach in promoting sustainable development stems from its inside-out approach<sup>10</sup>. This internalisation approach (as against 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 (i) the Kampus Sejahtera (Healthy Campus) programme, (ii) the University in a Garden concept, (iii) the transdisciplinary approach in promoting teaching and research activities, (iv) community action, and eventually, (v) as a global player, e.g., as an RCE.

As USM grew, its negative impact on the environment has also increased and will continue to increase unless policies and practices for a sustainability-led university are put in place. Informed and enlightened decisions that the university makes in procurement, acquisition, energy consumption, transportation policies, disposal of wastes, design of new buildings, renovations, landscape maintenance, introduction of new courses, increase in enrolment, staff recruitment and even the travel behaviour (especially by air) of its staff can all contribute toward sustainability.

The issue confronting the university is how to achieve excellence holistically within a small ecological footprint.

<sup>9</sup> Adapted from Dzulkifli A.R. and Zainal, A.S. (2008). "Universities in the 21<sup>st</sup> century – in search for a 'new' metaphor: the experiences of Universiti Sains Malaysia". A paper presented at the Inaugural World Universities Forum, Davos, 21 Jan – 3 Feb.

<sup>10</sup> Gratton, L. & Goshal, S. (2005). "Beyond Best Practice", *MIT Sloan Management Review*, Vol. 46, No. 3, Spring.



# 3.0

## USM IN THE APEX PROGRAMME





## 3.0 USM IN THE APEX PROGRAMME



### 3.1 An Institutional Profile

#### 3.1.1 Talents

In the 39 years since its establishment, USM has built a workforce of almost 7,800 staff of which 21% or 1,628 are academic staff. Almost 80 percent of them have doctoral degrees and equivalent professional qualifications (as against the national average of 40%) and are actively involved in the core activities of the university, namely teaching, research and consultancy. There is a good mix of young and experienced staff within the three research experience cohorts of more than 20 years of experience (22%), between 10 to 20 years of experience (26%) and those with less than 10 years of experience (52%).

For the postgraduate programmes, USM presently has almost 7,000 students, of which 26 percent are enrolled in the doctoral programmes, including course-based Doctor of Management and Doctor of Education degrees. In terms of entry qualifications, 49 percent were admitted with a CGPA of  $\geq 3.0$ . Almost 21 percent are foreign nationals coming from more than 60 countries. Besides the teaching and research staff, USM also employs 3,400 administrative,

technical and support staff. See Annex 1, Annex 2a and Annex 2b for a detailed profile of human resources.

#### 3.1.2 Research and Innovation

Besides the 24 schools offering the various undergraduate and postgraduate programmes, USM has established 13 centres of excellence to drive its R&I activities. Four of these centres (the National Poison Centre, the Doping Control Centre, the National Higher Education Research Institute and the Centre for Archaeological Research Malaysia) are recognised as national research centres. The Doping Control Centre is fully accredited by the International Olympic Council (IOC) and the National Poison Centre is a Collaborating Centre of the World Health Organisation (WHO). Over the years, the amount of research grants from various sources (public, private and international funding) has increased from about RM16.0 million in 2004 to RM75 million in 2007. There has been an increase in the number of publications in citation indices, as well as the cumulative impact factor (see Annex 3a). In a similar vein, the number of patents, technology licensing and IPR continues to rise (see Annex 3b).



### 3.1.3 Infrastructure/facilities

USM continues to upgrade its infrastructure and facilities in its quest to provide high-end support to its teaching and research activities. Up to 2005, the university was able to obtain 75 percent of its equipment for accreditation to GLP/ISO 17025, complying to safety and quality standards.

With regard to other support facilities, such as networking, shared facilities, service centres, recreational facilities and access to high-end research facilities, the university has reached a 75 percent level of compliance.

Up to 2007, the library has accumulated almost 900,000 books and online books and titles. It is the aim of the university to reach the one million collection by 2008 and 1.5 million by 2015.

See Annex 4 for a detailed profile of USM infrastructure/facilities.

### 3.1.4 Financial resources

As one of the Research University (RU) criterion, MoHE stipulated a quantum of RM50,000 per S&T staff per year as an indicator to qualify the university to be a RU. For 2007, USM surpassed this criterion with each S&T staff holding a grant to the value of RM78,500 from government agencies.

USM has been extremely successful in 2007 in generating income from training courses (RM6.8 million), consultancies (RM11.9 mil), and endowment including professorial chairs (RM17.9 mil).

See Annex 5

### 3.1.5 Current strengths and weaknesses

Given the existing human resources, infrastructure/facilities and financial resources mentioned above, it is obvious that USM has the relative strengths to be nurtured and move forward to become a world-class university. Its greatest impact is in the area of research and innovation where many of its discoveries and innovations have won awards and have been commercialised. In a similar vein, its researchers have been recognised and received accolades at international forums and for reputable publications.

As a result of its eminence in R&D activities, the number of postgraduate students applying to do their higher degrees has also increased exponentially, especially from abroad. The number of foreign postgraduate students has increased by almost 30 percent since 2002 and they come from more than 60 countries. Through a more assertive approach, USM will be able to attract a higher enrolment of postgraduate students in its quest for excellence through R&D.

At the undergraduate level, USM is now able to attract quality applications from amongst school leavers. Some programmes, such as medical sciences, health sciences, dental sciences, pharmaceutical sciences, computer sciences, engineering, communication and management have remained the programmes of choice for top students in the country<sup>11</sup>. Given such quality, it will further spur the growth of postgraduate programmes at this university if we are able to attract these students to continue with their education by offering cutting-edge research opportunities.

<sup>11</sup> MoHE (2006). *Academic Reputation Survey (ARES)*.



The university will undertake more rigorous and relentless steps to attract higher quality staff and students. Almost immediately, the short-term goal is to increase its composition of foreign staff, especially those with special expertise and

RU criterion. However, more efforts are still required to diversify the sources of these grants, such as from private and international sources, rather than relying solely on the government.



skills to build niche specialisations at USM. For the students, the university need to attract well-rounded, multi-talented and creative applicants. The administrators too need to have leadership abilities and are able, confident and have high managerial skills. On top of it all, the staff have to be fluent in Bahasa Malaysia and English to partake in activities organised at the global level.

Another critical strength of USM is its ability to look forward and attuned itself to the changing needs of society and the industry whilst remaining relevant and contributing towards human capital development. To this end, since 2004, USM has attempted to map out alternative futures moving toward a desired goal. This is the preferred scenario of the emerging vision of 4S (the Symbiotically Sustainable Studies Space). Some salient characteristics of this preferred scenario include the ability to be global in outreach, have flexible human resources to attract the best talent, perpetuate the continuation of teaching and research in a collaborative environment and links with the industry for academics and students, developing entrepreneurial culture, multiple sources of funding and portray a global outlook with local contents (see also USM, 2007a)<sup>12</sup>.

Since the past 39 years, USM has been able to accumulate and establish reasonably good facilities in the three campuses to enable its staff to use high-end multiple users equipment for their research activities. A majority of the laboratories (75%) have obtained accreditation for GLP and ISO 17025. For this APEX programme, the university would certainly require a major update and upgrade of its facilities which will wholly comply with the standards.

### 3.2 USM's Vision as an APEX University

The university has also been successful in securing reasonably large research grants to sustain its research activities. In terms of per staff quantum, in 2007 USM has surpassed the RM50,000/staff (from government agencies) stipulation of the

“Higher education for a sustainable tomorrow”

The choice for this vision is anchored to an

<sup>12</sup> USM (2007a). *Constructing Future Higher Education Scenarios – Insights from Universiti Sains Malaysia, Celebrating 50 Years of Nationhood*. Penang: Penerbit USM.



earlier effort by the university to map out its alternative futures. Sustainability is one of the five scenarios in which USM is seen as a university in a garden. The university is likened to a big tree of knowledge whose roots are continuously being nurtured by dedicated and committed teaching professionals and whose branches represent the holistic development of young minds without abandoning their interconnectedness with nature in a sustainable way.

### 3.3 USM's Mission

“We aspire to lead and innovate in achieving excellence at the international level through advancing and disseminating knowledge and truth, instilling qualities that stress academic excellence and professionalism, developing holistic individuals, and providing a strong commitment towards the society's aspiration, the country's vision and universal aspirations.”

In support of the universality of this mission statement, USM will focus its commitment and responsibility to the element of sustainability by integrating sustainable operations, policy and practices for the long term in order to make the university a microcosm of the outside world in line with the concept of being a “University in a Garden” (2003), USM will embrace ecological protection, conservation of resources, and human development as well as position itself to assist in the global aspiration for poverty eradication, development of the bottom billion and ultimately outreach to the global community and society. To this end, the university will be involved in three major activities – governance, education (or academic departments) and research

operations in extending its reach to the local community.

### 3.4 The USM's APEX Framework

As a university, USM follows a two-tiered approach. First, the university aspires to be world renowned for sustainability. Second, it also aims to be a sustainability-led university (see Figure 5 above).

#### 3.4.1 A renowned university for sustainability

With regard to the first tier, since 2000 USM has embarked on a series of initiatives to become socially responsible as it develops. It has embraced ecological protection, the conservation of resources and human development and the accepted framework for achieving sustainability on campus. This will provide the platform as the university moves forward in the years to come. To realise this aspiration, the university has taken initial steps to refocus and retool its teaching and research programmes and activities toward the need to live within the environmental limits.

Those initial steps taken to excel in the issues of sustainability will now be accelerated under the APEX programme. Throughout the programme period, USM will be more assertive in moving toward sustainability by reinvigorating and transforming its teaching and learning programmes, R&D activities and services to produce quality outcomes which are equitable, accessible, available and affordable. The ultimate aim is to support the drive to improve the well-being of humanity, the marginalised bottom of the pyramid in particular (Pralhad, 2006)<sup>13</sup>. Eventually our efforts would also contribute

<sup>13</sup> Pralhad, C.K. (2006). *The fortune at the bottom of the pyramid: eradicating poverty through profits*. Upper Saddle River, NJ: Wharton School Publishing.



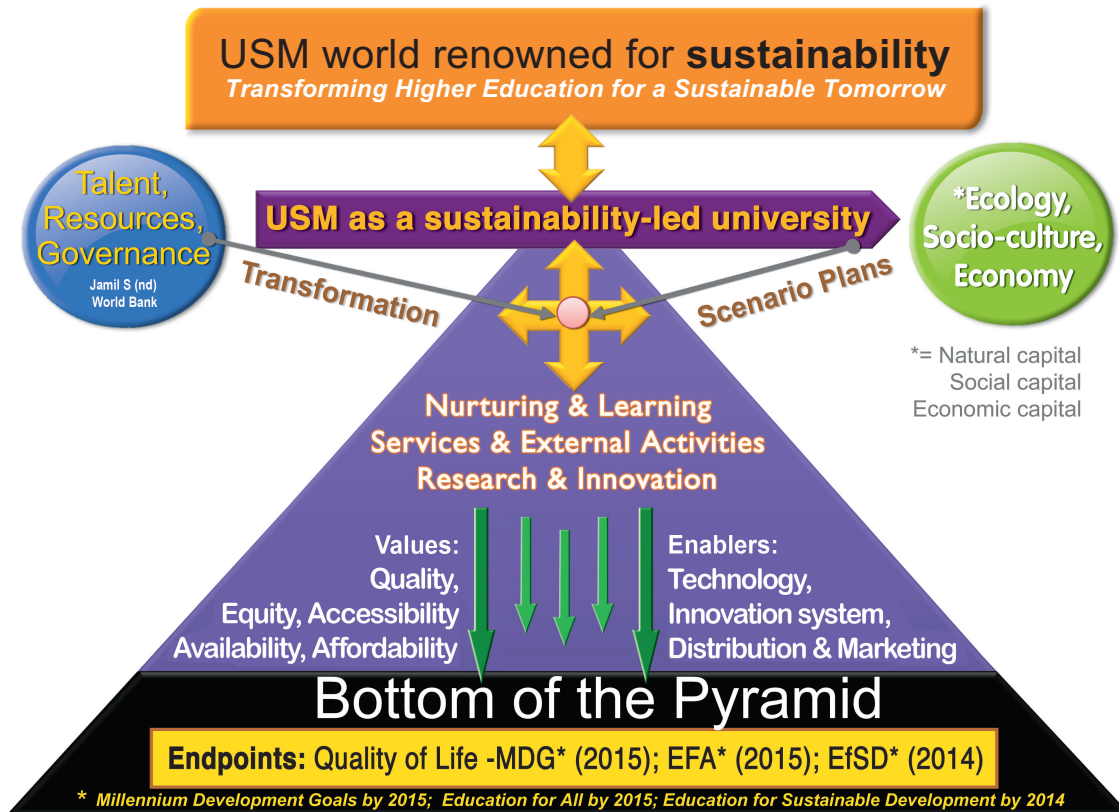


Figure 5  
THE USM'S APEX UNIVERSITY FRAMEWORK

toward the attainment of global visions as endorsed by world leaders including Malaysia, such as the Millennium Development Goals (MDGs)<sup>14</sup> by 2015, and Education for Sustainable Development (ESD) by 2014<sup>15</sup>.

**3.4.2 USM as a sustainability-led university**

For the second tier, i.e., transforming USM to be a sustainability-led university, the effort started in early 2001 will be rigorously pursued and expanded in order to ensure the campus produces human capital as the seeds of social transformation that is sustainable from amongst staff and students. This endeavour is proposed on the understanding that education is the key to change unsustainable lifestyle and mindset. Students and staff must be provided with learning tools and opportunities in the real world environment to integrate knowledge and concepts of sustainability to local practices, applications and solutions. In turn, outreach programmes by the university will introduce sustainability to the local and global community.

This strategy is congruent to the transformational role played by USM as the UNU-RCE on Education for Sustainable Development (RCE Penang @ USM) since 2005 (see page 21, RCE factfile). An RCE is a network of existing formal, non-formal and informal education organisations aiming to deliver education for sustainable development (ESD) to a regional/local community. All RCEs have a common framework aspiring to achieve the goals of the UN Decade of Education for Sustainable Development (DESD, 2005-2014), by translating the global agenda such as the Millennium Development Goals, Climate Change and Education for All into the context of the local/regional/global community in which they operate.

RCE Penang @ USM, of which the university plays the leading and Secretariat role, is one of the pioneer groups of seven RCEs (Pilot RCEs) to receive recognition by UNESCO/UNU in June 2005 for its work on education for sustainable development. There are currently

<sup>14</sup> United Nations (2000) UN Millennium Development Goals, Secretary-General's Report 2000.

<sup>15</sup> [http://portal.unesco.org/education/en/ev.php-URL\\_ID=23279&URL\\_DO=DO](http://portal.unesco.org/education/en/ev.php-URL_ID=23279&URL_DO=DO), accessed on 14 March 2008



some 52 RCEs around the world and the number is expected to reach 200 by the end of the Decade of Education for Sustainable Development. Hence USM can establish itself as a recognised leader.

RCE Penang @ USM has brought together a wide range of NGOs, organisations and individuals which are actively involved in SD related activities in local, regional and international levels. RCE Penang @ USM has organised various activities ranging from publications, workshops, consultations and seminars on various themes of sustainability such as re-orienting teachers' education to address sustainability. RCE Penang @ USM has also hosted several visits from overseas personnel who are interested to see and share the practices of EfSD. Various collaborative projects with the stakeholders have also been conducted ranging from forums, exhibitions and the training of trainers to strengthen and coordinate common understanding and plan for EfSD activities in the region.

### 3.5 The Transformation Strategies

#### 3.5.1 Strategies for excellence

In the need to strategise itself toward global excellence for the APEX programme, USM will, as a start, emulate and adapt approaches that

have been successfully practised elsewhere. Since the early 2000s, the European Commission has set forth a plan to reform the universities based on several critical arguments to make EU universities more dynamic and competitive. In March 2000, the European Council organised a meeting on higher education in Lisbon with the aim of "making Europe and the EU the world's most dynamic and competitive economy and in respect of higher education, it has particularly focused on the knowledge and learning economy". Known as the Lisbon Strategy, this conference also aims at connecting innovation to research and development activities<sup>16</sup>.

As a result of this meeting, in May 2006 the European Commission recommended various strategies to reform higher education to ensure the breakdowns of barriers and impediments to the universities as well as to make European universities and research more visible and attractive in the world. The recommended strategies include:

- Ensuring autonomy and accountability
- Providing incentives for partnership and business
- Providing "the right mix" of skills and competencies for the labour market
- Reducing the funding gap and making funding work more effectively in education and research
- Enhancing interdisciplinarity and transdisciplinarity
- Facilitating the interaction of knowledge and society
- Rewarding excellence

The above strategies are obviously aimed at capturing the world-class label for the European universities. At another conference held later in London in June 2006, the specific aim then was to position these universities to capture the top spot of the league tables of the Times Higher Education Supplement (THES) and the Shanghai's Jiao Tong University. For this purpose, the EC's

<sup>16</sup> Deem, R., Mok, K.H. and Lucas, L (2008). "Transforming higher education in whose image? Exploring the concept of the 'World-Class' university in Europe and Asia." *Higher Education Policy*, Vol. 21.



Director General for Education and Culture suggested three approaches toward modernisation, namely (i) to give them the capacity to run their own lives with less bureaucracy and using block funding, (ii) to be more flexible and competitive about bidding for research funding, and (iii) to increase the scale and global scope (Deem et al., 2008:87).

Another strategy which has been successfully adopted in the business world and which can be used as a model is what is known as the “Blue Ocean Strategy” (BOS) introduced by Kim and Mauborgne (2005)<sup>17</sup>. The Blue Ocean Strategy is a concept defined as “[the] untapped market space, demand creation, and the opportunity for highly profitable growth” (Kim and Mauborgne, 2005:4-5). According to the authors, the “blue ocean” connotes the unknown market space which is untainted by competition. It is also a metaphor to describe the wider, deeper potential of market space that is yet to be explored. This strategy requires the industry to expand its existing boundaries and change the rules of the game which, in turn, will render competition irrelevant.

The authors suggested that rather than fight over space and competition as is happening in what they referred to as the “Red Ocean” (in which the boundaries of the industries are defined and accepted and the competitive rules of the game are known), businesses and institutions should create their own market space and

demand. A blue ocean is created when a company achieves value innovation that creates value simultaneously for both the buyer and the company. One has to find the value that crosses conventional market segmentation and offers more value and lower cost. Demand is created rather than fought over and there is ample

opportunity for every entity to grow. On this note, the authors argued,

“To maximise the size of their blue oceans, companies need to take a reverse course. Instead of concentrating on customers, they need to look to noncustomers. And instead of focusing on customer differences, they need to build on powerful commonalities in what buyers value. That allows companies to reach beyond existing demand to unlock a new mass of customers that did not exist before” (Kim and Mauborgne, 2005:102).

This suggests that it is almost impossible for fledgling businesses and institutions, including universities, to play the catch-up game and be at par with more advanced and established competitions. Some examples used by Kim and Mauborgne (2005) to support this strategy which has created new market spaces are *Cirque du Soleil* (which blends opera and ballet with the circus format), *Southwest Airlines* (which offers flexibility of bus travel at the speed of air travel using a secondary airport) and *Home Depot* (which offers competitive prices for a range of lumber yard products hand-in-hand with consumer classes to help buyers with DIY projects). In higher education, USM could take a leading role in transforming itself using the BOS. Sustainability in higher education, for all intents and purposes, is a blue ocean opportunity.

Another strategy would also include the bringing

<sup>17</sup> 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.



in of “towering professors” who can stimulate the impetus of research at USM towards sustainability with the balanced approach of social and economic impact. These solutions when practised and shared among Asian countries may finally turn around the world impact of having Asia in the lead.

### 3.5.2 USM’s transformation strategy

Looking back at the approaches available, it is therefore apparent to USM that its transformation strategy will consist of two primary foci:

- Transforming the three pillars of a world renowned higher education institution, namely the concentration of talent, the abundance of resources and the acculturation of supportive governance, and
- Transforming the output/outcome necessary to be world renowned.

Underlying these focused areas is the overall paradigm of blue ocean thinking as well as the approach taken by the European universities. This means that USM will realign itself in the transformation process to move into uncharted space and untapped markets. This allows the university to grow and innovate untainted by competition, through the creation of new

demands by introducing new value innovation and opportunities.

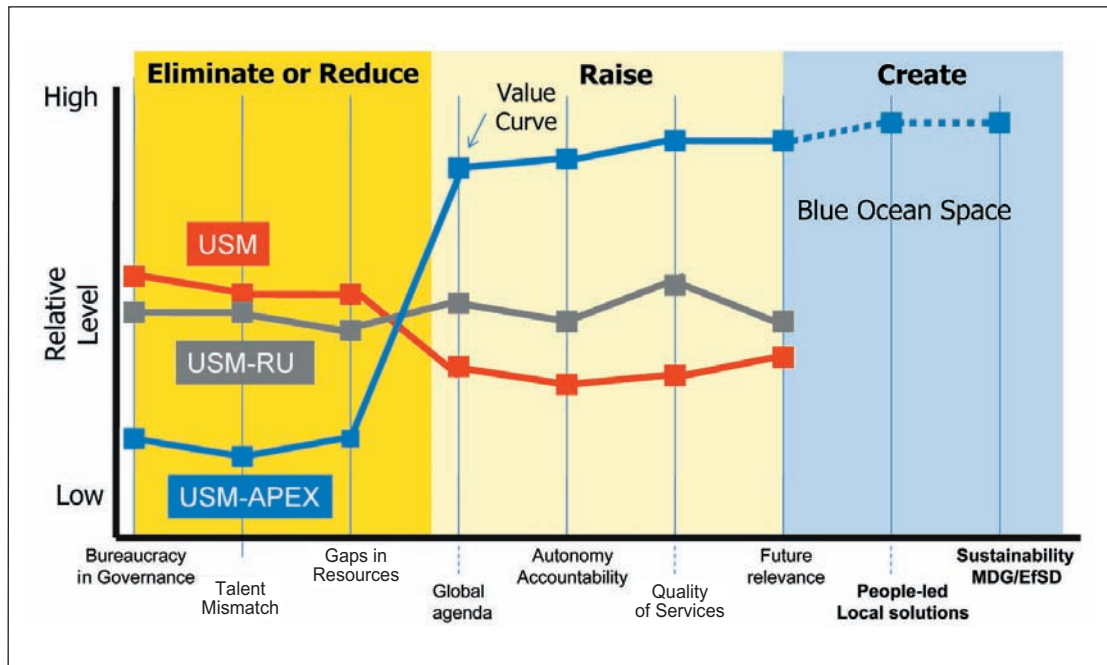
In so doing, the university will seek greater autonomy, provide the right mix of skills and competencies for the sustainable economy, reduce funding gaps and make funding work more effectively in education and research, enhancing interdisciplinarity and transdisciplinarity, facilitate the interaction of knowledge and society and reward excellence. All these will be carried out within the context of sustainability-led education and research.

To realise this strategy and as shown in Figure 6, USM-APEX (in blue dotted line) will undertake a strategy to innovate to promote new “markets” for knowledge by introducing sustainability-led education through creating new demands which focus on the needs of the masses at the bottom of the pyramid. Following the blue ocean strategy, as shown in Figure 7, USM will take steps to transform itself by eliminating or reducing bureaucracy, reducing the funding gap and talent mismatch whilst raising the global agenda, autonomy and accountability, quality and future relevance, creating “people-led” local solutions for global problem, thus creating sustainability, in conformance to the indicators exemplified by the MDGs and EfSD.



Taking cognisance of the need to navigate USM toward sustainability-led education, the university will adopt a stance that conducts science for humanity, which in essence fuses science and technology with the arts and humanity. The focus will now be on research outcomes that will enhance sustainability that includes reducing inequity and increasing availability, affordability, accessibility and quality of our innovations to those who need them most – the people in the bottom billion. In addressing local





**Figure 6**  
**The General Strategy Canvas for USM**  
 (Adapted from Kim and Mauborgne, 2005:87)

problems, USM will in essence also provide solutions to global problems. It is therefore important that USM’s strategy is focused on addressing global problems such as energy security, water security, food security and the wellness paradigm, to name a few. The current global food and energy crises are cases in point. They require urgent attention. In channelling the energy to work on a bigger agenda, the university

will encourage the fundamental and the applied with researchers working together towards a common goal. Working on local problems will finally create the significant impact that sustainable society needs to see from local researchers.



**Figure 7**  
**Transforming Higher Education @USM**  
 (Adapted from Kim and Mauborgne, 2005:93)

## Regional Centres of Expertise

on education for sustainable development

### RCE PENANG

#### Geography

The geographic scope for RCE Penang's activities is the State of Penang with its island, territories in the mainland and its neighbouring states, with possible satellite activities in several areas such as Kubang Kerian in Kelantan, Transkrian and states in East Malaysia. There is also the possibility of collaboration with other interested organisations working on ESD in Southeast Asia.



#### Regional challenges

Penang is acknowledged as among the most successful and liveable places in Asia. It is rich in tropical and cultural treasures. However, like any other state with rapid economic development, Penang faces challenges such as rapid urbanisation and large scale property development that are causing environmental and social stress.

There is a high level of concern and awareness among the communities on environmental issues, and a variety of programmes and activities are in place to address these as well as the social and economic aspects of sustainable development. While these awareness-raising programmes are very important, a more comprehensive education-based approach is still needed.

#### RCE Penang's perceived role in the region

Penang's challenges need to be addressed with an educational framework that is capable of ensuring sustainability in the region. Thus, educational programmes form the backbone of RCE Penang.

The mission of RCE Penang is to build capacity to deliver, support and generate innovative education for sustainable development (SD) in Penang. This will be achieved by working with partners and by developing a coordinated communication and dissemination framework for regional ESD projects and programmes.

#### Organisations involved

The core organisation of RCE Penang is Universiti Sains Malaysia. Among the potential actors identified are the Department of Environment, Penang State Government, Municipal Council, and NGOs such as Social and Environmental Research Institute (SERI), Sahabat Alam Malaysia (SAM), Malaysian Nature Society (MNS), Consumer Action of Penang (CAP), Third World Network, Pesticide Action Network-Asia Pacific, Penang Environmental Working Group (PEWOG), Water Watch Asia and the Asia & West Pacific Network for Urban Conservation. Centres within USM such as the Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREE), Centre for Marine and Coastal Studies (CEMACS), Centre for Archaeological Research-Malaysia and the Museum, River Engineering and Urban Drainage Centre (REDAC), Unit of Women and Human resource Studies (KANITA), Basic Education Research Unit (BERU), are also involved.

Universiti Sains Malaysia



PHOTO © LIK MENG



## Goals of the RCE

- Create public awareness and understanding on SD and the needs for ESD.
- Move higher education institutions to spearhead ESD activities and awareness in the region.
- Coordinate the compilation of current ESD practices from across Penang and the neighbouring states in order to share and generate regional ESD good practices.

## Objectives

- Cultivate sustainable development competence of the existing workforce.
- Promote the region's commitment to sustainable development.
- Advance sustainable development competence of all the region's citizens to facilitate social inclusion and active participation in SD.
- Increase opportunities for sustainable development volunteering.
- Promote sustainable management and use of the community's physical, cultural and environmental assets.

Strategies to achieve the objectives include:

- establishing leadership for sustainable development;
- developing and promoting compelling images of sustainable regional development;
- developing and promoting sustainable development training opportunities for school teachers, teacher educators and school administrators;
- working with key partners to identify funding sources for ESD projects;
- developing an ESD Strategy guide for local authorities; and
- establishing one stop shop for information on ESD good practices in the region.

## Achievements

RCE Penang through USM as the leading actor and main operation centre has contributed to the expected functions of RCE in several ways. Awareness on ESD among the university communities and in Penang has been raised through seminars and workshops. ESD awareness has also been raised nationally through the government representatives working on ESD and through the recognition of the RCE. Contributions have been made to reorienting the approach towards environmental education, and ideas and information on implementing the DESD strategy have been disseminated. Collaborations and a network among various stakeholders in the region are also being developed.

## Activities

Activities at the university level are the Healthy Campus Programme, programmes on energy saving, and the University and the Community Programme in which faculty members disseminate research findings to benefit the community or in which students' clubs and societies work on various SD-related activities with the outside community.

Several awareness and capacity building seminars have been conducted – National Seminar for Teacher Development on ESD, International Healthy University Conference, ASEAN-EU EfSD Workshop, Training of Trainers' series, and the ASAIHL International Conference on Education for Sustainable Development.

Planned activities include:

- encouraging the active engagement of stakeholders through relevant programmes;
- developing ESD partnerships focusing on priority themes in the region such as waste management, tourism, and cultural heritage;
- cultivating ESD partnerships that address social equity issues, with education activities that aim to address the social, environmental and economic dimensions of ESD;
- fostering ESD partnerships that address the concept of efficiency in the use of natural resources;
- developing partnerships to test the potential of internet to develop innovative and effective online ESD learning communities; and
- promoting professional development of teachers.

## Decision-making structure

RCE Penang is operated by four main committees – the RCE Penang Council consisting of all stakeholders in Penang (representative of USM, NGO leaders and other civil society actors); the Eminent Persons' Group; a Specific Taskforce whose activities are based on specified areas of sustainable development such as recycling and energy conservation is headed by the USM representative and includes representatives of NGOs working on the identified issues; and an Operational Committee consisting of representatives from different schools and centres at the University.



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# 4.0

## THE TRANSFORMATION PLAN







## 4.0 THE TRANSFORMATION PLAN



The transformation strategy consists of two primary foci, namely (i) transforming the output/outcomes necessary to be world renowned in sustainable development, and (ii) transforming the three pillars of higher education, namely the concentration of talent, the abundance of resources and the acculturation of supportive governance (Salmi, 2006)<sup>18</sup>.

In transforming USM for the APEX programme, the university is reviewing its activities in all areas, including nurturing and learning (commonly known as teaching and learning), research and innovation, consultancy and services, postgraduate studies, and students and alumni. This review will particularly address the seven thrusts of the National Higher Education Action Plan (MoHE, 2007), in terms of:

- Widening access and enhancing equity
- Improving the quality of teaching and learning
- Enhancing research and innovation
- Strengthening the institution
- Intensifying internationalisation
- Enculturation of lifelong learning
- Delivery system

A summary of the transformation plans and their relationship to the seven thrusts is provided and in pp.56-58.

### 4.1 Transforming Nurturing and Learning

Higher education is currently based on the industrial model in which the objectivist view of education dominates. The objectivist knows only one truth and does not encourage multiple views, meanings or understanding of knowledge. In the context of the university, the professor is the authority who knows what that truth is and imparts that knowledge to his students primarily through a one-way flow of information. In other words, he stands in front of a large hall and gives a lecture, making little or no effort to engage the audience in a discourse.

The emerging alternative learning model is built on the constructivist paradigm in which learning is a facilitated social and cognitive activity with multiple ways of interaction between the professors and learners. Knowledge has multiple meanings in different contexts and at different stages in the learning process which is centred on the learner rather than the lecturer. This is

<sup>18</sup> Jamil Salmi (n.d.) "The challenge of establishing world class universities". Washington D.C.: The World Bank



a model more suited for the rapid changes of the knowledge society and is subscribed to by *The Four Pillars of Education*<sup>19</sup> which provides a comprehensive framework for both lecturers and students to understand their roles in the university as an institution of higher education:

- **Learning to know** – It is less concerned about structured knowledge and more about mastering the tools for learning (learning how to learn) by developing concentration, memory skills and ability to think. Any attempt to know everything is pointless because knowledge is multifarious and capable of infinite development. As a means, it enables people to better understand the world around them in order to live with dignity, develop skills for employment and to communicate with others. As an end, it is primarily enjoyed by researchers but pleasures of understanding, knowledge and discovery can be enjoyed by everyone through good teaching.
- **Learning to do** – How do we equip people with the skills to do the jobs of the future which are changing from the skill-based jobs of the industrial model to economies which are dependent on turning advances in knowledge into innovations to generate new businesses and new jobs? Instead of certified physical skills, the shift is to personal competence measured by a combination of skills, talents, certified skills through technical and vocational training, social behaviour, interpersonal (social and communication) skills, personal initiative and willingness to take risks.

- **Learning to live together** – Human diversity and similarities and interdependence of people taught through geography, history, foreign languages and literature can help avoid misunderstandings, hatred and violence by encouraging youths to look at the world through the eyes of other religious or ethnic groups. Working on collaborative projects and lively debates, discussions and forums nurtures openness and helps to develop common goals and causes rather than focus on differences and conflicts. Sports, cultural and social projects involving groups of students and teachers can help to build a spirit of solidarity and commitment to a common cause.
- **Learning to be** – Education should contribute to every person's complete development - mind and body, intelligence, sensitivity, aesthetic appreciation and spirituality by equipping them to develop their own independent, critical way of thinking and judgement so that they can make up their own minds on the best courses of action in the different circumstances in their lives. It must ensure that all people enjoy the freedom of thought, judgement, feeling and imagination to develop their talents and to fulfil their various commitments - as an individual, a member of a family and of a community, a citizen and producer, an inventor of techniques and creative dreamer.

It can also be the model for education adopted under the *United Nations Decade of Education for Sustainable Development*. *Education for Sustainable Development (EfSD)* is about education but unlike earlier efforts which concentrated on educating students about what is sustainable development, the new focus is to educate so that we can achieve sustainable development. It desires to bring about a change in people so that they will take action rather than to simply absorb information for examinations. Action is the key and EfSD aims to help people understand that

<sup>19</sup> UNESCO Task Force for Education in the 21st Century  
<http://www.unesco.org/delors/fourpil.htm>, (accessed on 14 March 2008).



the responsibility for sustainable development lies with “me and us”, not just “them”. The educational programme must therefore provide the students with :

- the ability to think for themselves;
- to be more independent but yet participatory in decision-making;
- to be able to reflect and debate issues leading to the formation of their own opinions, demonstrating their ability to think critically and to solve problems;
- to foster learning through discovery and life experiences using multiple pedagogies engaging multi-intelligences.

The EfSD approach relies very heavily on the constructivist paradigm for teaching and learning to save Mother Earth. The Ministry of Education and the Ministry of Higher Education had in various official publications including their strategic plans also proposed that the

constructivist approach be adopted for certain subjects or courses.

#### 4.1.1 Strategies

The strategies for nurturing and learning (commonly referred to as teaching and learning) will involve the eliminate-reduce-raise-create grid (ERRC) as illustrated in the following strategy canvas (see Figure 8):

##### a. Eliminate and/or Reduce

- Examinations** – Students now study mainly to pass examinations, not to gain or develop knowledge for the benefit of humankind.
- Lectures** – Most lectures are conducted as monologues in front of very impersonal big classes with the assumption that every student has the same level of skills, knowledge, understanding and interest (one-size-fits-all).

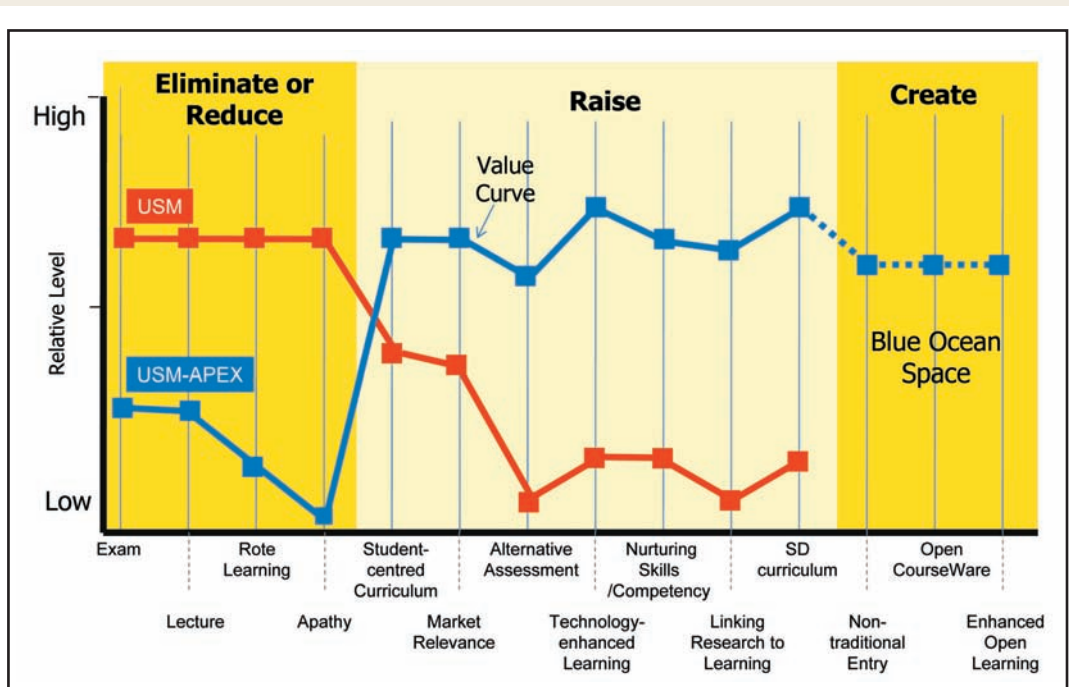


Figure 8  
A Strategy Canvas for Nurturing and Learning



iii. **Rote Learning** – Students also have difficulty applying the knowledge for practical use because the emphasis is too encourage memory work and discourage creativity and innovation.

iv. **Apathy** – The level of social conscience is low amongst the majority of students leading to unsustainable lifestyles and lack of interest to make a difference in the community.

**b. Raise**

i. **Student-centred Curricula** – Learning should focus on the students, not the lecturers - it is not about what the lecturers know and can impart to the students. The curricula and learning must be suited to different learning styles, abilities (physical and non-physical), types of activities, the students' level of understanding or knowledge, multiple intelligences and even divergent academic and non-academic interests of the students. The curricula should be flexible and cut across disciplines to provide the necessary skills and tools to lead sustainable lifestyles. They should encourage collaborative social learning. Examples of student-centred curricula include Problem-based Learning (PBL) currently used at USM in the health sciences and Outcome-based Education (OBE) which is a requirement of the professional institutes accrediting engineering degrees as well as the Malaysian Qualifications Agency (MQA).

ii. **Market Relevance** – The intention is not to be market- or industry-driven but graduates unable to secure meaningful employment are a drain on resources. Practical and industry experience must go hand-in-hand with the theories and knowledge acquired in the classrooms. At the same time, courses on entrepreneurship will be offered.

iii. **Alternative Assessments** – Other than examinations there are methods or approaches which are student-centred such

as use of portfolios, rubrics, matrices, peer assessments and personal reflections which offer greater flexibility and creativity for evaluation suited to each student's learning style, multiple intelligences, analytical capabilities and interests.

iv. **Technology-enhanced Learning (TEL)**

– TEL is the new term for e-learning which embraces infostructure, new markets, new applications, open access, social networking and video-conferencing. New forms of media and technology could enhance the learning experience for the digital natives familiar with podcasting, blogging, massively multiplayer online role playing games (MMORPG), electronic forums, multitasking, instant gratification and so on. This is in line with one of five scenarios for the futures of USM, i.e., the invisible university (USM, 2007a).

v. **Nurturing Skills / Competencies** – The priority for the “teaching” component is currently low amongst lecturers as they do not have to innovate or show effectiveness in this component. Lecturers must acquire the necessary skills to nurture learning and must learn to relinquish their role as the authority of his area of study and take on the role of mentor and facilitator of learning.

Lecturers must not only know the hard science of his own discipline but must cross into the soft sciences to acquire social and interpersonal skills needed of this new breed of professors.

vi. **Linking Research to Learning** – Research findings should not be disseminated amongst academic peers only in obscure or highly dedicated academic journals. Research findings must be disseminated for the benefit of humanity or local community through

monographs or mass media for the general public. The community can also benefit when lecturers utilise or apply the findings in the classroom using live or real world projects.

vii. **Sustainability Development (SD)**

**Curricula** – Currently, certain courses such as engineering are required by their professional institutes to incorporate sustainable development into their curriculum. To become a sustainability-led university, an across the board review and revision should be made for all programmes and courses in USM to identify areas where sustainability issues can be integrated into the curriculum.

c. **Create**

i. **Non-traditional Entry** – To accommodate students of different abilities (physical and non-physical), capabilities, talents, experiences and intelligences who would otherwise not benefit from the democratisation of knowledge. The changing global trends in technology, career, models of education and rapid development of knowledge will require universities to respond to demands for entry through new entry channels which may include students without formal school qualifications. This form of entry should be available to those who are disadvantaged or have disabilities (differently-abled OKUs) as well as those who are gifted. Currently USM has special entry arrangements for the OKUs and the Warga Emas.

ii. **OpenCourseWare (OCW)** – OCW democratises knowledge and education by making university courses available to the public free-of-charge. The Massachusetts Institute of Technology initiated it but Open University UK has taken it all the way by making available its open learning modules on the web for free using open source e-learning software (Moodle). By making courses and learning modules available, USM

will facilitate the achievement of MDGs and reach those at the bottom of the pyramid. A major portion of undergraduates will take courses under OCW thus freeing up vast academic resources to focus on postgraduate studies and research.

iii. **Enhanced Open Learning (EOL)** – EOL will add economic value in a sustainable way to the university and the students by offering certification as an option for OCW students at the completion of the course.

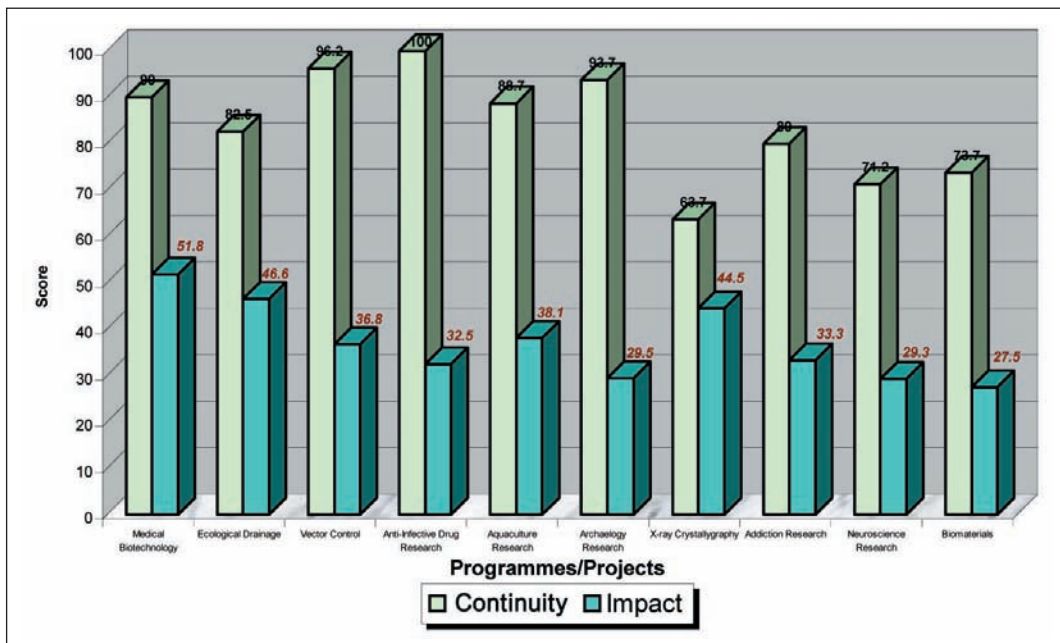
Based on the above transformation strategies, the strategy canvas can be seen in Figure 8.

**4.2 Transforming Research and Innovation**

The initiative to reinvigorate R&D activities at USM started in December 2000. An extensive and comprehensive exercise was conducted to audit all research programmes and projects with the aim of formulating a strategy to acculturate and nurture programmes which have the potential to become world class and incubate those which show the potential to reach this level. The outcome of this audit shows that USM has several niche areas which could anchor its path for excellence in R&D. The top five areas which have reached or on the verge of world class standing are medical biotechnology, ecological drainage technology, vector control, anti-infective drug research and aquaculture research, most of which dealt with the underlying theme on sustainability.

One critical lesson learned from this audit conducted seven years ago, and as shown in Table I, is that research activities at USM are relatively strong in their continuity outlook (i.e., they have sizeable research teams, sufficient research grants, adequate resources and extensive networks). However, they are relatively weak for impact, i.e., in publications, patents/commercialisation, technology transfer, impact on policy/consultancies and awards and





**Table 1**  
**Audited Top-10 Ranking R&D Programmes**  
**in USM according to Continuity and Impact<sup>20</sup>**

recognition.

#### 4.2.1 Strategic Research Initiatives

As a result of this audit exercise and to overcome some of the impediments, several recommendations were made and subsequently implemented to improve R&D programmes and activities of the university. They include<sup>21</sup>:

- The creation of a *research management office* known as the Research Creativity and Management Office (RCMO) to act as a one-stop centre for R&D providing management, administration and implementation needs as well as support, liaise and sustain R&I activities of the university;
- The establishment of *research clusters* in terms of borderless platforms to promote and encourage multi-disciplinary research and to increase collaboration and cooperation among researchers. Currently, USM has a total of almost 1,300 research grants addressing numerous topics and almost all are addressed in clusters rather than individually.
- The establishment of *Research Dean positions* for the following research platforms: social transformation (for social sciences and humanities), engineering and technology, information technology and communication, life sciences, health and biomedicine, clinical sciences and fundamental sciences. Their roles include congregating researchers from different disciplines, seeking grants as well as evaluating research proposals through their scientific committees.
- The setting up of a *Research Endowment Fund* to supplement the inadequacy of the grants provided by the public and private sectors, especially for basic and fundamental research. This is based on the belief that fundamental research is the beacon of basic research and it is the fountain of knowledge and understanding and contributes to a search of new knowledge. To date, nearly 250 topics have been successful in obtaining fundamental research funds.
- The university has also expanded *research incentives* to include travel grants, a larger quantum of research grants, honorariums to researchers, awards and fellowships, waiver of teaching duties, attendance at conferences and participation in the organisation of international conferences.

<sup>20</sup> Lee, M. N. N. (2005). *Research assessment in institutions of higher learning*. Penang: USM.

<sup>21</sup> Adapted from Dzulkifli, A.R. and Ramlı, M "Promoting R&D within the constraints of managing a teaching university: the case of Universiti Sains Malaysia", in H. Vessuri and U. Teichler (2008). *Universities as centres for research: an endangered species?* Rotterdam, Netherlands: Sense Publishers (in-print).



- In order to *promote and market its research products and services*, the university created several units for this purpose, including to network and collaborate with the industry and reputable universities. For the industry, USM initially established the University-Industry Liaison (before it was formalised as Bahagian Jaringan Industri dan Masyarakat or BJIM), to promote cooperation, collaborations and partnerships between the two entities. To enhance better research relations, the university set up the Engineering Innovation Technology Development (EITD) and Medical Innovation and Technology Development (MITD) units to spearhead innovations in the fields of engineering and medicine. It has also since then introduced the Industrial Advisory Panel (IAP) for all the schools.
  - With the aim of attracting a *pool of “towering personality”* (i.e., persons who are eminent and whose performance and achievement could and should be emulated by others), the university created more professorial chairs and other special schemes to commensurate with it. This allows the university to explore uncharted research destinies (including sustainability) and provide the direction and guidance to young staff to conduct value-added and knowledge discovery research. For this purpose, USM is in the process of hiring a renowned professor to spearhead the proposed Centre for Chemical Biology (CCB) to investigate fundamental problems in science in a transdisciplinary manner involving molecular biology, biocrystallography, structural biology, bioinformatics and drug discovery.
- USM has some of the *best research facilities* that others can only envy. Our desire to be among the finest means we have to constantly acquire state-of-the-art research infrastructure to remain competitive. USM’s research infrastructure includes advanced facilities such as:
    - \* X-ray diffractometers for structure determination of protein and small molecules,
    - \* chemical databases as well as a high performance server for structural and genomic analysis and supercomputer,
    - \* The Nano-Optoelectronics Research and Technology Laboratory (NOR) is one of a small number of places in the world to have, in close proximity and on the same site, gallium nitride growth equipment such as Molecular Beam Epitaxy (MBE),
    - \* extensive advanced simulation facilities,
    - \* advanced structural characterisation facilities,
    - \* optical properties measuring systems,
    - \* electrical properties measuring equipment, and
    - \* advanced fabrication equipment.
- The drug discovery related research centres have several state-of-the art unique facilities such as proteomic equipment, densitometer, Fourier Transform Infra-Red (FTIR) spectrometer, scintillation counter, spectrophotometer, high performance liquid chromatographs (HPLC) with ultra-violet, fluorescence and electro-chemical detectors, gas chromatographs (GC) with FID, ECD and NPD detectors, HPLC with mass spectrometers, GC with mass spectrometers and infra-red detectors, supercritical fluid chromatograph (SFC) and supercritical fluid extractor (SFE), ultra-centrifuge, and atomic

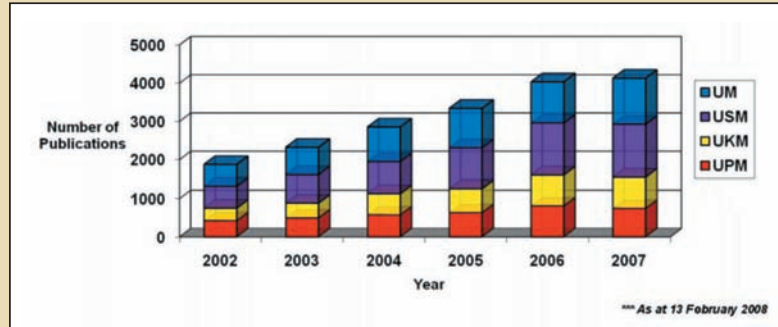


Figure 9  
Total Publication (WEB OF SCIENCE and SCOPUS) of Research Universities (2002 – 2007)<sup>22</sup>

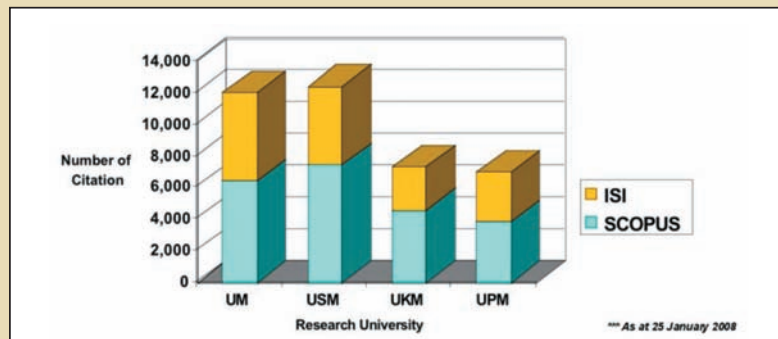


Figure 10  
Total Number of Citation for Papers Published since 2002 In WEB OF SCIENCE and SCOPUS<sup>22</sup>

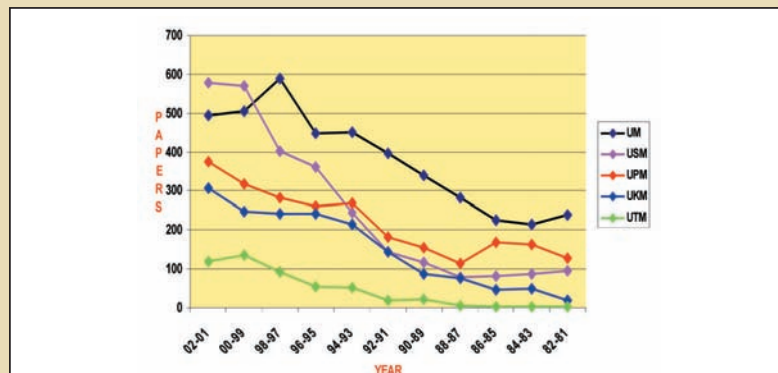


Figure 11  
Comparison of S&T Outputs From the Top Five Universities<sup>23</sup>

<sup>22</sup> Muhammad Rasat (2008). "Strategi mempertingkatkan penerbitan dan citation di kalangan universiti penyelidikan. Pembentangan di mesyuarat bagi merangka strategi ke arah universiti bertaraf dunia", 25 Feb, Putrajaya.

<sup>23</sup>MASTIC (2003-2004), Ministry of Science Technology & Innovation.



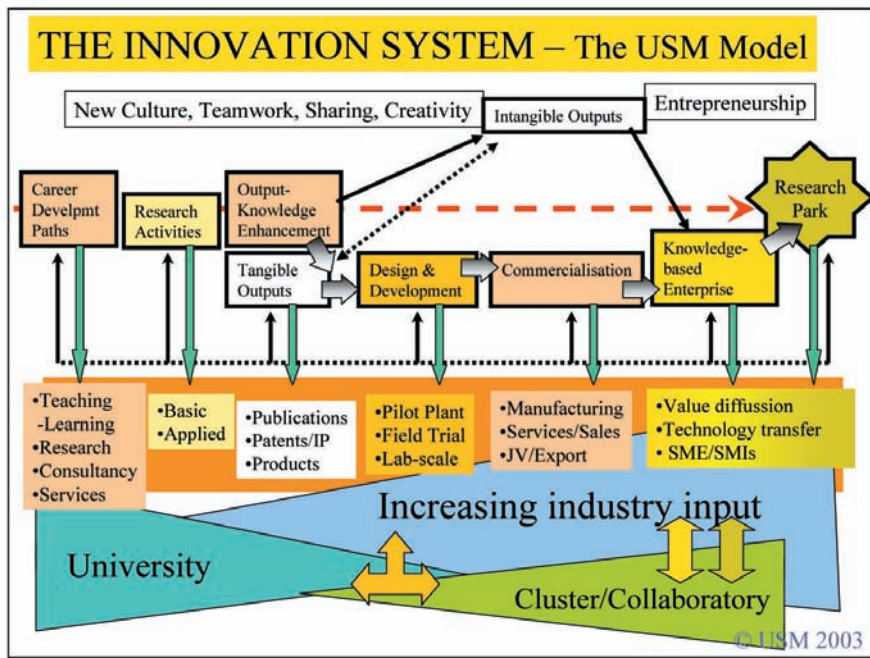


Figure 12  
The USM Innovation System Framework

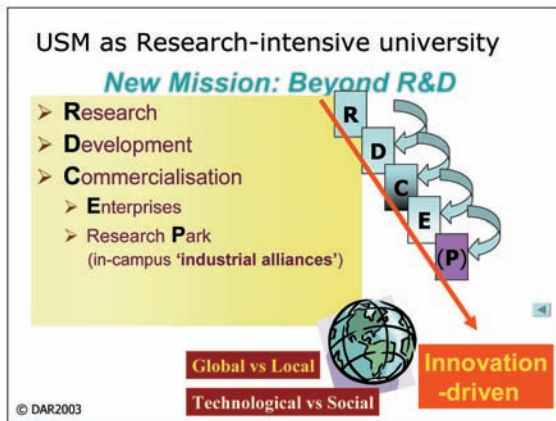


Figure 13  
Beyond Research and Development @ USM

absorption spectrometers.

Our close relationship and proximity to the newly formed Malaysian Institute of Pharmaceuticals and Nutraceuticals (IFMN) allows exceptional collaboration and access to more of the latest equipment for leading-edge research in this area. Our research with international partners such as RIKEN (Japan), Nancy-Université (France), University of Hawaii, Australian Antarctic Division, Rockefeller Centre and many others allow first-rate access to various

facilities around the world.

#### 4.2.2 The Publication Output

In terms of publication output, USM has continuously generated an upward trend in research performance as shown in Figure 9. Our total publication overshadowed our counterparts who each has a bigger population of researchers.

In terms of the total number of citations published the last five years, USM eclipsed its colleagues as shown in Figure 10. These results display the high quality of research output produced in the past five years in terms of publications and reflect USM's commitment to be an outstanding teaching and research institution. The results of these initiatives, as can be seen in Figure 11 are impressive, and USM will definitely do more to foster this unique strength. Our challenge for the future is to expand the number of areas in which we are internationally competitive and to grow a critical mass of top-class researchers to ensure the sustainability of our research excellence.

#### 4.2.3 Innovation and Inventiveness

In order for progress to take place, the findings from basic research usually lay the foundation for the applied science that follows. The spin-offs often eventually result from this kind of

|    | <b>PROJECT TITLES</b>   | <b>ALLOCATION (RM)</b> |
|----|---|------------------------|
| 1. | Development and Production of Dense Hydroxyapatite for Bone Graft Substitutes                         | 7,598,500.00           |
| 2. | Development and Production of Innovative Biomaterials for Developing Countries                        | 5,769,500.00           |
| 3. | Innovative Technology for the Production of (S) – Ibuprofen   | 2,987,500.00           |
| 4. | Development and Production of Oil Zob - A Novel and Reactive Oil Adsorbent from Various Rubber Wastes | 1,989,000.00           |
| 5. | Development and Production of the Nitrocellulose Membrane   | 1,625,000.00           |
| 6. | Enzymatic Deinking as an Environmental Friendly Solution for Recycling of Printed Waste Papers        | 1,601,500.00           |
| 7. | Development and Production of Bioconjugates   | 1,440,000.00           |
| 8. | Single Step Production of Carbon Nanotube and Hydrogen from Natural Gas                               | 1,340,000.00           |
|    | <b>TOTAL</b>  | <b>RM24,351,000.00</b> |

**Table 2:**  
**Projects funded by the Malaysian Technology Development Corporation Sdn Bhd (MTDC)**

|    | <b>PROJECT TITLES</b>   | <b>ALLOCATION (RM)</b>  |
|----|---|-------------------------|
| 1. | The Pre-Commercialisation Development of Natural Fibre Reinforced Thermoset Composite for Table Top Products                    | RM4,757,282.00          |
| 2. | A Closed Loop Electronic Waste Recovery System  | RM3,000,000.00          |
| 3. | An Intelligent Management Enterprise System (IMES)  | RM1,895,000.00          |
| 4. | The Development and Implementation of a Digital Smart Community Platform Using the RFID (Radio Frequency Identification) System | RM1,812,000.00          |
|    | <b>TOTAL</b>  | <b>RM 11,464,282.00</b> |

**Table 3**  
**Projects funded by the Technofund Grant (Ministry of Science Technology and Innovation)**

research and USM has been reaping the benefits of this faith on basic research. The USM Innovation System (as in Figure 12) was created to facilitate innovation, by allowing and encouraging as many of USM talents to participate in the entire journey of Research – Development – Commercialisation (R-D-C).

In fact USM has extended the usual innovation nexus of R-D-C to have additional elements of E for enterprise and P for Innovation Park (Figure 13) with specific reference to the SAINS @ USM initiatives mentioned earlier.

The Malaysian Technology Development Corporation (MTDC) recently funded eight projects to be taken to the next level for commercialisation purposes (see Table 2). Five of these projects have direct relevance towards environmental sustainability while the others are of medical importance to sustainable health. USM researchers have also been successful in capturing more than RM11 million of the Technofund Grant from the Ministry of Science, Technology and Innovation as shown in Table 3. TechnoFund is a competitive funding to undertake innovation to develop and commercialise new, cutting-edge and breakthrough technologies in agriculture, biotechnology, ICT and industry clusters and aims to create new businesses and economic wealth for Malaysia. USM researchers are collaborating with industrial partners to successfully bid for these grants. Research carried out are not only focusing on technology but are also targeted for social innovation.

USM has recently established an Innovation Office under the Research and Innovation (formerly known as R&D) Section to be the champion and custodian of this innovation system.

USM will soon complete its innovation system entities by establishing the Science and Arts Innovation Space (SAINS@USM). To assist in this effort, an Innovation Office was set up especially to conceptualise and manage SAINS@USM as an epitome of sustainability.

#### **4.2.4 Science and Arts Innovation Space SAINS @ USM**

One of USM's unique strengths is the impressive breadth and diversity from which its researchers can draw expertise and address the problems of sustainability. USM's latest endeavour, the development of Science and Arts Innovation Space (SAINS @ USM), is an outstanding example of this potential. This project combines the talents of USM's staff from all centres and schools such



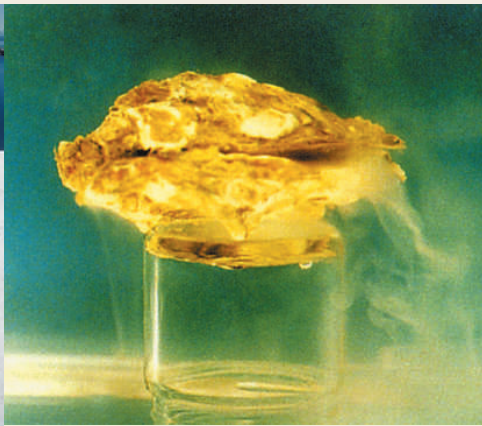
as engineering, housing, building and planning, the social sciences, humanities and management to create an environmentally-friendly innovation space. Their work is truly at the cutting-edge of each of their disciplines, and the integrated whole will definitely be more than the sum of their parts.

SAINS @ USM acts beyond just being an incubator for the nurturing of the life and earth sciences. It is also a space that fuses innovative ideas in a transdisciplinary way. This is emphasised in the layout plan of SAINS @ USM which blends three main types of space as seen in Figure 14. The common space at the forefront of SAINS @ USM provides the first node for interaction between the visitors and occupiers 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 which house various exhibits for the public. The intermediate space mediates between the public

and private, allowing for limited public access to the area for the more serious and discerning visitors or clientele. Finally, located further into the recesses of SAINS @ USM is the private customised space within a highly secured area where specialised activities and research are conducted almost exclusively by the occupiers of SAINS @ USM. In addition, there are other spaces called “satellites”, which are areas and facilities physically located outside SAINS @ USM as the hallmark of USM’s research and collaboration centres which are invariably linked to SAINS @ USM. Ultimately, all our initiatives on SAINS @ USM will be the inspiration for the development of a new resource and talent management system that can act as a model to our commercial and business communities.



Figure 14  
The Proposed Conceptual Plan of SAINS@USM



#### 4.2.5 Strategies

The key towards creating a blue ocean is to boldly go where no man has ventured before. This can be made possible by the following ERRC grid:

- a. **Eliminate and/or Reduce**
  - i. **Traditional research labels** such as “physicists, biologists or chemists” in preference to a transdisciplinary mindset through the clustering approach, for example. One of the ways of breaking down barriers is through thoughts and actions, and researchers should begin by eliminating traditional labels as described above. A transdisciplinary mindset should be given the chance to work for creating advanced thinking and new knowledge.
  - ii. **Boundaries and silos at all levels** are a hindrance towards collaboration and creativity. Personal or even school/centre level boundaries or empires have been the bane for research creativity and productivity. The concept of the borderless laboratories is capable of fostering faster development of knowledge as this flexible concept facilitates the integration of different individuals and disciplines. USM has a number of those “collaboratories”.
  - iii. **School/centre-based research and discrete disciplines** should also be clustered as an extension of the point above.
  - iv. **Employment based on staff teaching**
- v. **needs only** should be removed and the accountability of recruitment is transferred to a university search committee who acts based on the research needs of the university as a whole. This will also eliminate narrow searches as well as identify efficient ways to meet a broad spectrum of prospective candidates.
- vi. **Administrative roles of researchers** should be decreased as they are not primarily trained for these duties and their contribution towards research is more valuable. In place, RCMO will provide the administrative management support to all research activities.
- vii. **Any non-productive process on R&D evaluation** can be reduced by having a proper on-line process. This will also enable high quality assessment by having top grade assessors around the world to review and make proper recommendations on the proposals. This process can be managed at the level of the schools or centres of excellence.
- viii. **Time for decision-making in recruitment** can be lessened in cases where central authorisation is required. For example, a simple solution will be to invite a member of the central authority to be a member of the interviewing panel.
- viii. **Publications which are not in priority** should be reduced so that researchers are encouraged to perform the highest quality research for publications in reputable journals.



**b. Raise**

i. **Diversity of talents.** The main challenge currently confronting universities is how to accurately anticipate and most effectively foster innovation in research and teaching. USM can be turned into a temple where supremacy of ideas reign while working hard at creating the environments that are supportive of idea generation and the innovation system. Creative and innovative people normally stay at places that are more in tune to their needs. The opportunities for discovery today are more promising than ever especially if there are outstanding talents within our population of researchers or those closely linked with the university. The diversity of researchers among USM staff can be raised and retained through the creation of more fellowships and chairs that will attract researchers from around the world to spend time at USM. Talents are not only limited to staff or principal investigators but also support staff and students. The latter bring with them incredibly rich and different backgrounds and experiences that shape their interactions with others inside and outside the classroom. This will ultimately increase the impact on research and innovation. Diversity begets

diversity and among the most obvious effects will be the generation of transdisciplinary-type of research.

- ii. **Quality of staff** should be further raised as this is an essential factor towards producing high quality research. This can be done by recruiting the best possible high quality candidates to USM as well as improving the calibre of the current researchers.
- iii. **Quality of students** should also be appropriately raised at all levels. Strategies should be put in place to bring the best students from all over the world to USM. These include the creation of scholarships and fellowships to ensure that our research programmes remain strong and become even stronger. It is also important to realise that the quality of students is reflected in both academic excellence as well as diversity.
- iv. **Publication infrastructure** (such as editorial assistance and linkages) is also an important component to increase the amount and quality of research output. For example, editors of high ranking international journals should be invited to provide regular training in scientific writing as well as to personally guide researchers on their manuscripts (on a consultancy basis).
- v. **International collaboration on the world's most complex problems** should be enhanced and this can be done by getting them fully involved in international linkages, consortia and in support of global agenda. Sustainability is one such agenda. The university should encourage and facilitate such endeavours as these undertakings will normally snowball into much greater benefits at all levels of research and innovation.
- vi. **Freedom of inquiry** is without doubt the fundamental nature of the mind of every researcher. We must take steps to facilitate freedom of enquiry as failure to do so will damage the course of pursuit of knowledge.





vii. **Support for fundamental research** should be increased. As elaborated earlier, fundamental research has demonstrated its value over time and universities have always been the beacon of basic research. As long as universities are dynamic and their researchers are free to follow the truth wherever it may lead, there will always be a surge of new knowledge.

viii. **Shared and integrated facilities** to enable all kinds of interactions, intersections, collaborations and weaving should be allowed to happen all the time.

ix. **Chair to attract towering professors.** USM should endeavour to invite more “towering professors” to bring research of the university up to the next level. Among their roles will be to establish a proper research system and culture to perform the highest quality of research within this university.

**c. Create**

i. **Outreach programmes to schools** (local and regional) to uncover talents from different backgrounds.

ii. **International fellowships and scholarships** to recruit high quality staff and students.

iii. **Pilot programmes with a research-focused curriculum** (rather than traditional teaching-focused) with exit points at all three levels. Students will be taken into a pilot programme designed “to teach science the way you do science” as promoted by the Howard Hughes Medical Institute. Students in this programme will be engaged in the process of discovery and be transformed into future researchers, in this case toward sustainability.



iv. **New research horizon** is an important perspective of a living institution especially with respect to sustainability. This must be a constant constituent within the population of researchers. A dynamic amoeboid-like generation of ideas will keep USM at the forefront at all times and will ensure a continuous flow of discoveries and innovations.

v. **Individual research accountability goes to the university** rather than to the schools or centres of excellence. This novel suggestion requires a change in governance. Under this system, the schools will only be involved with the teaching of their curricula. Responsibility regarding research, however, is directed back to between the researcher and the university. This means that the university finally evaluates the annual performance of the researcher

- rather than the dean or director. The heads of departments will evaluate just the teaching performance and services.
- vi. **Performance-based one-line budget** in which researchers are also evaluated on their past records.
  - vii. **Employment towards research needs** rather than teaching needs as dictated by the schools.
  - viii. **A new flexible salary structure** to attract good researchers is imperative if we are to compete at the global level. Undoubtedly an adjustment is needed towards the current salary structure to entice good post-doctoral trainees and towering personalities to come to Malaysia.
  - ix. **Management system or structure for every research cluster** will facilitate the operation of the group. An experienced research manager who knows every aspect of research activity is needed to run the strenuous motion of doing research inter alia with the community.
  - x. **Sustainable community involvement in research projects** is an important aspect of research as in the end, it is the community which funds our research and it is also the community which will benefit from it. As part of the transdisciplinary approach, innovation originating from the community can be just as remarkable and this has often been seen, and vice versa.
  - xi. **Imprinting or branding of USM as a unique research venue** is an essential aspect within the mindset of researchers. The uniqueness of the USM main campus as well as our location on the beautiful island of Penang will entice many top researchers in the world to set up linkages and collaborate with us. USM's unique atmosphere of sustainability research and living-learning "university in a garden" campus can be used as an attractive stance to lure top notch scientists.

Based on the above transformation recommendations, the strategy canvas for the transformation of research and innovation can be summarised in Figure 15.

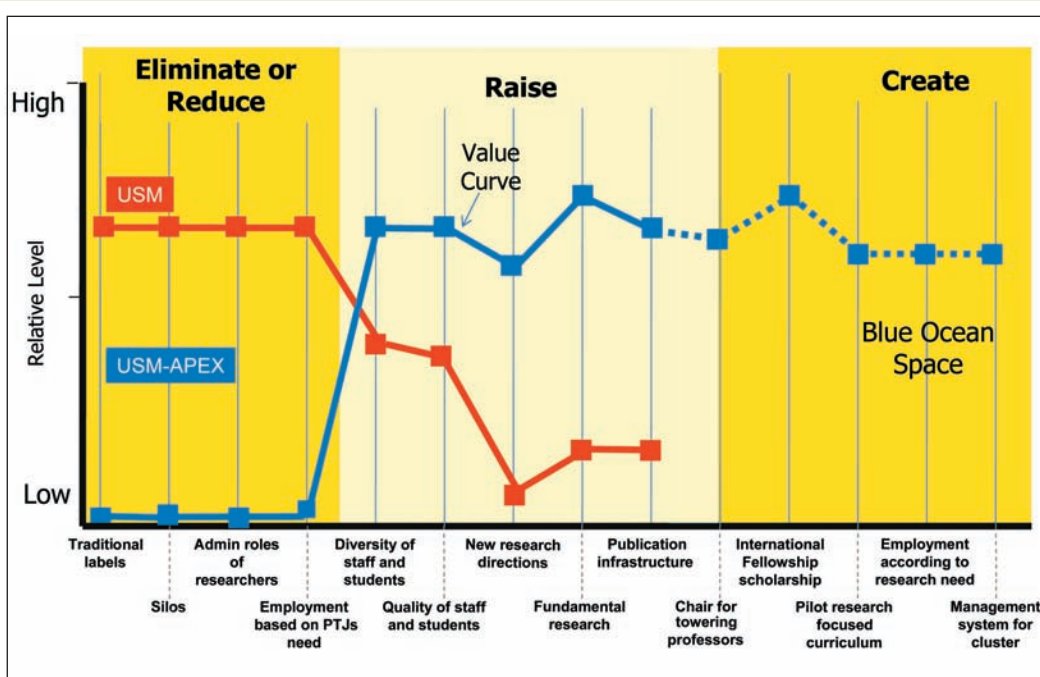


Figure 15  
A Strategy Canvas for Research and Innovation

### 4.3 Transforming Services and External Activities

One of the most important principles of sustainability is to establish a strong functional and institutional linkage between universities and the communities locally, regionally or even internationally.

Based on the concept of a University in A Garden (2003), which builds on the Program Kampus Sejahtera, USM has, since 2000, embarked on a number of activities/projects that have elements of sustainability. The concept, programme and examples of activities/projects that have been successfully experimented within the campus are:

#### 4.3.1 The University in a Garden<sup>24</sup>

This is an overarching concept that governs the overall process of policy drafting, policy implementation and execution of activities in the campus. The idea is to develop the university based on the following "gardenic" concept:

- Garden and the People
- Garden of Knowledge
- Garden of Vistas
- Garden of Nature
- Garden of Heritage
- The Garden Tomorrow

The "garden" metaphor is juxtaposed as the new sustainable metaphor for a university of tomorrow in place of the industrial model.

#### 4.3.2 Program Kampus Sejahtera (Healthy Campus Programme)

This is the programme that builds the foundation for the above concept based on the wellness principle of mind, body and soul which is also the ultimate aim of sustainability. Sejahtera connotes an all-encompassing nexus of mind-body-soul. Action plans for the programme are carried out based on the following five criteria:

- volunteerism, consultative, participatory
- transdisciplinary teams
- R&D-based, data driven
- in-sourcing of expertise
- complete & thorough documentation of the activities

Activities are open to all members of the campus community. More than 20 monographs have been written and produced on topics ranging from the participatory planning process, to community wellness, climate change survey, food and dietary improvement, and wildlife conservation in USM campus.

#### 4.3.3 Specific Examples of Sustainability-Led Activities/Projects Carried Out Within USM

These activities are aimed at increasing awareness of the students in several sustainability issues:

- The White Coffin Campaign** – This is the latest in a series of student-centred activities where they are encouraged to take the lead against the use of polystyrene (a petrochemical material widely used in food containers for take away food) on campus. The ultimate goal of this campaign is to develop a deeper students' understanding of sustainable development principles by getting them involved in an action campaign on the danger of using such containers. The white coffin (referring to the white container made from polystyrene) campaign was launched through the Healthy Campus Programme and sustained by the students themselves. USM students now have agreed to bring their own food containers or to use biodegradable containers to pack their food. The campaign is now being emulated by other campuses.
- The Campus-Wide Recycling Project** – Another project is to raise the awareness of students on recycling as one

<sup>24</sup> USM (2003). The university in a garden. Penang: Penerbit USM.





of the important elements in environmental sustainability. Throughout this programme, 70 students and university staff were exposed and trained on how to recycle and promote the activities among the entire campus community including e-wastes. This model of participation and training will be adopted by other sustainable development related projects and programmes.

- c. **The Tree Planting Project** - Tree planting has become an annual activity during the orientation week of newly admitted students and in 2006 alone, some 600 trees were planted including several varieties of local fruits.
- d. **Earth Hour and Earth Day** – As a measure of global concern, USM participated in events such as the Earth Hour 2008 on 28 March as an awareness exercise to save energy for an hour worldwide. USM also celebrates the World Earth Day on 22 April 2008.

#### 4.3.4 Activities/Projects Conducted Outside USM

In addition to the above activities, USM has also embarked on a number of activities/ projects with elements of sustainability with the world outside the campus. Examples of such activities/projects are outlined below.

- a. **Sustainable Health Programmes** – A series of activities carried out by various centres on issues pertaining to dangers of drug abuse, anti-smoking and prevention of doping in sports in campus.

- b. **Project Warga (The Citizenship Project)** – The objective of this programme is to train high school students to carry out problem-solving activities in their communities. In this programme, students engage members of the community and identify problems in their residential areas or villages. The programme also involved local councils and other local authorities apart from the community. They then propose possible solutions to some of the identified problems. In this process the students get to learn skills such as decision-making, communication and problem-solving that are important in real life.

Up till now as many as 5,000 pupils from nearly 50 schools nationwide have gone through the educational and training process. Various issues have been explored by the students ranging from environmental matters to social issues such as moral degradation. For it to be sustainable, a group of staff members within the university are now well-trained in conducting such projects.

Based on the success of these projects, USM is now replicating the same model to involve university students. This would definitely bring in higher levels of analysis and greater complexities of issues contributing to their development of better citizens.

- c. **Going Bananas: a Lesson on Sustainability**<sup>25</sup> – This is one of the major attempts in promoting

<sup>25</sup> USM (2007). Going bananas: a lesson in sustainability. Penang: Penerbit USM.

transdisciplinary projects that bridge the university and the community. The idea is to transfer the university's research and development products to benefit the community. The project is to "recycle" the entire banana trees, for example, the biomass can be tured into paper suitable for simple printing or writing but also for decorative purposes such as lamp shades and lanterns. In order to bring the technology to the community, the project has brought together staff from industrial technology, art, humanities and social science. A community near to USM has been chosen as the "adopted village" to carry out the activities. Finally, it is hoped that this project will help to generate economic income for the community while conserving the environment.

- d. **The Worm Composting Project**– While the project is still at the initial stage, it has already benefited the community by increasing the villagers' income by up to a hundred percent. Using technology developed by USM scientists, the community was able to produce compost using wastes from paddy, cow dung and general wastes from the village. The same technology is now being promoted at the kindergarten that operates in the university.
- e. **Sustainable Penang Initiative II** –This is a continuation of the original Sustainable Penang Initiative which ended in 1999. Under the current phase, USM through RCE Penang@USM is serving as the Main Steering Committee Member to develop a framework for sustainability in Penang especially on environmental issues. USM also serves in the same capacity in the Penang Eco-town Project.
- f. **Educational and Promotional Service to the Community on**



### **Energy Efficiency and Renewable Energy**

- This is another transdisciplinary flagship project of USM carried out by its Centre for Education, Training and Research in Renewable Energy and Energy Efficiency (CETREE). It serves as an excellent example of a university-community project. Apart from providing textbooks for schools to teach about renewable energy, CETREE through its mobile unit has introduced the subject of renewable energy and energy efficiency to 2.5 million school children nationwide. It has also carried out programmes through its mobile unit to 150,000 members of the public via community centres. The programme is now forging a strong corporate social responsibility partnership with PHILIPS.

Such projects/activities and others with similar objectives will be further enhanced and broadened in the future. For projects that were successfully carried out within the campus, they would be extended to the community outside, even globally. This can be done via the innovative platform of RCE to gather various vertical and horizontal stakeholders from the lowest level of community activists up to policy makers.

#### **4.3.5 One-Stop Centre**

In an effort to foster closer, effective, meaningful and sustainable linkages and partnerships with the industry and the community, the Division of Industry & Community Network (BJIM) of USM was set up as a one-stop centre within the

Chancellory in September 2007. In its interaction with the world outside USM, sustainability will be the focus of BJIM.

In the area of services to the community, besides the specific projects already mentioned earlier in section 4.3.4, the Division plans to concentrate for now on issues pertaining to the well-being of families which in turn will lead to the well-being of the community. Examples of issues that will be given attention include drug and tobacco abuse, domestic violence, gender equality, poverty, efficient utilisation of resources such as energy and family health. For 2008, 15 such projects have been planned to support sustainable health.

For the industrial sector, USM will only encourage consultancy services and collaboration projects in areas that have elements of sustainability. Issues on energy and resource efficiency and substitution as well as non-polluting technologies are examples that will be given emphasis. For industries that operate unsustainably, USM will assist in looking for avenues to reorient their activities towards sustainability. It will also discuss with and encourage companies to pursue Corporate Social Responsibility (CSR) projects that are sustainability biased.

A recent Bursa Malaysia report<sup>26</sup> on CSR in Malaysian Public Listed Companies (PLCs) found that “on average, our PLCs fall far behind international best practices and disclosures on CSR”. Nearly two thirds of PLCs fall either at the average, below average or poor categories and only 4.5% are in the leading category. Almost 70% of the latter are from MNCs. PLCs that scored best are in industries that are more regulated as the nature of their business has inherent social and environmental impacts. Examples of such companies are those in the tobacco, alcohol and gambling industries. The conclusion of the report states that in particular two areas in CSR need special attention, namely environment and diversity, with environment

receiving the lowest score out of the four dimensions studied in the survey.

As such, there are ample opportunities for USM to engage PLCs in Malaysia on CSRs, vis-à-vis their role in sustainability. PHILIPS is one example in which USM has been collaborating in the area of renewable energy. This engagement will involve not only the science and technology-based schools but the humanities and social sciences as well. As a corporate body, USM is actually already very much into adopting CSR concepts, and hence the theme of these submission.

#### 4.3.6 Strategies

##### a. **Eliminate and/or Reduce**

- The use and wastage of resources.
- Indifferent/uncaring attitudes towards the environment.

##### b. **Raise**

- Awareness that resources are finite and therefore should be utilised efficiently. In so doing, savings may also be enhanced.
- Civic consciousness must also be inculcated in all especially in the 4R mantra of Refuse, Reuse, Recycle and Reduce.

##### c. **Create**

- Passionate public attitude towards conservation and a love for the environment, i.e., fully embrace sustainability as a necessity.
- A new mindset within industries and community that they must at all times internalise the external cost (i.e., the cost to the environment and health) in all their procedures and operations.

Based on the above recommendations, the transformation strategy for services and external activities of the university can be summarised in Figure 16.

<sup>26</sup> Bursa Malaysia (2007) Corporate Social Responsibility in Malaysian PLCs. The CSR 2007 Status Report. An Executive Summary.



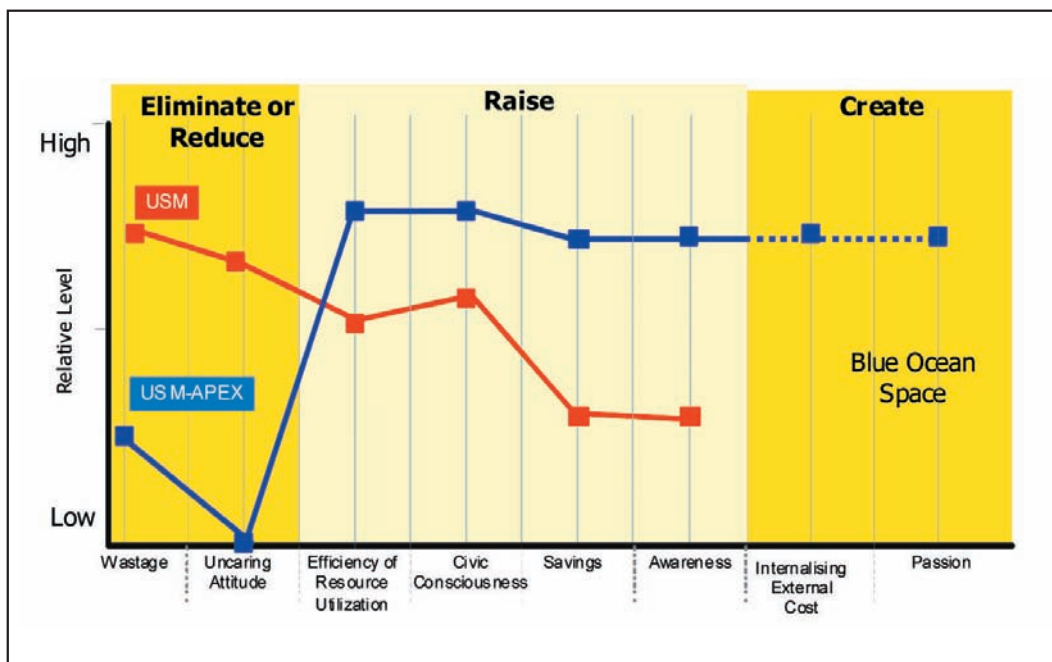


Figure 16  
A Strategy Canvas for Services and External Activities

#### 4.4 Transforming Students and Alumni Services

The Student Affairs and Development Division is an important aspect of the university's administration responsible for the management of all facets of students' affairs. This Division is responsible in ensuring students' physical and spiritual comfort and welfare, their achievements, as well as their development and conduct in the university. The responsibilities include the administration, finance, facilitation monitoring of student activities in the areas of co-curriculum, sports, cultural, recreational and international activities. Regular services include accommodations services, financial assistance and welfare support.

Alumni services are provided through the Alumni Liaison Office in close collaboration with the Vice-Chancellor's office.

The objective for both the students and alumni services is to create a balance between students' activities and academic programmes and link to the community in a strategic synergistic approach. This can be achieved through the enhancement of quality services by fostering and encouraging a friendly service environment for students.

##### 4.4.1. The Strategies

The strategies proposed are summarised as follows:

##### a. Eliminate and/or Reduce:

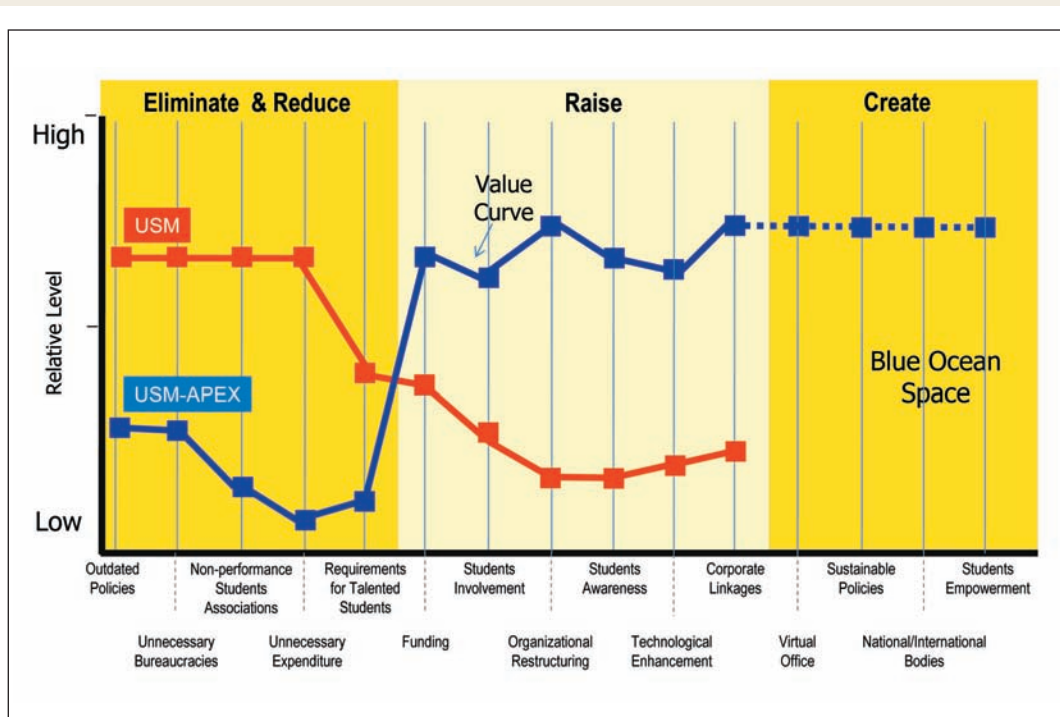
##### i. Outdated policies

There is a need to eliminate policies and unnecessary bureaucracies which are irrelevant to the current practice towards a sustainability-led university.

- ii. **Unnecessary bureaucracies**  
There is a need to enhance operations without unnecessary and hasty consideration by cutting the red-tape procedure in order to expedite the decision-making process.
- iii. **Non-performance students' associations**  
To rehabilitate the number of such associations that are incapable of sustaining themselves in their activities.
- iv. **Unnecessary expenditure**  
To manage more effectively by reducing annual expenditure such as cost-effectiveness of the project and the use of audits and alternative approaches.
- v. **Academic requirements for talented students**  
To appropriately adjust entrance requirements for talented students to gain entry for studies in culture and sports.

**b. Raise:**

- i. **Funding**  
Fund-raising is a very significant and important aspect. The success of fund-raising can be judged by the number of pledges made, the amount collected and the list of potential donors and philanthropists.
- ii. **Students' involvement**  
Students' involvement and participation in intellectual, cultural and social activities at the national and international level are to be increased. These can enhance the awareness of students on various issues. Program Kampus Sejahtera is already a good start.
- iii. **Student awareness**  
It is important to update and increase students' knowledge on global or domestic issues which can broaden their scope of thinking and ideas.



**Figure 17**  
**A Strategy Canvas for Students and Alumni Programmes**

iv. **Technological enhancement**

The increase in the use of technology enhancement such as networking, services, databases, etc. can further improve learning as well as services offered.

v. **Organisational restructuring**

Various policies, methodologies, infrastructure and personnel are to be revised to meet the aspiration of a sustainability-led university.

vi. **Corporate linkages**

Engagement with corporate bodies towards enhancing knowledge and experiences should be widened as part of organisational restructuring.

c. **Create**

i. **A virtual office**

Create a conducive virtual working environment for students' and Alumni services.

ii. **Sustainable policies**

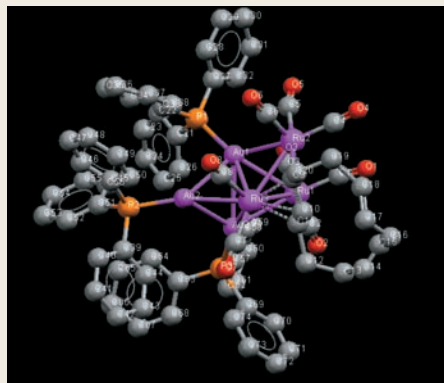
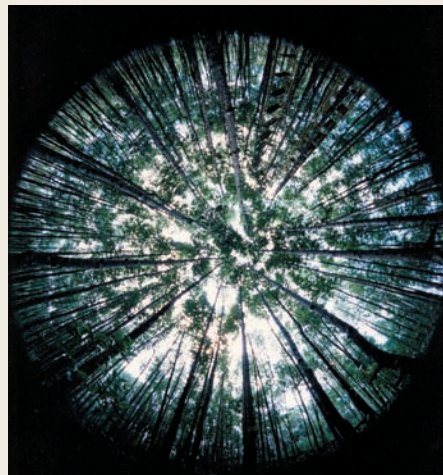
Develop policies related to students' activities

on sustainability such as recognition of cultural diversity, flexible class scheduling and optimal utilisation of existing facilities.

iii. **Student empowerment**

Give more autonomy in exercising their perceived rights and actions by expanding their skills on leadership, creativity, innovation and financial independence towards sustainability.

A world-class university can be created by nurturing the creative talents of students in an environment reflecting the sustainability elements that will prepare the students for the future. These strategies outlined and depicted in the canvas (see Figure 17) foresee some of the elements of transformation that can be suitably applied to USM's existing environment. Given the appropriate funding, governance and support systems, the nurturing talents can expedite the achievement of being a world-class university. These aspects will be discuss next.







## 4.5 Transforming Postgraduate Studies

A university's most important asset and product are the students. From the perspective of sustainable education, this translates into students that can adapt and contribute towards a society that is diverse and with amorphous, fluid and extensive requirements. A sustainable supply chain of a highly skilled workforce lies in the delivery of an effective postgraduate education agenda that embodies competitiveness and innovation while inculcating social and environmental awareness. The knowledge-based students will become the lynchpin in the mechanisms of social advancement that transverse from the institution to the population.

USM endeavours to become a university that produces postgraduate students who are not only trained in their disciplinary knowledge but also possess deep analytical skills and capacities that allow them to navigate a variety of careers and adapt to changes after graduation. USM will constantly seek to encapsulate innovative reality research, challenging the status quo, extrapolating future scenarios; in other words, outcomes from a postgraduate education contribute directly to sustained economic growth and societal development.

USM recognises that the key drivers of change to its current postgraduate education framework include among others;

- international benchmarking,
- emphasis on employability which relates directly to skills and training,
- submission rates and quality of supervision, and
- changes in the examination of the thesis.

In response to these drivers and challenges, USM aims to redress these issues by;

- Engaging in effective partnerships with the stakeholders
- Expanding innovative collaborations
- Establishing programmes that promote citizen scholars
- Supporting the concept of intellectual entrepreneurs

### 4.5.1 Strategies

Postgraduate studies, as the frontier of research simultaneously bridging institutional findings into society has necessitated a strategic alignment that is entrenched in a four-pronged eliminate-reduce-raise-create approach as presented in the ensuing strategy canvas:

#### a. Eliminate and/or Reduce

- One-size Fits All Approach** - Typically, postgraduate studies are stifled with rigid programme structures which are intolerant to flexible approaches and time frame regardless of the curriculum needs of a programme.
- “Secret Garden” Model Supervision<sup>27</sup>** - The student-supervisor working relationship is not transparent with low accountability from both the supervisor and research student and is without institutional and faculty intervention. Traditional Assessment Mechanism – Postgraduate research assessment mechanisms are thesis-based irrespective of the field of research undertaken and this can undermine creativity and impartiality in areas where a treatise is not appropriate

<sup>27</sup> Park, C.C. (2006). “The end of the secret garden: Reframing postgraduate supervision.” <http://lrvle.lancs.ac.uk/CELT/supervision.nsf> (Accessed on 24 April 2008).

**b. Raise**

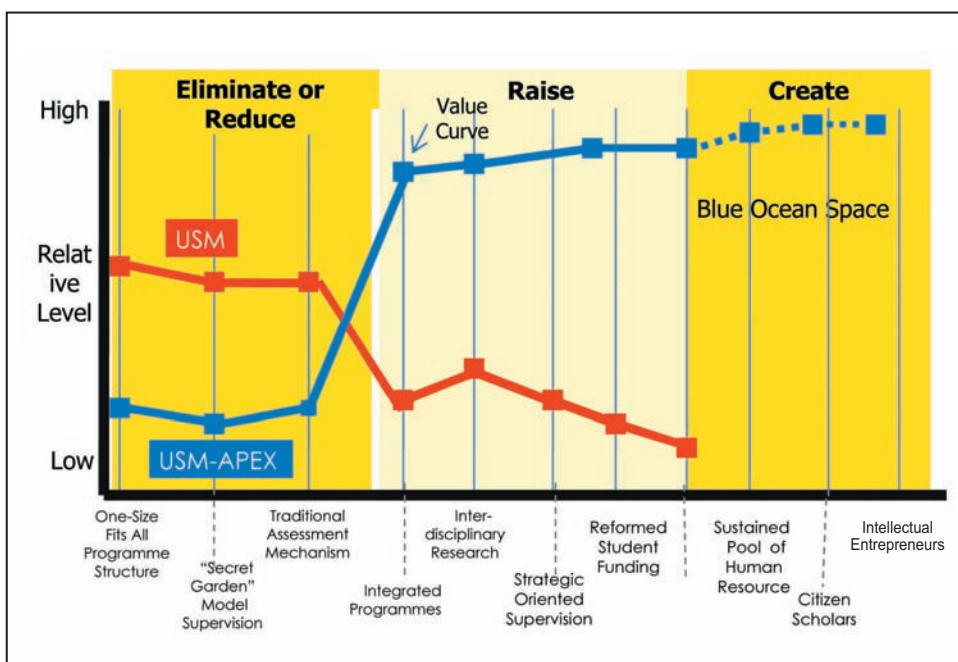
- i. **Integrated Programmes**– As a means for the preparation of postgraduates for employment. The curricula should provide opportunities for postgraduate students towards career options in non-academic settings as well as providing professional and personal development skills.
- ii. **Interdisciplinary Research** – Growth of interdisciplinary and applied research programmes whereby researchers are able to dissect traditional boundaries between disciplines as well as between theoretical knowledge and the broader world. The programmes should also incorporate socially relevant research.
- iii. **Strategic Oriented Supervision** – Identify best practices for graduate supervision and time required to receive a degree. Formalization and an institutionalised strategically-oriented approach to postgraduate supervision is crucial.

**iv. Reformed Student Funding**–

Transformation of postgraduate student support to address gaps in student funding resulting from an unequal funding mechanism. A distinctive funding set up by the university which allows opportunities for postgraduates to develop their projects and not be constrained by the limiting research scope of the supervisor’s grants. This new funding strategy will support long term, creative risk-taking or ground breaking research. Empowering postgraduate students to explore is integral to the development of “new knowledge” independent of funding agencies.

**c. Create**

- i. **Sustained Pool of Trained Human Resource** – A provision that encourages a sustained pool of researchers, technical support and postgraduate students is central to the development of an APEX university. A pre-requisite is a revamp of the current employment and remuneration scheme for technical support as recognition of their critical input in bench laboratories.



**Figure 18**  
A Strategy Canvas for Transforming Postgraduate Studies

ii. **Diverse Postgraduate Awards** – Current traditional postgraduate degree award can be re-packaged into a range of diversified awards such as Degree by Publication, New Route Degree, Professional Degree and Practiced Based Degree (based on the portfolio of work) that matches specific research niche areas.

iii. **Citizen Scholars**<sup>28</sup>

– postgraduates with enhanced cultural awareness, skills and expertise to compete in an interdisciplinary environment and connect their disciplinary knowledge with the needs of society.

iv. **Intellectual Entrepreneurs** – a workforce comprising of workers who are equipped with skills and knowledge of the real world. The success in meeting these challenges depends on a strong engagement and converging interplay between the university, private sector and the government.

the best talents must be assembled, nurtured and encouraged before they can, in turn, produce equally excellent talents for the nation and humanity. Talent here means more than just the players we commonly understand such as students, faculty, researchers and administrative personnel. Talent for USM may be defined according to the dimensions depicted in Figure 19.



**Figure 19**  
**USM's Dimensions of Talent**

#### 4.6 Transforming the Concentration of Talent

Underlying this transformation plan would be the overall paradigm of the blue ocean thinking when identifying strategies that are unconventional and most probably untested. Such a paradigm either makes competition irrelevant or makes the strategies unique.

A concentration of talent refers to the talented individuals who will be part of the transformation plan for USM. Talent has to be appropriately chosen as any effort without such talent, will be futile. USM needs talent to produce talent. Incoming talent will ensure that the talents in USM will be performing to serve the recipient, which in turn will be future talents produced by USM. They too can actually contribute to USM's excellence, either directly or indirectly. Therefore,

Many consider the right talent as paramount to the success of any organisation. Jim Collins<sup>29</sup> located talent as the first requirement in his level 5 leadership scale, by stating "FIRST WHO THEN WHAT". It is not a matter of having people, but it is about having the right people.

In terms of transforming USM, strategies to be adopted may be categorised into the following tasks:

- Getting the best talent.
- Nurturing talent for growth.
- Retaining and grooming talent.

They should involve the following which are considered talents within USM's domain:

<sup>28</sup> Council of Graduate School (2007). *Graduate education: the backbone of American competitiveness and innovation.* A Report from the council of Graduate Schools Advisory Committee on Graduate Education and American Competitiveness.

<sup>29</sup> Collins, J.C. (2001). *Good to great: why some companies make the leap.... and others don't.* Harper Collins: New York.





- Academic staff
- Research staff
- Technical staff
- Administrative staff
- Postgraduate students
- Undergraduate students
- Vendors / suppliers
- Partners and collaborators
- Alumni
- Other stakeholders

#### 4.6.1 Getting the best talent

USM needs to recruit the best to be the best. It may be able to do so when the positive image of USM attracts the best. Staff would like to work at USM for all the positive reasons, while students would like to enrich themselves through the system provided by USM, because of its reputation. It is absolutely critical for the university to lay out branding strategies and to ensure that the correct impression is created. Indeed, impression will not last without sustained performance and actual satisfying experience.

Getting the best talent, however, requires more than just image. USM must have the ability to provide the right offer, and more often than not, the best talents do not come cheap. This means USM must have the means to amass sufficient funds to give the right and most attractive offers.

The processes of recruitment must also be swift. The processing speed regarding invitations, selections, decisions and appointments must be minimal. Procedures must be perfected as much as possible so as to remain competitive.

Having the right people also entails knowing the correct required number so that efficiency will be positively correlated with effectiveness, and the number of staff may be optimised. Collins (2001) also asserted that to transform from

good to great, organisations must not only bring in the right people, they must also manage them, to the extent of discarding the inappropriate ones. Collins (2001) stated, “... it is not just about assembling the right team – that’s nothing new. The main point is to first get the right people on the bus and the wrong people off the bus before you figure out where to drive it”. The challenge will be how this can be achieved in a government statutory body, when hiring and firing are not easily carried out.

Each talent category will have varying strategies; however, the following general strategies may be adopted:

- **Eliminate:** unnecessary bureaucracies.
- **Reduce:** in-competition, in-rivalry
- **Raise:** speedy and professional decision facilitation
- **Create:** enablers and shared values/vision

#### 4.6.2 Nurturing talent for growth

Getting the best talents will not be enough if they do not perform as required. The best staff must help USM to deliver, whilst the best students must achieve the intended outcomes. It is therefore imperative to allow the talents to prosper, deliver and grow.

There are many factors needing attention to support this. This is where all the intangible values shall prevail. The non KPI-based performance will need to support the need to deliver the KPIs. Often enough, the former is compromised, and as a result could become the cancer that would make an organisation irrelevant or worse, put to rest. Team spirit must blossom for USM to steer its way to greatness, especially when sustainability is the main thrust of the university.



Quality is a moving target; hence USM's talents must be dynamic in their capability enhancement. Effective training programmes, supported by good professional development programmes, must be in place. USM has been the leader on this, and shall continue to perpetuate the strategies to sustain the position.

The “feel good factor” is the critical element among staff and students, and this will be dependent upon the above-mentioned qualities, as well as the efficiency of systems in place. All operating systems and facilities must be seen to be facilitating the nurturing and growth drive.

Once again, each talent category needs to address different varying strategies; however, the following general strategies are needed:

- **Eliminate:** non-facilitatory culture and attitude
- **Reduce:** barriers/obstacles to growth
- **Raise:** professionalism and facilitation
- **Create:** opportunities and common culture and mission

#### 4.6.3 Retaining and grooming talent

In order for USM to sustain its position, its talents must also be sustained. Retaining talents is very difficult to achieve, especially when the talents at USM are among the best available. Our graduates shall continue to be the “hot-catch”. USM must strive to retain as many of them as required.

Whilst the “feel good factor” will always be relevant for this course, other requisites may become critical. In great institutions, of which USM aspires to be one, visionary leadership is imperative. This shared vision will move USM with a common mission and will invigorate the

entire talent pool at the university. The available talents must be groomed for such a leadership position.

Equally important is the common mission and shared values amongst the leaders at all levels. USM must have more of the 360° leader as prescribed by John C. Maxwell<sup>30</sup>. However, these leaders must be facilitators and must understand and share the USM vision and mission. Often enough, middle managers who do not do so, are the cause of the demise of great organisations. An effective succession plan for USM must be put in place. There must be room to grow for all and USM must provide for it.

USM must also not be too frigid and rigid. At times, great organisations over-cherish the past as it has contributed to their present greatness, making them non-adaptive to change. USM must ensure that its strategies, whilst effective, need to be accommodative and dynamic as well.

While the retention and grooming of different talent categories will definitely require varying strategies, some of the general strategies for adoption may include (see Figure 20):

- **Eliminate:** non-facilitatory supervisors
- **Reduce:** one/few persons dependency
- **Raise:** empowerment and accountability
- **Create:** teamwork and a sense of togetherness

In conclusion, USM needs to succeed in its effort for this pillar of concentration of talent. The strategies of recruitment, nurturing, retaining and grooming must be exercised for a variety of talents. The following have to be given due considerations:

- a. All levels of leadership must understand the need for talent and be able to facilitate and

<sup>30</sup> Maxwell, J.C. (2005). The 360° leader: developing your influence from anywhere in the organization. Nashville, Tennessee: Nelson Business.

- uphold this pillar of concentration of talent.
- b. The culture in USM must be to facilitate, and as a consequence, USM must insist that only facilitators are amongst its supervisors.
- c. USM must subscribe to the understanding that the “right people/talent” are those who share this value.
- d. USM must also strengthen the organisation that breeds the champion and the custodian of this pillar.

#### 4.7 Transforming Resources

Resources is one of the three pillars identified in transforming USM as an APEX university.

##### 4.7.1 Strategic Drivers

###### a. Sustainability

The APEX university aims to be sustainable in terms of resources. These include finances, human capital, infostructure (ICT), infrastructure and other facilities. These determine what the goals should be, policies and strategies for implementation, and will create the necessary linkages between sustainability concerns, the economic and budget considerations and how the institution will respond.

###### b. Transparent and Supportive Governance

The APEX university relates to good governance practices in managing its resources. The major characteristics include participation, rule of law, transparency, responsiveness, consensus orientation, equity and inclusiveness, effectiveness and efficiency and accountability. In transforming the management of resources, rigorous auditing shall contribute to supportive governance. A flexible working environment is likewise required, encompassing the mass participation of the university community. It shall be supported by strong customer relationship management.

##### 4.7.2 The ERRC Grid

Based on the above premise, the following transformation strategies for services of the university under the APEX programme are proposed.

###### a. Eliminate and/or reduce:

- i. Irrelevant bureaucratic procedures & policies
- ii. High energy consumption
- iii. The knowledge gap
- iv. Duplication of tasks and resources

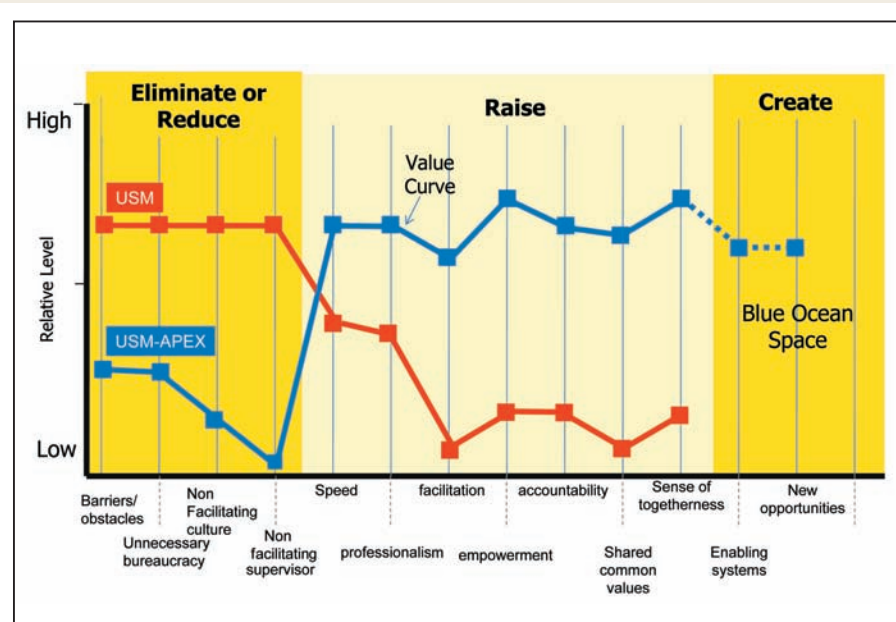


Figure 20  
A Strategy Canvas for the Concentration of Talent



- v. Energy consumption
- vi. Environment impact (e.g., carbon footprint)
- vii. Operating cost
- viii. Unnecessary control on procedures
- ix. Numbers of non-performers
- x. Processing/delivery time
- xi. Space requirements

**b. Raise:**

- i. Investment on basic necessities
- ii. Access to green facilities
- iii. Staffing and financial autonomy
- iv. Fast-track procurement
- v. Waste management process
- vi. Staff competency
- vii. Technology enabling services

**c. Create:**

- i. Green procurement design (green standards)
- ii. Green objectives baseline (USM footprint)
- iii. Integrated facilities design
- iv. Leverage on student talents
- v. Flexible working/teleworking (office anywhere)
- vi. Mass participation
- vii. Transferring business processes
- viii. Smart partnership and shared services
- ix. Excellent leadership

The strategy canvas can be seen in Figure 21.

The following have to be given due consideration, namely an integrated 5-year resource and strategic plan, including:

- a. Human capital planning incorporating training needs analysis, continuous professional development and life long learning.
- b. Sustainability plan e.g., a sustainable campus master plan.
- c. A financial sustainability plan.
- d. A multi-modality awareness programme.
- e. An empowerment and decision-making plan.
- f. An environmental management system.

### 4.7.3 The Outcomes and KPIs

As resources are crucial for the success of the transformation plan, the following outcomes and KPIs are envisaged:

- Adopt best practices towards world-class services comparable to the region and worldwide. It is targeted at 1:10:200, being first in the country, tenth in Asia and 200<sup>th</sup> in the world.
- Establish Seamless Integrated Support Services supporting all platforms for resource management by 2010.
- Provide Green Services and achieve a Green Campus whereby the USM Carbon Footprint is measured and reduced.
- Develop competent and committed human capital through sustainable training and continuous professional development by the end of 2009.
- Attain financial sustainability according to the 50:50 formula in funding by 2010.
- Achieve an Integrated Management System which incorporates all organisational needs by the end of 2010.
- Arrive at full autonomy by the end of 2010 enabling the university to be a towering leader in decision-making toward sustainability.

### 4.8 Transforming Supportive Governance

Governance has been identified as one of the three main pillars in the transformation plan of the USM-APEX university. In order to steer confidently and effectively into the Blue Ocean, USM proposes “supportive governance” as its vehicles. The primary issue in supportive governance is not simply the autonomy from the government, but how to build a credible internal overall audit system that would necessitate less intervention from outside agencies – government, legislature and politicians, funding bodies, etc.

The transformation plan of governance includes all aspects of nurturing and learning activities, research and innovations, services and resources as well as students’ development.

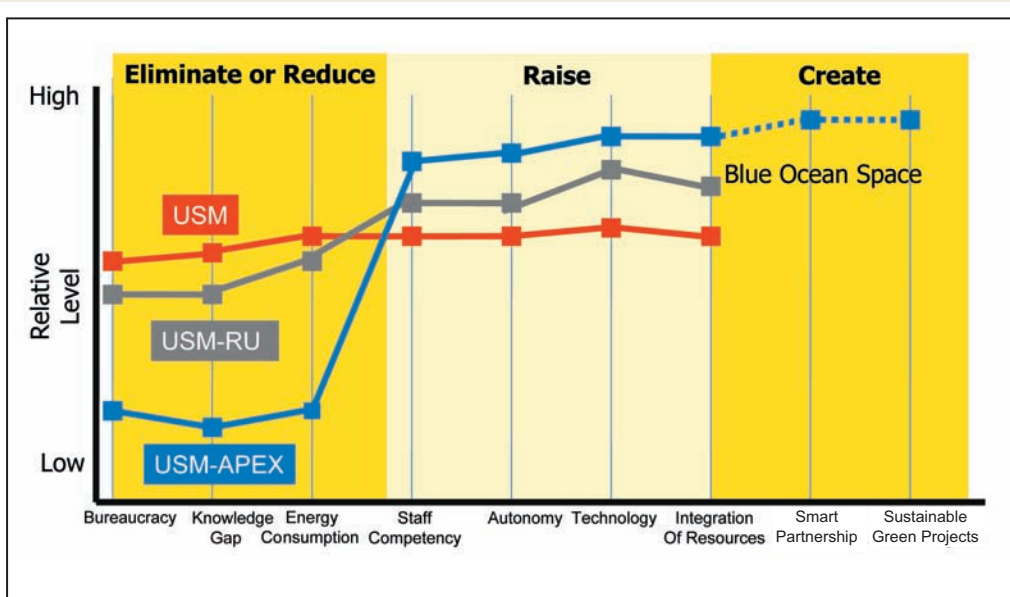


Figure 21  
A Strategy Canvas for the Transformation of Resources

To be a sustainability-led university, USM needs a system of governance that encourages and facilitates positive, proactive, and continuous institutional transformation. The current system of governance, to some extent, impedes and hinders the development of the university as a reputable academic institution. In spite of the current system of governance, the university has shown its ability to shine and stand out from other local universities. To compete in the global arena and to effectively make an impact, USM seeks to secure greater autonomy but will create a highly responsible, accountable, transparent, efficient system of governance to steer the university forward. The traits of good governance are aptly outlined as follows:

*The reason why universities have been the most durable institutions in history, practically speaking from the thirteenth century on, is that their unique combination of autonomy and decentralization creates exactly the modern type of institution which is able to innovate, which is able to manage change, in a far more effective way than either government bureaucracy or corporate hierarchy. In fact, corporate hierarchies are moving to flatter and more decentralized models of organization which mimic the university rather than vice versa. (Stevenson, 2004<sup>31</sup>).*

The most central issue for colleges and university is the relationship between governance and the internal environment for nurturing and learning. This has been emphasised by El-Khawas (2002)<sup>32</sup> and McMillin and Berberet (2002)<sup>33</sup>. Gayle et al. (2003)<sup>34</sup> further states that “in enhancing learning and individual student development, the key is not simply for faculty to teach more and better, but to create conditions that motivate and inspire students to educationally purposive activities, both inside and outside the classroom. Faculty who engage deep and relational learning must have the institutional support to do so”. According to McMillin and Berberet (2002), “the essential variable in effective teaching and learning may be whether universities and colleges are viewed from the top as academic corporations or as institutions intended to foster innovative teaching and learning.”

To achieve autonomy and sustainability, USM should create credible internal audit (finance, academic and resources), self-assessment, peer-assessment and evaluation.

The most important pillars of autonomous and governance are the issues of quality and accountability. An autonomous university comes with the burden of achieving high quality with accountability. Autonomous governance and

<sup>31</sup> Stevenson, M. (2004). “University governance and autonomy. Problems in managing access, quality and accountability”. Keynote address to ADB conference on university governance, Denpasar, Indonesia, April 26.

<sup>32</sup> El-Khawas, E. (2002). *Governance in US universities: Aligning internal dynamics with today’s needs in governing higher education - National perspectives on institutional governance*. The Netherlands: Kluwer Academic Publishers.

<sup>33</sup> McMillin, L.A., & Berberet, W. G., (Eds.) (2002). *A new academic compact: Revisioning the relationship between faculty and their institutions*. Boston, MA: Anker Publishing.

<sup>34</sup> Gayle, D. J., Tewarie, B. and White, A. Q. Jr. (2003). “Governance in the twenty-first century university: Approaches to effective leadership and strategic management” ERIC Digest.

accountability are equivalent to freedom and responsibility. Both come hand-in-hand.

USM will continue to support the education system which is accessible to the masses as opposed to the few, is affordable and is one which upholds and places the interests of the nation as the guiding principles in its endeavour to create an equitable and a quality society.

USM would strive for a system of governance that would promote and enhance quality in nurturing and learning, apart from research and services.

Among Malaysian higher learning institutions, USM is already at the forefront in quality assurance with internal academic and research audits already in place. These are examples of internal quality assurance measures that ensure autonomy with quality and accountability.

Administrative efficiency is another aspect expected of good governance. Administrative efficiency is both a by-product of good governance and becomes the foundation for quality and accountable governance. USM will continue to strive to create efficient administration through decentralisation of decision making structures and processes, collective responsibility and wider participation in decision making processes.

The university should be vested with complete autonomy on academic matters. This means that powers should reside with the Senate on all academic decisions without interference from outside. USM needs to enhance the measures and framework for internal accountability measures based on strong performance management systems for the academic, administrative and support staff. Below are key aspects of governance that are important during the process of transformation:

- Accountability on the academic front requires a peer review system for teaching and research

and complementing with a regular (say 5-year) system audit.

- Introduce systems of monitoring satisfaction and performance by students.
- Students' representation in decision-making.
- Internal performance indicators – e.g., commercialisation of intellectual property.
- A strong system of overall internal review.
- Review existing governing bodies for their relevance and scope of authority.
- Ultimate authority on academic matters, finance and staff recruitments.

Reputable universities worldwide are built on a culture of autonomy. USM would propose for a supportive governance autonomous university with strong accountability and transparency which will promote quality teaching, research and effective management. It is particularly important for USM to establish clear governing principles which include administrative representation, students' representations and external entities representation.

#### 4.8.1 Strategies

Transformation of governance encompasses the three key/core activities of USM, namely nurturing and learning, research and innovations, and services and administration. Using the ERRC grid, the transformation strategies of USM governance include:

##### **a. Eliminate and/or reduce**

- i. Restrictive rules and regulations
- ii. Unnecessary bureaucratic structures
- iii. External authority and interference
- iv. Rules and regulations that govern academic activities
- v. External control and functions from governmental and non-governmental influences and directives
- vi. Central control

##### **b. Raise**

- i. Internal accountability and monitoring measures:



- Financial
- Nurturing and learning
- Services
- ii. Academic audits
- iii. A peer review system
- iv. Decentralisation
- v. Strategic directions:
  - Staff participation in the formulation of university aspirations and vision
  - Policy statements
  - Individual action plan
- vi. Performance management systems:
  - Reward system based on KPIs. USM should formulate its own reward system which is based on individual KPIs.
  - Systems of monitoring satisfaction and performance by students and alumni.
  - Internal performance indicators e.g., commercialisation of intellectual property, publications, etc.

**c. Create**

- i. Student participation and empowerment
  - Student representations in decision making processes
  - Autonomous students' governing body
- ii. Staff self-accountability
- iii. An autonomous administrative system and structure. The current administrative system and structure is tied up and is determined by Jabatan Perkhidmatan Awam (Public Services Department). USM should be allowed to set up an institute of its own administrative system, remuneration scheme, creation of posts based on the needs of USM.

The strategy canvas for the transformation of the governance can be seen in Figure 22.

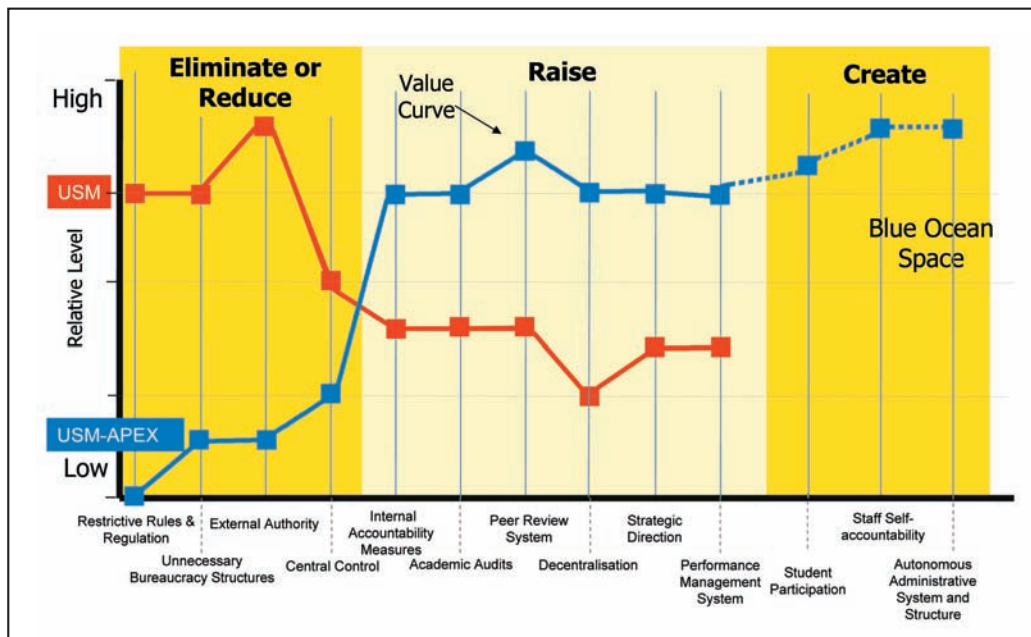


Figure 22  
A Strategy Canvas for the Transformation of Governance

# SUMMARY OF ERRC GRID AND THE RELATIONSHIP WITH THE THRUSTS OF HIGHER EDUCATION ACTION PLAN (2008 -2013)

## GENERAL

- Bureaucracy in Governance [a.b.c.d.e.f.g]
- Gaps in Resources/Funding [a.b.c.d.e.g]
- Talent Mismatch [b.c.d.e.g]

## NURTURING AND LEARNING

- Examinations [a.b.c.e.f]
- Lectures [b.c.f]
- Rote Learning [b.c.d.e.f.g]
- Apathy [b.c.d.e.f.g]

## SUPPORTIVE GOVERNANCE

- Restrictive Rules and Regulations [a.c.d.e.g]
- Unnecessary Bureaucratic Procedures [c.d.e.g]
- External Authority and Interference [a.c.d.g]
- Rules and Regulations that Govern Academic Activities [a.b.c.d.e.f.g]

## RESEARCH AND INNOVATION

- Traditional Research Labels [a.b.c.d.e.f]
- Boundaries and Silos at All Levels [a.b.c.d.e.f.g]
- School/centre-based Research and Discipline [c]
- Employment based on Teaching Needs Only [c]
- Administrative Roles of Researchers [c.e.f]
- Non-productive process on R&D Evaluation [c.g]
- Time Decision-making in Recruitment [a.c.d.e.g]
- Publications which are not priority [b.c]

## ELIMINATE AND/OR REDUCE

### RESOURCES

- Irrelevant Bureaucracies & Procedures/Policies [g]
- High-energy Consumption [d.g]
- Knowledge Gap [a.b.c.d.f]
- Duplication of Tasks and Procedures [d.g]
- Environmental Impact (e.g.: Carbon Footprint) [d]
- Operating Cost [d.g]
- Unnecessary Control on Procedures [b.c.d.g]
- Non-performers [a.b.c.d.e.f]
- Processing and Delivery Time [b.c.d.g]
- Space requirements [b.c]

### SERVICES & EXTERNAL ACTIVITIES

- The Use and Wastage of Resources [c.d.g]
- Indifferent/Uncaring Attitudes towards the Environment [b.c.d.f]

### CONCENTRATION OF TALENT

- Unnecessary Bureaucracies [a.b.c.d.e.f.g]
- In-competition, In-rivalry [c.d.g]
- Non-facilitatory Culture and Attitude [a.b.c.d.g]
- Barriers/Obstacles to Growth [d.e.g]
- Non-facilitatory Supervisors [b.c.f.g]
- One/Few Persons Dependency [b.c.d.e.f]

### STUDENT AND ALUMNI SERVICES

- Outdated policies [a.b.c.d.e.f.g]
- Unnecessary bureaucracies [a.c.d.e.f]
- Non-performance students' associations [e.f.g]
- Unnecessary expenditure [d.g]
- Academic requirements for talented students [a.f]

### POSTGRADUATE STUDIES

- All-size fit-all mentality [a.b.c]
- Less transparent and less accountable supervision system [b.c]
- Traditional assessment mechanism [b.c]

#### Note:

The alphabets next to each item represent approximate relations and relevance to the seven (7) trusts of MoHE's (2007) *National Higher Education Action Plan – 2007-2010*. These are: a = Widening access and enhancing equity; b = Improving the quality of teaching and learning ; c = Enhancing research and innovation; d = Strengthening the institution; e = Intensifying internationalization; f = Enculturation of lifelong learning; and g = Delivery system.

## GENERAL

- Global Agenda [a.c.e.d.g]
- Autonomy and Accountability [b.c.d.f]
- Quality of Services [b.c.d.e.f.g]
- Future Relevance [a.c.d.e]

## SUPPORTIVE GOVERNANCE

- Internal Accountability and Monitoring [b.c.d.g]
- Academic Audits [a.b.c.d.e.f.g]
- Peer Review System [b.c.d.g]
- Decentralisation [b.c.d.g]
- Strategic Direction [a.b.c.d.e.f.g]
- Performance Management System [a.b.c.d.g]

## RESOURCES

- Investments on Basic Necessities [a.b.c.d.e.f.g]
- Access to Green Facilities [b.c.d.e.f.g]
- Staffing and Financial Autonomy [b.c.d.e.f.g]
- Fast-track Procedure [c.d.g]
- Waste Management Process [d.g]
- Staff Competency [b.c.d.f.g]
- Technology-enabling Services [a.b.c.d.e.f.g]

## CONCENTRATION OF TALENT

- Speedy and Professional Decisions, Facilitation [a.d.e.g]
- Empowerment and Accountability [b.c.d.f.g]

## POSTGRADUATE STUDIES

- Integrated programme [a.b.c.d]
- Interdisciplinary Research [a.b.c.d]
- Strategic-Oriented Supervision [b.c]
- Reformed student funding [a.b.c.d]

## NURTURING AND LEARNING

- Student-centred Curricula [a.b.c.d.e.f]
- Market Relevance [b.d.e.f]
- Alternative Assessment [a.b.c.d.f]
- Technology-enhanced Learning (TEL) [a.b.d.e.f]
- Nurturing Skills/Competencies [a.b.c.d]
- Linking Research to Learning [a.b.c.d]
- Sustainability Development Curricula [a.b.c.d]

# RAISE

## RESEARCH AND INNOVATION

- Diversity of Talents [a.b.c.d.e.f]
- Quality of Staff [a.b.c.d.e.f]
- Quality of Students [a.b.c.d.e.f]
- Publication Infrastructure [a.b.c.d.e.f]
- International Collaboration on World's Most Complex Problems [a.b.c.d.e]
- Freedom of Inquiry [b.c.d.f]
- Support for fundamental research [b.c.d.e]
- Shared and Integrated Facilities [a.b.c.d.f]
- Chair to attract towering professors [b.c.d.e.f]

## SERVICES & EXTERNAL ACTIVITIES

- Awareness that resources are finite [c.d.g]
- Civic Consciousness and 4R Mantras [c.d.f.g]

## STUDENT AND ALUMNI SERVICES

- Funding [a.b.c.d.e.f.g]
- Students' Involvement [a.b.c.d.e.g]
- Student Awareness [a.b.c.e.f]
- Technological Enhancement [a.b.c.d.e.f.g]
- Organisational Restructuring [c.d.f.g]
- Corporate Linkages [a.c.d.e.f.g]

For explanation of alphabets, see note on page 56.



## GENERAL

- People-led Local Solutions [a.b.c.d.e.f]
- Sustainability (Eg: MDGs) [a.b.c.d.e.f]

## NURTURING AND LEARNING

- Non-traditional Entry [a.b.c.d.e.f]
- OpenCourseWare (OCW) [a.b.c.d.e.f]
- Enhanced Open Learning (EOL) [a.b.c.d.e.f]

## SUPPORTIVE GOVERNANCE

- Student participation and empowerment [a.d.e.f.g]
- Staff Self-accountability [b.c.d.g]
- Autonomous Administrative System and Structure [a.c.d.e.g]

# CREATE

## RESOURCES

- Green Procurement Design [b.c.d.g]
- Green Objectives Baseline (USM Footprint) [g]
- Integrated Facilities Design [a.b.c.d.f.g]
- Leverage on Student Talent [a.b.c.d.e.f]
- Flexible Working/Teleworking [a.c.d.e.f.g]
- Mass Participation [a.d.e.f]
- Smart Partnership and Shared Services [a.b.c.d.e.f.g]
- Excellent Leadership [a.b.c.d.e.g]

## RESEARCH AND INNOVATION

- Outreach Programmes for Schools [a.c.d.e.f]
- International Fellowships and Scholarships [a.b.c.d.e.f]
- Pilot Programmes with a Research-focused Curriculum [b.c.d.e.f]
- New Research Horizon [c.d.e.f]
- Individual Research Accountability to the University [c.d.g]
- Performance-based One-line budget [c.d.g]
- Employment towards Research Needs [c.d.e.f.g]
- Management System or Structure for Research Cluster [c.d.g]
- Imprinting or Branding of USM as a Unique Research Venue [a.b.c.d.e.g]

## CONCENTRATION OF TALENT

- Enablers and Shared Values/Vision [b.c.d.e.g]
- Opportunities and Common Cultures/Mission [a.b.c.d.e.g]
- Teamwork and Sense of Togetherness [b.c.d.g]

## SERVICES & EXTERNAL ACTIVITIES

- Passionate Public Attitude towards Environmental Conservation [b.c.d.g]
- A New Mindset on External Cost [d.g]

## POSTGRADUATE STUDIES

- Sustained Pool of Trained Human Resource [a.b.c.d.f]
- Diverse Postgraduate Awards [b.c.d.e]
- Citizen Scholars [a.b.c.d]
- Intellectual Entrepreneur [a.b.c.d]

## STUDENT AND ALUMNI SERVICES

- A Virtual Office [a.d.e.f.g]
- Sustainable Policies [b.c.d.e.f.g]
- Student Empowerment [b.c.d.e.f.g]

For explanation of alphabets, see note on page 56.



# 5.0

THE KEY  
PERFORMANCE  
INDICATORS







## 5.0 THE KEY PERFORMANCE INDICATORS

### 5.0 The Key Performance Indicators

Measures of being world-class or world-renowned have to be adapted within the context of the “academic space” which in USM’s case is the “sustainability issues at the bottom of the pyramid”. Thus in considering the Key Performance Indicators (KPIs), we should take into account those tangible factors directly related to the successful implementation of a sustainability-led university. Needless to say, there are a myriad of intangible issues that must also be taken into consideration for which there are no simple KPIs or forms of measures.

In this regard, USM proposes the following indicators be used to measure the performance of institutions selected for the APEX programme.

#### 5.1 Measures for the Concentration of Talent

In this submission, USM has strategised on how to increase not just the number, but also the quality of individuals. They include the students, the academic staff, the researchers and the

support personnel. Among the measurements for talents are the issues of quality, quantity, productivity, diversity as well as the role they play in terms of academic leadership and involvement in the community. For productivity, performance can be measured in numerous ways which are commonly used for world renowned measures such as publications, research projects and grants, inventions, marketable patents and commercialisation, policy papers and impact, awards, learning modules produced and technology transfer, in particular, transfer to the classroom and to the community.

In terms of academic leadership, some measurement indicators can also include the participation and acceptance among the peers at the global level, for example, presentation of invited keynote addresses, to act as track chairs in academic conferences, as chief editors of academic journals, holding positions in academic associations and heading national or international bodies. At the organisational level, this would include the recognition accorded to USM as a referral centre known for its excellence worldwide.





In the final analysis, talents should be measured for their diversity and resourcefulness in every facet of their job description, including teaching, research and leadership. We are mindful of the intangible dimensions, in particular aspects of values, ethics, attitudes and relationships that are equally significant in the nurturing of talents.

A comprehensive list of KPIs for concentration of talents is provided in Annex 9a.

### 5.2 Measures for Abundance of Resources

As indicated in this submission, resources include financial, human capital, infostructure (ICT), infrastructure and facilities in terms of their size, quality, diversity and linkages. Financial resources should include the total annual budget and the amount spent on emolument, research and new development/facilities as well as available space in general. In physical resources, one needs to know the collection of the university library, subscription of journals, accreditation status of laboratories and equipment. Similarly, the intangibles would include flexibility and relevance of these resources for the purposes intended.

A comprehensive list of KPIs for abundance of resources is provided in Annex 9b.

### 5.3 Measures for Supportive Governance

It was earlier emphasised that the primary issue in supportive governance is not simply the

autonomy from the government, but how to build credible external and internal overall audit systems that would necessitate less intervention from outside agencies. These include all aspects of nurturing and learning, research and innovation, service and resources as well as students' and alumni development.

Under governance, we need to measure the state of government relations, internal governance, including whether there is a written vision and mission statements, and levels of bureaucracy. The intangibles would be the creation of a dynamic and conducive atmosphere and the balance between tasks to be carried out to that of collegiality amongst team members, for example.

Details of KPIs under governance can be seen in Annex 9c.





When all is said and done, there is a need to recognise that whatever KPIs or forms of measures agreed upon, it cannot be at the expense of the intangible factors noted earlier. To use the garden metaphor yet again, one may be able to “measure” and “quantify” the standard or status of a garden by keeping track of the numbers of plants or trees therein, or the type of varieties found in the garden. Or for that matter the state of health of each species, apart from how well the garden is maintained and so on. All these could be equated to any one of the measures or KPIs proposed in this section in terms of talent, resources and governance within the Transformation Roadmap suggested by the Action Plan of MoHE (2007). This includes the proposed Institutional Pillars and Critical Agenda set forth in the Plan.

What is not articulated sufficiently well-enough however is the fact that every one plant and tree that makes up the garden depends on what is made available and accessible beneath the ground where the roots of all the flora are firmly anchored. For example, the soil type, its nutrient contents, the water retention capacity, the organisms found in it and the like that would interact and feed into the roots therein. Each of these will have a definite impact on what is invariably measured above ground as a mark of quality and thus levels of accomplishments. The analogy would be elements such as values, ethics, integrity, cultures, attitude, transparency, tacit knowledge, level of teamwork, relationships and commitment which, among others, will go a long way in influencing the ways in which talent, resources and governance are being shaped.

Yet, there is no clear cut emphasis on the need to promote or consider them as vital to the KPIs set. Indeed, the relationship between them often remains nebulous.

For example, a highly qualified talent may have been recruited and retained based on conventional academic criteria, but in terms of the values and cultures required of the person is left unsaid, let alone any criteria attached to it. Similarly, there may be more than adequate resources allocated, but the practices adopted in managing them are not entirely ethical or transparent. So too in terms of governance that is rigidly a “tick-box” assessment without much room for creativity as though one-size-fits-all forms of transactions is feasible an academic setting that demands an out-of-the-box thinking!

In other words, whether one realises it or not, the intangibles must be seriously considered and factored in setting the KPIs such that their achievements can ensure the long-terms goals of a sustainable tomorrow. Indeed, there are important determinants in ensuring sustainability as envisaged in this submission. In other words, each one of the possible KPIs listed in Annex 9 (a-c) must take cognisance of the vital roles of intangible factors as suggested above. In short, efficiency, effectiveness and productivity alone as conventionally understood and interpreted are no longer sufficient in determining the success of transforming higher education for a sustainable tomorrow.



# 6.0

CONCLUSION







## 6.0 CONCLUSION



### 6.1 Dare to be Different

Under the circumstances, USM realises that it is almost impossible to play a catch-up game with established universities and break into the stranglehold of their dominance in the world league table. Judging by their talent pool, abundance of resources and supportive governance, USM believes that we simply cannot play the same game in order to be excellent. As defined by their “rules”, we chose a different path to strategically be eminent and excellent measured in different terms and contexts. Adapting to the Blue Ocean Strategy, we chart a canvas which will embolden us to navigate into the unknown horizon and do what others are not doing and will not do.

For this APEX programme submission, USM has chosen to position itself as a world renowned university for sustainability with relevance to the future, nurturing, learning, conducting research and services towards the stated goal. With the support given during the programme, USM will be able to transform itself as a leading sustainability-led university. Through sustainability,

we intend to orient higher education towards a growth and development model that safeguards environmental and natural resources, food security and energy production as well as socio-cultural diversity and lifestyles engaged in a transdisciplinary mode. In choosing this sustainability path forward, we hope to embrace the protection of the multiple ecosystems, the conservation and restoration of resources as well as the heightening of human and intellectual capitals. Further, USM will position itself to facilitate the meeting of existing and other future global and universal aspirations, as stated in its mission statement, towards the betterment of the billions trapped at the bottom of the socio-economic pyramid. The unfolding events of impending global food and energy crises as well as economic recession are among the compelling reasons why USM, as a global university of consequence, should venture in this direction.

This overarching philosophy of sustainability will eventually lead to a talent pool of students who do not only fulfil the human capital needs for the future national development of Malaysia, but who are also more involved, committed and



dedicated for the sustainable wellness of the institution, community and global environment. We hope this path will further enhance our initial attempts to instil values that will shape a new generation of ethically-responsible and morally sound adolescents endowed with “new” knowledge and mindset of the day. Their presence in our midst will then uplift the level of corporate social responsibility in tandem as global citizens with strong social commitment.

By taking the uncharted course towards sustainability and in pursuit of the spirit of the UN Decade of Education for Sustainable Development (2005-2014), USM hopes to be:

- the source of expertise through research, consultancy and advocacy,
- able to bring together diverse actors and elements of capacity to embed the sustainability process,
- a model institution to demonstrate good practices through on-campus management and development activities, and
- magnanimous in recognising and awarding incentives to staff who are involved in the development of sustainability as leaders and champions.

USM is well-poised to take up this challenge and is confident in proposing the numerous transformation plans to realise the sustainability vision it has set out to be at the end of this APEX period. In so doing, we hope to be

autonomous and independent in our stance and provide new and better platforms for partnerships with the industry and community, and the right mix of skills, attitude, value, and knowledge for a sustainable world. In essence, it seeks to transform the governance, expand the talent pool as well as optimally build the appropriate resources.

## 6.2 In Support of the National Higher Education Action Plan

As a responsible leading public university, it is incumbent on USM to uphold and promote the national higher education policies and strategies. It would therefore be pertinent for us to declare that our proposal and submission fully comply with those policies and strategies, especially the recently launched National Higher Education Action Plan 2007-2010 (MoHE, 2007)<sup>35</sup>. The numerous transformation strategies articulated in this proposal clearly conform and are relevant to the seven thrusts of the plan (including the five institutional pillars and five critical agendas) as follows.

### a. Widening access and enhancing equity

Higher education should be geared for the well-being of the individual, community, economy, and the environment. USM’s sustainability-led strategies are aimed at doing just that. In this case, we will not only widen our offer to ensure greater access of higher education to those who need it the most, but also diversify the entry

<sup>35</sup> Kementerian Pengajian Tinggi (2007). National higher education action plan – 2007-2010. Kuala Lumpur KPT.

requirements that are considered non-traditional in order to accommodate students of different abilities, capabilities, talents, experiences and intelligence who would otherwise not benefit this democratisation of knowledge. By the same token, the proposal to provide free access of our courses to the public through OpenCourseWare demonstrate our desire to contribute to the realisation of the Millennium Development Goals of the United Nations and reach out to those at the bottom of the pyramid in terms of access and equity.

**b. Improving the quality of teaching and learning**

As stated in the transformation plan for teaching and learning (in this document we refer to it as nurturing and learning), our transformation proposal will not only improve this activity but also will be unique in that we hope to mainstream it to be more student-centred (i.e., will focus more on the students and less of the lecturers) and market relevant (i.e., to ensure that students can secure meaningful prestigious employment). Concomitantly, we also propose that our nurturing and learning can be enhanced by targeting them at raising skills and competencies (i.e., introducing innovative and creative methods of nurturing and learning), and linking research to learning (i.e., to disseminate research findings through the classrooms and community). To do these, we hope to embrace new e-learning modes especially the technology-enhanced learning (TEL).

**c. Enhancing research and innovation**

Since its designation as one of four research universities by MoHE in 2007, USM has made great strides in accelerating research and innovation activities. There are more staff who are involved in R&I and more resources allocated for this purpose. As a result, our publications have increased markedly and our products and findings have received recognition and awards at the national and international levels. At the same time we have set our innovation system

in motion and expect to launch our Science and Arts Innovation Space (known as SAINS@USM) into operation by mid-2008.

Under the APEX programme, we hope to do more, especially in the other critical agendas and enlisted by MoHE, especially Mybrain15 and the Graduate Training Scheme. We believe that the numerous transformation strategies to be adopted under the APEX programme should enhance the standing and image of USM as the premier research institution in the region and worldwide. This we hope to do by encouraging and promoting greater transdisciplinary, publications in more reputable journals with a high impact factor, fellowships and financial assistance to postgraduate students, recruitment of “towering personalities”, including from abroad to help navigate our research destiny, and expand our technology transfer, and outreach to the classrooms as well as the community.

**d. Strengthening the institution**

By positioning USM as a sustainability-led university, we hope to strengthen the university’s global image and reputation. Two important elements will be the enhancement of leaders and leadership talents at all levels in consonance with the targeted vision of an APEX university. To ensure this, a proper and consistent performance audit of the core businesses of the university will be periodically performed, as well as the monitoring of its governance.





#### e. Intensifying internationalisation

Judging by the existing networks and collaborations with other universities abroad, USM is already an international university. To date, the number of postgraduate international students has increased threefold spanning more than 50 nationalities. The international academic arena has already emerged as the “play-ground” for our staff and students, as well as our products and services (such as publications, innovations and expertise) are readily accepted by the international community. Through this APEX programme proposal, we hope to accelerate the internationalisation of USM to even higher with a wider diversity.

#### f. Enculturation of lifelong learning

For its early age, USM has recognised the importance of learning and that it should not necessarily be confined to classrooms. USM is the pioneer of distance education through its Luar Kampus programme (since the 1970s) in which thousands of Malaysians of all ages and both genders have obtained their higher education and degrees without jeopardising and uprooting their living arrangements and employment status. By the same token, we have diversified our entry requirement to ease the admission of differently-abled (OKUs) and Warga Emas to pursue higher education at USM with the first batch graduating recently.

Modelled on the Warga Emas successes and under this APEX programme, USM hopes to

intensify the access and reach of Malaysians of all ages and both genders to higher education through similar programmes of Warga Budaya dan Warga Sukan. This will be the foundation of a University of the Third Age that is being planned to support lifelong learning in USM.

#### g. The delivery system

Every facet of transformation in this proposal is aimed at enhancing the overall outlook and operations of the university and the MoHE. These will be supported by the plan to transform the three support pillars: talent, resources and governance, apart from the other elements of institutional pillars as entrusted by MoHE, especially in the areas of leadership and autonomy. The sum total of these proposed changes will indeed ensure the improvement of not only the delivery system of higher education but capture the essence of its mission to accelerate the university to greater heights.

This APEX programme which is proposed and submitted by USM is done on the basis of our fervent desire to be the best not only in the country but the region and the world. We have articulated this belief in our plan. We share the aspiration of MoHE (2007:49), that is, to lay “the foundation for the revolution of Malaysian higher education - a revolution that is not merely desirable, but is necessary for our survival”.



## SUMMARY OF ERRC GRID ACCORDING TO ACTIVITIES AND RELEVANCE TO THE SEVEN THRUSTS OF MoHE'S NATIONAL HIGHER EDUCATION ACTION PLAN

### GENERAL

| To Eliminate and/or Reduce | a | b | c | d | e | f | g |
|----------------------------|---|---|---|---|---|---|---|
| Bureaucracy in Governance  |   |   |   |   |   |   |   |
| Gaps in Resources/Funding  |   |   |   |   |   |   |   |
| Talent "Mismatch"          |   |   |   |   |   |   |   |

| To Raise                    | a | b | c | d | e | f | g |
|-----------------------------|---|---|---|---|---|---|---|
| Global Agenda               |   |   |   |   |   |   |   |
| Autonomy and Accountability |   |   |   |   |   |   |   |
| Quality of Services         |   |   |   |   |   |   |   |
| Future Relevance            |   |   |   |   |   |   |   |

| To Create                       | a | b | c | d | e | f | g |
|---------------------------------|---|---|---|---|---|---|---|
| People-led Local Solutions      |   |   |   |   |   |   |   |
| Sustainability-led (e.g.: MDGs) |   |   |   |   |   |   |   |

### CONCENTRATION OF TALENT

| To Eliminate and/or Reduce            | a | b | c | d | e | f | g |
|---------------------------------------|---|---|---|---|---|---|---|
| Unnecessary Bureaucracies             |   |   |   |   |   |   |   |
| In-competition, In-rivalry            |   |   |   |   |   |   |   |
| Non-facilitatory Culture and Attitude |   |   |   |   |   |   |   |
| Barriers/Obstacles to Growth          |   |   |   |   |   |   |   |
| Non-facilitatory Supervisors          |   |   |   |   |   |   |   |
| One/Few Persons Dependency            |   |   |   |   |   |   |   |

| To Raise  | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Speedy and Professional Decisions, Facilitation |   |   |   |   |   |   |   |
| Empowerment and Accountability                  |   |   |   |   |   |   |   |

| To Create                                 | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Enablers and Shared Values/Vision         |   |   |   |   |   |   |   |
| Opportunities and Common Cultures/Mission |   |   |   |   |   |   |   |
| Teamwork and Sense of Togetherness        |   |   |   |   |   |   |   |

### RESOURCES

| To Eliminate and/or Reduce                     | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| Irrelevant Bureaucracies & Procedures/Policies |   |   |   |   |   |   |   |
| High-energy Consumption                        |   |   |   |   |   |   |   |
| Knowledge Gap                                  |   |   |   |   |   |   |   |
| Duplication of Tasks and Procedures            |   |   |   |   |   |   |   |
| Environmental Impact (e.g.: Carbon Footprint)  |   |   |   |   |   |   |   |
| Operating Cost                                 |   |   |   |   |   |   |   |
| Unnecessary Control on Procedures              |   |   |   |   |   |   |   |
| Non-performers                                 |   |   |   |   |   |   |   |
| Processing and Delivery Time                   |   |   |   |   |   |   |   |
| Space Requirements                             |   |   |   |   |   |   |   |

The alphabets next to each item represent approximate relations and relevance to the seven (7) thrusts of MoHE's (2007) *National Higher Education Action Plan – 2007-2010*. These are: a = Widening access and enhancing equity; b = Improving the quality of teaching and learning ; c = Enhancing research and innovation; d = Strengthening the institution; e = Intensifying internationalization; f = Enculturation of lifelong learning; and g = Delivery system.



| To Raise                         | a | b | c | d | e | f | g |
|----------------------------------|---|---|---|---|---|---|---|
| Investments on Basic Necessities |   |   |   |   |   |   |   |
| Access to Green Facilities       |   |   |   |   |   |   |   |
| Staffing and Financial Autonomy  |   |   |   |   |   |   |   |
| Fast-track Procedure             |   |   |   |   |   |   |   |
| Waste Management Process         |   |   |   |   |   |   |   |
| Staff Competency                 |   |   |   |   |   |   |   |
| Technology-enabling Services     |   |   |   |   |   |   |   |

| To Create                                 | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Green Procurement Design                  |   |   |   |   |   |   |   |
| Green Objectives Baseline (USM Footprint) |   |   |   |   |   |   |   |
| Integrated Facilities Design              |   |   |   |   |   |   |   |
| Leverage on Student Talent                |   |   |   |   |   |   |   |
| Flexible Working/Teleworking              |   |   |   |   |   |   |   |
| Mass Participation                        |   |   |   |   |   |   |   |
| Smart Partnership and Shared Services     |   |   |   |   |   |   |   |
| Excellent Leadership                      |   |   |   |   |   |   |   |

## SUPPORTIVE GOVERNANCE

| To Eliminate and/or Reduce                            | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Restrictive Rules and Regulations                     |   |   |   |   |   |   |   |
| Unnecessary Bureaucratic Procedures                   |   |   |   |   |   |   |   |
| External Authority and Interference                   |   |   |   |   |   |   |   |
| Rules and Regulations that Govern Academic Activities |   |   |   |   |   |   |   |

| To Raise                               | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| Internal Accountability and Monitoring |   |   |   |   |   |   |   |
| Academic Audits                        |   |   |   |   |   |   |   |
| Peer Review System                     |   |   |   |   |   |   |   |
| Decentralisation                       |   |   |   |   |   |   |   |
| Strategic Direction                    |   |   |   |   |   |   |   |
| Performance Management System          |   |   |   |   |   |   |   |

| To Create                                      | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| Student participation and empowerment          |   |   |   |   |   |   |   |
| Staff Self-accountability                      |   |   |   |   |   |   |   |
| Autonomous Administrative System and Structure |   |   |   |   |   |   |   |

## NURTURING AND LEARNING

| To Eliminate and/or Reduce | a | b | c | d | e | f | g |
|----------------------------|---|---|---|---|---|---|---|
| Examinations               |   |   |   |   |   |   |   |
| Lectures                   |   |   |   |   |   |   |   |
| Rote Learning              |   |   |   |   |   |   |   |
| Apathy                     |   |   |   |   |   |   |   |

| To Raise                             | a | b | c | d | e | f | g |
|--------------------------------------|---|---|---|---|---|---|---|
| Student-centred Curricula            |   |   |   |   |   |   |   |
| Market Relevance                     |   |   |   |   |   |   |   |
| Alternative Assessment               |   |   |   |   |   |   |   |
| Technology-enhanced Learning (TEL)   |   |   |   |   |   |   |   |
| Nurturing Skills/Competencies        |   |   |   |   |   |   |   |
| Linking Research to Learning         |   |   |   |   |   |   |   |
| Sustainability Development Curricula |   |   |   |   |   |   |   |

For explanation of alphabets, see note on page 68



| To Create                    | a | b | c | d | e | f | g |
|------------------------------|---|---|---|---|---|---|---|
| Non-traditional Entry        |   |   |   |   |   |   |   |
| OpenCourseWare (OCW)         |   |   |   |   |   |   |   |
| Enhanced Open Learning (EOL) |   |   |   |   |   |   |   |

## RESEARCH AND INNOVATION

| To Eliminate and/or Reduce                  | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Traditional Research Labels                 |   |   |   |   |   |   |   |
| Boundaries and Silos at All Levels          |   |   |   |   |   |   |   |
| School/centre-based Research and Discipline |   |   |   |   |   |   |   |
| Employment based on Teaching Needs Only     |   |   |   |   |   |   |   |
| Administrative Roles of Researchers         |   |   |   |   |   |   |   |
| Non-productive process on R&D Evaluation    |   |   |   |   |   |   |   |
| Time Decision-making in Recruitment         |   |   |   |   |   |   |   |
| Publications which are not priority         |   |   |   |   |   |   |   |

| To Raise   | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| Diversity of Talents   |   |   |   |   |   |   |   |
| Quality of Staff   |   |   |   |   |   |   |   |
| Quality of Students  |   |   |   |   |   |   |   |
| Publication Infrastructure                                   |   |   |   |   |   |   |   |
| International Collaboration on World's Most Complex Problems |   |   |   |   |   |   |   |
| Freedom of Inquiry   |   |   |   |   |   |   |   |
| Support for Fundamental Research                             |   |   |   |   |   |   |   |
| Shared and Integrated Facilities                             |   |   |   |   |   |   |   |
| Chair to Attract Towering Professors                         |   |   |   |   |   |   |   |

| To Create  | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| Outreach Programmes for Schools                          |   |   |   |   |   |   |   |
| International Fellowships and Scholarships               |   |   |   |   |   |   |   |
| Pilot Programmes with a Research-focused Curricula       |   |   |   |   |   |   |   |
| New Research Horizon                                     |   |   |   |   |   |   |   |
| Individual Research Accountability to the University     |   |   |   |   |   |   |   |
| Performance-based One-line budget                        |   |   |   |   |   |   |   |
| Employment towards Research Needs                        |   |   |   |   |   |   |   |
| Management System or Structure for Research Cluster      |   |   |   |   |   |   |   |
| Imprinting or Branding of USM as a Unique Research Venue |   |   |   |   |   |   |   |

## POSTGRADUATE STUDIES

| To Eliminate and/or Reduce                               | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| One size fit-all mentality                               |   |   |   |   |   |   |   |
| Less transparent and less accountable supervision system |   |   |   |   |   |   |   |
| Traditional assessment mechanism                         |   |   |   |   |   |   |   |

| To Raise                       | a | b | c | d | e | f | g |
|--------------------------------|---|---|---|---|---|---|---|
| Integrated programme           |   |   |   |   |   |   |   |
| Interdisciplinary Research     |   |   |   |   |   |   |   |
| Strategic-Oriented Supervision |   |   |   |   |   |   |   |
| Reformed student funding       |   |   |   |   |   |   |   |

For explanation of alphabets, see note on page 68

| To Create                                | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| Sustained Pool of Trained Human Resource |   |   |   |   |   |   |   |
| Diverse Postgraduate Awards              |   |   |   |   |   |   |   |
| Citizen Scholars                         |   |   |   |   |   |   |   |
| Intellectual Entrepreneur                |   |   |   |   |   |   |   |

## SERVICES AND EXTERNAL ACTIVITIES

| To Eliminate and/or Reduce                             | a | b | c | d | e | f | g |
|--|---|---|---|---|---|---|---|
| The Use and Wastage of Resources                       |   |   |   |   |   |   |   |
| Indifferent/Uncaring Attitudes towards the Environment |   |   |   |   |   |   |   |

| To Raise                            | a | b | c | d | e | f | g |
|-------------------------------------|---|---|---|---|---|---|---|
| Awareness that resources are finite |   |   |   |   |   |   |   |
| Civic Consciousness and 4R Mantras  |   |   |   |   |   |   |   |

| To Create   | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Passionate Public Attitude towards Environmental Conservation |   |   |   |   |   |   |   |
| A New Mindset on External Cost                                |   |   |   |   |   |   |   |

## STUDENTS AND ALUMNI SERVICES

| To Eliminate and/or Reduce                  | a | b | c | d | e | f | g |
|---|---|---|---|---|---|---|---|
| Outdated policies                           |   |   |   |   |   |   |   |
| Unnecessary Bureaucracies                   |   |   |   |   |   |   |   |
| Non-performance Students' Associations      |   |   |   |   |   |   |   |
| Unnecessary Expenditure                     |   |   |   |   |   |   |   |
| Academic Requirements for Talented Students |   |   |   |   |   |   |   |

| To Raise                     | a | b | c | d | e | f | g |
|------------------------------|---|---|---|---|---|---|---|
| Funding                      |   |   |   |   |   |   |   |
| Students' Involvement        |   |   |   |   |   |   |   |
| Student Awareness            |   |   |   |   |   |   |   |
| Technological Enhancement    |   |   |   |   |   |   |   |
| Organisational Restructuring |   |   |   |   |   |   |   |
| Corporate Linkages           |   |   |   |   |   |   |   |

| To Create            | a | b | c | d | e | f | g |
|----------------------|---|---|---|---|---|---|---|
| A Virtual Office     |   |   |   |   |   |   |   |
| Sustainable Policies |   |   |   |   |   |   |   |
| Student Empowerment  |   |   |   |   |   |   |   |

### Definition of ERRC

**Eliminate** = what is redundant, outdated or trivial and providing no value

**Reduce** = what is not providing enough value

**Raise** = what has the potential to add more value

**Create** = what is not available yet but can bring more value

For explanation of alphabets, see note on page 68

**BASIC DATA FOR THE UNIVERSITI SAINS MALAYSIA**

| No | Data  | 2004 – 2008 |       |       |       |       |
|----|---|-------------|-------|-------|-------|-------|
|    |   | 2004        | 2005  | 2006  | 2007  | 2008  |
| 1a | Number of Academic Staff<br>(permanent/contract staff only) – <i>Not including staff on study leave</i> | 1140        | 1167  | 1209  | 1272  | 1287  |
|    | a. Professors   | 111         | 109   | 130   | 136   | 142   |
|    | b. Associate Professors   | 357         | 331   | 306   | 328   | 326   |
|    | c. Senior Lecturers   | 159         | 241   | 231   | 353   | 389   |
|    | d. Lecturers  | 513         | 486   | 542   | 455   | 430   |
| 1b | Number of Academic Staff<br>(permanent/contract staff only) – <i>on study leave</i>                     | 46          | 41    | 46    | 44    | 38    |
|    | a. Professors   | 0           | 0     | 0     | 0     | 0     |
|    | b. Associate Professors   | 1           | 1     | 2     | 1     | 0     |
|    | c. Senior Lecturers   | 3           | 6     | 6     | 9     | 9     |
|    | d. Lecturers  | 42          | 34    | 38    | 34    | 29    |
| 2  | Total number of fulltime students (local and international students including postgraduate students)    | 21832       | 22356 | 21869 | 21175 | 20842 |
|    | (i) Number of local students  | 20733       | 21295 | 20552 | 19565 | 16270 |
|    | (ii) Number of international students   | 827         | 1060  | 1330  | 1610  | 206   |
|    | a. Bachelor   | 18148       | 18541 | 17940 | 16610 | 16289 |
|    | b. Diploma  | -           | -     | -     | 90    | 81    |
|    | c. Certificate  | -           | -     | -     | -     | -     |
|    | d. Others (Foundation Programme: e.g. Asasi Sains Pertanian)  | -           | -     | -     | -     | -     |
|    | (ii) Number of postgraduate students<br>(Provide separate data for local and international students)    | -           | 6523  | 6721  | 6896  | -     |
|    | (i) Number of local students  | 4956        | -     | 4430  | 4702  | -     |
|    | (ii) Number of international students   | -           | -     | 1158  | 1417  | -     |
|    | a. Masters  | 4498        | 4856  | 4430  | 4702  | -     |
|    | b. PhD  | 735         | 845   | 1066  | 1354  | -     |
| 3  | Number of Research Centres<br>(with its own operating budget and/or postgraduate students)              | 13          | 13    | 13    | 13    | 13    |

**Note:** Figures for 2006-2007 are based on USM's unaudited data.  
Figures for 2008 is from January to April only.



## QUANTITY AND QUALITY OF RESEARCHERS

| No | Criteria  | Indicators   | 2004 – 2008 |      |      |      |      |
|----|---|--|-------------|------|------|------|------|
|    |   |  | 2004        | 2005 | 2006 | 2007 | 2008 |
| 1  | Critical Mass   | Total number of academic staff involved as principal investigator (leadership) of research grants                      | 626         | 689  | 674  | 871  | 841  |
| 2  | PhD Qualification or Equivalent   | a. Total number of staff with PhD/DSc, DEng  | 764         | 771  | 788  | 830  | 835  |
|    |   | b. Total number of staff with Professionals Qualifications (such as medical, engineers, architects, accountants, etc.) | 193         | 196  | 224  | 242  | 245  |
| 3  | Research Experience (3 cohorts)   | Total number of research experienced staff:  | 1186        | 1208 | 1255 | 1316 | 1325 |
|    |   | a) >20 years experience  | 296         | 313  | 271  | 290  | 305  |
|    |   | b) 10 – 20 years experience  | 428         | 411  | 345  | 335  | 324  |
|    |   | c) < 10 years experience   | 462         | 484  | 639  | 691  | 696  |
| 4  | Recognition/awards/ stewardship conferred by national and international learned and professional bodies | a. Total number of awards conferred by national bodies   | 66          | 44   | 45   | 51   | 15   |
|    |   | b. Total number of awards conferred by international bodies  | 49          | 54   | 60   | 55   | -    |

**Note:** Figures for 2006-2007 are based on USM's unaudited data. Figures for 2008 is from January to April only.

**QUANTITY AND QUALITY OF POSTGRADUATES**

| No | Criteria   | Indicators   | 2004 – 2008 |       |        |        |        |
|----|--|--|-------------|-------|--------|--------|--------|
|    |  |  | 2004        | 2005  | 2006   | 2007   | 2008   |
| 1  | Number of PhD graduated                                      | a. Total number per year   | 109         | 94    | 101    | 124    | 36     |
|    |  | b. Ratio of PhDs graduated to academic staff (including staff on study leave)        | 1:11        | 1:3   | 1:12.4 | 1:10.4 | 1:36.8 |
|    |  | c. Percentage of PhD in S&T  | 51%         | 39%   | 55%    | 52%    | 53%    |
| 2  | Number of PhDs enrolled                                      | a. Total number per year   | 1,215       | 1,379 | 1,575  | 1,824  | 1,711  |
|    |  | b. Ratio of PhDs enrolled to academic staff (including staff on study leave)         | 1:1         | 1:0.9 | 1:0.8  | 1:0.72 | 1:0.77 |
|    |  | c. Percentage of PhD enrolled in S&T   | 46%         | 47%   | 53%    | 56%    | 58%    |
| 3  | Postgraduate enrolment                                       | a. Ratio of postgraduates to academic staff (including staff on study leave)         | 5.4:1       | 5.4:1 | 5.3:1  | 5.2:1  | 4.9:1  |
|    |  | b. Ratio of postgraduates (based on research and mixed-modes only) to undergraduate  | 1:6         | 1:6   | 1:5.2  | 1:4.6  | 1:5.1  |
|    |  | Percentage of international postgraduate students                                    | 13%         | 15.4% | 19%    | 22%    | 24.4%  |
| 4  | Entry qualification at Bachelor level                        | Percentage of postgraduate intake with CGPA $\geq$ 3.0 or equivalent                 | 68%         | 68%   | 51%    | 49%    | 51%    |
| 5  | Fellowships/grants awarded to postgraduate via research mode | Percentage of postgraduates via research modes (with thesis) with fellowships/grants | 7.5%        | 7.3%  | 17.9%  | 15.6%  | 13.8%  |

**Note:** Figures for 2006-2007 are based on USM's unaudited data. Figures for 2008 is from January to April only.

### QUANTITY AND QUALITY OF RESEARCH

| No | Criteria                               | Indicators  | 2004 – 2008                                    |            |            |            |            |
|----|--|---|--|------------|------------|------------|------------|
|    |  |   | 2004   | 2005       | 2006       | 2007       | 2008       |
| 1  | Publications                           | a. Total number of publications in citation-indexed journals including refereed proceedings (ISI Serials)   | 221  | 329        | 467        | 521        | 151        |
|    |  | b. Total number of publications in non-citation-indexed journals  | 404  | 350        | 325        | 635        | 31         |
|    |  | c. Total number of books authored   | 81   | 146        | 33         | 85         | 18         |
|    |  | d. Total number of chapters in books  | 48   | 47         | 311        | 244        | 78         |
|    |  | e. Other publications that have created an impact to government/ society/policy (abstracts, articles in magazines, newsletters, etc.- not including unpublished reports | 478  | 414        | 850        | 1304       | 15         |
|    |  | f. Cumulative impact factor of publications   | 289.078  | 402.323    | 503.164    | 575.187    | 63.3       |
| 2. | Citations                              | Total number of citations for papers published in Scopus indexed journals   | 659  | 899        | 1463       | 1629       | 555        |
|    |  | Total number of citations for papers published in ESI indexed journals  | USM has not subscribed to ESI indexed journals |            |            |            |            |
| 3. | Research grants for S&T academic staff | a. Total amount of public funding (from government agencies)  | 11,472,361                                     | 18,186,327 | 23,442,996 | 74,034,163 | 5,598,623  |
|    |  | b. Total amount of private funding (including contract research)  | 2,267,658                                      | 1,840,199  | 629,123    | 1,175,464  | 14,689,627 |
|    |  | c. Total amount of international funding  | 2,270,326                                      | 1,793,650  | 1,729,128  | 749,482    | 102,480    |
| 4  | Research expenditures for each project | a. Total amount of research grants received   | 20,014,262                                     | 27,724,482 | 28,056,775 | 87,101,969 | 21,861,238 |
|    |  | b. Total amount of research grants spent  | 31,981,380                                     | 31,006,084 | 24,626,344 | 35,081,759 | 11,654,570 |
| 5  | Post-doctoral appointment              | a. Number of post-doc appointed   | 7  | 10         | 2          | 5          | 11         |
|    |  | b. National   | 0  | 4          | 2          | 2          | 2          |
|    |  | c. International  | 7  | 6          | 0          | 3          | 9          |

**Note:** Figures for 2006-2007 are based on USM's unaudited data. Figures for 2008 is from January to April only.



INNOVATION

| No | Criteria                                     | Indicators  | 2004 – 2008 |      |      |      |      |
|----|--|---|-------------|------|------|------|------|
|    |  |   | 2004        | 2005 | 2006 | 2007 | 2008 |
| 1  | Patents                                      | a. Total number of patents granted  | 7           | 7    | 20   | 21   | 21   |
|    |  | (i) National patents  | 6           | 6    | 10   | 11   | 11   |
|    |  | (ii) International patents  | 1           | 1    | 10   | 10   | 10   |
|    |  | b. Total number of patents pending  | 56          | 57   | 52   | 54   | 54   |
|    |  | (i) National patents  | 18          | 19   | 31   | 23   | 23   |
|    |  | (ii) International patents  | 38          | 38   | 21   | 31   | 31   |
| 2  | Commercialised products                      | Total number of products licensed for commercialisation                           | 7           | 3    | 7    | 4    | 4    |
| 3  | Technology know-how licensing                | Total number of technology know-how licensing                                     | 8           | -    | -    | 6    | 6    |
| 4  | IPR/copyrights (including original writings) | Total number of IPR (other than patents)/copyrights (including original writings) | 62          | 71   | 63   | 61   | 18   |

**Note:** Figures for 2006-2007 are based on USM's unaudited data.  
Figures for 2008 is from January to April only.

## INFRASTRUCTURE AND FACILITIES

|   | Criteria   | Indicator   | Performance USM |         |         | KPI       | Target  |           |           |
|---|--|---|-----------------|---------|---------|-----------|---------|-----------|-----------|
|   |  |   | 2001-2005       | 2006    | 2007    |           | 2007    | 2008      | 2009      |
| 1 | Equipment (accreditation to GLP/ISO 17025) fully operational and calibrated or physical facilities that meet safety and quality standards        | Total number of equipment (accreditation to GLP/ISO 17025) fully operational and calibrated or physical facilities that meet safety and quality standards (% of compliance) | 75% (2005)      |         |         | 100%      | 85%     | 95%       | 100%      |
| 2 | Library facilities   | a. Total number of books/titles<br>b. Total number of online books and titles   | 764,805         | 800,295 | 877,909 | 1,350,000 | 960,000 | 1,154,000 | 1,350,000 |
| 3 | Supporting facilities including networking and shared facilities service centre or recreational centre or access to high end research facilities | Total number of supporting facilities (% of compliance)   | 75% (2005)      |         |         | 100%      | 85%     | 95%       | 100%      |

**Note:** Figures for 2006-2007 are based on USM's unaudited data. Figures for 2008 is from January to April only.

**PROFESSIONAL SERVICES AND GIFTS**

| No | Criteria  | Indicators   | 2004 – 2008 |            |            |            |            |
|----|---|--------------|-------------|------------|------------|------------|------------|
|    |   |              | 2004        | 2005       | 2006       | 2007       | 2008       |
| 1  | Income generated from training courses                              | Total Amount | 8,314,942   | 4,920,439  | 1,839,702  | 6,894,895  | 1,334,840  |
| 2  | Income generated from consultancy excluding contract research       | Total Amount | 18,561,812  | 12,009,428 | 15,284,882 | 11,565,536 | 4,802,161  |
| 3  | Endowment (including professorial chairs)                           | Total Amount | 19,565,259  | 19,416,093 | 14,326,843 | 17,909,549 | 17,909,549 |
| 4  | Gifts (money, equipment research materials, etc.)(worth ≥RM3,000.00 | Total Amount | NA          | NA         | 5,000      | 754,480    | NA         |

**Note:** Figures for 2006-2007 are based on USM's unaudited data.  
Figures for 2008 is from January to April only.



## NETWORKS AND LINKAGES

### 1a. INTERNATIONAL - RESEARCH

| Code    | Project Leader                  | School/Centre              | Project Title  | Sponsor   |
|---------|---------------------------------|----------------------------|--|---|
| 1 A0774 | Johan Saravanamuttu<br>Abdullah | Social Sciences            | Ethnic peace and civil society – Malaysia 1  | The Regents of the<br>University of Michigan                |
| 2 A0755 | Loh Kok Wah @ Francis           | Social Sciences            | Peace building in multi-ethnic, multi-religious<br>Southeast Asia                                    | The Ford Foundation   |
| 3 A0727 | Ng Wing Keong                   | Biological<br>Sciences     | The utilisation of oil palm by-products and<br>palm oil in pelleted feeds for tilapia and<br>catfish | International<br>Foundation for<br>Sciences, Sweden         |
| 4 A0995 | Othman Sulaiman                 | Technology<br>Industry     | Development of ethanol production system<br>using oil palm SAP                                       | Japan Ins. Research<br>Centre for Agric<br>Science (JIRCAS) |
| 5 A0767 | Yuen Kah Hay                    | Pharmaceutical<br>Sciences | UW-USM chronic prostatitis clinical research   | University of<br>Washington                                 |

### 1b. INTERNATIONAL - ACADEMIC

| Criteria  | Indicators  | Activities/Projects  |
|---|---|--|
| 1 International collaborations in academic/research related activities/projects | Describe the top five (5) on-going activities/projects with renowned universities or research institutes. | <ol style="list-style-type: none"> <li>University of British Columbia, Canada – Credit transfer student exchange programme.</li> <li>KEIO University, University of Tokyo and WIDE Japan – Japanese-wide project and involves the setting up and commissioning of an earth station for communications and internet experiments with the other A13 partners. Currently Thailand, Indonesia and Hong Kong are connected on the KU-Band and Malaysia and Singapore will be connected on the C-Band.</li> <li>National University of Singapore – Exchange of students in Education and Development of Tropical Environmental Programme.</li> <li>University of Sydney – USMUS (USM and University of Sydney) programme involving work in the curriculum development for USM M.Med Programme and short-term training of academic staff from the School of Medical Sciences.</li> <li>RIKEN – Joint Graduate School Programme involving training of talented young scientists and the appointment of visiting professors.</li> </ol> |

**2a. INDUSTRY/PROFESSIONAL BODIES/ASSOCIATIONS (Individuals)**

| Code | Project Leader            | School/Centre                       | Project Title   | Sponsor   |
|------|---------------------------|-------------------------------------|---|---|
| 1    | Suzina Sheikh Abdul Hamid | Medical Sciences                    | Development and production of innovative biomaterials for the developing countries.                 | Malaysian Technology Development Corporation (MTDC)         |
| 2    | Azlina Harun              | Chemical Engineering                | Innovative technology for the production [S] Ibuprofen  | Malaysian Technology Development Corporation (MTDC)         |
| 3    | Radzali Othman            | Materials and Mineral Resources Eng | Development and production of reformulated calcium phosphates for bone graft substitutes (REKACRAF) | Malaysian Technology Development Corporation (MTDC)         |
| 4    | Sureswaran Ramadas        | Computer Science                    | Design and development of a bi-directional realtime low ATM-Ethernet IP Bridge                      | MIMOS   |
| 5    | Kamarulzaman Askandar     | Social Sciences                     | Southeast Asian conflict studies network  | Swedish International Development Cooperation Agency (SIDA) |

**2b. INDUSTRY/PROFESSIONAL BODIES/ASSOCIATIONS (Schools/Centres)**

|   | Industry                   | School/Centre                                 | Description  |
|---|----------------------------|---|--|
| 1 | Agilent Technologies       | School of Electric and Electronic Engineering | <ul style="list-style-type: none"> <li>23 years of collaboration with USM. Recently Agilent Technologies donated equipments worth about RM300,000.00 for the setting-up of the USM-Agilent Technology Instrument Laboratory.</li> </ul>  |
| 2 | INTEL Technology Sdn. Bhd. | a. School of Computer Sciences                | <ul style="list-style-type: none"> <li><b>Intel Multicore Lab</b><br/>Following the global trend of the computer industry that is moving towards multicore architectures, USM's School of Computer Science has been selected as Intel's Multicore Training Centre where academics from identified Computer Science/IT departments from other public universities in Malaysia will be trained and exposed to the various application/software tools related to multicore architecture. This is to enable the software industry to embrace the development of multi-threading applications in order to ensure that consumers observe the continued performance improvements they expect.</li> <li><b>Intel eLite Programme</b><br/>Intel eLite program is a program initiated by the Intel Corporation (Penang) in collaboration with the School of Computer Sciences, Universiti Sains Malaysia in Penang. The program is a structured Intel-University programme to build up graduates' readiness for industries and to develop a predetermined hiring resource pipeline of USM's Computer Science undergraduates</li> </ul> |

|   |                   |  |   |
|---|-------------------|--|---|
|   |                   | <p>b. School of Materials and Mineral Design Engineering</p> | <ul style="list-style-type: none"> <li>• Collaboration between Intel and the School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia, includes academic and research activities with the aim of enhancing the development of technical competencies and innovativeness amongst young material engineering graduates so as to enable them to join the industry. In the year 2003, Intel (M) designated the School of Materials and Mineral Resources Engineering as the Centre of Research and Teaching in Materials Technology in Malaysia. Under this Centre an Electronic Packaging course for the M.Sc mix-mode was developed together with Intel and two research projects were granted financial support. The two research projects are in the area of Lead free and Thermal Interface Materials.</li> </ul> <p>Other collaborative activities are monthly seminars on Electronic Packaging and related issues given by Intel staff. A number of staff members of the School of Materials and Mineral Resources Engineering and staff from Intel are undertaking research projects sponsored by Intel under its Research Grant Programme. Postgraduate students working on Intel related projects are also given Intel Fellow Scholarships.</p> |
| 3 | UEM Group Bhd.    | School of Management   | <ul style="list-style-type: none"> <li>• The School of Management's relationship with United Engineers Malaysia began with the establishment of the USM-Plus Accounting Professional Chair in the year 2000. Since then, various on-going projects have been formulated. Officers of UEM are regular presenters and speakers during the School of Management's Week. Encik Ahmad Zakie Ahmad Shariff, the Group General Manager of UEM's Business Development Office, is one of the School's panellists in the curriculum review project. UEM also hosted management students as trainees, while the students were also nominated for the YES Programme. Last year, UEM was one of the School's sponsors for the 7<sup>th</sup> Asian Academy of Management Conference. An agreement to work with BINUS Nusantara University of Jakarta is being explored. The School also intend to collaborate with UEM's Leadership Centre in developing EDP and Mini-MBA Programmes.</li> </ul>   |
| 4 | Finisar Sdn. Bhd. | School of Computer Sciences                                  | <ul style="list-style-type: none"> <li>• Four (4) projects will be carried out through this joint venture between USM researchers and Finisar Malaysia Sdn. Bhd. The projects are Evolutionary computation and optimization for smart industry environment, Optoelectronics interconnects and packaging technology, Finisar Training &amp; HR Database and Finisar On-line Administration System. USM researchers comprised of lecturers from IPv6, School of Computer Sciences, School of Physics, School of Chemical Engineering, School of Electrical and Electronic Engineering and School of Materials and Mineral Resources Engineering which is expert in their field.</li> </ul>  |
| 5 | MOTOROLA          | School of Management   | <ul style="list-style-type: none"> <li>• The School of Management's relationship with Motorola had a humble beginning. It started with a loosely found cooperation where Motorola officers were invited to be guest lecturers for classes under the Operations Management Section. Accountants from Motorola were also invited to give career guidance talk during the annual Management Week. They were also members of the panel during the initial years of the formulation of the Bachelor's Degree in Accounting Programme.</li> </ul> <p>In mid 2007, a formal "smart-partnership" structure began between the two entities, as a way to get closer to the industry.</p>  |



|  |  |   |
|--|--|---|
|  |  | <p>Various discussions were held and a formal visit was made by the School's Executive Committee in July 2007 to the Motorola Plant. Thus, in August 2007 a formal MOU was drawn between the School of Management and Motorola Malaysia Berhad. From the MOU, Motorola Malaysia agreed to assist the School of Management in the following manner:</p> <ul style="list-style-type: none"> <li>(i) A more structured Industrial Training Programme for Students.</li> <li>(ii) A formalization of the "Best Student Award" for the Management students with the objective of permanent employment in Motorola.</li> <li>(iii) A sabbatical programme and internship opportunity for academic staff of the School of Management.</li> <li>(iv) Research opportunities for academic staff from the School of Management.</li> <li>(iv) Collaborating in terms of Executive Development Programmes and Training Opportunities for employees of Motorola.</li> </ul> |
|--|--|---|

### 3. NATIONAL

|   | Project Leader        | School/Centre                                 | Project Title   | Sponsor                            |
|---|-----------------------|---|---|------------------------------------|
| 1 | Asma Ismail           | INFORMM                                       | Development of diagnostic tests for enteric pathogens: a genomic approach                                 | National Biotechnology Directorate |
| 2 | Khatijah Aisha Yaacob | Material and Mineral Resources Eng<br>Physics | The development of electron transport analysis techniques in the quantum dots/wires                       | MOSTI                              |
| 3 | Md Roslan Hashim      |   | Fabrication of SI-GE-based waveguides and optical amplifiers.   | Universiti Malaya                  |
| 4 | Mohamed Isa Abd Majid | National Poison Centre                        | Genomic approaches to seaweed genes and natural product discovery   | National Biotechnology Directorate |
| 5 | Mohd Rizal Arshad     | Electric & Electronic Engineering             | Design and development of intelligent hybrid underwater vehicle for inspection and monitoring application | National Oceanography Directorate  |

## PROFILE OF TOP RESEARCH PROJECTS AND RESEARCHERS

### 1. Government Funding

| Bil | Nama Ketua                      | Pusat Tanggungjawab                     | Tajuk Projek   | Penaja  | Tarikh Mula | Tarikh Hingga | Jumlah Geran Yang Diterima Sehingga Kini (RM) |
|-----|---------------------------------|---|--|---|-------------|---------------|---|
| 1   | ZAINURIAH BINTI HASSAN          | PUSAT PENGAJIAN SAINS FIZIK             | Material (III-V Nitrides And Organic Layers) Fabrication And Characterization  | RM8 - KATEGORI SR                                   | 7/1/2002    | 12/31/2006    | 11,299,914.00                                 |
| 2   | MD ROSLAN BIN HASHIM            | PUSAT PENGAJIAN SAINS FIZIK             | FABRICATION OF SI-GE-BASED WAVEGUIDES AND OPTICAL APLIFIERS  | UNIVERSITI MALAYA                                   | 4/1/2002    | 8/31/2005     | 6,124,500.00                                  |
| 3   | AZLAN BIN ABDUL AZIZ            | PUSAT PENGAJIAN SAINS FIZIK             | Fabrication, Characterization And Reliability Analysis Of III-V Nitrides And Organic Based Blue Light Emitting Devices                                       | RM8 - KATEGORI SR                                   | 7/1/2002    | 6/30/2006     | 4,995,414.00                                  |
| 4   | MOHAMED ISA BIN ABD MAJID       | PUSAT RACUN NEGARA                      | GENOMIC APPROACHES TO SEAWEED GENES AND NATURAL PRODUCT DISCOVERY  | DIREKTORAT BIOTEKNOLOGI KEBANGSAAN (NBD)            | 1/31/2002   | 12/31/2004    | 4,198,675.00                                  |
| 5   | ASMA BINTI ISMAIL               | P PENGAJIAN SAINS PERUBATAN             | DEVELOPMENT OF DIAGNOSTIC TESTS FOR ENTERIC PATHOGENS : A GENOMIC APPROACH   | DIREKTORAT BIOTEKNOLOGI KABANGSAAN (NBD)            | 1/1/2002    | 12/31/2004    | 3,660,636.00                                  |
| 6   | MOHD RIZAL BIN ARSHAD           | P P KEJ ELEKTRIK & ELEKTRONIK           | Design and Development of Intelligent Hybrid Underwater Vehicle for Inspection and Monitoring Application  | DIREKTORAT OSEANOGRAFI KEBANGSAAN (NOD), (MOSTI)    | 7/1/2007    | 6/30/2009     | 2,222,000.00                                  |
| 7   | ASMA BINTI ISMAIL               | INSTITUT PENYELIDIKAN PERUBATAN MOLEKUL | Development of Malaysian-Cuban Diagnostic for Tropical Diseases  | JIKUASA TEKNIKAL & JIKUASA STRATEGIK DALAMAN BIOTEK | 3/1/2007    | 2/28/2009     | 1,999,992.00                                  |
| 8   | YUEN KAH HAY                    | PUSAT PENGAJIAN SAINS FARMASI           | Multicentre Study of the Cardioprotective Effects of Palm Vitamin E Tocotrienols   | LEMBAGA MINYAK KELAPA SAWIT MALAYSIA (MPOB)         | 2/1/2006    | 2/28/2009     | 1,800,000.00                                  |
| 9   | KHATIJAH AISHA BINTI YAACOB     | P P KEJ BAHAN & SUMBER MINERAL          | PROG: THE DEVELOPMENT OF SINGLE-ELECTRON TRANSISTORS. PROJEK: The Development Of Electron Transport Analysis Techniques In The Quantum Dots/Wires            | AGENSI LUAR (TOP-DOWN IRPA KATEGORI SR) MELALUI UTM | 6/1/2004    | 5/31/2007     | 1,679,160.00                                  |
| 10  | MOHD NAZALAN BIN MOHD NAJIMUDIN | P PENGAJIAN SAINS KAJIHAYAT             | STRUCTURAL GENOMICS AND FUNCTIONAL STUDIES OF EXTREMOPHILIC PROTEINS: Structure And Function Studies Of Glycolytic Enzymes From Psychrophilic Microorganism. | DIREKTORAT BIOTEKNOLOGI KABANGSAAN (NBD)            | 9/1/2003    | 8/31/2006     | 1,631,482.00                                  |

## 2. Industry Funding

| Bil | Nama Ketua                            | Pusat Tanggungjawab               | Tajuk Projek  | Penaja  | Tarikh Mula | Tarikh Hingga | Jumlah Geran Yang Diterima Sehingga Kini (RM) |
|-----|---------------------------------------|-----------------------------------|---|---|-------------|---------------|---|
| 1   | SUZINA BT. SHEIKH<br>ABDUL HAMID      | P PENGAJIAN SAINS<br>PERUBATAN    | Development & Production of Innovative Biomaterials for the Developing Countries  | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 3,553,500.00                                  |
| 2   | RADZALI BIN<br>OTHMAN                 | P P KEJ BAHAN &<br>SUMBER MINERAL | Development and Production of Reformulated Calcium Phosphates for Bone Graft Substitutes [REKACRAF]                                       | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 3,432,480.00                                  |
| 3   | SURESWARAN A/L<br>RAMADASS            | P PENGAJIAN SAINS<br>KOMPUTER     | Design and Development of a Bi - Directional Realtime Low ATM - Ethernet IP Bridge  | MIMOS   | 10/2/2000   | 7/31/2003     | 2,365,680.00                                  |
| 4   | AZLINA BINTI<br>HARUN @<br>KAMARUDDIN | P PENGAJIAN<br>KEJURUTERAAN KIMIA | Innovative Technology for the Production of [S]-Ibuprofen   | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 2,149,500.00                                  |
| 5   | HANAFI BIN ISMAIL                     | P P KEJ BAHAN &<br>SUMBER MINERAL | Development & Production of OilZob - A Novel and Reactive Oil Absorbent from Various Rubber Waste   | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 1,290,000.00                                  |
| 6   | ABDUL LATIF BIN<br>AHMAD              | P PENGAJIAN<br>KEJURUTERAAN KIMIA | Development and Production of Nitrocellulose Membranes  | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 1,149,500.00                                  |
| 7   | DARAH BINTI<br>IBRAHIM                | P PENGAJIAN SAINS<br>KAJIHAYAT    | Development of Pilot Plant Scale System for Enzymatic Deinking as an Environmental Friendly Solution for Recycling of Printed Waste Paper | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 1,018,000.00                                  |
| 8   | ABDUL RAHMAN<br>BIN MOHAMED           | P PENGAJIAN<br>KEJURUTERAAN KIMIA | Single-Step Production of Carbon Nanotubes and Hydrogen from Natural Gas  | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 950,800.00                                    |
| 9   | TAN SOO CHOON                         | PUSAT KAWALAN<br>DOPING           | Development and Production of Bioconjugates   | MALAYSIAN TECHNOLOGY DEVELOPMENT CORPORATION [MTDC] | 3/15/2008   | 3/14/2011     | 910,000.00                                    |
| 10  | JAMIL BIN ISMAIL                      | PUSAT PENGAJIAN<br>SAINS KIMIA    | NANO SILICA-POLYMER COMPOSITE SYNTHESIS & CHARACTERIZATION  | INTEL TECHNOLOGY SDN. BHD.                          | 11/1/2005   | 10/31/2007    | 345,101.00                                    |



### 3. International Funding

| Bil | Nama Ketua                     | Pusat Tanggungjawab            | Tajuk Projek   | Penaja   | Tarikh Mula | Tarikh Akhir | Jumlah Geran Yang Diterima Sehingga Kini (RM) |
|-----|--------------------------------|--------------------------------|--|--|-------------|--------------|---|
| 1   | KAMARULZAMAN BIN ASKANDAR      | P P SAINS KEMASYARAKATAN       | Jarigan Konflik Asia Tenggara "Southeast Asian Conflict Studies Network"                         | SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION ENGENCY (SIDA) | 01.01.01    | 30.06.01     | 6,906,641.00                                  |
| 2   | RAHMAH BT. NOORDIN             | P PENGAJIAN SAINS PERUBATAN    | DIAGNOSIS ON INFECTION & MORBIDITY IN LYMPHATIC FILARIASIS DEVELOPMENT OF FIELD APPLICABLE TOOLS | EUROPEAN COMMUNITY (EC)                                      | 01.01.02    | 31.05.06     | 582,233.00                                    |
| 3   | YUEN KAH HAY                   | PUSAT PENGAJIAN SAINS FARMASI  | UW/USM CHRONIC PROSTATITIS CLINICAL RESEARCH CENTRE.   | UNIVERSITY OF WASHINGTON                                     | 01.09.03    | 28.2.08      | 528,885.00                                    |
| 4   | RAHMAH BINTI NOORDIN           | INST PENY PERUBATAN MOLEKUL    | T Cell Regulation and the Control of Helminth Infections (TRANCHI)                               | EUROPEAN UNION   | 01.10.06    | 30.09.09     | 460,090.00                                    |
| 5   | LOH KOK WAH @ FRANCIS          | P P SAINS KEMASYARAKATAN       | PEACE BUILDING IN MULTI-ETHNIC, MULTI-RELIGIOUS SOUTHEAST ASIA.                                  | THE FORD FOUNDATION  | 01.09.03    | 30.09        | 376,871.00                                    |
| 05  | OTHMAN BIN SULAIMAN            | P PENGAJIAN TEKNOLOGI INDUSTRI | Development of Ethanol Production System Using Oil Palm SAP                                      | JAPAN INST RESEARCH CENTER FOR AGRICULTURAL SCIENCE (JIRCAS) | 01.07.07    | 28.02.08     | 367,435.00                                    |
| 7   | VISWESWARAN NAVARATNAM         | P PENY DADAH & UBAT-UBATAN     | Kajian Naltrexson  | WHO  | 18.07.00    | 19.07.01     | 247,520.00                                    |
| 8   | KHAIRUN AZIZI BT. MOHD. AZIZLI | P P KEJ BAHAN & SUMBER MINERAL | HIGH TECHNOLOGY AGGREGATES AND MANUFACTURED SAND TECHNOLOGY.                                     | METSO MINERAL (NEW ZEALAND) & METSO (AUSTRALIA)              | 01.12.03    | -            | 238,160.00                                    |
| 9   | VISWESWARAN NAVARATNAM         | P PENY DADAH & UBAT-UBATAN     | WHO/PHARMACOKINETICS OF ANTIFILARIAL DRUG (MACROFIL IV)  | WHO  | 01.06.94    | 31.05.95     | 235,249.00                                    |
| 10  | LEE CHOW YANG                  | P PENGAJIAN SAINS KAJIHAYAT    | Novel Pest Management Strategies Against Urban Insect Pests in South East Asia                   | DUPONT CROP PROTECTION (USA)                                 | 01.06.06    | 31.05.10     | 222,000.00                                    |

PROFILE OF TOP RESEARCH PROJECTS AND RESEARCHERS - CLUSTERS

| No | Research Cluster   | Research Dean                       | Current and on-going project(s)   | Selected list of publications (not more than 10)   |
|----|--|-------------------------------------|---|--|
| 1  | Health Sciences & Biomedical Research Platform<br>• <i>Brain Science</i> | Prof. Syed Mohsin Sahil Jamalullail | <ol style="list-style-type: none"> <li>Epilepsy and Obstructive Sleep Apnea Syndrome (OSAS).</li> <li>The Potential Antiepileptic Bioactive Compounds Acting On GABA (A) Receptor from Myristice Fragrans.</li> <li>Studies on Nitric Oxide (No), Citrulline- No cycle Enzymes, Gultamine Synthetase and Oxidative Status in Epilepsy Rat Model.</li> <li>Genetic Studies in Generalised Epilepsy.</li> <li>Quality Of Life in Paediatric Epilepsy Children.</li> <li>A Study of Lymphocyte Subset in Epileptic Patients.</li> <li>Normative Data for Hippocampal and Temporal lobe Volume in Normal Malay Population.</li> </ol> <p>EEG Biofeedback and Mental Health: An Integrative Agenda</p> | <p>1. Ahmad, F., A. P. M. Yusof, P. D. Mourad, M. Bainbridge, and S. Ab Ghani. 2006. "Effects of hydrogen peroxide towards gap junction communication in astrocytes and permeability of blood brain barrier." <i>Neuroscience Research</i> 55:S57-S57.</p> <p>2. Ibrahim, M., M. Abdullah, L. Naing, J. M. Abdullah, and S. Al Junid. 2005. "Cost effectiveness analysis of using multiple monitoring modalities in treating severe traumatic brain injury (CESTBI)." <i>Journal of Neurology</i> 252:74-74.</p> <p>3. Ryan, G., T. Grimes, B. Brankin, Mjemf Mabruk, M. J. Hosie, O. Jarrett, and J. J. Callanan. 2005. "Neuropathology associated with feline immunodeficiency virus infection highlights prominent lymphocyte trafficking through both the blood-brain and blood-choroid plexus barriers." <i>Journal of Neurovirology</i> 11(4):337-345.</p> <p>4. Kiflie, A., N. A. Alias, M. M. A. Kareem, W. Mar, and J. Abdullah. 2004. "The prognostic value of follow-up computerised tomography of brain in adult patients with moderate and severe head injury following motor vehicle accident." <i>Journal of Neurology</i> 251:76-76.</p> <p>5. Kumaraswamy, N., A. Naziah, J. Abdullah, A. R. A. Mmed, M. R. Abdullah, and G. Ghazaim. 2002. "Outcome of children with traumatic brain injury in rural Malaysia." <i>Journal of Clinical Neuroscience</i> 9(3):251-255.</p> <p>6. Awang, M. S., J. M. Abdullah, M. R. Abdullah, A. Tahir, J. Tharakan, A. Prasad, and S. A. Razak. 2007. "Nerve conduction study of healthy Asian Malays: The influence of age on median, ulnar, and sural nerves." <i>Medical Science Monitor</i> 13(7):CR330-CR332.</p> <p>7. Idris, B., S. Sayuti, and J. M. Abdullah. 2007. "History of neurosciences at the school of medical sciences, Universiti Sains Malaysia." <i>Journal of Clinical Neuroscience</i> 14(2):148-152.</p> <p>8. Latip, L. S. A., N. A. A. Alias, A. R. Ariff, I. L. Shuaib, J. Abdullah, and N. N. Naing. 2004. "CT scan in minor head injury: a guide for rural doctors." <i>Journal of Clinical Neuroscience</i> 11(8):835-839.</p> <p>9. Muiz, A. J., J. Abdullah, N. N. Naing, G. Ghazaim, and A. R. Ariff. 2003. "Spontaneous intracerebral hemorrhage in northeast Malaysian patients: A four-year study." <i>Neuroepidemiology</i> 22(3):184-195.</p> <p>10. Abdullah, J. M., Z. A. Ghani, N. A. A. Alias, S. Jalaluddin, J. Tharakan, N. N. Naing, and A. R. I. Ghani. 2006. "Computer tomography perfusion of penumbra versus outcome in hypertensive intracranial haemorrhage undergoing conservative versus surgical management: a prospective study." <i>Journal of Neurology</i> 253:65-65.</p> |

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|---|---|---|--|--|
| 2 | <p>Life Sciences Research Platform</p> <ul style="list-style-type: none"> <li>• <i>Chemical Biology</i></li> <li>• <i>Biodiversity &amp; Environment</i></li> </ul> | <p>Prof. Mohd. Nazlan Mohd. Najimudin</p> | <ol style="list-style-type: none"> <li>1. Tropical Biodiversity: Studies From Our Rich Tropical Natural Resources.</li> <li>2. Structure Based Drug Design for bird Flu Hemotherapeutic: Structural Evaluation and Activity Relationship; De novo Design; Chemical Synthesis and Biological Evaluation.</li> <li>3. Synthesis of Novel Neuraminidase Inhibitors.</li> <li>4. Drug Discovery for Avian Flu H5N1: Identifying Key Mutations in Neuraminidase N1 and Its Bioactivity.</li> <li>5. Construction of chemical libraries from natural products for avian influenza therapeutics.</li> </ol> <p>Molecul Characterization of Ha, Na &amp; Ha-Na Proteins Cloned From Avian (Bird) Influenza H5N1.</p> | <ol style="list-style-type: none"> <li>1. Bakus, G. J., G. Nishiyama, E. Hajdu, H. Mehta, M. Mohammad, U. D. Pinheiro, S. A. Sohn, T. K. Pham, Z. bin Yasin, T. Shau-Hwai, A. Karam, and E. Hanan. 2007. "A comparison of some population density sampling techniques for biodiversity, conservation, and environmental impact studies." <i>Biodiversity and Conservation</i> 16(9):2445-2455.</li> <li>2. Choudhary, M. I., S. Sultan, S. Jailli, S. Anjum, A. A. Rahman, H. K. Fun, and A. U. Rahman. 2005. "Microbial transformation of mesterolone." <i>Chemistry &amp; Biodiversity</i> 2(3):392-400.</li> <li>3. Wahab, H. A., N. Bahiyah, A. Khairudin, M. R. Samian, and N. Najimudin. 2006. "Sequence analysis and structure prediction of type II Pseudomonas sp USM 4-55 PHA synthase and an insight into its catalytic mechanism." <i>Bmc Structural Biology</i> 6.</li> <li>4. Wahab, H. A., R. Yusof, and N. A. Rahman. 2007. "A search for vaccines and therapeutic for dengue: A review." <i>Current Computer-Aided Drug Design</i> 3(2):101-112.</li> <li>5. Rozilawati, H., J. Zairi, and C. R. Adanan. 2007. "Seasonal abundance of Aedes albopictus in selected urban and suburban areas in Penang, Malaysia." <i>Tropical Biomedicine</i> 24(1):83-94.</li> <li>6. Darah, I., K. Jain, S. Suraya, S. H. Lim, N. Hazarina, and A. S. N. Adnalizawati. 2006. "Screening for antiyeast activities from selected medicinal plants." <i>Journal of Tropical Forest Science</i> 18(4):231-235.</li> <li>7. Singh, M. S. J. and S. I. S. Hassan. 2004. "Comparison of 1-minute rainfall rate distributions for tropical and equatorial climates." <i>Space Communications</i> 19(3-4):193-198.</li> <li>8. Ab Rahman, A. F., M. I. M. Ibrahim, M. B. Bahari, M. H. N. Mohamed, and R. Awang. 2002. "Design and evaluation of the pharmacoinformatics course at a pharmacy school in Malaysia." <i>Drug Information Journal</i> 36(4):783-789.</li> <li>9. Rahman, N. U., K. H. Yuen, N. A. K. Khan, and J. W. Wong. 2006. "Drug-polymer mixed coating: A new approach for controlling drug release rates in pellets." <i>Pharmaceutical Development and Technology</i> 11(1):71-77.</li> <li>10. Fathelrahman, A. I., A. F. Ab Rahman, and Z. M. Zain. 2005. "MS 04-044: Demographic features of drug and chemical poisoning in Northern Malaysia." <i>Clinical Toxicology</i> 43(2):89-94.</li> </ol> |
| 3 | <p>Clinical Sciences Research Platform</p> <ul style="list-style-type: none"> <li>• <i>Cancer</i></li> </ul>  | <p>Prof. Nor Hayati Othman</p>            | <ol style="list-style-type: none"> <li>1. The Socio-Economic Impact of Breast Cancer on the Female Patients and Her Family in Penang and Kelantan.</li> <li>2. The Mapping of Colorectal &amp; Breast Cancer Cases With Reference To the Location of Conventional Health Facilities.</li> <li>3. Pre-Clinical Studies of Standardized Extracts of Orthosiphon Stamineus (Os) And Strobilanthes Crispus (Sc) As Bio-enhancers In the Treatment of Breast and</li> </ol>   | <ol style="list-style-type: none"> <li>1. El-Tawil, S. G., S. W. Shah, R. Adnan, N. M. Zaki, and N. H. Othman. 2006. "Comparative study between Pap smear cytology and FT-1R spectroscopy - A new tool for screening for cervical cancer." <i>Modern Pathology</i> 19:33-34.</li> <li>2. Esugasini, S., M. Y. Mashor, N. A. M. Isa, and N. H. Othman. 2005. "Performance comparison for MLP networks using various back propagation algorithms for breast cancer diagnosis." Pp. 123-130 in <i>Knowledge-Based Intelligent Information and Engineering Systems, Pt 2, Proceedings</i>, vol. 3682, Lecture Notes in Artificial Intelligence. Berlin: Springer-Verlag Berlin.</li> <li>3. Farini, M. S., A. Azlina, I. Rushdan, M. Manoharan, R. B. Zain, and A. R. Samsudin. 2005. "Clinical pathological evaluation and risk factors of oral cancer cases of east coast of peninsular Malaysia." <i>Oral Oncology</i> 1(1):166-167.</li> <li>4. Mabruk, Mjempf and C. O'Flatharta. 2005. "Telomerase: is it the future diagnostic and prognostic tool in human cancer?" <i>Expert Review of Molecular Diagnostics</i> 5(6):907-916.</li> </ol>   |



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| 4 | Engineering & Technology Research Platform<br>• Waste Management | Prof. Zainal Arifin Mohd Ishak  | <p>Colorectal Cancers.</p> <p>4. Phase-II Clinical Trial Using Withania Somnifera (Ashwagandha) In The Prevention Of Chemotherapy Induced Fatigue Among Breast Cancer Patients.</p> <p>5. Sreening of Colorectal Carcinoma among Moderate Risk Patient Using Immunological Fecal Occult Blood in Kelantan.</p> <p>6. Genome-Wide Analysis of the Allelic Imbalance in Sporadic Crc among the Chinese in Malaysia.</p> <p>Trans-Disciplinary Research On Prevention Early Screening, Detection, Treatment And Social Impact Of The Two Most Common Cancer In Malaysia</p>   | <p>5. Zain, R. B., R. J. R. Latifah, I. A. Razak, S. M. Ismail, A. R. Samsuddin, S. A. Atiya, B. Y. Hashim, A. Jallaludin, W. M. Nasir, S. C. Cheong, A. Z. Bustam, W. M. W. Mahadzir, M. T. Abraham, Z. A. A. Rahman, G. Krishnan, N. P. Kipli, J. Norma, K. K. Tay, and K. M. Yuen. 2005. "Oral cancer and precancer research in Malaysia - the database and tissue resource bank." <i>Oral Oncology</i> 1(1):123-123.</p> <p>6. Ramli, D. A., A. F. Kadmin, M. Y. Mashor, N. Ashidi, and M. Isa. 2004. "Diagnosis of cervical cancer using hybrid multilayered perceptron (HMLP) network." Pp. 591-598 in <i>Knowledge-Based Intelligent Information and Engineering Systems, Pt 1, Proceedings</i>, vol. 3213, <i>Lecture Notes in Computer Science</i>. Berlin: Springer-Verlag Berlin.</p> <p>7. Biswal, B. M., A. Zakaria, and N. M. Ahmad. 2003. "Topical application of honey in the management of radiation mucositis. A Preliminary study." <i>Supportive Care in Cancer</i> 11(4):242-248.</p> <p>8. Biswal, B. M., A. Zakaria, and A. N. Min. 2002. "Topical application of honey in the management of radiation mucositis: A randomized study." <i>International Journal of Cancer</i>:480-481.</p> <p>9. Isa, N. A. M., S. Sabarudin, U. K. Ngah, and K. Z. Zamli. 2005. "Automatic detection of breast tumours from ultrasound images using the modified seed based region growing technique." Pp. 138-144 in <i>Knowledge-Based Intelligent Information and Engineering Systems, Pt 2, Proceedings</i>, vol. 3682, <i>Lecture Notes in Artificial Intelligence</i>. Berlin: Springer-Verlag Berlin.</p> <p>10. Omar, E., M. Madhavan, and N. H. Othman. 2004. "Immunohistochemical localisation of RET and p53 mutant protein of thyroid lesions in a North-Eastern Malaysian population and its prognostic implications." <i>Pathology</i> 36(2):152-159.</p> |
| 4 | Prof. Zainal Arifin Mohd Ishak                                   | <p>1. Advancement Of The Best Waste Management Practice In The Northern Corridor Economic Region (NCER);</p> <ul style="list-style-type: none"> <li>• Enhancement of Wastewater Management</li> <li>• Soil and Groundwater Contamination Investigations for the Rehabilitation and Remediation of Decommissioned Sanitary Landfill</li> <li>• Reduce the Amount of Municipal Solid Waste to the Landfill Via Reuse, Recycle Combustion Utilization</li> <li>• Treatment of Hazardous Human and Animal Wastes Using Supercritical</li> </ul> | <p>1. Isa, M. H., F. A. H. Asaari, N. A. Ramli, S. Ahmad, and T. S. Siew. 2005. "Solid waste collection and recycling in Nibong Tebal, Penang, Malaysia: a case study." <i>Waste Management &amp; Research</i> 23(6):565-570.</p> <p>2. Aziz, H. A., M. N. Adlan, M. S. M. Zahari, and S. Alias. 2004. "Removal of ammoniacal nitrogen (N-NH3) from municipal solid waste leachate by using activated carbon and limestone." <i>Waste Management &amp; Research</i> 22(5):371-375.</p> <p>3. Aziz, H. A., M. S. Yusoff, M. N. Adlan, N. H. Adnan, and S. Alias. 2004. "Physico-chemical removals of iron from semi-aerobic landfill leachate by limestone filter." <i>Waste Management</i> 24(4):353-358.</p> <p>4. Chan, C. H. and P. E. Lim. 2007. "Evaluation of sequencing batch reactor performance with aerated and unaerated FILL periods in treating phenol-containing wastewater." <i>Bioresourc Technology</i> 98(7):1333-1338.</p> <p>5. Hussain, S., H. A. Aziz, M. H. Isa, M. N. Adlan, and F. A. H. Asaari. 2007. "Physico-chemical method for ammonia removal from synthetic wastewater using limestone and GAC in batch and column studies." <i>Bioresourc Technology</i> 98(4):874-880.</p> <p>6. Aghamohammadi, N., H. B. Aziz, M. H. Isa, and A. A. Zinatizadeh. 2007. "Powdered activated carbon augmented activated sludge process for treatment of semi-aerobic landfill leachate using response surface methodology." <i>Bioresourc Technology</i> 98(18):3570-3578.</p> <p>7. Najafpour, G. D., A. L. Zinatizadeh, and L. K. Lee. 2006. "Performance of a three-stage aerobic RBC reactor in food canning wastewater treatment." <i>Biochemical Engineering Journal</i> 30(3):297-302.</p> |   |

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| 5 | <p>Information Communication &amp; Technologies Research Platform</p> <ul style="list-style-type: none"> <li>• Grid Services &amp; Applications</li> </ul> | Assoc. Prof. Bahari Belaton | <ol style="list-style-type: none"> <li>1. G Modeling Tsunami propagation &amp; Inundation with Grid Computing</li> <li>2. Secure Multimedia Conferencing System over WAN</li> <li>3. Construction of Ontology-based Multilingual Sense Dictionary for Supporting Online WSD Service and Sense Dictionary Look-up</li> <li>4. Voice-enable Automatic Question Answering System</li> <li>5. Development of An Automated Unit Testing Tool For Java Program</li> <li>6. Development of a Software Fault Injection Tool to Ensure Dependability of Commercial-off-the-Shelf Components (COTS) for Embedded System Applications</li> <li>7. G Modeling Tsunami propagation &amp; Inundation with Grid Computing</li> <li>8. Secure Multimedia Conferencing System over WAN</li> <li>9. Construction of Ontology-based Multilingual Sense Dictionary for Supporting Online WSD Service and Sense Dictionary Look-up</li> <li>10. Voice-enable Automatic</li> </ol> | <ol style="list-style-type: none"> <li>8. Ahmad, A. L., M. Sarif, and S. Ismail. 2005. "Development of an integrally skinned ultrafiltration membrane for wastewater treatment: effect of different formulations of PS/NMP/PVP on flux and rejection." <i>Desalination</i> 179(1-3):257-263.</li> <li>9. Aziz, H. A., S. Alias, M. N. Adlan, Faridah, A. H. Asaari, and M. S. Zahari. 2007. "Colour removal from landfill leachate by coagulation and flocculation processes." <i>Bioresource Technology</i> 98(1):218-220.</li> <li>10. Lee, K. M. and P. E. Lim. 2003. "Treatment of phenolic wastewater using agricultural wastes as an adsorbent in a sequencing batch reactor." <i>Water Science and Technology</i> 47(10):41-47.</li> <li>1. Koh, H. L. and Lee, H. L. (2006). Catchment Management Modeling: From Headwater to the Coasts, <i>Aquatic Ecosystem Health &amp; Management</i>, 9(2): 261-268</li> <li>2. Teh, S. Y., Koh, H. L. and Izani, A. M. I. (2006). A Model Investigation on Tsunami Propagation In Malaysian and Thailand Coastal Water. <i>Association of Engineering Education in Southeast and East Asia and the Pacific (AESEAP) Journal of Engineering Education</i> 31: 7-14.</li> <li>3. Goh, E. and Koh, H. L. (2006b). Tsunami- Dynamics of Wave Energy Propagation and Mitigation Measures, <i>Ingenieur</i>, Vol.26, 14-20.</li> <li>4. Mohammed Saghir, Tat-Chee Wan, Rahmat Budiarto, A New Cross-Layer Framework For Qos Multicast Applications In Mobile Ad Hoc Networks, <i>International Journal of Computer Science and Network Security (IJCSNS)</i>, 6 (10):142-151.</li> <li>5. A. Hadi Arifin, Dahlan Abdullah, Sami Mohamed Berhan, and Rahmat Budiarto, An Economical IPv4-to-IPv6 Transition Model: -A Case study for University Network-, <i>International Journal of Computer Science and Network Security (IJCSNS)</i>, 6(11):170-178.</li> <li>6. Saravadee Sae Tan, Gan Keng Hoon, Tang Enya Kong, "A Lazy Approach for Category Model Construction using Training Texts", <i>Proceeding of 2006 IEEE/WIC/ACM International Conference on Web Intelligence (WI-06)</i>, Hong Kong, 18-22 December 2006.</li> <li>7. Nor Ashidi Mat Isa, Arifuddin Joret, M. Subhi M. Al-Batah, Ahmad Nazri Ali, Kamal Z. Zamli, Khairun Azizi Azili, "Microcontroller Based HMLP Realization for Aggregate Classification Systems", <i>International Journal of Factory Automation, Robotics, and Soft Computing</i> (ISSN: 1828-6984) Issue 2:19-26.</li> <li>8. Nor Ashidi Mat Isa, Mohd Yusoff Mashor, Kamal Z. Zamli, Nor Rizuan Mat Noor, Nor Hayati Ohman, "Supplementary and Alternative Techniques to Interpret Pap Smear: A Review", <i>International Journal of Factory Automation, Robotics, and Soft Computing</i> (ISSN: 1828-6984) Issue 2:27-34.</li> <li>9. Kee Sim Ee, Chan Huah Yong, Fazilah Haron, <i>Mining of Resource Usage Using Evoc Algorithm in Grid Environment</i>, DFMA 07, Paris, France, 2007.</li> <li>10. Rosni Abdullah, Chan Huah Yong, <i>Grid Computing</i>, Research at Universiti Sains Malaysia, volume 6, Knowledge Processing: Methodologies, Tools and Applications, Series Editor K.J. Ratnam, Editors Zaharin Yusoff, Koh Hock Lye, Penerbit Universiti Sains Malaysia, 2005.</li> </ol> |
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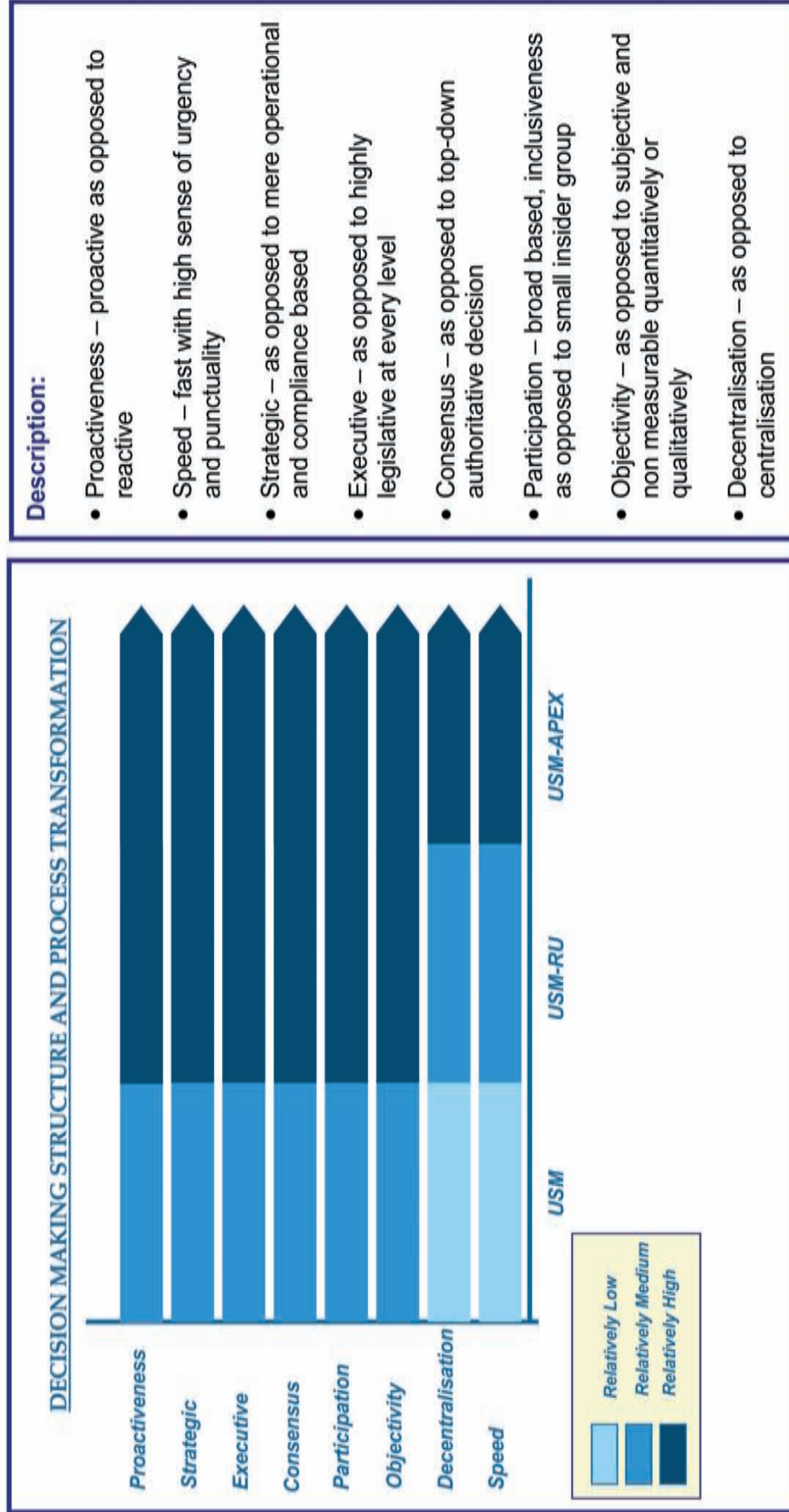
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| 6 | <p>Fundamental Science Research Platform</p> <ul style="list-style-type: none"> <li>Nanoscience Cluster</li> </ul> | Prof. Abd Aziz Tajuddin | <p>Question Answering System</p> <p>11. Development of An Automated Unit Testing Tool For Java Program</p> <p>12. Development of a Software Fault Injection Tool to Ensure Dependability of Commercial-off-the-Shelf Components (COTS) for Embedded System Applications</p> <p>Nanoscience is a new multidisciplinary field resulting from an integration of basic sciences such as physics, chemistry, biology, materials science and mathematics with engineering. Nanoscience involves studying and working with atoms, molecules and objects whose size is on the nanometer scale (1 – 100 nm). Nanoscience is also about the creation of new materials, devices or systems through the fundamentally control of the assembly of matters into larger and more complex functional structures.</p> <p>One of the nanoscience researches in USM is the synthesis of carbon nanotubes (CNTs). CNT's promises to revolutionize several fields in material science and will pave the way into nanoscience and nanotechnology.</p> | <p>1. Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2004). Mn/Ni/TiO<sub>2</sub> catalyst for the production of hydrogen and carbon nanotubes from methane decomposition. <i>Energy &amp; Fuels</i> 18(5), 1336 – 1345.</p> <p>2. Zein, S.H.S., Mohamed, A.R., Sai, P.S.T., and Zabidi, N.A.M. (2004). Production of hydrogen and carbon nanotube from methane. <i>J. Industrial &amp; Eng. Chem.</i> 10, 869 – 876.</p> <p>3. Sharif Hussein Sharif Zein, Abdul Rahman Mohamed and Siang-Piao Chai (2006). The screening of metal oxide catalysts for carbon nanotubes and hydrogen production via catalytic decomposition of methane. <i>Studies in Surface Science and Catalysis</i>, 159, 725-728.</p> <p>4. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2006). Preparation of carbon nanotubes over cobalt-containing catalysts via catalytic decomposition of methane. <i>Chemical Physics Letters</i>, 426, 345-350.</p> <p>5. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2006). Formation of Y-junction carbon nanotubes by catalytic CVD of methane. <i>Solid State Communications</i>, 140, 248-250.</p> <p>6. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2006). COx-free hydrogen and carbon nanofibers produced from direct decomposition of methane on nickel-based catalysts. <i>Journal of Natural Gas Chemistry</i>, 15, 253-258.</p> <p>7. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2007). Moderate temperature synthesis of single-walled carbon nanotubes on alumina supported nickel oxide catalyst. <i>Materials Letters</i>, 61(16), 3519-3521.</p> <p>8. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2007). Synthesizing carbon nanotubes and carbon nanofibers over supported-nickel oxide catalysts via catalytic decomposition of methane. <i>Diamond &amp; Related Materials</i>, 16(8), 1656-1664.</p> <p>9. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2007). The effect of catalyst calcination temperature on the diameter of carbon nanotubes synthesized by the decomposition of methane. <i>Carbon</i>, 45, 1535-1541.</p> <p>10. Siang-Piao Chai, Sharif Hussein Sharif Zein and Abdul Rahman Mohamed (2007). The effect of reduction temperature on Co-Mo/Al<sub>2</sub>O<sub>3</sub> catalysts for carbon nanotubes formation. <i>Applied Catalysis A: General</i>, 326, 173–179.</p> |
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### RANKING AND RATINGS (FOR THE LAST 3 YEARS)

| Ranking Organisation                      | Criteria  | Position   |
|---|---|--|
| THES                                      |   | 111 (2004)<br>326 (2005)<br>277 (2006)<br>307 (2007) |
| SETARA                                    |   | -  |
| ARES                                      |   | Cemerlang (2007)                                     |
| Webometrics Ranking – Southeast Asia      | For institution with systems that support Open Access initiatives, electronic access to scientific publications and other academic materials                          | 14 (July 07)<br>15 (Jan 08)                          |
| Webometrics Ranking – World Ranking       |   | 1125 (July 07)<br>1065 (January 08)                  |
| Managing Information Strategies (MIS) 100 | The ranking recognises companies and government institutions for the commitment for using IT for business gain. It sets the benchmark for technology adoption in Asia | 24 (2004)<br>34 (2005)<br>8 (2006)                   |

USM'S DECISION MAKING STRUCTURES AND PROCESSES TRANSFORMATION



# WORLD RENOWNED MEASURES KEY PERFORMANCE INDICATORS FOR THE CONCENTRATION OF TALENT

## 1 Quantity

- a Number of academic staff
- b Number of post-doctoral staff
- c Number of visiting professors
- d Number of visiting lecturers (> 3 months)
- e Number of doctoral students
- f Number of researchers (Research Officers)
- g Number of administrative personnel

## 2 Quality

### 2.1

- a Number of academic staff (lecturers, associate professors, professors) with PhD
- b Number of post-doctoral staff
- c Number of visiting professors
- d Number of visiting lecturers (> 3 months) with PhD
- f Number of postgraduates (full-time) with CGPA > 3.5
- f Number of researchers (Research Officers) with masters or higher
- g Number of administrative personnel with bachelors degree
- h Number of administrative personnel with masters degree
- i Number of administrative personnel with doctoral degree
- j Number of lecturers with certification or training in facilitating learning (pedagogy, andragogy, heutagogy)
- k Number of lecturers using technology to enhance learning
- Number of lecturers trained in counseling and special education
- Number of lecturers linking research to learning (e.g., using sustainability research findings in classrooms)

### 2.2 Productivity of Talent

- a Publications
  - Number of articles in all journals
  - Number of articles in ISI journals
  - Total impact factor
  - Total citations
  - Number of staff involved in writing books



Number of books authored  
Number of articles written for the mass media (newspaper, magazines) by staff and students  
Number of staff and student writing in the electronic media (e.g., logs, forum, e-zines)

**b Grants**

Number of staff acting as principal researchers in grants  
Number of grants obtained  
Value of grants obtained

**c Contract Research**

Total value of contract research/consultancies

**d Invention/Patent**

Number of patents held  
Number of patents licensed

**e Policy Papers**

Number of staff involved in writing policy papers  
Number of policy papers produced

**F Awards**

Number of staff winning awards  
Number of awards won

**g Learning**

Number of learning modules developed by staff and students available under OpenCourseWare (OCW)  
Number of modules or curricula integrated with sustainable development concepts and practices

**h Community outreach**

Number of staff and students volunteering in NGOs or community groups to promote sustainability education  
Number of training workshops conducted for the underprivileged  
Number of training workshops conducted for children with special need

Number of campaigns or workshops conducted by students and staff and in the community and schools (outside campus) to promote sustainability

### **2.3 Academic Leadership**

Number of staff giving Keynote Addresses in learned meetings  
Number of Keynote Addresses in learned meetings  
Number of staff serving as track chairs in academic conferences  
Number of track chairs in academic conferences  
Number of staff acting as Chief-Editor of academic journals  
Number of Chief-Editorship of academic journals (including special issues)  
Number of staff serving on Editorial Boards of academic journals  
Number of memberships on Editorial Board of academic journals  
Number of staff serving in the top management of academic associations  
Number of memberships in top management of academic associations

### **2.4 Society Leadership (Non-Academic)**

Number of staff heading national/international bodies (committees)  
Number of chairmanships of national/international bodies (committees)  
Number of staff serving on national/international bodies (committees)  
Number of students heading national/international bodies (committees)  
Number of students serving on national/international bodies (committees)  
Number of alumni serving as society leaders (ministerships/leaders)

## **3 Quality**

### **3.1 Diversity of Personnel**

- a Number of countries-of-origins of foreign staff
- b Number of countries-of-doctoral training of local staff
- c Number of countries-of-origins of post doctoral members
- d Number of countries-of-origins of visiting lecturers/professors
- e Number of countries-of-origins of foreign students
- f Number of countries-of-training of researchers

### **3.2 Diversity of Research Productivity**

- a Total value of international (foreign) grants

- b Total value of international (foreign) research contracts/consultancies
- c Number of books with international publishers
- d Number of countries in which patents are obtained
- e Number of countries in which inventions are licensed

### **3.3 Diversity of Academic Leaderships**

- a Number of countries in which keynote addresses were delivered
- b Number of countries in which track chairs were held
- c Number of countries in which membership on the editorial board were held
- d Number of countries (where HQ of the academic association) in which staff are members of top management
- e Number of books and articles written for the general public

### **3.4 Diversity of Society Leaderships**

- a Number of chairmanships of international bodies/committees (include those held by staff, students, alumni)

### **3.5 Diversity of Staff (faculty, researchers, visiting faculty) by Age**

- a Number of Staff with more than 20 years of experience
- b Number of Staff with 11-20 years of experience
- c Number of Staff with 10 or less years of experience

### **3.6 Diversity of Awards Won**

- a Number of International Awards (from Academic and Non-academic bodies)



# WORLD RENOWNED MEASURES KEY PERFORMANCE INDICATORS FOR THE ABUNDANT RESOURCES

## I Size

### 1.1 Financial Resources

- a Total annual budget
- b Total emoluments
- c Total budget for research
- d Total budget for new development/facilities
- e Total budget allocated for green purchasing
- f Total budget allocated for making knowledge accessible to the public

### 1.2 Physical Resources

- a Library
  - No. of titles
  - No. of copies
  - No. of journals subscribed
  - No. of databases
  - Annual budget allocations
- b Laboratories and equipment
  - No. of laboratories
  - Value of equipment (current, using 10% depreciation rate)

## 2 QUALITY OF RESOURCES

- a Age of Laboratories (since operational use)
- b Average age of equipment
- c No. of Laboratories/Equipment fully certified
- d Maintenance Records
- f Number of green-certified buildings

## 3 DIVERSITY OF RESOURCES

### 3.1 Diversity of sources

Percentage of total budget from

- a National government
- b Tuition fees
- c Endowment

- d Contract research
- e Gifts

### **3.2 Quality of Sources**

- a Endowments
  - Percent from government bodies
  - Percent from the domestic private sector
  - Percent from foreign governments
  - Percent from international agencies
  - Percent derived from green sources (e.g., UN-Habitat, WWF, Danced, etc.)
- b Contract Research
  - Percent of contract research value from domestic government bodies
  - Percent of contract research from domestic private sector
  - Percent of contract research from foreign government bodies
  - Percent of contract research from international agencies

### **3.3 External Linkages**

- No. of MOUs with domestic agencies
- No. of MOUs with international agencies
- No. of countries involved in the MOUs
- No. of collaborations/partnerships with agencies dedicated to sustainability

# WORLD RENOWNED MEASURES KEY PERFORMANCE INDICATORS FOR THE SUPPORTIVE GOVERNANCE

## I GOVERNMENT RELATIONS

For each of the following decisions, what percentage of the decision authority (approval) is located internally?

Positions of top management (VC, DVC, Registrar Bursar)

Academic programmes

Human resource decisions

Financial decisions

Linkages with external parties

## 2 INTERNAL GOVERNANCE

### 2.1 Vision

Is there a written mission and vision statement?

### 2.2 Level of Bureaucracy/Complexity

- a Ratio of academic (include research/science officer) to Non-Academic Staff
- b No. of levels of hierarchy that is required for final approval of
  - i Grant applications
  - ii Purchase of equipment
  - iii Changes in curriculum
  - iv Hiring of Academic Personnel
  - v Linkage/Networks
- c Average length of time (weeks) for decisions regarding
  - i Grant applications
  - ii Purchase of equipment
  - iii Changes in curriculum
  - iv Hiring of academic personnel
  - v Linkage/networks



# THE COMMITTEE

## USM APEX UNIVERSITY DREAM TEAM

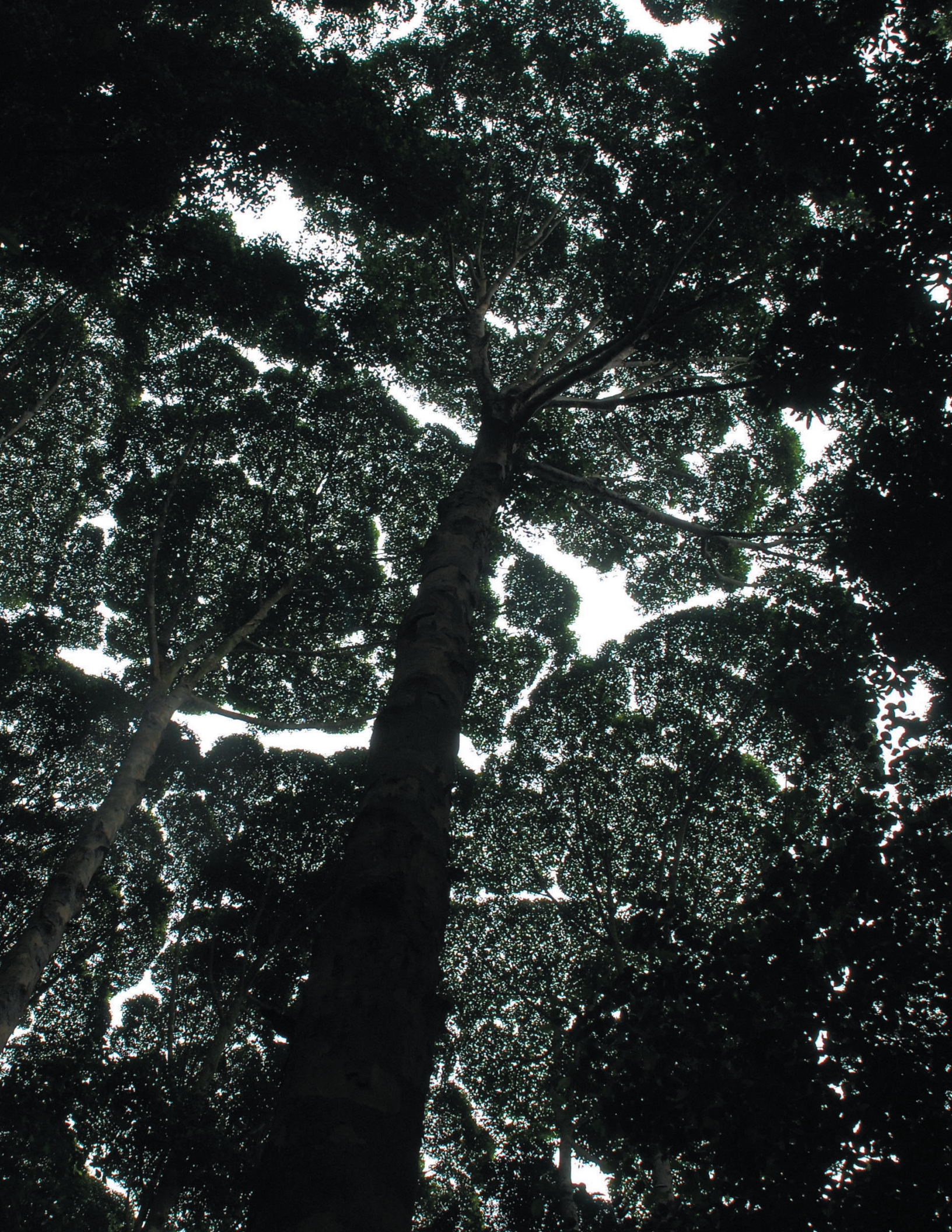
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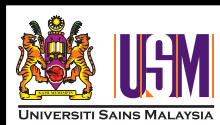
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Ms Shahnaz Riza Sukor  
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Professor Ir Mahyuddin Ramli  
Assoc Prof Omar Majid  
Assoc Prof Abdul Rashid Mohamed  
Assoc Prof Ishak Hj Ismail  
Dr Ahmad Tajuddin Othman

..... and also those who have contributed  
in various ways. Terima Kasih

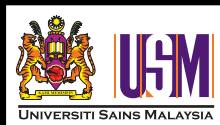








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