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EDITORIAL BOARD

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myForesight®
Malaysian Foresight Institute
MIGHT
3517, Jalan Teknokrat 5
63000 Cyberjaya, Selangor Darul Ehsan

FOR INQUIRIES
myForesight®
Phone : +603 8315 7888
Fax : +603 8312 0300
E-mail : foresight@might.org.my
Website : www.myforesight.my

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Greetings & Salutations,

It is my pleasure to bring you the latest edition of myForesight® magazine, the first one for 2013. We hope your 2012 has been a good one and in hindsight would enable you to undertake foresight with gusto.

I am glad to say though myForesight® - Malaysian Foresight Institute, have been operational as an institute for quite some time under the purview of MIGHT, we have just finalized the appointment of the our Governing Board and we are honoured to have the Science Advisor to Malaysia’s Prime Minister, Prof. Emeritus Dato’ Sri Dr. Zakri Abdul Hamid as our Chairman.

We believe that members of the Governing Board (please see the next page) will bring their extensive experience and insights into myForesight®’s work where we hope to initiate future oriented subject or topic for discussions and attention.

It is the intent of myForesight® to undertake projects that will draw upon a range of disciplines and deal with key issues where science and technology offers valuable insights & solutions. We believe that by looking ahead further than the conventional norms would enable us to assist the Government and the relevant stakeholders to strike the right balance between long-term thinking & tackling issues that need immediate attention. Our goal is that any Foresight project must:

• Looking at least 10 years ahead;
• Future-oriented and based upon science & technology;
• Trans-disciplinary, and policy issues that cut across ministries/departmental boundaries;
• Can produce results that can influence Government policy;
• Will not duplicate work taking place elsewhere;
• Has support in and commitment from key stakeholders.

myForesight® will be undertaking this in three ways:

• **Foresight Projects**: Looking at major issues 10-20 years into the future, which provide futures and evidence analysis to fill a specific gap in existing policy understanding;
• **Horizon & Trend Scanning**: Framework in continuous monitoring of trends to pick up weak signals and emerging issues;
• **Capacity Building**: Training, toolkits and networks to strengthen future thinking capacity and share best practice within and across government.

On the subject of capacity building, one of the element to address in looking at the future will be the most important of all, us; people, the human being. That is why a lot of effort is being put forth to look into this matter, ensuring the future generations are given the right skills and knowledge.

Therefore, for this particular edition, we are dedicating almost the whole magazine to the subject of capacity building and human capital development.

For the past year, we have been fortunate enough to meet up with prominent personalities who speaks passionately about capacity building and education.

One of the highlights would have been an enlightening conversation we had with Dr. Sonia Ortega of US, National Science Foundation who have abundance of experience in tackling the issues of education especially in the subject of S.T.E.M (Science, Technical, Engineering & Mathematics). You can read about her thoughts on the subject matter in page 4.

We are also presenting the viewpoints and arguments about future mismatch of skills and knowledge and the type of jobs that will be available for the next 10 years. One of the interesting things we found is that currently in the top 20 companies in Malaysia less than 40% of the top management are of the technical background. This begets the question “what career prospect are there for science students?” since we are pushing for more enrolment in the science stream.

As usual, we hope you find the magazine beneficial and thought provoking. We expect you to have your opinion on certain matters. We want to hear them. We welcome your feedback and contributions.
A knowledge-interfacing institute, that promotes and harness strategic national development through foresight methodology and initiatives

Vision:
To be a renowned foresight center that integrates idea and promotes networking across a broad spectrum of individual futurists, private think tanks and academic establishments

Mission Statement:
To be a Referral center for Foresight and future studies towards a sustainable future for the country by connecting researchers & decision makers in developing a vision of the future for the country and providing brain trust & decision support on future oriented areas and activities.
Role of Science in High Technology Development in Malaysia

The role of technology and the development of Science go hand-in-hand. We cannot have one without the other. Science and Technology (S&T) is the future. Their contributions should be monitored and channelled to the right sectors. S&T is an essential component to move a country forward.

Malaysia’s education scenario

Malaysia has its own standard National Education System which should be complimented. Without the national curriculum, the implementation of S&T education programmes would be dependent on individual states that have their own curriculum, making it difficult not just to the students but teachers and parents too.

Malaysia’s S&T education path is on the right track, there are a lot of potential in numerous ways to move forward in S&T innovation, and I have been very pleasantly surprised with some of the things that I have seen in Malaysia.

Instilling the interest of S&T

There are several components needed to be included in S&T education. One: You need a good curriculum. A good national curriculum would make it easier to promote S&T education to everyone because it is standardized. Two: Teachers need to be well prepared in terms of knowledge and material to enable them to teach and encourage students. Three: We need to find a way to evaluate what the children are learning in order to assess the efficiency of the teaching skills. These three components have to work together. There has to be willingness. S&T education needs to be put forward as a national priority because it is important for the country’s development.

Another important consideration is how S&T is taught. There has to be an engagement. It is not just about learning and memorizing facts. Young people, i.e. students, have to be engaged in the education, involving them in the process of S&T and allow them to experience hands-on activities. Malaysia has a lot of programmes that are moving forward with this approach, and has had so for many years. It is also pleasing to find out that not only Malaysia but the whole region has also been engaging S&T education, and there is a movement towards the hands-on method of teaching and learning science.

Critical Issues in Education

Critical issues in education are subjective. In general, the beginning is most critical. The basic essence is to engage young people who want to learn. Then it can be sub-categorised into different groups – Primary Education, Formal Education, Informal Education, College Education, Graduate Education, and Science Education – with many different aspects depending on how you want to uphold the education structure.

Who is responsible?

In the 20th century the people who train the students are the professors and teachers. However, in the 21st century, there is a wide access to information and the young people today have more accessibility to information. Nowadays, there is no excuse for the young people to be ignorant about science careers because they can simply ‘GOOGLE’ it. It is everyone’s responsibility, the whole society – parents, teachers, and the young people – to learn how to look for information because it is so much easier than back in the days when looking for information means having to go to the library, and even not knowing where to start.

On teaching as a secondary career path

It is unfortunate that teaching is quite commonly thought of as a secondary job. This problem exists in many other places as well. Only a few countries uphold the teaching profession as a highly respected profession, where teachers are very well respected. This is not the way it ought to be. After all, teachers are responsible in educating the next generation. Thus, it is very unfortunate to not be able to raise the teaching profession to a higher standard with salary. If that is done, the teaching profession would be more attractive and competitive, and the incentive to be a teacher would be higher.

The right time to train individuals for their careers

The right time to start educating individuals is when they are in middle-school: 12-15 years of age. This is when they start to either gain or lose interest in science. We notice that a lot of young children are interested in science but, as they grow to adolescence age, they lose it. However, if the interest in science is retained, the next step is when they start developing into it. This is the time to be constantly encouraging children to look forward to science and communicate with other people in the field to know the possibilities and options of science. The interested children would be asking lots of related questions like:
S&T education needs to be put forward as a national priority because it is important for the country's development.

“What are the opportunities they have when they graduate?,” “What kind of jobs?,” “How much money will they make?” and so on. We need more programmes that help young science students see the opportunities available to them and the competition they would face at an early age.

Arts Stream over Science Stream?
This issue does not concern Malaysia alone but many other countries as well. People do not know their career options when they venture into science. They think that the only career in science is as a professor at the university or a researcher. They do not know that science education can bring about careers in industries and non-profit organizations as consultants, entrepreneurs and so on. In my view, these people don’t know the options available, therefore they do not consider going into the science stream because they think science stream provides limited career choice.

The industries should also be involved along the way. Some companies have vested interest in this course because they also want people to join them in the future. It would be good if the industries support some of the initiatives since the return of investment will affect them, especially in the aspects of future development of human capital. It is important to have people who are prepared and ready to work. It benefits industries to support science, not only for their own advantages but, to create a better web, partnership with universities, schools and the community.

The top 10 jobs in 2010 did not exist in 2001: Are we preparing students on the right education track?
Some of the top careers of today did not exist before, but there are a few basic elements that can lead the young people on the right track and prepare them for the future careers. One of them is to be a problem solver. Knowing how to solve problems is a skill that can be applied to any career, whether in business or science. Next skill that needs to be acquired is critical thinking as it is essential for decision making. Then the skill of leadership is important for those who are in the leadership roles because it teaches how to lead. Teambuilding skill is also important as it allows individuals to adapt and work in teams. The last element is communication skill, i.e. to be able to convey the appropriate message or information in the right manner.

These critical skills: Problem solving, critical thinking, leadership, teambuilding, and communication are required in any line of career. If students are educated in critical skills and technical skills, whether in accounting, business, science, or engineering, they are better prepared for the future, and even in careers that do not exist yet because those critical skills are helpful regardless of the type of jobs they would be engaged in.

To be exam-oriented or not to be
There is the tendency to over test students, not only in Malaysia but, in several other parts of the world as well. So much of emphasis is put on the test that teachers end up teaching for the purpose of the test. Teachers want their students to pass the test as it is used to measure their capabilities. This could prevent some teachers from engaging in more creative ways of teaching as they are afraid that engaging in inquiry-based or place-based methods might lead to their students not getting good results or even fail the test, and this would reflect poorly on them. In my opinion too much test prevents creativity.

Science education challenge: US case study
In terms of science education, the USA is facing problems with teachers insufficiently trained and children learning science merely to pass tests. On the other hand, graduates who are training to become scientist lack the critical skills. In order to solve this problem, the former Director of the National Science Foundation (NSF) decided to combine these two factors together by having the students of science and engineering link with elementary and secondary schools – with children and teachers.

The basic aim of the link is to benefit the children, teachers and graduate scientists. It would enable the children to obtain a hands-on approach towards the process of science – to engage the children in science. Second, it would provide teachers with the tools and background necessary for better teaching application for the infusion of sciences into the classrooms. Third, the link allows scientist graduates to learn critical skills; for instance, translate their own research into a simpler medium for the children and bring their research into the classrooms. This system was designed to be a win-win situation that helps everybody: Helps teachers acquire more knowledge in science and enable them to encourage and excite the children by showing them career opportunities in science; and to prepare graduate scientists for any career path, and to be able to communicate and gain the support of the public towards their researches. The engagement between universities and school system would open up the bridge of communication between them. The school system will learn that universities have resources they can utilise and experts they can approach to seek advice on preparation of lessons; and expertise and materials if there is need to set up their laboratories, or when taking students on educational field trips. This is a complex system that is aimed to benefit all participants, giving very positive experience to everyone.

Final Words
It has been a great opportunity being in Malaysia. The support has been tremendous and very good. It has given me the exposure to several people and organizations that will add to a positive experience and learn things that I was not aware of previously. I do also see opportunities for future involvements with the network that has been developed here in my stay. I would like to see on-going cooperation between USA and Malaysia among scientists, teachers, schools, and the different organizations. This opens the opportunity of having Malaysia-USA collaboration. I hope to see more people from the USA coming to Malaysia and from Malaysia to the USA, and working together.

Critical skills: Problem solving, critical thinking, leadership, teambuilding, and communication are required in any line of career.

Dr. Sonia Ortega
Program Director,
Division of Graduate Education,
U.S. National Science Foundation (NSF)
U.S. Science Fellow Dr. Sonia Ortega arrived in Malaysia on September 2, 2012 to begin a two-month working visit with the Malaysian Industry-Government Group for High Technology (MIGHT) in connection with the Global Science and Innovation Advisory Council and Ministry of Higher Education Cradle to Career initiative.

Dr. Ortega specializes in STEM (science, technology, engineering and mathematics) education programs at the U.S. National Science Foundation. She is especially interested in developing strategies to engage young students in science and technology studies.
experts’ insights

BY
Pierre Rossel
College of Management of Technology, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
pierre.rossel@epfl.ch

Cristiano Codagnone
European Commission, Joint Research Centre, Institute for Prospective Technological Studies (IPTS) Seville, Spain
cristiano.codagnone@ec.europa.eu

Gianluca Misuraca
European Commission, Joint Research Centre, Institute for Prospective Technological Studies (IPTS), Seville, Spain
gianluca.misuraca@ec.europa.eu

FORESIGHT AND POLICY MODELLING ON ICT FOR GOVERNANCE:
EXPLORING THE NEXT FRONTIERS
This research activity, which links very diverse research disciplines with practitioners’ views and policy makers’ concerns, through a multi-stakeholder and participatory approach, the paper elaborate further on highlighting some paradoxes of current ICT-enabled societal modelling efforts, and address the issues of measuring and modelling of the Information Society. In doing so, the paper attempts to link foresight techniques with policy modelling approaches and to assess their implications for the future Digital Europe 2030. Innovation, sustainability, economic recovery and growth will in fact depend more and more on the ability of policy makers to envision clearly and effectively both the root causes and the possible solutions to complex, globalised issues.

The paper concludes presenting some policy and research challenges that policy makers will be confronted to in implementing the Digital Agenda for Europe, which aims to increase growth and competitiveness of the EU in the fast evolving global landscape, and address the grand challenges our world is confronted with today. Going further, the paper proposes some suggestions for future research oriented towards combining foresight techniques with policy modelling in search of an ‘integrated and distributed policy intelligence paradigm’.

The pace at which the elements of the visions unfold will, however, be influenced by the speed of change of the overall technological landscape and societal context.

By combining scenarios design with gap analysis and technology roadmapping, the research identified a set of Grand Challenges to define the Roadmap on the future research on ICT for governance and policy modelling. Building on the findings of this research activity, which links very diverse research disciplines with practitioners’ views and policy makers’ concerns, through a multi-stakeholder and participatory approach, the paper elaborate further on highlighting some paradoxes of current ICT-enabled societal modelling efforts, and address the issues of measuring and modelling of the Information Society. In doing so, the paper attempts to link foresight techniques with policy modelling approaches and to assess their implications for the future Digital Europe 2030. Innovation, sustainability, economic recovery and growth will in fact depend more and more on the ability of policy makers to envision clearly and effectively both the root causes and the possible solutions to complex, globalised issues.

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experts’ insights

ever? Certainly changes are ubiquitous. The world is increasingly interconnected via the Internet and other new media. Most would agree that complexity and unpredictability were also robust thirty or forty years ago. As a matter of fact, since 1957 the neo-classical homo oeconomicus approach (that choices are made based on fully rational human) (see Herbert Simon, 1957), has been challenged. In 1985 the American sociologist Marc Granovetter (1985), advancing beyond his first 1973 classic on the ‘strength of weak ties’ (Granovetter 1973), argued that rationality is socially embedded and not exercised in a social vacuum. In other words, we act according to the socially shaped structure of opportunity we face, using and being influenced by the network of social relations into which we are embedded.

These important social pressures may go unobserved and not be considered in policy design, implementation and evaluation thus enabling a mounting systemic policy resistance and defeating the policies using only the traditional tools of policy making such as regulation and incentives. In other words, when changing tastes and preferences are influenced by social interaction, a simple ‘stick and carrot’ incentive based policy or regulation may be impotent in effecting desired change. In addition, restricting full freedom of choice may backfire and trigger unintentional systemic resistance to the policy. However, opportunities for policy-making may be enhanced precisely because we do not act strictly according to instrumental rationality. Our actions are not always self-interested yet may still lead to contributions that can be harnessed to achieve policy goals. Citizens can be unobtrusively and intelligently helped to make optimal choices supporting both their individual well-being as well as group well-being policy goals. In addition to this, a number of technological, economic, societal, political and environmental trends and developments affect all countries as well as most policy domains. In order to deal with the challenges associated to these developments a new culture of future-oriented thinking is needed [Havas et al, 2010]. Our claim is thus that combining foresight and ICT-enabled modelling techniques in support of governance and policy-making may be useful to improve policy intelligence. More specifically, embedding foresight methodologies in policy modelling techniques may lead us to a new generation of policy making, so to avoid the often shortsighted and piecemeal approach of current decision-making that is usually incremental and step-by-step, and does not pay sufficient attention to changes in the environment and cross-policy dimensions.

1.2 ICT for Governance and Policy Modelling: a possible solution?

Given the significance of globalisation, increasing technological and organisational changes as well as the even increasing importance of learning capabilities and applications of knowledge, our future cannot be predicted by any sophisticated model in a sufficient and reliable way [Havas et al, 2010]. As for policy-making itself, there is a widening gap between the speed, complexity and uncertainty of technological and socio-economic changes, on the one hand, and the ability to devise appropriate policies, on the other. Even the credibility of science is somewhat fading. Scientific research no longer stands for ‘true’ in itself and the ‘objectiveness’ of policies based on models is questioned as scientists and ‘modellers’ themselves are known to have different opinions and models often come to different conclusions on the same issues.

Within this evolving context, the European Commission launched in 2009 a new area of research on ICT for governance and policy modelling. According to the European Commission’s 7th Framework Programme (Work Programme ICT 2009-2010) [European Commission, DG Research, 2009a], ICT for governance and policy modelling joins two complementary research fields, which have traditionally been separate: the governance and participation toolbox which includes technologies such as mass conversation and collaboration tools; and the policy modelling domain which includes forecasting, agent-based modelling, simulation and visualisation. These ICT tools for governance and policy modelling aim to improve public decision-making in a complex age, enable policy-making and governance to become more effective and more intelligent, and accelerate the learning path embedded in the overall policy cycle [European Commission, DG INFSO - 2008a].

Within this framework, in 2010 the European Commission funded a Support Action to design the Future Research Roadmap on this domain: CROSSROAD - A Participative Roadmap for ICT research on Electronic Governance and Policy Modelling, aiming at defining a shared vision, able to inspire collaborative, interdisciplinary and multi-stakeholders research. CROSSROAD in fact links very diverse research disciplines with practitioners’ views and policy makers’ concerns, through a multi-stakeholder and participatory approach and provides an useful tool for the support and orientation of future policy-making.

Overall, the CROSSROAD research roadmap aims to push to new outreach options the boundaries of traditional eGovernment research and help resolve the complex societal challenges Europe is facing by applying ICT-enabled innovations and collaborative policy modelling approaches, which include the harnessing of collective intelligence, agent-based modelling, visual analytics and simulation, just to mention a few [CROSSROAD, 2010a, b]. In this context, CROSSROAD aimed at building a consensus-driven Research Roadmap to consolidate and advance research in a new, yet highly fragmented, domain and to provide strategic directions for the future of research in ICT for governance and policy modelling. The main goal of the CROSSROAD project has been to drive the identification of emerging technologies, new governance models and novel application scenarios in the field of governance and policy modelling, leading to the structuring of a beyond the state-of-the-art research agenda, fully embraced by research and practice communities. In summary, CROSSROAD identified and characterized the key research challenges

1. Simon introduced the concept of ‘bounded rationality’, arguing that many times we do not search for optimal solutions but are content with satisfying ones given the boundaries we face. Such a boundary is lack of perfect information coupled with the incapacity to fully process the information we possess (“a wealth of information produces a scarcity of attention”).

2. More recently these insights have been further developed in the brilliant work of behavioural economists and economic psychologists (see for example, Bartley, 2010; Naheman, 1999 and 2003; Plous, 1993, and Smith, 2008).

3. Regulation can forbid certain behaviours, such as smoking in public places. Financial incentives can alter the behaviour of individuals, by making more costly the dysfunctional ones (i.e. through taxes). Financial incentives are used when market price does not reflect positive or negative externalities: for example, high taxes on fuel and cigarettes are designed to reflect their negative social externalities for health and environmental.
2 Conceptual and Methodological Framework

2.1 Conceptual frame and Objectives

The reasons for developing forward-looking analysis to support policy decisions stem primarily from the emergence of important science and technology applications and their wider implications for society. Science and technology interact with society in a complex way and their ‘effects’ are often neither immediate nor direct, but of second or third order and occur after a substantial time delay [EC, JRC-IPTS, ESTO, 2001]. More specifically, technological developments in the domain of governance and policy modelling happen at a fast pace. Policy-makers cannot afford to wait until situations are clarified and until the effects are evident before they take decisions. Though tomorrow’s developments are uncertain they originate in conditions established today. Hence, there is an important need for policymakers to scope the impacts of science and technology and how they may develop [Da Costa et al. 2003].

The history of forward-looking analysis and future studies spans decades [EC-JRC-IPTS, FOREN, 2001] and three main areas of future-oriented technology analysis can be identified [Cahill and Scapolo, 1999]: technology forecasting analyses the conditions and potential of technological development within a concrete framework; technology assessment supports decision-making by generating technology or problem-specific options arising from new developments; and technology foresight addresses the impacts of technological development on a broader scale. However useful these methods may be, the growing knowledge-intensity, the pace of technological and societal change and the increasingly distributed and networked character of the economy and of governance processes cannot be explored using only technology-oriented future studies [Compano and Pascu, 2005]. A more comprehensive approach is required. Designing scenarios relies on foresight methods, which are based on a much broader concept than technology assessment and forecasting. It calls upon a wide range of themes and stakeholder perspectives, in order to examine the social and economic aspects of future technological developments. The process is interactive, open-ended and bottom-up and paves the way to identifying possible breakthroughs and exploring implications and hypotheses that will support the definition of strategic directions and policy-related decision-making [EC-JRC-IPTS, 2003c].

The objective of this paper is therefore to present and discuss the main findings of the scenarios for Digital Europe 2030 designed by IPTS as part of the CROSSROAD’s project and based on a foresight exercise which included: 1) an analysis of the key areas of expected change in the domain of ICT-enabled governance and policy making to be placed in the context of various different future scenarios, and 2) envisioning, for each scenario, the risks and opportunities offered by ICT tools for governance and policy modelling techniques, as regards their contribution to overall EU policy goals. Based on these findings, aimed to explore possible alternative futures in governance and policy making, the paper elaborates further exploring new research frontiers embedding foresight methodologies in the future-expected mainstreaming of participatory ICT tools and policy modelling techniques.

2.2 Methodological approach

This paper is partly based on the results of the research carried out by CROSSROAD, an FP7 Support Action to design the Future Research Roadmap in the domain of ICT for governance and policy modelling. This Action aimed to provide strategic directions and define a shared vision, able to inspire collaborative, interdisciplinary and multi-stakeholder research. In this context, a participatory foresight exercise has been conducted outlining a set of scenarios on how governance and policy modelling, supported and enhanced by the use of ICT, could develop by 2030 in order to identify the research needs and policy challenges to be addressed. To design such scenarios, an analysis of future needs, risks and opportunities under different conditions was conducted based on the current state of the art of the domain (CROSSROAD, 2010a). The scenario design exercise resulted in four different scenarios which explore how governance and policy making could develop by 2030. The scenarios were developed by means of narration (storytelling) of possible future outcomes in selected key domains of European society where the development of ICT tools for governance and policy modelling techniques are likely to have a major impact. By looking at the future of ICT-enabled governance through four thought-provoking visionary scenarios, the research helps policymakers to foresee what European society could become twenty years from now, thanks to advances in ICT for governance and policy modelling. The scenarios, their formulation and interpretation, expose the gaps that exist today in research and what needs to be addressed in order to enable better governance and construct a more open, innovative and inclusive digital Europe tomorrow.

Scenarios in fact are systematic visions of future possibilities. In foresight research, this usually means plausible possibilities that do not rely on extreme wild cards. [Miles, 2003]. They are used as tools for political or strategic decision making and to explore the future impact of particular decisions or developments [Janseen et al, 2007]. More specifically, Scenario building aims to identify uncertain developments in the future and include them as elements of the scenario narrative [Janseen et al, 2007].

However, this exercise’s time horizon (i.e. 2030) and the interrelationships between different developments affecting it (e.g. rapid developments in specific domains of ICT) make the future of this research area dynamic, complex and uncertain, with little available evidence that can be used to predict or forecast these futures. Therefore the method of scenario design has been used for this exercise and it followed a common 5-step methodology: 1) a trend analysis to determine the developments that could be key drivers for the future of ICT tools for governance and policy modelling techniques, 2) the selection of the scenarios by determining the main impact dimensions and key uncertainties, 3) writing of the scenarios, 4) identification of the implications of the scenarios by participants at the Experts’ Workshop and by consulting the public and 5) deriving conclusions for policy implications and research challenges [EC, JRC-IPTS, FOR-LEARN, 2010].

With regard to the methodological approach informing the scenarios design exercise, it must be underlined that foresight research comprises many different methods that can be categorised in several ways. According to Popper [Popper, 2008], these methods can be: expert-based, creativity-
experts’ insights

The pace at which the elements of the visions unfold will, however, be influenced by the speed of change of the overall technological landscape and societal context. Considering the unprecedented growth and speed of ICT uptake in several research themes and the rapid emergence of technologies which enable applications for ICT for governance and policy making (e.g. social computing, mobile technologies, pervasive computing, etc.), we can argue that the world in 2030 will be radically different from the world we live in today.

Following the mapping and analysis of the state of the art in the research themes related to ICT for governance and policy modelling and the identification of emerging trends, the main impacts on future research in this area were defined. These were further refined through an analysis of existing scenario exercises and the current shaping of policies and strategies for the development of the European Information Society. They were then used to develop the visionary scenarios framework to depict possible state of the future Digital Europe.

The uncertainties underlying the scenario design are: 1) the societal value system we will be living in (more inclusive, open and transparent or exclusive, fractured and restrictive), and 2) the response (partial or complete, proactive or reactive) to the acquisition and integration of policy intelligence techniques in support of data processing, modelling, visualization and simulation for evidence-based policy making.
Accordingly, the key impact dimensions were classified on two axes: Degree of Openness and Transparency (Axis Y) and Degree of Integration in Policy Intelligence (Axis X) and they go from the extreme 0 (Low Openness and Transparency and Low Integration in Policy Intelligence) to 1 (High Openness and Transparency and High Integration in Policy Intelligence). The axes represent ways in which social and policy trends could develop. Based on this framework scenarios were then developed in a narrative manner (i.e. storytelling style) as descriptions of possible outcomes in selected key areas, representative of the European context, where emerging trends related to the development of ICT tools for governance and policy modelling techniques could have an impact. The scenarios for the future of governance and policy making of Digital Europe 2030 are presented in Figure 1.

The vertical axis indicates the degree of openness and transparency in a society, in terms of democratic and collaborative governance that could be further enabled by ICTs. The most open and transparent society would be one where even traditional state functions are completely replaced by non-state actors, through opening-up and linking public sector information for re-use. Such a society would be characterized by open standards and principles of transparency and accountability in governance and public management (Misuraca, 2009b).

The openness paradigm is also expected to apply to the research and business community which could benefit from open innovation and social/business networks of collaboration, where users are co-creators of products and services delivered globally via peer-to-peer social networks based on reputation and trust [EC-JRC-IPTS, 2009a]. An important aspect will be the regulatory and technological solutions, and also the socio-cultural attitudes to the basic digital rights underpinning the future Information Society. In fact, the concept of openness is not strictly related to technological solutions, but rather to socio-cultural and organisational aspects that can be enabled and supported by technological advancement [Misuraca, 2009a].

The horizontal axis concerns Integration in Policy Intelligence, i.e. the degree of integration of data and knowledge and way in which collaboration between all stakeholders in policy-design and decision-making mechanisms is enabled. This involves the possibility (enabled by ICTs) to mash-up data and information available from different sources in an ‘intelligent way’ (meaning efficient, effective and able to generate public value). It also involves the extent to which users, individually or as members of formal and informal social networks, can contribute to the co-design of policies, simulating and visualizing the effects of legal and policy decisions, and engage in real-time monitoring and prior assessment of possible expected impacts at local, regional, national and pan-European scale. This axis is also associated with the capacity and willingness of policy actors to share power and change decision-making mechanisms in order to facilitate the redefinition of basic democratic freedoms in a collaborative fashion. This could go to the extreme of redesigning the traditional mission of the State and the role played by governance stakeholders. Again, ICTs are not the driving force; rather change is driven by changes in social values, attitudes and new paradigm shifts in terms of information management, knowledge sharing (experts vs. non expert networks, for example) and allocation of resources [Rossel, Glassey and Misuraca, 2009].

In all the scenarios, the world in 2030 is expected to be radically different from today’s, due to the unprecedented growth and speed of ICT uptake in several fields and the related impact ICT tools which enable governance and policy modelling techniques may have. Moreover, the influences and drivers of innovation and renewal in the public sector, combined with increased financial pressure on states will result not only in change, but will also affect the pace at which the state adapts to the new environment, to its new roles and to increased engagement with stakeholders and users. However, whichever scenario dominates in the future, in the coming years, conventional wisdom and familiar governance models will be challenged as ICT-based disruptions impinge on democratic, consultative and policy-making processes. Evidence already gathered anticipates that the scope and scale of transformation will have a major impact on society [Broster, 2007]. Since 2005 there has been a phenomenal growth in mass, on-line collaborative applications, which has captured the imagination and creative potential of millions of participants - particularly the younger generations. In addition to new forms of leisure pursuits, community-building activities have also entered the political arena as witnessed in a number of recent national elections [EC, JRC-IPTS, 2009a, 2009c, 2009d].

Online communities can leverage considerable human knowledge and expertise and rapidly build their capacity. At the same
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Advances in wireless networking technology and the greater standardization of communications protocols make it possible to collect data from these sensors almost anywhere, any time.

Time, it is now recognised that online collaborations have the potential to trigger and shape significant changes in the way future societies will function. Extrapolation of the present exponential growth leads to scenarios where a very large percentage of the population could, if equipped with the appropriate ICT tools and capacities, simultaneously voice opinions and views on major and minor societal challenges [Tapscott and Williams, 2006]. Hence, these tools herald the transition to a different form of dynamically participative governance models.

While such scenarios are readily imaginable, we also recognise that we currently do not have appropriate governance models, process flows, or analytical tools with which to properly understand, interpret, visualise and harness the forces that could be unleashed. Present government processes (local, regional, national and EU level) provide laws and regulations, interpret and define societal norms and deliver societal support services. Their legitimacy is derived through democratic processes combined with a requirement for transparency and accountability. In a world that is increasingly using non-physical communication and borderless interaction, the traditional roles and responsibilities of public administrations will be subject to considerable change and classical boundaries between citizens and their governments will become increasingly blurred [Pew Internet, 2010b]. The balance of power between governments, societal actors and the population will have to adapt to these challenging new possibilities.

A key issue will therefore be to develop and apply advanced ICT tools to provide robust support to the change process and facilitate the transition to a new digitally-derived legitimacy. Inherent in this process is the definition and realisation of new, carefully crafted governance models. By 2030, there will no longer be any barriers which prevent citizens and businesses from participating in decision making at all levels, and hence the present democratic deficit will be overcome.

Advanced tools – possibly building on gaming and virtual reality technologies – will enable citizens to track the totality of decision making processes and see how their contributions have been (or are being) taken into account. Current linguistic and cultural barriers will have been largely overcome through use of semantic-based cooperation platforms [Broster, 2007]. Opinion mining, visualisation and modelling into virtual reality-based outcomes and scenarios will help to both shape, guide and form public opinion. These ICT-enabled processes and tools will have to demonstrate transparency, earn people’s trust and be devoid of manipulation. The outcomes of such consultative processes should be faster and more efficient policy revision and decision making.

By 2030, it is expected that transparency and trust in governance processes and policy making will characterise a changed relationship between governments, businesses and citizens. Governments traditionally collect, process and store significant quantities of data. In the future, the relationships will change and businesses and citizens will be in a position to ‘authorise’ access by governments to ‘data spaces’ of their own data which they control and update. Such a scenario would result in a ‘private shared space’ jointly accessed by data users and data providers [Reutter, 2008]. Equivalent data spaces will be adopted by businesses. These shared spaces will require extremely robust access rules and procedures and hence new technologies and ICT tools that ensure privacy and data protection. Trust in such technologies will need to be earned [EC, DG-INFSO, 2009].

In most organizations, information travels along familiar routes. Proprietary information is lodged in databases and analyzed in reports and then rises up the management chain. Information also originates externally: gathered from public sources, harvested from the Internet, or purchased from information suppliers. But the predictable pathways of information are changing: the physical world itself is becoming a type of information system [EC-JRC-IPTS, 2003b]. In addition to this, more objects are becoming embedded with sensors and gaining the ability to communicate. The resulting information networks promise to create new opportunities, improve governance processes, and reduce the costs and risks of policy decisions. In what is called the Internet of Things, sensors and actuators embedded in physical objects -from roadways to pacemakers- are linked through wired and wireless networks, often using the same Internet Protocol (IP) that connects the Internet. These networks churn out huge volumes of data that flow to computers for analysis. When objects can both sense the environment and communicate, they become tools for understanding complexity and responding to it swiftly. What is revolutionary in all this is that these physical information systems are now beginning to be deployed, and some of them even work largely without human intervention [EC, 2009e].

The widespread adoption of the Internet of Things will take time, but the time line is advancing thanks to improvements in underlying technologies. Advances in wireless networking technology and the greater standardization of communications protocols make it possible to collect data from these sensors almost anywhere, any time. Ever smaller silicon chips for this purpose are gaining new capabilities, while costs, following the pattern of Moore’s Law, are falling. Massive increases in storage and computing power, some of it available via cloud computing, make number crunching possible on a very large scale and at decreasing cost [Chui et al., 2010].

Research in the area of the Internet of Things is now strictly linked to advances in the field of Ubiquitous Networks and pervasive computing. Future applications are opening up huge opportunities for private and public sector organizations alike. Despite the fact that many of the technologies which underpin the future Internet infrastructure are not new (e.g. Radio Frequency Identification, sensor networks, GRPRS, UMTS-HSDPA and Near Field Communication, to mention a few), the conditions for their application may result in innovative and disruptive usages on a daily basis in forthcoming years [Pew Internet, 2010a]. This innovation could support several public policies, such as logistics, security, transport, environment and energy, education and health, and many others [Medaglia, Chicca, Orlando, 2010].

3.2 Implications of integrated foresight and modelling in support of governance and policy making

The scenarios developed as part of CROSSROAD served as an input to be compared with the integrated analysis of the state of the art in the domain of ICT for governance and policy modelling and, based on this comparison, a gap analysis has been conducted to identify an exhaustive list of specific gaps, where the on-going
research activities are not going to meet the long-term needs outlined by the future scenarios. This exercise resulted in a substantial contribution to shaping the roadmapping of future research in the domain thus proving to be useful and needed. Through a participatory foresight processes it was possible to bring together not only experts and interested parties from academia and research, industry and government, but also involve directly policy-makers and other interested stakeholders. The documents produced in fact were made available online for comments and feedback and received a general appreciation during discussions at specific workshops and conferences.

This also demonstrated that with such an open and participatory approach in mind, it is now increasingly being recognised that an opening of the political process is required to ensure robustness and effectiveness of its outcomes. In recent years in fact we have assisted to a shift in policy making practices from shaping framework conditions and structural settings towards strategic decision making. However, the growing complexity of governance and policy making processes is also recognised. A shift towards evidence-based / model-based policy making is happening, but this is sometimes not supported by effective empirical data and conceptually sound understanding of the societal implications of modelling techniques per-se. As a matter of fact, this shift in policy-making is also reflected in the evolving practices and interest in modelling techniques worldwide and in the EU in particular (see for example the Climate Change debate or Energy and Transport policy developments). However, in spite of its apparent success, initial enthusiasm is already given way to a significant deal of scepticism, both from ’traditional modellers’ and non-experts, including policy-makers themselves.

More recently, and this is consistent with the results of the CROSSROAD roadmapping exercise, as well as the policy direction the EU is focusing on, it has been recognised that the effectiveness of policy depends also on the involvement of a broader range of stakeholders than those formally in charge of policy decisions.

This concept of distributed policy-making and intelligence originally set out by (Kühman, 2001) is de facto at the core of the foresight and roadmapping exercise underpinning CROSSROAD, where it is assumed that openness of governance systems and integration of policy intelligence can harness collective intelligence, building on the knowledge, experience, and competence of various actors. Applying this network perspective to a ‘distributed platform’ based on ICT-enabled policy modelling and integrated foresight techniques (appropriately supported by participative and user-friendly simulation and visualisation tools), may prove to be instrumental to further implement policies and achieve socio-economic impacts, generating a ‘cascade’ of public and private decision-making on society’s course of change and affecting the interactions that precede formal policy-making processes.

In addition to this, behavioural change may also be stimulated as participating in the governance and policy making process may also enhance effectiveness of policy implementation from individual users and stakeholders other than the government. The role of government in fact is shifting from being a central steering entity to that of a moderator of collective decision-making processes.

However, in order to perform this role effectively, all stakeholders should be able to contribute to the policy directions commonly agreed, and governments need to be capable of setting up a shared platform for policy intelligence, where foresight and modelling techniques – if actually supported by ICT - can be crucial for improving governance and policy making processes.

4 Conclusions
4.1 Policy challenges and possible solutions

The scenarios developed aimed to define how the advancement of ICT tools for governance and the integration of policy modelling techniques could affect governance and policy making twenty years from now, so as to identify what research is needed and which policies should be promoted. Indeed, challenges in the emerging domain of ICT for governance and policy modelling are huge and complex and cannot be dealt with in isolation. In this regard, there is also a strict relationship with the broader task of envisioning and developing the Future Internet. The Internet was not originally designed to serve massive scale applications with guaranteed quality of service and security [Zittrain, 2008]. Emerging technologies like streaming high quality video and running 3D applications, or, in our specific domain, applications that enable mass collaboration, data processing, simulation and visualization through complex modelling, face severe constraints as regards running seamlessly anytime, anywhere, with good quality services. European scientists have proved they are at the forefront of ICT research since the invention of the web and throughout the rapid technological developments of the last 20 years [EC ISTAG, 2009]. It is now time to bring together different research disciplines that could help us benefit from the opportunities of ICT for better governance and policy making, and at the same time overcome the possible risks to society of mainstreaming large scale applications in this domain. Additionally, and from a technological infrastructure perspective, we should remember that the current Internet, as a ubiquitous and universal means for communication and computation, despite being extraordinarily successful so far, has a series of inherent unresolved problems. It is expected that it will soon reach its limits as regards both architectural capability and capacity [EC, 2009e]. However, the future development of internet infrastructure will be supported by complementary advancements in technological applications that are now
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consolidated trends and expected to grow even faster. The groundwork in place for years now should yield innovation in the near future [Pew Internet, 2010a]. More powerful devices, even cheaper netbooks, virtualization and cloud computing (including portable solutions), reputation systems for social networking and mass collaboration tools, as well as the proliferation of sensors, reporting and decision-support systems, do-it-yourself embedded systems, robots, sophisticated algorithms for processing data and performing statistical simulation and analysis, visualization tools to report results of these analysis, affective technologies, personalized and location-aware services, facial and voice recognition systems, electronic paper, anomaly-based security monitoring, self-heating systems and others are expected to become reality and mainstream in the next 10-20 years.

But far more important than network requirements and technological applications is the consideration of socio-economic aspects in the development of future ICT tools for governance and policy modelling techniques. Socio-economics as a multi-disciplinary field, which cuts across all research areas [EC DG Research, 2009b] of the ICT for governance and policy modelling domain, has manifold research challenges. Suitable governance and policy-making mechanisms, which provide appropriate incentives for participation, but at the same time ensure security and avoid risks (of enlarging digital exclusion, for example), need to be designed.

Moreover, legal and regulatory issues such as digital rights, privacy and data protection, also have to be taken into consideration, as the demand for the establishment of trust in governance may increase (or shift) as its usage scenarios change [Hildebrandt, 2009]. For example, an ever-increasing openness of ICT-enabled governance and policy modelling mechanisms, and the criticality and value of the transactions conducted over the open platform used for this purpose, may create incentives for malicious use of data and information. While security technologies will be developed to address the technological challenges linked to this, additional risks to trust arise, mainly due to its potential pervasiveness, large scale and involvement of users. The challenges include, for instance, the design of identity management systems capable of dealing with billions of entities, and their different roles in the governance sphere, the trustworthiness and control of distributed applications based on services offered through open service delivery platforms, and the secure and trusted interaction with real-world objects and entities through sensors and actuator network infrastructures [Pew Internet, 2010a]. More specifically, for example, the emergence of wireless networks could allow software applications and physical objects to be connected, opening up a wide range of stimulating new application scenarios in governance and policy making [Feijoo et al, 2009; Jaokar and Gatti, 2009]. At the same time, however, the same openness underpinning their mass-development and usage will expose sensor networks and related information and content to possible attack and misuse.

The opportunities provided by future ICT tools for governance and policy modelling for individuals, businesses and governments are huge but they will only be taken if appropriate conditions and ‘governance models’ are developed. In fact, it is expected that ICT tools for governance and policy modelling techniques will force change in institutions, no matter how resistant they are. And even if it could be predicted that governments that redefine their relationship with their stakeholders will be the ones to succeed, the market will still drive that process in the commercial domain, and tensions may emerge as stakeholders know more and more about the organizations that are trying to serve them [Pew Internet, 2010b].

At the same time, it seems that increasing demand from the scientific and business community, and from civil society organizations and citizens groups, will drive the emergence of ‘experimentally-driven research’, to address broad governance and policy-making challenges, developing and applying ICT tools and applications to exploit the full value of the mass collaboration and open and participatory paradigm underpinning the future technological developments and governance directions in Europe. This would eventually allow the testing of new ICT-based solutions and models for collaborative governance and participatory policy modelling, and socio-economic impact assessment of future societal changes. This last issue entails building on the momentum that the domain of ICT for governance and policy modelling has recently gained, by further developing the research community.

In order to bridge the gap between various stakeholders and long-term research and large-scale experimentation, enabling cross-fertilization across different scientific disciplines and integration of resources, special emphasis should be put on fostering common research results. This will create value for the EU, avoiding fragmentation of research efforts and it should also include the experiences gained at the international level. This requires developing a joint strategic research agenda, on ICT for governance and policy making to support the building of an open, innovative and inclusive Digital Europe 2030.
4.2 Future Research and next frontiers

Most remarkable and perhaps not comparable with the development of the Internet in its first evolution (what can be defined as the Web1.0) is also the exponential growth of the new generation of Web2.0 applications, both in terms of the number of applications and number of users. Remarkable too is the lightning speed with which the trend spread. It took barely three years to social computing to grow from a marginal community and become the dominant Internet trend which it is today.

The fast growth and massive uptake of Web 2.0 services are at the origin of a deeper socio-economic impact, the signs of which are however not clear yet. In fact, despite the rise of Web2.0 applications and its fast growth and pervasiveness, it is still quite difficult to capture the phenomenon and ‘measure’ it or even just building an empirically sound case for assessing specific impacts and its potential policy-relevance. Evidence of impacts of Web2.0 on our society is largely anecdotal and in most cases not systematically gathered and analyzed.

Existing metrics are not able to make sense of the transformations enabled by these emerging technologies as the changes they convey seem to be more behavioural and cultural than primarily ICT-driven. As a matter of fact, we are already witnessing several changes in our daily lives, and in personal and professional attitudes, especially if we look at the way the young people integrate their digital and real selves, or at how social networks and user-generated content is used and consumed (if not abused) (Misuraca, 2011 forthcoming).

In foresight terms, the momentum that has characterised the Web2.0 phenomenon is expected to continue, to further evolve and to mature. The driving forces and added values of it in fact reside in the practices (the values of social engagement) rather than in specific technologies and their sheer corresponding numbers. In the coming decade, Internet access and network bandwidths will continue to increase, and the Web, either as we know it today, or in yet surprising evolutions, will undoubtedly continue to contribute to the development of the Information Society, shaping new form of user participations.

In this regard, the measurement/modelling issue becomes crucial, particularly in the context of informing evidence-based policy decisions. The most urgent need is certainly for new metrics to address the emergence of new social media, and in general, for systematic measurements and internationally comparable data. These would enable better assessment of the long-term importance of Web 2.0 trends in terms of their socio-economic impact, and the quantitative and qualitative differences between countries across the world. This is especially necessary in order to bridge the gap between the wealth of “marketing-type” data and the lack of official statistics, which occurs for every new socio-techno-economic trend especially in the fast-evolving ICT landscape (Misuraca forthcoming).

At the same time, despite not yet supported by consolidated evidence, it seems that the most promising user-enabling ICT applications are emerging in the area of mass-collaboration for governance and policy-making, where mobilisation of politics and civic engagement is already in some cases producing a shift in the power balance between the “crowd” and political representatives. Moreover, web2.0 applications and values can support gathering collective intelligence of citizens and framing public opinion formation on specific policy-relevant issues in a structured manner so as to harness evidence-based policy-making and improve quality of regulatory and policy frameworks.

However, while ICT-supported modelling techniques are largely available to support impact analysis in specific policy areas, they often remain stand-alone models built in isolation and as ‘black-boxes’. They can contribute to respond to focused economic and techno-economic questions (e.g. impact of regulations on specific energy emissions or transport mode shifting) but cannot provide a comprehensive analysis of complex cross-sectoral issues that would affect the overall society (CROSSROAD, 2010).

In this regard, attempts to develop more sophisticated and integrated ICT-enabled models able to capture the various variables and consequences affecting societal changes are underway. However, in both the Web2.0 realm and more in general the ICT for governance and policy modelling domain, it should be considered that the quality of input that can be gathered from users through user-enabling technologies (e.g. social computing, mobile technologies, sensors, etc.) is highly variable, and filtering this content is still very much a resource intensive task. One key challenge is therefore to make sense of gigantic quantities of qualitative data, such as entailing mass conversations. In other words, the goal is to look at ways to improve signal-to-noise ratio, through a variety of means, with different human-computer balance, through tools such as sense-making, reputation management and collaborative filtering. In addition, visual analytics and simulations techniques (for example using virtual worlds or serious gaming) can help ‘domesticate’ and generalise results of modelling techniques to the wider public (CROSSROAD, 2010).

In conclusion, our assumption is that as current modelling techniques are not really adequate to predict, monitor and evaluate policy developments and their impacts on society, a new policy-measurement paradigm is required [Misuraca and Rossel, 2011, forthcoming]. As a consequence of what precedes, and broadly of our own research journey, we need to emphasize the relative absence of a meta-level of analysis, a reflexive layer where not only we would model, but also measure and model how we measure and model and with what implications. This epistemic concern is mainly about modelling issues. Basically, we could say that so far, obsessed with the need to play along the success story-line of more ICT the more welfare, we have downplayed the necessity to model our observations and discuss our modelling assumptions so as to improve them and more generally generate a knowledge process.
To effectively integrate foresight and policy modelling techniques it would be required to develop a more refined or high definition understanding of socially embedded desires, tastes, preferences, and behaviours of the policy recipients they would like to affect.

This broad perspective could for example build on the potential that gathering collective intelligence combined with advanced ICT-enabled policy modelling techniques. A shift is thus required, not only by enabling users to become ‘living sensors’ and providing data to be directly fed into comprehensive models, but also giving the possibility to the same users (being they researchers, businesses, civil servants or citizens) to have direct access to data they need, and process them using ICT-enabled simulation and visualization ‘intelligent’ systems (i.e. able to find meaning in confusion, independently of human-acquired knowledge). Ultimately this will not only allow to have a better measurement of policies (thus modelling and assessing the real implications of policies) but will also create new opportunities for people to interact with and influence governance and policy-making processes and make progress in solving societal problems; and therefore start to establish the target not only in the offer/use and therefore empowering paradigm as it has been profiled so far, but on more ambitious impacts and transformational options.

While so far this has not been the focus of research in the foresight field, we also argue that it would be required to explore this ‘foresight-modelling couple’ so to better grasp the potential of ICT dynamics, and especially user-enabling technologies for modelling and evaluating policy-options. This will also allow changing the perspective of the observer, thus gaining insightful evidence and data directly from the users, and in real time, and more generally speaking of usefulness/relevance of the accomplishments of ICT applications “in situation of use” towards the great variety of ways of addressing small and grand challenges.

In this regard, as suggested by Piniewski, B., Codagnone, C., and Osimo, D. (2011, forthcoming), it may also be worth exploring the popular and innovative approach to crowd management strategies presented in the best selling book Nudge [Thaler, 2008]. In this book, the authors contrast the stylized agents of classical economics called Econs to more human-like agents called Humans. The Econ relies on his reflexive cognitive system, whereas the Human is frequently unreliable in his reaction secondary to an automatic cognitive system4. The fundamental game changer presented by Nudge is that traditional simulation efforts that depend on Econs will under-perform dramatically today as Human behaviours are significant contributors to crowd outcomes. Folks will spend money every year paying for magazines that are not read only because they fail to pay attention to a automatic renewal or malignant nudge. The authors claim that left to their own devices, Humans unlike Econs will often continue to make poor decisions affecting their own wellbeing. Humans are especially vulnerable when mapping (view to the future) outcomes is delayed or unclear at least for the moment. In this connection, linking foresight with modelling techniques may provide a better understanding of the issues at stake while also provide alternative policy options to address societal challenges. However, to effectively integrate foresight and policy modelling techniques it would be required to develop a more refined or high definition understanding of socially embedded desires, tastes, preferences, and behaviours of the policy recipients they would like to affect. In addition, an understanding of how networks are born, grow and develop over time would be important. The effects of policies do not occur in a vacuum. They occur within a social network. Thus nudging alone will not be sufficient. Nudging plus network approaches raises challenges but also creates tremendous opportunities for innovative policy making [Omerod, 2010]. In a system of interconnected agents, changes by a few agents may produce a cascade of changes in many agents as they learn from each other, copy each other, and seek each other’s acceptance. If the network is scale-free (characterised by a power law) then changes enacted by the hubs can even more likely lead to a cascade effect5. Such cascade effects may drift a policy into unknown or unexpected directions. Thus by understanding the basic structure and flow of a network, a small nudge can be applied to relevant hubs to

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4. See for example the FET Initiative FuturICT http://www.futurict.ethz.ch/FuturICT and the EU FP7 projects in the domain of ICT for governance and policy modelling http://ec.europa.eu/information_society/activities/egov

5. An example of an Econ is Star Trek’s Mr. Spock who typifies the always-in-control person. The Human may be typified by Homer Simpson, who is a typical “yeah-whatever” person.

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Figure 2 Evidence in policy making: today and tomorrow, Source: Piniewski, B., Codagnone, C., and Osimo, D. (2011, forthcoming)
Combining foresight with policy modelling and especially visualisation techniques will provide a new set of tools extending from the presentation of discussion arguments in argumentation map formats for minimizing the complexity of policy debates to the creation of virtual environments which can simulate the behaviour of both policy makers and citizens in a real-life like environment.

Theoretically, a community of scientists and experts would produce the most comprehensive and robust form of evidence support for policy-makers. However, this insight may be delayed, difficult to use or not directly useful for specific policies. In turn, citizen-generated data may not be fully comprehensive (self-selected, biased, opinion) or robust (in need of filtering/validation). Sensitive issues such as security and privacy must also be addressed. For these reasons, citizen-generated data are slow to enter the policy making arena.

The paradigm shift in policy modelling will occur when the top right quadrant of the matrix characterizes the bulk of policy evidence activity. In a cycle of continuous improvement, collaboration across the three key groups of stakeholders (policy-makers, expert scientists and non-expert citizens) will drive evidence-based policy. Together these stakeholders will support innovative data intensive policy action, capable of timely reaction and redirection within networked systems.

In summary, ICT alone cannot solve everything and can be even generate new problems. For the desired paradigm shift to occur, both institutional and cultural changes are needed. Figure 3 is a visual summary of the elements needed for evidence-based effective policy making. The key elements needed for ICT to advance as a powerful instrument across the value chain of data collection, data analysis, and support for action have been identified by the FP7 project CROSSROAD which reviewed a large body of literature to generate a roadmap for ICT use in policy modelling.

The figure provides a synoptic visualisation of how various agents (policy makers, citizens, scientists and expert) share and collaboratively use data through distributed computing. Inside the ICT tool box are tools for data analysis, data presentation, and for persuasive feed-back. Together, all stakeholders are able to obtain answers to their queries and collectively optimize policy to optimize citizen behaviours.

Within this framework, it is clear that data and information are a fundamental building block upon which the paradigm-shift in policy modelling depends. However different data may come in different formats and be difficult to link correctly. More importantly, data about the future are not available, and even the more sophisticated model will not allow to predict exactly what impacts specific policies may have, due not only to ‘wild cards’ events, but especially because of the not rational neither linear evolution of policy directions.

Therefore, it is important to complement current modelling approaches with participatory foresight techniques, allowing for example the possibility to gather data and opinions directly from users. In this manner, strategic and critical information can be volunteered by users and the dramatic reduction in cost of consumer electronics is increasingly making sensor-based techniques to help bridge the knowledge asymmetry between the experts, the policy makers and the citizen. Foresight will become a crucial component as the real time dynamic of such a policy intelligence platform will not rely simply on data about past and present facts, but will provide the framework for alternative policy options and related impacts, and thus possibly anticipating the future.

In this context, highly specialized knowledge and analysis will become more accessible while retaining the robustness of rigorous analysis. Static visual analytics will advance to interactive visualization with supporting analytical reasoning and scenario-design to help make well-informed dynamic decisions in changing complex situations. Problems once unknowable due to their size and complexity may become quite knowable. Combining foresight with policy modelling and especially visualisation techniques will provide a new set of tools extending from the presentation of discussion arguments in argumentation map formats for minimizing the complexity of policy debates to the creation of virtual environments which can simulate the behaviour of both policy makers and citizens in a real-life like environment.

6. The best, more comprehensive and yet accessible analysis of network in general and of scale-free network in particular is that provided by Barabasi. Originally the idea emerged from a study of epidemiologists who discovered that most people have only a few sexual partners in their lifetime but a few have hundreds and even thousands and are the catalyst of sexual disease transmission.
7. This has been demonstrated in a study of binge drinking in the UK, (Ormerod P and Wiltshire G, 2009) and in the Framingham Heart Study. In the latter, a longitudinal cardiovascular study following residents since 1948, suggested that the chances of a person becoming obese rose by 57 per cent if they had a friend who became obese (Christakis, and Fowler, 2007 and 2008).
8. The figure and the table have used the monumental body of literature reviewed and transformed into the most comprehensive and up to date roadmap on the topic of ICT for policy modelling produced as part of the FP7 project CROSSROAD (CROSSROAD, 2010).
extending from the presentation of discussion arguments in argumentation map formats for minimizing the complexity of policy debates to the creation of virtual environments which can simulate the behaviour of both policy makers and citizens in a real-life like environment. Such techniques will be the building blocks of new integrated policy intelligence platforms. In this regard, the recent call of the FP7 ICT WP 2011-2012 reinforced the focus of the research in the area of ICT for governance and policy modelling and intends to further advance the understanding of how emerging ICT tools for governance and policy modelling can provide opportunities for decision-making in a complex world, through the dramatic and combined growth of data available, analysis and simulation tools, participative and behavioural change technologies. Integrating foresight methodologies in this process is required and represent in our modest view the next frontier to be overcome.

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industry insights

THE MISMATCH: FINDING THE BEST FIT

BY
Mohd Nurul Azammi
azammi@might.org.my
Based on study conducted by the World Bank on Malaysia, although jobs created in the past were for skilled professionals (high and medium skills), a large number of jobs available (about 44 per cent) is still low-skilled. Although there are a large number of vacancies of low-skilled jobs they are not appealing to Malaysians due to low salaries and uncomfortable working conditions. This resulted in a huge inflow of low-skill foreign workers, estimated at 1.8 million in 2010, to fill the gap. If Malaysia’s competitiveness is still derived from low-cost labour instead of innovation or creativity, it will be trapped in the middle as new investments will flow to neighbouring countries with relatively cheaper workforce, and higher value activities remain in developed countries. To address this, the Government initiated the Economic Transformation Programme (ETP) that laid down a comprehensive plan to transform Malaysia to a high income nation (GNI per capita from USD 6,700 in 2009 to more than USD 15,000 in 2020). The implementation of projects under ETP is expected to generate more than 3.3 million jobs by 2020. However, abundance job opportunities created by the economic activities is not expected to totally eradicate unemployment, and shortage of skills and talented workforce will continue to be the major stumbling block in national development agenda.

There are a number of factors affecting the shortage of talent in Malaysia. Based on a study by the World Bank, the major factors are:

a. **High brain drain intensity**: The number of skilled Malaysians living abroad has tripped over the last two decades. Two of every 10 Malaysians with tertiary education – almost all of them young adults – leave the country for Australia, the US, the UK and especially Singapore.
b. Lack of employability among graduates
A study on shortage of talent in Malaysia found that five (5) highest key restraints to hiring are: Lack of skill in information technology, English language, communication, creativity/innovation and technical training.

c. Shortages of top talent and highly skilled workers
Migration of skilled workers abroad due to more attractive remuneration and other incentives, especially in Middle East countries, has affected various sectors. The positions they left behind are left vacant for a period of time due lack of suitable candidates, thus hampering industry development.

d. Other factors
Productivity wage disconnect, insufficiently leveraged pool of talent, and costly and time consuming employment process.

Malaysia’s economy has evolved from agriculture based to industrialisation and today, services sector is taking large portion of overall economic activities.

followed by manufacturing 29.5 per cent, and primary sector with 3 per cent of Malaysia’s economic activities.

The planning and production of future human resources for the country need to take into account opportunities and risks presented by the change and liberalisation of the market, new industries growth and employment needs. The advancement of technology is dynamic. It enhances productivity and, in turn, changes human job functions. According to McKinsey, advancement of automation technology will free workers to focus on more creative tasks and create new occupations. Therefore, investment in time and resources to "reskilling" is important for an organisation to stay competitive in future marketplace. In addition, high technology utilisation will enable organisations to tap on underutilised human potential such as workers with various disabilities.

Mismatch of demand and supply of talents has benefited people with special talent as there are demands worldwide. This minority group has ability to demand higher salary set their own terms and conditions. However, the vast majority who are unable to market their talent are not neglected by the government. Various initiatives such as education review and graduate employability blueprint to improve quality of education; new economic model and strategic reform initiatives to ensure availability of talent; labour law reforms for workforce productivity and Government Transformation Program (GTP) for improving the quality of life have been implemented.
In the era of knowledge based economy, innovation is crucial for Malaysia to improve her global competitiveness. Research and development (R&D) and technological innovations are essential for local industries to grow and mature. And with Science, Technology, Engineering and Mathematics (STEM) education, technological development can be further upgraded to global standard.

Realising the importance of science and technology (S&T) for Malaysia to achieve her target of becoming a fully developed nation by 2020, an S&T policy that emphasises S&T education and training is formulated. The teaching of S&T is emphasised in the National Education System.

The Choice: Science or Art?
Theoretically individuals choose the stream of education with the intention and ambition to build a career. Person studies chemistry with the hope to become a chemist. Similarly, those learning finance aim for careers in the financial sector. Based on this theory, everyone expects to be involved and succeed in careers related to their choice of education.

Reality does not seem to support the theory of ‘choice of education as choice of career’. The majority of science students are not involved in science careers. It is common to see former science students pursuing careers in sales and marketing, administration, and other non-science professions. On the other hand, art students cannot build a career in science as science related professions require in-depth technical knowledge that is not in any of the art syllabus.

The Higher Education Planning Committee aims for the education paradigm to be 60% science stream, 40% art stream. However until today, this has not been achieved. The failure is clearly reflected when only 20% of the 472,541 students who sat for the Sijil Pelajaran Malaysia (SPM) examination in 2012 were science stream students.

It is also reported that there is a low workforce of Research Scientist and Engineers (RSE), only 29 per 10000. The figure is very low in terms of global competitiveness ranking. The facts are discouraging for a country that aspires to be a developed nation.

![Statistics from the Ministry of Higher Education indicated the inclination of students is towards the Social Sciences, Business and Law courses.](image)

**Figure 1**

1. Ministry of Education
Science in Tertiary Education

Talent Roadmap 2020 reports that tertiary education has doubled since 2000 to 2011 through the establishment of more local institutes of higher learning; providing for a larger number of school leavers and encouraging them to further their studies. However, even though courses offered by the learning institutes have been diversified and aligned to the country’s current and future talent requirements, students’ selection hovers over the non-science fields.

Statistics from the Ministry of Higher Education indicated the inclination of students is towards the Social Sciences, Business and Law courses⁴.

A study conducted by Kluster Sains dan Matematik Majlis Profesor Negara Laporan Tahun 2011 showed that, despite the implementation of science: arts students’ ratio at 60:40, the nation has not reached that target until today. In fact there has been a significant decrease of science stream students. The study showed that most students were interested in the science field but choose not to study in the science stream due to:

- The difficulty to achieve outstanding results in the science and mathematics subjects;
- The opportunities to pursue their studies are limited;
- There is a lack of knowledge and exposure on the available careers for science graduates or post-graduates.

Contrary to the findings, a survey conducted by myForesight® shows that 60% of university students nationwide see themselves working in technical field that includes engineers, scientists and researchers. This indicates that students realise and believe in the potential of science stream and believe that they would be able contribute to the economy in the near future.

Repulsive Factors

Education Cost

Science stream education cost more as it requires the purchase scientific equipment, laboratory maintenance fees and higher tuition bills. In comparison, law students are not burdened with courtroom maintenance fees, and hotel management students do not have to pay fees for facilities and cutlery.

Facilities and Educators

The study of science proves and experiments. Therefore, science stream education requires more tools and equipment in class. The lack of appropriate facilities in schools and higher learning institutes will definitely reduce the understanding of science subjects.

The Academy of Sciences Malaysia (ASM), through its 2011 Advisory Report on the Teaching and Learning of Science and Mathematics in Schools, stated that many felt the curriculum for science and mathematics is not relevant, cramped, rigid and heavy.

Teaching science is another serious issue as most job seekers treat teaching as ‘the last resort career’. They become ‘reluctant’ educators as their inspirations, ambitions and interests are elsewhere. The situation worsens when some schools, particularly in rural areas, are not equipped or equipped with poorly maintained computers and science laboratories. This results in students losing interest, and becoming discouraged to explore and experiment. The situation leads to the lack of linkage between theories learnt and hands on try-outs¹.

Parental Support

Parents are influential in any child’s development. Parents are responsible to inspire and provide supports – financial and motivational – for their children. In situations when parents are unable (or do not wish) to provide financial or motivational support (or both), the children/students would opt for the easier and less burdening choice. It has been recorded that among factors causing students to drop interest to further study in the science stream is due to lack of support from parents⁶.

As more than half of Malaysian households earn a monthly income of less than RM3, 000⁷, only a small percentage of students can afford to pay their way to a tertiary education without getting scholarship or loan.

Job Opportunities

Science and Technology (S&T) related employment is limited as most job opportunities in Malaysia are directed towards administration, sales and marketing, and finance. 50% of the labour force in Malaysia is employed in the service sector. The figure indicates that job prospects for a science stream students/graduates looks bleaker than it is promoted to be.

Table 1

<table>
<thead>
<tr>
<th>Areas of Study</th>
<th>Estimated Tuition Fee</th>
<th>Duration of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>RM43,000 – RM75,000</td>
<td>3 years</td>
</tr>
<tr>
<td>Hospitality &amp; Tourism</td>
<td>RM73,000</td>
<td>3 years</td>
</tr>
<tr>
<td>Science Stream</td>
<td>RM46,000 – RM65,000</td>
<td>3 to 4 years</td>
</tr>
<tr>
<td>IT</td>
<td>RM45,000 – RM65,000</td>
<td>3 years</td>
</tr>
<tr>
<td>Medicine</td>
<td>RM300,000</td>
<td>5 years</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>RM100,000</td>
<td>4 years</td>
</tr>
</tbody>
</table>

Source: Study Malaysia Research Team & Study in Malaysia Handbook (7th International Edition)

Table 2

<table>
<thead>
<tr>
<th>Employment Sectors</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, livestock and Fishing</td>
<td>12.5%</td>
<td>12.2%</td>
<td>12.0%</td>
<td>12.0%</td>
<td>11.8%</td>
</tr>
<tr>
<td>Mining &amp; Quarrying</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>28.9%</td>
<td>28.9%</td>
<td>28.8%</td>
<td>27.6%</td>
<td>27.8%</td>
</tr>
<tr>
<td>Construction</td>
<td>6.8%</td>
<td>6.6%</td>
<td>6.6%</td>
<td>6.6%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Services</td>
<td>51.4%</td>
<td>51.9%</td>
<td>52.2%</td>
<td>53.4%</td>
<td>53.5%</td>
</tr>
</tbody>
</table>

Source: Economic Planning unit and Department of Statistics Malaysia

¹. Statistics of Higher Education of Malaysia, MOHE (2011)
³. The Malaysian Insider Newspaper: Education Ministry forms committee to boost science student numbers (6th November 2012)
⁴. Department of Statistics Malaysia
⁵. The Institution of Engineers Malaysia (IEM)
industry insights

Top Positions
Who holds the top positions in multi-national and international companies? What are their educational backgrounds? What are the relationships between their education backgrounds with their positions and the companies they lead?

A survey has been conducted to determine the education background of individuals in highest management positions of the top 20 local companies involved in oil & gas, telecommunications, constructions, pharmaceuticals and engineering to understand the correlation between education and career. Companies from the financial industry were omitted from the survey as it is well-known that financial industries are led by professionals with matching educational background.

The study focussed on the top three positions in management team of the companies – Chairmen, CEOs, and COOs. CFOs and Financial Heads/ Presidents of the company were not included.

Despite omitting CFOs and Financial Heads of the organisations, the study showed that 61% of the high ranked officials from the top 20 companies in Malaysia are of non-technical background. Only 34% studied in the science stream and the reminder 5% have other qualifications.

The study shows that even big industries such as Petroleum and Aviation are led by individuals from the arts stream. Only a handful of companies are led by individuals with science background, such as Kuala Lumpur Kepong Berhad, CCM Duopharma (M) Sdn Bhd, and Clara International Beauty Group. They are led by individuals with education background in Agricultural Science, Pharmacy, and Chemistry respectively. As for engineering-related companies such as Tenaga Nasional Berhad, YTL Corporation, UEM Group Berhad, Petronas and Pernce Corporation Bhd, most of the top managements have engineering education background.

The study also shows that top positions in companies with high demand for technology are held by art stream educated individuals. Most top positions in organisations like PETRONAS, Sime Darby, and Boustead are held by individuals educated in business or finance.

Back to Basics
Even as the government is struggling to inculcate S&T in education, the targets are yet to be achieved. Public learnt that the science stream education provides rather poor promotion-prospects. At most, an engineer can be promoted as head of the engineering department and almost all other high-ranking positions are off limit to them! In a science-based company, the case is often that there is only one such position. Students do not see the importance of developing their skills in the science stream despite their interest. The target set by the Ministry of Higher Education Plan 2007-2010 is to achieve 100 RSE per 100,000 workforce and 10,000 PhDs by the year 2020. However, the figures are still far behind. In 2008, the ratio of researchers per 10,000 labour force, was 22.7.

S&T Education: What is next?
Students from art stream have better chances to rise to the top management levels. But, does this prove that science stream graduates are not fit to hold positions in top managements? Or does this say that, in whatever industry one can venture in, the financial and business aspects is superior to having the required technological understanding?

No one doubts the importance of research and development, together with a strong foundation of science and technology based human capital for a company or organization and even the nation to advance into a high technology era. But everyone seems to ignore the importance of having an individual with adequate S&T knowledge and R&D expertise to lead the appropriate organisations.
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SRI LANKA
SEYCHELLES
VIETNAM
UNITED KINGDOM

HAVE YOU MADE YOUR RESERVATIONS?
ENABLING THE FUTURE: Re-Energizing Malaysia Education from Cradle to Career
Have you ever thought about what your children actually learn in school? Education is perceived as an essential component of our society, but how does the reality of our children’s day-to-day education correlate with the country’s key development goals?

Looking at the macro level, one of the key elements to be recognized as a developed nation by 2020 is the foundation resource of human capital. It is, without a doubt, a crucial element for Malaysia to build up the necessary supply of human capital to meet the demand for Malaysia's cross sectorial Science & Technology (S&T) goals, which are based on the country’s economic indicators such GDP at 6% per annum with the support of entry point projects (EPPs) under the New Key Economic Areas (NKEAs). With new high impact projects coming into the picture, it will be vital to have a sustainable supply of highly skilled workers to support these government programmes.

**Education in Malaysia**

**An Overview**

The Malaysian education system encompasses students from pre-school through university. Pre-tertiary education (pre-school to secondary education) is under the authority of the Ministry of Education (MOE) while the custodian for tertiary education is the Ministry of Higher Education (MOHE).

Primary education (6 years) and secondary education (5 years total—comprised of 3 years of lower secondary and 2 years of upper secondary) make up 11 years of education. In this delicate stage, a total of 4 national exams are placed in specific years of schools: Ujian Penilaian Sekolah Rendah (UPSR) at Form 3, Penilaian Menengah Rendah (PMR) at Form 5 and Sijil Tertinggi Pelajaran Malaysia (STPM) at upper 6. Most of the students with good grades are able to apply for pre-U (or matriculation using SPM results) because of grades that show that the students are able to cope with university-level education.

At the tertiary education level, institutions of higher learning offer courses leading to the awards of certificate, diploma, first degree and higher degree qualifications (in academic and professional fields). The duration of study for a basic bachelor degree programme is 3 years and the courses of study at this level are provided by both the public and private education sectors, attracting many international students.

Looking at the current education landscape in Malaysia, it is important to understand that the whole value chain must head toward the same vision and direction in order to reach the national agenda to become a developed nation. Every development point (from primary to secondary or secondary to tertiary) must provide continuity and support.

**The issues**

One of the major issues that Malaysia has been battling is meeting the human capital demand that will be necessary in 2020. Currently, Malaysia is ranked 21st in the Global Competitiveness Report by the World Economic Forum, which highlighted that Malaysia has one of the most efficient and sound financial sectors (just behind Singapore and Hong Kong), highly efficient markets (ranked 15th) and shows improvement of the macroeconomic situation (despite a 5% budget deficit of GDP). To further move up the scale and meet the National Vision 2020, Malaysia needs to improve performance in education and technology readiness, improve access to higher education and training, and increase enrolment rates of secondary and tertiary education. Looking at these issues, it is clear that the value chain of the educational system must be in sync to meet the demand of human capital trained in science and technology by the year 2020.

Currently, Malaysia is unable to supply the needed amount science candidates for tertiary education (60 RSE by 2020). In reality, the science stream is a minority compared to its other counterpart programs such as Arts, Vocational, etc. In 1967, the Higher Education Planning Committee proposed that the science to arts ratio should be 60:40 in order to fulfill the future demand of a developing nation. Ministries and related agencies have conducted various workshops and policy changes to address the issues. But, despite various policies and action plans put in place, this target has yet to be achieved.

One recommendation to move closer to this goal is to increase the involvement of students in the science stream at secondary and tertiary levels by introducing inquiry based science education (IBSE) at both primary and secondary levels. The beauty of the IBSE teaching methodology is that it is designed to be inclusive for both weak and excellent students. Secondly, we recommend strengthening the quality and relevance of S&T in schools. It is important to ensure that the scientific knowledge that is passed along to students is of the highest quality & standards. Lastly, we recommend increasing and strengthening R&D related to Science and Mathematics Education. It is important for policy makers to draft policies using the right data and also for agencies to implement policies in the best strategic way with interest of the Rakyat.

**The Intervention: Cradle-to-Career**

In the United States, people working in education theory have developed various initiatives and programs to strengthen the educational system. Even industry players and policy makers play a role. One thing missing from many of these theories, however, is teamwork and collaboration. This includes bringing in community leaders and experts, as well as academic institutions and family support to be a part of children’s roadmap to success. The STRIVE approach (http://strivenetwork.org/) is based on this holistic view of education.

As depicted above, in every juncture of a child’s journey, it is important to evaluate benchmarks and properly facilitate not only the right educational exposure, but also guidance from family and other support networks. We believe that the direction and target of our national educational system must possess the same vision and purpose as the STRIVE approach. In line with that, there is a core belief that working in silos will never work; instead various support systems must work together to have a collective impact on the macro and micro levels. In this particular case, our focus needs to be “What works for our kids?” Convening to answer that question is the first step toward a holistic and integrated civic infrastructure where everyone in the community works together toward a common goal.

The diagram below explains the building blocks of Career-to-Cradle (C2C) infrastructure (a key component of the STRIVE approach) with 4 pillars. The first pillar is shared community vision. The spirit of the partnership needs to be set from the start and it relies on an understanding that everyone shares accountability, even while there are different responsibilities for outcomes.

The second pillar is evidence based decision making. We must not allow perfect to be the enemy of good and get in the way of releasing data, but instead should use evidence based data to prioritize decisions and work toward better results in the years to come.
The third pillar is collaborative action which is designed to promote collective impact at a large scale. It is critical for teams to come together and identify common goals and data needs to align resources and develop common action plans.

The last pillar is the investment and sustainability pillar. In using the Strive framework, funders can be encouraged to support specific outcomes. For example, industry players would prefer to fund research programs that produce a more highly skilled workforce rather than lower level or K-12 focus areas. In essence, the group must enable options for funders to align their support with their own missions, while still maintaining a commitment toward the larger vision of the educational system. Additionally, it is critical to establish a backbone of staff and communal resources to ensure the long-term sustainability and viability of these efforts.

GSIAC : Putting things together
On May 16, 2012, in New York, the Global Science and Innovation Advisory Council held its 2nd GSAIC meeting. One of the Council’s initiatives is Cradle-to-Career, which is a movement implemented in the United States and designed to improve student success from preschool up to university. This initiative is a joint venture between the Ministry of Higher Education (MOHE), the New York Academy of Sciences (NYAS) and the State University of New York (SUNY), of which Nancy Zimpher, co-creator of the STRIVE Cradle-to-Career approach is Chancellor. This initiative will provide benefits to Malaysia as a step in the development of human capital which lines up with efforts to transform Malaysia into a high-income, globally competitive nation. Implementation will involve the following three main components:

a. The main component is an innovative human capital improvement that focuses on strengthening the education of Science, Technology, Engineering and Mathematics (STEM) in primary and secondary schools. Initial implementation will come through a partnership between NYAS and UKM PERMATA-Pintar that aims to cultivate the "Nobel Laureate mindset" among bright Malaysian children by exposing them to actual Nobel Laureates and providing them with education on key areas of science that will facilitate their ability to translate their research across countries and cultures.

b. The second component is a focus on research excellence, which will be achieved by placing Malaysian research scientists in world-class laboratories based in the U.S., such as Brookhaven National Laboratory, High Technology Center, Cold Spring Harbor Laboratory and the Earth Institute at Columbia University. Malaysian scientists will be able to be exposed to these renowned laboratories, inspiring their development as researchers.

c. The third component is focused on bringing research to market. This can be achieved through an additional allocation of grants, research, development and pre-commercialization, and effective participation of educational institutions, government, industry, and entrepreneurs. One of the suggested projects was to put a new Malaysian CEO from SMEs at Stony Brook University where the CEO will be able to experience and also enhance international business relationships.

In conclusion, these initiatives have to involve everyone in the education value chain and should be centered towards students’ needs. Without everyone being on the same page and of the same vision, we might not be able to achieve our goals and support other government initiatives to make Malaysia a developed nation by 2020.
The future is not what it used to be.

In this volatile era, with the world changing rapidly, people are more curious than ever to know what lies ahead.

Will relentless consumerism end up destroying our planet? Or can science and technology allow us to innovate our way out of trouble? Perhaps a greater social consciousness and community-based living will take over. Or, conversely, the competition for limited resources may result in everyone fighting for them.

Drawing on these four possible futures, Richard Watson and Oliver Freeman invite us to examine critically the risks and opportunities to come. They discuss the key factors – trends, critical uncertainties, and wildcards – that will shape the future, guiding us to a greater awareness of long-term problems and possible solutions, and empowering us not only to adapt to what might happen, but also to shape our future and to generate change.

It’s impossible to know for certain what the future holds, but we can remove some of its surprises by engaging in a meaningful debate about the choices we face now. This book shows us how.
WASTE NOT WASTED

BY
Muhammad Hasif Hasan
hasif@might.org.my

The world we now live in is withstanding many serious challenges. A fast-growing human population and the consequent mounting demand for food, energy and water are the most critical issues to address. In addition, anthropogenic climatic change is a severe threat to mankind and requires that we significantly reduce our current greenhouse gas (GHG) emissions to avoid detrimental consequences for the globe. Global demand and prices for the human necessities have been resilient during the recession, leading policy-makers in countries with the potential to increase production to look to that sector as a potential engine for economic growth.

One correlation that we shall consider is that as the population rises, the amount of waste generated will also increase. Archaeologist E. W. Haury once cited that ‘Whichever way one views the mounds [of waste], as garbage piles to avoid, or as symbols of a way of life, they…are the features of more productive information than any others.’ Archaeological excavations have yielded thicker cultural layers from periods of prosperity; correspondingly, modern waste-generation rates can be correlated to various indicators of opulence, including gross domestic product (GDP)/capita, energy consumption/capita and product consumption/capita.

In the modern world that we live in, waste implies unnecessary depletion of natural resources, unnecessary costs, and environmental damage. Sustainable waste management is about using resources more efficiently. In most developed and developing countries with increasing population, prosperity and urbanization, it remains a major challenge for municipalities to collect, recycle, treat and dispose of increasing quantities of solid waste and wastewater. A cornerstone of sustainable development is the establishment of affordable, effective and truly sustainable waste management practices. It must be further emphasized that multiple public health, safety and environmental co-benefits accrue from effective waste management practices which concurrently reduce GHG emissions and improve the quality of life, promote public health, prevent water and soil contamination, conserve natural resources and provide renewable energy benefits.

Solid waste management is a major challenge for Malaysia to address in the light of Vision 2020 which lays out the direction for Malaysia to become a fully developed nation by 2020. The National Strategic Plan (2005) estimated that 31,500 tons of solid waste will be generated per day by 2020. Current waste production stood at 25,000 tons per day and from the current projection based on the waste generation trend, 42,780 tons of waste is going to pile up in the landfill by 2020 in a ‘Business As Usual’ (BAU) assumption which is more than the forecasted earlier. If the solid waste is not managed efficiently and effectively, it will give rise to negative impact to the health of the local community and environment.
The Industry

A sanitary landfill has features consisting of liners, this total, only eight are sanitary landfills. Another way to take a look at it is by improving since most of the waste end-up in landfill. Act 672 provides that almost the entire value of waste management. Solid Waste Management Value Chain

Under the Economic Transformation Program (ETP), development of efficient Solid Waste Management (SWM) is provided under the Greater Kuala Lumpur/Klang Valley key economic areas. There are four major initiatives:

1. Increase Reduce, Reuse, Recycle (3R) implementation by
   i) Creating a recycling ecosystem which includes composting to stimulate waste disposal reduction and target a recycling rate of 40 per cent by 2020 from the current 11 per cent;
   ii) Introducing composting and anaerobic digestion to tackle high levels of organic waste, and
   iii) Stimulating Construction and Demolition (C&D) waste recycling with a proper system and a recycling facility.

2. Increase waste treatment capacity to reduce the amount of solid waste disposed in the landfill.

3. Improve governance of solid waste management and public cleansing services.


Measures are being taken to meet this challenge. Malaysia is on the verge of a significant change following the passing of the Solid Waste and Public Cleansing Management Act 2007, the main tenets of which underpin the institutionalisation of strategies and procedures for solid waste management. This legislation brings management of solid waste directly under the Federal Government’s jurisdiction, allocates responsibilities to newly established agencies, redefines the role of local authorities, and aims to improve the collection, recycling and disposal of solid waste throughout Peninsular Malaysia. The changes to the administrative structure are substantial and the infrastructural improvements will be extensive but, to be effective, both require major changes in established disposal practices and in public attitudes and behaviour.

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The Industry

Solid Waste Management Value Chain

Act 672 provides that almost the entire value chain is under the mandate of the government. Since most of the waste end-up in landfill, another way to take a look at it is by improving the current operation of disposal. Currently, Malaysia has 296 landfills (dumpsite), 165 of them are in operation and 131 not in operation. Out of this total, only eight are sanitary landfills.

A sanitary landfill has features consisting of liners, leachate collection and treatment, gas harvesting, and daily and final covers. A typical dumpsite is a MSW site without facilities such as liner or leachate collection/treatment. The long-standing landfill problem has affected almost everyone in the country. The landfills produce gases that consist of carbon dioxide, methane, hydrogen sulphide, ammonia and other traces of gas. They can be harvested, treated and applied for electricity generation or direct heating if not being flared. Methane is known to be one of the contributors to global warming. The generation of these gases is the consequence of the amount of waste being deposited.

Besides causing social and environmental problems, landfills are also economically detrimental, and eight sanitary landfills is definitely insufficient for Malaysia.

Another take away point is to improve the overall industry structure by dedicating dedicated food waste collection. The sorting has to start at home, and there should be a specially designed collection vehicle with the sole purpose to collect food waste and channel them to a treatment plant. What is with the food waste anyway?

Food waste is the source of carbons, tightened up by strong chemical bonding which, if treated the right way, can produce energy, biogas, and sludge for composting.

In Malaysia, about 50% of the MSW portion originates from food waste which is expected to be 13,500 million tonnes/day by 2020.

One way of removing the burdening of landfill is by removing its food waste share.

Since food waste will generate methane from its abundance carbon source, a proper utilization would enable a more consistent generation of biogas or energy. A case study in UK indicates that it currently has a total of 222 anaerobic digestion plants, which produce more than 1.3 Terrawatt hours (TWh) of electricity a year. Studies have shown that this capacity has the potential to increase very significantly to 11 TWh by 2020, enough to power about 2,500,000 homes, which is roughly 10% of the UK’s households specifically generated power from food waste.

Besides anaerobic digestion, options for treating MSW include incineration and compost. The table 1 summarize the option for MSW treatment.

Anaerobic Digestion- Huge Potential

Anaerobic Digestion (AD) is a process which breaks down organic compounds – including waste – to produce biogas and nutrient-rich digestate. AD is important because biogas is a renewable energy which may help Malaysia reduces its reliance on fossil fuel. When AD uses waste feedstock, it diverts material from landfill, a priority as we have a dwindling number of suitable landfill sites and are committed to complying to the ultimate target of nothing goes to waste (dumpsite).

AD is a treatment process that breaks down organic material with microorganisms in the absence of air. It has been used in the world to process sewage sludge for over 100 years, but its full potential for treating other materials including food and farm wastes and purpose-grown crops has only been recognised in the past decade. AD produces energy at all hours of the day regardless of weather conditions, unlike other renewable sources such as wind, solar and tidal energy.
viewpoints

**Anaerobic Digestion (AD) Plant Configuration**

A renewable natural biogas comprised mostly of methane and carbon dioxide is emitted. It is extremely versatile and can displace the use of non-renewable natural gas. Biogas from AD can be used for:

1. **Direct combustion** – combined heat and power (CHP) Generators convert biogas into electricity which can be transferred to the national electricity grid and provide heat for local use.
2. **Injection into the grid** – biogas can be processed to produce bio-methane which can be compressed/liquefied to make CNG fuel or injected into the national gas grid where it can be stored with liquefied to make CNG fuel or injected into the national electricity grid and provide heat for local use.
3. **Post-treatment**

Both of these options create clean and renewable energy from the biogas produced by AD. Apart from the energy part, AD also produces a residual nutrient-rich digestate which accounts for around 90% of the original feedstocks mass. The digestion process preserves nitrogen and releases other nutrients contained in the organic compounds of the feedstock, including phosphates. Digestate is a renewable fertiliser which can displace greenhouse gas (GHG) emissions associated with the creation of conventional inorganic phosphate fertilisers. When produced in close proximity to agricultural land, digestate also saves transportation costs associated with commercial synthetic fertilisers. In liquid form, it also penetrates through to crop roots unlike granular fertilisers which rely on rain or irrigation.

### Challenges

Implementation of approach has always been an issue, especially since the culture in the country itself did not warrant for any proper treatment. First and foremost, the challenge faced by the technology is the amount of manual sorting needed. Even if the source separation is in place, there will be room for contamination by metals, chemicals and other inorganic material. Before any AD treatment takes place, the source separation still requires the removal of impurity of the feedstock which will hinder the efficiency of the process itself. As far as the technology is concerned, there is no efficient process of removing this impurities and the best we can hope is that people do their source separation properly at home. The collection authority will then collect the waste separately and source the organic based waste into AD treatment. As removing the first barrier is crucial, massive education and awareness program should be introduced for the community to be inculcated.

Malaysia is on the verge of a significant change following the passing of the Solid Waste and Public Cleansing Management Act 2007, the main tenets of which underpin the institutionalisation of strategies and procedures for solid waste management.

Digestate as by product of AD process is very high in nutrient content, thus suitable for soil conditioning. Since Malaysia is the second largest oil palm plantation country in the world, the opportunity to supply digestate as chemical replacement for the traditional manure certainly is in line with the sustainability concept. The question is, if the organic source comes from non-halal eateries or household which is difficult to keep track of, are we willing to use that as fertilizer?

On the micro-scale of project, the uncertainty of this project will hinder the commercial entity from participating in the industry. Many AD schemes have struggled to secure financing. AD schemes’ small size rules out non-recourse project finance, and the significant risks inherent in operating an AD plant generally mean that they have to be funded with a significant proportion of equity with any debt fully secured on assets. The financier will also rely on the ability to secure feedstock and the threshold of fluctuation that the process can tolerate. This is highly dependent on the amount of waste, which is not under the process control. The project will also rely on the Feed in Tariff (FiT) for revenue which, on current rate, is relatively low. Market for the methane gas from AD is not fully developed. Standards for methane for transportation, and also engine acceptance will need further R&D before any commercialization can takes place.

### Final Say

AD has the potential to remove dependency on landfills which is currently a problem in the country. Apart from the potential the AD is producing, AD also offers environmental benefits in reducing GHG emission. The sustainability concept is applied in all aspect of the process, thus creating a greener way of treating waste.
Introduction
In order for nations to be developed, Capacity Building and Talent Development (CBTD) in Science, Technology and Innovation (STI) is extremely crucial as these are now considered as the means to enhance the economic competitiveness of industrialised countries. The emerging technologies have drastically changed over the years as the economic sector move from one phase to the next. There is also a need for capable personnel to be leaders in the new emerging technologies who are able to take charge of the business. Globally, the use of Information Communication Technology (ICT) in the digital era has made communications more accessible at high speed. This has increased the competitiveness of all industries. To be ready to face all these challenges, new breed of engineers and technical experts are needed in all technological sectors.

The Government has introduced various measures, focusing on the development of talent at all levels: primary education, through to secondary and tertiary levels, and onwards to the working level.

Nurturing Today’s Talent for Future Leaders
viewpoints

Malaysia has transformed its economic growth strategy from input driven to one that is increasingly driven by knowledge. This notable economic transformation could not be achieved and sustained without significant and consistent investments from the public and private sector in nurturing talent, as well as developing an ecosystem in which talent can develop and thrive.

Recognising the importance of human capital development in driving the nation forward, Malaysia has committed substantial resources in improving and enhancing its talent pool over the last five decades. The Government has introduced various measures, focusing on the development of talent at all levels: primary education, through to secondary and tertiary levels, and onwards to the working level. These efforts are intended to cultivate and improve the talent and capabilities of Malaysia’s workforce, which forms the bedrock of the nation’s socioeconomic growth.

The success of Malaysia’s economic transformation will rely greatly on the quality of its workforce. Recognising this, the Economic Transformation Programme (ETP) has identified Human Capital Development as a Strategic Reform Initiative (SRI) that cuts across all 12 National Key Economic Areas (NKEAs) (Figure 1).

The Human Capital Development through SRI is a critical enabler to help transformation of the workforce and workplace (Figure 2). This involves the implementation of strategic programmes parked under six key policy areas that include modernising labour legislation, focusing on upskilling and upgrading the workforce, strengthening human resource management, leveraging on women’s talent to increase productivity, undertaking a labour market forecast and survey programme, and enhancing labour safety net by introducing unemployment (Figure 3).
The challenge ahead should not be underestimated. According to the World Bank Malaysia Economic Monitor report titled, “Brain Drain” noted that the country has to work on improving its higher education and attract talent and skilled labour while managing the emigration of highly skilled people.

To bridge the skills gap, the Human Capital Development Strategic Reform Initiative (SRI) which comes under the Ministry of Human Resource (MoHR) is rolling out the implementation of strategic programmes under six key policy areas as mentioned earlier. The SRI has identified “quick wins” to address immediate key skills gaps in several sectors which include Oil, Gas and Energy (OGE), Electrical and Electronics (EE), Communications Content and Infrastructure (CCI), and Business Services as well as Outsourcing and Data Centers.

The up-skilling has the following main benefits:

- Enhance and sharpen the skills of the candidates
- Practice based curriculum
- Exposure to the industrial practice
- Provide practical knowledge of business situations and brainstorming solutions to the same
- Real time monitoring of learner path and capabilities
- User defined modules and granular learning support
- Aims to encourage candidates to develop poise, grace and confidence
- Fulfill the gap between desired and existing skills
- A successful, proven and market tested concept
- Provision for instant evaluation and feedback for further improvement

"Every year about 180,000 students graduate with diplomas and degrees from institutions of higher learning. The Government will launch the Government Employability (GE) Blueprint to assist unemployed graduates by the end of 2012. The GE Blueprint focuses on strengthening the employability of graduates. The Government will establish a Graduate Employability Taskforce with an allocation of RM200 million."

Quote from the Prime Minister’s Budget Speech (September, 2012)

Six major issues concerning graduate employability that need urgent attention have been identified (Figure 4). It includes unknown market size and needs for a high income economy, unknown intake and exit attributes except for a few professional courses, poor intake attributes, the notion that industry prefers ready-made instead of fundamentals, stop-gap measures versus immersion at IHL level, and not obtaining the right choice of courses.
To achieve the target of 33% workforce in the highly skilled category by 2015 and 50% by year 2020, the country is under immense pressure to overcome what is seen as a top investment obstacle; skill issues. It is imperative that efforts to improve this dire need which is plaguing our nation are not only implemented effectively, but speedily.

Currently, the government through the Ministry of Higher Education (MoHE) has conducted many initiatives to overcome the Graduate Employability (GE) issues. Among others GE enhancement programmes is Degree++ Programme, whereby students obtain additional high-end certificates that are recognized by industry on top of the degree that they have received. MoHE also has created the Bridging Gap Programme where graduates need to be trained according to the attributes required before being placed in the industry. Some of the other initiatives include Entrepreneurship Programme, Apprenticeship Programme, and Finishing Schools Programme.

Solution through High Value CBTD Approach

MiGHT-Meteor Advanced Manufacturing (MMAM) Sdn. Bhd. has been spearheading the Capacity Building Talent Development (CBTD) programme initiatives. The stages of implementation of MMAM’s CBTD strategy are as follows:

1) Identify knowledge and Research and Technology (R&T) areas being developed by universities, research institutes and centers of excellence (COE)
2) Identify industry partners to match technological areas to jointly develop and apply and commercialise in on-going and future national mega projects
3) Apply and integrate Technology Development Management (TDM) for Research and Technology (R&T) and Human Capital Development (HCD) programs for prioritised technological development
4) Determine industrial technological product being designed, produced, applied, and supporting strategic government procured projects
5) Collaborate with global industry players undertaking technological projects, especially for the Government.
6) Identify technological gaps and determine the source of technology available and transferable from foreign partners, in collaboration with local Lead Companies
7) Coordinate collaborative CBTD program between Industry players, Universities and technology providers
8) Prepare technological modules, syllabus, timeline, selection and manage engagement of all parties involve

Examples of innovative CBTD programs for HTI which are implemented as high impact national initiatives:

**LEADER (Leadership in Domain Expertise) Series**

LEADER’s program is a unique Human Capital Development program in line with the National Key Economic Area (NKEA) towards a high income nation by 2020. The program is sponsored by Ministry of Higher Education (MOHE) and targeted at fresh engineering graduates from Public Universities.

The programme has been successfully implemented for 24 engineers in Aerospace sector. Currently, another 150 engineers are being trained under the LEADER programme in Oil and Gas, Green Technology (Solid State Lighting), Electrical & Electronics (Wafer Fabrication and IC Design) and Instrumentation Control. The programs focus on specialised contents, case studies and industrial practices which are necessary to make the graduates more value added and employable with accredited contents from industries which are recognised globally. This is the winning strategy which brings impact and shows the Government’s seriousness to prepare the human capital and gain confidence from industry to invest in Malaysia.

**TeSSDE (Technology Specialist in Specific Domain Expertise)**

TeSSDE is a unique human capital development program in line with the economic transformation program (ETP) towards a high-income nation by 2020. The program is sponsored by Economic Planning Unit (EPU) via TalentCorp and targeted at fresh engineering graduated from public universities.

This is similar in approach and concept to LEADER Series but shorter in duration and customised for all industries cross cutting all sectors. Currently implemented for 675 engineers in highvalue, strategic clusters such as Oil & Gas, Maritime, Green Tech, EE, Renewable Energy, Sensor vRFID, Telecommunication HSBB, Mobile telecommunication, Design and Digital Engineering, Avionics involving local universities and Multi-National Companies (MNCs), Government Link Companies (GLCs) and SMEs.

**National Talent Enhancement Programme (NTEP)**

The National Talent Enhancement Programme (NTEP) is a 12-month traineeship program initiated by the Government under the Economic Transformation Programme’s (ETP) Human Capital Development (HCD). As an initiative under the PEMANDU Strategic Reform Initiative (SRI) program, it is targeted towards the Rail, Marine and Aerospace sectors. The objective of the NTEP is to accelerate the development of graduates and skilled professional workforce through a partnership and collaboration with the private sector. It aims to build a talent pool of skilled workforce via industry relevant skills training and on-the-job practical exposure. Currently implemented for 100 engineers in Rail, Marine and Aerospace sectors.

**Demand of Engineering Talents**

Actions that need to be addressed to accelerate talents development especially in the High Technology Industry (HTI) for transformation agenda includes reducing unemployment, enhancing skills and accelerating career development, sustaining continuous Life Long Learning (LLL), fulfilling specific competency needs of industries and enticing potential foreign investors.

The High Technology Industry (HTI) Engineers is a key enabler to becoming a high technology nation. There is a dire need to create critical mass of HTI Engineers to sustain Malaysia’s competitiveness. It has been reported in the ETP Roadmap for Malaysia that the total demand of HTI Engineers by the year 2020 is approximately 125,000. In order to achieve the required number of highly specialized engineers, the government and the private sectors have to spend a huge amount of money for the training programme. Figure 5 below shows the estimated number of HTI engineers in various strategic sectors required by the nation in year 2020.
**Industrial Modular Based Education**

MMAM is working closely with Significant Technology Sdn. Bhd to craft a training programme called Industrial Modular Based Education (IMBE) in order to support the government initiatives to provide the required HTI engineers. IMBE is a Module based Teaching, Learning and Assessment. The registration and enrolment also were based on module whereby the student will take one Module at a time. The module is intensive and based on short course styled classes. Industry-led modules are prepared through inputs from professionals and academics. Several standardized Modules make up a regular Course. All Modules are Professionally Certified, and can be aggregated into Academic Courses and further into Academic Programs recognized by higher institutions. IMBE programme used Progressive Conferment Model, whereby students are conferred with an academic qualification accordingly, at each stage of his study. Furthermore, IMBE also uses Progressive Career Development Model, whereby students can be employed at any stage of his study.

**CONVENTIONAL EDUCATION SYSTEM**

1. **EDUCATIONAL INSTITUTIONS**
2. **ACADEMIC AWARD**
3. **ACADEMIC PROGRAM**
4. **ACADEMIC TRANSCRIPT**
5. **ACADEMIC COURSE**

3-4 yrs of education must be completed before one can begin his/her career/professional development.

**INDUSTRIAL MODULAR BASED EDUCATION SYSTEM**

1. **EDUCATIONAL INSTITUTIONS**
2. **ACADEMIC AWARD**
3. **ACADEMIC PROGRAM**
4. **ACADEMIC TRANSCRIPT**
5. **ACADEMIC COURSE**

**INDUSTRIAL EMPLOYERS**
1. **LOI/OL/MOA**
2. **PROFESSIONAL TRAINING PROVIDES**
3. **PROFESSIONAL BODIES**
4. **PROFESSIONAL COURSE**
5. **PROFESSIONAL CERTIFICATE**

**CONVENTIONAL EDUCATION SYSTEM**

- 3-4 yrs of education must be completed before one can begin his/her career/professional development

**INDUSTRIAL MODULAR BASED EDUCATION SYSTEM**

- Expedited career path
- Academic-Professional integration path

**Several standardized Modules make up a regular Course. All Modules are Professionally Certified, and can be aggregated into Academic Courses and further into Academic Programs recognized by higher institutions.**

The IMBE model is based on three main elements that include Professionally Certified Modules, Industry Recognised Training and Academically Certified Programmes as shown in **Figure 7**. The main purposes of IMBE programme are (i) to enhance the industry-led education and training programme, (ii) to facilitate flexible educational programs compilable to professional certifications as well as to academic recognitions, (iii) to release the education delivery approach from the rigidity, unsustainable conventional systems, (iv) to integrate and coordinate the various HCD related programs such as Industrial PhD, Degree ++, TeSSDE, LEADER, NTEP etc. and (v) to establish the first of its kind Industrial Modular Based Education system thus placing Malaysia as the pioneer in sustainable, future-proof professional-educational system.
viewpoints

Conclusion:
It has been discussed that for effective growth of High Technology Industry, the integration of Capacity Building and Talent Development (CBTD) need to be taken care by taking stock the current situation of the industry and institutional synergy between all the stakeholders comprising the academia, technology partners, industry players, COEs, government agencies and the most important beneficiary of the initiative that is the graduates themselves. The ecosystem of funding, training and research must be made available such that HTI issues can be appreciated through clear and targeted government policy and agenda. The success of CBTD programs which integrate all the collaborators in a synchronous, harmonious, well-structured and managed approach as disclosed are manifestation of the quintuple helix model of collaboration at its best. IMBE model is proposed to be the way forward in Capacity Building Talent Development to complement the existing tertiary education system. Cost of training is cheaper under IMBE. Hence, it is affordable, flexible while quality is maintained (qualification awarded and recognized by universities) and complementing the tertiary education.

‘Each of you is a Leader and each of you will be held responsible for his leadership’
– Hadith Bukhari

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CTRM

Composite Aero Structure • General Aviation MRO • Composite Repair
Composite Testing • Defense • Composite Marine • Systems Integration
Unmanned Aerial Vehicle (UAV) • Engineering & Design
Composite Automotive • Composite Mass Transport
The world faces the ‘urgent challenge’ of creating 600 million productive jobs over the next decade in order to generate sustainable growth and maintain social cohesion.

IN 2011, 74.8 MILLION YOUTH (AGED 15-24) WERE UNEMPLOYED, AN INCREASE OF 4 MILLION SINCE 2007

900 MILLION WORKERS LIVE WITH THEIR FAMILIES BELOW THE US$2 A DAY POVERTY LINE

12.7% UNEMPLOYMENT RATE: ABOVE PRE-CRISIS LEVEL

Source: ILO

MORE THAN 400 MILLION NEW JOBS WILL BE NEEDED OVER THE NEXT DECADE TO ABSORB THE ESTIMATED 40 MILLION GROWTH OF THE LABOUR FORCE EACH YEAR.

87% OF YOUTH LIVE IN DEVELOPING COUNTRIES

GLOBALLY, YOUTHS ARE NEARLY 3X AS LIKELY AS ADULT TO BE UNEMPLOYED

Source: ILO

Globally, youths are nearly 3x as likely as adult to be unemployed.

IN MALAYSIA FOR EVERY 100 CHILDREN

ATTEND PRIMARY SCHOOL 97

FINISH PRIMARY SCHOOL 78

ATTEND UPPER SECONDARY SCHOOL 66

FINISH UPPER SECONDARY SCHOOL 55

RECEIVE TERTIARY EDUCATION 46

Source: OECD

In Malaysia for every 100 children, over 97% attend primary school, 78% finish primary school, 66% attend upper secondary school, 55% finish upper secondary school, and 46% receive tertiary education.

EDUCATION AND SKILL LEVELS OF LABOUR FORCE, MALAYSIA V.S. SELECTED ECONOMIES

Labour force with Tertiary Education (%) 2007

Labour force (%) 2008

Source: OECD

Globally, youths are nearly 3x as likely as adult to be unemployed.

From Cradle To Career
Young men and women today build the foundations for the economies and societies of today and tomorrow. They bring energy, talent and creativity to economies and make important contributions as productive workers, entrepreneurs, consumers, agents of change and as members of civil society.

**JOBSMALAYSIA: (AS OF DEC 2011)**

RECORDED 303 VACANCIES FOR GRADUATES FROM A TOTAL OF 30,413 VACANCIES BY INDUSTRY

**I’M HIRED: The Stat**

Government programmes nationwide have targeted to offer a promising amount of job opportunities in the near future. The Economic Transformation Programme announced that 3.3 million jobs are ready to be filled in order to accelerate our economy.

**NEW CAREERS TO COME**

<table>
<thead>
<tr>
<th>ECONOMY</th>
<th>TECHNOLOGY</th>
<th>SOCIAL</th>
<th>POLITICS</th>
<th>ENVIRONMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate Engineering Industry</td>
<td>Water traders, Land right traders, business consultant for climate change compliance</td>
<td>Climate Change Compliance Auditor, Wind Farmer, Consumer Energy Analysts</td>
<td>Virtual Police, Weather Modification Police, Quarantine Enforcer</td>
<td>Bioinformationists, Recycling Analyst, Green Accounting, Drowned City Specialist</td>
</tr>
<tr>
<td>Education Services</td>
<td>Personal Enhancement Advisors, Robot Counsellors</td>
<td>Mind Reading Specialist, Cybratans, Memetics Manager/Analyst, Personal Learning Programmer</td>
<td>Culturalization Therapists, Knowledge Broker, Social Network Analysts</td>
<td>Chief Networking Officer, New Science Ethicist</td>
</tr>
</tbody>
</table>

**FIVE REGIONAL CITIES AND ECONOMIC CORRIDORS TO PROPEL NATIONAL TRANSFORMATION AGENDA**

- Sabah, 900,000 Jobs
- Iskandar Malaysia, 817,500 Jobs
- East Coast Economic Region, 2010
- Kuala Lumpur, 10,500 Jobs
- Labuan, 10,000 Jobs

**ARE THESE JOBS FOR ME?!!**

- 3.3 Million Jobs
- 1.92 Million Jobs
- 817,500 Jobs
- 304,130 Jobs
- 303 Jobs

**Source:** MOHR, Jobstreet
Mad Scientists Mania

Idealism must be polished, creativity must be inculcated and talent must be nurtured. There are funds in helping youth to venture in business!

**UNTIL NOW, THE EXACT FIGURES SEEM TO FLUCTUATE; BUT THEY ALL FALL SHORT OF THE DESIRED 60 PER CENT TARGET.**

<table>
<thead>
<tr>
<th>MYCREATIVE VENTURE CAPITAL</th>
<th>AMANAH IKHTIAR MALAYSIA (AIM)</th>
<th>TABUNG EKONOMI KUMPULAN USAHA NIAGA (TEKUN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM 200 MILLION</td>
<td>RM 2.1 MILLION</td>
<td>RM 300 MILLION</td>
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</table>

**THERE IS A DECLINING INTEREST IN CHOOSING SCIENCE & MATHEMATICS (S&M) STREAM IN TERTIARY LEVEL.**

<table>
<thead>
<tr>
<th>LACK OF SUPPORT FROM PARENTS AND FRIENDS</th>
</tr>
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</table>

| NEGATIVE PERCEPTION – S&M IS DIFFICULT |
| UNCERTAIN OPPORTUNITY PLUS UNATTRACTIVE CAREER PATHS AND SALARY SCHEME |
| CONSIDERED ‘DRY’ AND KILLER SUBJECTS. |

**HOWEVER, BASED ON OUR SURVEY, FUTURE CAREER INCLINATION WILL BE**

| 60% SCIENCE | 40% ARTS-BASED STUDENTS. |

**TO BECOME A STABLE INDIVIDUAL, YOUTHS**

- Need to feel needed
- Seek approval
- Require guidance from someone more mature
- Must learn discipline and boundaries

**A HOME MUST BE STABLE, SECURE, CLEAN FOR YOUTHS TO THRIVE EMOTIONALLY AND PSYCHOLOGICALLY**

Parents need to play their part in educating their children: Parents should

- Ensure an open communication
- Be reasonable
- Be firm

**YOUTHS FORESIGHT SURVEY**

**YOUTH FORESIGHT**

60% in technical fields

40% others

**Source:** Majlis Profesor Negara 2011

**Mass media**

**Youths are easily impressionable by the people and things around them**

Youths are the hope for the future, and they need to be guided and developed to become healthy, stable individuals capable of taking up the mantle of leadership when their calling comes. Positive actions produce positive results.
PLA YING A ROLE IN THE GROWTH OF NATIONS

Muhibbah Engineering (M) Bhd incorporated in 1972, is an international engineering construction specialist in Malaysia. Throughout the years, it has diversified its business and expanded its operations globally.

Main subsidiaries include:
- MEB CONSTRUCTION SDN BHD
- FA VELLE FAVCO BERHAD
- MUHIBBAH MARINE ENGINEERING SDN BHD
- MUHIBBAH STEEL INDUSTRIES SDN BHD
- MUHIBBAH PETROLCHEMICAL ENGINEERING SDN BHD
- MUHIBBAH AIRLINES SUPPORT INDUSTRIES SDN BHD
- ITS KONSORTIUM SDN BHD
- MUHIBBAH MARINE ENGINEERING (DEUTSCHLAND) GmbH
- FREYSSINET PSC (M) SDN BHD
- ROADCARE (M) SDN BHD
- MUHIBBAH MASTERON CAMBODIA JV LIMITED

GLOBAL NETWORK

<table>
<thead>
<tr>
<th>ASIA REGION</th>
<th>MIDDLE EAST &amp; AFRICA REGION</th>
<th>EUROPE REGION</th>
<th>NORTH AMERICA REGION</th>
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<tr>
<td>Malaysia</td>
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<td>Germany</td>
<td>Germany</td>
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<tr>
<td>Cambodia</td>
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SCOPE OF MAIN ACTIVITIES

CONSTRUCTION
- Infrastructure Works
- Marine and Port Construction
- Building & Airport Construction
- Onshore and Offshore Pipelines
- Petrochemical Tank Farms
- Steel Fabrication
- Integrated Transport Information System Provider

CRANE
- Onshore & Offshore Crane
- Wharf / Multi Purpose Crane
- Tower Crane
- Crawler Crane
- Winches

SHIIPYARD
- Ship Building
- Ship Repair
- Ship Conversion
- Ship Supplies
- Offshore Structures

CONCESSION
- Airport
- Road Maintenance

Contact Us
MUHIBBAH ENGINEERING (M) BHD (12737-K)
LOT 586 & 579, 2ND MILE, JALAN BATU TIGA LAMA, 41300 KLANG, SELANGOR, MALAYSIA
Tel: +603 3342 4323 Fax: +603 3342 4327 / 9818
Email: admin@muhibbah.com.my Webpage: www.muhibbah.com

Pre-Assembly Gordon LNG Jetty & Marine Structures Project for Barrow Island LNG Plant, Australia

Offshore Crane FAVCO PC 1000 for Jack Up Barge B.V
Lifting capacity: Max. Lift 1000 tonne @ 22m radius
Boom Length: 60.76m to 97.23m

Newly Fabricated 70m Anchor Handling Tug Supply / DP2 -MV IDS Darussalam by Muhibbah Marine Engineering (MME)

EPCC of Central Oil Distribution Terminal (CCDT), Sarawak

LNG Regasification Project, Malacca
As a strategic policymaker or stakeholder, you can help map out a desired future for Malaysia.

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