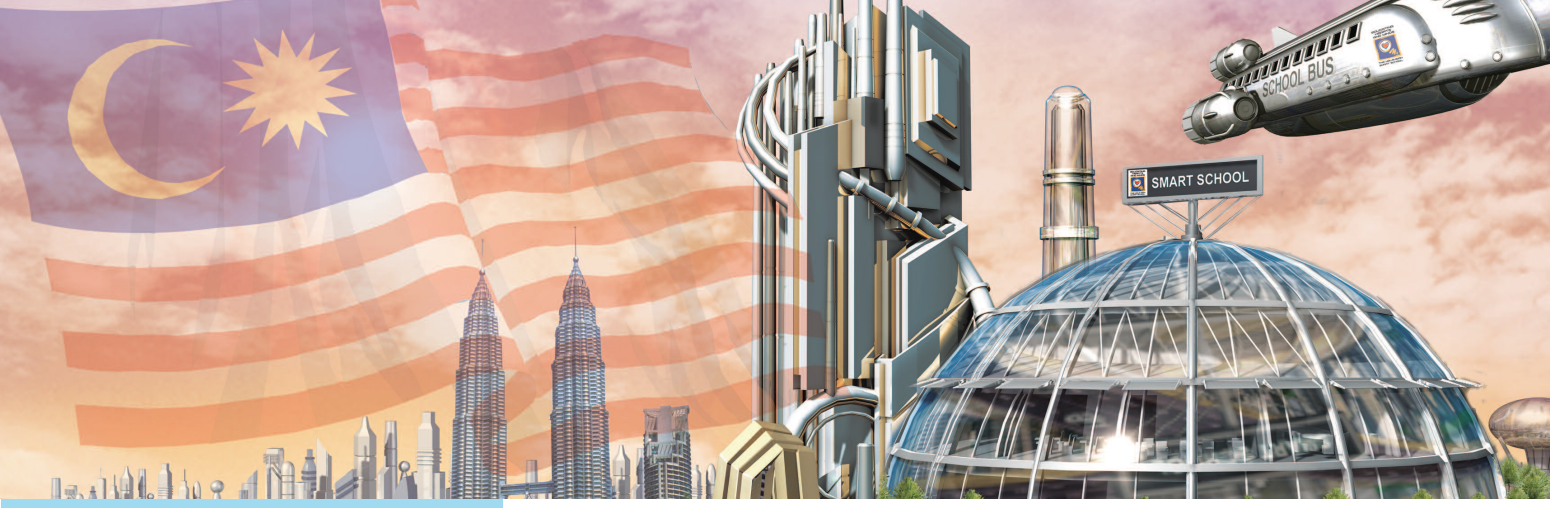
THE SMART SCHOOL
ROADMAP 2005-2020: AN EDUCATIONAL ODYSSEY

A consultative paper on the expansion of the Smart School initiative to all schools in Malaysia

FOR

Multimedia Super Corridor
Multimedia Development Corporation

OCTOBER 2005



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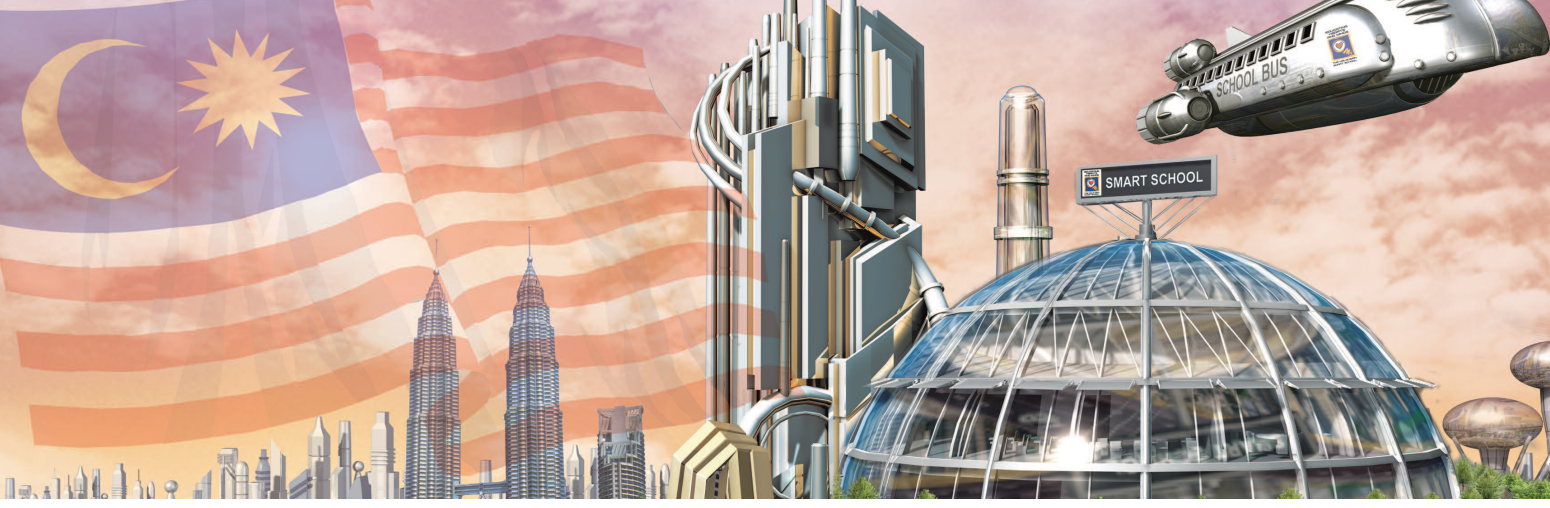

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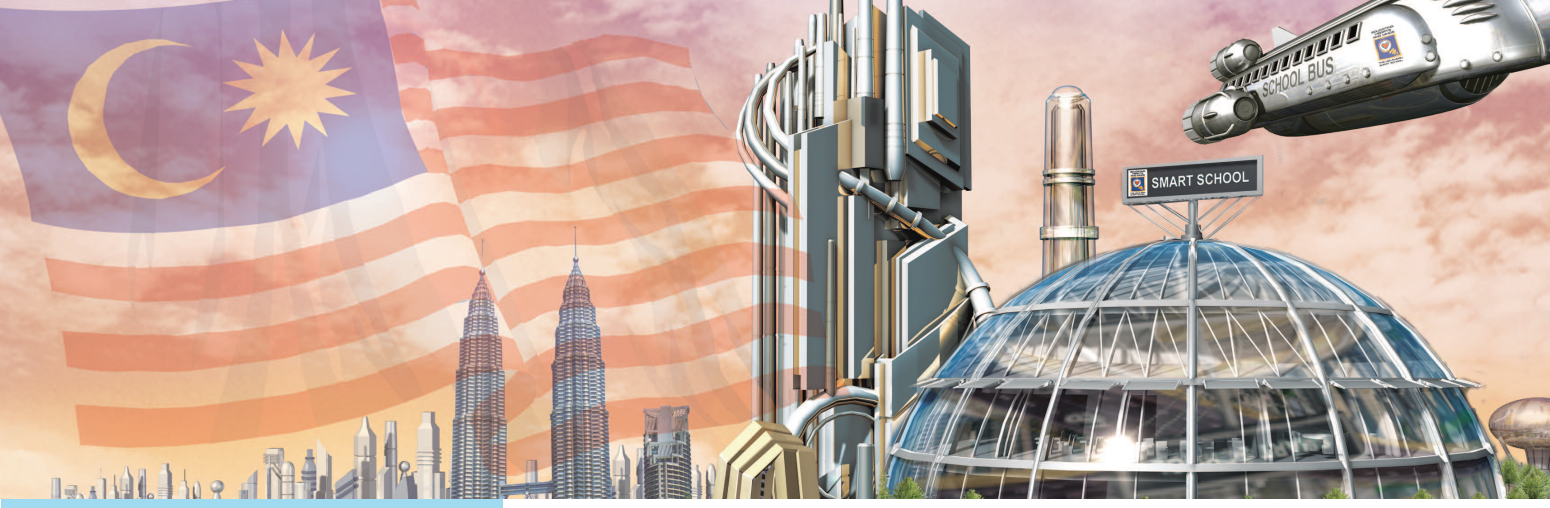


Section 1:

EXECUTIVE SUMMARY

The Malaysian Smart School Flagship was premised on the strong belief that information and communication technology is a key enabler to imparting the learning desire to all. The impact of technology on education and future generations is undoubtedly enormous.

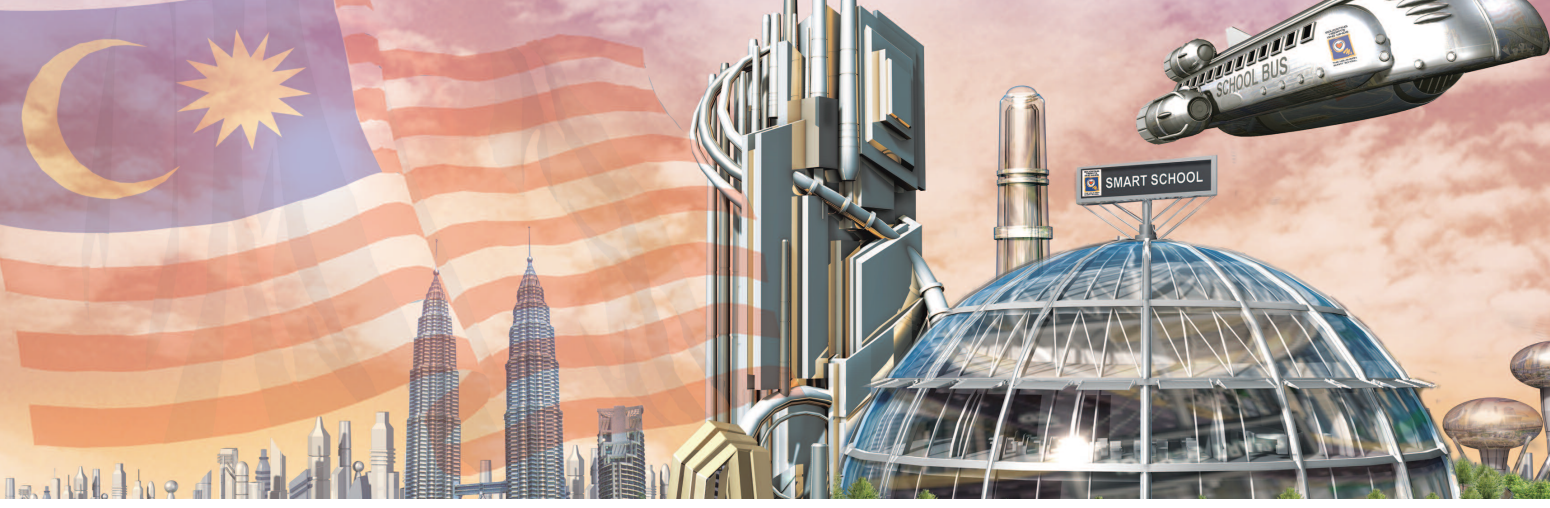
The Smart School Flagship is one of the seven flagship applications envisaged under the Multimedia Super Corridor initiative. It was implemented on a Pilot basis between 1999 and 2002. Deemed one of the most forward-looking ICT-mediated learning initiatives in the world, the Smart School Flagship attempts to reinvent the teaching-learning processes.

In the Pilot, the Smart School Integrated Solution (SSIS) was rolled out to 87 schools in the country at the cost of about USD78 million (RM300 million). The Smart School project is implemented by the Ministry of Education (MoE), Malaysia. The MoE's industry partner is Telekom Smart School (TSS), that was awarded the contract to develop the project in collaboration with the MoE and the Multimedia Development Corporation (MDC).

The Pilot Project was evaluated on multiple fronts by different groups of evaluators. These were:

- Technology evaluation by the MoE/TSS team
- Evaluation by a group of local universities
- Benchmarking study by independent consultants

Subsequent to the Pilot Wave and the evaluation, gaps were identified in terms of technology, infrastructure, support, and human resources. The Post-Pilot Wave focused on identifying measures to plug these gaps and ensure course correction before the Smart School is rolled out to all schools in Malaysia.



The Smart School expansion will be based on a comprehensive Roadmap that identifies the key stakeholders and their responsibilities in order to ensure a smooth migration to ICT-mediated teaching-learning processes.

The milestones proposed and the four waves of the Smart School implementation plan are:

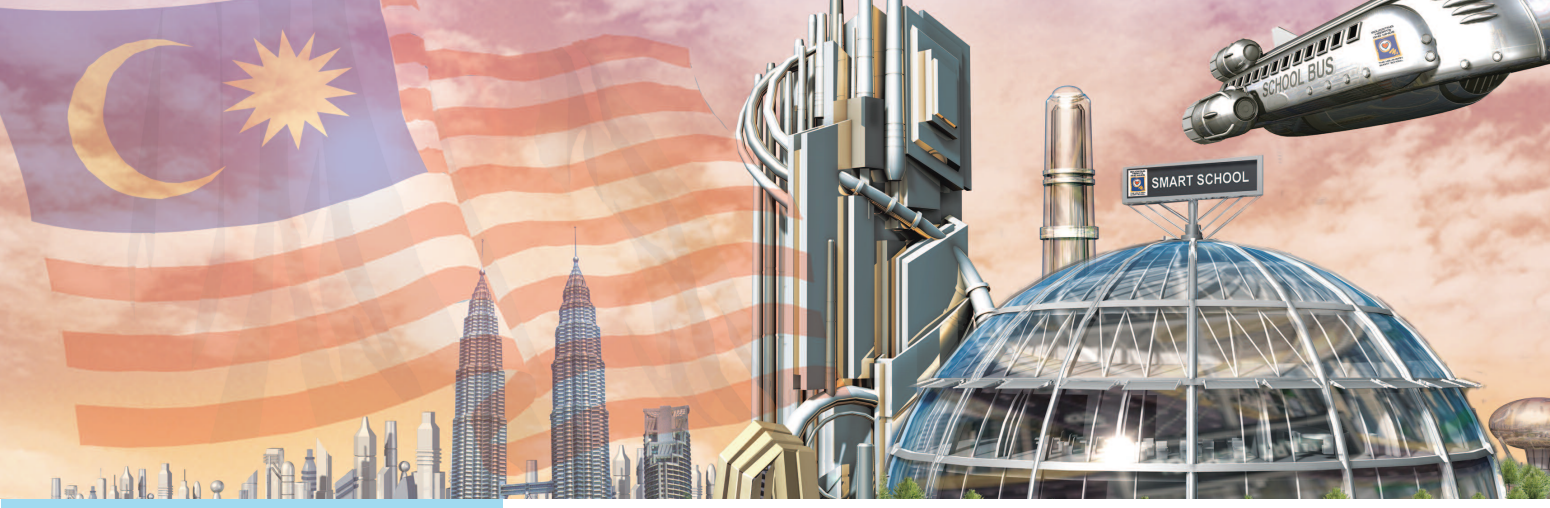
1. **Wave 1 – The Pilot (1999-2002)**
   Implementation on 87 schools
2. **Wave 2 – The Post-Pilot (2002-2005)**
   Lessons learnt from the Pilot
3. **Wave 3 – Making All Schools Smart (2005-2010)**
   Extending the digital transformation to all
4. **Wave 4 – Consolidate and Stabilise (2010-2020)**
   Technology becomes an integral part of the nation's learning process

This document summarises the outcome of the Pilot and the Post-Pilot phases and describes in detail the Roadmap and the key responsibilities of the School, Community, MoE, State and the Industry stakeholders.

The stakeholders and their responsibilities were identified at workshops conducted by the MDC and the MoE in 2005. These formed the basis of the Roadmap, which is more of a strategic intent than an implementation schedule for making all schools in the country 'smart'.

The strategic Roadmap envisages the expansion of Smart Schools to about 10,000 schools by the year 2010. The Roadmap also introduces potential technology direction for the 2020 scenario which includes learning objects, personalised content and delivery, embedded learning objects, wearable technologies, pervasive learning using new-wave broadband technologies, virtual learning environments, home schooling, and RFID.

Ten years from the expansion will see the stabilisation of the solution, the building of value-added applications, and an all-pervasive Smart School environment where the use of ICT in the teaching-learning environment will be the norm rather than a novelty.



Section 2:

THE SMART SCHOOL ROADMAP 2005-2010

The seven applications identified under the MSC initiative will translate into economic growth, and wealth creation competitiveness for the country

The implementation will lead to the creation and nurturing of a local pool of world-class companies that would position Malaysia as an export hub for technology products

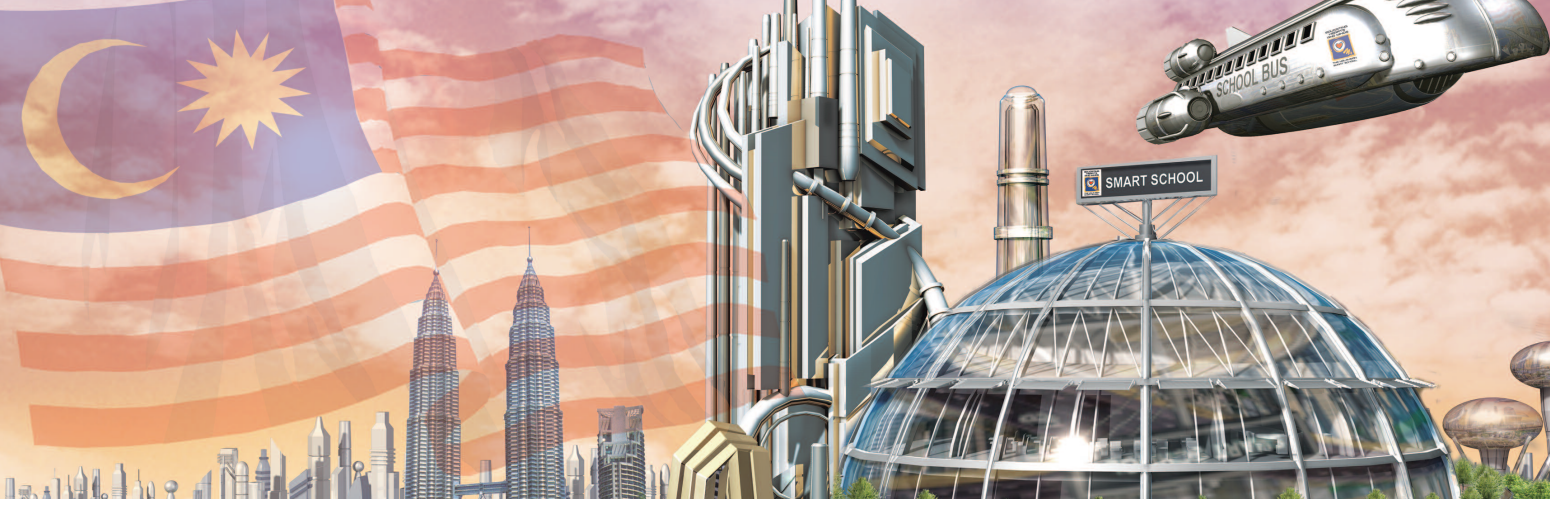
1. INTRODUCTION

BACKGROUND

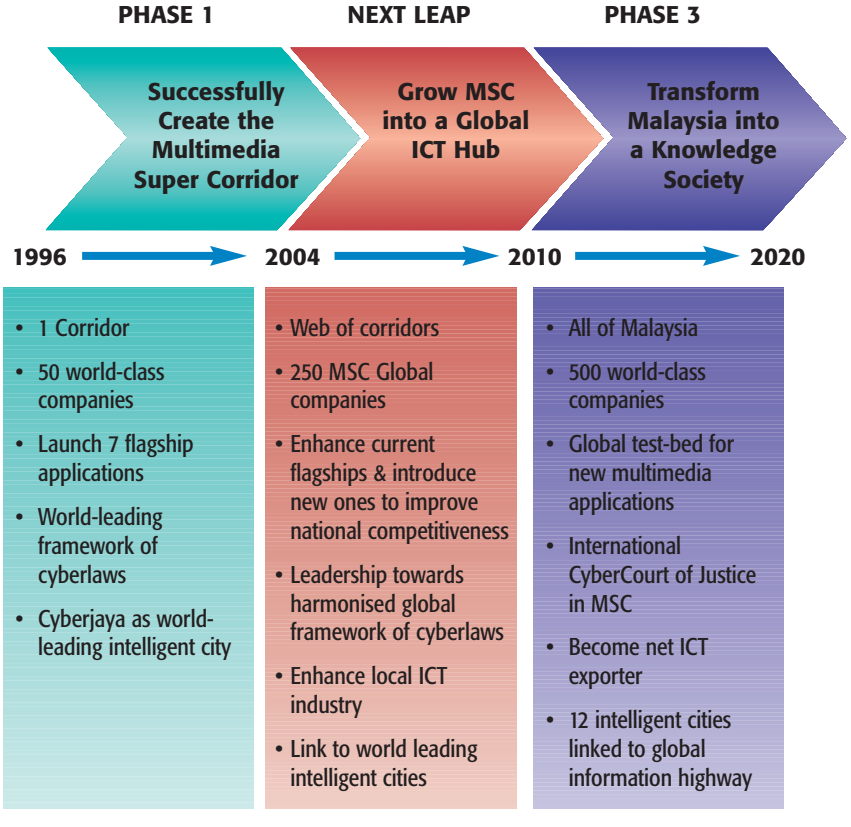
In 1996, Malaysia identified information and communication technology (ICT) as one of the key foundations for its projected transition from a production-based economy to a knowledge-based economy by 2020. In declaring these goals, the government also acknowledged that such a transition will require a workforce capable of exploiting ICT to create new economic opportunities.

In order to develop this talent pool, the government announced under the Eighth Malaysia Plan the need to re-engineer the country's education system and align it with its Vision 2020. The Smart School Flagship was one of the seven applications identified under the Multimedia Super Corridor (MSC) initiative, which envisages the creation of high-value jobs in the country, achieving high and consistent growth driven by exports, improving national productivity and competitiveness and achieving value creation. All these will eventually translate into economic growth, wealth creation and competitiveness for the country.

The MSC's vision for Malaysia in the Knowledge Economy outlines three phases of incremental progress, right from the launch of the seven flagships to their gradual expansion, enhancement and pervasiveness. The implementation of these flagships will lead to the creation and nurturing of a local pool of world-class companies that will position Malaysia as an export hub for new-wave multimedia technologies and products. This vision is illustrated in the following chart.



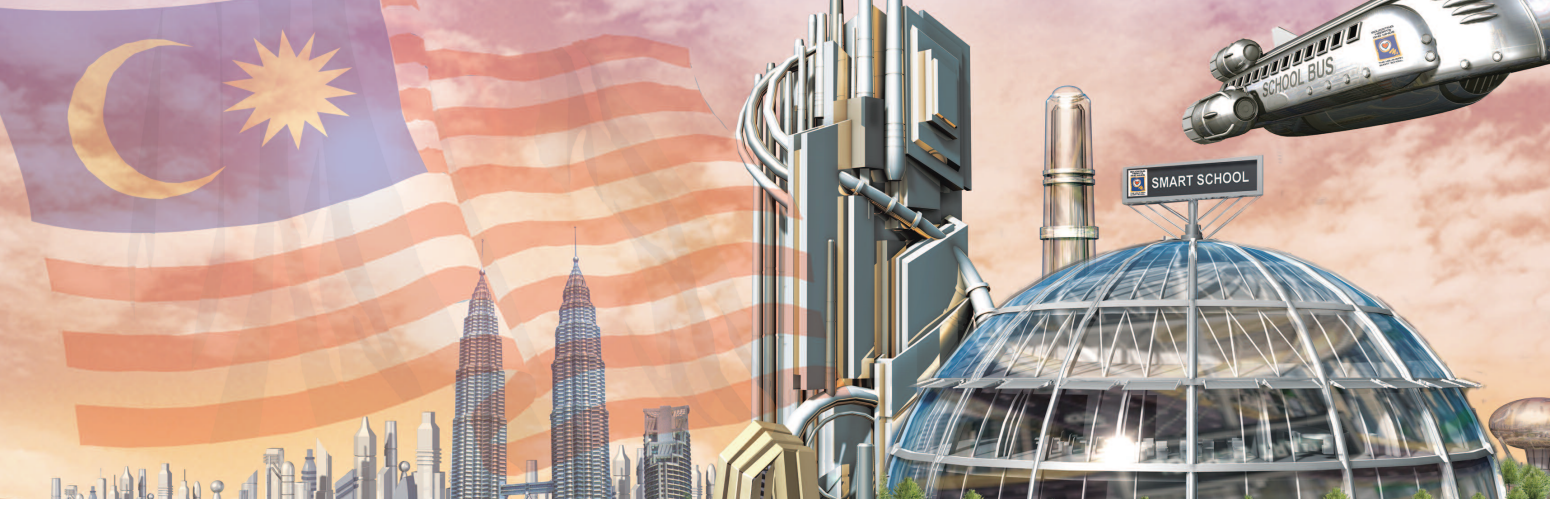
Malaysia's Vision for the Knowledge Economy



Source: Multimedia Development Corporation, 2005

1.1 THE SMART SCHOOL VISION

The Multimedia Super Corridor (MSC) Smart School Flagship Application Conceptual Blueprint was launched in July 1997 by Tun Dr Mahathir Mohamad, the then Prime Minister of Malaysia. The MSC Smart School Flagship Application is a collaborative effort between the Ministry of Education (MoE) and the Multimedia Development Corporation (MDC). The ICT expertise for the initiative was provided by the Telekom Smart School (TSS) industry consortium. The MDC, which has been entrusted with the development of the MSC, plays a key role in the implementation and ensuring that targets are achieved as planned.



1.2 A BRIEF HISTORY OF THE SMART SCHOOL FLAGSHIP APPLICATION

Since the early 1970s, the Malaysian Government introduced various initiatives to facilitate a wider adoption of ICT to boost capabilities in every field including education. The history of the Smart School Project is rooted in the two-pronged objectives of the flagship, which are:

- To jumpstart the MSC towards:
  – Building a knowledge-based economy
  – Contributing to the growth of the ICT industry
  – Creating a pool of talent resulting in high-value job creation
- To prepare the citizens for the information age through an innovative education delivery process

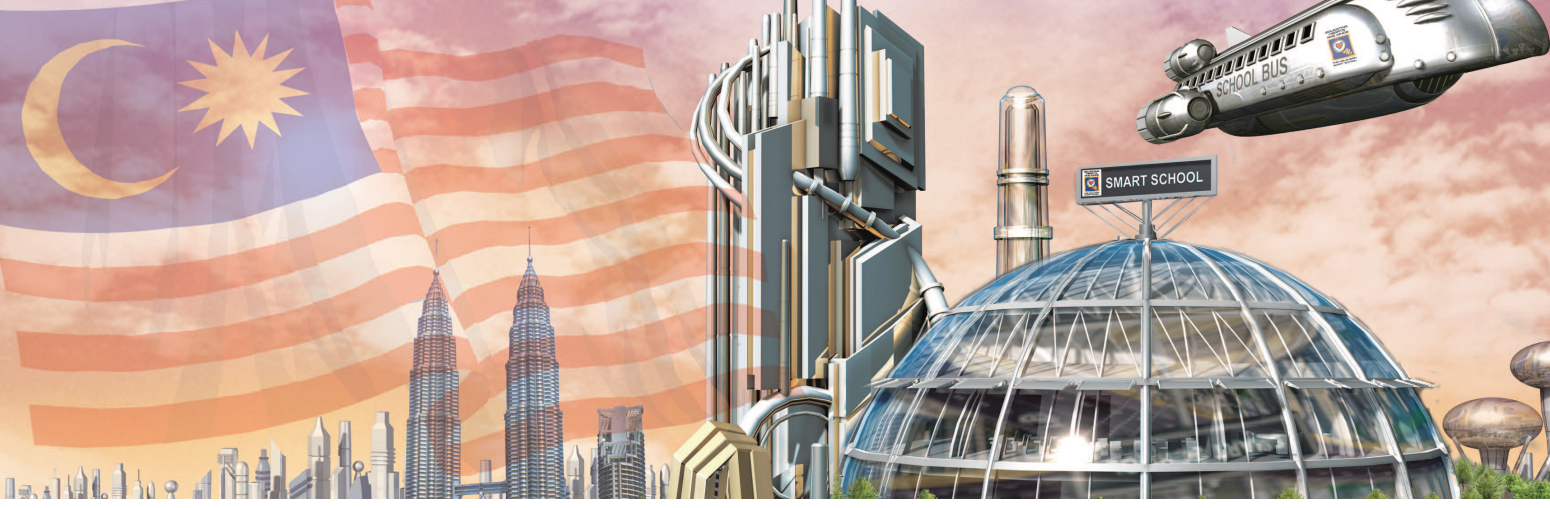
The Concept Requests for Proposals (CRFP) process was used for the first time ever in the country to establish partnerships between the government of Malaysia and the private sector to help conceptualise plan and implement the Flagship Applications of the Multimedia Super Corridor. In July 1997, the Prime Minister launched the Smart School Flagship Application documents to invite proposals for solutions from the private sector within and outside the country.

The Concept Requests for Proposals (CRFP) process was used for the first time ever in the country to establish partnerships between the government and the private sector

1.3 THE PRINCIPAL STAKEHOLDERS

Driving the development of the Flagship Applications are government ministries and agencies that report directly to the MSC Implementation Council, chaired by the Prime Minister of Malaysia. The Smart School project is driven by the Ministry of Education, Malaysia, which spearheads all key initiatives under this flagship. The MoE's industry partner is the Telekom Smart School (TSS), a consortium led by Telekom Malaysia that was awarded the contract to develop the project in collaboration with the MoE and the MDC.

The MDC is a private company wholly owned by the Malaysian Government, created to facilitate the development of the MSC, expedite the entry of investors, and spawn as well as nurture new breed of Malaysian ICT entrepreneurs. The MDC reports to the MSC Implementation Council whose members consist of members of the Cabinet and government agencies.

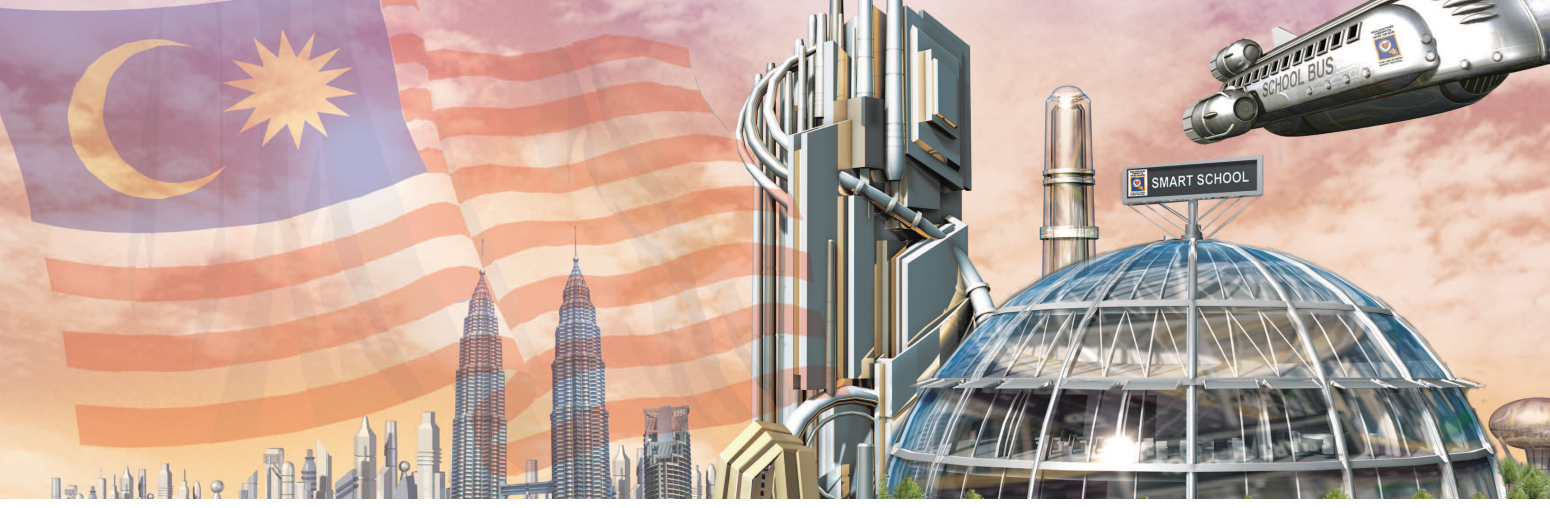


2. THE SMART SCHOOL FLAGSHIP APPLICATION

In 1996, the MoE planned the Smart School concept based on a critical look at the creative teaching and learning processes. Technology is seen as an enabler and will become an important guiding principle of the Smart Schools. In technical jargon, the Malaysian Smart School is a learning institution that has been systemically reinvented in terms of teaching and learning as well as the improvement of the school management processes in order to help students cope and leverage on the Information Age.

Smart School is not just about ICT intervention in teaching and learning. The national curriculum and pedagogy are given the highest importance, with the role of teachers, administrators, parents and the community enhanced in the education of the Malaysian students. Individuality, creativity and initiative amongst the students are prioritised. However, ICT is critical in making the teaching and learning processes easier, more fun and effective, as well as making communication and management among the stakeholders more efficient. The Malaysian Smart School is a place where all students can learn within a condusive learning environment. It offers various curricula with on-going evaluation, handled by professional administrators and teachers.

The Smart School applications brings the benefit of technology to the educators and administrators. These also allow the young to get familiar with the ICT world – using tools such as personal computers, scanners, printers, multimedia products, TV/videos, etc. – at a much earlier stage in life. They get to appreciate the power of the Internet and multimedia applications, which can make learning more interesting and enriching. This will in turn result in them becoming more technology savvy.



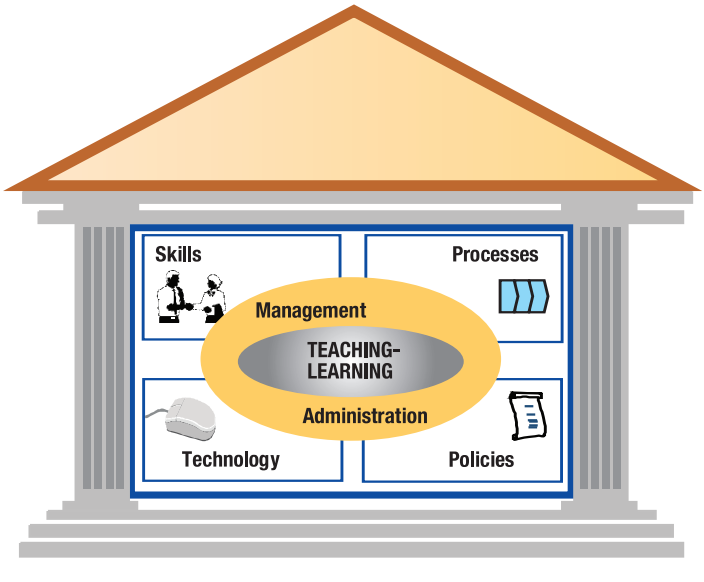
2.1 SMART SCHOOL COMPONENTS

The main components within the Malaysian Smart School are as follows:

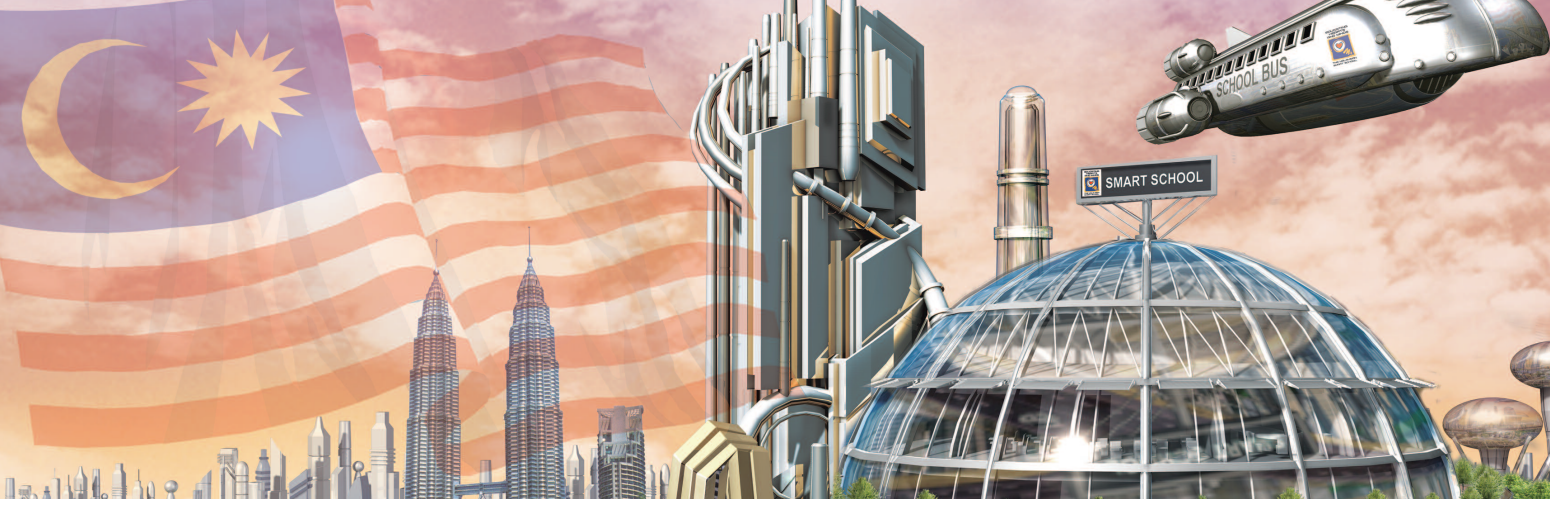
1. ***Teaching-learning Processes:*** The teaching-learning processes are the core or the "heart" of the Smart School. The processes relating to curriculum, pedagogy, assessments, and teaching-learning materials (TLMs), are reinvented to help students learn more effectively and efficiently. The Smart School enable students to practice self-accessed and self-directed learning, at their own learning pace.
2. ***Management and Administration:*** The management and administration of the Smart School, which represents the driver or the "brain" of the Smart School, is computerised. Management software helps the Smart School principals and headmasters to manage more efficiently and effectively the resources and processes required to support the teaching-learning functions.

The Smart School will enable students to practice self-accessed and self-directed learning, at their own learning pace

The Smart School Components



Source: The Malaysian Smart School Blueprint, 1997



3. ***Human Resources, Skills and Responsibilities:*** Parents, the community, and the private sector as stakeholders, play more active roles in improving the performance of the school. All these parties are constantly involved in professional and knowledge development relating to school management, teaching-learning, and other aspects of the Smart School.

4. ***Processes:*** The Smart School processes are viewed as a system. These processes have been and will continuously be studied reviewed carefully to ensure that the system provides accurate and functional input to produce the desired output.

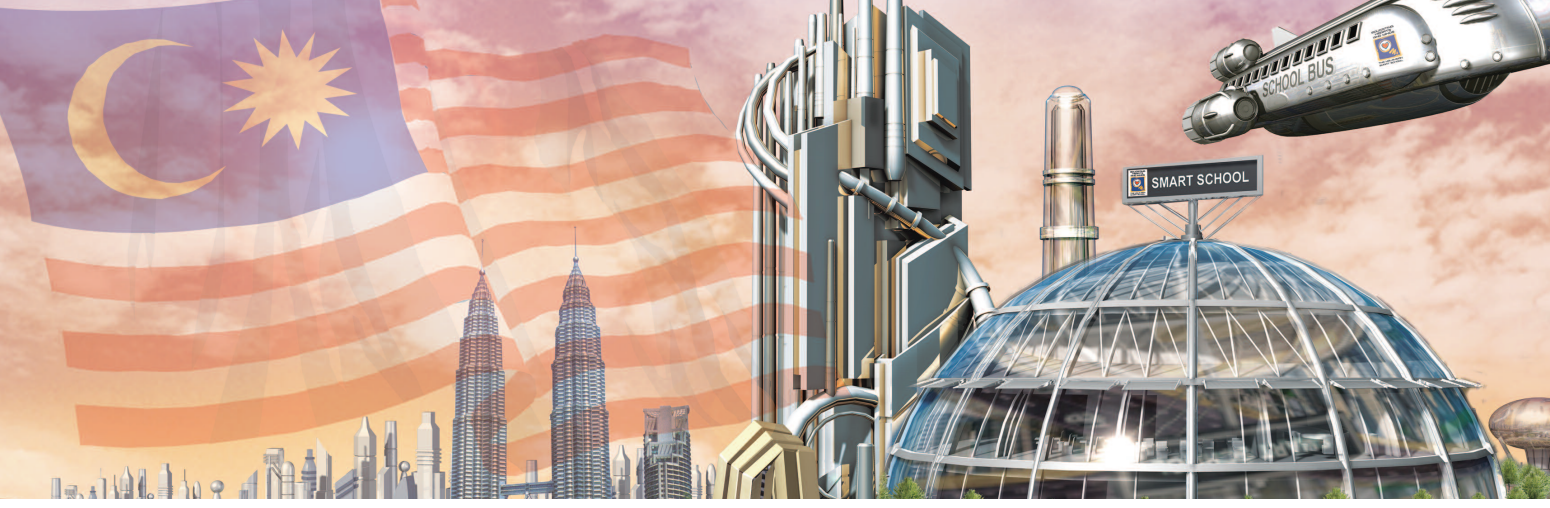
5. ***Technology:*** Technology is used as an enabler for Smart School practices in teaching-learning, management, and communications with external constituencies.

6. ***Policies:*** To ensure the successful implementation of the Smart School, changes in existing policies and regulations, as well as the formulation of new policies and regulations, have to be conducted.

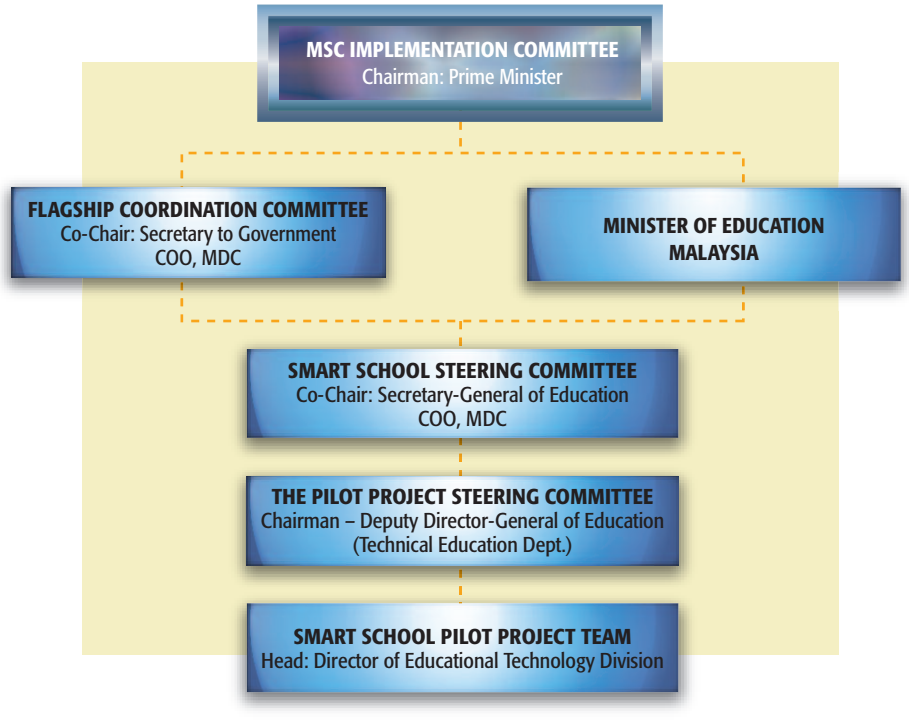
2.2 THE IMPLEMENTATION STRUCTURE

The implementation of the Smart School Flagship Application is directed by a high-level Implementation Council (Malaysia) chaired by the Prime Minister of Malaysia. This high-level committee plans and drives all the various flagships. Directly under this is the Flagship Coordination Committee (FCC) which is co-chaired by the Chief Secretary to the Government and the Chief Executive Officer of MDC, to whom the Smart School Flagship, along with the other flagships, reports the progress, identifies issues and suggests the next necessary steps.

At the MoE, the Smart School Flagship comes under the Smart School Steering Committee, which is chaired by the Secretary-General of Education. The members of the Committee include the Director-General of Education, the Deputy Directors-General, the Deputy Secretaries-General, Directors of the various divisions in the



Smart School Implementation Structure

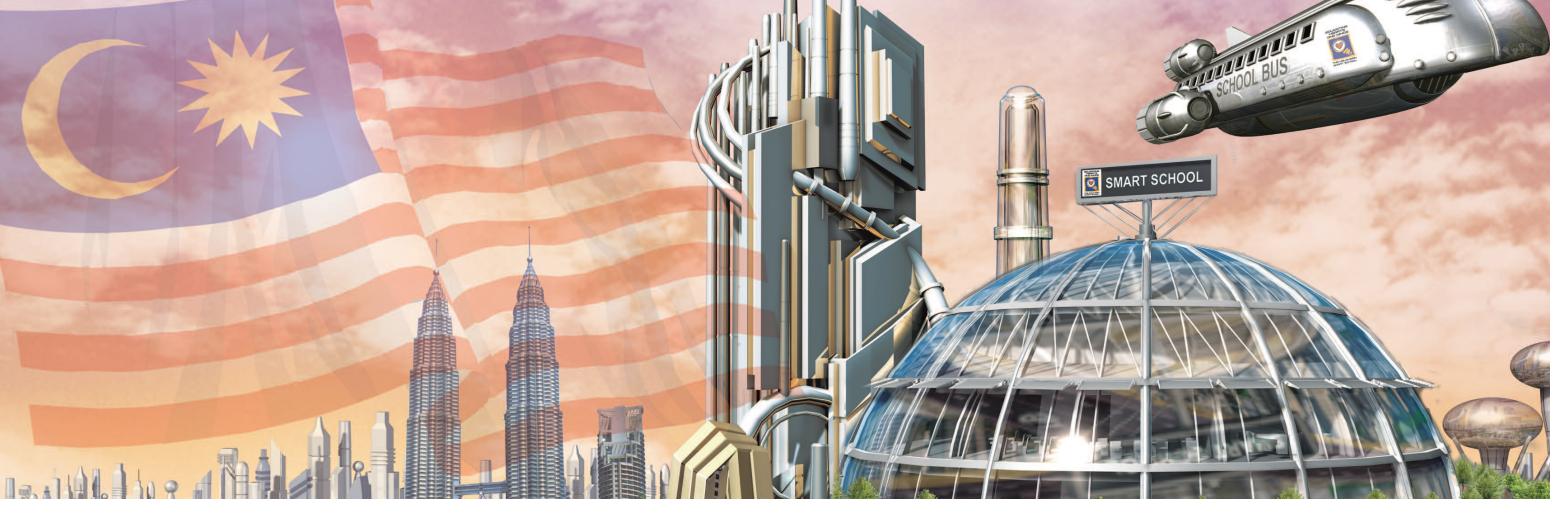


MoE, and representatives from the Treasury and Malaysian Administrative Modernisation and Management Planning Unit (MAMPU). There is also a dedicated Project Team that is responsible for all planning, development and implementation of the Smart School which resides at the Educational Technology Division (ETD).

The industry partner of this three-party collaboration is a joint venture company, TSS which comprises seven local companies. These are:

- Telekom Smart School Sdn. Bhd. (component provider for telecommunications services in the Wide Area Network, and the Local Area Network)
- Sapura Holdings Sdn. Bhd. (component provider for hardware, systems software and systems integration)
- Educational Trend Sdn. Bhd. (component provider for TLMs for English)

There is a dedicated Project Team residing at the Educational Technology Division, which is responsible for all planning, development and implementation of the Smart School



- DEMC Anzagain Sdn. Bhd. (component provider for TLM for Primary Mathematics)
- Digital Technology Sdn. Bhd. (component provider for TLM for Secondary Mathematics)
- Multi Media Synergy Corporation Sdn. Bhd. (component provider for TLMs for Malay Language)
- Custommedia Sdn. Bhd. (component provider for the Smart School Management System)

In addition, three multinational corporations were also involved in the development of Smart School Integrated Solution (SSIS). The three corporations are as follows:

- BT Multimedia (Malaysia) Sdn. Bhd. (component provider for Project Management and Implementation)
- Electronic Data Systems IT Services (Malaysia) Sdn. Bhd. (component provider for Systems Integration)
- NIIT Malaysia Sdn. Bhd. (component provider for TLMs for Science).

3. SMART SCHOOL: THE FOUR WAVES

The Smart School Flagship is one of the few initiatives in the region that incorporates strategic planning elements into its implementation Roadmap. At the outset, it was envisaged that a Pilot Project would be implemented and subjected to a proof-of-concept evaluation before subsequent phases are implemented. Full project rollout will take place where the concept solution fulfils the scope of the services required. The approach for the expansion phase is to enhance the scope of the project in terms of functionality and reach as well as increase the number of applications so as to encompass a broader spectrum of services.

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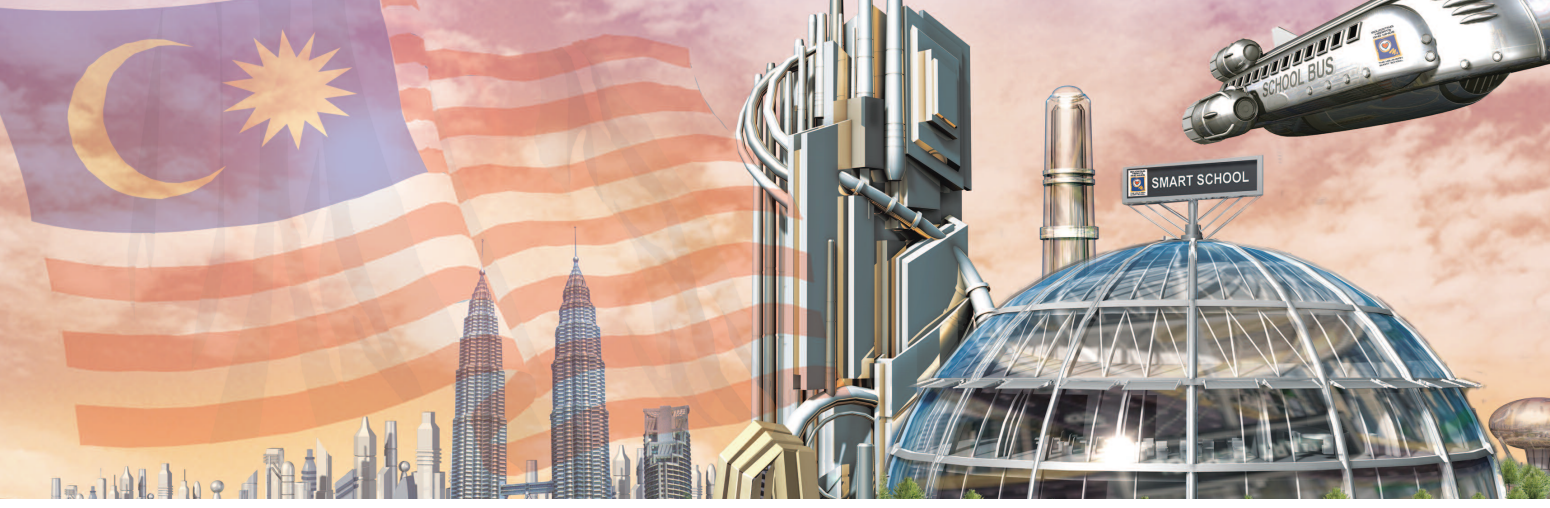
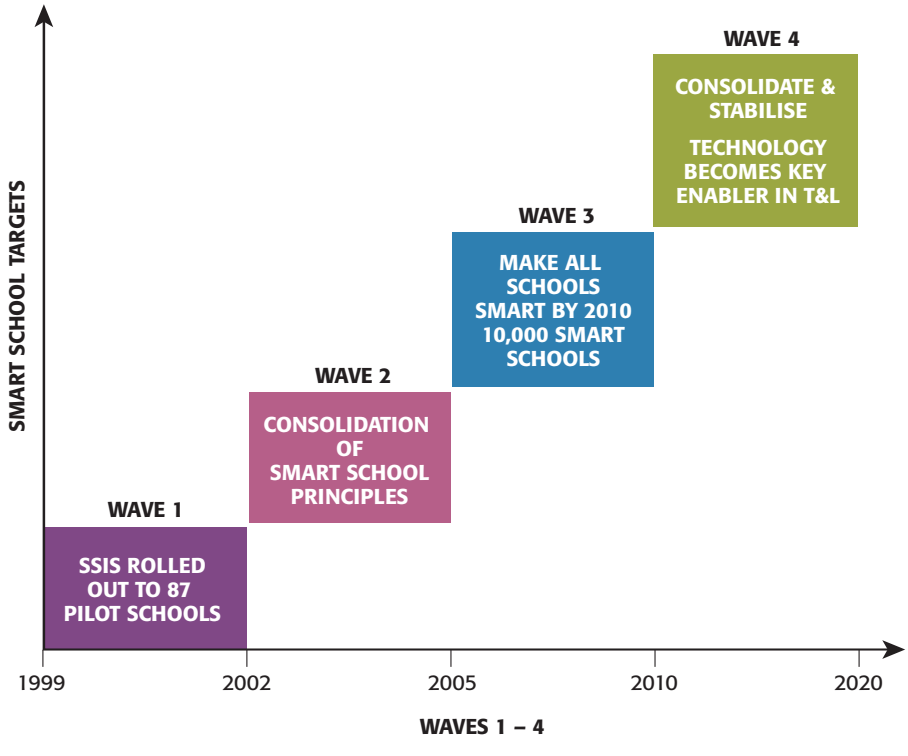
The milestones for the Smart School Flagship are set out in the following chart.



The Smart School Milestones (Four Waves)

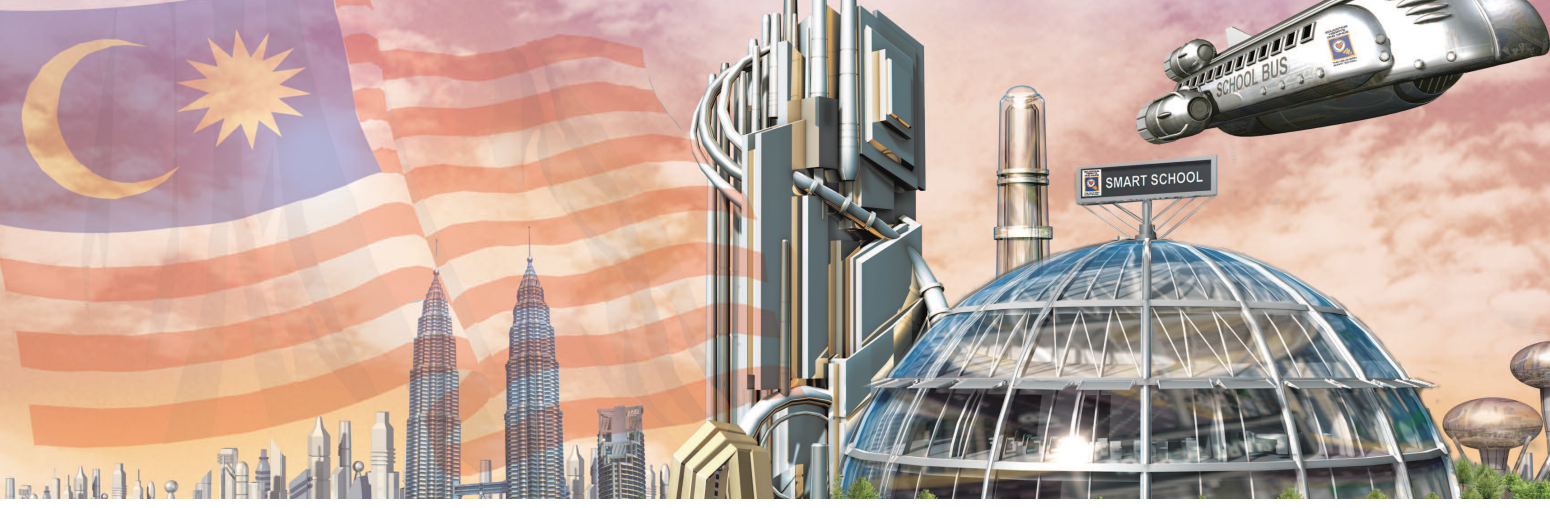


Source: Multimedia Development Corporation, 2005

The four waves of the Smart School implementation plan are:

1. **Wave 1 – The Pilot (1999-2002)**
2. **Wave 2 – The Post-Pilot (2002-2005)**
3. **Wave 3 – Making All Schools Smart (2005-2010)**
4. **Wave 4 – Consolidate and Stabilise (2010-2020)**

This document will summarise the outcomes of the Pilot and the Post-Pilot phases and describe in detail the key responsibilities of the different stakeholders.



4. WAVE 1 • THE SMART SCHOOL PILOT (1999-2002)

In order to implement the Pilot Project, a smart partnership was forged between the MoE, TSS and MDC, ensuring involvement from both the central and state levels. The MoE provided the educational expertise while the industry partner, TSS, was instrumental in realising the two-pronged objectives of the MSC and provided the solutions to fulfil the requirements and objectives of the Smart School.

The technology-enabled teaching-learning environment and school culture is anticipated to produce future scientists and inventors for a knowledge-based economy by 2020. The partnership leverages on the strengths of the three parties:

- MoE's educational expertise
- TSS's technological know-how for setting up the infrastructure, and developing applications & teaching-learning solutions
- MDC's strategic position and role in the ICT growth and development process of the MSC for forging partnerships with the industry.

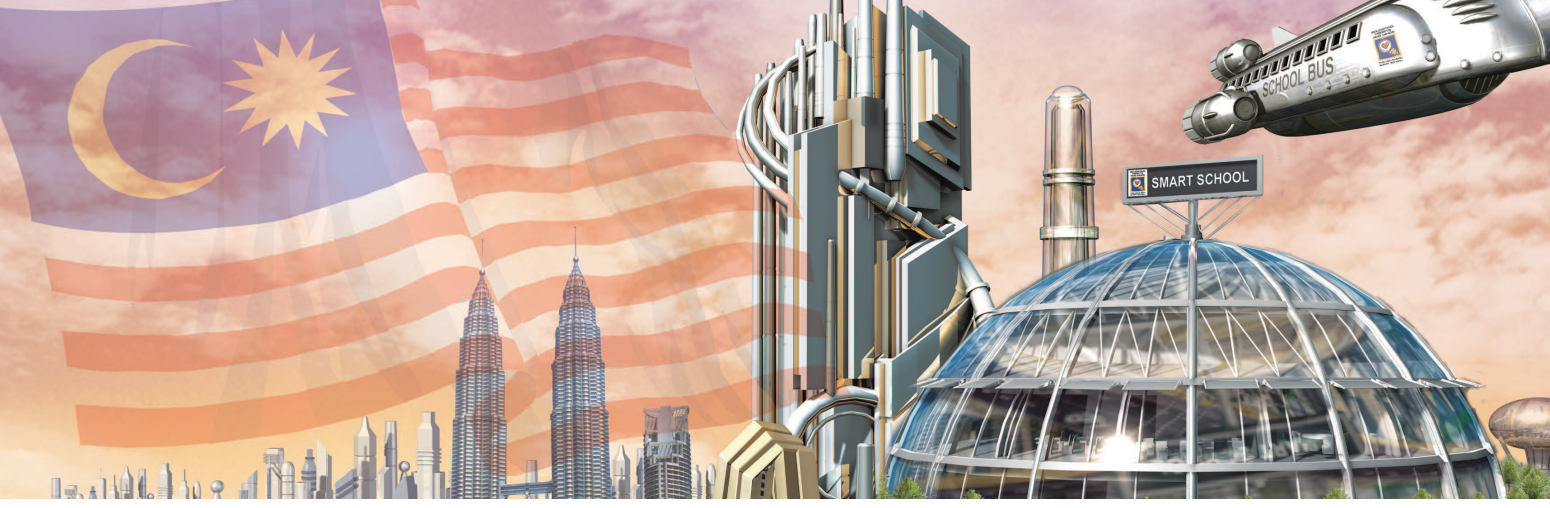
This synergy and combined expertise ensured the development and implementation of a comprehensive teaching-learning product, the Smart School Integrated Solution.

4.1 THE SMART SCHOOL PILOT PROJECT IMPLEMENTATION

The Conceptual Blueprint clearly states that the Smart School implementation comprises two phases, that is, a Pilot Project phase and a broad roll-out phase.

- Eighty-seven (87) Pilot schools were involved in the Pilot Project phase which tested three models of technology, that is, a computer laboratory model (Level B), a limited classroom model (Level B+), and a full classroom model (Level A).
- In the original Implementation Plan, the Ministry of Education would use the findings of the Pilot Project to prepare a Master Plan to ensure that all schools in the country become smart schools in stages, by the year 2010.

Eighty-seven (87) schools were involved in the pilot project phase, which tested three models of technology



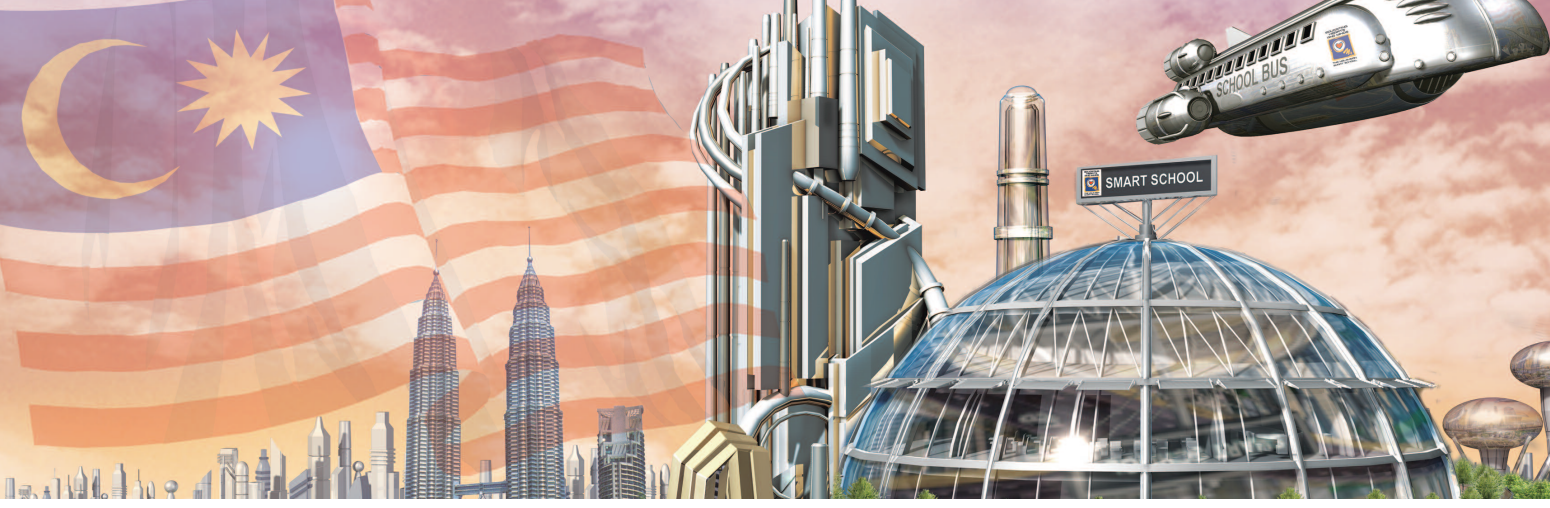
- In the broad roll-out phase, the Government of Malaysia is expected to play the role of architect and driver for the Smart School project in the following ways:
  – Prepare the guidelines and provide the basic amenities to schools according to their individual needs
  – Actively encourage all schools to become Smart Schools on their own initiative by using their own financial resources and expertise.

The Malaysian Government is expected to play both the role of architect and driver for the Smart School project

4.2 THE SMART SCHOOL INTEGRATED SOLUTION

The 87 pilot schools were identified to act as the nucleus for the eventual roll-out of Smart School concepts, materials, skills and technologies. This Pilot Project tested the Smart School Integrated Solution (SSIS) via the following components:

- The provision of ICT infrastructure and system
- TLMs (1,494 courseware titles) and related print materials for Malay Language, English, Science and Mathematics
- A computerised Smart School Management System (SSMS) with the management of major school functions provided in modular form
- A Smart School Technology Infrastructure involving the use of computers and non-IT equipment, Local Area Network (LAN) and a Virtual Private Network (VPN) that connects the schools to the Ministry's Data Centre and Help Desk
- Support services in the form of centralised Help Desk and a data centre which can provide teaching-learning and management support for the schools
- Related specialised services which form part of the SSIS such as systems integration, project management, business process reengineering and change management to achieve a total solution to all the teaching-learning, management and leadership functions of the school
- The provision of training for teachers, Principals and School Heads in Smart teaching and learning, the use of Smart School applications software, courseware, and ICT literacy. Training is also be imparted on how to utilise the LAN for TLM and the Help Desk when assistance is needed or a problem needs to be resolved



- The post of an ICT Coordinator for Smart Schools approved by the MoE and made available to assist teachers in the day-to-day operations of infrastructure and the dedicated software.

The implementation phase, 1999-2002, was closely monitored by the parties concerned, i.e. the MoE, TSS and MDC. Issues were resolved at the steering committee and monitoring meetings attended by the three main players.

When the Pilot Project was successfully concluded in 2002, a consortium of evaluators made up of experts from the local universities was commissioned by the MoE/MDC partners to conduct an evaluation of the project. This evaluation work began in April 2003 and a report of the findings was published in 2004. There was also a review by a MoE/TSS team of 'Power Rangers' and a benchmarking study. These serve to illustrate the current status of Smart Schools.

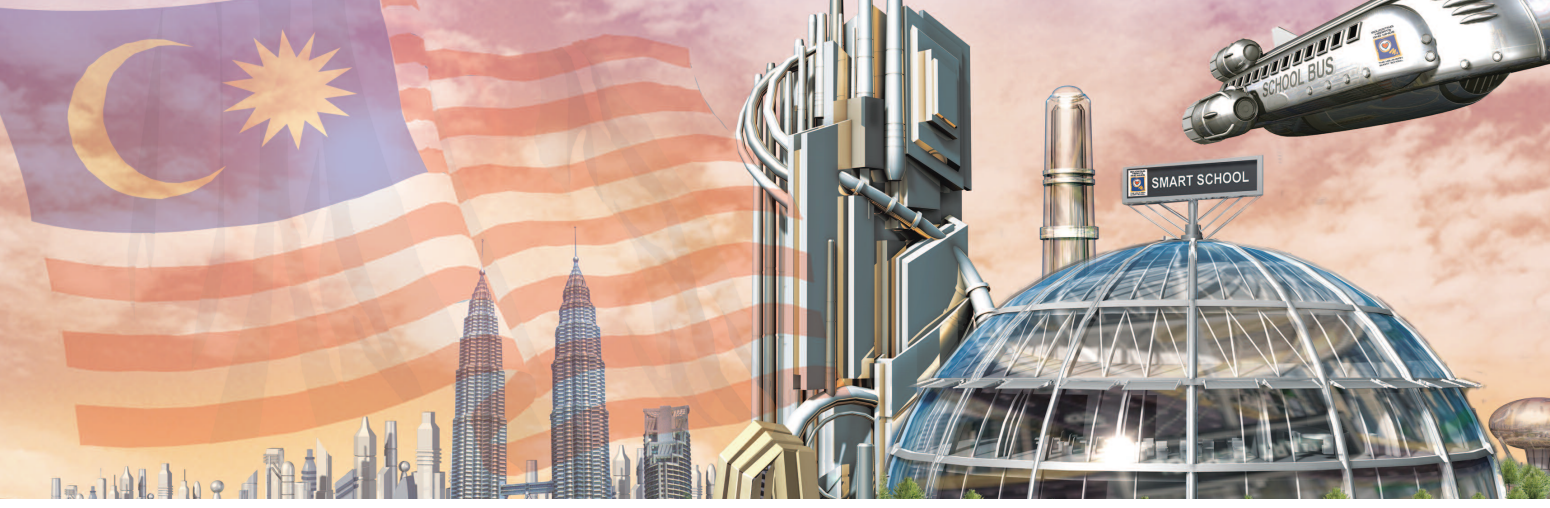
4.3 THE POSITIONING OF THE SMART SCHOOL

The challenges related with "new ways" of doing things, hardware maintenance and technology obsolescence were amongst the main concerns of all stakeholders

Although there were no major difficulties identified, it was evident from the start that the schools provided with Level B ICT infrastructure found it difficult to share the lab facilities between the classes. The SSMS, developed in three (3) releases was not introduced until a few years into the program. The challenges with "new ways" of doing things, hardware maintenance and technology obsolescence were main concerns amongst all stakeholders. Maintenance of hardware was problematic and breakdowns were frequent.

A review was undertaken by a support and monitoring team made up of ETD/TSS personnel. The team was able to identify a list of common issues that were constraining many pilot schools from developing into fully-functioning "Mentor" schools after the pilot phase was completed in 2002. The common issues are listed based on the feedback from the support and monitoring group.

It is imperative to note that the period 1999-2002 was actually subsumed by developmental activities. The full integrated solution was utilised fully only in March 2003.



4.3.1 Feedback from Review by MoE/TSS Team (The Power Rangers)

4.3.1.1 Technology/Infrastructure/Help Desk (February–March 2003)

- The MoE Help Desk, which was handed over by TSS at the end of the Pilot, was facing problems in addressing queries within a stipulated time-frame.
- Infrastructure and technology problems could not be addressed effectively as there was no dedicated manpower to assist in such tasks.

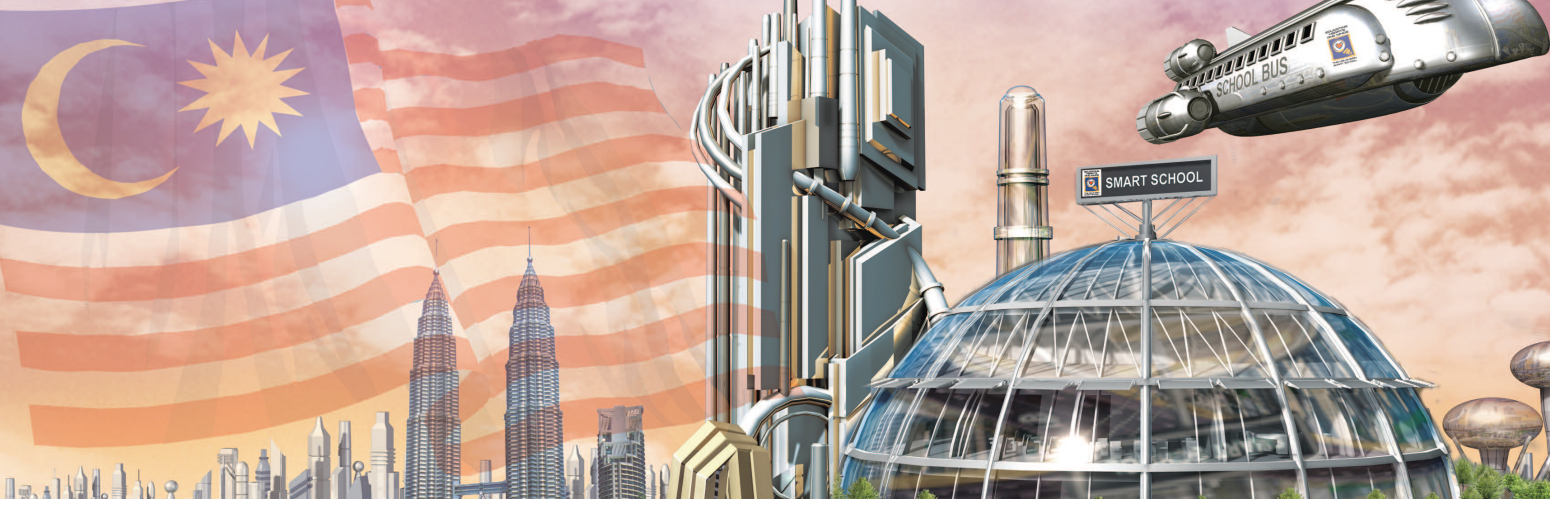
4.3.1.2 Utilisation of Software Applications and Courseware

The Power Rangers group reported the following findings with regard to use of the SSIS applications and TLM:

- The Smart School courseware was found to be under-utilised as schools preferred to use the newer courseware produced to teach Science and Mathematics (PPSMI) by the MoE. Since, Science and Mathematics were being taught in English in Primary Years 1 to 3 and Secondary Forms 1 to 3, while the Smart School courseware was in Malay Language.
- Other parallel projects (e.g., Microsoft Partners in e-Learning, the Open Source Project, the ICT-integrated teaching courseware for Science and Mathematics in English – PPSMI) had some influence in teachers' commitment to using the SSIS.
- Teachers were not keen on using the SS courseware as they found usage of materials directly related to exam preparation saved precious teaching time.
- Lack of monitoring and support made teachers less inclined to be rigorous in implementing TLM the SSIS way.
- Teachers needed more training to use the SSIS courseware, and be comfortable with using ICT in general.

4.3.1.3 Smart School Management System (SSMS)

- There were other systems from other divisions and departments that had to be installed and used. Schools found these demands overwhelming.
- SSMS utilisation was reported at 40%-50% because there were too many systems to be implemented at once.



The Power Rangers recommended adequate and dedicated technical support to be provided by MoE. If resources were unavailable, then it suggested MoE should outsource

4.3.1.4 Recommendations from the MoE/TSS Review

The most important recommendations made by the review were in the area of technical maintenance and the need for more supportive monitoring of schools.

1. The review recommended suitably adequate and dedicated technical support to be provided by the MoE. Outsourcing of support from vendors was suggested as an alternative.
2. Outsourcing was recommended for asset management, maintenance and upgrading of hardware and other infrastructure components. The review also strongly suggested regular monitoring by the MoE.

4.3.2 Evaluation by the Local Academics (March–April 2003)

This was carried out approximately less than three months after the complete deployment of the SSIS. The findings of the study are listed below.

4.3.2.1 Teaching-Learning Materials

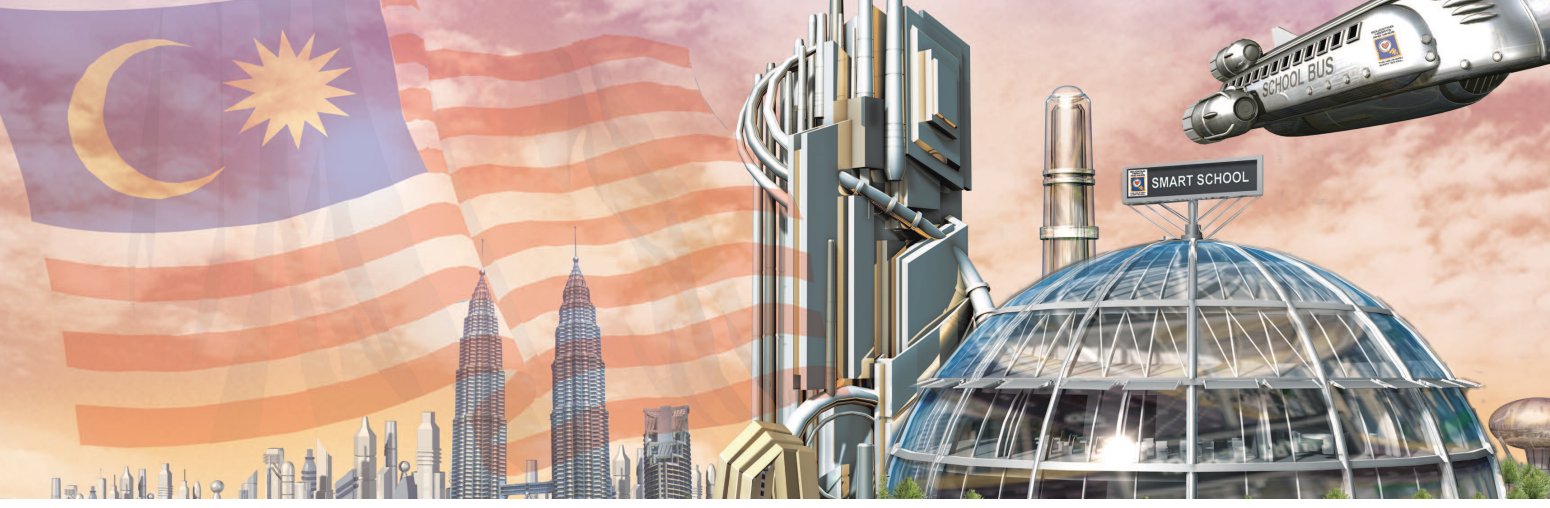
On an average, the teachers used the computer labs for teaching-learning only for four times in a month. They were also not inclined to use the lesson planning software because of its perceived limited practical usefulness

The TLMs were received well by both teachers and students. However, the frequency of their usage was limited as some of the lessons could not adequately cater to the students' needs and did not reflect the complete curriculum.

The study found the teachers used the computer labs for teaching-learning only four times a month on an average. There were limitations in using the lesson planning software. Teachers' competence in the four subjects for which courseware was provided was reported to be satisfactory.

4.3.2.2 Teacher Training

Almost half the teachers surveyed mentioned that in-house training for subject teachers was only moderately successful in achieving its objectives. Majority of them said the training was not sufficient enough in helping them apply the SSIS principles.



There was lack of repeat training for 'new' teachers who had just been transferred to the Smart School on how to teach the 'smart' way.

The overall rating for in-house training was satisfactory, although Senior Assistants and Afternoon Supervisors of schools said that their teachers needed more (effective) training than what was available and delivered in-house.

4.3.2.3 Response to Change

Overall, the end users, the SSIS coordinator, subject teachers and management staff did not appear to have been overwhelmed by the changes heralded by SSIS in teaching-learning and school management.

4.3.2.4 Technology Infrastructure

Most schools reported that the computer lab(s) were not adequate in number. A number of schools did not have enough computers for students' use. Hardware problems related to the LAN, PCs and servers were also reported.

4.3.2.5 Help Desk

The service rendered by the central MoE Help Desk was reported to be satisfactory. TSS, which was managing the Help Desk during the Pilot Wave, received a subsequent extension for this service contract.

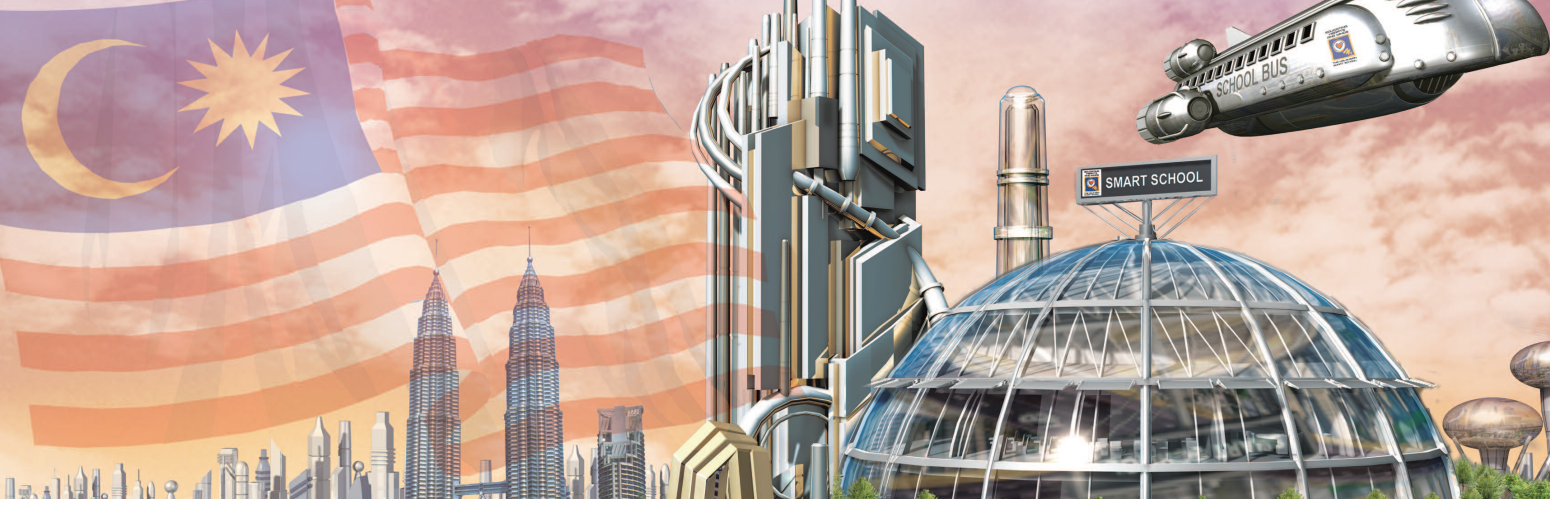
4.3.2.6 The Smart School Management System (SSMS)

The Principals and Heads of schools reported that they knew how to utilise 16 out of the 31 SSMS components. On-site visits, however, found that actual use of the SSMS was minimal to moderate.

Principals and Heads of schools were confident in their ability to handle the SSMS although they reported problems utilising three of the SSMS components – financial management, personnel management and premises and facilities management.

Most Principals and Heads of schools rated the success of SSIS as moderate. They said the success rate could have been higher if SSMS, which formed the backbone of the SSIS, was more stable and utilised to the fullest.

Principals and Heads of schools were confident of their ability to handle the SSMS although they had reported problems in utilising some of its components namely financial management, personnel management and facilities management modules



4.3.2.7 Students and Parents' Feedback

The study found that students were not aware that the SSMS was being used in their schools. Similarly, parents too were not well-informed about the unique features of their children's 'smart' school, though they knew that their children attended a 'smart school'.

Despite the bottlenecks in the usage of TLMs and the SSMS, there was consensus that the concept and the blueprint of Smart Schools and the TLM culture propagated by it were visionary.

Benchmarking of the Smart School Integrated Solution by Frost & Sullivan with similar programs in eight (8) other countries revealed that Smart School in Malaysia was exceptional as an educational initiative

4.3.3 The MoE/MDC Benchmarking Study

A benchmarking of the Smart School Integrated Solution by Frost & Sullivan with eight (8) other countries demonstrated that the Smart School initiative in Malaysia was exceptional as an educational initiative even when compared with advanced countries of the world such as Australia, Britain, Canada, Ireland, Japan, New Zealand, Singapore and the USA.

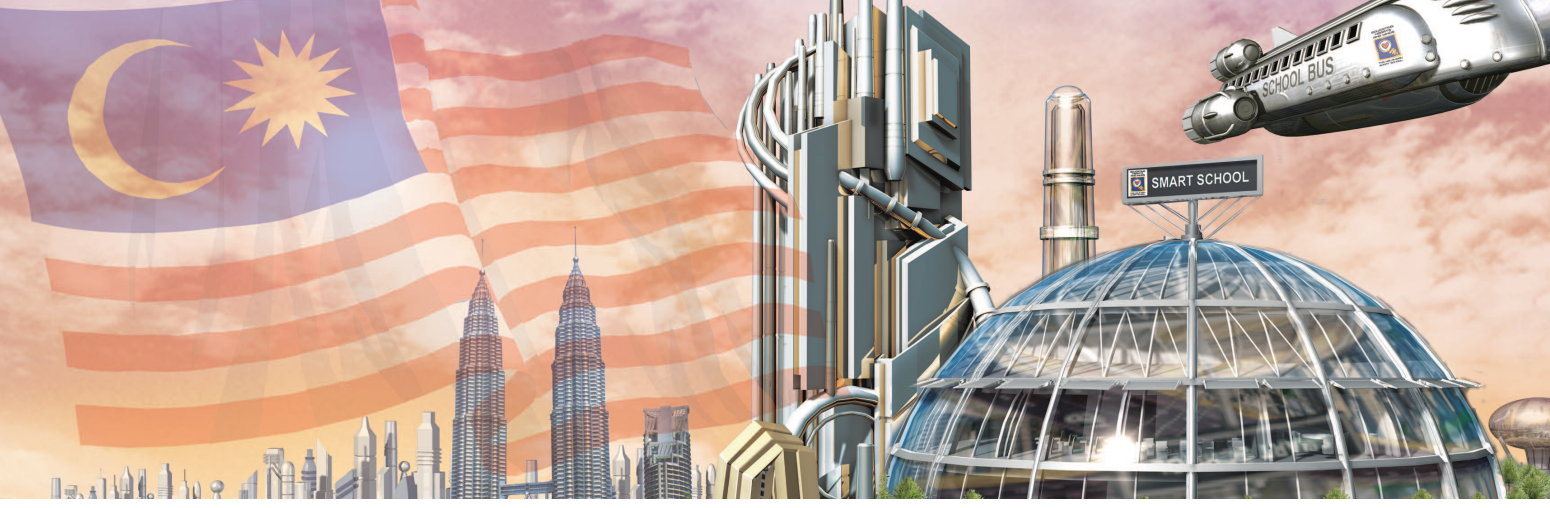
4.3.3.1 SSIS, One of a Kind

The study reported that no other country had contemplated automating the entire school process. Full automation was the practice only in the very affluent residential schools in these advanced countries. The Malaysian achievement was all the more significant as it had brought such sophisticated advantages within the reach of the average child attending a smart government school.

A comprehensive set of courseware consisting 1,494 titles covering subjects such as Malay Language, English Language, Science and Mathematics was developed within the country

4.3.3.2 Tailor-Made Courseware

Most learning courseware in other countries is private-sector-owned and developed for a generic market. In contrast, the Smart School teaching-learning courseware was tailor-made for the Malaysian curriculum. Malaysia had in fact developed a comprehensive set of courseware comprising 1,494 titles covering Malay Language, English Language, Science and Mathematics.



4.3.3.3 Creation of Skilled Talent Pool

The Smart School initiative also resulted in the training and development of a pool of ICT-skilled people associated with the project, i.e. teachers, students and administrators who would not have had the same opportunities had there not been the SS pilot. These include the skills of:

- Understanding and managing technology
- Planning and managing student learning environments through the use of ICT
- Managing the social, ethical and human issues surrounding the use of technology

4.3.3.4 School Processes Become Efficient

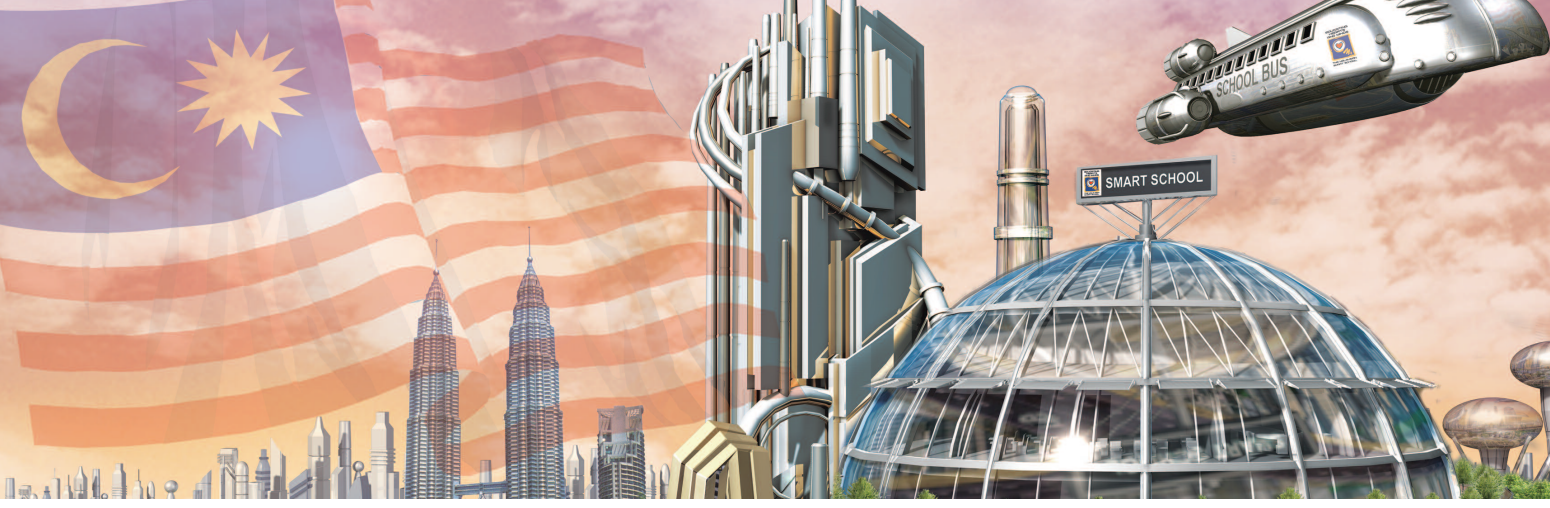
The SSIS Pilot also resulted in the use of more efficient school processes both in terms of school management and teaching.

This was aimed at increasing productivity and a higher level of professionalism all round in the 87 schools.

4.3.3.5 Recommendations of the Benchmarking Study

The benchmarking study has made the following recommendations that echoed the sentiments of the other parallel studies mentioned in this report:

- Intensify change management programs and pedagogy training for all teachers on how to integrate ICT in teaching and learning
- Introduce enforcement strategies in schools, in terms of key performance indicators (KPIs) and policy so as to achieve targeted utilisation rates
- MDC should lead a high performance management team to assist in the above issues.



4.3.4 Lessons Learnt from the Pilot

The Pilot period was hugely subsumed by development activities for application, installation, testing and integration. The actual usage of the total solution, as a result, was not fully realised until early 2003 when the complete SSIS was deployed and accessed by users.

However, **there were various issues and challenges from the pilot that are summarised as follows:**

- **Infrastructure readiness**
- **Connectivity**
- **Change management**
- **Parallel ICT initiatives**
- **Training**
- **Technology obsolescence**
- **Policies**

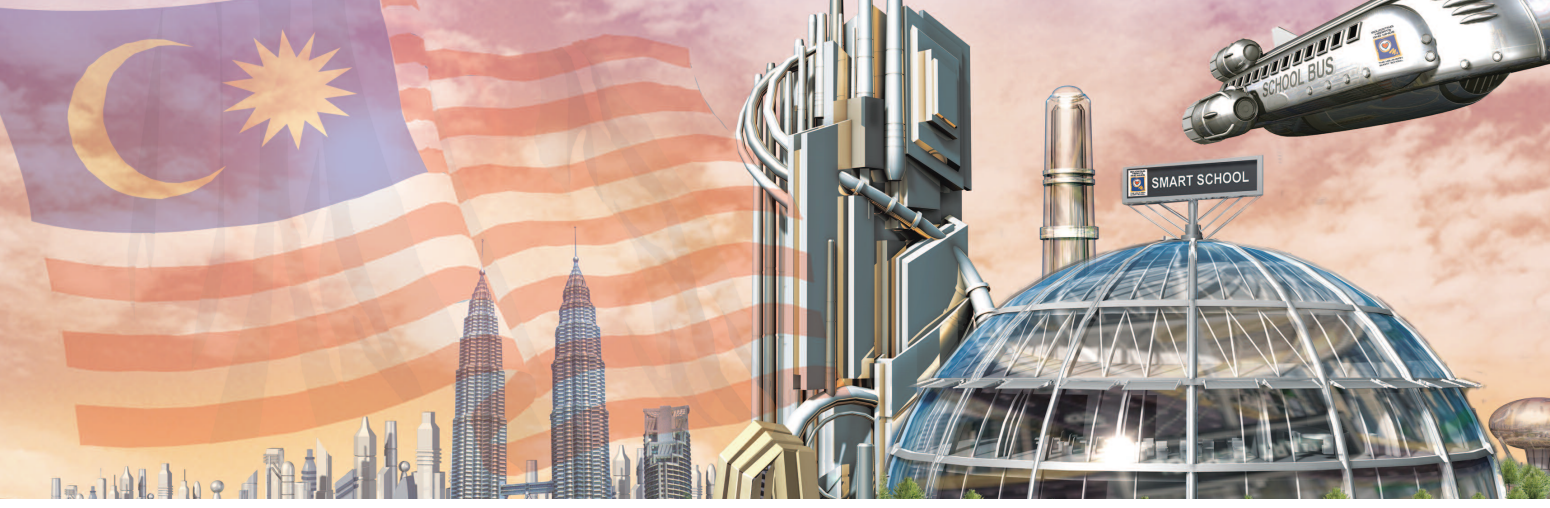
It was envisaged that the Post-Pilot stage and the subsequent expansion phase would address the above challenges, in correspondence with the government's resource readiness.

4.4 ENHANCEMENT EFFORTS

The Smart School concept is still a 'work in progress' and remains open to evolutionary refinement, including advances in pedagogy and improvements in information technology

As stated in the Smart School Conceptual Blueprint, the Smart School concept is a work in progress and remains open to evolutionary refinement, including advances in pedagogy and improvements in information technology. Consistent with this, the Smart School implementation progress and enhancement takes into consideration other efforts of expanding the role of ICT in Malaysian schools.

To date (2005), there have been several enhancement efforts by various parties to expand the role of ICT in Malaysian schools. These are mainly the ICT-enabled teaching of Science and Mathematics in English (PPSMI), the government's school computerisation project aimed at equipping all schools with PCs



and a computer lab, and the SchoolNet project which provides connectivity to all schools.

With these efforts coming after the implementation of the SSIS, there has arisen a need to integrate these parallel efforts, as enhancements to the total Smart School model. Chief among these is the PPSMI and, as with the PPSMI, the SSIS must make the transition to English for Science and Mathematics teaching. As the PPSMI produces teaching courseware and the SSIS produces learning courseware, a combination of the two will strengthen teaching-learning in the classroom. These recommendations are taken up again in the Roadmap, where they will be discussed more comprehensively together with other directions the Smart School must take.

As the PPSMI produces teaching courseware and the SSIS produces learning courseware, a combination of the two will strengthen teaching-learning in the classroom

5. WAVE 2 • THE POST-PILOT (2002-2005)

5.1 THE KEY OUTCOMES

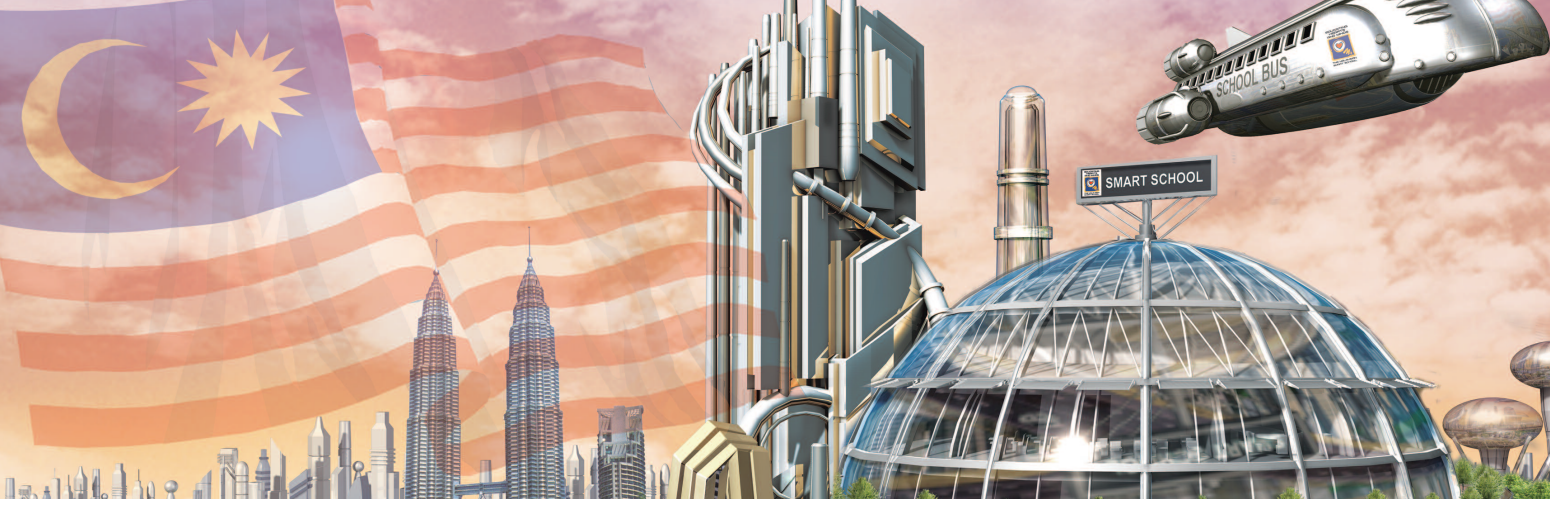
5.1.1 ICT AS A KEY ENABLER FOR LEARNING

The Roadmap outlined in the subsequent sections advocates a way to implement ICT-integrated teaching more effectively and to obtain all stakeholders' support to the nationwide implementation of the Smart School.

5.1.2 MONITORING AND CORRECTIVE ACTION KEY IN ATTAINING TARGETS

The monitoring and corrective measures are so critical that negligence in addressing constraints highlighted in the various studies will jeopardise the successful implementation of the Smart School.

There is an urgent need for supervision and support. Hence, the Roadmap will need to incorporate this as an integral part of the expansion plan for Smart Schools.



5.1.3 Seek Further Enhancement of SSMS Utilisation

The Smart School Management System (SSMS) holds the promise of a total, comprehensive and complete approach to learning. Measures to improve the SSMS and schools' transition to a knowledge culture will be facilitated strongly. While improving the user-friendly aspect of the SSMS, steps will also be taken to integrate parallel efforts such as the PPSMI, the school computerisation program and the SchoolNet project.

6. WAVE 3 • MAKING ALL SCHOOLS SMART (2005-2010) & WAVE 4 • CONSOLIDATE AND STABILISE (2010-2020)

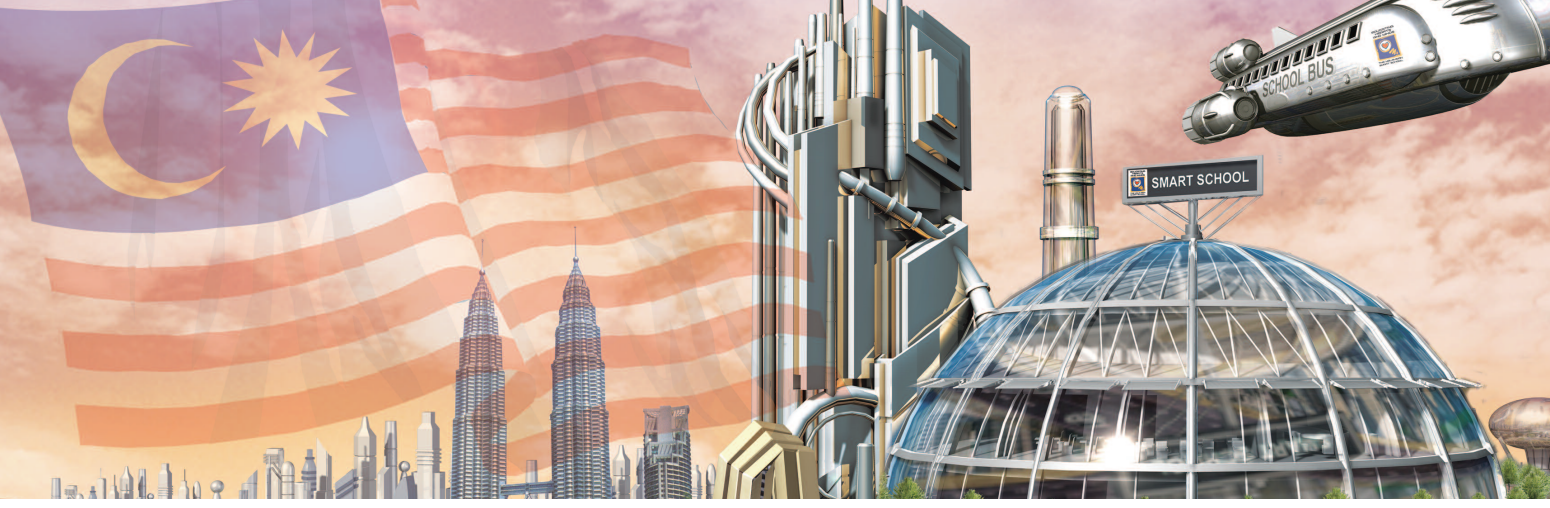
The strategic Roadmap identifies and puts in perspective the objectives, the time-frame, the stakeholders and their key responsibilities

Keeping in mind the critical milestones for Smart School, a strategic Roadmap has been developed in order to put in perspective the objectives, the time-frame, the stakeholders and their key responsibilities. This Roadmap is a strategic one, and not an operational plan. Details of its execution will have to be worked out between the various divisions of the MoE and its partners.

The Roadmap comprises the following key components:

- Identify the stakeholders as customers
- Identify the roles of different stakeholders and customers
- Performance-based management for the implementation of the Roadmap
- Set clear attainment targets and fixed timelines from 2005 to 2020
- Concretise a Malaysian Smart School scenario in 2020

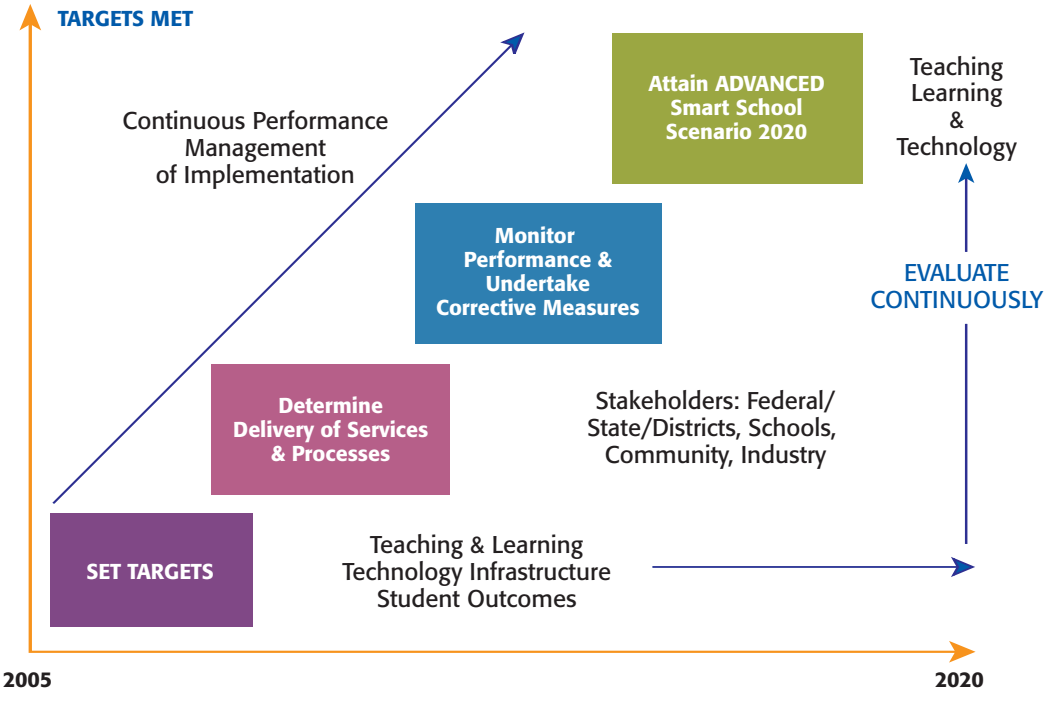
The Roadmap begins with the setting of targets to realise an advanced Smart School scenario by 2020. These targets will clarify the deliverables expected of the main players and stakeholders consisting of representatives from the MoE and its industry partners, parents, teachers and students.



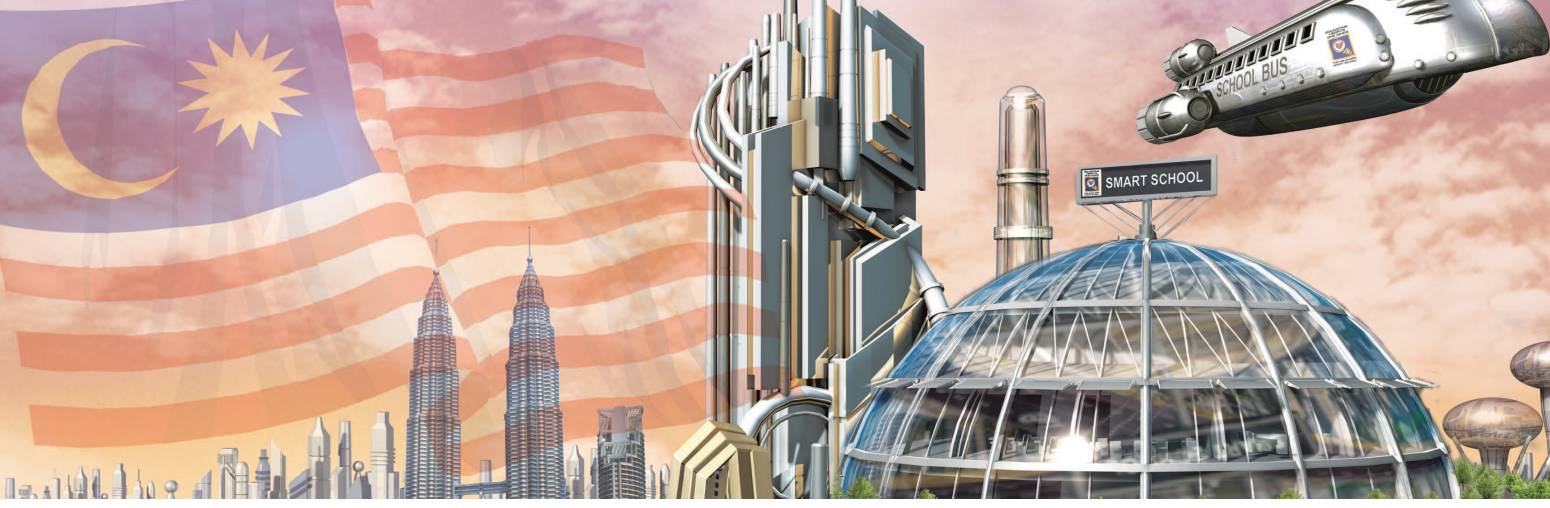
The deliverables are in the form of services to be delivered such as materials, training, etc. It also means delivering on quality, i.e. quality of materials and quality of training. The Smart School expansion process adopts a performance-based approach where progress is evaluated and reported and feedback gathered for immediate corrective action. The Roadmap will eventually lead to the realisation of an advanced Smart School scenario by 2020.

The main components and features of the Roadmap are illustrated below:

The Smart School Roadmap



Source: Multimedia Development Corporation, 2005



Five (5) stakeholders as customers have been identified as key to the success of the Smart School. The different stakeholders are:

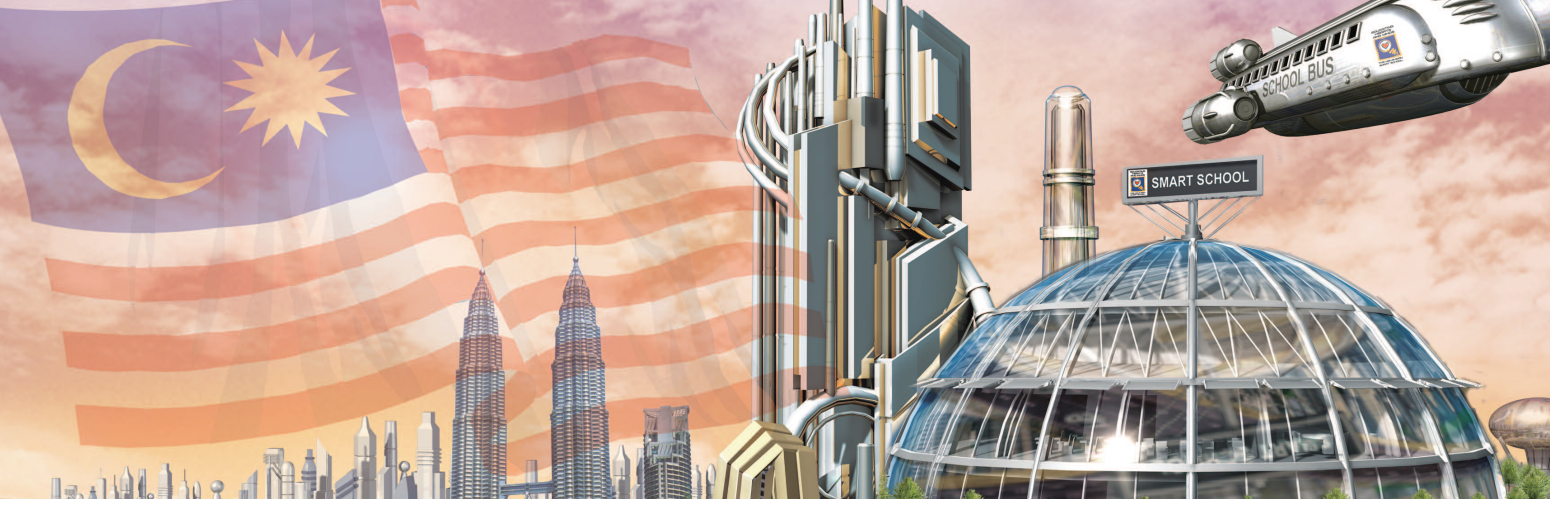
Smart School Stakeholders

6.1 ROLES OF STAKEHOLDERS, PLAYERS AND KEY CUSTOMERS

One of the initial steps in the Roadmap is to clarify the roles of stakeholders and key customers. This is to ensure that the stakeholders fulfil their responsibilities for the Smart School expansion plan. For the stakeholders to deliver services with ease and facilitate processes, they need to identify common goals. Such a buy-in will ensure that they execute their roles and function more effectively and deliver the services required to make all schools smart.

6.1.1 Roles & Responsibilities of School Stakeholders

The School Stakeholders consist of school administrators, teaching staff, non-teaching staff and students.



6.1.1.1 School Administrator

- Ensure effective and optimum usage of hardware and courseware
- Develop a good monitoring system to enhance teaching and learning in classroom
- Develop effective management support for teaching and learning
- Render training to users at all levels, i.e., management, teachers and pupils
- Form smart partnerships with non-government organisations (NGOs) and the private sector

6.1.1.2 Teaching Staff

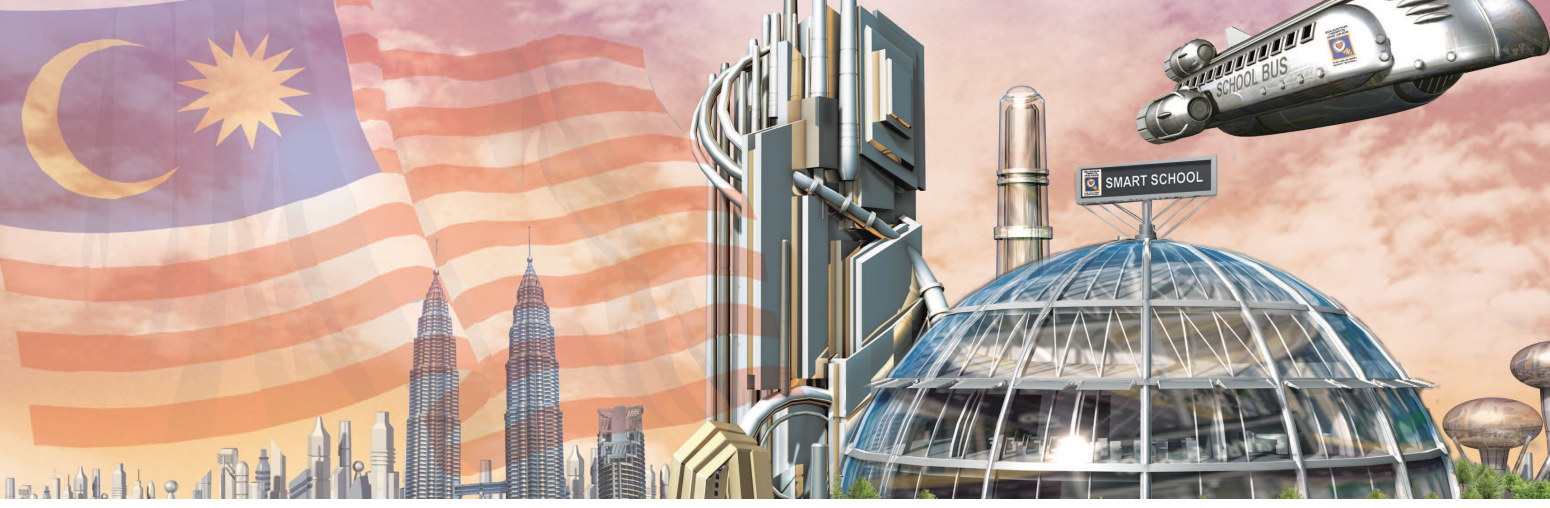
- Address fear of technology and change
- Strive for continuous education even if students decide to pursue non-academic careers (e.g., singers, athletes)
- Go beyond portal stage to using applications such as planning and scheduling of lessons online
- Nurture balanced thinking among pupils

6.1.1.3 Administrators, Teachers and Non-Teaching Staff

The school personnel play a key role in achieving the vision of a fully functioning Smart School scenario in Malaysia by 2020. Their main role is to create a teaching-learning environment that can provide the following:

- Education, not in the sense of acquiring "knowledge for knowledge sake" but rather to respect knowledge and to have an awareness of the uses knowledge can have for personal and societal gain.
- Teaching-learning that engages and drives students to want to know more.
- Education not for the sake of passing examinations and scoring excellent grades but one that will help the child meet challenges effectively.

The learning environment should provide education, not in the sense of acquiring "knowledge for knowledge sake" but rather to respect knowledge and to have an awareness of its uses for personal and societal gain



6.1.1.4 Students

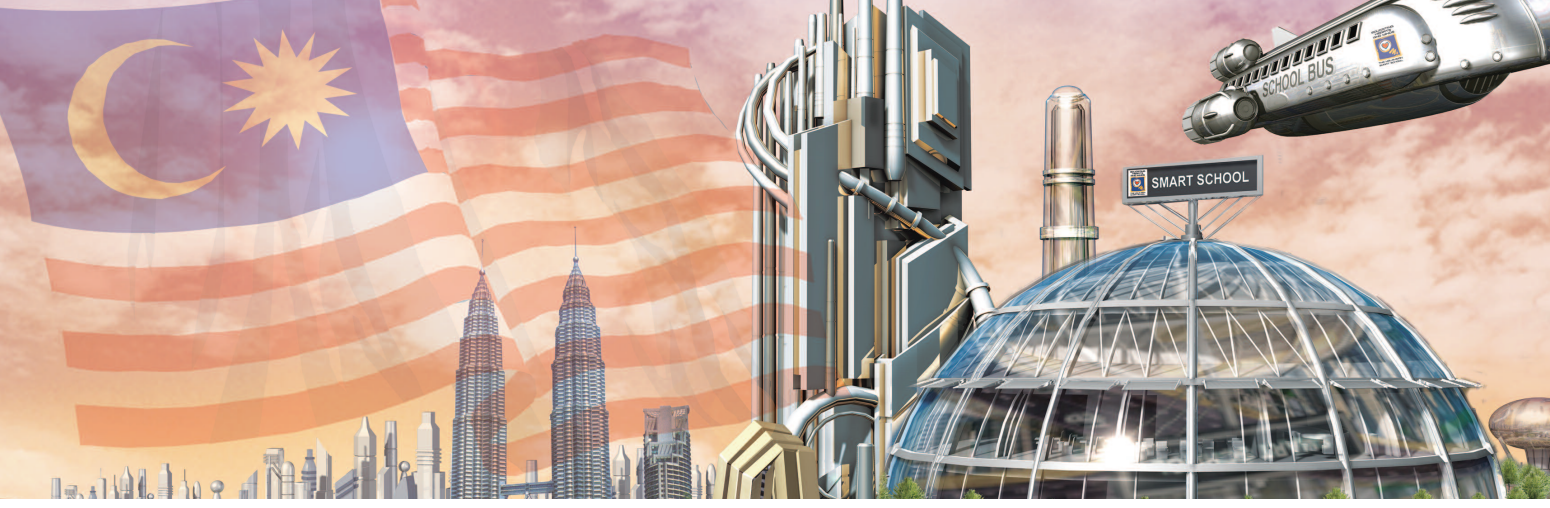
Students play a pivotal role in making the Smart School vision a success. They need to reap the benefits of self-paced learning, learning away from school and making learning a creative and enjoyable experience. The Smart School scenario calls for redefining the role of the teacher and the student, which would sometime result in role reversals where the students are encouraged to play a more active role in the teaching-learning process instead of being mere passive recipients of knowledge.

In the smart learning scenario, students will make extensive use of facilities that can help them learn in the school as well as away from it. The formation of help-groups such as the "Bestari Brigade", where students help with troubleshooting and maintenance of the ICT infrastructure in schools heralds changes in the role of students in the teaching-learning process.

The ultimate vision of the Smart School is where students work in distributed, collaborative groups, playing a more proactive role in the teaching-learning process. Learning will eventually become student-centric, with the students becoming experts in "managing" the learning environment.

6.1.1.5 School Stakeholders' Influence on Learning

Teachers and the entire school personnel including the non-teaching staff have a stake in driving the desired outcomes in the pervasive Smart School scenario of 2020. They achieve this by creating a suitable school environment. One of the ways is through the optimised usage of the ICT facilities and the teaching and learning materials that can contribute to the students' growth and development.



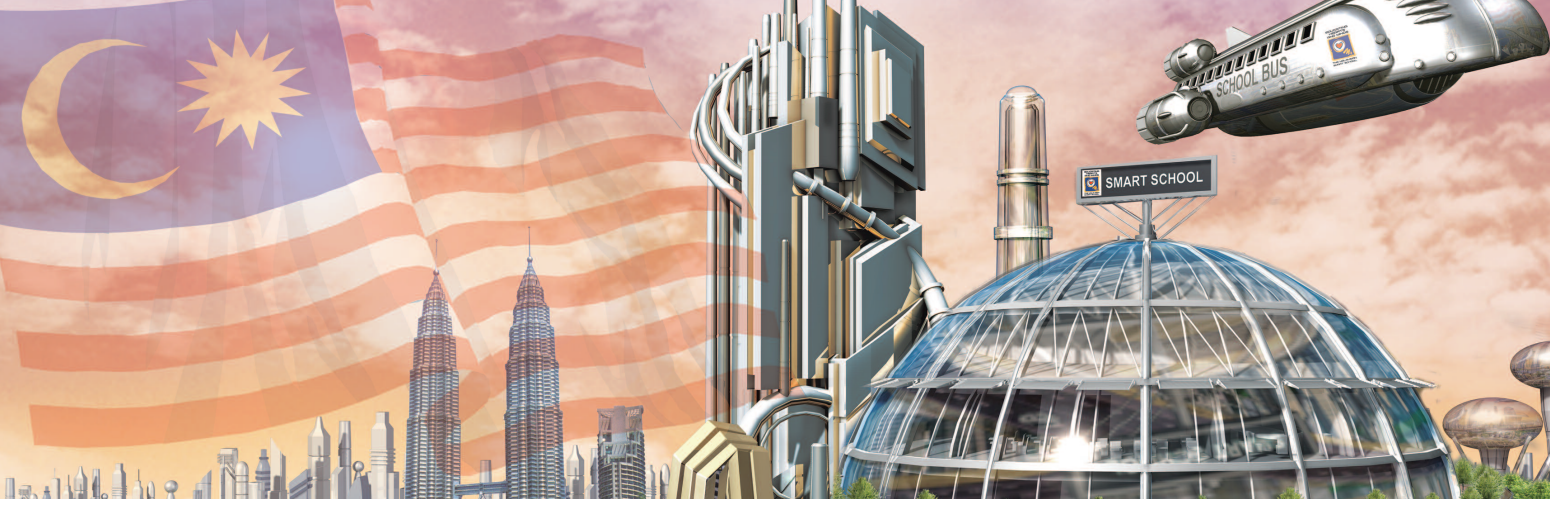
It is particularly important that students' strengths in the arts, humanities and recreational fields are also honed and developed while at school to ensure a rich, vibrant, balanced Malaysian society. All these are possible within an environment that allows a more self-paced, self-accessed and self-directed learning without the threat of formal examinations and their accompanying inflexible schedules.

6.1.1.6 School Stakeholders' Influence on Teaching

Teachers, the administrative staff and school management will also need to transform themselves to realise the vision of the Smart School of 2020, such as keeping up-to-date with current practices. Educational technology is leveraged by teachers for teaching and learning needs such as problem solving, critical thinking and the acquisition of new content. Part of this involves participation in professional networks, allowing exchange of experiences and ideas and open discourses on effective methodology to take place. Teaching and learning need not cease outside of school hours as teachers can choose to continue to interact online to provide additional support with homework tasks and assignments.

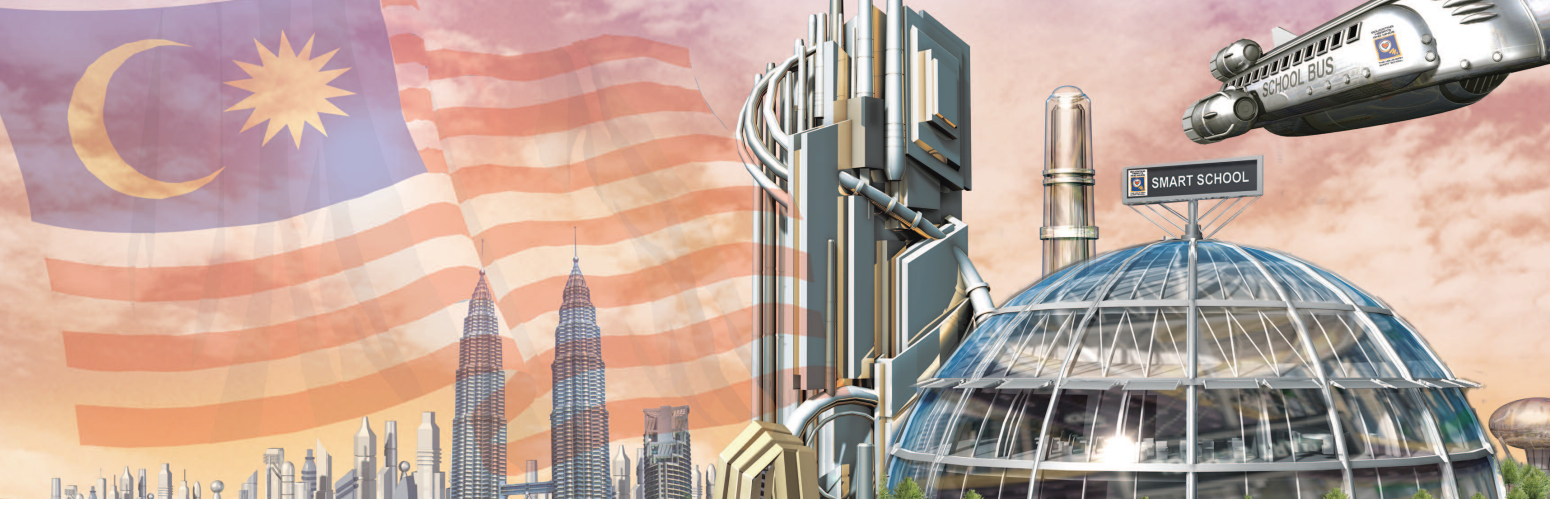
6.1.1.7 School Stakeholders' Influence on Management

It is expected that in the Malaysian scenario of 2020, in which every school is a Smart School, schools will be managed by trained, qualified, professional educational managers. These managers are familiar with a specialised curriculum area and are technologically savvy so that they can play effective and simultaneous roles as curriculum and instructional leaders. They will be skilled in people management and are innovative and willing to explore new territories and chart new routes towards ensuring effective classroom practices. Such personnel will also promote educational research to enhance learning among their students.



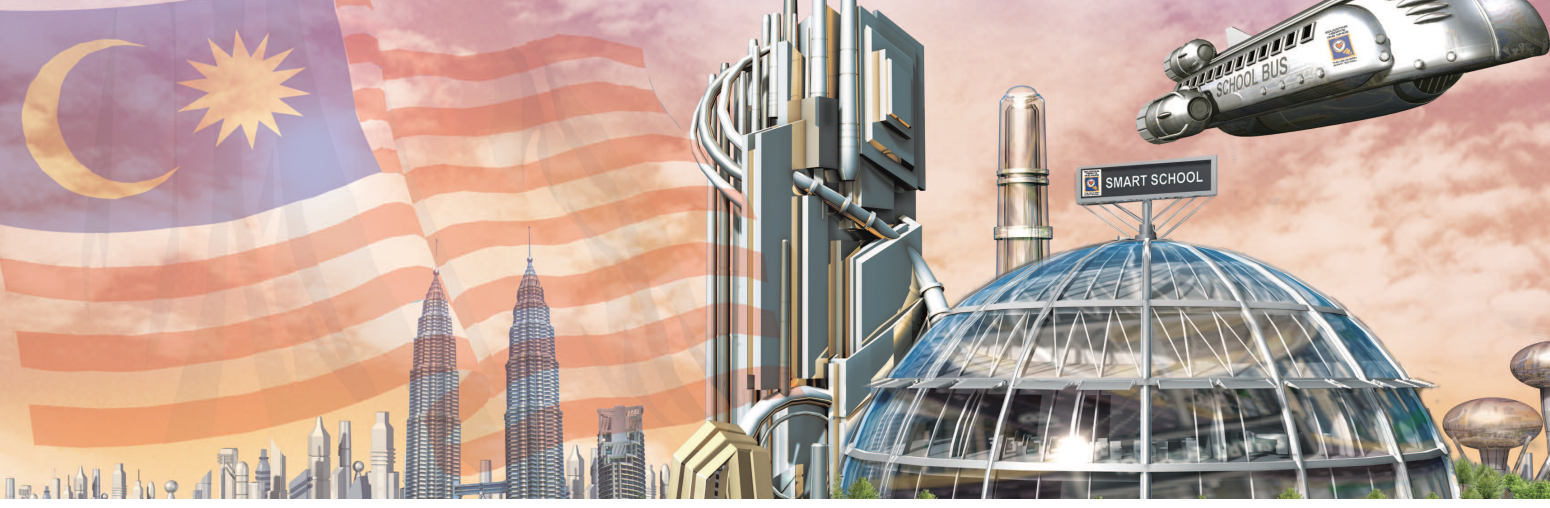
Summary of Roles & Responsibilities of SCHOOL STAKEHOLDERS for 2005-2010 (The Ramping Up Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Human Capital	• Develop a framework providing guidelines and best practices on effective usage of courseware and hardware • Conduct a continuous renewal study of the curriculum/modules for training the trainers for practitioners (teachers and administrators) • Compel teachers to use applications through multiple strategies, i.e., policies, training, communication plan, campaigns, competitions, etc. • Introduce on a widespread basis (pre-service and in-service) and through self-learning materials (CD-ROM or online) for the training in integration of ICT in lessons	MoE Teachers & Administrators at state and district levels MoE
2	Managing stakeholders' expectations	• Device mechanisms to engage parents on e-learning, benefits, and their roles; PTAs can be a good platform • Make known to students the desired learning outcomes so that they will give focus and learn meaningfully • Cater to students with special needs through flexibility in grade progression • Access to PCs/labs for after school hours and for community use • Introduce gradually home schooling (pure and partial) for special cases, i.e, rural areas or special needs through tutors or e-learning for more prepared parents	Parents Students MoE Private schools
3	Bridging ICT divide	• Establish a special committee comprising representatives from relevant agencies to strategise and monitor the technology and basic infrastructure (electricity, water, communications, support structure) deployment in rural schools • Manage and monitor the consolidation and rationalisation of small rural schools with their ICT requirement implications • Identify special strategies to ensure expansion of Smart School to 2,300 small schools • Allow access to school facilities for community use after school hours; Identify rural schools that need to operate after school hours and provide the necessary operational support	Government (MRTD, MEWCM, MoE, MIMOS) Private sector



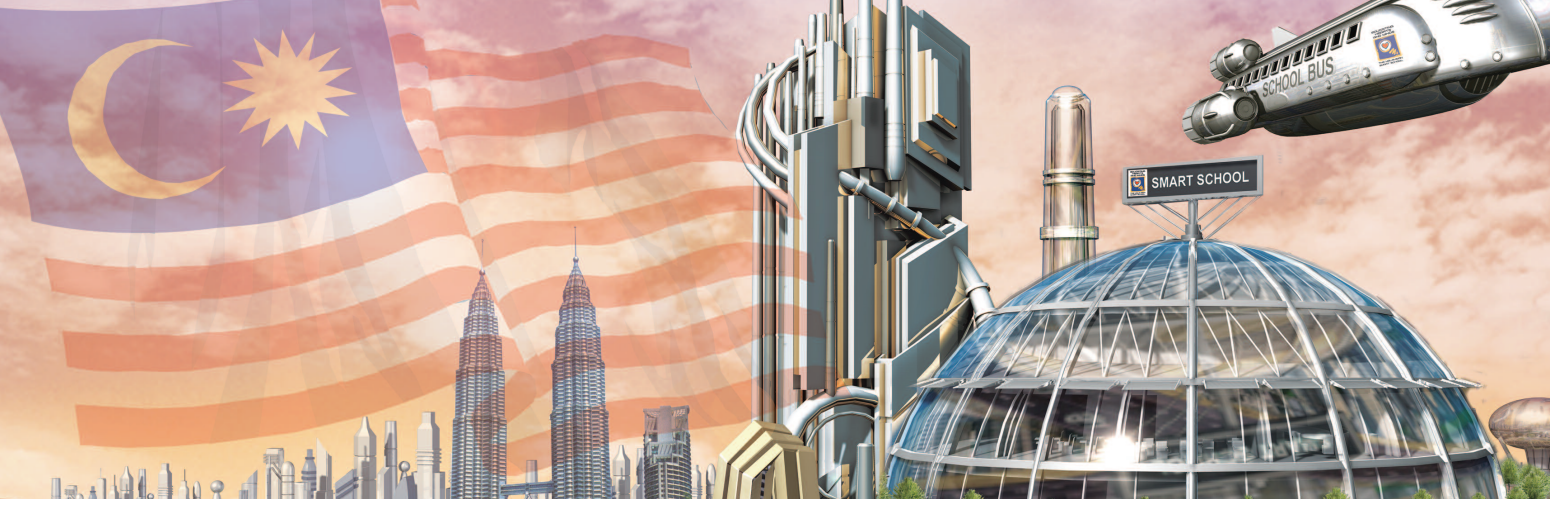
Summary of Roles & Responsibilities of SCHOOL STAKEHOLDERS for 2010-2020 (The Ramping Up Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
4	Innovations in Teaching & Learning Methodology/ Pedagogy	• Create a parallel avenue for teachers to be innovative and creative in TLM beyond the existing curriculum requirement through a standardised and customised (1 – curriculum-based + 1 – teacher-based content delivery system) • Provide peer support and networking through a portal, special forums, and interest groups • Create awareness through e-newsletters	MoE Teachers Union Teachers Administrators
5	Smart Partnership	• Motivate private sector to directly be involved in Smart School implementation – Indirect private sector involvement (HRDF) supporting freelance effort (guided) – Managing Transfer of Technology – Development (Corporate Social Responsibility) – Operations: Training	MoE Private sector (direct & indirect involvement) Parent Teachers Association (PTA) MoF MDC
6	Standards	• Benchmarking of standards with relevant global peers • Set up standards for the development of TLM and School Management System • Ensuring compliance with the pre-defined standards • Validating standards compliance	MoE, MDC MoE, MDC TLM–MoE Technical – MDC MoE, MDC



Summary of Roles & Responsibilities of SCHOOL STAKEHOLDERS for 2010-2020 (The Stabilisation Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Increasing students' involvement	• Introduce strategies in teaching approaches that increase student involvement (e.g., role reversals – active students and passive teachers) • Identify the ideal student-teacher ratio and norms • Introduce a training series that will update teachers on innovative pedagogical approaches • Take teaching beyond a single location through innovation, e.g., hyper media	MoE Teachers Administrators Students MDC
2	Managing expectations effectively	• Obtain students' feedback, review and respond to ensure greater student empowerment • Align industry and students expectations for post-schooling transition	Students MoE Administrators Teachers MDC/Industry
3	Addressing the changing roles of teachers	• Ensure continuous innovation in training provisions to keep pace with technology changes • Introduce special incentives and mechanisms to encourage teachers to independently gain necessary skills (i.e., innovative pedagogy and technology management) • Conduct special courses/programs to help teachers to better manage the relationship between parents and students • Sustain networked community of teachers through a formalised support structure	Teachers Administrators PTA Private sector Teachers Union
4	Taking the Smart Partnerships to the next level	• Establish revenue models for schools to exercise • Allow schools to seek competitive funding • Establish more charter schools (corporate management)	MDC/MoE Private sector Board of governors Alumni
5	Technology renewal	• Outsource technology management • Regulate technology benchmarking and institutionalise relevant findings for adoption and implementation • Establish international networking for continuous collaboration and consultation with key ICT players globally • Develop the framework to guide and strengthen clusters of technology application	MoE/Private sector MoE/MDC MDC MDC
6	Standards	• Set up standards derived from regional and global network consensus	MDC, MoE, Private sector



6.1.2 Roles & Responsibilities of Community Stakeholders

Community Stakeholders comprise parents, guardians, community, leaders, interest groups and NGOs

- Encourage participation of parents in seminars, road shows and counseling sessions on the concept and implementation of the Smart School project
- Develop an awareness system for parents to support and contribute to the development of their child's multiple-intelligence

6.1.2.1 Parents, Guardians, NGOs & Others (Community Collaboration)

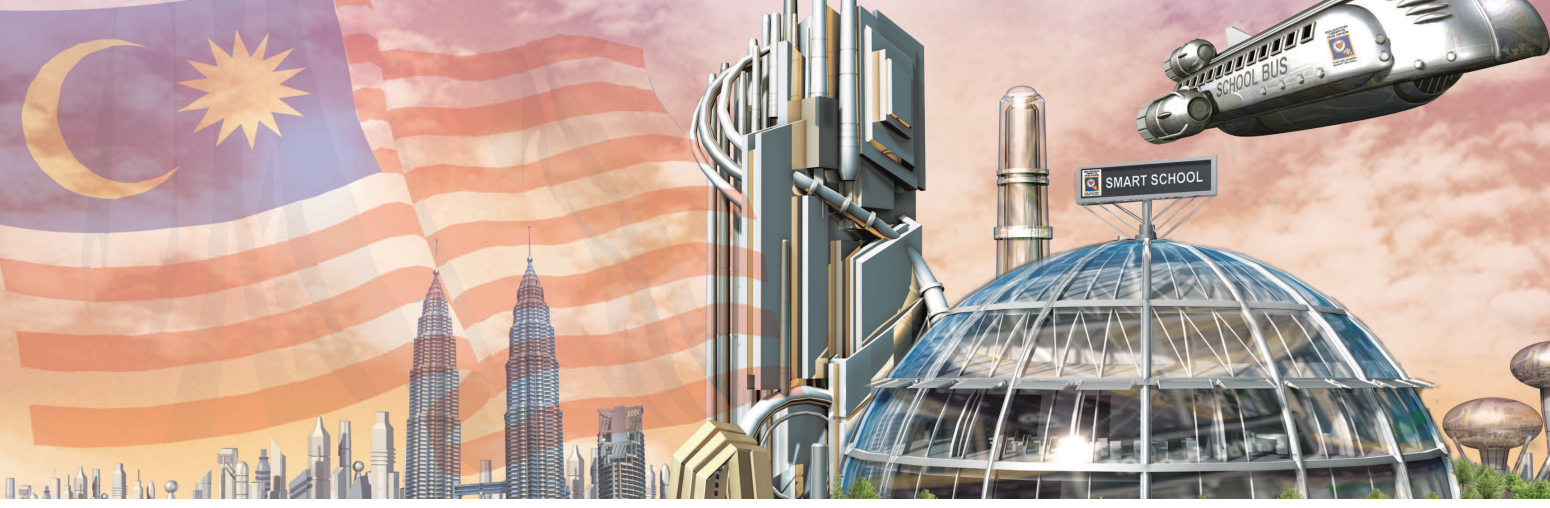
Resources possessed by parents, the community, industry and civil society will be leveraged on to contribute to the schools' development and growth so that schools achieve higher levels of excellence.

6.1.2.2 Parents as Stakeholders

In the new school scenario of 2020, it is expected that parents will play a significant role in school governance.

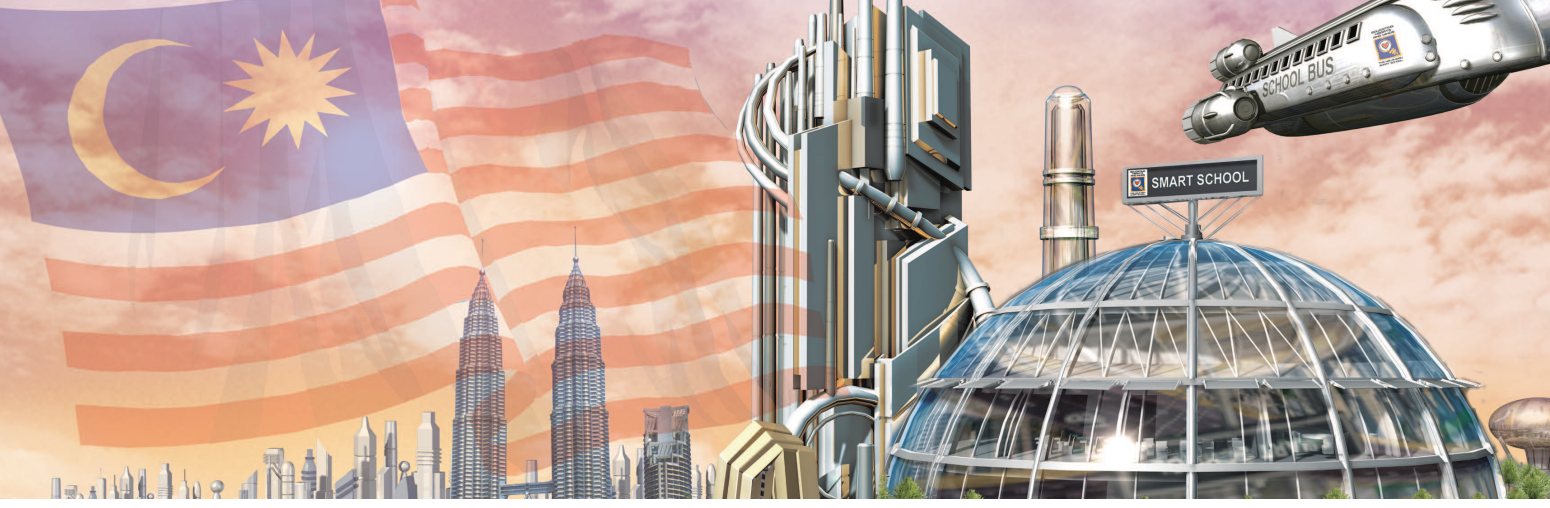
Parents will enjoy and utilise the ready access to school and relevant school information to forge a close relationship with the teachers and the staff. The children's educational experience will be enriched by the participation of their parents.

Parents who are kept informed and made to feel they are part of the school community will readily contribute cash, materials or services to help initiate projects that will enhance their children's learning experience. If this were to happen on a large scale, the government's financial responsibilities will be eased so that resources could be directed to schools in poorer localities.



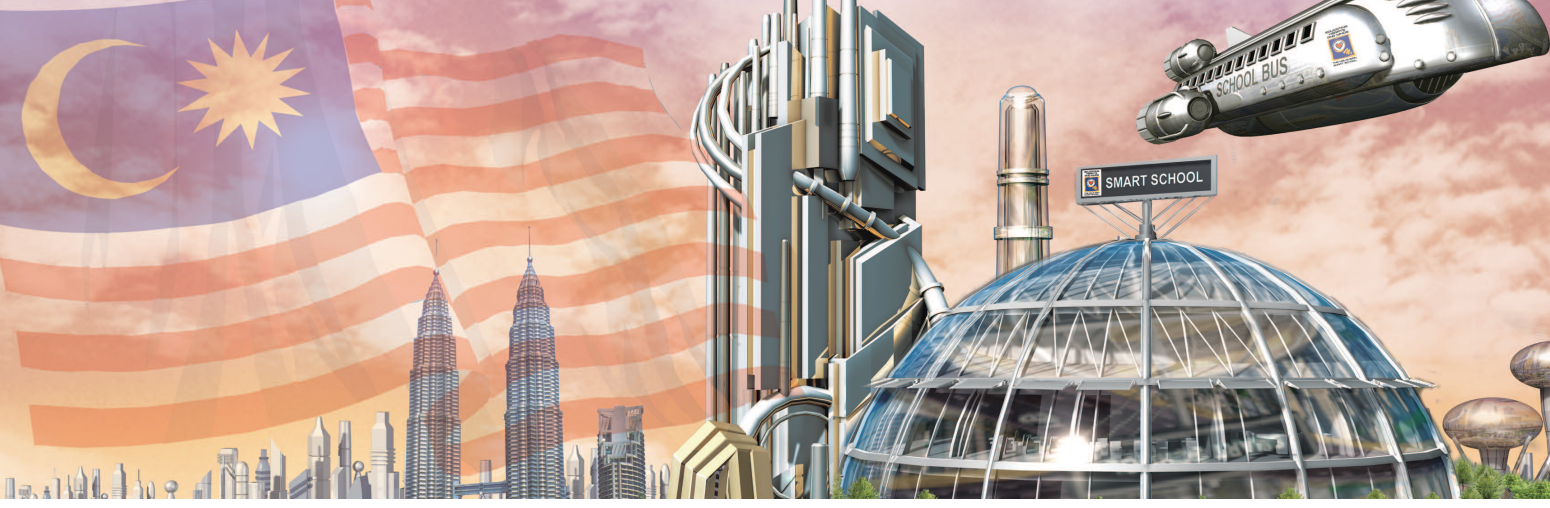
Summary of Roles & Responsibilities of COMMUNITY STAKEHOLDERS for 2005-2010 (The Ramping Up Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Awareness and understanding of Smart School	• Impart information and knowledge about Smart School to parents/employers/NGOs/religious groups through networking sessions and campaigns	Employers NGOs/religious bodies MoF/MDC
2	Handling of finances generated from the community	• Appoint a central independent body to coordinate and manage funding from the community	Independent body
3	Publicity	• Organise continuous publicity campaigns professionally by engaging agencies, advertising companies, and the mass media	MDC, MoE Agencies Advertising companies Mass media
4	Engagement model	• Draw a guideline highlighting methods to engage different stakeholders by different levels of practitioners • Create incentive programs for those who will engage and those who will be engaged • Articulate impacts on lifestyle through campaigns • Set up special desks to address inquiries, conflicts, bureaucracy at the Federal, state, and district levels	MoE Government Teachers Parents MDC
5	Relevant and localised content on the Internet	• Put in place mechanisms for the creation of a localised and lifestyle content	Federal and State governments Content developers



Summary of Roles & Responsibilities of COMMUNITY STAKEHOLDERS for 2010-2020 (The Stablisation Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Loss of interest/ disengagement	• Publicise the success over the past years. Recognise and celebrate success of parents' involvement through awards and publicity campaigns	PTA Schools Parents
2	Tackle social fabric changes. E.g. Decline in writing things down, overdependence on technology/computers	• Anticipate and strategise to overcome the problems and reinforce the benefits • Conduct regular services and studies to identify such impacts and solutions	MDC MoE
3	Catering to children with special needs	• Introduce special programs and develop solutions to cater to the disabled	NGOs MoE Youth and Sports Ministry
4	Disparate infrastructure	• Execute ICT infrastructure implementation in accordance with the national broadband plan via the special committee	MEWCM/MoE/MDC
5	Increased community pressure on the Smart School system	• Create an effective feedback system	Schools, Parents, PTAs

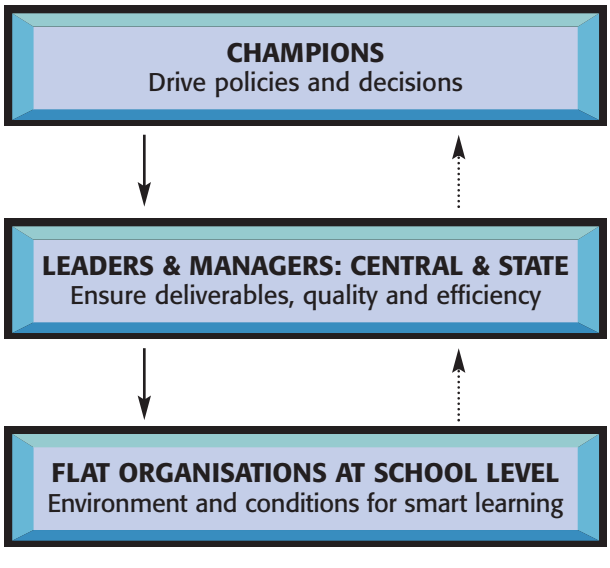


6.1.3 Roles & Responsibilities of Ministry of Education (MoE) Stakeholders

The Ministry of Education Stakeholders include the ministerial personnel and MoE's Top Management

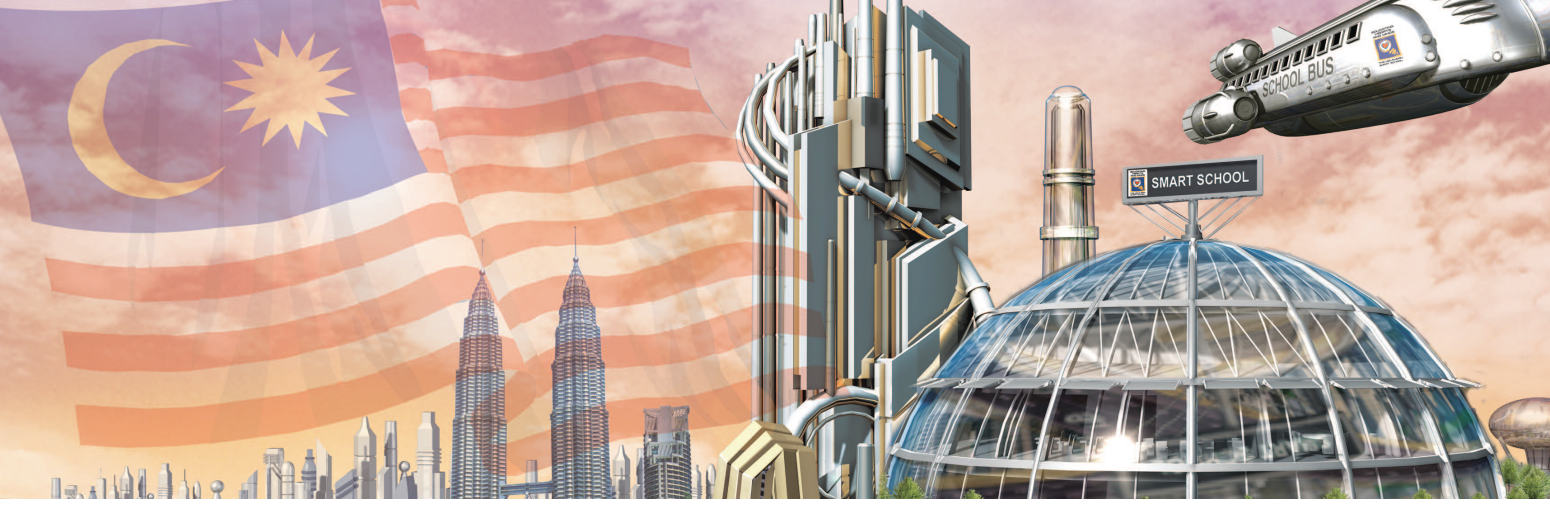
- Move toward a more unified management structure
- Introduce flexible, flatter and non-hierarchical structures
- Work hand-in-hand with the industry
- Ensure that there are clear directions from the MoE Champion
- Expand career path for teaching professionals to become education specialists
- Restructure existing promotional exercise from one that used to be based on seniority to one of performance.

Implementation Structure



6.1.3.1 Gather Champions (Policy Formulators and Decision Makers)

As older personnel are promoted or transferred, there is a need to create a new group of champions within the ranks of the MoE that will be the energy and force, driving the expansion of Smart Schools. Smart School champions should be allowed to emerge from all levels.



6.1.3.2 Issue Policy Statement on the Future of Smart Schools

A definitive policy statement and the framework of an action plan from 2005 to 2020 are critical at this juncture. This policy statement must set out explicitly future goals and objectives for the Smart School expansion, define outputs and targets, set timelines for their attainment, and make clear the roles of stakeholders and main players.

The policy statement must define outputs and targets, make clear the roles of stakeholders and main players, as well as set timelines for attainment of the targets

6.1.3.3 Create Integrated Multi-Sector Management Team

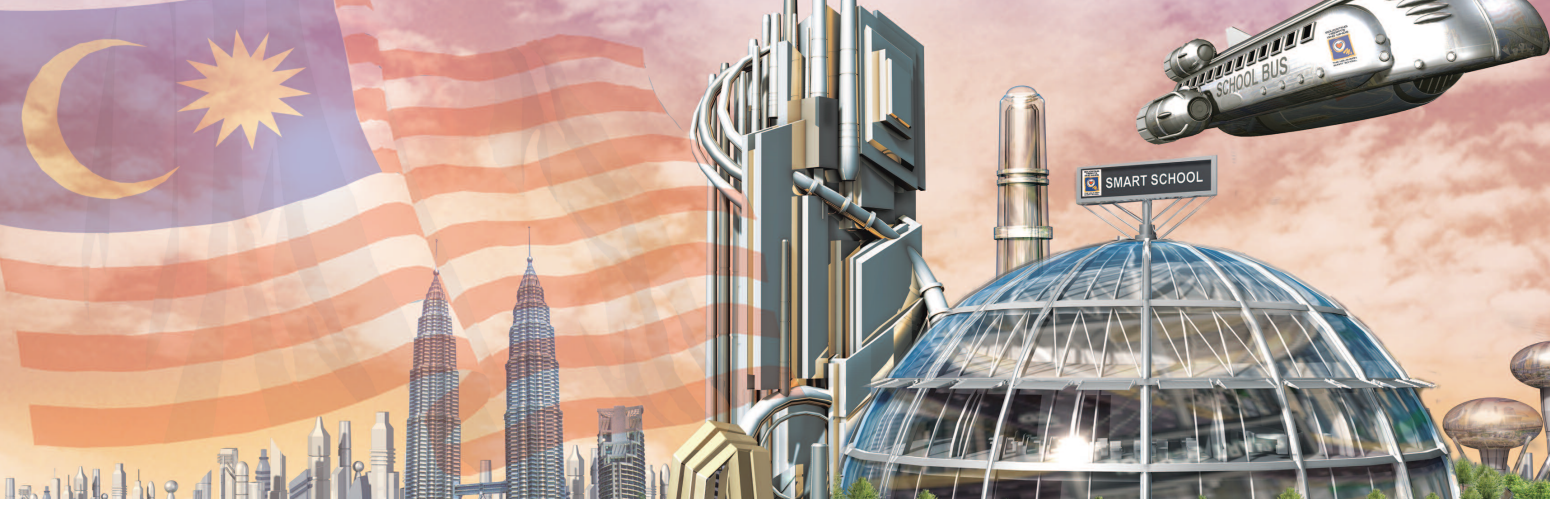
All key players should work with a common goal and purpose. There is a need for a unified management team to plan the way ahead. In order to do this, the stakeholders must ensure a seamless exchange of information and sharing of developments.

6.1.3.4 Create Flexible, Organisation of Implementers at Ground Level

An effective implementation of Smart School also calls for a flexible organisation of implementers who are empowered. Expertise will be acknowledged and utilised efficiently, so that the large numbers who possess postgraduate qualifications with research experience in their respective areas of expertise can be utilised gainfully for research and development work.

Summary of Roles & Responsibilities of MoE STAKEHOLDERS for 2005-2010 (The Ramping Up Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Human factor	• Invest in professionally designed and managed change management programs	MoE Community
2	Lack of compliance	• Reevaluate and standardise the deployment framework	MoE MDC
3	Ensuring industry standards to promote exports	• Develop the framework for standards based on consultation with the MoE, local e-education and big industry players	MDC/Industry
4	Lack of shared vision towards ICT implementations	• Introduce incrementally decentralisation features; increasing autonomy or responsibility focused on components of the Smart School can be an initial step	MoE State governments



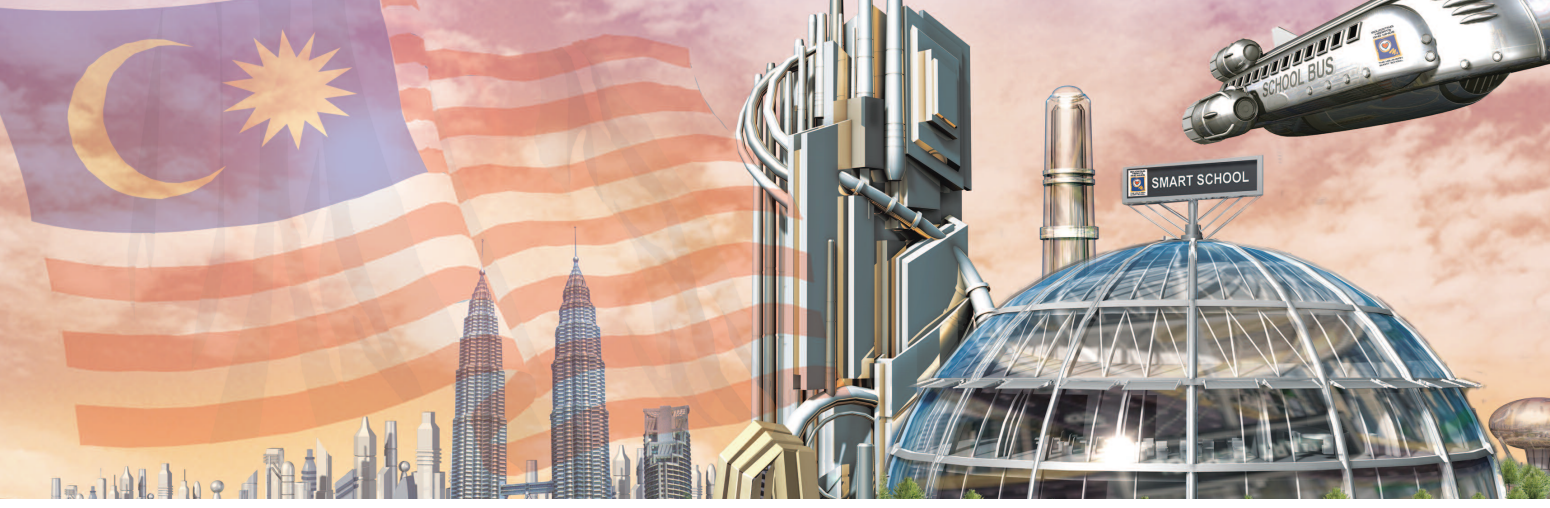
Summary of Roles & Responsibilities of MoE STAKEHOLDERS for 2010-2020 – (The Stablisation Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Repository of learning objects	• Establish a professionally managed central repository for teachers to share TLM	MoE
2	School-based content development	• Provide compensation for teachers and MoE staff to develop school-based content	MoE and PSD
3	Management and maintenance of infrastructure	• Outsource management and maintenance of infrastructure with increased school autonomy for faster service delivery	MoE
4	e-Examination/Evaluation	• Convert 10%-15% of the examination/evaluation process to incorporate ICT approaches	MoE

6.1.4 Roles & Responsibilities of State Stakeholders

The State Stakeholders refer to the State Education Departments (SED), District Education Offices (DEO), State Education Resource Centres (SERC) and Teacher Activity Centres (TAC)

- Develop and circulate directives, goals and KPIs
- Develop and implement change management training program for SED and MoE
- Upgrade IT facilities and environment at DEO
- Define KPIs to create competent Smart School drivers
- Expand the professionally-run support system – "Help Desk" to cover state and district levels
- Foster greater interaction and appreciation between DEO and schools through various programs and activities



6.1.4.1 Ensure Accountability of Managers at Central and State Level

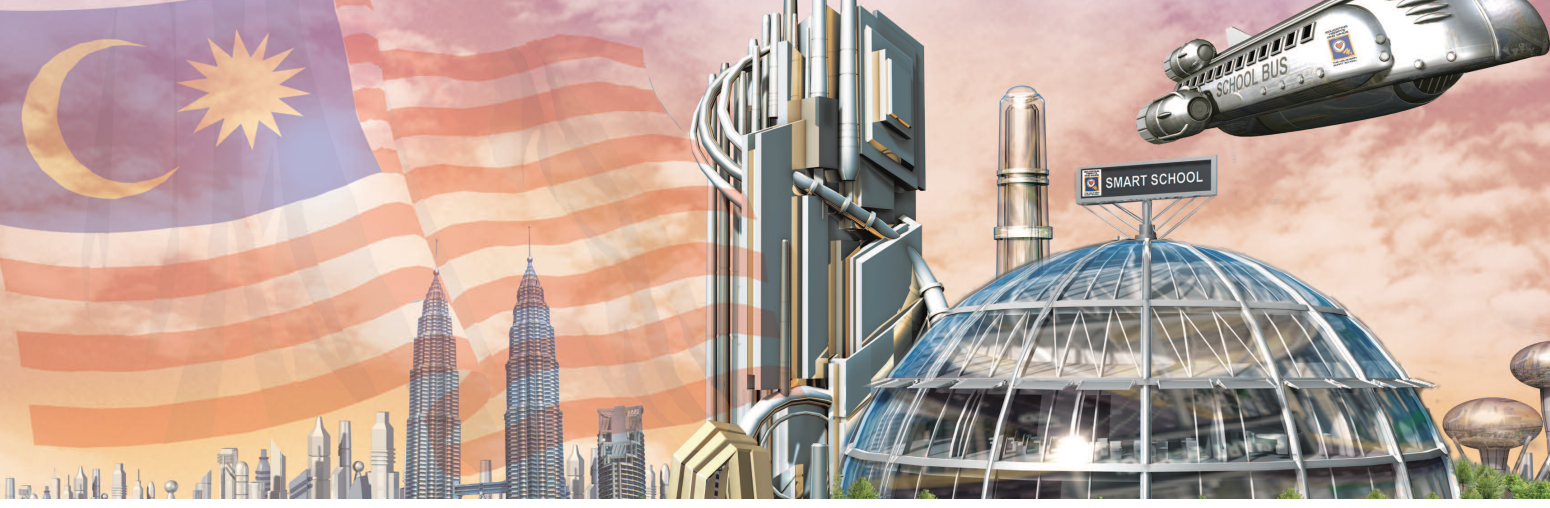
It is imperative that Directors of the relevant Divisions and State Education Departments manage the Smart School expansion effectively. These stakeholders, who are managing the implementation of the Smart School expansion, will be assessed periodically on the results of the programs under their supervision and control. Hence, there is a need for those in top management to have the highest credentials and professional qualifications to implement a nationwide ICT initiative such as the Smart School which, if well implemented, holds the promise of effecting change in the country's social, political and economic landscape.

6.1.4.2 Utilisation of Performance-Based Management Model

Directors at both the central and state levels will be those who possess the capacity to interpret correctly the policies, decisions, implementation plans and strategies for implementing Smart School nationwide. They are expected to be familiar with what each member of their team should do so that they will be in a position to monitor and evaluate their performance based on established key performance indicators. They will know where the shortfalls are and act accordingly to fill in the gaps, either through the provision of additional resources be it hardware/courseware or additional human resources and training programs.

The MoE which is responsible for the expansion at both the central and state levels will ensure that the enabling criteria for the success of the implementation are present. These are:

- Ensuring full understanding of the implementation on the part of major players and stakeholders through information dissemination via brochures, materials, letters, mail, websites, etc. to the relevant parties
- Have a workable action plan with the dates and deliverables well defined for activities undertaken at state and school level and ensuring the execution of the plan



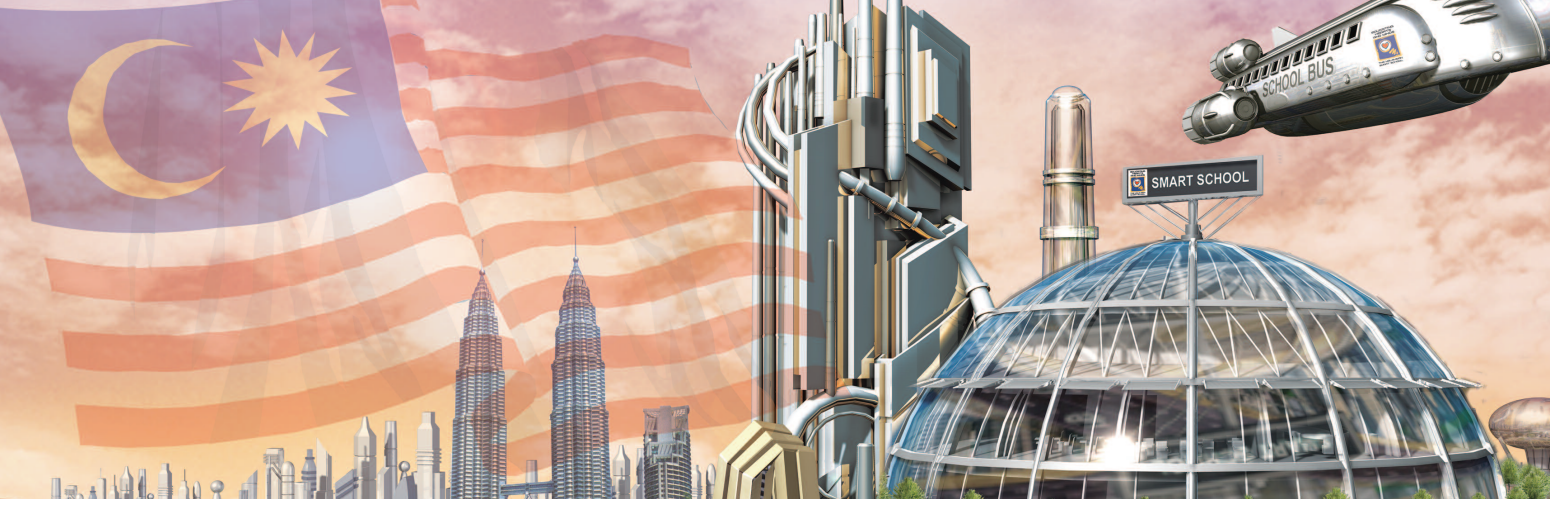
- Have a plan to manage the logistics of the expansion program
- Supervise, support and advise members of the team so that they will be able to discharge their responsibilities well
- Identify training needs and ensure that these are met at the various stages of the expansion process

Summary of Roles & Responsibilities of STATE STAKEHOLDERS for 2005-2010 (The Ramping Up Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Lack of understanding of state officers and teachers on the KPIs	• Conduct training on KPIs	MoE/Universities MDC
2	Disparate access to the SSMS amongst key state stakeholders	• Link SED and DEO's IT facilities/systems to all the schools and to the SSMS at the schools	MoE and Schools
3	Structural constraints impeding MoE stakeholders (DEO) from becoming effective drivers of Smart Schools	• Revise DEO's roles and responsibilities	MoE
4	Existing support system not synchronised to provide support for Smart School Programs (e.g., DEO and TAC)	• Streamline and synchronise the resources and expertise through a Special Task Force	MoE
5	Insufficient human resource for the existing support system (Teaching & Learning)	• Form a partnership with external/internal resources	MoE Industry

Summary of Roles & Responsibilities of STATE STAKEHOLDERS for 2010-2020 (The Stabilisation Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Existing KPI insufficient to measure Smart Schools' performance and effectiveness	• Review and enhance KPIs to determine if improvements and further training for teachers are needed	MoE
2	Administrative roles of DEO may become obsolete due to effective IT infrastructure	• Enhance its role with an emphasis on teaching and learning	MoE



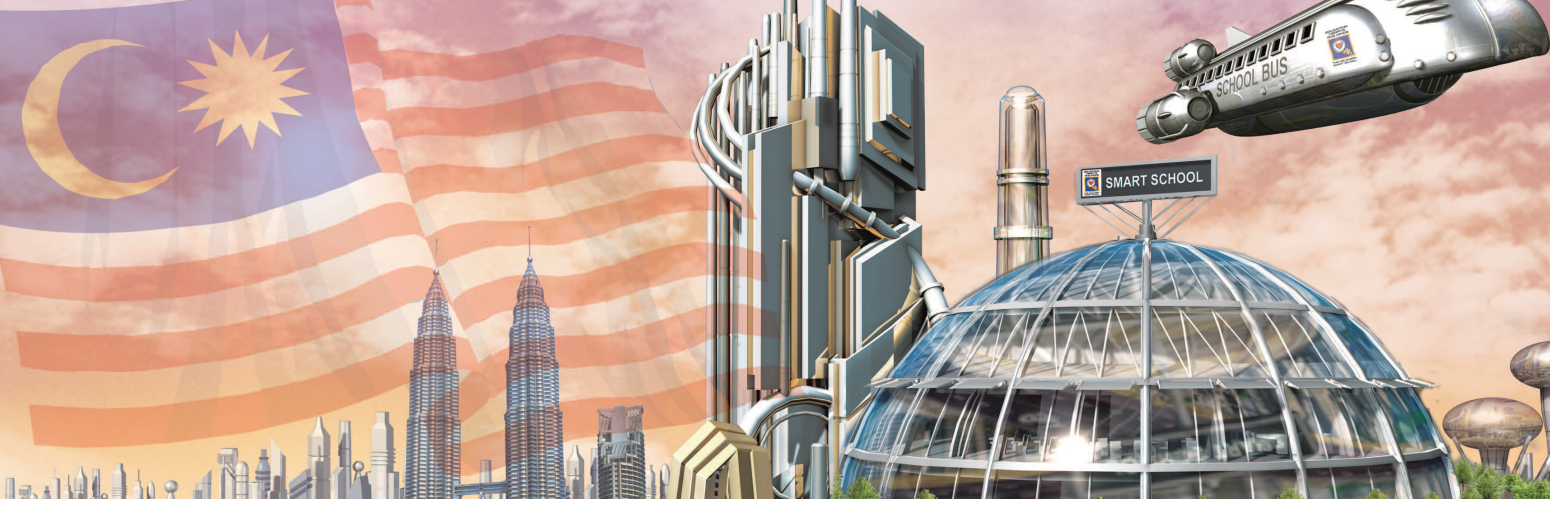
6.1.5 Roles & Responsibilities of Industry Stakeholders

Industry Stakeholders include all corporations, multinational companies and business entities in the public and private sectors

- Establish a common vision
- Establish an MoE Public-Private Partnership framework
- Conduct a Public-Private Partnership awareness program to vendor communities and MoE officials
- Establish a task force of (MoE vendors) team members
- Recognise best practices
- Develop a Partner Satisfaction Index (PSI)

Summary of Roles & Responsibilities of INDUSTRY STAKEHOLDERS for 2005-2010 (The Ramping Up Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Thrust – Areas of transparency – Communication – Equity between vendor and government/agencies	• Set up standard operating procedures • Ensure equity through a dashboard monitoring system • Set up adequate follow through mechanisms	MoE/MDC Vendors
2	Decision making/bureaucracy Approval processes	• Ensure timely and unequivocal decision making	MoE
3	Mutual benefits – acknowledgement of collaborations	• Set a common vision • Create a Partner Satisfaction Index (PSI) • Establish a common task force consisting of MoE and vendors	MoE/MDC Vendors
4	Lack common objectives and KPIs	• Establish common milestones • Establish a task force to define shared KPIs	MoE/MDC Vendors
5	Leadership – Lack of continuity – Lack of coordination of initiatives within/between government agencies – Gaps between industry and government processes	• Ensure buy-in and collective ownership of different initiatives at MoE by assigning divisional roles and responsibilities in every initiative • Increase accountability and responsibility of project leaders through shared KPIs • Introduce secondment to various industries as professional development for teachers and administrators	MoE Vendors MDC



Summary of Roles & Responsibilities of INDUSTRY STAKEHOLDERS for 2010-2020 (The Stabilisation Phase)

Priority	Issues/Challenges	Resolution	Roles/Collaboration
1	Too many players and solutions in the market – Challenge in creating new relationships – Interoperability of various platforms	• Set up an independent governing body • Adopt open standards/open technology	MoE/MDC
2	Obsolescence of hardware, software and content – Costly to maintain – Curriculum changes (content)	• Widen and enhance the adoption of the outsourcing model • Conduct regular forums between MoE and vendors to provide updates and address issues	Vendors MoE MDC

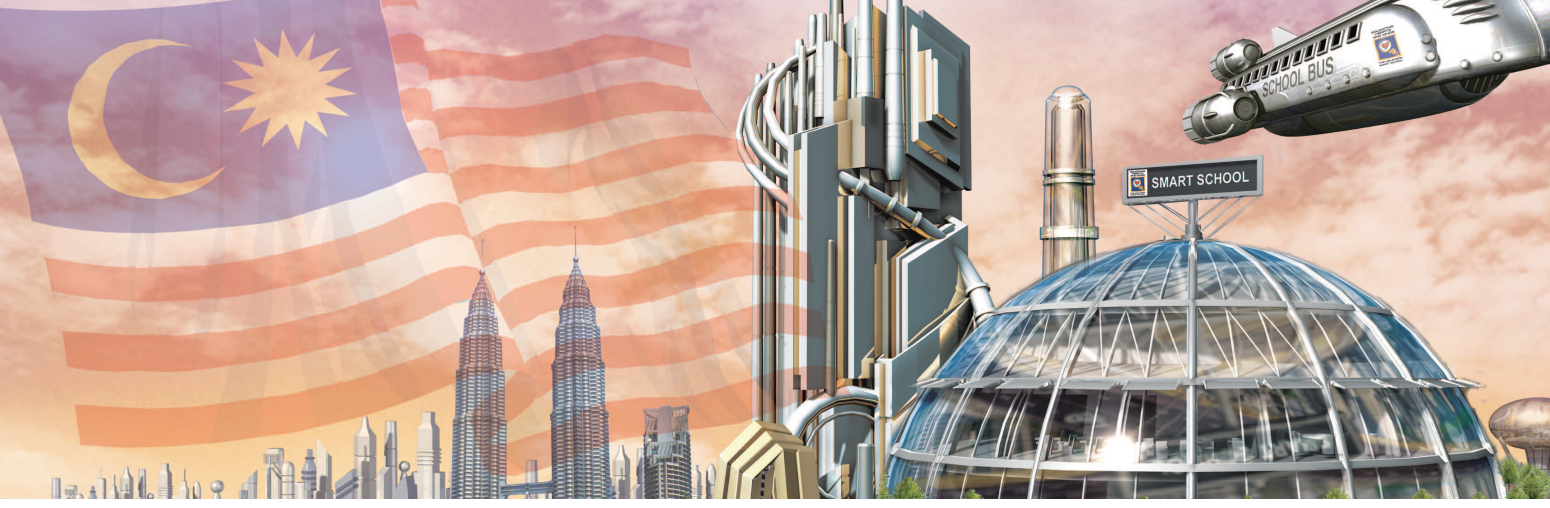
7. POLICIES, MANAGEMENT, GOVERNANCE

Clear Directives Issued and Enforced Prior to Implementation

Clear directives, goals and performance that are expected to drive the Smart School expansion will have to be in place. This means the effective understanding of roles and responsibilities in the scheme of things and what is expected of them by the management. Policies and legislation for greater efficiency can change the processes governing the delivery of educational services. Mechanisms will be in place for regulating and enforcing policies as well as ensuring compliance at all levels.

Change Management Programs Instituted for Effective Execution of Responsibilities

At this stage, the significance of Change Management programs for a successful Smart School would have been realised by all key players. Personnel at all levels of management will undergo training in change management. Results of the training will be manifested in clear goals and objectives, identification of targets to be achieved, and strategic plans in place for the achievement of the set targets.



Strengthen State Level Implementation Mechanism

Improvement measures will be instituted to enhance the capacity of the DEO. This would include upgrading of equipment and facilities, and identifying key personnel to be placed in positions of responsibility to monitor, supervise, provide advice and assistance in decision making and problem solving at the district level.

Set Up a Fully Functional Dedicated Technical Support System

Technical support that is fully functioning in the form of the expansion of the Help Desk which will be professionally managed will be in place to provide the necessary support for teachers.

Ensure Closer Interaction between DEO and Schools

Programs will be instituted to enable greater interaction and appreciation between the DEOs and schools.

Collect Feedback through Periodic Monitoring for Improvement

Leaders and managers of the MoE will act as a conduit for feedback, suggestions and recommendations from the ground level. Such feedback will be channeled upwards to help influence policy decisions of the MoE.

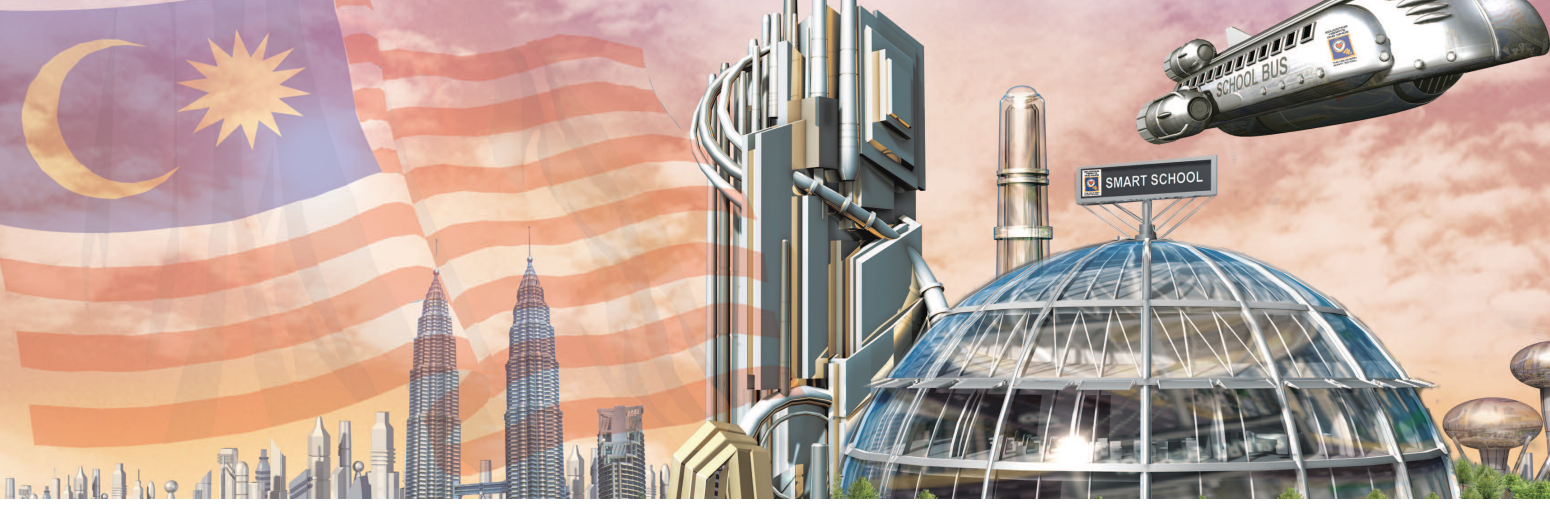
Improve Teachers' Career Prospects

Promotions and rewards will be made based on performance through a scheme to expand career prospects. Exceptional teachers will be made education specialists with a different salary structure, without effecting a change in their current position.

The promotion process will also take into consideration the following factors:

- Teachers' experience
- Courses attended
- Performance achieved
- Support from the head of department

The process will provide an opportunity for new teachers to acquire experience and reinforce their confidence to evolve into leaders.



Teachers are required to attend courses at least once a year. Salary increments will be awarded according to their competency results upon completion of the relevant courses attended. This will encourage teachers to attend courses that will enhance their competency levels.

Formulate Certification Standards for Technology Applications

Certification standards for Technology Applications will be made mandatory for those involved at different levels of the Smart School enterprise.

Include Parents and the Community in School Governance

Parents will support and assist schools in their efforts to turn smart. The potential of parents to contribute synergies that can exploit faster and more efficient technological innovations should be seriously explored.

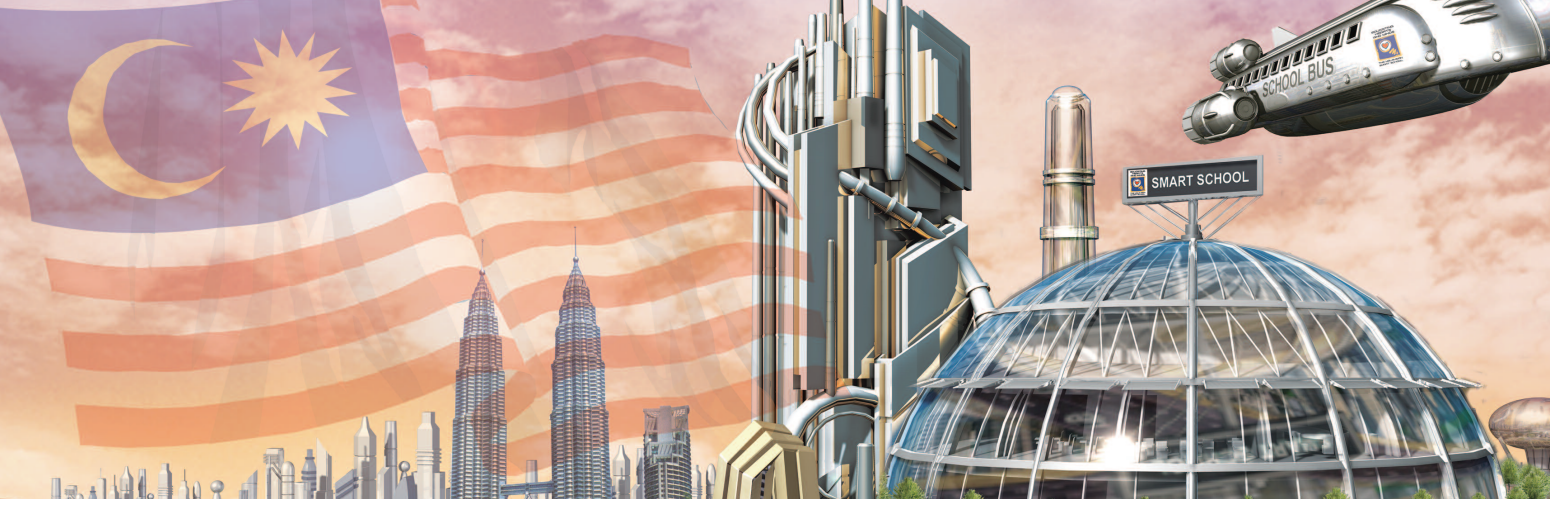
7.1 ENVIRONMENT AND CONDITIONS FOR SMART LEARNING

Training

Teachers and related personnel will be trained for the Smart School expansion. Educator Preparation and Development Programs for new and practicing teachers, administrators, curriculum developers, ICT coordinators, counselors and librarians will be put in place. It is expected that the attainment of this target will be supported by the Faculties of Education of Higher Learning Institutions and Teacher Training Colleges currently in existence.

Technology-Enabled Learning Environment

Computers will be made available for teachers' use so that they can manage the learning process better. Measures will be taken to enhance the infrastructure in localities where electricity supply is a problem. For example, battery-powered computers will be used in places that are prone to electricity shortages.



Flexible Timetabling

Timetables will be made flexible and arranged in such a way that there is more time for teacher-student interaction.

Provision for Use of Students' Own Laptops

Provision will be made in the expansion plan to meet the likelihood of students bringing their own laptops to school.

Provision for Special Education

Various innovations and assistive technologies will be utilised in Smart Schools to aid special education. The latest innovations and tools will be deployed to assist students with cognitive and sensory challenges to learn. The Ministry of Education will actively identify a number of such enabling technologies that can be deployed in the teaching-learning process of such students.

Targets and Timeline 2005-2020

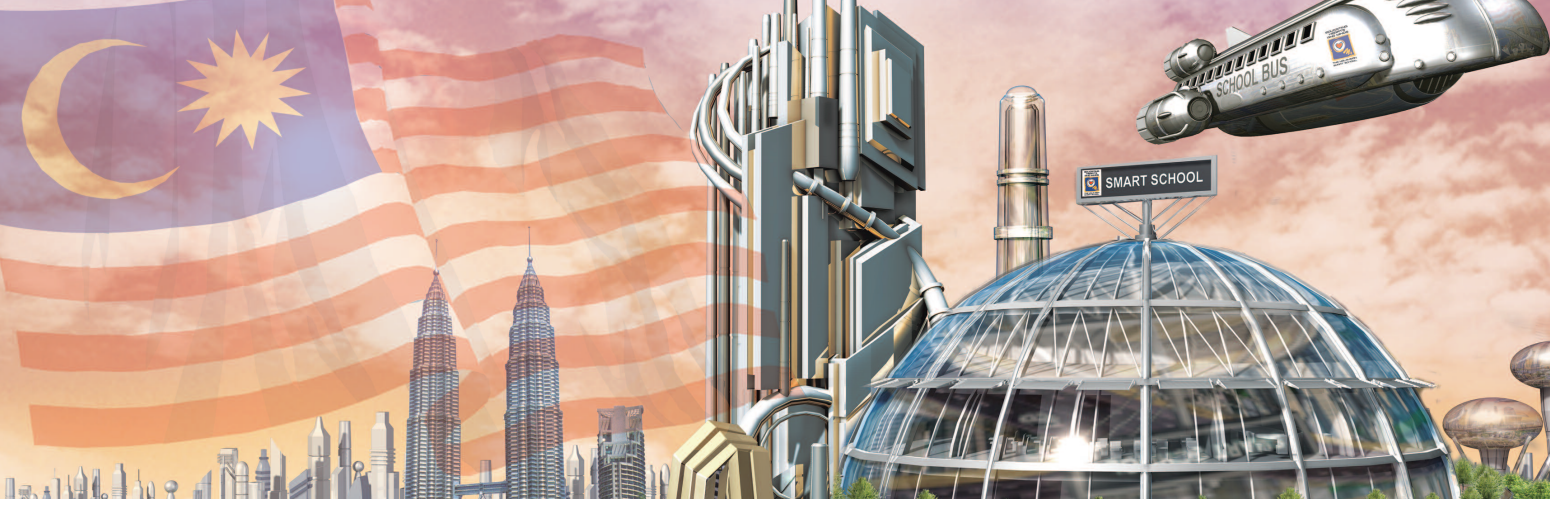
Following the Pilot Project in 1999-2002, the MoE has developed a visionary plan for the roll out of the Smart School during 2006-2010. The plan to "make all schools smart by 2010" will leverage on all the initiatives MoE has undertaken prior to and since 1999, as well as future initiatives.

Target by 2010: 10,000 Smart Schools

Basic ICT Infrastructure provided by Parallel Projects:

- Schools will turn smart by synchronising and integrating all current ICT Initiatives under the umbrella of the Smart School Program, i.e.
  - Computer Lab Project
  - Teaching of Science and Mathematics in English (PPSMI)
  - Training of teachers to teach Mathematics and Science in English (ETeMS)
  - SchoolNet Project, and
  - Educational TV (ETV)

The MoE has come out with a visionary plan for rolling out Smart School during 2006 to 2010. The plan to "make all schools smart by 2010" will leverage on all the initiatives MoE has undertaken prior to and since 1999, as well as future initiatives



Much of the activities between 2006 and 2010 will be focused on ensuring that all schools are equipped with the basic requirements for the implementation of the Smart School. The basic requirements comprise the following components:

- Hardware
- Courseware
- Training

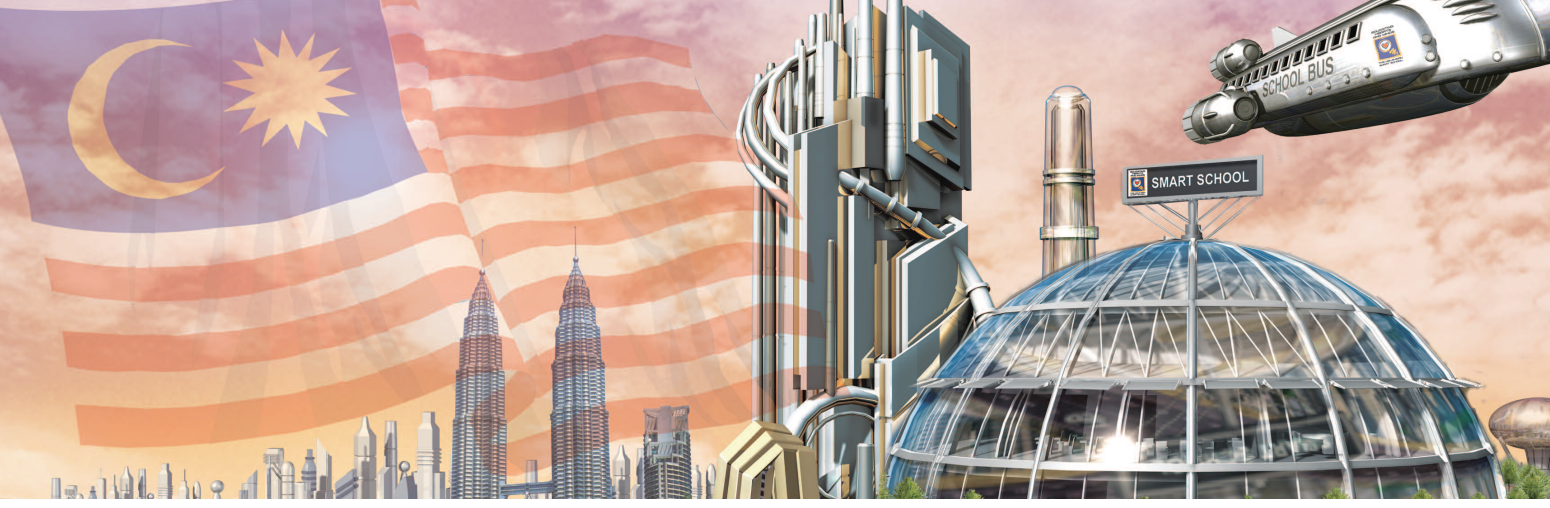
The hardware component includes installation of computers in self-accessed centres and in the laboratories built during the computerisation programs. Peripherals such as servers will also be installed. For teaching Mathematics and Science through English, computers, LCD projectors, screens, trolleys and printers will be deployed for assistance. ETV will be implemented with television sets and DVD recorders. The bandwidth capacity of the SchoolNet will be increased from the current 1 Mbps to 2 Mbps or more.

Hence, each of the 10,000 schools turning smart in 2010 will have at the minimum, the following:

- 1 laboratory with at least 20 computers along with peripherals
- Between 1-3 computers for the school administrative work
- Self-accessed centres with PCs shared between 5 or more classes
- Broadband access
- Local Area Network (LAN)
- Peripherals consisting of LCD projector, printer, scanner, digital camera
- Personal laptops for all teachers (for the subjects of Science and Mathematics in English (PPSMI)) along with LCD projectors

An enhanced and more user-friendly Smart School Management System for selected modules will be deployed to ensure a seamless integration of ICT solutions for all aspects of school functioning

An enhanced and more user-friendly School Management System for selected modules that are immediately required will be deployed to ensure seamless integration of ICT solutions for all aspects of school functions. These chiefly include the management, administration and teaching-learning functions. The system will incorporate financial management from the Ministry of Finance and also other state management requirements such as discipline, teacher deployment and related matters.



All new courseware produced by ETD, MoE will be web-enabled. The courseware will reside in MoE's repository, which will be made available for the 10,000 schools. The subjects will comprise the following:

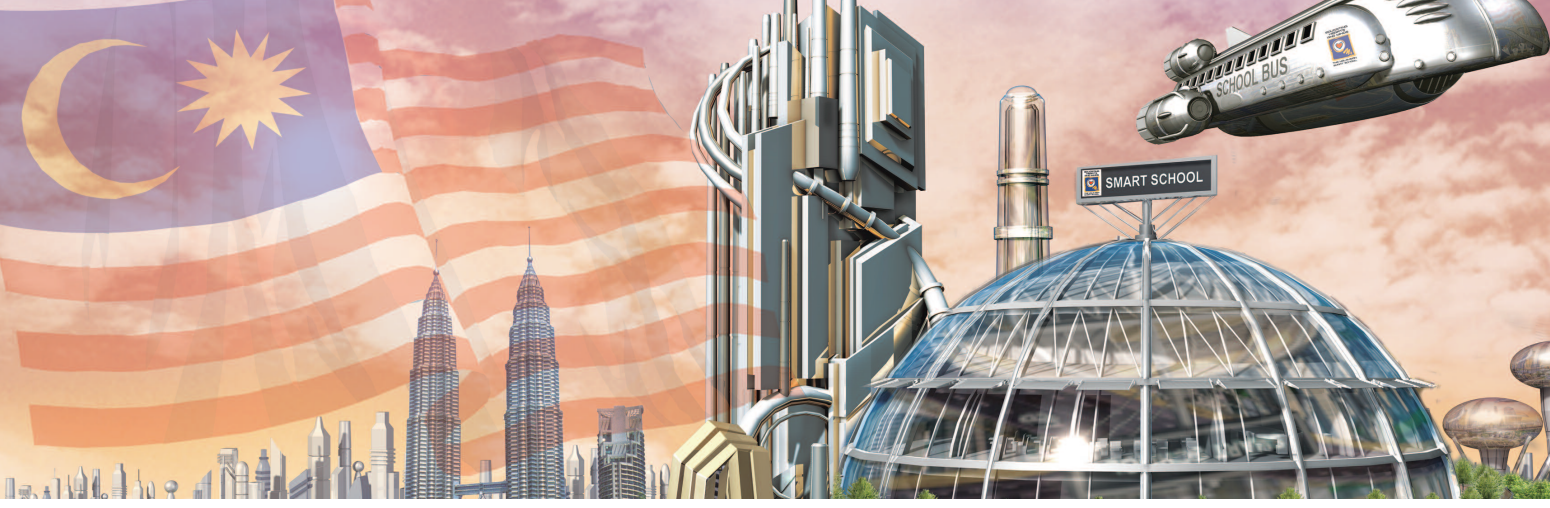
- Biology, Chemistry, Additional Math, Physics, Islamic Education, Morale Education, e-Bahan for English, e-Bahan for Malay Language, and Citizenship and Civic Education
- Technical and Vocational subjects – Electronic and Electrical Engineering Study, Mechanical Engineering Study, Engineering Technology
- PPSMI stand-alone CDs have been distributed in stages to 10,000 schools. The subjects will comprise the following:
  – Science, Mathematics and English – Year 1 to Form 6, and Matriculation
- MoE/ETD CDRI Interactive courseware comprising of the following:
  – Malay Language, Science, Mathematics, History, Geography, English and other subjects – Pre-school, Year 1 to Form 5
- Educational TV materials – covering the curriculum from Pre-school, Year 1 to Form 5

Training of teachers by 2010 will cover the following:

- Teaching of Science and Mathematics in English
- Educational TV
- Smart teaching and learning
- A module on integrating the above ICT initiatives in a lesson
- Other relevant programs developed by the Teacher Training Division

Training of administrators of Smart Schools is vital. Administrators will be mandated to undergo a course on Educational Technology Management or similar courses so that they can be effective managers for a dynamic educational environment.

The MoE will need to focus on a number of issues to drive the education system forward towards a virtual school environment where digital content will be the norm. Such issues will include



innovative budgeting along with the strengthening of leadership, supporting e-learning, improving on teacher training and on their career prospects.

In this context, it will be required,

- To determine the total cost for technology upgrading as a percentage of total spending
- To systematically restructure budgets to realise efficiencies, cost savings and to include re-allocations in expenditure on textbooks, instructional supplies, space and computer labs, etc.
- To consider the option of leasing hardware/software with 3-5-year refresh cycles or refurbished PCs
- To create a technology innovation fund to carry funds over a yearly or 2-yearly budget cycles.

Change management programs will continue for all school heads, teachers and state officers. The programs should aim to instill the ownership of this Smart School initiative among the stakeholders.

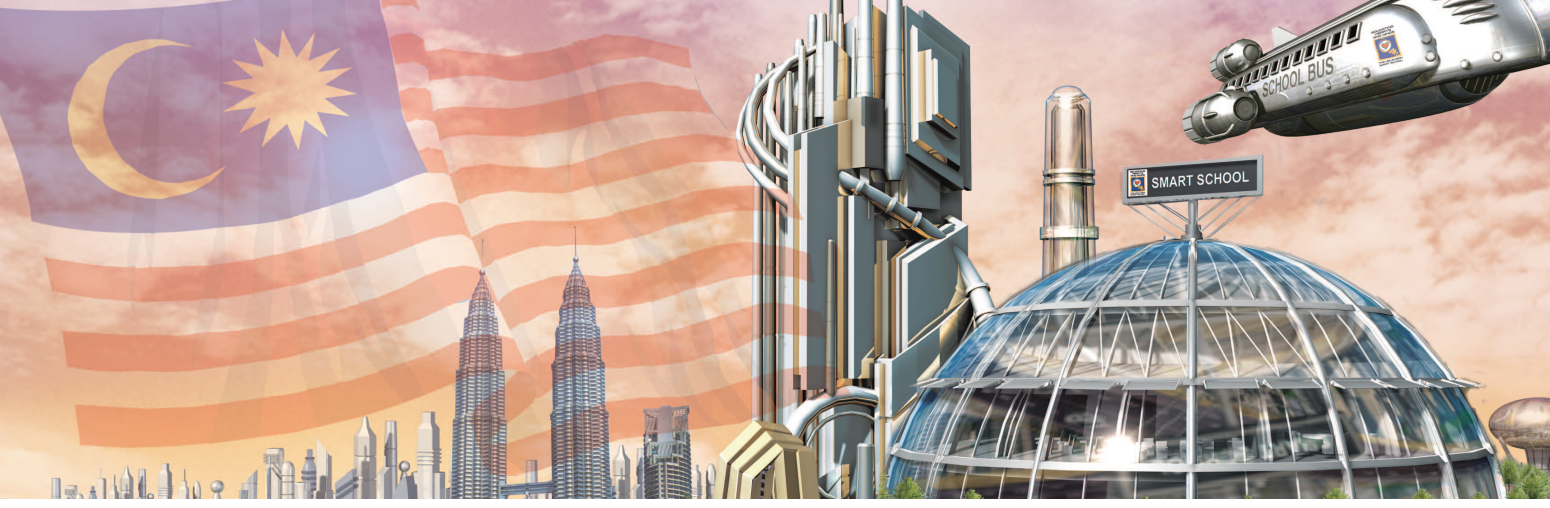
Promotional campaigns such as road shows, expos and fairs should be held and targeted at the community and the industry stakeholders.

Champions at the Ministerial and MoE Management level can highlight the Smart School initiative through periodic updates through the various platforms.

The period between 2006 and 2010 will also see the culture of using ICT for teaching, learning and management becoming more visible. This will be, in part, the result of having the right policies in place along with a good supporting infrastructure, courseware, training and the on-going change management procedures.

Smart School Roll-Out Leveraging on Parallel Projects

Projected numbers for the expansion of the Smart School initiative follows closely the MoE's computerisation program



where schools get 1-2 computer labs each depending on their student enrollment.

Combining and integrating efforts by leveraging on hardware provisions and using the School Management System (SMS) and the Smart School TLM is a practical approach.

Industry

Some of the technologies that are expected to be exploited, refined, made relevant to local requirements and successfully adopted as part of the Smart School initiative will be the following:

Open Source Systems

The open source system will be one where efficient products and services can be utilised at minimal cost. However, its shortcomings will also have to be weighed alongside its cheap initial costs and other advantages.

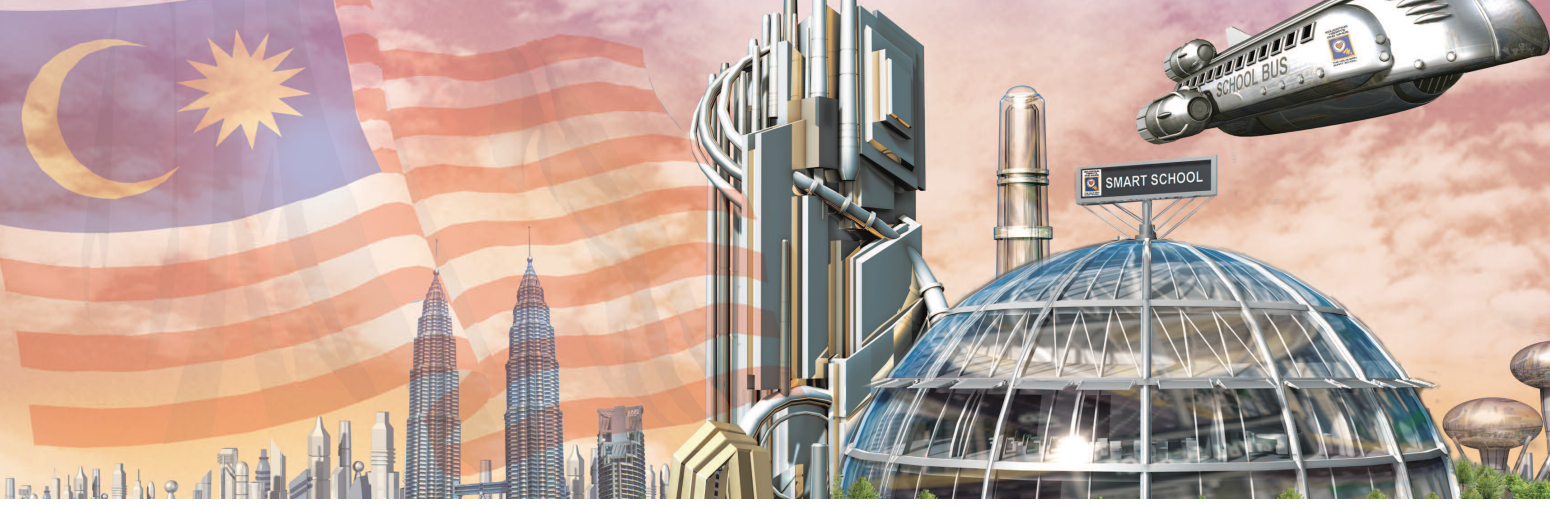
Open Standards

Open standards offer interoperability and continuity and can, in a way, help arrest technology obsolescence in order to address the challenges of cross-platform compatibility, seamless transitions from legacy hardware and software, mission-critical reliability and Internet computing. The industry sector can in fact suggest ways and means to not only minimise initial costs for the government but also the overall costs in the long run to counter the effects of technology obsolescence.

Mobile Learning

Enhancement initiatives can include mobile technologies for teaching-learning purposes, for M-learning or in common usage, the "wireless" way to learning.

A scheme is to be instituted in order to help all children buy an access device for M-learning for use during the child's school-going days. This is one of the solutions schools and parents can consider as part of school governance.



Learning Content Management

The Learning Content Management System (LCMS) will be expanded to allow ordinary non-technical users (such as teachers, etc.) to create, publish content and post such material on the Malaysian Grid for Learning. This is highly exciting, motivating and empowering for teachers. The LCMS will add to the richness of the content being used in schools now.

2020: SMART SCHOOL CONCEPT PERVASIVE IN ALL SCHOOLS

The period between 2010 and 2020 will present opportunities for the advancement of the Smart School applications being implemented in schools. Applications of the Smart School and other ICT initiatives would have converged into effective Smart School solution and advanced applications built on it.

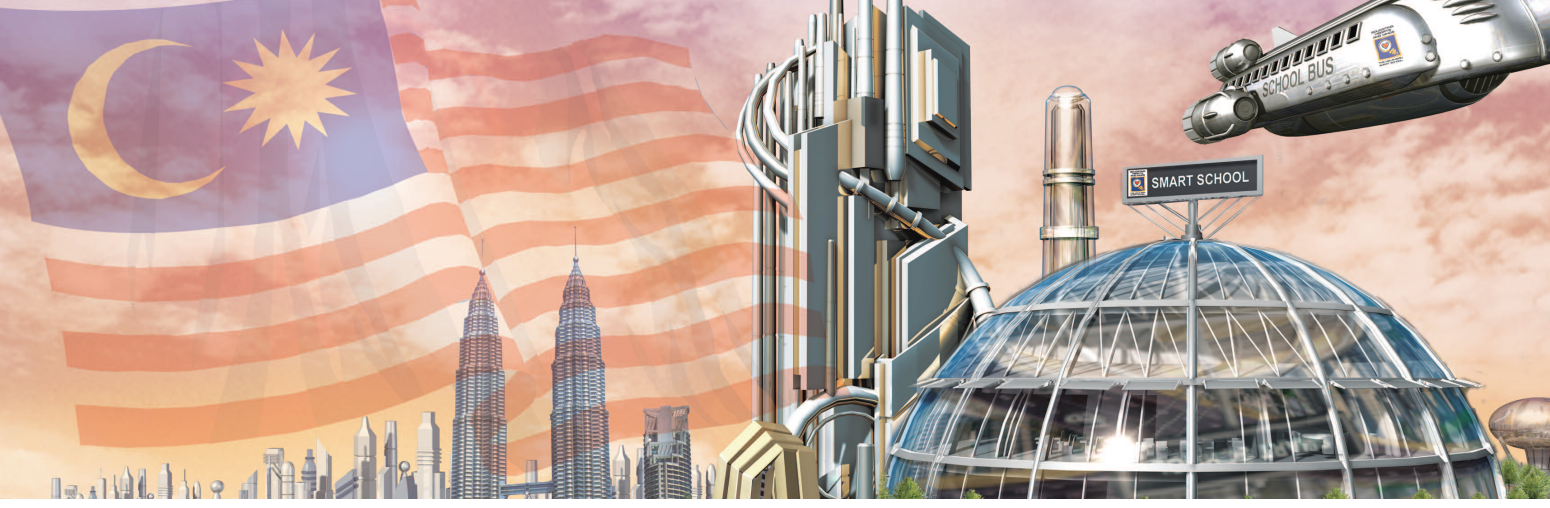
A critical mass along with support in terms of policies would increase the potential of the Smart School applications and give it the required impetus to reach the desired target in 2020

These advancements will be made possible due to the readily available elements of the Smart School ecosystem to be put in place between 2006 and 2010. A reasonable critical mass along with support in terms of policies would increase the potential of the Smart School applications and give the required impetus to reach the desired target in 2020.

The expansion phase, between 2005 and 2010 will see the physical environment of teaching and learning becoming transformed into an electronic environment. The second wave, however, will see the usage of technology in new ways, taking learning beyond the classroom.

Apart from these, the period will also see the enforcement of policies for the use of ICT-based TLM and management tools.

The advancement may be in the form of an improved management system, which for example, could incorporate LCMS.



Educators

Training and upgrading of professionalism will continue as a yearly program of the Teacher Training Division. This, however, will be refreshed with new inputs to incorporate latest developments in teaching-learning approaches and technology.

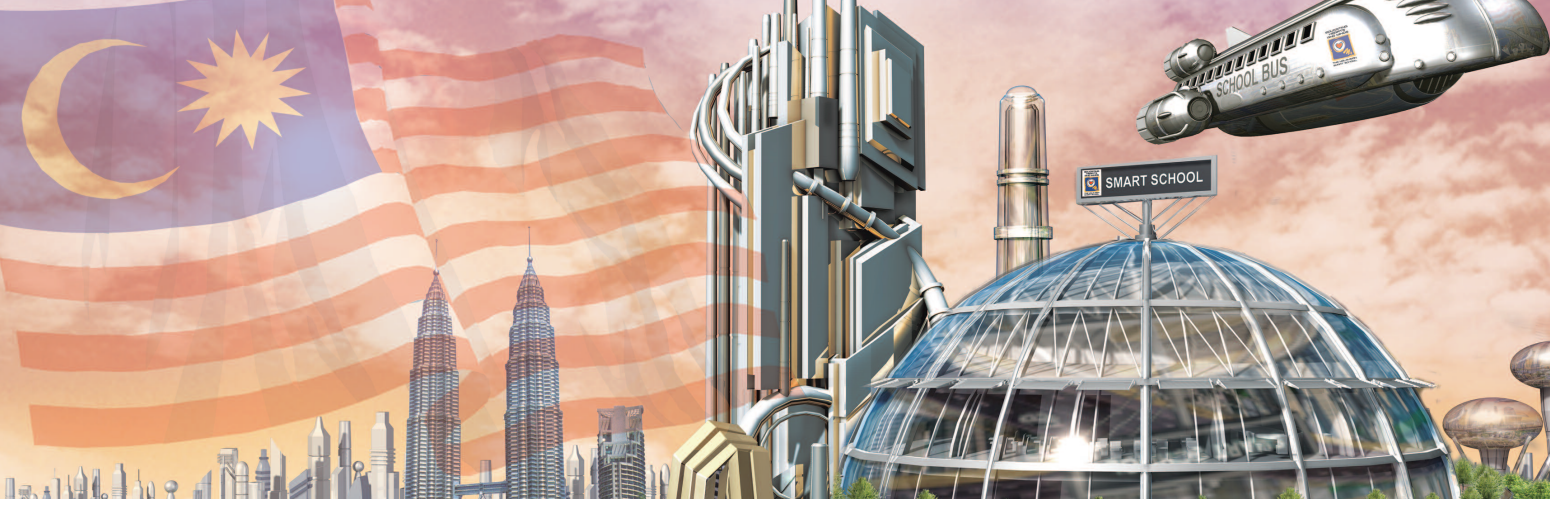
Support systems for teachers must be in place to enable them to cope with the ever widening choices made available by ICT. For excellence in education, administrators and teachers (both new and old) should be provided continuous training to enable them to hone their skills in the use of educational technology meant for problem solving, improving critical thinking and increasing knowledge through learning. Teacher-networks will become routinely used by educators to source out content and obtain assistance in order to enhance their teaching abilities.

The task of preparing both new and experienced teachers along with administrators to guide this 21st century learning in a technology-savvy society, would involve a re-assessment and a retooling of the professional core of our education system. This is a goal that must be shared by all stakeholders and supported by a flexible approach to professional preparation and development.

It would not be impossible to imagine that by 2020 a community-led process (involving parents, teachers, university lecturers, professionals, industry members who actually make up the community) would emerge. Through this, all students would have access to the best teachers and the best educational material anywhere in the country. A development like this would make learning so much more fun and effective.

By 2020, the teaching-learning scenario could be very much different from the one we have today. The Smart School and the accompanying technologies, coupled with growth in broadband and communication infrastructure would pave the way for pervasive learning environments. These learning environments

It is not impossible to imagine that by 2020 a community-led process would emerge through which all students would have access to the best teachers and the best educational material anywhere in the country



would be formed through a programme of interconnected networks that increases communication, connectivity, shared and experiential learning.

Virtual reality teaching-learning experiences would become common. Researchers are already suggesting that schools may not be what they are today, thanks to a technology that is still in conceptual stage – tele-immersion. Using tele-immersion, three-dimensional virtual images of the teacher could be projected to a student's home. The teacher and the student could meet and interact online in real time. Some of the revolutionary changes that may happen in a sophisticated ICT-enabled teaching-learning environment are described as below.

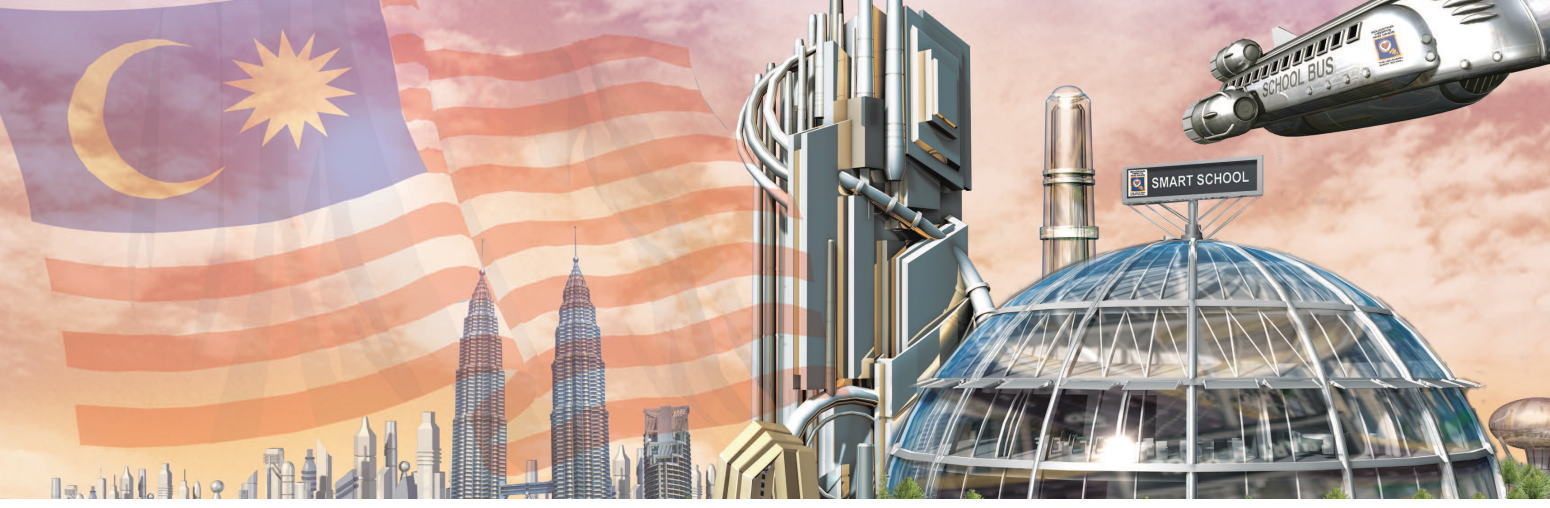
THE SCENARIO BY 2020

Learning Objects

By 2020, the MoE and the MDC visualise the creation of re-usable e-learning objects that can be put together for use in various teaching-learning scenarios, which are not just restricted to schools. Such re-usable learning objects will enable instructors to publish instructional programs on the go. The availability of such re-usable content will create large learning environments, paving the way for peer-to-peer learning where content is published and shared via public networks. Students will complete their assignments by designing re-usable e-books rich with simulations. The creation of re-usable learning objects will also lead to the availability of related resources such as learning repositories and syndicated content that will make 'smart' learning pervasive.

Personalised Content and Delivery

The emergence of standards such as Sharable Content Object Reference Model (SCORM), will ensure that content and Learning Management Systems (LMS) are interoperable. This will support the creation of re-usable learning objects that can be used across LMS, irrespective of the platforms they were developed on.



Customisable learning objects, which can be scaled down to fit mobile devices, will ensure delivery through handheld devices, facilitating anytime, anywhere learning and real-time sharing of information.

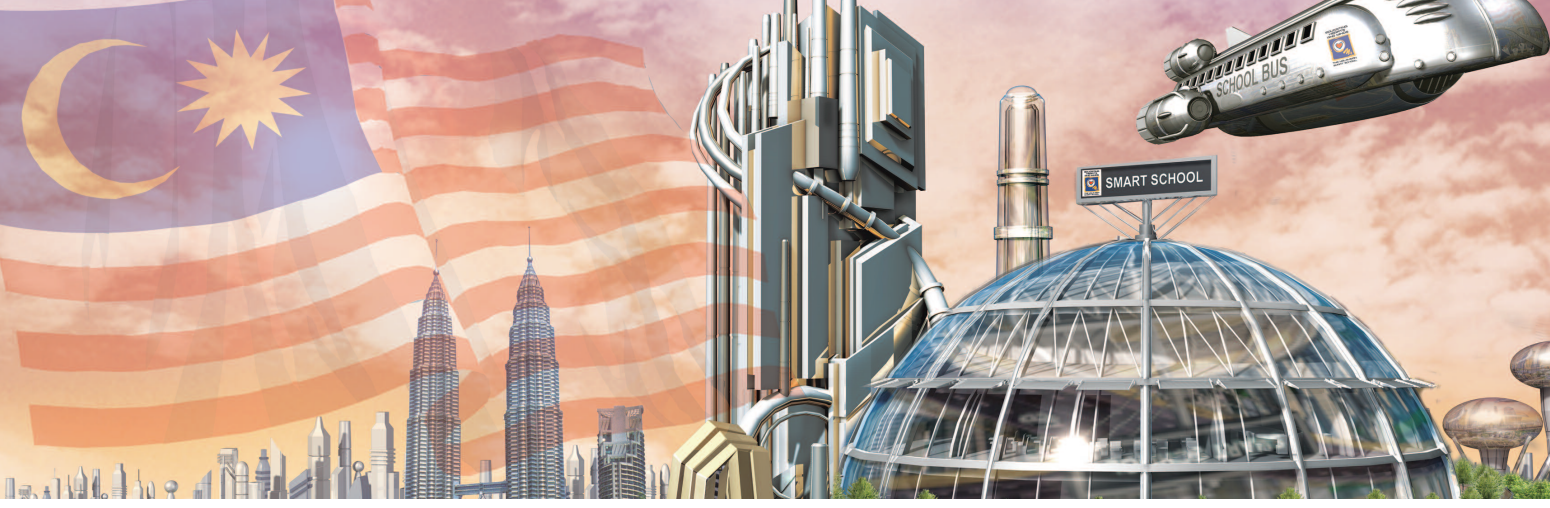
Embedded Learning Objects Create Learning Environments

Devices could well have learning objects embedded in them, which are capable of instructing the user. For example, a learning kit could help a group of people learn how to build a car, assemble a household electrical circuit or even construct a building. Embedded learning objects will help create learning environments never before envisaged.

Such embedded objects will ensure that the process of learning starts in a child's early years. Intelligent toys with embedded objects capture and record the learning preferences of children as they play. Essentially, they could create learning profiles of the children, help teachers and parents personalise and enhance the learning experience of the child early in life. Such tracking will also help in positioning the child into specific skills groups very early in life.

Wearable Technologies Help Students Publish, Exchange Content

Technologists are already talking of "body area networks", where people would wear nano-engineered smart fabrics or carry implanted chips that aid in the exchange, collection and communication of information. In such a scenario, students will collect information from peers, teachers and other learning sources on the fly. The information collected will be automatically mapped to the learning objectives of the skills group that he/she belongs to. The focus will be not on individual learning but collective learning and sharing of experiences and inferences. The pervasive and ambient environment closely monitors and guides the learning process, querying the student, and prodding them into the right direction.



Pervasive Learning Using New-Wave Broadband Technologies

The advent of new broadband technologies such as Worldwide Interoperability for Microwave Access (Wi-Max) could bring e-learning to remote places in Malaysia where access problems have severely curtailed learning the smart way in the past. Wi-Max, which can offer wireless T-1 connectivity at affordable prices, can help the rural poor access rich multimedia content over metropolitan area networks.

Virtual Learning Environments would Herald Changes in the Roles of Teachers

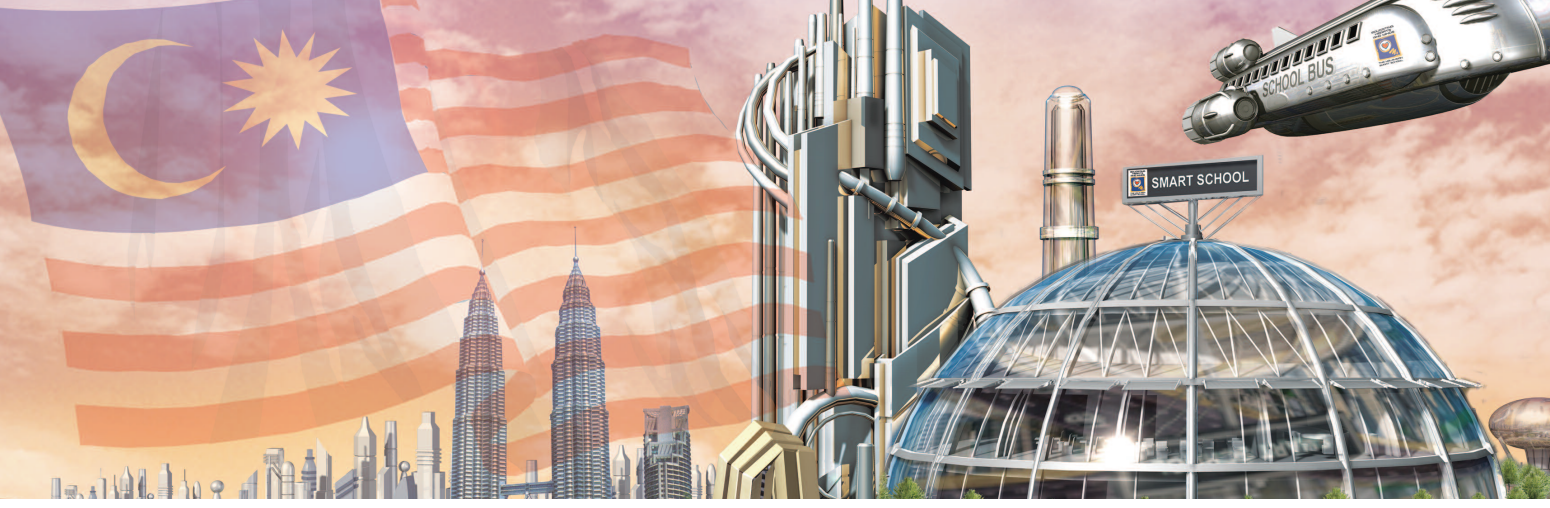
Teachers will continue to be the students' mentors. Each student will have one or several virtual mentors who can be accessed anytime. These mentors will monitor the online activities of their wards, offering advice, suggestions and feedback. Such mentors will also report any significant happening in the child's learning to the parents, teachers and any other interested parties. One of the key roles of such a virtual mentor will be the continuous mapping of performance goals with student activity, offering real-time course corrections, replacing evaluation through periodic tests.

Home Schooling, the Next Big Wave

The presence of pervasive learning, coupled with the availability of enabling infrastructure and technology will ensure a shift from the school as the centre of teaching and learning, to the home. Self-paced learning, continuous learning and life-long learning will all become distinct possibilities in such an environment.

Usage of Radio Frequency Identification (RFID)

Radio Frequency Identification (RFID) systems can provide multiple functionalities ranging from the tracking of student attendance to other monitoring and management capabilities. RFID Tags is a microchip with a tiny antenna broadcasting a specific ID to the reader unit. This reader when connected with the database helps track down relevant data and update the information accordingly.



RFID chips will help track students and ensure their safety during school hours. The RFID-based system can have an interface with the School Management System to provide substantiated data on attendance in respective classes. Information pertaining to disciplinary record, library loans, punctuality in attending school/classes, loans of other school assets, visits to nursing stations and cafeterias etc. can be tracked via the RFID systems leading to better student management mechanism for all the Smart Schools.

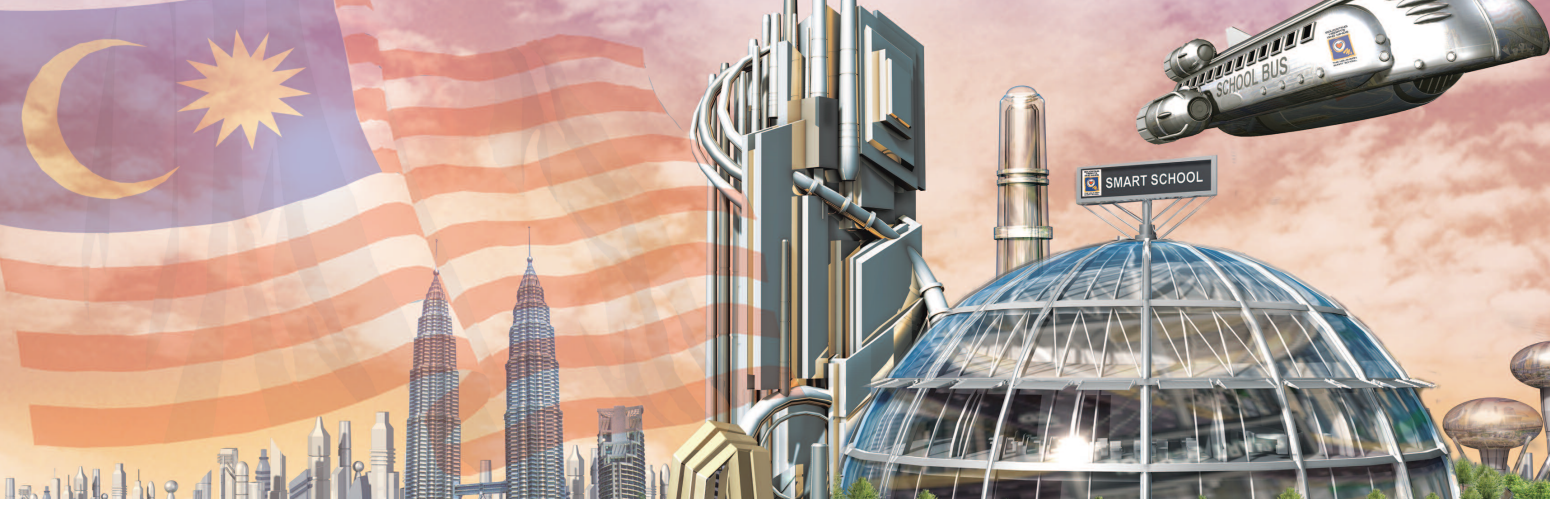
RFID tracking will further reduce the time taken for some of the daily administrative activities thereby furthering the goal of the Smart School initiative to make schools more efficient and highly effective in imparting knowledge.

CONCLUSION

The Smart School initiative, as envisaged in the Conceptual Blueprint, can revolutionise learning in ways that are beyond our grasp today. The Pilot and the Post-Pilot phases have helped in identifying weaknesses and corrective steps have been identified to rectify these and enhance the strengths. Ensuring the successful implementation of the nationwide expansion of the Smart School will require certain moves as summarised below.

A long-term implementation plan for the period 2005-2020 will set performance targets that will have to be met by the major players. The plan would have to get the approval and full backing of the government in terms of its commitments to the goals of the Smart School. Having relevant policies in place is an important factor to enhance implementation. Support will also be provided in terms of making available the necessary human, financial and physical resources required by the initiative.

The establishment of exclusive target setting and performance measuring groups made up of bureaucrats, educationists (from the public and private sectors), and representatives of the industry and NGOs is required to conceptualise and re-affirm continuity



strategies. This will help in anticipating and creating alternative competing scenarios for every stage of implementation and in recommending follow-up policies to attain the desired goals.

Many other recommendations that have been discussed at length in the previous sections will have to form a part of any successful implementation strategy. Other government agencies, such as the Ministry of National and Rural Development, Tenaga Nasional Berhad and Telekom Malaysia Berhad can play significant roles, especially in providing for the needs of rural areas. This will have a positive impact on the Smart School.

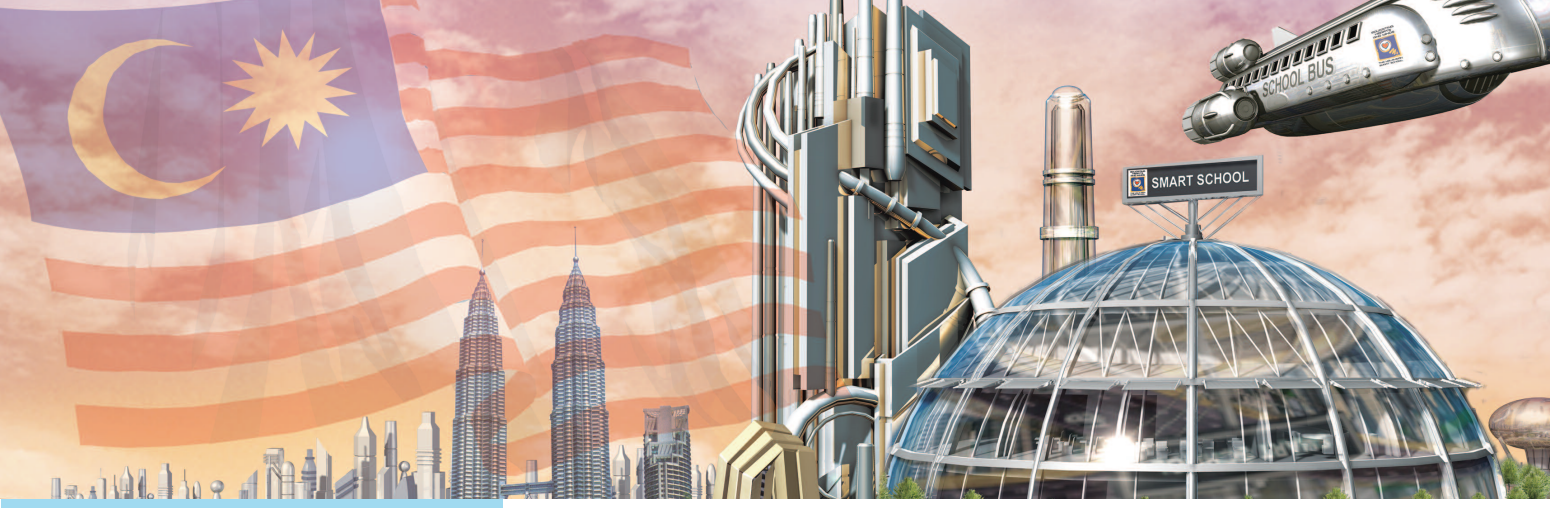
The MDC will act as a bridge between government agencies and other external parties to ensure the realisation of the Smart School Vision

The MoE, by virtue of its expertise in education and responsibility over schools nationwide, will lead the way. The MDC, meanwhile, besides the role it was entrusted with during the Pilot Project, is well placed to act as coordinating agency. It can engage with the private sector, address the R&D concerns as well as involve the educational institutions through its vast and strategic network. It will act as a bridge between the government agencies and other external parties, along with being an initiator and prime mover of public-private sector collaborations.

An exclusive approach, where it is recognised that many other parties can effectively contribute to the enterprise, needs to be applied. There are similar initiatives by private sector courseware providers within the country that can be studied as a model. These companies provide content and services to improve the teaching-learning of English, Mathematics, Science and Malay Language/ vernacular languages in independent schools not directly under the ambit and financing of the government.

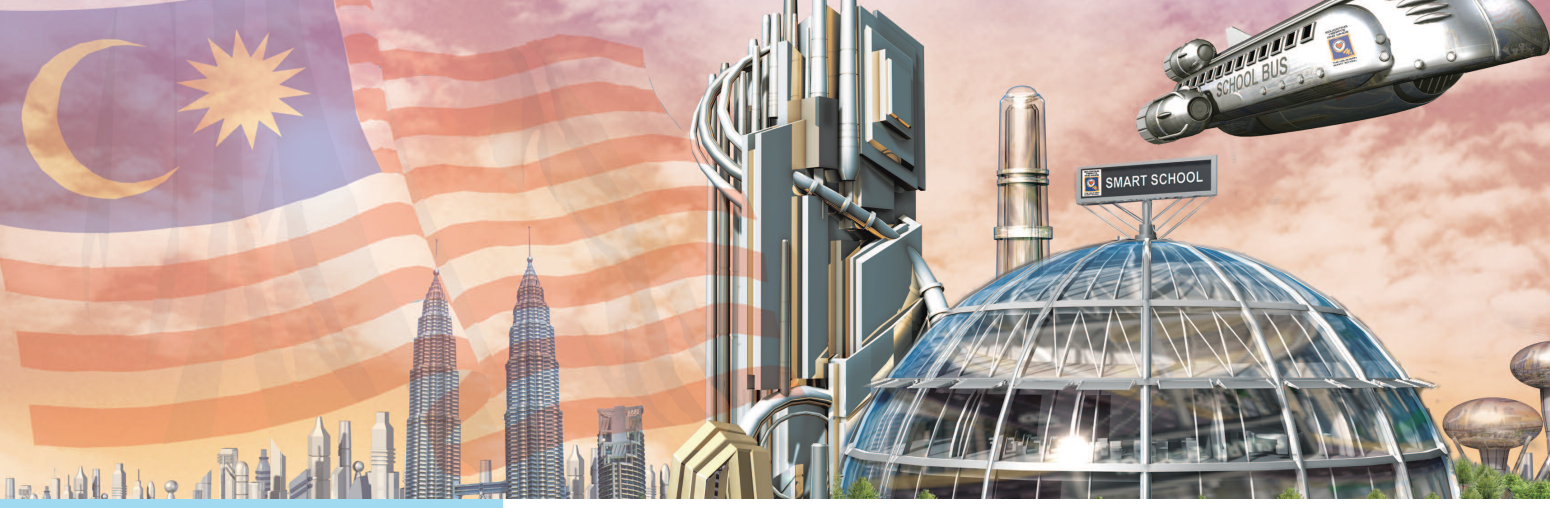
Private sector initiatives to utilise technology/Internet for net-working and project-based learning and their successes should be considered and adopted.

A beginning has been made and strong foundations have been laid. A meeting of determined and committed minds, conducted in an environment that is conducive to such endeavours in order to carve the Roadmap into its proper constituents, approaches, strategies, and phases is the next vital step to take.



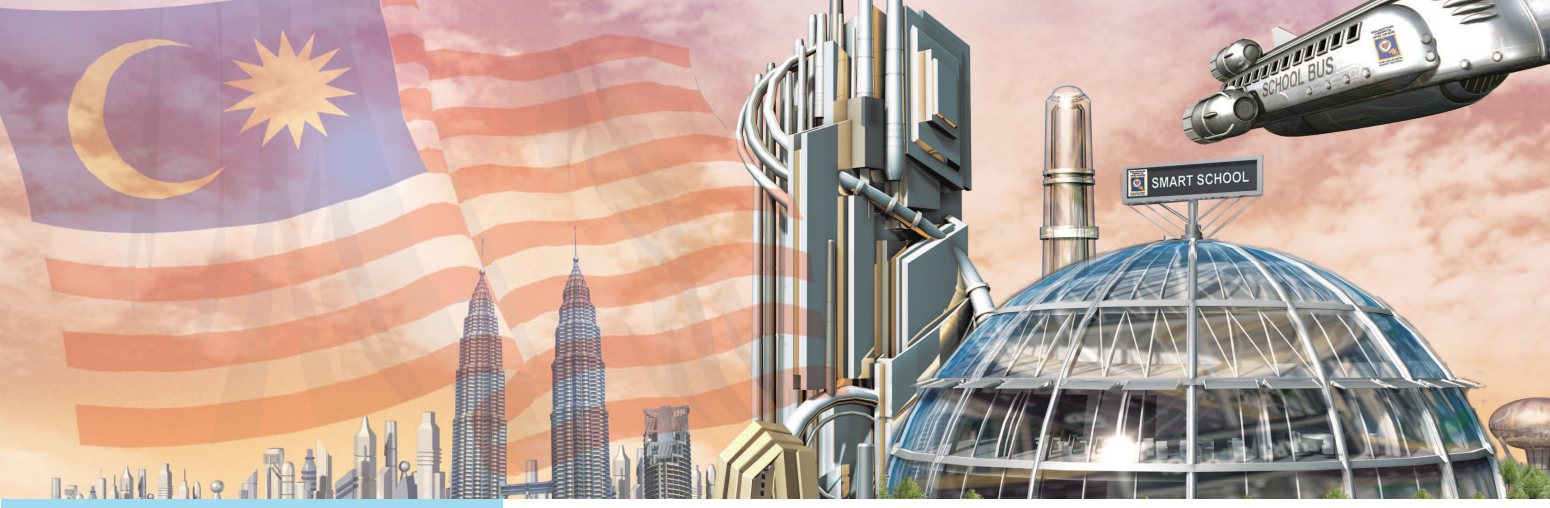
Glossary

CDRI	CD ROM Interactive
CRFP	Concept Requests for Proposals
CT	Computing Tablet
DEO	District Education Offices
ETD	Educational Technology Division
ETeMS	English Teaching of Mathematics and Science
ETV	Educational Television
FED	Federal Education Department
ICT	Information and Communication Technology
IT	Information Technology
KPIs	Key Performance Indicators
LAN	Local Area Network
LCD	Liquid Crystal Display
LCMS	Learning Content Management System
LMS	Learning Management System
MAMPU	Malaysian Administrative Modernisation and Management Planning Unit
MCMC	Malaysian Communications and Multimedia Commission
MDC	Multimedia Development Corporation
MEWCM	Ministry of Energy, Water and Communications
MIMOS	Malaysian Institute of Microelectronic Systems
MoE	Ministry of Education
MoF	Ministry of Finance
MRTD	Ministry of Rural and Territory Development



Glossary

MOSTI	Ministry of Science, Technology and Information
MSC	Multimedia Super Corridor
NGOs	Non-Government Organisations
PCs	Personal Computers
PPSMI	*Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris* (Teaching and Learning of Science and Mathematics in English)
PSI	Partner Satisfaction Index
PSD	Public Services Department
PTA	Parent Teachers Association
R&D	Research and Development
RFID	Radio Frequency Identification
SCORM	Sharable Content Object Reference Model
SED	State Education Departments
SERC	State Education Resource Centres
SS	Smart School
SSCTPP	Smart School Computing Tablet Pilot Project
SSIS	Smart School Integrated System
SSMS	Smart School Management System
TAC	Teacher Activity Centres
TLMs	Teaching Learning Materials
TSS	Telekom Smart School Sdn Bhd
TV	Television
UNDP	United Nations Development Programme
USA	United States of America
Wi-Max	Worldwide Interoperability for Microwave Access



Acknowledgement

Two workshops were held to brainstorm and gather relevant information about lessons learnt, strategies and action items to move forward for the Roadmap.

Participants of the workshop are representatives from key agencies, the industry, and higher learning institutions: (1) MoE (Teacher Education Division, Communication, Multimedia and Technology Divison, Educational Technology Division, Minister Office, School Division, Malaysian Examination Syndicate, Curriculum Development Centre, Educational Planning and Policy Research Division and Special Education Department), Sekolah Menengah Kebangsaan Jinjang, Sekolah Kebangsaan Bukit Rimau, Sekolah Menengah Agama Persekutuan Labu and Sekolah Kebangsaan Putrajaya 2, Ministry of Science, Technology and Information, Ministry of Energy, Water and Communications and Economic Planning Unit, (2) Industry representatives (Telekom Smart School, MultiMedia Synergy Corporation, EduTrend, Pintar Media, New Technology and Innovation, NIIT, Gerak Mobile Technology, KDEB Anzagain, Sapura Technology Berhad, GITN, Omnilogic, MIMOS, Microsoft and Intel Electronic), (3) technologists/educationists/ academics (Open University, Multimedia University, University Kebangsaan Malaysia).