MALAYSIAN RAIL SUPPORTING INDUSTRY ROADMAP 2030

MiGHT
Malaysian Industry-Government Group for High Technology

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We would also like to acknowledge the contribution of all participating stakeholders involved in the focus group and working group throughout the formulation of the roadmap.

Land Public Transport Commision (SPAD)
Ministry of Transport (MOT)
Ministry of Finance (MOF)
Ministry of International Trade and Industry (MITI)
Ministry of Science, Technology and Innovation (MOSTI)
Ministry of Higher Education (MoHE)
Malaysian Investment Development Authority (MIDA)

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Scomi Group Berhad
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Thales International (M) Sdn Bhd
Global Rail Sdn Bhd
PSI Incontrol Sdn Bhd
Sutera Teknik Sdn Bhd
Majestic Engineering Sdn Bhd
DK Composite Sdn Bhd

Emrail Sdn Bhd
Asia Communications & Electronics (Asiakom) Sdn Bhd
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Gamuda Berhad
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Muhibbah Engineering (M) Berhad

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UniKL - Institute of Product Design And Manufacturing (IPROM)
UniKL - Malaysian Institute of Aviation Technology (MIAT)

UniKL - Malaysia France Institute (MFI)
UniKL - Malaysian Institute of Industrial Technology (MITEC)
UniKL - British Malaysian Institute (BMI)
UniKL German-Malaysian Institute (GMI)
KLIA Professional & Management College
Universiti Teknologi MARA (UiTM)
UiTM Malaysia Institute of Transport (MITRANS)
Rapid Rail Academy

Executive Summary

The Malaysian Rail Supporting Industry Roadmap 2030 has been prepared as a guideline for the development of this industry to complement the growing rail transportation industry. The plan identifies key initiatives for the transformation of the local rail industry into a strong and sustainable business, capable of satisfying the demands of the national rail transportation and turning Malaysia into a competitive global player that optimises the use of indigenous resources and technologies by 2030.

In reviewing and finalising the roadmap, a working committee called the Future Rail 2030 Committee was established in February 2012 to provide strategic advice, to steer the roadmap development and to share the information on the latest and future rail-related initiatives. It consists of selected representatives from major rail operators, manufacturers, MRO service providers, the related Government agencies, the academia and the regulators.

The recommendations in the roadmap are expected to contribute to the national economy. The characteristics of the industry as envisaged by Vision 2030 shall be attained by creating conducive rail industry eco-system, increasing the localisation of rail products and services to compete with the regional and global players.

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MiGHT
Malaysian Industry-Government Group for High Technology

About MIGHT

MIGHT is the nation's lead agency in setting the high technology agenda for Malaysia. It is responsible for managing high technology industry development and is the premier platform for international Science, Technology and Innovation (STI) engagements for the Prime Minister of Malaysia.

What is MIGHT?

The Malaysian Industry-Government Group for High Technology (MIGHT) is an agency under the purview of the Prime Minister's Department, tasked with the advancement of high technology industries. MIGHT is a not-for-profit entity, supported by the Government of Malaysia and revenue generating activities including but not limited to consulting, technology management and membership.

How does MIGHT work?

As an organization, MIGHT achieves its objectives principally through industry-government consensus building and smart partnership between organisations in the public, private and academic sectors. Since 1993, MIGHT has been a key provider of STI policy input and has been responsible for much of the country's technology road-mapping and high technology industry strategising.

MIGHT has spearheaded partnerships at both the local, regional and international levels and holds alliances with Centres of Excellences around the world including the United States, South Korea, Germany and Australia.

Where is MIGHT headed?

The organisation's recent repositioning under the Prime Minister's Department has brought with it a new mandate for internationalisation. In May 2011, Prime Minister Najib Razak launched Global Science and Innovation Advisory Council (GSIAC), meant to act as a hub for high technology network facilitation providing Malaysia with improved access to global subject matter experts and emerging technologies through network facilitation and other appropriate platforms.

Today, MIGHT is more central than ever, lending key support to national objectives for global competitiveness and sustainable development in high-value, knowledge-based industries. Through technology prospecting, management and policy-making, MIGHT empowers the industry, the government and the academia towards a global future in science, technology and innovation.

Core Competencies

Advisory

Based on its extensive experience engaging in direct dialogues with industrial, governmental and academic stakeholders, MIGHT provides strategic council and advisory services to a variety of cross-sector organisations from both the private and public sectors. As a member-based organisation under the Prime Minister's Department, MIGHT serves the national interest and the interests of its members, helping to bridge the gap between the public and the private sectors. Advisory services include activities such as consulting, offset management and MIGHT's cutting-edge Foresight division, which employs

proven futurology study methods to provide insights into emerging technologies, trends and areas of commercial opportunities.

Intelligence

One of MIGHT's strongest core competencies stems from its nearly 20-year history generating policy input and strategic planning for the development of Malaysian high technology industries - intelligence services. Through MIGHT Interest Group (MIG), experts with vast public and private sector experience, equipped with the latest data conduct primary and secondary research contribute to some of Malaysia's most important industry planning exercises.

The organisation is backed by a long track record of planning success and has been responsible for much of the ground work that has allowed leading sectors such as automotive, maritime, biotechnology, ICT and aerospace to flourish in Malaysia. MIGHT has seen the development and handover of the Malaysian Automotive Institute (MAI) and continues to be the home of the country's leading aerospace industry authority, the Malaysian Aerospace Council (MAC), chaired by the Prime Minister.

Rail is the latest sector to be introduced, which counts the Malaysian Rail Supporting Industry Roadmap 2030 as its first contribution to the national high technology eco-system.

Partnership

Providing cross-programme support to all of MIGHT's activities, MIGHT's partnership platforms are ingrained in the DNA of the organisation. MIGHT's various partnership platforms bring together diverse interests such as those from the research and academic communities, public and private sector capital providers, government policy makers and private sector companies.

It is this multi-pronged approach to industry development that allows MIGHT to act as the premier platform for multi-interest consensus building in areas of high technology. This partnership approach has given rise to organisations such as the Advanced Manufacturing Institute (AMI) and the Aerospace Malaysia Innovation Centre (AMIC), which bring together global industry leadership with local universities, research centers and private sector companies to advance high technology industry goals.

Globalization

In 2011 MIGHT took on a new mandate for the internationalisation of Malaysia's high technology industry. This has meant both playing an increasingly important role in science and technology projects of the Prime Minister of Malaysia and also major changes to the positioning of MIGHT as an organisation.

While MIGHT has long been an active participant in the global community around high technology projects, the recent positioning of the organisation under the purview of the Prime Minister's Department has made way for the launch of MIGHT International, organised to act as a hub for international science and technology projects. Characterised by a network of partnerships and interconnected offices around the world, MIGHT International provides improved access to global expertise and resources and acts as a spring board for Malaysian high technology companies seeking improved access to technology and international technology partners.

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Prime Minister's Quotes on Rail

Dato' Sri Mohd Najib Tun Abdul Razak

Prime Minister of Malaysia

"With all the on-going projects that Malaysia had, namely, the construction of the Mass Rapid Transit (MRT), Light Rail Transit (LRT) extensions, High Speed Rail project as well as the development of Rail Centre in Batu Gajah, it would become the catalyst for the growth of industries for railway technology in Malaysia.

"Growth of rail sector is a huge task for all of us; the industry players, agencies like CIDB, SPAD and research agencies like MIGHT, and in particular the challenges of training the required number of skilled workers that will be needed to support the industry's growth. This of course will require a combination of R&D efforts, technology transfer and learning from more advanced rail countries.

"In 10 years, it is anticipated that there will be a demand for another 250 units of rail cars and locomotives in Malaysia alone and the demand from ASEAN and the Middle East is expected to touch 2,900 units of new trains. This is a massive market. Apart from this, maintenance, repair and overhaul (MRO) of trains is yet another opportunity waiting to be tapped as it is estimated that in five years about 1,350 trains will require MRO services.

Message from

Dato' Sri Dr. Zakri Abdul Hamid

Science Advisor to the Prime Minister of Malaysia

Year 2030 has been envisioned to have transformed the Malaysian rail industry landscape to become one that is highly modernised as a result of the implementation of the roadmap recommendations by the local rail industry focus groups. As a dynamic global industry, rail proven to be the favoured mode of public transportation in the face of urbanisation, traffic congestion, climate change and the ever challenging issues enveloping energy.

With the significant amount of rail investment by the Government until 2020 through the Greater Kuala Lumpur initiative of the Economic Transformation Programme, the rail industry will offer abundant opportunities in engineering, electronics, maintenance, repair and overhaul (MRO), as well as design, manufacturing and assembly. Further developing the rail industry here, therefore, will help us acquire higher technologies and build skills, many of them transferable to other industries as well.

Future Rail 2030 presents a unified view of the industry's key initiatives for transformation of the local rail industry into a strong and sustainable business, capable of satisfying the demands of the national rail transportation. This initiative is symbolic of the industry's determination to achieve a consensus to transform Malaysia into a competitive global player that optimises the use of indigenous resources and technologies by 2030.

This roadmap has brought industry stakeholders, government and academia together to deliver a vision for Malaysia's rail industry's future. The formulation of goals, strategies and key initiatives have involved engagement by more than 200 key individuals from more than 60 organisations. It will certainly position the Malaysian rail industry well to continue to grow to 2030 and beyond.

I congratulate the industry on its support and engagement during the roadmap's preparation and encourage you to embrace it so we can harness these opportunities to innovate and to grow the Malaysian rail industry.

Thank you.

Dato' Sri Dr. Zakri Abdul Hamid
Science Advisor to the Prime Minister of Malaysia

Message from

Dr. Mohd Yusoff Sulaiman

President and Chief Executive Officer of MIGHT

The rapid rail industry development in Malaysia offers both challenges and opportunities. In order to reap the benefits from the huge Government investment, the development of the local industry in manufacturing, maintenance, training and education, and electronics must be accelerated and targeted. The challenges confronting us must be met and overcome with solidarity among the relevant agencies and partnerships between private and public sectors. With proper governance and extensive industry participation, we could expect the local rail industry to compete effectively at the global level by 2030, or earlier.

This was why the Malaysian Rail Supporting Industry Roadmap 2030 was developed. It brought together the best rail practitioners from the public sector, local and international industry players, academicians, and NGOs to identify the opportunities and resolve the challenges. Led by MIGHT and SPAD, the Roadmap successfully outlines the growth strategies for the rail industry and focuses on niche businesses. The engagements, not unlike the labs, encompass a series of workshops, industry intelligence exercises and through direct inputs from the Future Rail 2030 group. The Roadmap promotes an industry-driven approach and addresses the technology and management challenges to the industry including rolling stocks, rail-related systems, infrastructure, maintenance and human capital development.

The Government has stated its commitment to improve the public transportation services as outlined in the New Economic Model and 10th Malaysian Plan. The commitment in implementing the Trans-Asian Railway has also triggered the Government to invest heavily in the rail infrastructure. Although the Government itself should not be in business and certainly not competing with the industry, the Government must be prepared to invest and provides the platform and support for the local industry to grow. In the near future, the rail industry will certainly provide Malaysia with another revenue generating and growth area for socio-economic excellence.

I sincerely thank all participants and stakeholders involved in the development of the Roadmap and also to the Future Rail 2030 Committee for their excellent support in providing guidance and validating the works in the report.

Dr. Mohd Yusoff Sulaiman
President and Chief Executive Officer

Message from

Lt. Col (R) Sarbini Tijan

Chairman of Future Rail 2030 Committee

The history of Malaysian rail is about more than just a train. For the past century, rail has been part of Malaysian culture and lifestyle, creating job opportunities for our people and being the transport mode of choice to move people and goods.

The emerging issues such mobility, environmental pollution, space congestion and spin off from huge investments had urged Government's commitment to re-positioning rail transport industry. The industry also has undergone significant changes over the past decade with the implementation of initiatives by the Governments aimed at promoting more use of rail transport under the National Key Result Area (NKRA) and to improve the coverage of rail-based public transport in Klang Valley under National Key Economic Area (NKEA).

In line with the Government's aspiration, the rail industry is looking forward to face the challenge by taking charge in materialising the national goals. Starting-off in 2011, the rail industry players have embarked on a very important journey to revive the current state of railway industry in Malaysia. Thus, a strategic roadmap, Malaysian Rail Supporting Industry Roadmap 2030 was formulated in preparing the rail industry for challenges and growth in the next 15 years.

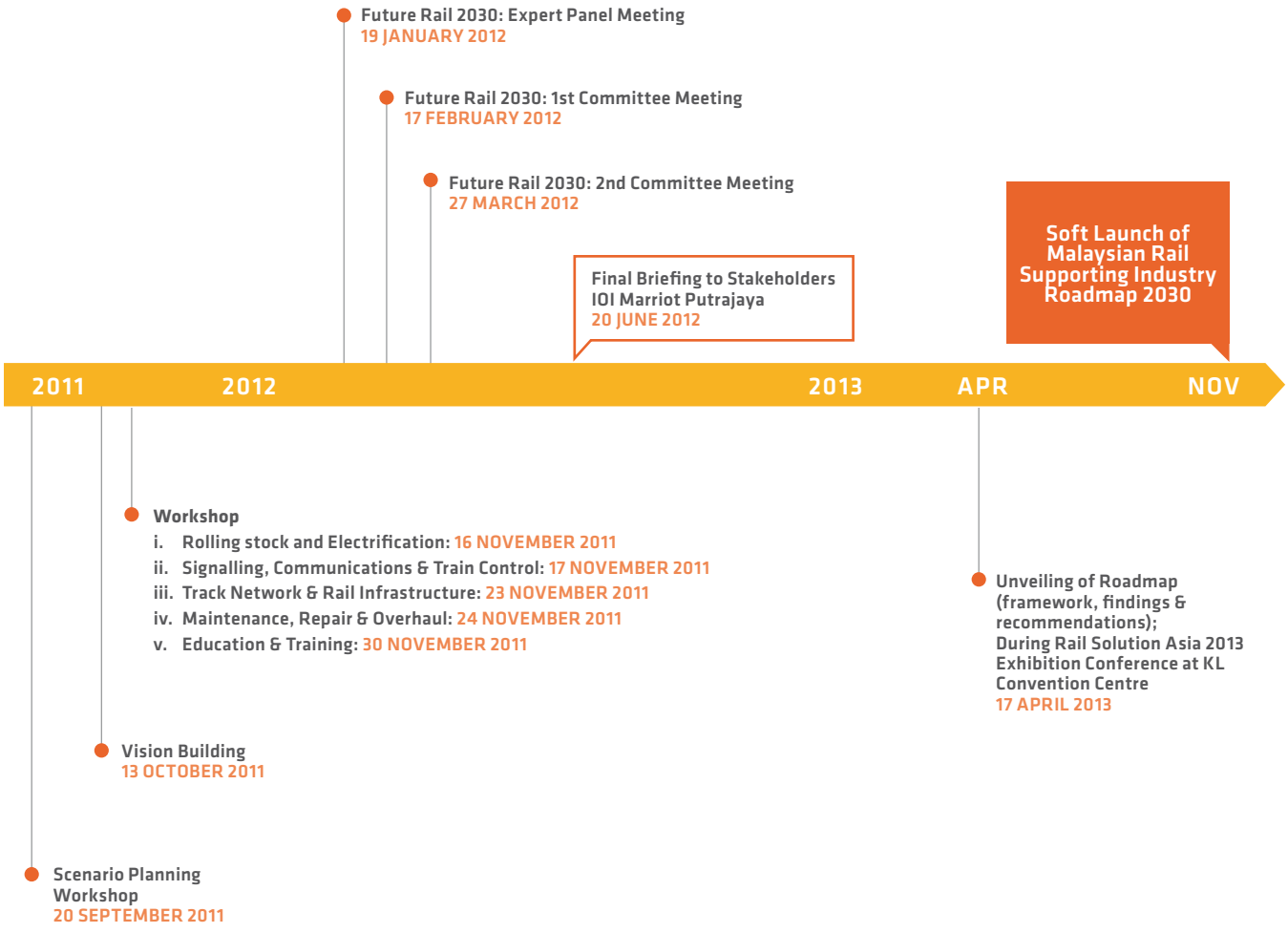
With the formation of industry advisory committee - Future Rail 2030; together with the involvement of industry players, government agencies and academia, this roadmap provided a unified voice in defining the vision of the industry by developing consensus on the goals, key strategies and initiatives.

I praised the continuous support and engagement to all participants during the preparation of the roadmap. Let us together move forward towards improving the industry's competitiveness and maximising opportunities for future sustainability.

Lt. Col (R) Sarbini Tijan
Chairman of Future Rail 2030 Committee

Roadmap Moments

Milestones of Malaysian Rail Supporting Industry Roadmap 2030



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Stakeholders Engagement & Meetings

1. Scenario Planning Workshop, 20 September 2011
2. Scenario Planning Workshop, 20 September 2011
3. Vision Building Workshop, 13 October 2011
4. Rolling Stock & Electrification Focus Group, 16 November 2011
5. Signalling, Communication & Train Control Focus Group, 17 November 2011
6. Track Network & Rail Infrastructure Focus Group, 23 November 2011
7. Maintenance, Repair & Overhaul Focus Group, 24 November 2011
8. Education & Training Focus Group, 30 November 2011
9. Industrial Visit to Ampang Line LRT, 9 February 2012
10. Industrial Visit to PSI InControl Sdn Bhd, 13 February 2012
11. Industrial Visit to SMH Rail Sdn Bhd, 1 4 February 2012
12. Industrial Visit to Malaysian Rail Academy (MyRA) KTMB, 25 September 2012
13. Industrial Visit to SCOMI Rail Bhd, 10 February 2012
14. Industrial Visit to Jabatan Keretapi Negeri Sabah, 18 May 2012
15. Briefing to Captains of the Industry
16. MIGHT Interest Group for Rail (MIG Rail), 25 October 2012
17. Specific Purpose Mission to UK, France & Spain (7 – 17 July 2012)
18. Specific Purpose Mission to Austria & Germany and Innotrans 2012 (16-22 September 2012)
19. Business Mission to Spain, 17-21 June 2013
20. Benchmarking Visit to Korea, 18-24 February 2012

Final Stakeholders Briefing
20 June 2012, IOI Marriot, Putrajaya

1 FROM LEFT: Datuk Ir. Kamarulzaman Zainal, Senior Vice President of MIGHT; Lt. Col (R) Sarbini Tijan, Chairman of Future Rail 2030 Committee; Omar Jaafar, Chairman of Sutera Teknik Sdn Bhd; Mansor Tahir, Senior Vice President of Scomi Special Vehicle Sdn Bhd; and Mohd Nasir Md Ibrahim, Senior Principal Analyst II

2 Briefing to Stakeholders Future Rail 2030 participants

3 Dato' Wan Ahmad Shihab Ismail, Special Officer to the Prime Minister of Malaysia (left) and Azmi Abdul Aziz, Chief Development Officer of SPAD (right)

4 FROM LEFT: Habibur Rahman Ibrahim, Director of DK Composites Sdn Bhd; Lt. Col (R) Sarbini Tijan; Muhamad Nur Ismal Muhamed Kamal, Chief Executive Officer of SPAD; Datuk Ir. Kamarulzaman and S.M Sabri S.M Ismail, Executive Vice President of Prasarana

5 The arrival of Guest of Honour

6 Dr. Mohd Yusoff Sulaiman, President and CEO of MIGHT (right) handing in the memento to Tan Sri Dato' Seri Syed Hamid bin Syed Jaafar Albar, Chairman of SPAD (left)

7 FROM LEFT: Lt. Col (R) Sarbini Tijan, Dr. Mohd Yusoff Sulaiman and Tan Sri Dato' Seri Syed Hamid bin Syed Jaafar Albar

8 Briefing to Stakeholders Future Rail 2030 participants

9 Q&A Session

10 FROM LEFT (BACK): Lt. Col (R) Sarbini Tijan, Chairman of Future Rail 2030 Committee; Datuk Ir. Kamarulzaman Zainal, Senior Vice President of MIGHT; and S.M Sabri S.M Ismail, Executive Vice President of Prasarana

FROM LEFT (FRONT): Muhamad Nur Ismal Muhamed Kamal, Chief Executive Officer of SPAD; Tan Sri Dato' Seri Syed Hamid bin Syed Jaafar Albar, Chairman of SPAD; and Dr. Mohd Yusoff Sulaiman, President and CEO of MIGHT

11 The arrival of Guest of Honour

12 Networking/Appreciation Session

OPENING ADDRESS BY YANG BERHORMAT TAN SRI DATO' SERI SYED HAMID BIN SYED JAAFAR ALBAR CHAIRMAN OF LAND PUBLIC TRANSPORT COMMISION (SPAD) ON THE OCCASION OF THE OFFICIAL OPENING CEREMONY OF BRIEFING TO STAKEHOLDERS MALAYSIAN RAIL SUPPORTING INDUSTRY ROADMAP 2030 AT KUALA LUMPUR ROOM IOI MARRIOTT PUTRAJAYA 20 JUNE 2012

Dr. Mohd Yusoff Sulaiman
President and CEO, Malaysian Industry-Government Group for High Technology (MIGHT)

En. Mohd Nur Kamal
CEO, Suruhanjaya Pengangkutan Awam Darat (SPAD)

Lt. Col. Haji Sarbini Tijan
Executive Vice President, Keretapi Tanah Melayu Berhad (KTMB)
Chairman of Future Rail 2030 Committee

Distinguished guests, Tan Sri – Tan Sri and Datuk – Datuk; Ladies and Gentlemen, Assalamualaikum & Salam 1Malaysia.

Thank you for inviting me to give a few words in this exciting journey undertaken by MIGHT, endorsed by SPAD. I would like to bid a warm welcome to all of you present, for the "Briefing Session to Stakeholders Malaysian Rail Supporting Industry Roadmap 2030". It has come to my attention that today's session is attended by various rail stakeholder bodies, developing a roadmap for our local Railway Industry. For your information, SPAD is also currently undertaking a bigger study, and top of the list is the National Land Public Transport master plan comprising of not only rail but integrating all modes of land public transport. In addition to that, SPAD is also developing several comprehensive rail studies such as the "Urban Rail Development Plan" (URDP), High Speed Rail (HSR) and Rapid Transit System (RTS). It is timely for MIGHT through this roadmap to lead the local rail stakeholders to seize opportunities available and rise to the challenge.

Ladies and Gentleman,

The Malaysian railway has a rich history that spans over a century. The first tracks being laid in 1885 for transporting the precious commodity at that time: tin. It was vital for transporting tin from mines and ran between Port Weld and Taiping. The world has evolved; we are now more into transporting the world's greatest asset: people!

Who could have envisioned that today, trains capable of travelling at speeds of 450 km/hour connecting from one country to another. Additionally, with the global concerns on energy utilisation and the environmental impact resulting in favour of the rail transport mode, it is timely for Malaysia to set the right and proper direction for the industry.

Presently, we are working at improving our position towards realising the goal of Vision 2020 – high quality of life, technological advancement, self-sufficient industrial; all those contribute towards becoming a developed nation. Thus, the contribution from rail industry in terms of logistics and market demand has increasingly gained the Government's as an engine of growth. In 2010, the industry has generated an estimated turnover of RM1.7 billion employing a total workforce of 9,500 people.

Ladies and Gentlemen, SPAD was created as a result of the Government effort to transform our public transport landscape into an integrated system that is safe, reliable, efficient, planned, responsive and sustainable, all with the intention of making land public transport as the Rakyat's mode of choice. The Government's aspiration to improve the land public transport is reflected in the **NKRA** (National Key Result Area) and **NKEA** (National Key Economic Areas) through the vision of our Prime Minister, YAB Dato Sri Najib Tun Razak who brainchild **GTP** (Government Transformation Plan) and **ETP** (Economic Transformation Programme). The Mass Rapid Transit (MRT) for example, will be the backbone of Klang Valley's public transportation system integrating with other public transport modes offering seamless connectivity especially with the establishment of Integrated Transportation Terminal (ITT) aimed at improving quality of life and increasing ridership (modal share) to 50% by 2020.

Under the Urban Rail Development Plan (URDP), SPAD is undertaking a series of studies aimed at making our Land Public Transport system into a world class infrastructure.

Amongst them are:

1. KL Monorail Extension Plan from Tun Sambanthan (Brickfields) to Happy Garden at Old Klang Road. (approx. 7 km)
2. LRT Line Extension from Kelana Jaya to Klang (approx. 23 km)
3. MRT 2 Circle Line from Sentul Timur to Ampang (approx. 36 km)
4. MRT 3 North-South Line Selayang to Putrajaya (approx. 58 km)
5. KTMB Freight Relieved Line Subang to Port Klang (approx.18 km)

Ladies & Gentlemen, The Government has invested more than 50 billion in Rail transport since the 90's. More is expected with bigger investment estimated to reach RM 160 billion for future Rail projects until 2020. As such, it is vital to have a proper and coordinated development strategies and action plans. This is where MIGHT plays a role to lead the local Rail industry to be a strong and sustainable business, capable of meeting market demands.

I am particularly interested to highlight about the Offset program. Apart from setting the pace and direction of the Rail industry, the Offset program is also a significant contributor. It offers opportunities to enhance the Nation's industrial, technological and overall economic capability, with the aim of further increasing National competitiveness and supporting high-income society. This can certainly be applied to leverage better business prospects for our local players enabling them to be linked with the global supply chain.

I wish to end my address by expressing my appreciation to MIGHT for making effort in organizing this event, but most importantly a warm and heartfelt thank you to all the Rail industry stakeholders for your participation. Without your support this industry will not grow and will remain stagnated. My gratitude goes to the Future Rail 2030 Committee for their commitment and support, I am confident the outcome will be a highly recommended Roadmap which will be geared towards bringing the industry to the next level in the best interest of the Rakyat.

Assalamualaikum wrbt. and have a productive day ahead.

Summary of Malaysian Rail Supporting Industry Roadmap 2030

Where is our industry today?

RELIABILITY

Discontinued OEM support after 10 years

Low localisation rate

High cost of imported materials & spare parts

Numerous specifications of rails asset

GLOBAL COMPETITION

short life-cycle of asset

high maintenance cost

lack of track record

LIFE-CYCLE SUPPORT

Where is our industry going?

How do we get there?

GOAL 1
Conducive rail industry eco-system

GOAL 2
High localisation of rail products & services

GOAL 3
Competitive regional & global player

3 GOALS **8** STRATEGIES & **32** KEY INITIATIVES

Malaysian Rail Supporting Industry Roadmap 2030

The Background

1. Introduction

The Malaysian Rail Supporting Industry Roadmap 2030 is an initiative by the Malaysian Industry-Government Group for High Technology (MIGHT), an organisation under the Prime Minister's Department to chart the way forward for the rail industry development in Malaysia until 2030. The initiative is timely to collectively address various local development projects and global concerns on climate change, urbanization and population growth, congestion, oil scarcity, and the hike of energy price. Rail is one of the options put forth to collar these megatrends. Most of the discussions revolving around this matter have indicated strongly that rail is going to be a vital mode of public transportation in the future.

The rail operation and support industry in Malaysia is still very small although it has been in existence for more than 100 years. Apart from extensive investments during its pre-war period to help extricate hinterland resources of rubber and tin to post-war main travel avenue by the government of its day, rail has been quite steady in its development until the beginning of the 1990s. According to the Land Public Transport Commission (SPAD), *The Government of Malaysia* (GoM) has invested more than RM50 billion on rail-related equipment since 1990s and is expected to continue under the initiatives of the *New Key Economic Areas* (NKEAs) of the *Economic Transformation Programme* (ETP) namely the *Greater Kuala Lumpur* and the *New Key Result Areas* (NKRA) of the *Government Transformation Programme* (GTP) which is the *Urban Public Transport*. It is estimated that about RM160 billion worth of investments are in the pipeline until 2020. These new and subsequent expansion of the rail-related networks and infrastructure have further spurred more opportunities for the industry to grow in the future.

Additionally, Government of Malaysia has announced that the High Speed Rail (HSR) linkage between Kuala Lumpur and Singapore; and the Rapid Transit System (RTS) from Johor Bahru and Singapore are to be undertaken and completed by 2020.

2. The Roadmap Initiative

The Future Rail 2030 which was initiated in August 2011 is focused on developing the business side of rail industry; defined as those that provide technology and support services to rail operations rather than on the aspect of rail transportation. The major objective underpinning the overall development of the initiative is to set the direction and synergise the local rail-related players in achieving a common vision. The industry aspires to become a significant contributor to the national economy to enable long-term sustainability beyond 2020.

In order to ensure the initiative covers the whole gamut of the rail industry, the industry is divided into

several sub-sectors namely design, manufacturing and assembly of rail-related products, infrastructures and the related systems as well as maintenance, repair and overhaul (MRO) to support the life cycle of rail products and other pertinent services that can be promoted through this initiative. The formulation of the roadmap was undertaken by examining and analysing information from the following perspectives but it was not limited to:

- **Trends and drivers** that shape the development of the rail industry;
- **Industry supply chain** in terms of strengths and weaknesses, critical areas that need to be promoted as well as cross-support of the non-rail industries;
- **Human capital requirements** and **other support elements** in creating a conducive industry eco-system;
- **Roles of rail-related stakeholders** (the Government, the Industry and the Academia) to support the recommendations of the roadmap;
- Possible **cross-industries and technologies** to expedite the development of the rail industry; and
- **Monitoring mechanism** for effective implementation.

3. Methodology

The development of the framework for the roadmap took six (6) months to complete starting from August 2011 and conducted using Foresight methodology. In brief, Foresight is not about predicting the future but it is concerned with anticipating a variety of possible futures. It can be defined as the application of systematic, participatory, future intelligence gathering and medium-to-long-term scenario planning process to inform present day decisions and mobilising joint-action.

In undertaking the initiative, the team utilised roadmapping approach together with other foresight methods such as literature review, expert panels, scenario building, brainstorming, interviews, questionnaires/survey, environmental scanning, SWOT analysis and other methods. Roadmapping can be described as a planning process that guides decision making in identifying and evaluating strategic investment alternatives for achieving specified objectives (Industry Canada, 2006). It involves change from one state to another through the understanding of internal and external influences and their impacts to the overall eco-system. It helps to answer three main questions as follows:

i. Where are we now?
ii. Where are we going to?
iii. How do we get there?

Data gathering for various parameters that was described earlier was carried out throughout the stages as follows:

a. **Environment Scanning.** Conducted during the preliminary stage to comprehend the nature

of the industry such as rail-related products and terminologies, major activities, local and international players, market outlooks, trends, structure of the industry and its linkages in the overall supply chain, issues and challenges and other parameters. The preliminary information gathered, facilitated the team in the scoping and designing of the overall process to prepare for the roadmap. For this initiative, the survey form was developed online and delivered to more than 100 rail-related organisations. The information obtained from the survey enabled the team to develop a basis for the national rail industry database. This is similar to the effort made on other industries, where MIGHT has developed significant databases, among others the aerospace; shipbuilding and ship repair; and automotive. The database is useful in monitoring the performance of the industry from year to year.

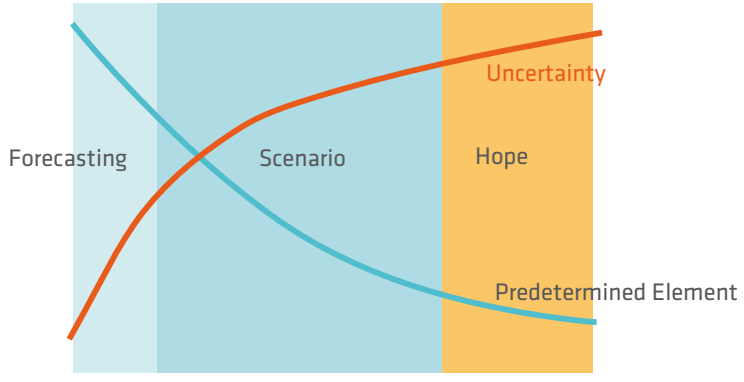


Figure 1.1: Time to the future
(adapted from van der Heijden, 1996)

b. Preliminary Stakeholder Engagement. With the initial data gathering during the above stage, the team called for preliminary stakeholder. The objectives inter alia were to get buy-in from related stakeholders to participate and support the whole process of the roadmap preparation at the earliest stage, obtaining initial comment and feedback, as well as the major concerns of the industry that will be channelled into the improvement of the existing scope. The participants were presented with the overall background of the initiative, processes in preparing the roadmap, the issues and the challenges.

c. Scenario and Vision Building. Scenario planning is a disciplined method for imagining possible futures in which organisational decisions may be played out. It relates to the tools and technologies for managing the uncertainties of the future. Unlike traditional business forecasting or market research, scenarios do not merely extrapolate current trends; they also present alternative images of the future based on different assumptions.

In this stage, options are generated for each of the identified scenarios. The participants involved in the scenario planning activities then can identify new and innovative services, technologies, markets and partnerships or processes that can be applied to the scenarios.

d. Focus Group Workshops. Based on focus areas developed during the visioning workshops, there are five focus groups formed and conducted namely:

i. **Rolling-stocks** – focused on designing, manufacturing and assembling activities of rolling-stocks related equipment, parts and components

ii. **Signalling, Communication, Electrification and Train Control** – focused on design, manufacturing, assembly, MRO, system integration of signalling, communication, electrification and train control equipment as well as parts and components.
iii. T**rack Network and Rail Infrastructure** – focused on design, manufacture, assembly, MRO, system integration of rail tracks and rail infrastructure.
iv. **Maintenance, Repair and Overhaul (MRO)** – focused on activities related to maintenance, repair, overhaul, upgrading, and refurbishment of the above three focus groups.
v. **Human Resource Development** – focused on the type of human capital and skills requirement to support the above (four) focus groups.

The above four workshops namely rolling-stocks, signalling, communication, electrification and train control, track network and rail infrastructure and MRO; touched on matters related to the major components of the groups, capabilities status and focus areas. In order to support the focus areas, the group identified, discussed and proposed development of related capabilities, technology, human capital and market potential. Throughout the discussions, the participants also highlighted issues and challenges with regards to the future development initiative.

4. Final Review/Findings

Considering that the inputs gathered during the focus group are more operational and technical, the team conducted high level engagement with captains of the industry such as KTMB, Prasarana, Rapid Rail and Scomi, which can influence change to the industry's landscape. It is critical to capture their strategic views on the future development of the rail industry in Malaysia. Both inputs were matched to form a comprehensive approach towards the development of the industry.

In reviewing and finalising this document, a working committee called the Future Rail 2030 committee was established in February 2012 to provide strategic advice, to monitor the progressive achievement of the roadmap recommendations, and to share the information on the latest and future rail-related initiatives. It consists of selected representatives from major rail operators, manufacturers, MRO services, the related Government agencies, the academia and the regulators (refer Rail Directory).

The shortcomings and the future opportunities that have been discussed and analysed through the committee have become critical input to the fine-tuning of the formulation of the vision, goals, strategies and action plan.

Did you know?

Malaysian Rail History

The generally known history states that the first rail track in the country connected Taiping and Kuala Sepetang which was operational in 1885. But do you know that the first ever rail track built in the country was actually in Johor connecting Tanjung Puteri and Gunung Pulai?

On 21 July 1869, the Sultan of Johore at the time, declared the opening of Keretapi Johor (the Johor Rail) in Johor Bahru through a placing of the track ceremony attended by locals and British officers. Phase 1 of the trial stage was the construction of a 20-mile track to Gunung Pulai. The rail track was made of wood with timber sleepers acquired from the jungle in which the track crossed through. There was no tunnel along the track and it was not known why the project was abandoned. According to a report in 1889, the Johor Bahru – Gunung Pulai rail track was destroyed by termites and this ended what would have been the first effort at establishing rail service in the then Tanah Melayu (Peninsular Malaysia).

Rail History in Malaysia (M.M. Fauzi) *translated by Zakariah Bin Yusof.*

Global Scenario

1. Overview

Rail is recognised as one of the important modes of land transport due to its salient advantages such as long-distance capability with large cargo capacity. Additionally, it is one of the safest forms of transportation, and it operates out of congestion. Globally, the accumulated length of rail network is approximately 1.2 million kilometres, based on the study by SCI Verkehr back in 2003. The longest widespread network can be found in North America on the long transcontinental overland routes, followed by Asia and the Commonwealth of Independent States (CIS). However, most of the railway networks are single-track, not electrified and over long sections do not possess any points of intersection with other lines[1]. Growing investment on public infrastructure since then has expanded the accumulated rail lines worldwide to more than the amount stated above.

2. Snapshot of the Global Economic Situation

The global economic behaviour has a direct impact over the health of transport industry either related

[1] *Maria Leenen, SCI Verkehr GmbH: Worldwide Rail Market, October 2003*

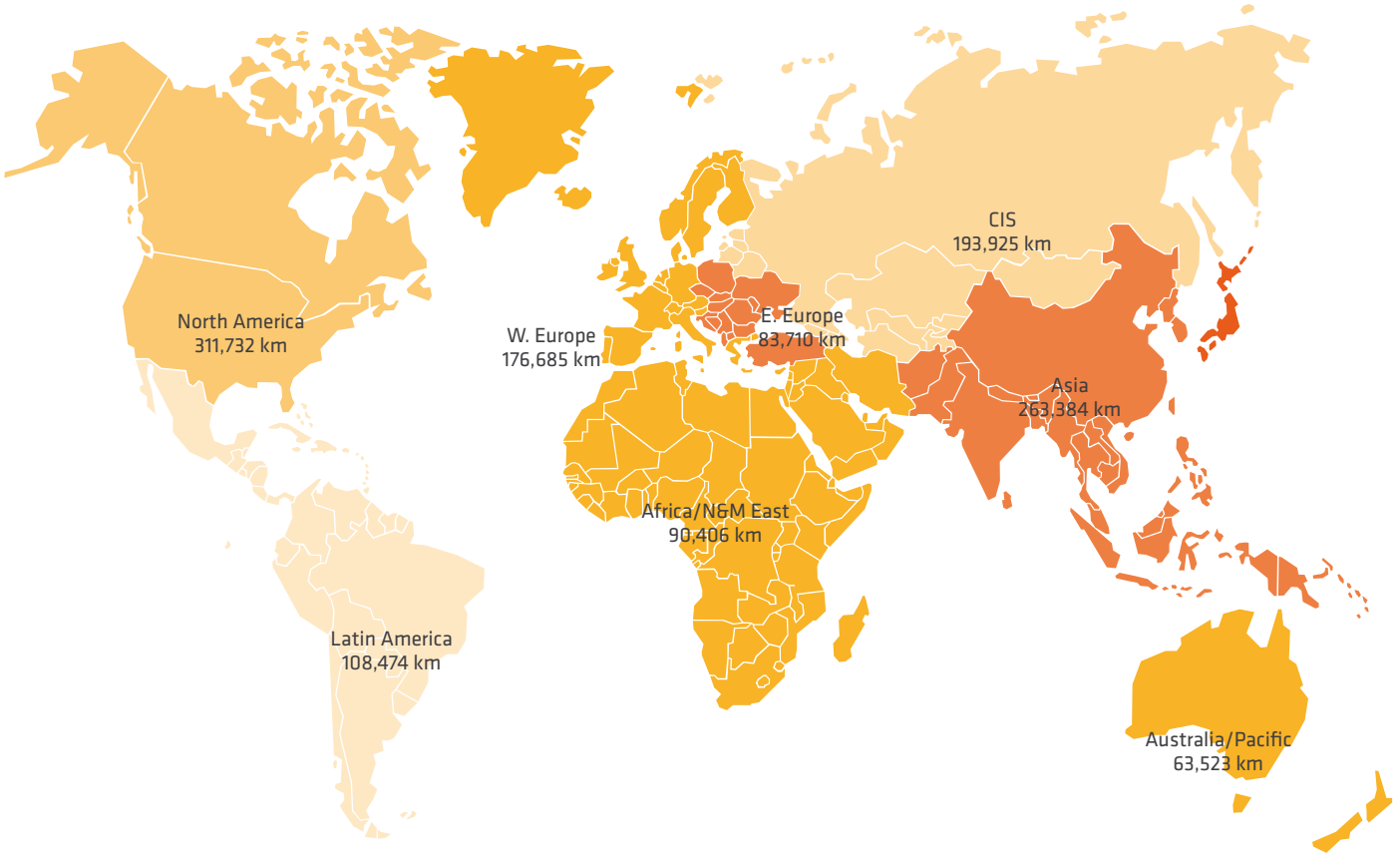


Figure 2.1: Existing rail tracks worldwide

SOURCE: SCI VERKEHR

to vehicle production or transportation service itself. Nevertheless, looking at the state of the economy in 2011 and the years ahead, it has been described by a number of renowned sources as being less blissful and a struggle to climb up a positive growth since its sudden drop in 2008. According to projection by the International Monetary Fund (IMF), the global economic growth is projected to drop from about 4% in 2011 to about 3.5% in 2012. Some of the causes are contributed partly by the effect of events such as the earthquake and tsunami tragedies in Japan, which caused disruption in the global industry supply chain, the political situation in the United States and the sovereign debt crises in a number of European countries. The emerging economies were also experiencing slowing down of growth due to the currency and commodity price volatility on top of the downturn effects in developed countries. Based on the 'World Economic Situation and Prospects 2012' report by the United Nations, growth in China is projected to slow to below 9% in 2012-2013, while India is expected to grow by between 7.7 and 7.9%.

In view of the situation, the report also stated recovery of world trade that is decelerating as demonstrated by the declining merchandise trade

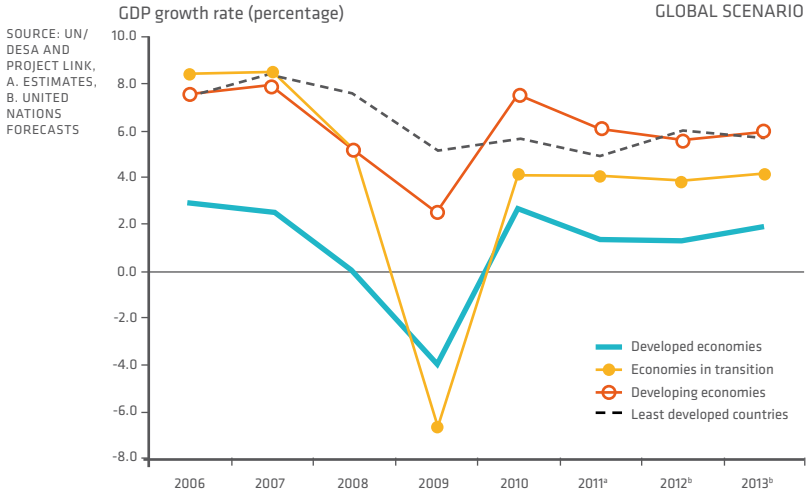


Figure 2.2: GDP growth rate (percentage)

from 12.6% in 2010 to 6.6% in 2011. On the bright side, developing countries were more resilient to the crisis and led the recovery by contributing half of the world import growth in 2011, compared with only 43% on average in the three years prior to the crisis. The price of oil is another important factor that forms a rising trend and has considerable effect on the development of the transport industry (Figure 2.2) as 96% of transportation globally depends on oil followed by others namely industrial product at 43%, residential and commercial at 21% and electric power[2] at only 3%.

[2] *U.S Energy Information Administration (EIA)*

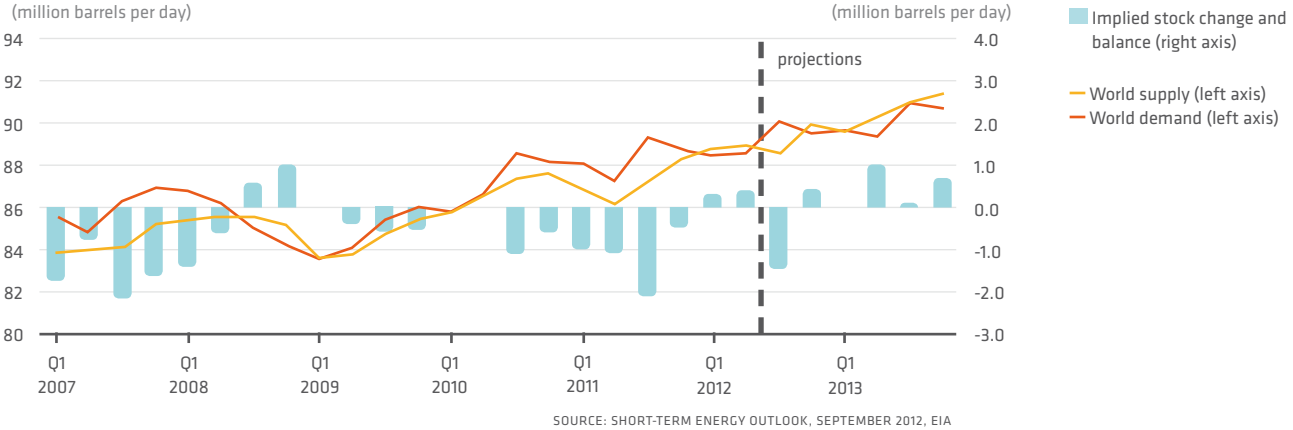


Figure 2.3: World Supply and Demand Balance of Oil

3. Global Rail Passenger and Freight Traffic

The global rail transportation services are estimated to worth about USD300 billion annually, where passenger makes up 49.5% whilst freight takes a 50.5% share of the total revenue from the services[4]. However, during the recession, both passenger and freight traffic were badly affected. According to SCI Verkehr, rail freight experienced a much bigger drop in traffic compared to passenger segment as several major freight transport markets such as Russia, the United States and Canada were hit hard during the period. However, quick recovery has managed to gain back the volume in those major markets, consequently pushing the traffic up (Figure 2.4).

Based on statistics provided by UIC members, the total freight traffic globally stands at more than 9 trillion tonne-kilometres (Figure 2.5) with the overall growth of an average of 3.4% in 2010. The positive growth was attributed by major markets as mentioned earlier. Russia has an extremely dynamic freight sector that represents almost a quarter of tonne-kilometres transported in the world managed to gain 8% increase compared to the figure in 2009. About 4% growth was recorded by the United States and Canada which represented 25% of the total tonnage transported and the same situation in Europe (non CIS) that showed an increase of 7%. In Asia (and Oceania) market, China that held 70% of the total tonnage experienced a slight dip of 3% but a significant increase of 9% of freight traffic was recorded by the Indian Railways.

In terms of rail passenger, SCI Verkehr reported that the world rail passenger traffic was recorded around 3 trillion passenger-km in 2010 which was a 3.5% jump in passenger-kilometres worldwide from the previous year. Out of the total traffic, three-quarter

[4]Datamonitor 2010

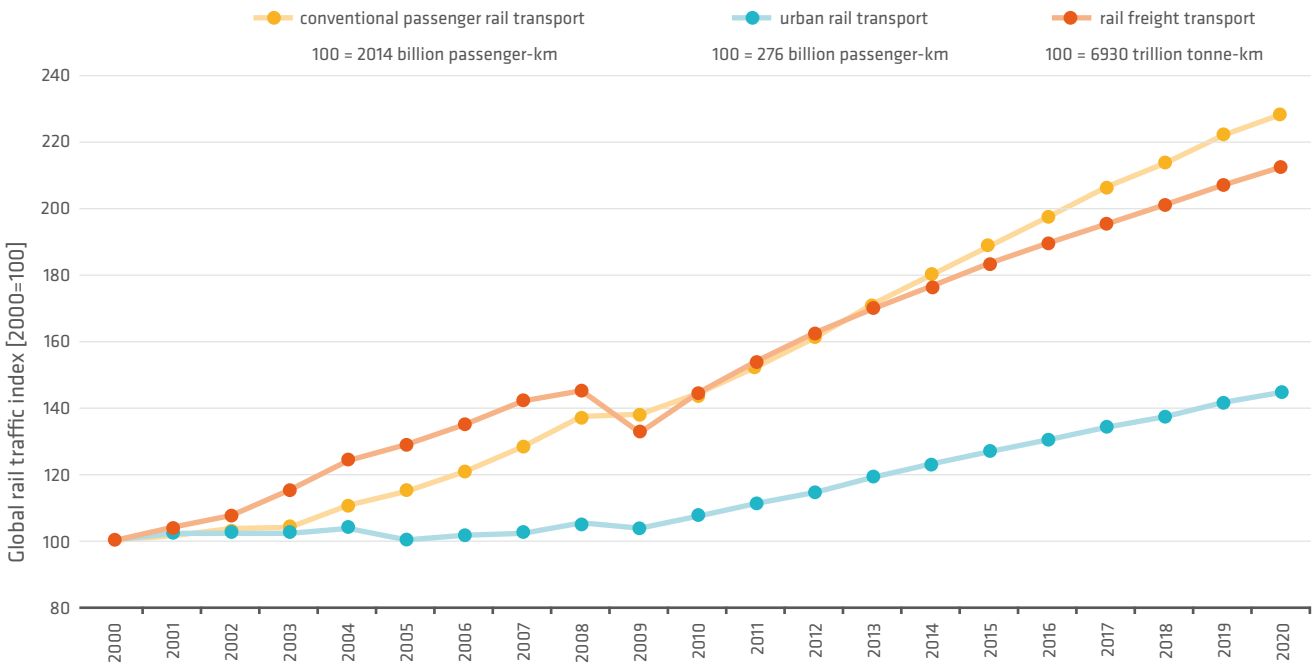


Figure 2.4: Global Rail Passenger and Freight Traffic

SOURCE: NEWS ANALYSIS, GLOBAL RAIL TRAFFIC MAKES A RAPID RECOVERY, SCI VERKEHR

of the figure was contributed by the Asian region. According to UIC, the traffic in India experienced an 8% increase compared to 2009 where the country represented almost half of the passengers in the Asian region. While China that represented over a third of the traffic volume recorded an increase by an average of 0.4% in 2010.

Besides the state of economic health, factors such as climate change, urbanisation, and the price of energy also contribute to the increase in demand for rail passenger and freight traffic. Green gas emission has been a growing concern worldwide as it is one of the major contributors towards global warming. Carbon emission, which is a result of high dependency on fossil-based fuel, is projected to deplete in future, which will eventually push the price up. Trains are moving towards electrification and some are even using hybrid engines that reduce carbon emissions. Studies showed that an estimated 34% savings in energy could be achieved by using electric power. Electrification of just 10% of the present rail trackage (in the densest traffic corridors) can result in a 40% reduction in railway diesel fuel consumption[5]. In addition, the rising population globally and the urbanisation demand an effective means to transport a huge number of people especially during peak working hours.

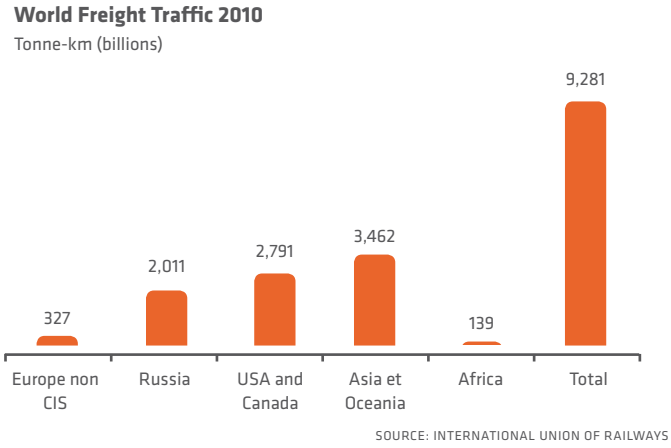


Figure 2.5: World Freight Traffic 2010

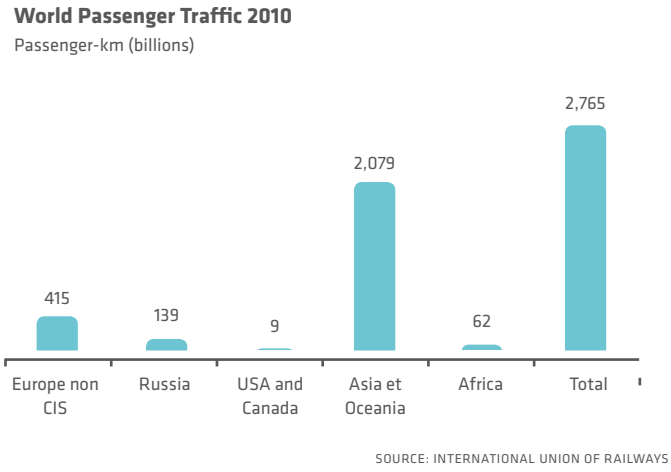


Figure 2.6: World Passenger Traffic 2010

[5] *Practical Guide, Chapter 9, American Railway Engineering and Maintenance-of-Way Association, viewed 7 December 2011.*

4. Global Rail Investment and Supply Market

The continuous uptrend on the global rail passenger and freight will fuel the need for new and the expansion of rail investment globally. A study by business consultants Booz Allen Hamilton concluded that the world's major cities will be investing more than USD 6.5 trillion in their road and rail infrastructures by the year 2035. In 2010, about 30% of the rail investment worldwide are localised in Asia Pacific including China, which is an increase from 10% back 10 years ago (Table 2.1 depicted several investment opportunities in the Asia Pacific region).

China, Russia and the USA have been identified as the biggest world rail markets with a total volume of USD57.5 billion or €44.5 billion (annual average 2009–2011)[6], whilst the Asia/Pacific will grow in line with the developed market. Meanwhile, the accessible market in Africa and the Middle East is expected to grow at an annual rate of about 4.5% by 2016. This investment is mostly funded by the state, local, or central Government where 80% will be allocated for infrastructure such as tracks, stations and viaduct and the remaining 20% of the investments are for trains, signalling, tracks and other equipment[7]. However, cumulative investment in rail projects with private participation in developing countries is set to grow. In most developing countries, the governments aim to improve the efficiency of railway networks and at the same time targeting to reduce the burden of subsidies, hence witness a significant growth of participation by the private sector. Now, almost all developing countries have some private sector activities in the infrastructure development.

[6] UNIFE/BCG, May 2010
[7] Interview with Senior Vice President, Transport Asia Pacific Region, Alstom, Business Line, India
[8] Global Opportunities ASEAN, India and Middle East, June 2009

Countries	Strategic Market Opportunities
INDONESIA	• Only 10% of the railroads are double-track. • State-owned monopoly for railway operations. • Actively encouraging foreign investment. • Japanese firms have a strong presence. • Projects: i. East Kalimantan Province: 125 kilometres of coal railway. ii. South Sumatra Province: 270 kilometres of coal railway. iii. US$740 million Central Kalimantan Railways Project
MALAYSIA	• Electrified Double Track Project will provide freight connections with Thailand and other ASEAN countries. • Urban transportation project will be tendered under the 10th Malaysia Plan (2011-2015).
CAMBODIA	• Joint venture arrangement to operate the Cambodian railways and related freight logistics under a 30 year concession. • Cambodian railways are likely to become a vital link in the Trans-Asia railway.
INDIA	• Indian Government's 11th Five Year Plan which focuses on railway modernisation. • Dedicated Freight Corridor Project (DFC) consists of six freight corridors.
MIDDLE EAST	• 1,065 kilometres East West Land Bridge in Saudi Arabia (US$7 billion). • Bahrain to Qatar "Friendship Bridge" for road and rail (US$4 billion). • 1,500 kilometres Gulf Corporation Council regional railway (US$14 billion)

Table 2.1: Rail Market Opportunities[8]

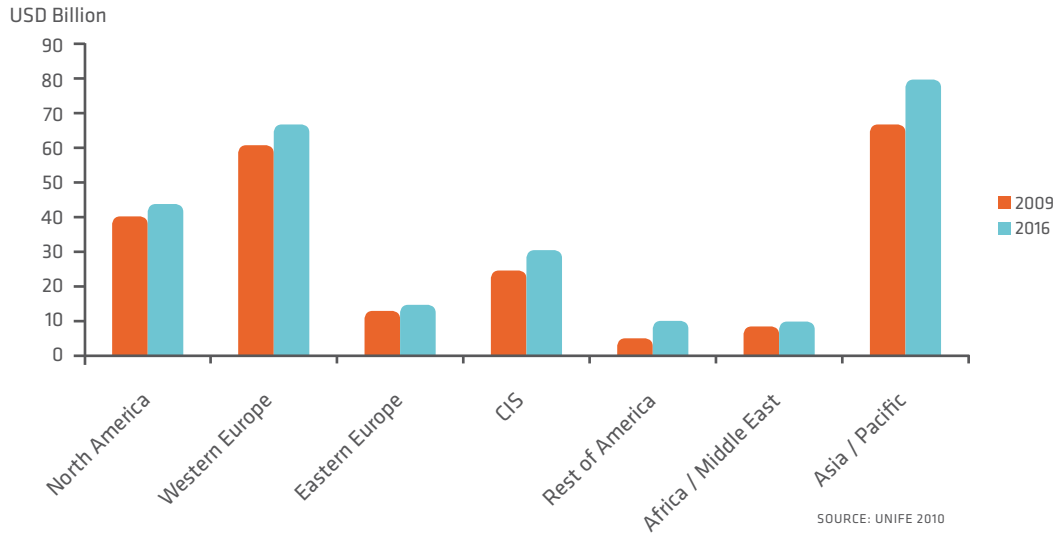


Figure 2.7: Market Size by Region

Continuous demands for new investments have generated business opportunities for the rail-related product market such as rolling-stocks, various systems, rail tracks and infrastructure. It was estimated to worth about USD 219 billion in 2009 where Asia Pacific has the largest market share with 32% followed by Western Europe with 28%. According to UNIFE, the market can be divided into four major segments where the highest Compound Annual Growth Rates (CAGR) from 2007 to 2009 was the rail control segment with 3.2% followed by the rolling stock segment of 2.5%, the infrastructure at 0.7% and 2.9% for services that include labour and parts for maintenance/refurbishment.

The rail supply chain like other industries is divided into various tiers where the highest level consists of complete system train producers supported by sub-systems, equipment and parts and component suppliers. Based on the market segment, rail control systems are dominated by Western suppliers such as Alstom, Ansaldo STS, Bombardier, Invensys Rail, Siemens and Thales RSS. In the case of rolling-stocks, established players in this segment are the likes of Alstom of France, Bombardier of Canada, CAF of Spain, and Siemens of Germany. Nevertheless, Asian players are gaining market share with strong capabilities in those segments such as Kawasaki, Mitsubishi and Hitachi of Japan, Hyundai Rotem of Korea, and China's CSR and CNR.

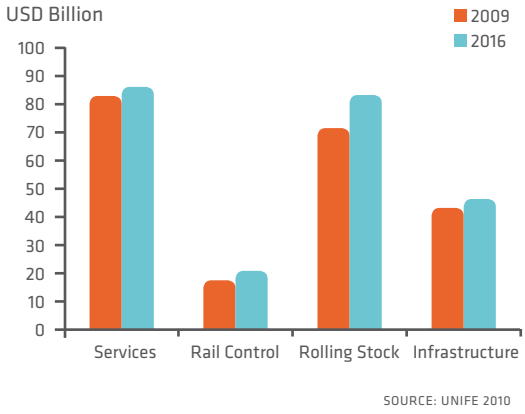


Figure 2.8: Market for Rail Equipment

5. Technology Development in Rail

Modern train is made from a number of high technology components ranging from its structure, on-board systems, bogie, train movement up to health monitoring. Benefits from the convergence technology have been utilised in various sectors such as nanotechnology, alternative energy, ICT, advanced electronics and many more. Greener transportation, energy saving, information rich technology interfaces for customer making it integrated and interoperable for multi-modal, that are among factors driving the advancement of rail technology.

Based on benchmarking carried out by ARUP on "*A Review of Opportunities of Rail in Wider Transport Context*", reported focus areas of research in rail-related technology undertaken globally are as follows:

European Union. *The European Rail Research Advisory Council* (ERRAC) set the mission to help revitalise the European rail sector and make it more competitive by fostering increased innovation and guiding research efforts at the European level.

Focus Areas as identified by their Strategic Rail Research Agenda 2020:

- Intelligent mobility (customer focus, service flexibility, compatible ticketing across EU and transport modes)
- Energy and environment (reducing dependence on fossil fuels, energy efficiency, weight reduction, reducing noise/vibration)
- Personal security (from vandalism to terrorism, satellite navigation)
- Test, homologation and security (passenger fatalities, operational performance/degraded operation, cost of safety acceptance)
- Enabling technologies (enabling concepts related to interface harmonisation and modularity, lifecycle cost reduction, efficient construction methods)
- Strategy and economics (models to better understand costs of operating and maintaining rail infrastructure)
- Infrastructure (cost efficient maintenance, maintenance free, interoperable)

Japan. The *Railway Technical Research Institute* (RTRI) covering basic research to application with the following focus areas:

- Maglev (superconducting magnet)
- Natural disasters (lateral damper to prevent derailment during earthquakes)
- High efficient utilisation of energy (aerodynamics, weight, new power systems/fuel cells)
- Maintenance (condition monitoring, fault detection, failure prediction, low maintenance tracks)
- Intermodal (technologies at/around stations to make transfers simpler)
- Simulation (functional railway simulator, virtual running test environment, post derailment behaviour simulation)

India. The *Research Design and Standards Organisation* tests and conducts applied research in rail. Focus areas of this organisation are as follows:

- Ultra-portable track monitoring systems
- Heavy haul technologies
- Vehicle dynamics
- High speed technology
- Track research
- Energy efficient traction power supply system
- Maglev
- Integrated processors for railway application
- Material sciences for railway-related composites
- Artificial intelligence for predictive maintenance and management

United States of America

a. *Transportation Technology Centre Inc.* (TTCI) set the vision to be the worldwide provider of choice for high value rail transportation technology development, testing, standards and training. The focus areas are as follows:

- Track (keyed insulated joint, signal wire connections on track, rail fatigue)
- Track/train interface
- Control and communications (high accuracy GPS, positive train control, narrow band emissions)
- High speed rail
- Testing (aerodynamic modelling)
- Training centre (security and emergency response

b. *Railroad Research Foundation* is a policy research organisation devoted to sustaining a safe, secure, technologically advanced and productive marketplace-driven railroad industry. Focus areas are security, safety, and technology (wireless communications, positive train control)

c. *Federal Railroad Administration*, where part of its mission is the research and development to support improved railroad safety and national rail transportation policy. Focus areas include vehicle/track interaction modelling and simulation, safety (inspection and monitoring, fault detection, reliability) and intermodal transportation.

Korea. Focus areas of *Korea Railroad Research Institute* are:

- Advanced material tilting train
- Rail safety systems
- Urban transit standardisation
- Light Rail Transit (LRT) systems
- Bimodal transportation systems
- Advanced Electric Multiple Unit (EMU) systems
- High speed rail
- Logistics standardisation

Australia. *Cooperative Research Centre for Rail Innovation* is a collaborative research organisation set up as a venture between leading organisations in the Australian rail industry and Australian universities. The focus areas are:

- Climate change and the environment
- Safety and security
- Performance
- Urban rail access
- Workforce development
- Smart technologies

In Malaysia, research and development activities related to the rail technology require a huge boost. This initiative should not be left to public research institutions or universities alone but needs a strong drive from industry players as well. Focus areas for research needs to be identified and prioritised and subsequently formalised to become a part of national prioritisation research activities.

Malaysian Rail Industry Overview

1. History

The first railway system deployed in Malaysia was during the British colonial era around 1885, operated by the *Federated Malay States Railway* (FMSR) and the *Malayan Railway Administration* (MRA). The first railway line was opened between Port Weld and Taiping to transport tin from the mines. By 1962, FMSR was changed to *Keretapi Tanah Melayu* (KTM), later corporatised in 1992; and since its inception more than a century ago, was the only rail operator in Peninsular Malaysia until recently.

The rail network has expanded since then and the Keretapi Tanah Melayu Berhad (KTMB) initiated Malaysia's first electrified rail system through its Komuter service in 1995. In the same year, Malaysians witnessed the opening of the light rail transit systems for the Ampang Line (formerly known as the STAR LRT) which was operated by a different operator, namely the Rapid Rail (previously known as RapidKL) and later added its second urban line which is the Kelana Jaya Line (formally known as the PUTRA LRT) in 1998. In 2002, Malaysia began to operate its first high-speed train, the KLIA Ekspres that connects Kuala Lumpur with the Kuala Lumpur International Airport followed by its first urban monorail system in 2003. Besides Peninsular Malaysia, there is a short rail line in Sabah which is currently being operated by the Sabah State Railways. The operation started back in 1896 when it was known as the North Borneo Railways.

SOURCE: MALAYARAILWAY.COM

Figure 3.1: Port Weld Station

Additionally, a monorail line operating from Taman Rempah and Kampung Bunga Raya was built in 2010 to promote tourism in the city of Melaka. The line was operated and maintained by River and Coastal Development Corporation Malacca.

2. The Malaysian Rail Industry Structure

In order to understand the current state of the rail industry in Malaysia, rail-related activities are grouped into seven major components; Policy/ Regulatory, Asset Management, Rail Operation, Design, Manufacturing & Assembly, Maintenance, Repair & Overhaul, Support Services, and Education & Training (Figure 3.2).

Today, there are about 60 organisations which are directly involved in rail-related activities. In 2010, the industry generated a turnover of RM3.5 billion and generated employment for more than 9,500 people. Albeit small in terms of figure compared to other transport industries such as aerospace (RM25.9 billion), automotive (RM25.5 billion) and shipbuilding/ship repair (RM7.26 billion), rail industry has the potential to grow as the demand will be driven by the increasing rate of urbanisation, congestion, Government investments on rail networks and others.

2.1 Group 1: Regulatory Framework & Administration

The Regulatory Framework and Administration has influence in transforming the policy landscape,

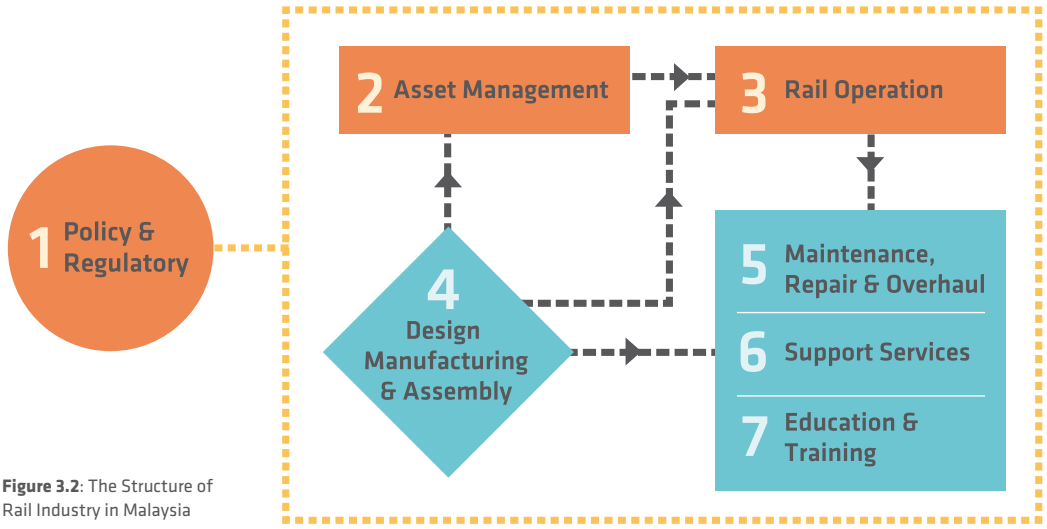


Figure 3.2: The Structure of Rail Industry in Malaysia

making it competitive and conducive, whilst facilitating the development of the industry. The group comprised the related Government Ministries and agencies that are responsible for policy formulation, regulatory aspects, and facilitation in investment processes, incentives and other supports. Among the Government organisations that are directly related to the development of the rail industry in Malaysia are as follows:

a. **Suruhanjaya Pengangkutan Awam Darat (SPAD)**. SPAD or the Land Public Transport Commission is responsible for drafting the policies and plans, regulating and enforcement of rail transportation.
b. **Ministry of Transport (MOT)**. The Ministry that is responsible for KTMB and Railway Asset Corporation (RAC).
c. **The Ministry of International Trade and Industry (MITI)**. The Ministry that is responsible for trade facilitation for various industries including transport and logistics. Various agencies under MITI that relates to rail transportation are as follows:
   - The **Malaysian Investment Development Authority (MIDA)**. Responsible for promotion of the manufacturing and services sector in Malaysia
   - **Malaysia External Trade Development Corporation (MATRADE)**. Responsible for promoting Malaysia's export in the international market
   - **Small Medium Enterprise Corporation (SME Corp.)**. Responsible for spurring the development of small and medium enterprises (SMEs) by providing infrastructure facilities, financial assistance, advisory services, market access and other support programmes
d. **The Royal Malaysian Customs**. An agency under the Ministry of Finance that provides services in trade and industries facilitation, revenue collection and enforcement related to imports and exports.
e. **Standards and Industrial Research Institute of Malaysia (SIRIM)**. An agency under the Ministry of Science, Technology and Innovation (MOSTI) that is involved in discovering and developing new technologies to help businesses compete better through quality and innovation.

The above list is not exhaustive and may involve other organisations depending on case by case basis due to them being cross-ministerial in nature. From the date of its existence, the rail industry development has not been the sole responsibility of a specific Government-related organisation/ agency but it comes under a myriad of agencies. This is one of the major factors that require an urgent

attention by the Government if the development of the industry is to be comprehensively handled and accelerated.

2.2 Group 2 & 3: Asset Management and Rail Operators

Currently, there are three major train operators that provide rail transportation services in the country. Each operator operates the rail assets owned by different organizations (asset owners) and correspondingly operates on different rail lines (Figure 3.3). Further description of each operator is stated below:

a. **Keretapi Tanah Melayu Berhad (KTMB)**. KTMB operates the main inter-city lines from the North to the South of Peninsular Malaysia and the commuter for intra-city networks serving both passenger and cargo transportation services. Rail assets operated by the company is owned by the *Railway Asset Corporation* (RAC) which is a federal statutory body under the *Ministry of Transport* (MOT). In providing the services, KTMB operates 91 units of locomotives, 221 units of passenger coaches, 2,727 units of freight wagons. They also currently operating 57 sets of three-car EMU, 38 sets of six-car EMU and 5 sets of Electric Train Sets (ETS).

b. **Rapid Rail Sdn Bhd**. Rapid Rail's core business covers not only the passenger rail service but also public buses. For rail service, the company operates three lines namely the Ampang Line light rail transit (LRT) also known as the Star LRT, the Kelana Jaya Line LRT that is also known as the Putra LRT and the Monorail Line. Rail networks operated by the company link major places within the Klang Valley. In order to serve these areas,

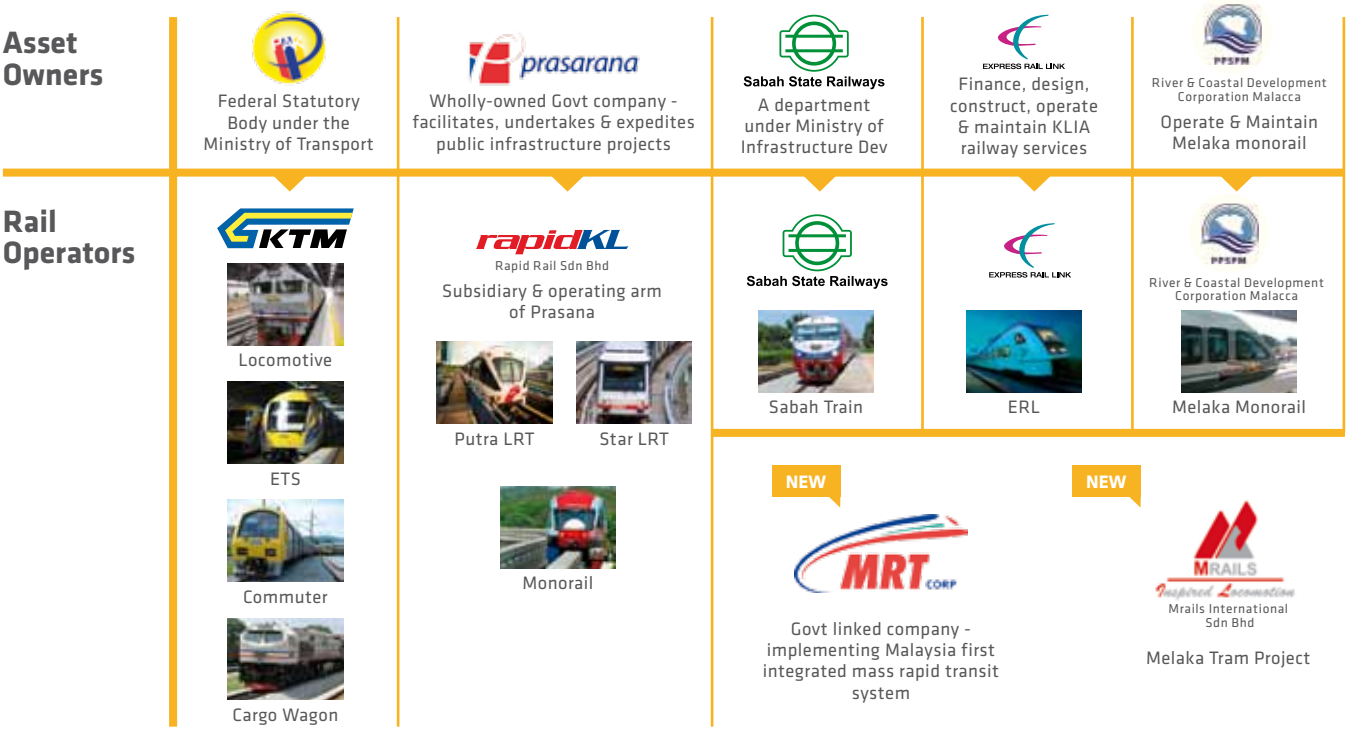


Figure 3.3: Assets Owners and Rail Operators

Rapid Rail deploys 35 sets of two-car train and 35 sets of four-car trains for the Kelana Jaya Line, plus 30 sets of six-car trains for the Ampang Line. These assets are owned by *Syarikat Prasarana Berhad* (SPNB), a wholly-owned Government company.

c. **The Express Rail Link (ERL)**. ERL is a private rail operator that was given a concession to finance, design, construct and operate the KLIA Express and KLIA Transit services. It provides passenger rail service from the Kuala Lumpur Sentral to the *Kuala Lumpur International Airport* (KLIA).

d. **The Sabah State Railways**. It is the only rail service in East Malaysia (Sabah and Sarawak) that is operating on a short length of 134 km. Currently, the operator serves mainly tourist specific passengers with a small amount of freight transportation.

e. **Others**. Besides the above operators, there are several new players in the rail transport services such as the up and coming *Mass Rapid Transit* (MRT) under the MRT Corporation, the Melaka Monorails under River & Coastal Development Corporation Malacca.

In terms of passenger traffic, the intra-city which is connecting places in the Klang Valley and its vicinity recorded ridership with more than 167 million passengers in 2010 which is an increase of 3.7% from the previous year. The figure will increase as more people opt for train transportation to commute to workplace every day. However, inter-city travel connecting between states in Malaysia is far smaller in number at 4.2 million passengers in 2010, slightly dipped from 2% from the previous year. This is compounded by the fact that inter-city train is mostly selected for leisure and seasonal travelling for Malaysians during the festive seasons.

In the freight segment, cargo volume by rail is expected to increase to 6.2 million tonnes in 2012 as compared to 5.9 million tonnes in 2011. With major clients the likes of Lafarge, Petronas, YTL, CIMA, Malayan Sugar Manufacturing (MSM) and Tasek Corporation Berhad, cargo transported by rail will continue to be on the uptrend especially with the completion of the KTM's double tracking project in the next few years.

2.3 Group 4: Design, Manufacturing and Assembly

The designing, manufacturing and assembling activities can be divided into several tiers, where generally the highest tier is occupied by the final integrator who designs and produces the complete train systems for rail operators such as the high speed train, the metro, the tram and the monorail. At the second tier, there are rail players who produce major systems and subsystems such as the propulsion systems, the bogies and others. The first and second tiers are supported by various parts and components suppliers.

In Malaysia, more than 30 players are involved in the designing, manufacturing and assembling of rail-related products. In 2010, the group has recorded a total revenue of RM427 million and employed 408

Figure 3.4: Design, Manufacturing and Assembly

technical workers and 529 non-technical workers. Currently, a local manufacturer that possesses the capabilities of producing a complete train system is *SCOMI*. The company has successfully delivered and supported the monorail systems in Malaysia which is operated by Rapid Rail. In addition, it has also managed to secure contracts from Brazil and India. Hartasuma is another local company that is capable of performing assembly and has secured a contract to assemble Bombardier's train parts for the Kelana Jaya Line LRT. Another player, SMH Rail is capable of flash butt welding of rail track and axle manufacturing and to a certain extent, refurbishment of locomotives, whilst PSI In-Control is in systems integration and correspondingly provides integrated communication solutions, and Sutera Teknik is in the heating, ventilation and air-conditioning (HVAC) equipment. There are also a host of other smaller but capable players.

Through focus group discussions, the status of local capabilities in design, manufacturing and assembly activities related to rolling-stocks, signalling, communication and train control, electrification and rail tracks and infrastructure are as depicted in **Appendix A.**

Figure 3.5: Maintenance, Repair and Overhaul (MRO) players

2.4 Group 5: Maintenance, Repair and Overhaul (MRO)

Maintenance, repair and overhaul (MRO) group comprise companies that provide maintenance support services to the rail operators. According to MIGHT's rail database, there are more than 40 local companies involved in this business, which contributed about RM310 million in 2010 and employed 426 technical workers and 391 non-technical workers. It is important to note that the bulk of the MRO works are conducted in-house by the respective rail operators with less outsourcing activities. It is the 'chicken and egg' question to be addressed: do local players have the capability and able to ensure reliability of the maintenance service required? If local players start to invest according to the requirement, do local operators commit themselves to outsourcing the maintenance jobs? These questions are also addressed in this roadmap in terms of encouraging the outsourcing to capable MRO players.

Despite the situation, there is already a specific amount of outsourcing activities to local MRO providers by both major operators namely KTMB and Rapid Rail. As an example, SMH Rail benefited from KTMB outsourcing by successfully developing its capability to perform maintenance on locomotives. The same benefit goes to SCOMI, whereby apart from manufacturing, the company is also capable of carrying out freight wagon maintenance and refurbishment. Other major players that are capable in particular areas are Ara-Rail Technology in refurbishment works of KTMB coaches; PSI In-Control in communication; Majestic Engineering in traction motors and undercarriage casting; and Sutera Teknik in areas related to HVAC. On the private operation side, E-MAS is a separate company, established to support the whole maintenance activities for ERL trains.

Through focus group discussions, the status of local capabilities in MRO activities related to rolling-stocks, signalling, communication and train control,

electrification and rail tracks and infrastructure is as depicted in **Appendix B.**

2.5 Group 6: Education & Training

The growth of an industry is not only driven by technology but also supported by adequate number of knowledge and skilled workforce in various fields. Currently, for major rail operators, the supply of dedicated skilled workforce is catered for by the respective in-house training academies such as MyRA in Batu Gajah, Perak for KTMB and Rail Academy of Rapid Rail Sdn Bhd (RARR) in Kelana Jaya, Selangor.

On the other hand, other industry players that are involved in manufacturing and maintenance activities are hiring people with general qualifications either in mechanical, electrical, electronics, IT and many other fields of study from local universities, polytechnics and other institutions. This is because there are no specific local training institutions offering degree or diploma programmes dedicated to rail engineering fields. However, there is a rail-related module being taught under degree programme in logistics management offered by the *University of Kuala Lumpur*, Institute of Product Design and Manufacturing, also known as UniKL IPROM. There is also a recent initiative by the *University of Tun Hussein Onn Malaysia* (UTHM) which offers rail engineering as an option for its masters degree programme. The programme was developed through consultation with local operators namely KTMB and Rapid Rail.

In enhancing the quality of skills and knowledge in the rail industry, Government intervention is critical. On-going initiative to certify specific rail skills through the *National Occupational Skill Standards* (NOSS) was carried out by *Department of Skills Development (DSD)* under the Ministry of Human Resources (MOHR). This is done through collaboration with industry players and as a result, skills standards for rail have recently been developed. In order to ensure a continuous momentum of the local rail industry activities, supply of manpower needs to be strengthened. Competition with other industries in retaining skilled people, migration

rapidKL

	Course	KJ Line	Ampang Line	Monorail
MECHANICAL/ ELECTRONICS	Rolling Stock	✓	✓	✓
CIVIL	Track Network	✓	✓	✓
ELECTRONICS	Wayside Electronic	✓	✓	✓
	Wayside Power	✓	✓	✓
OPERATION	Train Operation		✓	✓
	Station Operation		✓	✓
	Field Operation	✓		
	Operation Control Center	✓	✓	✓
IT	Auto Fare Collection	✓	✓	✓
	Common Core	✓	✓	✓

KTM

	Competency Profile
OPERATION	EMU Driver
	Locomotive Driver
	EMU Technician
	Station Operation
	QAC
MECHANICAL/ ELECTRONICS	Coaches & Wagons Technician
	Locomotive & PGC Technician
	EMU Maintenance
	Rail Electrification
IT	Signalling & Communication Technician
	Centralised Traffic Control (CTC)
	Rail Operations Controller
CIVIL	Permanent Way

SOURCE: KTMB / RAPID RAIL

Table 3.1: Rail Academy of Rapid Rail and MyRA, KTMB Competency Training

abroad and retirement will always be the challenges that the industry has to face. All these are apart from the basic element; to create a positive view for the industry from amongst the new generation. It has to portray the industry in a new light, reflecting the high technology, cutting edge mechanics that is parallel with the other transportation modes. This will help ensure a continuous supply of interested recruits.

3. Key Issues and Challenges

The local rail industry strives to grow, however it has been dragged down by long-overdue issues and challenges. There are numerous factors that have caused the industry to be less dynamic to charge forward and grow on par with other industries. Among the major issues and challenges that need urgent attention are as follows:

3.1 Lack of Commonality in Rail Assets

Currently, rail assets in service comprised systems, equipment and components (in rolling-stocks, signalling and train control systems and others) with different technical specifications. This trend continues in any new procurement and as a result, it keeps adding up to the complexity of the asset. This situation has led to various difficulties and problems to the rail operator. Limited inter-changeability requires operators to store a bigger and more assorted amount of spares for different parts and components or cannibalise from existing assets to support subsequent maintenance undertakings. In view of this, operators need to deal with various suppliers as well as training schemes, which need to be developed and introduced for every unique or peculiar parts and components. In addition, systems are unable to be integrated and all of these have significantly affected the overall cost and serviceability of the assets.

There is a need to address this by looking at the root of the problem right from the procurement process. Currently, there is no common technical specification and standards adopted by Malaysia to be used as a guideline in determining the type of systems, equipment and components to be purchased. The absence of these have resulted in the industry being taken advantage of by foreign suppliers to impose standards and specifications recognized only by their countries of origin. It gets even worse when these suppliers cease operation or have stopped producing the particular parts or components. It does not help to get the local players to produce or fabricate the parts, since the solution would be unattractive due to the lack of critical mass.

Another pertinent matter is regarding the gauge used by local train operators. Since the colonial era, Metre gauge was introduced and it was used until today by KTMB trains, while intra-city rail operated by Rapid Rail as well as the ERL are running on Standard gauge (wider than Metre gauge). The trend is moving towards Standard gauge (Table 3.2) where in terms of global population, it represents 60.2%, followed by Broad gauge at 23.2%, Narrow gauge at 8.7% and Metre gauge at 7.9%. Therefore, parts and components that are commonly found are based on Standard gauge. Others require customisation.

Gauge Types	Total Route (km)	% world total
Standard gauge	688,688	60.2%
Metre gauge	90,375	7.9%
Narrow gauge	99,528	8.7%
Broad gauge	263,120	23.2%

SOURCE: DEPT. OF TRANSPORT SOUTH AFRICA, RAIL GAUGE STUDY REPORT 2009

Table 3.2: Global Rail Track

3.2 High Dependency on Foreign Products

This issue may be attributed to an earlier factor in terms of opportunities to develop local capabilities to support local operators not only in maintenance activities but also in the capability of supplying quality products on par with OEMs. Localisation rate is still relatively low (10% to 30%) in rolling-stocks and systems which are reflected in various projects undertaken by respective rail operators (Table

PROJECTS	Local Contents		
	Rolling-Stocks	Systems	Infra. (Civil Works)
KTMB			
• Rehabilitation of EMU	10%	Nil	Nil
• Purchase of Locomotive, ETU & ETS	Nil	Nil	Nil
Prasarana - Rapid Rail Sdn Bhd			
• Kelana Jaya Line Expansion	30%	0-19%	100%
• Ampang Line Expansion	Nil	Nil	100%
• Monorail Expansion	100%	Nil	100%

SOURCE: KTMB, RAPID RAIL

Table 3.3: Local content in rail investment projects

3.3). Local strength is seen in the building of rail infrastructure due to well established capabilities in civil works and manufacturing e.g. monorail products in which Malaysia is now, one of the global players.

Currently, local rail operators continue to depend on OEMs in order to support and maintain rail operation. Based on Comtrade, Malaysia imported rail-related parts and components worth about USD 265 million in 2010 and this figure will continue to grow unless specific steps are taken. Although it is inevitable to source safety-critical products from OEMs especially those related to propulsion systems, signalling, and the likes which need thorough inspection and certification, other non-critical components can be sourced locally. There are several industries which have a strong presence in Malaysia such as composite, electric and electronics, automotive, chemical, telecommunication and others that can be leveraged to produce the required alternative parts. High dependency on foreign products will affect long-term sustainability of rail operation. Rail operators are facing long lead time for delivery process of replacement parts and thus escalate the cost of operation tremendously.

3.3 Deficiency of Skilled & Knowledge Manpower

The fundamental issue that is faced by the industry is that rail has been perceived by the public as less compelling and interesting compared to others such as aerospace, automotive and the shipping industry. Apart from the dull image portrayed to the younger generation, there is no rail-related course offered by local universities which could be an option to pursue their career path. Considering this situation, industry players have to employ common engineering graduates and retrain them to become familiarised with the rail environment which generally takes two years.

Currently, dedicated training related to the rail technology are provided by in-house training academies established by the respective rail operators. In this matter, the content of training and facilities need to be strengthened to keep up-to-date with the dynamic evolvement of the rail technology. This is because rail products have evolved to be more sophisticated and embedded with high technology components which no longer exist in the mechanical form alone but combined with electronics, information technology and others. These demand for a workforce imbued with knowledge, multi-skills and competency to deal with specialised technical areas.

Competition with other industries or even workforce migrating abroad is unavoidable. Retaining specialists in certain competencies, which can be applied in other industries is a challenge especially

during downturn when there is no contract/project secured. This is true when a company is relying heavily on Government projects as it is cyclical in nature.

3.4 Through Life-cycle Support

Through life-cycle support is one of the critical elements that needs to be considered in the earlier stage of a procurement process. Most of rail assets such as rolling stocks can last for about 30 years and during the period, rail operators need to perform various levels of maintenance in order to ensure a high rate of serviceability of the assets. Currently, most of the maintenance works are being carried out by the respective rail operators through their dedicated maintenance division. Unfortunately, most of them are capable only of performing maintenance activities up to Level 2 and to a certain extent, undertake minor modification and upgrade. However, most of the parts and systems especially the critical safety components need to be sent back to the OEMs for repair. The worst case which can be expected (based on feedback by industry players) is obsolescence i.e. when the suppliers have ceased operation or have stopped production of the specific products. This has caused rail operators huge loss in terms of cost and time. The lack of maintenance capabilities including testing facilities and certification are among the factors that also need to be developed if the industry is to be sustainable in the future.

3.5 Institutional Support

The rail industry development planning and monitoring has not been solely a prerogative of any specific Government Ministries/agencies but it is rather fragmented and attended to by multiple agencies. As an example, the policy and regulatory affairs for rail fall under the SPAD's jurisdiction; rail training on the other hand falls under the MOHR as well as the Ministry of Education (MOE), while the trade and investment aspects requires the prerogatives of MITI. There is no single platform coordinating, planning and monitoring

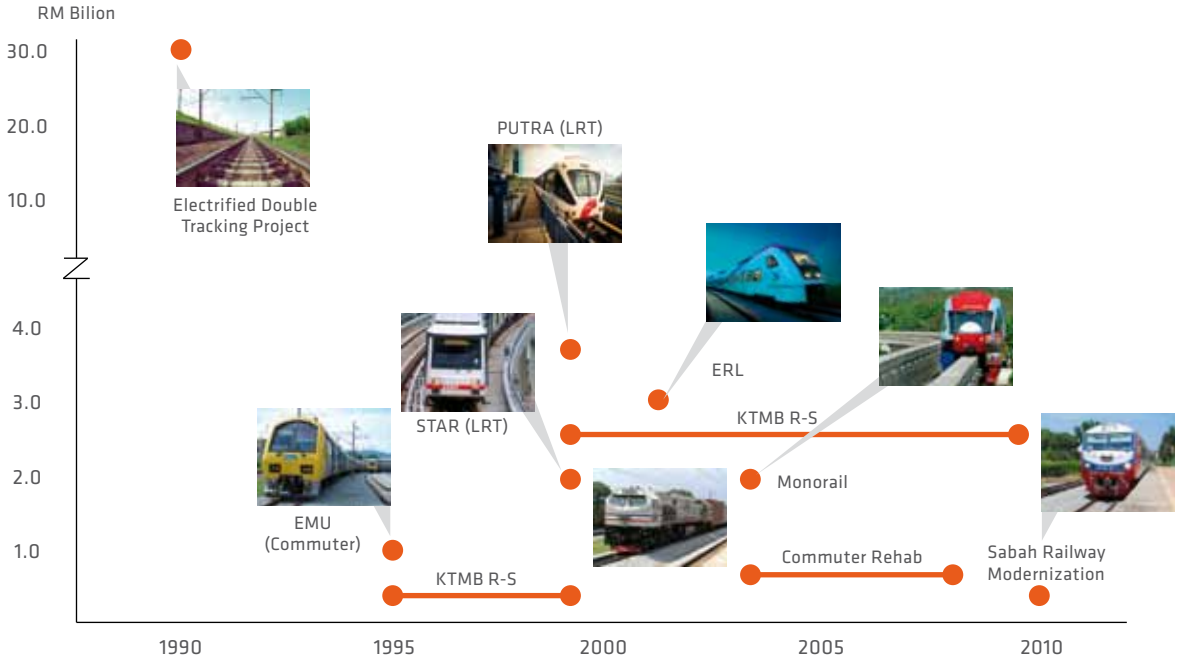


Figure 3.6: Government Investment on Rail Systems and Infrastructure

the development of this industry in a holistic manner. The institutional structure of the industry development is not comprehensive to bridge the gap between prerogatives of the different domains; the Government, the industry and the academia.

4. Future Rail Investment

As stated earlier, since the 1990s, the Government of Malaysia has invested more than RM50 billion on rail infrastructure. More investment is expected to come with major projects registered under the New Key Economic Areas and the Greater Klang Valley under the Economic Transformation Program. Two major projects are the Mass Rapid Transit (MRT) and the High Speed Rail (HSR) initiatives. Apart from these, there is a number of rail investment projects in the pipeline until the year 2020 and beyond which are estimated to worth about RM160 billion as announced by the Chairman of SPAD in June 2012.

In view of the huge investment committed by the Government, the local rail industry players and other stakeholders should work together in ensuring the maximum returns through to the industry development that could be achieved through the transfer of technology, localisation, capabilities development and other benefits.

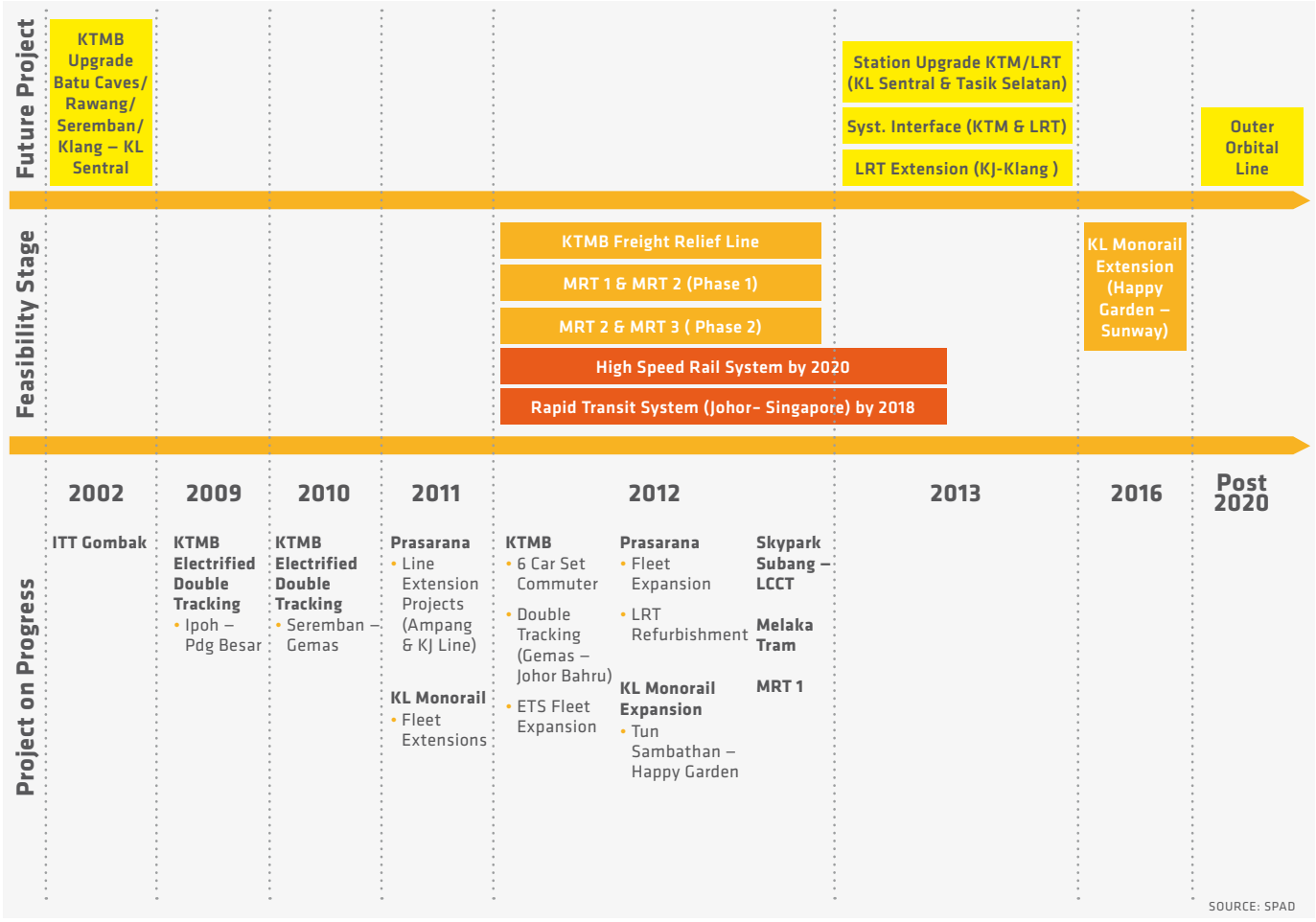


Figure 3.7: On-going and future rail projects in Malaysia until 2020

Appendix A: Status of Rail Industry Capabilities – Design, Manufacturing & Assembly

a. Rolling-Stocks & Electrification

Group	Major Sub-system	Major Components	Status of Capabilities
Electrical Systems	Propulsion	Electric Generator	Partial
		Traction Motors	Partial
		Linear Induction motor	None
		Transformer	Partial
		Power Inverter	None
		Diesel Engines	None
	APU(Aux. power Unit)	Inverter	None
		Low Voltage Power Supply	Partial
		Battery	None
	Current Collector	Pantograph	None
		Slider	None
	Lighting	Interior	Full
		Exterior	Full
	Switch Gears	Relay etc.	Partial
	Miscellaneous:	Cables	Partial
Electronics Systems	Communication Systems	Radio	Partial
		CCTV	Full
		PA	Full
		Infotainment Panel	Full
	Signalling Systems	ATC Equipment	None
		Tachometer	None
	Health Monitoring Systems	Software	None
		Electronic Module	None
Body & Interior	Bogie	Suspension System	Partial
		Wheel Set	Partial
		Under carriage casting	Partial
		Gearbox & Couplings	None
	Interior	Bathroom	Full
		Hatch Cover	Full
		Seat and Berth	Full
		Flooring	Full
		Wiper	Full
		Window	Full
		Ceiling Panels	Full
		Side panels	Full
		Electrical Lockers	Full

NOTE:

None

There is no capability available locally for designing, manufacturing and assembling of rail product

Partial

There is capability available locally but only involves a small portion of the major component

Full

Complete capability in design, manufacturing and assembly of major components

Group	Major Sub-system	Major Components	Status of Capabilities
		Stanchion	Full
		Grab Handlers	Full
		Diffuser	Full
		Brackets	Full
	Exterior	Windshield	Full
		Super structure	Partial
		End cap	Partial
		Painting	Full
		Decals	Full
Mechatronics	Door Systems	Motor Drive	None
		Belt	Partial
		Door Control Unit	None
		Door Panels	Full
	HVAC	Compressor	Partial
		Controller	Full
		Evaporator	Full
		Condensor	Full
	Brake Systems	Electronic Brake Controller	None
		Brake Calliper	None
		Brake Disc/Pad	None
		Track Brake	None
Mechanical	Gangway	Side Panel	Full
		Rubber Bellow	Partial
	Coupler	Mounting	Full
Final Assembly			Full
Testing and Commissioning			Full
Electrification	Component Suppliers	Transformers	None
		Switch Gears	Partial
		Cables	Full
		Poles & Mast	Full
		Earthing	Full
		Rectifier	None
	Installations	Traction power Substation	Partial
		Overhead catenary system	Full
		Conductor Rail	Full
	Power Monitoring	SCADA	Partial

Appendix A: Status of Rail Industry Capabilities – Design, Manufacturing & Assembly

b. Signalling, Communication and Train Control

Signalling	Major Components	Sub-components	Status of Capabilities
Certification and Safety	Integration		None
Systems Engineering	Specification		Partial
	Design		None
	Integration		None
Project Management			Partial
Integration, Testing & Commissioning			Partial
Component for Signalling (Safety related)	Interface	Hardware	Partial
		Software	None
		Relay/Switches	None
		Microprocessor Based	None
	Inter-locking Systems	Relay/Switch	None
		Microprocessor Based	None
	Automatic Train Protection	Transponder	None
	Automatic Train Supervision		None
	Automatic Train Operation		None
	Proximity Target Plate		None
	Proximity Sensor		None
	Controller		None
	Tachometer		None
	Antenna		None
	Point Machine		None
	Signalling Cable/Inductive Loop		Partial
	Switch Positioning Indicator		Partial
	Train Detection	Track Circuit	None
		Axle Counter	None
		Radio Frequency	None
Components for Signalling (Non-safety related)	Display Board/Panel		Full
	Cables		Full

Communications	Major Components	Sub-components	Status of Capabilities
Certification	Integration		Partial
System Engineering	Specification		Full
	Design		Full
	Integration		Full

NOTE:

None
There is no capability available locally for designing, manufacturing and assembling of rail product

Partial
There is capability available locally but only involves a small portion of the major component

Full
Complete capability in design, manufacturing and assembly of major components

Communications	Major Components	Sub-components	Status of Capabilities
Project Management			Full
Integration, Testing & Commissioning			Full
Communication Systems	Control Centre	Integrated/Centralized Control Centre for Communication and SCADA	Full
	Non-interference Radio System		None
	Communication Support	>CCTV	Partial
		>Help Point	Partial
		>Digital Transmission System (DTS)	Partial
		>PA	Partial
		>PIS	Partial
		>Access Control	Partial
		>PABX	Partial
		>SCADA	Partial
		>Backbone -Fibre -Wireless	Partial
	Passenger Communication Systems	Wireless	Partial
		Entertainment/ Advertisement	Full

c. Rail Tracks & Infrastructure

Rail Tracks Components			Status of Capabilities
Track work	Rails	Steel	None
		Rolling	Partial
	Sleepers	Timber	Full
		Concrete	Full
		Concrete Slab	Full
	Fastenings	Coach screw	Partial
		Clips	Partial
		Plates	Partial
		Bolts, Nuts, Washers & Springs	Full
	Ballast		Full
	Switch & Crossing/ Turnout	Switch	None
		Frog	None
		Guard Rails	None
		Rail Plate	None

c. Rail Tracks & Infrastructure (Continued)

Rail Tracks Components			Status of Capabilities
Electrification / Power Rail / Conductor Rail / 3rd Rail	Insulator		Full
	Conductor	Conductor Rail	None
		Conductor Rail Support	None
		Conductor Rail Ramp	None
		Conductor Rail Expansion Joint	None
		Conductor Rail Joint	None
	Cables	Connector	Partial
		Feeder Cable	Partial
	Mid-Point Anchor		None
	Poles/Mast		Full
	Catenary		Full
	Transformer/ Power Station		None
Track Maintenance Vehicles	Grinding Machine		None
	Tamping Machine		None
	Track Recording Car		None
	Flat Wagon		Full
	Unimog		None
	Ballast Hopper		None
	Ballast Cleaning Machine		None
	Trolley		None
	Work Car (Monorail)		Full

Rail Infrastructure Components		Status of Capabilities	
		Construction	Installation
Civil Works	Station	Full	Full
	Bridges	Full	Full
	Tunnel	Partial	None
	Guideway/Viaduct	Full	Full
	Drainage	Full	Full
	Walkways	Full	Full
	Earthworks	Full	Full
	Other Buildings (Power/Control)	Full	Full
	Depot & Workshop	Partial	Full
Systems	Platform Screen Door	Partial	Partial
	Domestic Power Backup System	Full	Full
	Facilities SCADA/ BMS/ EACS	Partial	Full

NOTE:

None
There is no capability available locally for designing, manufacturing and assembling of rail product

Partial
There is capability available locally but only involves a small portion of the major component

Full
Complete capability in design, manufacturing and assembly of major components

Appendix B: Status of Rail Industry Capabilities – Maintenance, Repair and Overhaul (MRO)

a. Rolling-Stocks & Electrification

Group	Major Sub-System	Major Components	Status of MRO Capabilities
Electrical Systems	Propulsion	Electric Generator	Partial
		Traction Motors	Partial
		Linear Induction Motor	Partial
		Transformer	Partial
		Power Inverter	Partial
		Diesel Engines	Partial
	APU (Auxiliary Power Unit)	Inverter	Partial
		Low Voltage Power Supply	Partial
		Battery	Partial
	Current Collector	Pantograph	Full
		Slider	Full
	Lighting	Interior	Full
		Exterior	Full
	Switch Gears	Relay etc.	Full
	Miscellaneous	Cables	Full
Electronics Systems	Communication Systems	Radio	Full
		CCTV	Full
		PA	Full
		Infotainment Panel	Full
	Signalling Systems	ATC Equipment	Partial
		Tachometer	Partial
	Health Monitoring Systems	Software	Partial
		Electronic Module	Partial
Body & Interior	Bogie	Suspension System	Full
		Wheel Set	Full
		Under carriage casting	Full
		Gearbox & Couplings	Full
	Interior	Bathroom	Full
		Hatch Cover	Full
		Seat and Berth	Full
		Flooring	Full
		Wiper	Full
		Window	Full

NOTE:

None

There is no capability available locally for undertaking maintenance, repair and overhaul activities

Partial

There is capability available locally but only involves the first and second levels or a small portion of the major components

Full

Complete capability up to the highest level of maintenance, repair and overhaul (MRO) of the major components up to modification and upgrading works

a. Rolling-Stocks & Electrification (Continued)

Group	Major Sub-System	Major Components	Status of MRO Capabilities
		Ceiling Panels	Full
		Side panels	Full
		Electrical Lockers	Full
		Stanchion	Full
		Grab Handlers	Full
		Diffuser	Full
		Brackets	Full
	Exterior	Windshield	Full
		Super structure	Full
		End cap	Full
		Painting	Full
		Decals	Full
Mechatronics	Door Systems	Motor Drive	Full
		Belt	Full
		Door Control Unit	Partial
		Door Panels	Full
	HVAC	Compressor	Full
		Controller	Partial
		Evaporator	Full
		Condensor	Full
	Brake Systems	Electronic Brake Controller	Partial
		Brake Calliper	Full
		Brake Disc/Pad	Full
		Track Brake	Full
Mechanical	Gangway	Side Panel	Full
		Rubber Bellow	Full
	Coupler	Mounting	Full

NOTE:

None
There is no capability available locally for undertaking maintenance, repair and overhaul activities

Partial
There is capability available locally but only involves the first and second levels or a small portion of the major components

Full
Complete capability up to the highest level of maintenance, repair and overhaul (MRO) of the major components up to modification and upgrading works

b. Signalling, Communication and Train Control

Group (Signalling)	Major Components	Sub-components	Status of Capabilities
Certification and Safety	Maintenance & Repair	Vital Parts	None
		Non-vital Parts	Partial
	Operation		None
Operation Engineering	Performance Analysis & Design		Partial
	Operation Support		Partial
MRO	Asset Management	Preventive Maintenance	Full

Group (Communications)	Major Components	Sub-components	Status of Capabilities
Certification	Maintenance & Repair		Partial
	Operation		Full
Operation Engineering	Performance Analysis & Design		Full
	Operation Support		Full
MRO	Asset Management	Preventive Maintenance	Full

c. Rail Tracks & Infrastructure

Rail Tracks Components			Status of Capabilities	
Major	Minor	Sub	MRO	Upgrading/ Modification
Track work	Rails	Steel	Partial	Partial
		Rolling	None	None
	Sleepers	Timber	None	Partial
		Concrete	None	None
		Concrete Slab	None	None
	Fastenings	Coach screw	None	None
		Clips	None	None
		Plates	None	None
		Bolts, Nuts, Washers & Springs	None	None
	Ballast		Full	Partial
	Switch & Crossing/ Turnout	Switch	Full	None
		Frog	Full	None
		Guard Rails	Full	None
		Rail Plate	Full	None
Electrification / Power Rail / Conductor Rail / 3rd Rail	Insulator		Full	Full
	Conductor	Conductor Rail	Full	None
		Conductor Rail Support	Full	None
		Conductor Rail Ramp	Full	None
		Conductor Rail Expansion Joint	Full	None
		Conductor Rail Joint	Full	None
	Cables	Connector	None	None
		Feeder Cable	None	None
	Mid-Point Anchor		None	None
	Poles/Mast		Full	Full
	Catenary		Full	None
	Transformer/ Power Station		None	None

c. Rail Tracks & Infrastructure

Rail Tracks Components		Status of Capabilities	
Major	**Minor**	**MRO**	**Upgrading/ Modification**
Track Maintenance Vehicles	Grinding Machine	Partial	Partial
	Tamping Machine	Partial	Partial
	Track Recording Car	Partial	Partial
	Flat Wagon	Partial	Partial
	Unimog/	Partial	Partial
	Ballast Hopper	Partial	Partial
	Ballast Cleaning Machine	Partial	Partial
	Trolley	Partial	Partial
	Work Car (Monorail)	Full	Full

Rail Infrastructure Components		Status of Capabilities
Civil Works	Station	Full
	Bridges	Full
	Tunnel	Full
	Guideway/Viaduct	Full
	Drainage	Full
	Walkways	Full
	Earthworks	Full
	Other Buildings (Power/Control)	Full
	Depot & Workshop	Full
Systems	Platform Screen Door	Full
	Domestic Power Backup System	Full
	Facilities SCADA/ BMS/ EACS	Partial

NOTE:

None

There is no capability available locally for undertaking maintenance, repair and overhaul activities

Partial

There is capability available locally but only involves the first and second levels or a small portion of the major components

Full

Complete capability up to the highest level of maintenance, repair and overhaul (MRO) of the major components up to modification and upgrading works

Visioning The Future of Malaysian Rail Supporting Industry 2030

1. Background

During the engagement with rail stakeholders, lack of a clear policy, vision and direction for the industry development have been identified as major factors contributing to the current state of the industry. In addressing these issues, the Future Rail 2030 initiative has taken steps to construct consensus views from all related parties on the desired state of the rail industry in the future. As a result, this exercise gathered industry players on the same page to provide better communication during the implementation especially with related Government agencies, and created a motivation for them to focus their investments to be in line with the set target. The consensus picture in the mind of all stakeholders could be realised partly with the support of the Government. A significant amount of rail investment by the Government until 2020 through the Greater Kuala Lumpur initiative of the Economic Transformation Programme will become a reason to strengthen the required capabilities to ensure the industry's competitiveness and its future sustainability.

In previous parts of the report, understanding of the current situation for both global and local rail industries helps us to answer the question of 'where we are now'. Next in this chapter is to answer the question of 'where do we want to go'. The foresight method namely the Scenario Building was used in this phase. All views from stakeholders (the Government, the Industry and the Academia) were consolidated through a structured process to identify future drivers of change and consequently developed a consensus view on desired state (future scenario) of the Malaysian Rail industry in 2030.

2. Global Megatrends

"MEGATRENDS ARE GLOBAL, SUSTAINED AND MACRO-ECONOMIC FORCES OF DEVELOPMENT THAT IMPACTS BUSINESS, ECONOMY, SOCIETY, CULTURES AND PERSONAL LIVES THEREBY DEFINING OUR FUTURE WORLD AND ITS INCEREASING PACE OF CHANGE"

SOURCE: FROST & SULLIVAN

Extensive discussions, debates and even research themes conducted around the world are centred on the preparation towards resolving or mitigating the impact of megatrends. Some people may ask: "Is

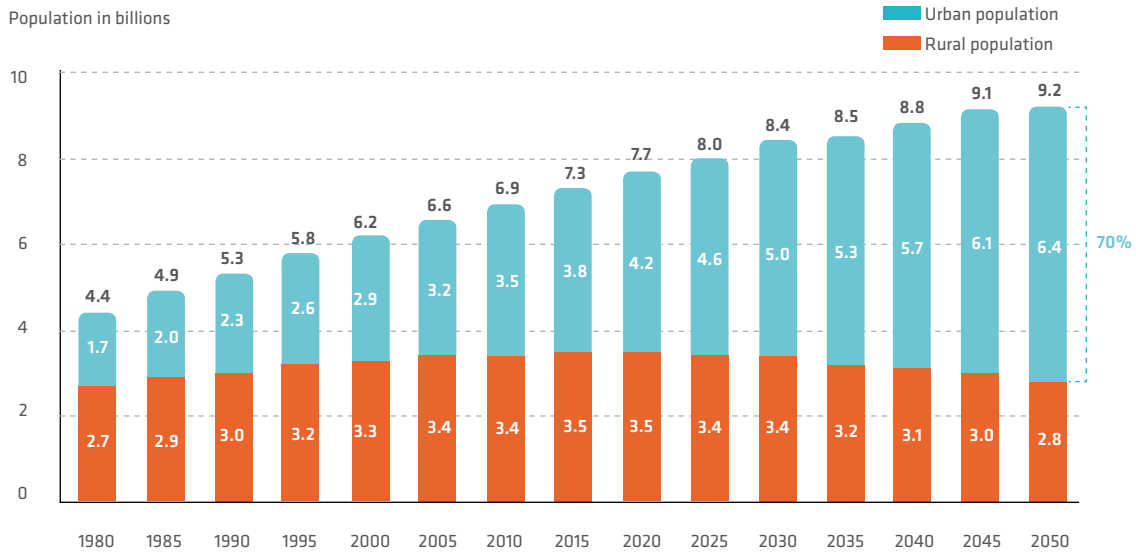


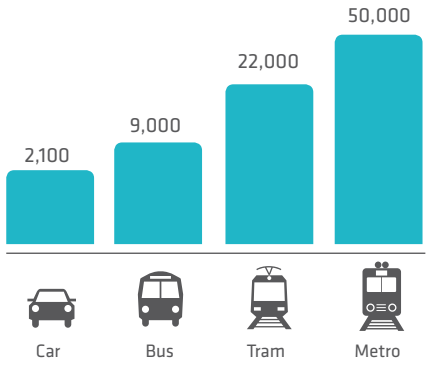
Figure 4.1: Growing Urban Population [2]

it the right time for rail?" and "How is rail going to be one of the future solutions for megatrends?". There are many future forces that are considered as megatrends which among others are as follows:

2.1 Trend 1: Urbanisation and Increase of Population

Urbanisation is defined by the United Nations as movement of people from rural to urban areas with population growth equating to urban migration. World population is projected to grow 20% over the next 20 years to 8.3 billion people by 2030. The highest growth will be in the developing countries which is seen to be seven times faster than that of developed countries[1]. Based on the projection by Frost & Sullivan, Asia's urban population has grown from 31.5% of the total in 1990 to 42.2% in 2010 and if the rapid growth of China's urban population is taken into account, the figure of 50% mark will be exceeded in the year 2026. A study by the consultant also indicates that 50% of the top mega cities in the world will be from developing countries by the year 2025.

In the future, more megacities will emerge resulting from the above trend leading to other problems such as congestion. Congestion will cause a country to lose billions of dollars. It is estimated that traffic delays in developed countries represent a loss of €500 billion per year where the cost of congestion in London alone is at least €3.5 billion per annum.[3] Based on *International Association of Public Transport* (UITP), rail proved to be an effective medium to move a significant number of people in a dense city. It is estimated that an amount of 50,000 people can be transported in an hour compared to other modes of transportation.



SOURCE: INTERNATIONAL ASSOCIATION OF PUBLIC TRANSPORT (UITP)

Figure 4.2: Number of people transported per hour in an urban environment

[1] *Rolland Berger*
[2] *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2007 Revision*
[3] *London First*

2.2 Trend 2: Price of Energy

Globally, oil will remain the most important source of energy in the next 20 years, meeting 31% of the world's energy needs (compared to 35% today). It will be followed by coal at 27% (today at 26%), gas at 23% (unchanged from today), renewables at 13% (today at 10%) and nuclear power at 6.4% (today at 5.5%). A study carried out by the consultant on this matter projected that "oil peak" or the point in time when the maximum amount of crude oil is extracted worldwide has reached, the rate of extraction will probably be declining by 2030 at the latest. Exceeding this point will tremendously boost the price of oil considering increasing trend in energy demand.

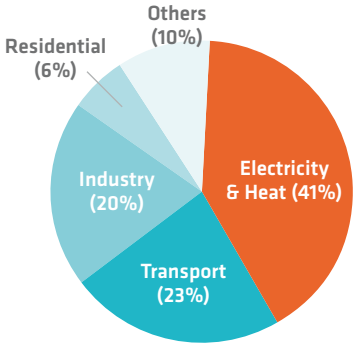
The modern trains are increasingly powered by electric traction which means moving away from dependency on fossil-based fuel. However, it will not resolve the issue if the generation of the electricity is by using carbon-based fuel. Today, there are extensive activities in research and development (R&D) of alternative energy sources such as nuclear, hydro, bio-fuel, solar, thermal and other alternatives which will potentially decrease the percentage of global dependency on fossil-based fuel in the future.

2.3 Trend 3: Climate Change

A projection by Rolland Berger, a consultant company, stated that the concentration of CO_2 in the earth's atmosphere is about 30% higher than atmospheric CO_2 levels were before the Industrial Revolution. The trend will continue since by 2030, world carbon emissions from coal, oil and gas combustion will increase by 16% to 35,053 megatons. Due to slow removal processes, atmospheric CO_2 will continue to increase in the long term even if emissions are substantially reduced from their present levels. The effect of green gases will have an impact to the global warming and it is forecasted that global temperature will rise from 0.5 to 1.5 C by 2030.

Figure 4.4 shows that rail contributed low carbon emission with existing power train using diesel. However, as explained in Item 2.2, modern trains are moving towards carbon-free emission by adopting electric traction or even improved efficiency using hybrid engine. Therefore, the main focus should now look at source of electricity generation and promote the use of non-fossil fuel to mitigate the overall green gas emission.

[1]*Thought Megatrends, Rolland Berger*



** Others includes commercial/public services, agriculture/forestry, fishing, energy industries other than electricity and heat generation, and other emissions not specified elsewhere*

Figure 4.3: World CO_2 emissions by sector in 2009

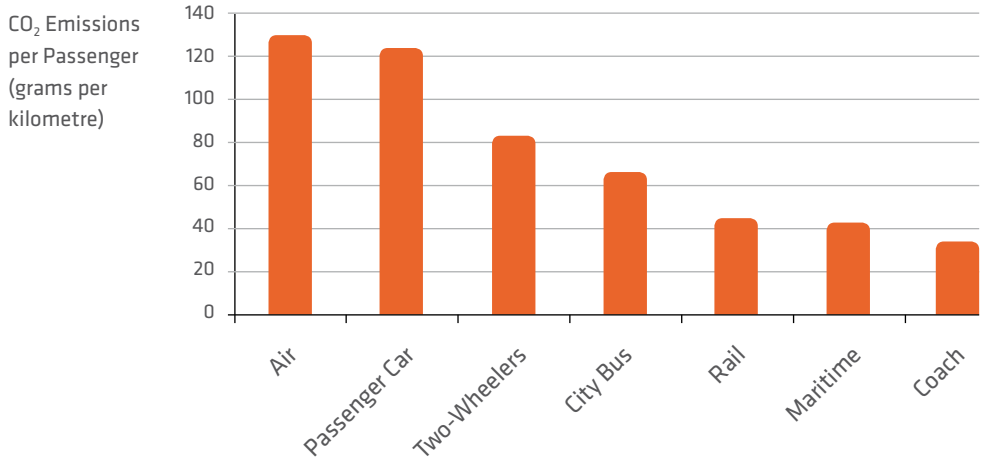


Figure 4.4: Transportation accounts for 23% of CO_2 Emissions

3. Encouraging Trends of Rail Transportation

The megatrends as described earlier have a significant impact to the development of the rail industry globally. Economic growth, climate change, urbanization and increasing population are among the factors that stimulate rail traffic and subsequently create a demand for new rail investment.

3.1 Growing Rail Passenger Traffic and Freight

World GDP is expected to grow strongly at 3.2% per annum until 2030 led by the Asian/Pacific region namely China and India with 4.6% per annum and 6% per annum respectively[1]. Encouraging economic trends create a huge need for both passenger and freight transportations. According to SCI Verkehr, three-quarters of the world rail passenger traffic which is currently contributed by the Asian region especially China and India will continue to drive growth of an annual average of 7.5% and 5% respectively up to 2020. By 2020, the figure is expected to reach a total of 4.8 trillion passenger-km which equates to an average annual growth of 4.8% from 3 trillion passenger-km in 2010. In terms of freight, this segment is projected to grow, fuelled by the high demand of raw materials transportation. In 2010, positive number of percentage growth was reported by UIC in various countries such as Russia (8%), USA and Canada (4%), China (3%) and India (9%), to name a few.

[1] *EIA 2010*

3.2 Increasing Rail Investment

Encouraging rail traffic will fuel the need to expand existing infrastructure and networks which in turn, provide huge opportunities for rail supply market. Based on *Strategic Transport Infrastructure Needs* to 2030 by OECD, it is estimated that global infrastructure investment needs across the land transport including rail amounted to USD53 trillion over 2010 until 2030. Out of the amount, new rail construction (including maintenance) portion is estimated to be a total of USD5 trillion from 2010 until 2030. Although conventional financing of this investment is normally funded by the central government, interest by private entity to participate is increasing either through *Public-Private Partnership* (PPP) or other innovative mechanisms. Nevertheless, certain issues with regards to both motivation and social obligation versus profit making will need to be harmonised.

3.3 Future of Mobility

When describing the trends of rail-related technology, it needs to be looked at from a much bigger picture of future mobility. Frost & Sullivan predicted that future mobility of transportation is going to be green, integrated and interoperable. These trends are relevant for rail as follows:

a. **Green**. Technology development focuses on energy efficiency partly to mitigate the impact of climate change. This includes development of alternative fuel to diesel such as biofuel, hydrogen engine, hybrid engine as being used by cars, regenerative braking systems, application of advanced materials such as advanced composite and other light-weight materials and improvement of existing design to be more aerodynamic. There are also a number of initiatives towards smaller scale lightweight systems such as automatic people movers which contain smaller number of passengers but run on a dedicated guideway.

b. **Integrated**. An integrated transportation means transportation mode either by air, sea or ground that involve delivering passengers or cargoes on a seamless journey. This is not only for multi-modal connecting airport, seaport and ground hubs but also includes multi-mode of public

transports such as bus, taxi and train. As an example, in Europe, the utilisation of intelligent transportation system (ITS) for road, traffic management system for rail (ERTMS) and single European sky's SESAR, backed by Galileo are able to optimise the use of network and improve safety. From passenger perspective, it translates into more information-rich interface leveraging on rapid development of IT and ICT applications especially in getting the process to travel from a place to another with less hassle and time consumption.

c. **Interoperable**. This is defined by Europa: EU Legislation as the capability to operate on any stretch of the rail network without any hitches. In other words, the focus is on making the different technical systems work together. This is critical to enhance competitiveness of the industry as well as open up wider networks beyond geographical border. This is critical especially in making the Trans-Asian Rail Network a success.

Figure 4.5: Integration of rail transport

4. Shaping the future of the Malaysian Rail Industry

Series of workshops conducted with more than 50 participants from various organisations have identified 15 drivers that will shape the future of local rail industry. However, after assimilation and thorough consolidation, it resulted with nine drivers of change selected as follows:

Driver 1:
Policy and Institutional Framework

Rail industry development planning and monitoring is not under prerogative of any single Government organisation. That is clearly a major factor that attributed to the unclear policy direction and the confusion of the roles of each individual Government agency not only with the operators but also with the public at large. This issue has been long overdue and there is a need for a single platform to coordinate, develop, and monitor the development of this industry.

Driver 2:
Technology and Human Capital Development

Exposure to rapid technology development is lacking for local workforce in the rail industry especially for an area that requires knowledge and skills of multiple domains e.g. mechanical and electronics or electronics, electric and IT. Continuity of sustainable manpower to support the industry growth is at stake as it is perceived unattractive compared to other modes of transportation. The industry is in dire need for sufficient human capital not only to be able to support life-cycle of existing assets, to expand and also to be creative and innovative in discovering new technology through research, design and development activities.

Driver 3:
Multimodal and Integrated Transport

Even with the bustling infrastructure development taking place as the nation advances towards achieving Vision 2020, an ineffective multimodal transportation system will still impede the progress of the nation. The many shortfalls manifested by the limited rail networks, the long duration of transit time as well as the insufficient volume of activities in the hinterland all add up to the challenges that call for effective solutions.

Besides that, the growing trend of integrating urban rail with other public transportation modes is seen as the starting step en route to the betterment of the local rail industry. Seamless journey from point A to point B via multiple modes of transportation with just one ticket or card has been the practice in other developed countries. There is on-going effort on this matter, at least for multiple transports owned by the same operator.

THE INDUSTRY IS IN DIRE NEED FOR SUFFICIENT HUMAN CAPITAL NOT ONLY TO BE ABLE TO SUPPORT LIFE-CYCLE OF EXISTING ASSETS BUT ALSO TO BE CREATIVE AND INNOVATIVE IN DISCOVERING NEW TECHNOLOGY THROUGH RESEARCH, DESIGN AND DEVELOPMENT ACTIVITIES.

Driver 4:
Market Competition and Value Added Products/ Services

The domestic rail market is very small and competitive. A sizeable Government procurement on rail assets has lured various foreign rail producers to promote their products and bid for the contracts. Local players with limited track records are struggling to compete with established players from abroad and end up making a futile bid. Partnering or joint efforts with foreign technology providers is the way to go in order to survive in this day and age. The question is: Will any local companies eventually benefit from this collaboration in terms of transfer of know how and technology or just sharing the profit?

Driver 5:
Connectivity and Tourism

The Malaysian rail networks over the decades have functioned to bridge the gap between urban and rural communities. There is a potential to promote the rail operation through tourism activities especially in Sabah and Sarawak. Nevertheless, most of the current rail network developments are concentrated in the Klang Valley as well as the expansion of the main inter-city connection from the North to the South of Peninsular Malaysia. The same model in the Klang Valley can be developed in each state of Malaysia in the future.

Driver 6:
Safety and Security

Matching its position as a nation heading for developed nation status, its public transportation service delivery should always be in check without making room for the slightest oversight to creep in. It will always have a high level of frequent users of rail services with the operators conforming to the high safety and security guidelines and avoid accidents at all costs no matter how idealistic the notion can sound. Provision of accident-free railway operation, avoiding derailments or collisions, reducing impact by using very light but strong material and excellent design to minimize catastrophe in case of accidents are some of the measures that rail operators can engage to ensure passenger safety.

Driver 7:
Localisation and Globalisation

High number of trade imbalance between export and import figures struck a concern over long-term sustainability and the heavy dependence on foreign suppliers. It is understandable though that some of the components referred to as safety critical items inevitably require intervention from OEMs due to highly specialised skills which are currently not available in the country. However, there are numerous non-safety items that can be produced locally as the required competencies are available if not in the rail industry but through other industries which are stronger such as electronics and telecommunications. Besides the manufacturing of rail products, the capability in supporting rail asset throughout its entire life-cycle is equally important which will affect availability for the rail operation. It will only make sense if the government and local players support this localisation initiative which can create industry champions.

Driver 8:
Sustainability

Sustainability first refer to continuous energy consumption and its short term as well as long term impacts on the environment. Climate change due to green gas emission and urbanisation proportionates with the increase of population and congestion. These are the megatrends that will affect the existing policy and sentiment of the people to move towards greener alternative.

Secondly, sustainability also refers to the ability of the industry to sustain itself economically. It points to an industry that can progressively endure indefinitely, with all its players, clients and users including the government having a symbiotic relationship that is a win-win for everyone concerned.

Driver 9:
Geopolitical

The Trans-Asian railway network initiated some 40 years ago is proof that for the longest time, rail has been perceived as the faster and more economical mode of transport to boost international trade among nations. The fact that the project still has not taken off after so many years should not affect Malaysian businesses, rather this should be seen as an opportunity still in place.

5. Scenario Building for the Malaysian Rail Industry in 2030

Through the process of cross-impact analysis, the highest influence among the drivers rated by the workshop participants are Policy and Institutional Framework, Technology and Human Capital Development, Multimodal & Integrated Transport, Market Competition and Value Added Products/ Services and Localisation and Globalisation. Each of these five key drivers forms a main framework to develop a desired scenario. The remaining drivers other than mentioned above will be a part of the narration wherever it is related.

Scenario 1.0:
Policy and Institutional Framework

By 2030, a total of RM180 billion worth of new rail infrastructure was invested by the Government since it was announced by the Chairman of SPAD in 2012. This explains the Government's commitment to provide the best rail transportation service on par with other developed countries. Recently, the regulator unveiled additional upgrading and expansion programmes of existing networks that will improve accessibility and capacity in several destinations for both passengers and cargos.

In order to support the growth of the industry, the Government through SPAD has developed and adopted a set of rail standards. This is obtained from past joint initiatives with Standards Malaysia and SIRIM. These standards are applied to strengthen the technical specifications which are currently being used in various procurement exercises. To date, there are already technical specifications developed by the regulator for different types of rolling-stocks, for example light, heavy and high speed rail. As a result, all new systems, equipment and components, regardless of the operators that own them, are common in terms of technical specification. The remaining legacy assets that are still a mix of standards and specifications will go through refurbishment and upgrading program.

Road-mapping initiative back in 2012 has provided a clear vision, direction and has laid down various programmes for the implementation of the key initiatives. To date, more than 90% of the recommendations have been implemented. This is due to an effective coordination and implementation by a central organisation through the National Rail Industry Council. All programs or proposals which are successfully implemented have been supported by various ministries and Government agencies with active participation by the industry and the academia.

Scenario 2.0:
Technology and Human Capital Development

By 2030, the Malaysian rail industry has expanded from about 50 to more than 100 related organisations. In addition to the growth of the industry, a sizeable investment made by the Government has also created huge job opportunities for Malaysian workers. High technology, sophisticated, and sleek design of current trains compared with the past 20 years has presented a new image to the public. These will serve as "feel good" factors that largely drive a huge number of young graduates of today to choose a career path in this industry. Besides, the attrition rate will remain very low for a long time as workers tend to stay in the industry when it is being constantly fuelled by a wealth of projects. Nevertheless, migration of local experts abroad is something that is inevitable. An outpour of job openings in the Middle East requires various types of manpower with different levels of skills to fill vacancies urgently. This has not proven to be detrimental to the industry but rather, shows that Malaysia has skilled manpower for export all over the world.

In ensuring sufficient supply of workforce in the industry, there are several skills training institutes established by the Government that continuously produce semi-skilled workers. This is on top of training institutions which are owned by major train

operators. A look at white collar jobs show some universities offering rail engineering as an optional major for final year and as full course post-graduate studies at Master and PhD levels respectively. However, there are avenues for graduates in general engineering fields who are interested to find jobs in the rail industry as well as opportunities for semi-skilled workers keen on furthering studies at a higher level within the same gamut. The Centre of Excellence for Rail which came into fruition from the enhancement of a training institute under KTMB back in 2013 has provided such an avenue for industry hopefuls. It is equipped with the latest facilities and provides students with the most updated knowledge on train technologies which are recognised by most of the global rail companies and associations. This is achieved through continuous partnership with foreign technology providers and experts from various rail organisations in Malaysia. All of the syllabuses used are reviewed by a panel of experts in order to ensure that they meet the current and future needs of the industry.

The technology development initiative since 2012 has not yielded many discoveries through research and development (R&D) activities. However, new technologies have been acquired through a procurement mechanism called offsets and reverse engineering. Almost all of the procurements endeavoured by the Government with a total value of RM160 billion coupled with offset program as a means to expedite the industry growth and further to achieve the aims as stated in the Malaysian Rail Supporting Industry Roadmap 2030. Local rail industry players and operators enjoy the healthy benefits derived from the Government investment programmes. Besides that, offsets also result in several joint technology development projects between local universities, local industry players and foreign technology partners on certain key areas. Correspondingly, reverse engineering ventures have been undertaken on critical parts. Funding for R&D is not an issue as it is now being allocated and coordinated under the National Science & Research Council (NSRC) which also registers rail-related technology development under one of the R&D priority lists. Some of the technologies acquired have contributed towards the improvement of energy efficiency, speed and comfort, inter-operability, as well as enhance the reliability of current rail operation.

BY 2030, THE MALAYSIAN RAIL INDUSTRY HAS EXPANDED FROM ABOUT 50 TO MORE THAN 100 RELATED ORGANISATIONS. IN ADDITION TO THE GROWTH OF THE INDUSTRY, A SIZEABLE INVESTMENT MADE BY THE GOVERNMENT HAS ALSO CREATED HUGE JOB OPPORTUNITIES FOR MALAYSIAN WORKERS.

Scenario 3.0:
Multimodal and Integrated Transport

By 2030, the rail networks that are formerly confined within the Klang Valley have expanded nationwide to cover other states in Malaysia. Upgrading and adding lines from the main trunk of KTMB tracks from North to South have now stretched from the west coast to the east coast of Peninsular Malaysia. There are also a number of spur lines that connect major ports with major industrial parks in the *East Coast Economic Corridors* (ECER), the *North Coast Economic Corridors* (NCER) and the *Iskandar Malaysia* in the South. Parallel to the existing trunk line, high speed rail which is operated by a private company is fast gaining popularity. Currently, the train is serving Singapore – Johor – Kuala Lumpur route and it plans to expand up to Bangkok. Based on rapid urbanisation progress especially in Selangor, Johor, Penang, Melaka, Perak and Negeri Sembilan, the intra-city or light rail networks soon start to face the same situation as the Klang-Valley fifteen years ago. In East Malaysia, there are also on-going projects developing railway tracks in Sarawak and expansion of existing tracks in Sabah. The train will be a medium to transport raw materials for energy sectors and passenger transportation especially for eco-tourism.

The idea of "seamless journey" which seems to be almost impossible to implement in the past has now

become a reality. The train has been conveniently integrated with most public transportations such as buses and taxis linking all major hubs in Peninsular Malaysia. Today, a passenger is able to swiftly travel from one destination to another, even embarking on trains by different operators with the purchase of only one ticket or using a dedicated travel prepaid card (subjected to conditions). This facility has now been expanded to other states in Malaysia outside the Klang Valley. The Government's investment on upgrading and expansion of rail infrastructure has changed the public's perception and preference for train over other types of transportation. This is largely due to improvement in punctuality, comfort and duration taken to reach a destination.

Apart from passenger transportation, rail freight has made a significant impact on being the choice of transport to move massive cargos to their final destinations. The effective cargo distribution was a result of upgrading and expansion undertaken by the Government in the previous decades. Raw materials, customised cargo containers, semi-finished and finished products can be transported from various seaports such as Port Klang, the Port of Tanjung Pelepas, the Kuantan Port, the Penang Port as well as major airports in the country. All of these would have been impossible to achieve had it not been for the efficient clearance process by the Royal Malaysian Customs. In anticipation of this, Malaysia will have gradually become the preferred regional distribution hub for freight transported from Eastern and Western regions.

Scenario 4.0:
Market Competition and Value Added Products Services

The year 2030 witnesses the upgrading and building of rail infrastructure activities mushrooming worldwide, driven by the need to address rapid urbanisation in major cities (such as in China, India and the Middle-East), climate change and congestion. Malaysia is not excluded from this trend as a sizeable investment in rail has been committed by the Government of Malaysia since 2012 to stretch a span of two decades to enhance the social and economic activities in the country.

A number of rail projects in the pipeline have lured local and foreign rail suppliers with each bidding a piece of the available contracts. Flashback to fifteen years before, intense competition is seen only among foreign suppliers where local industry players have almost no chance to compete directly due to unattractive track records, limited capability and product credibility. Today, the situation has changed. Local champions identified, groomed and developed for the past 20 years have positioned Malaysia as one of the respectable competitors in the global rail market. Strong grasp over design and development and system integration capabilities have enabled local players to enhance their products' competitiveness and support life-cycle of the asset more effectively. The local rail industry widened its offering from monorail to heavy rail products has successfully secured contracts in South East Asia, Brazil, India and the Middle East as it is dubbed to have 'Japanese quality, Chinese price'. In view of this, most of the recent contracts tendered by the Government are awarded to local players either for new purchases or refurbishment of existing assets. Track records are no longer an issue and the competitive advantages are due to its cost, quality of products and after sales services. Even more important is the multiplier effects to the country's economy as well as achieving national aspirations.

Scenario 5.0:
Localisation and Globalisation

In 2030, the Government's enforcement on local content in the procurement of rail assets has yielded positive impact to long-term industry development. Although a small percentage has been committed during the previous procurement back in 2010, the

strategies employed since then have generated a significant increase in figure from 5 to 10% to more than 40% today. The identification of strategic areas to be developed through road mapping exercise in 2012 have been fully completed that it enables all non-critical and to a certain extent, critical items to be developed locally and certified internationally. Cross-industrial strategy by leveraging on well-established and mature local industries such as automotive, telecommunications, advanced materials, aerospace and others help to further expedite the growth of the rail industry. Besides that, initiative to enforce common technical specification and adoption of dedicated standards have an impact in terms of creating critical mass of rail components which indirectly justify local players especially small, medium enterprises (SMEs) to invest or diversify in this business. Moreover, the situation has mitigated trade imbalance where the export has moved slightly above the import figure. Most of the MRO activities are no longer carried out by train operators but instead by a third party to improve train availability. A recent study showed that serviceability of train operation is at more than average of the current best practices around the world. Local MRO players have expanded their ability to fully perform Level 3 maintenance and to a certain extent modification, upgrading and testing without intervention from OEMs. Malaysia is now one of the authorised maintenance centres in the region certified by most top train producers.

In view of the pressure to be cost effective and meet the high demand of rolling-stocks in the Asian region, western train and equipment manufacturers were searching for a suitable location to setup their new production line. Apart from cost and market driven, easy access to the pool of skilled workforce, raw materials, IP protection, strong IT facilities and being geographically strategic have tremendous influence on selection of the location. Malaysia fulfils most of the criteria especially being located at the heart of South East Asia, thus making the country one of the attractive destinations for investors. Furthermore, the Government has launched target FDI on selected foreign rail suppliers to fill the critical gap in the local and regional supply chain. Today, most of the components, parts and systems made by world top rail producers/suppliers are sourced from Malaysia.

6. Future Opportunities

Encouraging trends in rail investment both local and global, international trades and passenger traffic as well as megatrends become a backdrop that demonstrates a promising future for the Malaysian rail industry. There are numerous opportunities that can be created from the above trends and scenarios which give significant impact to the future of the Malaysian rail industry development. The opportunities analysed by stakeholders provide multiple options for the industry to move forward in terms of where the industry want to be by 2030.

There is potential emergence of new rail operators such as in cargo transportation, high speed rail and in respective states in Malaysia. Therefore, there is a need for a strong support for the rail industry that will ensure a high rate of serviceability of their train. In view of this, potential business opportunities will be created ranging from rail components suppliers, manufacturing of spares, refurbishment of legacy assets, new infrastructure construction, systems developer, customise container fabrication, expansion of light rail to heavy rail products, maintenance, repair and overhaul (MRO) up to testing services, rolling-stocks leasing services and many more. These opportunities will fuel the industry sustainability economically and enhance the industry capabilities over the time until 2030.

The Malaysian Rail Supporting Industry Roadmap 2030 Action Plan

1. Introduction

The final chapter of this report was developed based on the understanding of the current state of the industry i.e. 'where are we now' both at the global as well as local stages and the desired picture of the Malaysian rail industry by 2030 in the 'where we want to go' question. In order to bridge the gap between now and the future, the question of "How can we get there?" becomes the focus of this chapter.

In view of the requirement, Future Rail 2030 Committee was established in February 2012 to provide strategic advice, to monitor the progressive achievement of the roadmap recommendations and to endorsed its outcome. It consists of selected representatives from major rail operators, manufacturers, MRO services, the related Government agencies, the academia and the regulators. The shortcomings and the future opportunities that have been discussed and analysed through the committee have become critical input to the formulation of the vision, goals, strategies and the action plan.

[1] Agreed during 1st Future Rail 2030 Committee meeting

2. Rail Vision 2030

Future Rail 2030 committee, together with various stakeholders involved in the development of the roadmap, unanimously agreed to integrate and streamline the industry to achieve one vision as depicted below:

"IN 2030, THE MALAYSIAN RAIL INDUSTRY WILL BE A STRONG AND SUSTAINABLE BUSINESS, CAPABLE OF SATISFYING THE DEMANDS OF THE NATIONAL RAIL TRANSPORTATION, AND A COMPETITIVE GLOBAL PLAYER THAT OPTIMISES THE USE OF INDIGENOUS RESOURCES AND TECHNOLOGIES."

This means that by 2030, the local rail industry will be resilient and able to remain competitive despite dynamic changes in the global and local environments. The Malaysian rail industry players will be at par with established foreign rail suppliers to secure continuous business opportunities from the local and global markets, whilst continuously enhancing and upgrading in-house capabilities. This will enable local players to not only become integrators and exporters of monorails but also be fully prepared to venture into heavy rails with speed of less than 200km/h[1]. Long-term sustainable competitive advantage will be driven by innovation and the related technologies acquired or developed through collective efforts led by the industry; and facilitated by the government and academia. A complete and strong local supply chain with world-class standards forms a backbone to the local rail operators in delivering the highest quality of rail transportation services to the *rakyat*.

3. Goal Setting and Strategies

The vision provides the summarised picture of the end game of the roadmap initiative. However, it can be broken down into three major goals that will contribute towards attainment of the vision. The major goals are as follows:

Goal 1:
Conducive Rail Industry Eco-System

Conducive environment is a catalyst for the industry to grow and therefore it needs to be strengthened to ensure effective implementation of future industry development. The goal was set to ensure that any barriers identified will need to be removed and any required assistance is to be provided so that a friendly eco-system for any rail- related businesses is formed. In doing this, focus will be given to strengthen existing Government mechanisms in supporting the industry through better coordination with all related Ministries/agencies. Among the parameters that can be configured to positively create conducive environment for industry players

include regulation, policy making, incentives, infrastructure development, investment facilitation, industry development program, import and exports, human capital development and funding, among others. Correspondingly, the key strategies to achieve the goal are as follows:

- **Strategy 1.1** Strengthening regulatory and institutional support
- **Strategy 1.2** Filling industry gaps through local and foreign investments
- **Strategy 1.3** Populating the industry with capable workforce
- **Strategy 1.4** Modernising rail infrastructure and through-life support

Goal 2:
High Localisation of Rail Products and Services

Optimisation of rail investment that is worth billions of ringgit made by the Government is partly related to the ability to support the whole life-cycle of rail assets (including rolling-stocks, signalling and train control systems, rail tracks and infrastructure and electrifications). The low rate of serviceability due to long lead time in getting replacement parts or spare part producers that no longer exist combined with other reasons will force rail operators to opt for cannibalising parts from other remaining assets. Consequently, some of the train sets are being left idle to rust over time, which will eventually shrink the overall size of assets available. The different mix of products with a variety of technical specifications is adding up to the complexity of the problem. Therefore, this goal is set to prepare the rail industry in supporting long-term assets handled by the rail operators ranging from maintenance, repair and overhaul (MRO), parts and components manufacturing and systems integration. This includes not only knowledge and skilled workforce but also the incorporation of the related indigenous technologies and the raw materials. Furthermore,

THIS GOAL IS SET TO PREPARE THE RAIL INDUSTRY IN SUPPORTING LONG-TERM ASSETS HANDLED BY THE RAIL OPERATORS RANGING FROM MAINTENANCE, REPAIR AND OVERHAUL (MRO), PARTS AND COMPONENTS MANUFACTURING AND SYSTEMS INTEGRATION.

the capabilities developed will also enable local train producers to expand their product portfolio from light rail to heavy rail segment in the future. The key strategies to achieve the goal are as follows:

- **Strategy 2.1** Developing capabilities in targeted technology areas
- **Strategy 2.2** Focusing on core business and undertake outsourcing

Goal 3:
Competitive Regional and Global Player

The final goal is for the rail industry to not only fulfil the social obligation but also emerge as a significant contributor to the national economic growth through exports of local products as demonstrated in the automotive, maritime (ships/boats), aerospace and other sectors. The focus is to consolidate the required expertise in various aspects of the local products to form a comprehensive package under the Malaysian brand. With this in place, the industry is to leverage on the existing Government's machineries that will facilitate in opening up a path to penetrate the global market. The key strategies to achieve the goal are as follows:

- **Strategy 3.1** Positioning regional and global players in the regional and global supply chain
- **Strategy 3.2** Maintaining competitiveness through technology advancement

4. The Key Initiatives

The strategies which were identified earlier will be deployed through the implementation of key initiatives. These initiatives were proposed as a guideline for further deliberation and shall be detailed out by the related parties which may result in the formulation of a specific program. However, the number of initiatives may expand or change in line with dynamic changes and urgency of need vis-à-vis the rail industry during the implementation period (2012-2030).

Goal 1:
Conducive Rail Industry Eco-System

Strategy 1.1 **Strengthening of regulatory and institutional support** to the rail industry is achieved through implementation of the following:

Initiative 1.1.1: Strengthening SPAD in regulating, design, operation, maintenance, safety, and security aspects of the Malaysian rail systems i.e. (rolling stock, electrification, signalling, track and automatic fare collection (AFC). Stakeholders are to be consulted including (but not limited to) SPAD, the rail operators, and the local industry players.

Initiative 1.1.2: Develop a common Malaysian rail system specification to promote commonality and interoperability and adopt the relevant design standards to each specification – to be adhered to in all future acquisition. Stakeholders are to be consulted including (but not limited to) Standards Malaysia, SIRIM, SPAD, the rail operators and the local industry players.

Initiative 1.1.3: Introduce an organizational level certification scheme to substantiate the capability of each and every industry player. Stakeholders are to be consulted including (but not limited to) regulatory agencies such as SPAD, Construction Industry Development Board (CIDB) and others and the rail operators.

Initiative 1.1.4: Form a national-level council or committee that will oversee the national rail industry development and well-being. Stakeholders are to be consulted including (but not limited to) SPAD, Prime Minister's Department, rail operators, local industry players and the relevant Ministries/agencies.

Strategy 1.2 **Filling of industry gaps through local and foreign investments** is implemented through the following initiatives:

Initiative 1.2.1: Undertake the targeted investment promotion to attract certain foreign companies to fill the current gaps. Stakeholders to be consulted including (but not limited to) MITI, MIDA, MIGHT, and the industry players.

Initiative 1.2.2: Provide fiscal incentives on all investment projects (new and re-investment) and award import duty sales tax exemption (valid for a specific time period) to organisations involved in the design/manufacturing/assembly and the MRO activities. Stakeholders to be consulted including (but not limited to) MOF, MITI, MIDA, MIGHT and the industry players.

Initiative 1.2.3: Provide non-fiscal incentive by simplifying customs regulations and processes. Stakeholders to be consulted including (but not limited to) MOF, MITI, MIDA, the Royal Malaysian Customs, MIGHT and the industry players.

Initiative 1.2.4: Employ offset as a means of attracting targeted FDIs. Stakeholders to be consulted including (but not limited to) MOF, MITI, MIDA, MIGHT and the industry players.

Strategy 1.3 **Populating the industry with capable workforce** is to be undertaken as follows:

Initiative 1.3.1: Develop institutions to deliver rail-ready professionals based on the demand of the industry (Figure 5.1), offering generic technical training programs for blue collar tradesmen,

bridging programs for graduate engineers and short courses for refresher/upgrading of the current workforce. Stakeholders to be consulted including (but not limited to) MOE, MOHR, and MIGHT.

Initiative 1.3.2: Introduce ab initio 'licensed train driver' program based on EMU operation through the use of simulators. Stakeholders to be consulted including (but not limited to) SPAD, the rail operators, industry players and MIGHT.

Initiative 1.3.3: Incorporate rail engineering modules/subjects into institution of higher learning diploma and degree programs. Stakeholders to be consulted including (but not limited to) MOE, MOHR, the rail operators, industry players and MIGHT.

Initiative 1.3.4: Promote awareness and public interest on rail industry to increase its attractiveness. Stakeholders to be consulted including (but not limited to) MOE, MOHR, SPAD and CIDB.

Strategy 1.4 **Modernising of infrastructure and through-life support** is achieved by implementing the following initiatives:

Initiative 1.4.1: Maintain project continuity by expanding existing rail networks and promote development of metro systems in congested cities and economic corridors. Stakeholders to be consulted including (but not limited to) MOF, SPAD, MOT, the State Governments, the rail operators and the Economic Development Authorities.

Initiative 1.4.2: Acquire rail systems with due consideration given to the total cost of ownership apart from technical, commercial and offset assessment, and to ensure a thorough evaluation of all available options. Stakeholders to be consulted including (but not limited to) the acquisition body, the rail operators, MOF, SPAD and MOT.

Initiative 1.4.3: Integrate all rail services for seamless connectivity by spinning off the 'transit acquirer' company to facilitate revenue apportionment based on a common AFC system (Figure 5.2). Stakeholders to be consulted including (but not limited to) SPAD, public transport operators, industry players, MIGHT and the related Ministries/agencies.

Initiative 1.4.4: Maintain passenger transport on Standard gauge systems and retain Metre gauge systems for shared freight and passenger transportation.

Initiative 1.4.5: Impose provision in all new urban development projects to include land reserve for rail transportation, transit-oriented development (TOD) and Intelligent Transportation System (ITS). Stakeholders to be consulted including (but not limited to) SPAD, CIDB, the State Governments, the rail operators and the related Ministries/agencies.

Initiative 1.4.6: Improve through-life support, configuration and software management of rolling stock fleet, signalling and AFC systems. Stakeholders to be consulted including (but not limited to) the rail operators, industry players, SPAD and MIGHT.

Goal 2:
High Localisation of Rail Products and Services

Strategy 2.1 **Developing capabilities in targeted technology areas** by undertaking the following initiatives:

Initiative 2.1.1: Invest in the capability to design, manufacture, integrate and test rail vehicles with design speed of less than 200 km/h, signalling, electrification, track and AFC systems.

Stakeholders to be consulted including (but not limited to) the rail operators, industry players, MOF, MITI, SPAD and MIGHT.

Initiative 2.1.2: Invest in the capability to design, manufacture, integrate and test strategic sub-systems and components of the above product segment (Table 5.2). Stakeholders to be consulted including (but not limited to) the rail operators, industry players, MOF, MITI, SPAD and MIGHT.

Initiative 2.1.3: Develop comprehensive capability to undertake rolling stock MRO up to modification/upgrade of systems and sub-systems (Table 5.3). Stakeholders to be consulted including (but not limited to) the rail operators, industry players, MOF, MITI, SPAD and MIGHT.

Initiative 2.1.4: Maximize the use of locally sourced materials & supplies in both manufacturing and MRO activities. Stakeholders to be consulted including (but not limited to) the rail operators, the acquisition body, MOF, MITI, SPAD and MIGHT.

Initiative 2.1.5: Obtain certification and approval from appropriate authorities. Stakeholders to be consulted including (but not limited to) the industry players.

Initiative 2.1.6: Employ offset as a means of acquiring foreign technology and know-how. Stakeholders to be consulted including (but not limited to) MOF, the acquisition body, SPAD, and MIGHT.

Strategy 2.2 **Focusing on core business and undertake outsourcing** by carrying out the following initiatives:

Initiative 2.2.1: Outsource industry wide common MRO services by means of performance based contracts (PBC) and long term 'rolling-wave' extension to capable local MRO providers. Stakeholders to be consulted including (but not limited to) the rail operators, MOF and MOT.

Initiative 2.2.2: Source subsystems and non-critical parts and components from capable local suppliers based on 'risk sharing' principles endorsed by regulators. Stakeholders to be consulted including (but not limited to) the acquisition body, MOF, MOT, SPAD, the rail operators and industry players.

Initiative 2.2.3: Migrate and upgrade current workforce into contract and supply chain management. Stakeholders to be consulted including (but not limited to) the rail operators, industry players, SPAD, MOE, MOHR and MIGHT.

Goal 3:
Competitive Regional & Global Player

Strategy 3.1 **Positioning regional and global players in the regional and global supply chain** is to be achieved by implementing the following initiatives:

Initiative 3.1.1: Employ offset as a means of securing contract manufacturing and design-build work packages from foreign companies. Stakeholders to be consulted including (but not limited to) MOF, the acquisition body, SPAD, and MIGHT.

Initiative 3.1.2: Secure foreign contracts by jointly participating in international tender bids – led by the anchor player and supported by its lower tier suppliers. Stakeholders to be consulted including (but not limited to) industry players, MOF, MITI, SPAD, and MIGHT.

Initiative 3.1.3: Collaborate with MITI, in marketing Malaysia's rail products and services through specific marketing mission abroad. Stakeholders to be consulted including (but not limited to) the rail operators, industry players, MOT, MATRADE, MIDA and MIGHT.

Strategy 3.2 **Maintaining competitiveness through technology advancement** is through the following initiatives:

Initiative 3.2.1: Establish an industry-led platform to coordinate rail-related research and technology (R&T) activities than can sustain Malaysia's competitiveness (quality, cost and delivery). Stakeholders to be consulted including (but not limited to) MIGHT, the rail operators and industry players.

Initiative 3.2.2: Undertake generic rail related R&T projects (cost to be shared among the industry with matching contribution from the Government) focusing on innovation in the areas as follows:

- **Energy efficient and environment friendly**. Technology or innovation that contributes to less energy consumption and carbon emission. Example: light-weight material, aerodynamic, alternative fuel, waste energy conversion and etc.
- **Interoperability**. Technology or innovation that enables different technical systems to work together including multi-modes transportation. Example: intelligent traffic management, sensor, integrated fare collection, software engineering, variable gauges switching technology and etc.
- **Speed and comfort**. Technology or innovation that contributes to the improvement in speed and comfortability of rail operation. Example: rubber technology, low vibration and noise, tilting train technology, braking systems, next generation bogie and etc.
- **Enhanced reliability/asset life-cycle**. Technology or innovation that optimises and life extension of rail assets. Example: condition-based monitoring technology, sensor, testing equipment design, train conversion etc.

Stakeholders to be consulted including (but not limited to) universities, research institutes, SIRIM, CIDB, the rail operators, industry players and MIGHT.

5. Implementation Timeline

The key initiatives will be implemented in three major timelines namely short-term (less than five years), medium term (between five to 10 years) and long-term (more than 10 years) which can be referred in Table 5.1. Based on expert judgement, the respective initiatives were assigned to the timelines according to an estimated duration taken for completion. Nevertheless, the table acts as a guideline for the implementer or coordinator and any initiatives can be implemented immediately if it is urgently needed.

Tables 5.2 and 5.3 show the timeline for development of capabilities in parts manufacturing and systems integration, and maintenance, repair and overhaul (MRO) respectively. The list of components and capabilities to be developed derived from the working groups' discussion based on gaps that required to be filled up in order to achieve Goals 2 and 3. It is an arduous task, since there is a need to leverage on non-rail industries which may well be established in certain areas that can be shared to expedite the technology and capability development.

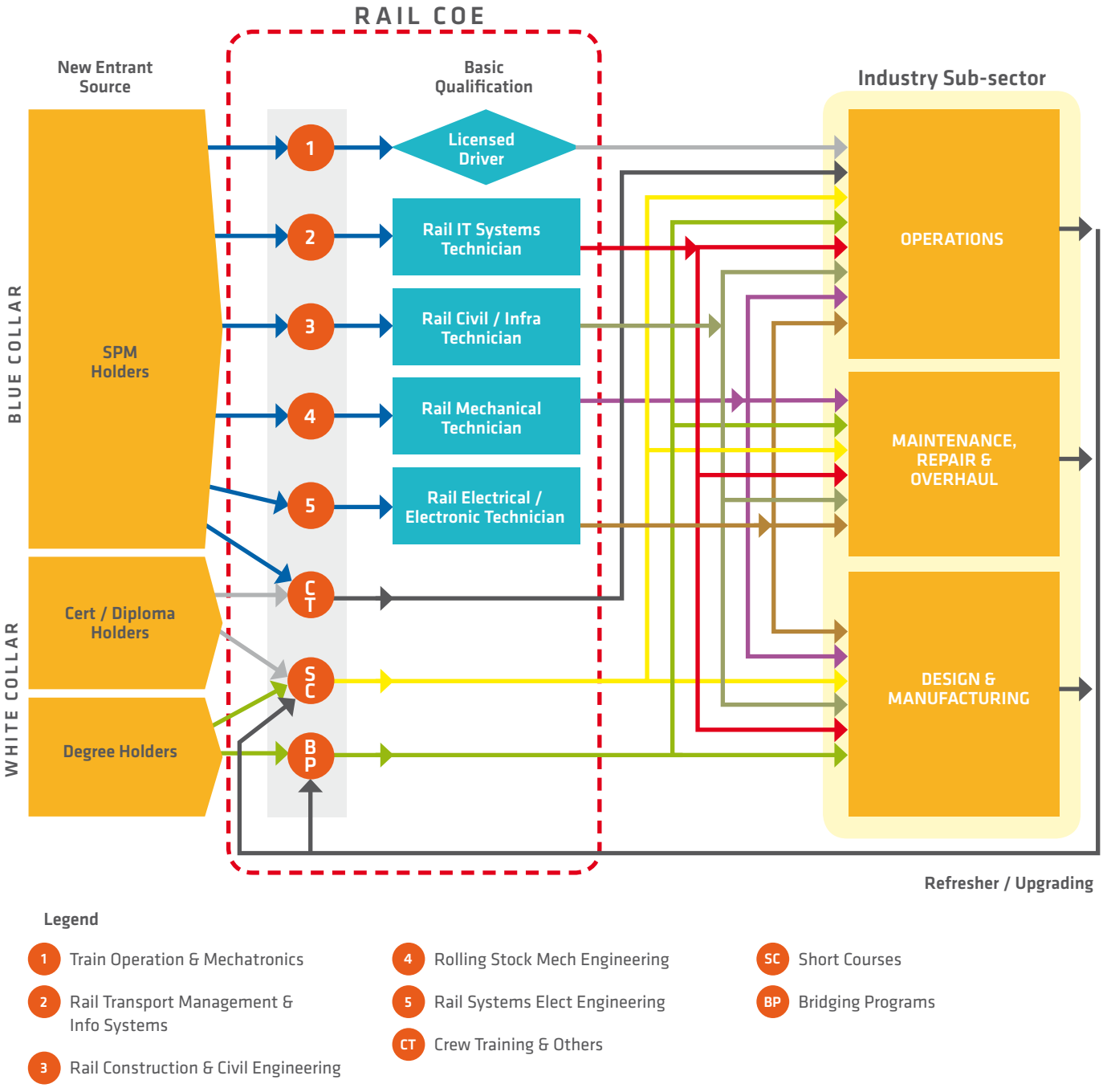


Figure 5.1: Initiatives 1.3.1 on developing institutions to deliver rail-ready professionals based on the demand of the industry

Transfer of source code from AFC system integrator to enable future software changes

- Change of currency (to be acceptable by ticket vending machine)
- Change of business operation
- Business hours
- Integration with other modes of transport

Endorsement from Government to spin off a company to act as a Transit Acquirer

- To distribute portion of revenues between rail operators
- Similar approach undertaken by Singapore LTA with the establishment of Transit Link

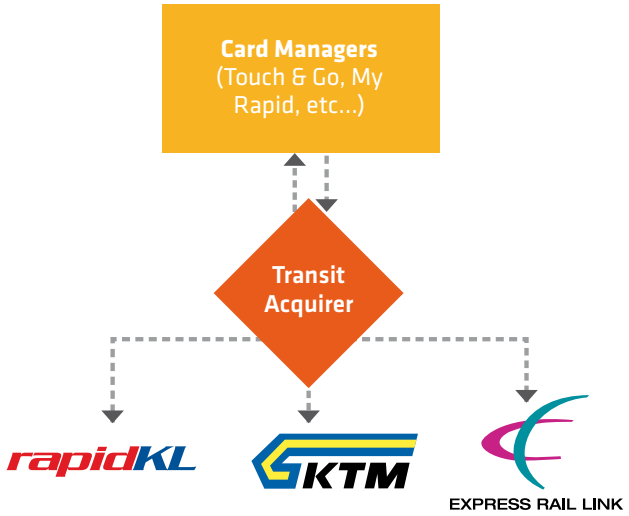


Figure 5.2: Initiative 1.4.2 on spinning off a "transit acquirer" company to facilitate revenue apportionment based on a common AFC system

Goals	Strategy	Short Term (< 5 years)	Medium Term (5-10 years)	Long Term (>10 years)
GOAL 1: CONDUCIVE	1.1 Strengthening regulatory & institutional support	1.1.2, 1.1.3, 1.1.4	1.1.1	
	1.2 Filling industry gaps through local and foreign investments	1.2.1, 1.2.2, 1.2.3, 1.2.4		
	1.3 Populating the industry with capable workforce	1.3.2, 1.3.4	1.3.1, 1.3.3	
	1.4 Modernizing rail infrastructure & through-life support	1.4.5	1.4.2, 1.4.4	1.4.1, 1.4.3
GOAL 2: SUSTAINABLE	2.1 Developing capability in targeted technical areas	Refer to Table 5.2 and 5.3 Industry Capabilities Development Timeline Table		
	2.2 Focusing on core business & undertake outsourcing	2.2.1, 2.2.2	2.2.3	
GOAL 3: COMPETITIVE	3.1 Positioning local players in the global supply chain	3.1.1, 3.1.2, 3.1.3		
	3.2 Maintaining competitiveness through technical advancement		3.2.1	3.2.2

Table 5.1: Overall Implementation Timeline

Short Term (<5years)	**Medium Term** (5 - 10 years)	**Long Term** (> 10 years)
• APU – Battery	• APU – Inverter	• Propulsion - Electric Generator
• Health Monitoring Systems – Software	• Current Collector – Slider	• System Engineering – Design
• Bogie – Gearbox, Couplings & Suspension System, Wheel Set	• APU - Low Voltage Supply	• System Engineering – Integration
• Door System – Motor Drive, Door Control Unit, Belt & Door Panels	• Bogie - Undercarriage casting	• Track works - Rail Steel Grade
• Brake System – Brake Disc/Pad	• HVAC - Compressor	• Switch & Crossing/Turnout – Switch, Frog, Guard Rails & Rail Plate
• Propulsion - Traction Motor & Transformer	• Gangway – Rubber Bellow	
• Exterior – Superstructure & End Cap	• Certification & Safety – Integration	
• Certification & Safety – Operation	• Safety-related Component – Interface Software	
• Operation Engineering – Operation Support	• Operation Engineering – Performance Analysis & Design	
• System Engineering – Specification	• Integration, Testing & Commissioning	
• Project Management	• Communication Certification – Integration	
• Communication Support – Digital Transmission System (DTS)	• System Engineering – Integration	
• Communication Support – SCADA	• Integration, Testing & Commissioning	
• Backbone – Wireless	• Integrated Control Centre (Communication & SCADA)	
• Non-safety - Display Board / Panel & Cables	• Conductor – Rail support, ramp, expansion joint & transformer	
• Communication System Engineering – Design	• Civil Works – Tunnel	
• Communication Project Management	• Systems – Platform Screen Door	
• Backbone – Fibre	• Facilities SCADA / BMS / EACS	
• Passenger Communication System - Entertainment/Advertisement	• Cables – Connector & Feeder Cables	
• Track works – Steel tracks		
• Fastenings – Coach screw & Plates		
• Electrification – Installation Traction Power Substation		
• Electrification – Power Monitoring SCADA		

NOTE:

The capabilities as agreed by the industry players covering rolling-stocks, signalling & communication, electrification and rail tracks & infrastructure

Table 5.1 Implementation Timeline – Parts Manufacturing and Systems Integration Capability

Short Term (<5years)	**Medium Term** (5 - 10 years)	**Long Term** (> 10 years)
• Communication Asset Management – Preventive Maintenance	• Signalling System – ATC Equipment	• Track works - Upgrading/Modification of Rail Tracks
• Propulsion – Traction Motor, Linear Induction Motor, Transformer, Power Inverter, Diesel Engines	• Signalling System – Tachometer	
• APU – Inverter, Low Voltage Power Supply, Battery	• Brake System – Electronic Brake Controller	
• Door System – Software for Door Control Unit	• Track works - Upgrading/Modification of Fastenings	
• HVAC – Interfacing of Controller	• Upgrading/refurbishment of Grinding Machine, Tamping Machine, Track Recording Car, Flat Wagon, Unimog, Ballast Hopper, Ballast Cleaning Machine, Trolley	
• Certification & Safety (Signalling) – Non-vital		
• Current Collector – Pantograph		
• Current Collector – Slider		
• Track works - Maintenance of Rail Tracks		
• Ballast – Upgrading/Modification		
• Maintenance of Grinding Machine, Tamping Machine, Track Recording Car, Flat Wagon, Unimog, Ballast Hopper, Ballast Cleaning Machine, Trolley		
• Maintenance of Facilities SCADA / BMS / EACS		

NOTE:

The capabilities as agreed by the industry players covering rolling-stocks, signalling & communication, electrification and rail tracks & infrastructure

Table 5.2: Implementation Timeline - Maintenance, Repair and Overhaul (MRO)

Providing Quality Services & Products

- Supply of Rolling Stock and Rolling Stock Components
- Maintenance, Repair and Overhaul (MRO) of Rolling Stock and Rolling Stock Components
- Refurbishment and Re-engineering of Rolling Stock
- Railway consultancy and project management
- Railway technology transfer and localisation programmes

towards quality service , zero defect

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LOCOMOTIVE

BOGIE

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The Transformation of LRT Ampang Line

Formerly known as STAR LRT, RapidKL Ampang LRT Line is a driver-operated light rail transportation system. It has two lines; covering Ampang eastern district to the City Centre and another line from Sentul towards the south to the National Sports Complex at Bukit Jalil. The system started in 1998 with an operational network covering 27km with 25 stations, transporting passengers from the northern, north-eastern, and south-western suburbs of the Klang Valley.

The construction of the Ampang Line began in August 1993 for Phase 1 and was completed in December 1996. It covers a distance of 12km comprising 14 stations and commencing commercial service in December 1996 between Ampang and Jalan Sultan Ismail. Phase 2 began in 1995 and commenced operations in mid-1998. The construction comprises of 12km extension from Chan Sow Lin station in Kuala Lumpur to Sri Petaling via Bukit Jalil and a 3km extension from Sultan Ismail to Sentul. Eleven stations were built to serve the northern and southern areas of Kuala Lumpur including catering for the KL Commonwealth in 1998.

Operating with 30 six-car trains, RapidKL Ampang Line manages a daily ridership of 180,000 or some 4.8 million passengers a month.

Comparison between Current LRV vs New LRV

In 2009, the Government announced a major initiative to further upgrade the standard of public transport services – extension of the current LRT network and integrating the two RapidKL Ampang and Kelana Jaya lines at a state-of-the-art Putra Heights station. While the Kelana Jaya Line would be extended by another 17kms; running through residential and commercial areas in Lembah Subang, Subang Jaya and USJ. Ampang Line, on the other hand, would be extended for 17.7km, passing through residential and commercial areas in Bukit Jalil, Bandar Kinrara, Puchong, Kg Sri Aman and Putra Heights.

The project would also see injection of new trains with RapidKL Ampang Line to boast 50 new sets of six-car trains or Light Rail Vehicles (LRV), manufactured by CSR Zhuzhou Electric Locomotive Ltd of China. The new LRV offers better improvement in term of passenger comfort, safety and train reliability.

No.	Description	Existing LRVs	New Ampang LRVs
1.	Train Configuration	• Six (6) coaches per train and divided into three (3) main vehicles • No gangway	• Six (6) coaches per train • Normal gangway available to enable passenger to move from end to end of the train
2.	Material used for Train Production	Stainless Steel	High Grade of Aluminium. • Using Friction stir welding technology in assembly • Lighter material thus lighter train
3.	Propulsion System	• GTO (Gate Turn On) with DC traction motor, an old technology • Heavier in weight and less reliable	• IGBT (Integrated Gate Binapolar Transistor) with AC traction motor. • Modern technology, lighter in weight and more reliable
4.	Train Movement	• Manual driving operation with normal ATP system (Automatic Train Protection) • The driver is fully control of the train movement	• Automatic train operation with attendant • Using the latest technology of communication based control system
5.	Safety Features	• Upgraded with CCTVs inside train • Equipped with fire extinguisher	• Design meets international fire standard requirement (BS6853) and crashworthiness standard • Equipped with Fire Alarm & CCTVs inside the train • Ventilation fan and hopper window during the emergency
6.	Door System	Pneumatic Door	Electric Door with door obstacle detection to enhance door reliability.
7.	Wheelchair Area	Nil	6 wheelchair areas per train
8.	Radio Technology	Analog	Digital
9.	Green Technology Features	• Regeneration brake • Single glaze window	• Regeneration brake • Double glaze window for optimizing the temperature inside the train
10.	Passenger Information System	• End Destination Display (EDD) • Side Destination Display (SDD)	• EDD & SDD • Internal Destination Display (IDD) above the gangway • Interactive Dynamic Route map (on top of every door) • LCD infotainment system 3 units per coach)
11.	Interior design Arrangement	• Non compartmentalize stainless steel seat • No priority seating	• Compartmentalize stainless steel seat • Priority seating (min. of 4 seats per coach) • Lighting lux meets the latest International Standard

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SCOMI Going Global

Malaysia's introduction to rail begun early in the 19th century, a period when the world went through an industrial revolution and technology invention brought about the steam engine which fired early locomotives. A century later, Malaysia now has the capability to engineer and manufacture its own trains and markets this technology abroad. Thus, only four manufacturers in the world are established with capabilities to design and manufacture monorail systems, with Canada and Japan being long established as railway majors. SCOMI's success brings it into the circle of who's who in the railways industry globally.

Spearheading this technology, Scomi Engineering Bhd took flight from its maiden project the Kuala Lumpur Monorail which opened for service in 2003, to further develop the next generation vehicle for a larger market outside of the country. The new model was code name the 'SUTRA' (Scomi Urban Transit Rail Application). Investments for R&D were done during a time when monorail systems are yet to be established as a public transport alternate. Extensively seen only in Japan, for SCOMI to develop such a business the company had no other choice but to muscle its own efforts, single handedly, promoting this type of public transport system to governments and industry players worldwide.

The pros and cons of the monorail system and the market niche for which this system was targeted for was made more convincing with the performance of the system already running in Kuala Lumpur. Ten years into engineering monorails SCOMI is today constructing monorail lines in Brazil and India; and at the same time contracted to replace the over capacity

Kuala Lumpur fleet with the newer generation trains which are larger and lighter in build. The company continues to seek and bid for other monorail projects worldwide and is hopeful that the growth in demand for this type of public transport will continue with an upward trend in the years to come.

The engineering housed in SCOMI's North Kuala Lumpur Facility (NKLF) is supported by system and rolling stock engineers who continue development work for improving the system components. The company has a rich pool of engineering talent from both inside and outside the country and actively promotes its resources regionally having the advantage of being a global company with regional presence. It is with this work force that SCOMI continues to invest in tomorrow's technology today.

NKLF is also a modern rail manufacturing facility equipped with a one kilometer test track and other testing facilities for trains. The engineers work closely with established component providers from all over the world to engineer the most reliable and cost effective components to be used in the system. Stringent engineering and manufacturing processes are employed to ensure the highest quality product.

Manufacturing for the international markets, their facilities and standards for design and production has been laid out to meet stringent ISO9001, ISO14001 & OHSAS18001 standards. The engineers also adapt to EU standards in their design practice as this today considered being the most comprehensive amongst standards worldwide. All their manufacturing is supported with test labs for close scrutiny of welding, machining works and material quality. Complex engineering for material properties and stringent industry safety requirements demands our continuous monitoring and testing of our processes and manufacturing works.

SCOMI's Gen2 monorails will soon be part of the landscape in major cities such as Sao Paolo, Mumbai and Kuala Lumpur. The company has also moved another level higher with its manufacturing capabilities adapting a regional strategy in support of the future market growth in Brazil, India and East Asia. SCOMI Engineering will remain as the single Malaysian rail technology owner after having developed the monorail. With the second generation model the company is perched to penetrate more rail markets locally and abroad. Along its expansion mode and the recent commissioning of the Mumbai Line the company has taken on operations and maintenance responsibilities which will continue to become a new part of its core business as a global operation company. The company will continue to invest in engineering and technology whilst maintaining its position in the market as a low cost high premium transport solution provider.

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SCOMI Engineering Bhd

National Talent Enhancement Programme (NTEP)

The National Talent Enhancement Programme (NTEP) was launched in June 2011 by PEMANDU to accelerate the development of the skilled workforce in Malaysia. It is targeted at boosting the employability of engineering graduates as well as technical and vocational certificate holders.

The programme places particular emphasis on supporting the skills requirements in each of Malaysia's Regional Economic Corridors. As such, the programme is implemented via nine different entities – Iskandar Regional Development Authority, East Coast Economic Region Development Council, Northern Corridor Implementation Authority, Sabah Economic Development and Investment Authority (SEDIA), Workforce Development Unit (Sarawak Chief Minister's Department), Akademi Technology Hijau (a Malacca state agency), Selangor Human Resource Development Centre, MIGHT-METEOR and Construction Industry Development Board Malaysia (CIDB).

The objective of the programme is to accelerate the development of graduates and skilled professional workforce through smart partnership and collaboration with the private sector. It aims to build a talent pool of skilled workforce via industry relevant skills training and on-the-job practical exposure.

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Trainees will gain the necessary skills through 40 days technical and 5 days soft skills trainings respectively. As part of the training programme, trainees are involved on real projects and job assignments.

Might-Meteor Advance Manufacturing Sdn Bhd (MMAM) has been given the mandate to conduct the programme in Railway, Oil & Gas and ICT sector. In total 100 trainees have been successfully placed and trained in the above high technology sectors.

Public Program for Railway Sector

MIGHT-METEOR'S mission is to train competent rail resources to support the demand of railway projects in Malaysia. MIGHT-METEOR ensures high-quality, comprehensive training programs for Engineers and Technicians who are involved in the Design, Construction and Maintenance of Railway Infrastructure.

With the amount of investment in the railway industry in Malaysia and Worldwide there is an increasing gap between supply and demand of skilled workforce. MMAM look forward to create an ideal platform to train people in order to address the needs of the railway industry in Malaysia through our specially designed training programs.

No	Course	Days
1	Overview of Railway Systems	3
2	Introductory Course on Signalling System	15
3	Introductory Course on Communication System	10
4	Introductory Course on Electrification System	10
5	Introductory Course on Track System	15

Apart from these courses, MMAM also offer various other custom-made programmes specific to industry needs and requirement.

Opportunities in Railway Signalling

Global Rail Sdn Bhd was founded in July 2007 by a group of local industry experts having vast experience in railway projects in Malaysia with a vision to be a leader in the Railway Industry. It has grown over the years to serve the railway industry in Malaysia with its expertise in the field of signalling, electrification and communication system for both metro and mainline. Being a pioneer local company providing total railway systems, our vision is to enhance its human capital and technology to provide railway services in compliance with International Standards.

Continuous improvement and new technology are important elements to the organisation and in line with these elements, they have built strategic partnerships with global players. Global Rail and Bombardier, has a long cooperative partnership approach since the formation of the company in the Signalling System mainly on the Automatic Train Protection System for both wayside and onboard and Signalling Interlocking System.

In September 2012, the Mass Rapid Transit Corporation Sdn Bhd (MRT Corp) awarded Bombardier the five-year signalling contract for the first MRT line. Bombardier is delivering its advanced, globally-proven CITYFLO 650 Communications Based Train Control (CBTC) solution for the driverless operation. As part of the contract, Bombardier and Global Rail will also contribute to Malaysia's railway industry by developing local expertise in a joint programme of activities.

The Sungai Buloh – Kajang (SBK) line will serve as a corridor for an estimated 1.2 million residents in the urban and suburban areas of Klang Valley and has an expected daily ridership of 400,000 passengers. CBTC technology was chosen due to the capacity and

safety benefits that the technology brings to such a high density application as well as its proven global record.

The CBTC system is a highly-proven, automatic train control solution designed for complex, high-capacity metros and monorails as well as automated people movers. Based on a true moving block CBTC system, it uses bi-directional radio communication between trains and wayside equipment. It is developed to support a wide range of automation; including semi-automated (Grade of Automation Level 2, GoA2), driverless (GoA3) and unattended (GoA4), as well as manual driving with automatic train protection (ATP) system as a fallback solution.

Within the system, the onboard equipment accurately tracks the location of the train. The trackside equipment keeps track of all train locations, the status of point machines, routes, etc. and provides movement authority to the trains over the radio. Wayside equipment is connected using a Data Transmission System (DTS), which provides a redundant, fault-tolerant communication network.

To ensure the sustainability of the Malaysian railway industry in the future, development of technology and locally-based expertise is critical. Bombardier and Global Rail have partnered in an "Offset Programme" to support the development of new skills. This will be achieved through joint developments during the project, such as on-the-job training and Institution of Railway Engineers (IRSE) licensing of engineers and technicians in Malaysia. This programme will bring long term benefits to the industry and is supervised by MIGHT.

This collaboration will not only benefit young graduates, engineers, and technicians, but also the country's economy. More employment will be created in tandem with the establishment of an industry that is capable of maintaining the advanced technology being deployed on the Malaysian railways, and exporting technology and services to neighbouring countries.

The selection of CBTC for the new Klang Valley MRT will shape the future of mobility in Malaysia, ensuring the optimal delivery of high capacity and safety in its application. Additionally, the cooperation between Bombardier and Global Rail will contribute to the sustainable development of local expertise, meeting the current and future needs of the industry.

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Realising Local MRO Capabilities

In line with the goals set under the Urban Public Transport (UPT), in particular for the railway UPT mode, Malaysia has embarked on huge capital investments involving the double tracking, speed upgrading and electrification of the entire North-South Railway Mainline; the extension of the Light Rail Transit (LRT) networks; and the implementation of the new Klang Valley Mass Rapid Transit (KVMRT) project.

Accordingly, Malaysia has also to ensure that our maintenance, repair and overhaul (MRO) capabilities are in place to provide the engineering support for the newly procured as well as existing Rolling Stock.

In the pursuit of developing local MRO capabilities, the following technical and commercial pre-requisites must be met. All potential MRO contractors must acquire:

- Specialised technical expertise, knowledge and experience to undertake the MRO works.
- Proper workshop, machinery, equipment and skilled manpower to undertake the MRO works.
- Reliable sources for the supplies of quality materials and spare parts required for the MRO works.
- Financial resources to fund the initial set up cost and subsequent MRO operations.

Majestic Engineering Sdn. Bhd. (MESB) is no exception. MESB has travelled a long and winding road before being recognized as an MRO contractor for the repair and overhaul of railway Traction Motor, both AC and DC. Started in 2003, MESB begin with identifying the right Technology Transfer Partner. The selected partner must be a competent manufacturer / repairer; must be sincere to help in developing railway MRO capabilities in Malaysia; and must see such development as a business expansion rather than a threat to its business.

MESB have chosen a reputable Traction Motor OEM and repairer in China to be the Principal and Technology Transfer Partner. The Principal was then already working with five (5) world renowned companies (Alstom, Hitachi, Toshiba, Siemens and General Motor) for the development and production of Electrical Machines and Traction Propulsion Systems for high speed trains in China and worldwide. Besides, the Principal also produce replacement spare parts used in Traction Motor MRO works such as:-

- Commutators
- Armature Cores
- Main Pole Cores
- Armature Winding
- Field and Interpole Coils
- Vee Ring

MESB have secure various contracts with the assistance from the Principal

- Overhaul of 184 units Traction Motors for KTMB
- Overhaul 2 complete units of Locomotive belonging to Petronas, 12 units of Traction Motors

Actual technology transfer from the Principal for Traction Motor MRO started in 2009 when MESB was appointed as Vendor for the overhaul and repair of AC & DC Traction Motors under the KTMB Vendor Development Programme for a five (5) year period.

Having a competent local MRO contractor for the repair and overhaul of railway Traction Motors, AC and DC, MESB strives to become the only Bumiputera company in Malaysia with the required experience and expertise to under repairs and overhauls of all types of Electric Rotating Machine including Traction Motor and Main Alternator.

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Rail Maintenance in the 21st Century

During the ages when diesel based traction dominated the railways, our nation had the complete local capabilities and setup of a MRO (Maintenance, Repair and Overhaul). Such prized abilities in diesel traction lost its relevance with the current dominance of electric based in both urban and suburban rail transit. The government recognises the importance to build such MRO autonomy and has included MRO as part of the Malaysian Rail Supporting Industry Roadmap 2030.

The ERL project, known as The Project KL Sentral to KLIA Express Rail Link, was an electrified standard gauge; double track railway with an alignment length of 57km. It runs over 6,000 services per month connecting the city centre with suburban areas of Cheras, Puchong, Sepang, as well as the national administrative centre, Putrajaya, with KLIA. It has maintained an on-time service record of 99.7% since its service commencement in 2002.

Among a few factors that have contributed to achievement of such service record is the maintenance of the railway. It should be noted that when the operations and maintenance company (E-MAS) was formed to undertake the O&M activities of ERL, many recruits of E-MAS did not have prior working experience in the transit industry. An earlier agreement was made with the project turnkey contractor where new employees were to be engaged during the installation and commissioning of all railway core systems. This informal training and

exposure laid the solid foundation before any formal training that was conducted later.

After the completion of the initial formal training, staff and skill retentions became the new focus of the management. Over 80% of staff who were trained in the pre and post operation period was still with the company 5 years after the service commencement. This bridged the knowledge and exposure gap for new employees who did not have the opportunities to be directly trained by the equipment suppliers. This has ensured all preventive and corrective maintenance can be carried out in-house with minimal support from the OEM.

The above stable performance further enabled E-MAS to look into maintenance optimisation, including new undertakings such as overhaul and repair. Furthermore, it supports the company effort to explore new and modern maintenance techniques. As a result, predictive maintenance techniques such as thermography, oil, vibration and power analyses were all part of the integrated maintenance scope that includes the traditional preventive and corrective maintenance.

All these maintenance activities are managed thru the use of a Computerised Maintenance Management System (CMMS). It provides a tool to the managers to ensure changes implemented to the maintenance plan are properly documented and disseminated to the floor where the actual maintenance works are carried out.

Electronic board repair at component level is the latest addition to the E-MAS maintenance port-folio. It is one of the last and also most difficult hurdles of the company to gain autonomy from the OEM. This ability is vital in the current ultra fast-phased obsolescence of electronic systems as it directly controls the company ability to provide continuous train service. As a logical development, printed circuit board overhauls are now a routine work in the repair centre and these are often done with improvements as the company has an extensive monitoring database to support the needed improvements.

With the inclusion of the electronic repair and overhaul, ERL may have achieved the *MRO-able* status, for which 99% of all maintenance related work is done in-house. ERL have also exported the skills to local and foreign projects. KLIA2 extension project; Sentul-Batu Caves extension project and Bangkok ARL O&M support are some of the examples of the external works the company have delivered.

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Building Competency via MRT Project

SMH Rail is one of Malaysia's leading railway engineering service provider. Since its incorporation in 2000, the company has been contracted to maintain Keretapi Tanah Melayu (KTMB) entire fleet wheelsets and bearings. Their existing wheelshop and bearing re-conditioning facilities are in compliance with and certified by the Association of American Railroads ("AAR"). With its international certification, SMH Rail has established itself in providing bearing re-condition facilities in Thailand servicing its National Railway. The company also plans to set-up similar facilities in Tanzania and Saudi Arabia.

Through MRT Project, SMH Rail and its consortium partner, Siemens, are contracted to design and supply fifty eight (58) numbers of four (4)-car electric train sets for MRT Line 1 which is schedule to operate in 2016.

SMH Rail's new 10-hectare MRT manufacturing plant at Rasa, Selangor shall be ready for operation in March 2014 and has the capacity of manufacturing 36 electric train sets annually. The Rasa plant is the only green manufacturing plant of its type in South East Asia. The company has positioned itself to be the major supplier of electric train in ASEAN and committed to the development of local industries as a player on the international rolling stock assembly place.

With the readily available talents and resources within Malaysia, SMH Rail is poised to meet the challenges to provide effective railway engineering solution for the development of the local railway industry. The Group has more than 500 workforce based in Malaysia, Cambodia, India, Tanzania, Thailand and Saudi Arabia.

KTMB's G10 Loco – After re-engineering

Locomotives Re-engineering

Potential growth of freight movement in the future are pushing the needs to have a reliable and efficient locomotives. One of the key cost drivers in a railway network is to expand the life-span of their fleets. SMH Rail total economic solution to regenerate time expired locomotives designed to meet these operational requirements while achieving substantial cost reductions.

With several years of experience in maintenance of KTMB's high-end locomotives, the company took a bold decision to invest in locomotive re-manufacturing activities. The company has now established a very successful locomotive re-manufacturing solution to transform old and obsolete locomotives to new motive power with advances in engineering integration at a very competitive price and shortest lead time Apart from the re-manufacturing activities in Malaysia, the company has also set-up another team in Tanzania. In 2013, Tanzania National Railway has awarded a contract to SMH Rail to re-manufacture their old locomotives.

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TRL Locomotives

Before Re-engineering

After Re-engineering

Promoting IRSE to Malaysia

International Railway Signal Engineers (IRSE) is a non-profit organization established in 1912 in United Kingdom whose main objective is the promotion and preservation of railways safety standards in the science of signaling and communication engineering within the railway fraternity. It is a licensed entity and is recognized by the Engineering Council of United Kingdom and domestic sections have been formed around the world to tap on the wisdom and experience of IRSE.

Malaysia is no exception and upon having enough members locally initiated an application and IRSE UK formally approved the domestic section on 21 August 2013. The IRSE Malaysian Section was inaugurated by the Prime Minister of Malaysia Y.A.B. Dato' Sri Mohd Najib bin Tun Abdul Razak on 10 September 2013 who signed a plaque to commemorate the inauguration. Subsequently a Memorandum of Understanding between Land Public Transport Commission and IRSE UK was formalized with the intention to co-operate on the professional competence for signal and communication engineers and technicians in Malaysia.

The primary objective of IRSE Malaysia Section is the provision of a neutral platform for railway authorities, regulators, operators and industry to share and develop professional expertise and experience on the domestic front and possibly the ASEAN nations. The second is the creation of a talented domestic workforce comprising of installers, technicians, designers and engineers to be equipped with skills, knowledge and certification through IRSE competency development programs.

Bearing these in mind, IRSE Malaysia section organized the first seminar on 19 November 2013 themed "Towards Innovative Rail Technology" which was a tremendous success and was attended by almost 200 participants. The general observation by the participants was that such seminar was productive as it provided a neutral platform for all railway operators and industries to interact and exchange experience and knowledge especially during this era of high technology.

From left: Section Inauguration in the presence of the Prime Minister of Malaysia Y.A.B. Dato' Sri Mohd Najib bin Tun Abdul Razak; Memorandum of Understanding between CEO SPAD, Y.Brs. En. Mohd Nur Kamal and President IRSE UK, Mr. David Weedon; Plaque as signed by Prime Minister of Malaysia Y.A.B. Dato' Sri Mohd Najib bin Tun Abdul Razak

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Designing in Innovative Age

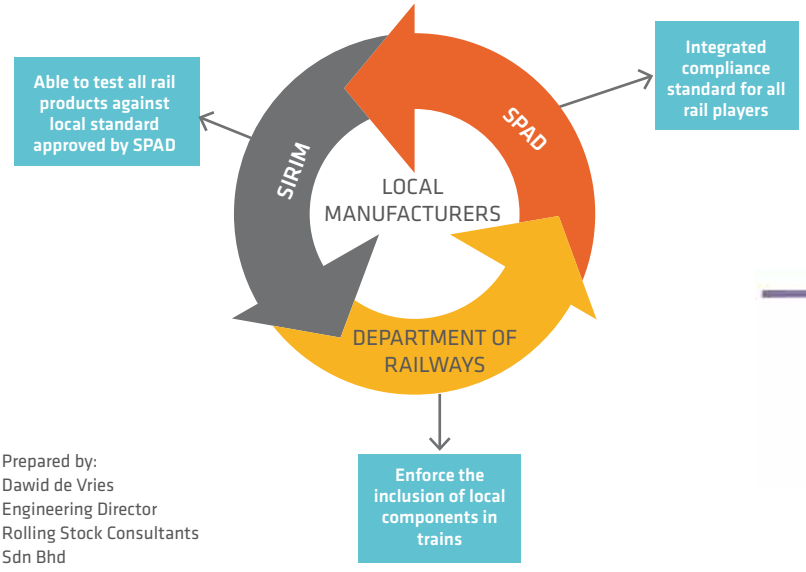
With a constantly evolving market and more discerning customers, rail borne solutions have become ultra-modern with lighter and smaller products that does not sacrifice function, cost effectiveness or safety. This in turn exerted pressure on traditional rail suppliers to re-think their design approach to product solutions in order to offer both the integrity of the older generation products, but meeting modern market demands in lower energy consumption and emissions.

Constant change always forges new alliances and solutions, but the most exiting aspect of this current climate change in the railway industry is that by implication, traditional railway system suppliers are not necessarily geared towards meeting modern market demands. Products with proven track records does not mean it can lower the ever increasing utility bills. Energy efficient systems must become the norm, and that not only leaves the door wide open for new players to prove their mettle on the international arena, it also promotes government engagement to spur and grow local rolling stock development, potentially growing the country's export volume.

Acquiring a track record for an unproven product solution has traditionally been done on the strength of other proven products from the same company. This obviously does not benefit new market players or spur local rolling stock systems development. A holistic approach needs be developed that does not only focus on incentives for product development or technology transfers, but deals with the standardization of applicable standards across all local operators, ensuring products can be certified locally, devising a mechanism or make available test tracks or trains to allow products testing and homologation, and enforce the use of local developed products in all new rolling stock to be utilized in Malaysia.

With the model (below) in place, companies like RSC which has been involved in developing gangways, passenger entrance doors, cab doors and fire doors for the past five years would be able to contribute to the local rail industry.

Rolling Stock Consultants Sdn Bhd focus on supplying design, engineering and automation support to the regional rolling stock industry. Their services vary from complete design solutions, alternative or upgraded solution servicing both manufacturer and operators. This includes fire engineering audit, design audit, tender support services, turnkey products solutions, modern vehicle design for bogies and mechatronic brake and door control system.



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Investing in Malaysia: Vossloh-Cogifer Perspective

Vossloh Cogifer, an industrial subsidiary of the Vossloh group, is one of the worldwide leaders in the production and sales of switchgears, turnkey gears and safety products for signaling systems for all types of rail networks e.g. heavy hauls, metros, trams as well as high speed and very high speed lines etc.

In June 2000, Vossloh Cogifer of France had set up Cogifer Services (Malaysia) Sdn Bhd (CSM). With the support of the local bumiputera partner Malnaga Sdn Bhd, the company produced, assembled and installed 227 turnouts for the Rawang to Ipoh electrified double track project. CSM has participated in two major projects in 2008, to produce, assemble and install 464 turnouts for MMC-Gamuda Joint Venture Sdn Bhd for the northbound electrified double track from Ipoh, Perak to Padang Besar at the Malaysia – Thai border; and to produce, assemble and install 123 turnouts for the Indian incorporated outfit, IRCON International Limited for the southbound electrified double track from Seremban to Gemas, Negeri Sembilan. One step further into the Malaysian localization and improvement of the local know how, CSM developed its local sourcing of components, performed the assembly of the turnouts in its factory located in Slim River and together with Malnaga Sdn Bhd installed and commissioned the turnouts as well as the signaling equipment on the turnout (Point Motor, Locking System as well as Detectors).

CSM transformed its capability from a product supplier to a solution supplier, managing all interfaces with the major contractors (MMC Gamuda Joint Venture, IRCON, Balfour Beatty Ansaldo Joint Venture and Invensys). The company also took over the maintenance of the turnouts from the completion of the installation and over a period of two years following the handover of the line to the Malaysian Railways. All dedicated trainings were performed in order to make sure that each employee is certified by local authorities. In parallel Vossloh Cogifer international experts spent over 2000 hours for the training of the local team and bringing another know how in Malaysia.

Among the local recipients of this technology transfer and know how, Malnaga Sdn Bhd was the main one and is now also fully capable of undertaking the turnout installation as well as the installation of the signaling equipment on the turnout (Point Motor, Locking System as well as Detectors).

Considering the unique experience of Vossloh Cogifer, Cogifer Services (M) Sdn Bhd and Malnaga Sdn Bhd in the field, this development signifies a splendid prospect for our participation as a reliable partner in the future modernization and expansion of the national rail network as well as the urban rail transportation system. Our present involvement in the extension of the Kelana Jaya LRT line (supply of 45 turnouts) and the extension of the Ampang LRT line (supply of 76 turnouts) emphasize yet again this "partner" status for the future railway development of Malaysia.

Its presence among the constellation of Vossloh Cogifer companies in Asia and the Rest of the World, the design and technical support from the Regional Office in Bangkok gives Cogifer Services (M) Sdn Bhd a unique capacity to propose and manage local solutions using proven leading edge technologies. Vossloh Cogifer group will keep on its localization strategy for sourcing and production, supported by transfer of know how. Vossloh Cogifer are convinced that it is the right move for the benefit of Malaysia and exports to neighborhood countries.

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Generating Prospects via Innovation

GUMMI METALL TECHNIK (M) SDN BHD (formerly known as RUBBER METALL TECHNIK (M) SDN BHD), is a 100% German owned company associated with GMT Group which has it operation headquarters at Buhl, Baden Germany. Located in Kuala Kangsar, the company has commenced its production operations since 1980 and has employed more than 120 employees.

From the beginning, GMT always has the requirements and demands with the future insight for business success which lead to continuously invest in Research & Development (R&D) sectors. Ever since the last decade, GMT has been one of the main technology leaders in the vibration engineering, setting new benchmark in the industry. The aspirations paid off - not only through flexibility and customized solutions, but also in close collaboration with the customers and partners worldwide

GMT special vibration dampening products for railway vehicles provide many application possibilities for different installation spaces and load spectra. With more than 40 years of experience, the GMT Group is one of the leading manufacturers of rubber / rubber to metal bonded components and systems in the field of Anti-Vibration Technology for several industrial sectors including:-

- Railway Vehicles & Power Transmission Systems
- Construction Machinery
- Commercial Vehicle / Automotive
- Marine Industry
- Defence Technology
- General Engine & Machine Industry

Based on the quality management, safety and valuable experience in machineries with technical know-how and development, GMT cultivate trustworthy cooperation and relationship with the clients and partners for a successful future.

• Quality and Safety
GMT observes highest quality requirements by means of quality assurance. The company is certified to ISO 9001:2008; and also certified according to customer specific requirements and standards for example Q1 Deutsche Bahn (German Railway)

• Commitment to People and Environment
GMT's dedication to people and environment provide a basis for ensuring that customers trust. The company's environmental management is certified according to international environmental standard DIN EN ISO 14001. With this commitment to people and environment, GMT forms the best prerequisite to build and secure our current and future customer's trust and confidence.

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Digitally Converged System: PSI Traffic Control System

Nowadays, technological advancement especially in industrial sector is changing rapidly and this includes the communication system for railway operation. Outdated communication SCADA system operates independently from each other and this results in a client having multiple operators to operate each system individually. Now, using digital converge operational control center approach basically removes the individual operators for each subsystem and replaces the various subsystems with an integrated operator workstation for the operation of the complete communication system plus SCADA.

The client is free to select any future subsystem for the extension of the networks and integrate it into the control center application. This is the biggest advantage the integrated system provides to the end client. The control system provides a modular architecture, which results in the additional modules, added without interrupting the existing system performance and interfaces.

The central system is the core of the operations control system. Information is collected here and distributed to other system components. The different subsystems and functions are implemented as plug-in modules which exchange data through the central operational database. This architecture ensures that individual subsystems can be added or modified with a minimum impact on other systems.

The PSI*traffic* system collects information from all external systems and distributes it to the user workstations. Core functions integrated in the central system include:

• Operational Database
The operational database maintains a record of the schedule and movements of all trains, as well as the status of all equipment controlled by the system. Information is distributed to all other systems through this database.

• Vehicle Control and Monitoring
This module is responsible for tracking the current position of trains, logging their progress and forecasting future arrival and departure times.
This information will be obtained from the CBTC

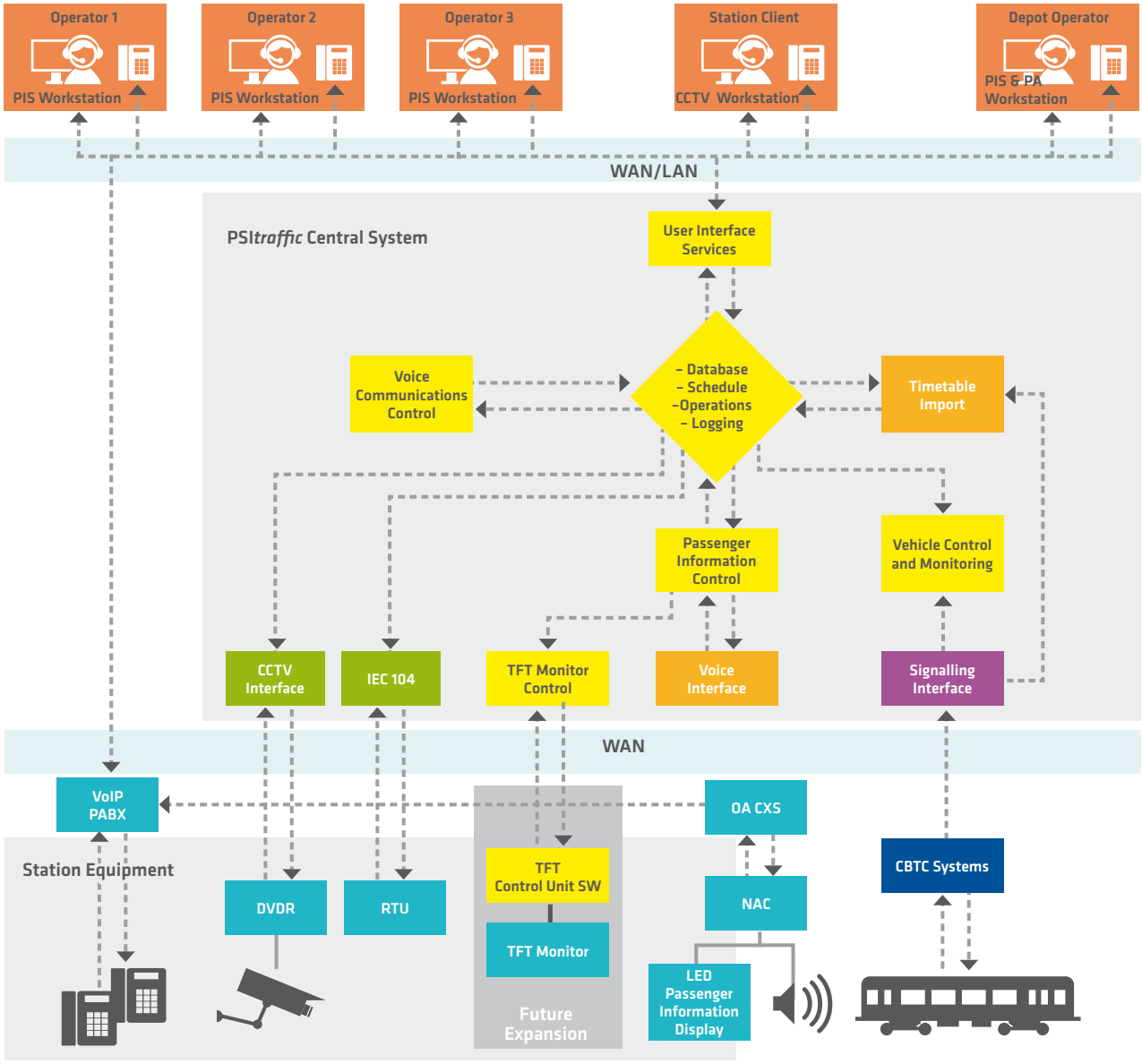

Figure 3: PSItraffic overview

system via the CBTC interface module. The PSI*traffic* software module shall receive the current train positions and tracks from the ILTIS system.

• Passenger Information Control
This subsystem is responsible for generating passenger information data based on the timetable and current rail operation status. It incorporates the rules according to which visual and acoustic passenger information is generated. This is distributed to the different passenger information devices at the stations including platform and station displays as well as public address systems. It uses different types of device drivers to interact with different categories of devices:

a) Announcement Generation
   This module generates audio announcements and streams them to platform or station loudspeakers via the open access system.
b) Message Control
   This module is responsible for generating the content of passenger information displays.

• User Interface Services
The PSI*traffic* software services that handle interaction with the control room applications on the PSI*traffic* workstations.

• Timetable Import
The software module that extracts the timetable data from train control systems.

• IEC 104 Interface to RTU (or any other protocols)
The interface of the PSI*traffic* control system to the RTU, handling the exchange of SCADA data using the IEC 104 protocol.

• CCTV Interface to CCTV Servers
The CCTV interface components allow users to access video cameras and video streams from within the PSI*traffic* control room application.

• Voice Communications Control
The generic PSI*traffic* software module that provides the logic for managing incoming and outgoing voice calls from a PSI*traffic* control system client. Users may establish calls directly with all objects (e.g. stations, emergency phones or radios) visualised in the control room application, without needing to know individual telephone numbers or access information.

This module interfaces with specific device drivers to make use of the PABX or make communication systems available.

• System Monitoring
The PSI*traffic* control system monitors connected external software modules and is connected to the installed network management system. In case of a component or network failure, an alarm message is generated in the alarm list. Based on this alarm message, the operator can initiate without delay a more detailed failure analysis.

Conclusion
Technological advancement in digital technology has fueled the integration of subsystems into a single integrated system. This helps to ensure a better system performance and efficient usage of resources which helps to meet the increasing demand of the commuter who are expecting more and more transparent information to help them plan their time and day better.

Railway operators cannot shy away from these advances and need to embrace them to improve their service level to meet increased expectations. The resources' skills also need to be upgraded to be able to handle and operate the advanced systems better.

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Design & Fabrication of Rail Coachwork using GFRP Materials

DK Composites Sdn. Bhd. is a Malaysian company established in 1997 specializing in GFRP advanced composite fabrication. DK's end products are used in marine crafts, architectural structures, train and bus coaches and other bespoke projects.

DK has a vast experience in train coachwork manufacturing and has worked on the following rail projects:

i) KTM Coach Interior Refurbishment (Ara Rails)
   Supplying interior panels to 40 KTM intercity passenger coaches refurbished by Ara Rails in 2005.
ii) Sutra Monorail Prototype (Scomi)
   Supplying interior and exterior parts for a monorail prototype in 2007.
iii) MRT Mock-Up (Scomi)
   DK supplied interior and exterior parts for an MRT mock-up in 2011.

In addition, DK is also currently working on several other projects such as:

i) Mumbai Monorail (Scomi)
   DK designed and is supplying ceiling panels for 15 monorail trains destined for Mumbai Monorail.
ii) Kuala Lumpur Monorail (Scomi)
   DK engineered and is supplying nose cabs for 12 monorail trains. These trains are new additions to the existing KL Monorail's fleet.

Composites have many advantages over traditional materials for rail applications which include:

- High strength-to-weight ratio, therefore saving energy.
- Ultra light weight parts.
- Can be molded to complex shapes, reducing number of parts by integration.
- Does not corrode, thus extending service life.

However, composites also face challenges in the form of outdated perceptions such as initial cost, difficulty in manufacturing, perceived weakness and inconsistent quality. On the contrary, composites are not expensive, and they pay back in terms of fuel and service cost savings. Composites require technical know-how to design and produce, something which DK is able to provide. Composites when designed and built properly, can meet consistent quality stipulated by international standards.

With rising energy cost, environment consciousness and booming urban population, Malaysia is taking the right step in expanding her rail transport network. DK as a company with experience and connections to local and foreign partners can help bring greener and better transportation solutions to all Malaysians, designed and made by Malaysians.

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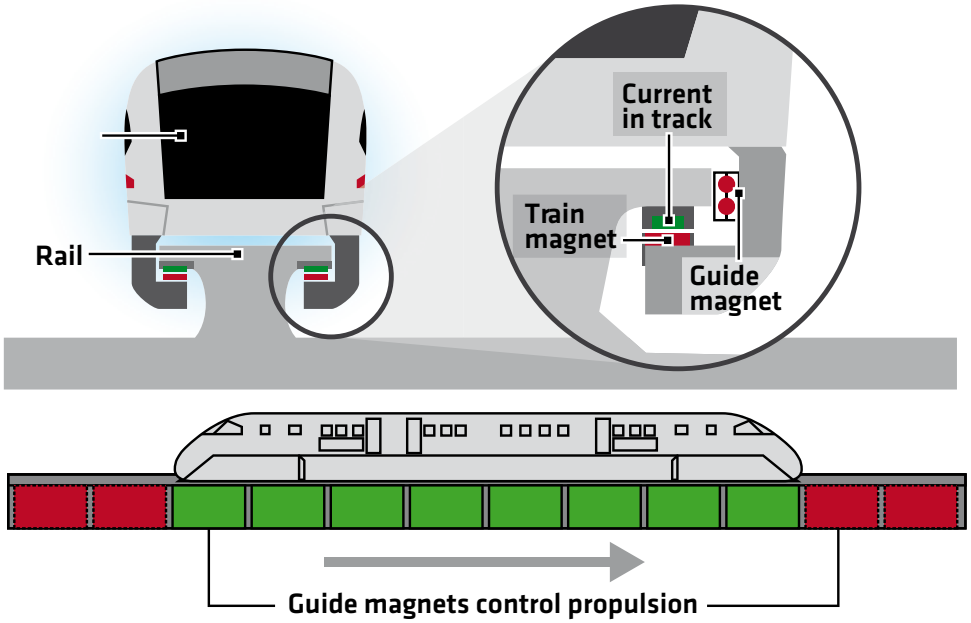
ARTICLE

Magnetic Levitation (Maglev) – A Cutting-Edge Technology



Longstator Linear Motor for propulsion

In the beginning of the 20th century the idea of Maglev, or magnetic levitation, would sound as something fictional. But nowadays it is a reality. Maglev is a system of transportation that suspends (levitates), guides and propels vehicles, predominantly trains, using magnetic levitation from a very large number of magnets for lift and propulsion.

The Germans have actually invented the whole new generation of the Maglev age. The German maglev system, called Transrapid, was developed to the present state of the art by close cooperation of the German conglomerates ThyssenKrupp, Siemens, and Max Boegl.

Since 2003, Shanghai is home to the only commercially running maglev high speed train in the world. The Shanghai line solved many important problems concerning the practical use of maglev transportation system. It has proved that the Transrapid technology is mature and can be put into practical application safely and with highest reliability. While the Shanghai Maglev (Transrapid) daily operation speed is 430 km/h, the Transrapid record speed in Shanghai is 501 km/h. Virtually, the limitation is only caused by the limited length of the route.

Why is Maglev operational only in Shanghai?

In spite of the obvious advantages of Maglev, very few projects have the chance to be implemented. Some of the reasons are :

- Where well established rail infrastructure already exists such as in Europe and China, preference is for rail upgrade rather than a novel system like

maglev, guided by the sentiment to stick to known technology - no support for a new technology that is wrongly perceived to be only marginally better than the latest HSR, but more expensive and environmental constraints

- Maglev can only be implemented as a completely new infrastructure project, rather than any upgrade or extension of an existing one. Therefore, a high amount of initial investment and – in actually each project case – a public funding is required. Traditionally, railway is much regulated by the railway authority and as such, prone to take risks on new innovations

- Wide perception that Maglev is substantially more expensive to implement with only marginal incremental benefits

- The stakeholders in the HSR industry have invested an enormous capital and need to break even on their investment

- HSR generates a lucrative spare parts business compared to Maglev. HSR after sales business is a continuous huge income for HSR stakeholders

Cost comparison between Maglev and HSR

The life cycle costs which covers the investments, operation and maintenance costs for Maglev can be cheaper than a comparable HSR after several years in spite of higher initial investment costs.

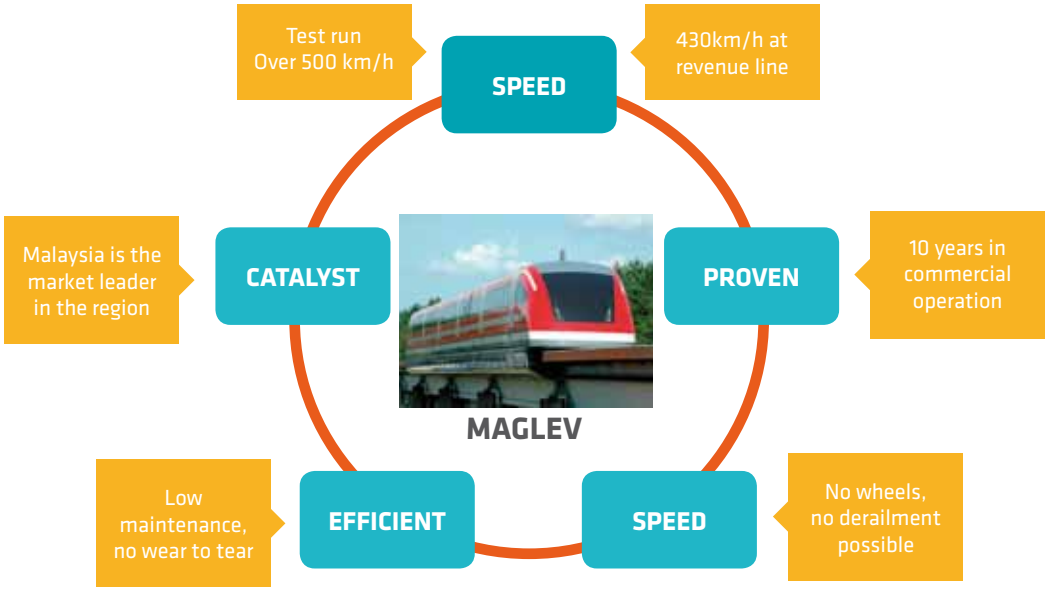
In 2003/2004, the German Federal Ministry of Transport, Building and Housing executed a life-cycle-cost (LCC) oriented cost comparison between Wheel/Rail and Maglev.

The aim - to identify the costs in the life cycle phases of construction, initial operation, operation as well as maintenance and modernisation for the two new high speed systems in Germany, ICE3 and Transrapid 08.

The system comparison on an LCC basis was to be implemented between two German cities by means of a 110 km long model line in uphill areas. Several operation assumptions were

Investment Costs	• Maglev is 20% more compared to Wheel/Rail System. • Though Maglev has lower proportion of tunnels and bridges due to the more potential alignment parameters, but the guideway (at grade and elevated) and the propulsion system plus power supply with the motor mounted in the guideway are generally more expensive than the railway system • Nonetheless, the cost saving potential of Maglev is expected to draw nearer to that of a Wheel/Rail System in the near future.
Operation Costs	• Maglev operation costs are lower than Wheel/Rail System on the basis of low personnel demands, a quarter lower • However, Maglev has higher energy costs due to higher operational speed, shorter turn around time and automatic operation**
Maintenance expenses	• Maglev maintenance costs are less than half that of the Wheel/Rail System, on the basis of little wear and tear and related low maintenance
Life Cycle Costs	• Maglev has lower LCC than the Wheel/Rail System • The study shows the obvious lower costs for maintenance and operation, results in the expectation that Maglev can be cheaper than a comparable Wheel/Rail System after several years, in spite of high initial investment costs

*** The energy costs of Maglev lie on the basis of higher design speed. With the same speed the energy cost of Maglev is lower*



The HSR technology has also reached the dusk of its development limited by expensive and time-consuming maintenance. Higher speed means also more wear and tear. The mechanical friction between train wheels and metal tracks of conventional trains has limited its further development substantially. The often mentioned high speed of HSR is in many cases only a peak speed and that in reality HSR trains hardly ever achieve a real significant high speed over long distances.

Opportunities for Malaysia

Malaysia will have the opportunity to set up a **Maglev's Center of Excellence** if Maglev technology is implemented in the country, particularly for the Kuala Lumpur – Singapore High Speed Train Link Project with a travelling time of below one hour.

The COE in Malaysia will facilitate the technology transfer between the German Development Consortium with support of the Shanghai Maglev Operational Firm and local partners. This will institute **Malaysia as the regional Maglev technology aggregation and development hub.**

If realised, Malaysia will be the frontrunner for this future-oriented transportation technology with sales and marketing advantages.

Other countries such as Korea, Japan and China recognised the advantages of Maglev technology and initiated research programmes. Higher speed, less noise and vibration, eco-friendly, more economical in power consumption and most importantly, lower maintenance cost are the drivers towards Maglev trains. Mechanical wheel based systems are maintenance intensive and financially draining. Therein lies the major advantage of magnetic levitation.

This leads to the global development of the Maglev (no friction) trains. Just like the propeller progressed to the jet, the Maglev is the present and will eventually be the future!

Conclusion

Malaysia with her advanced geographical location and potential can be the Maglev breakthrough, manufacture and operate the technology within the country and subsequently market the product beyond its borders.

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PSI INCONTROL SDN BHD is a solution provider for automation & protection technologies. Established in 1997, PSI Incontrol Sdn Bhd has achieved tremendous growth & is one of the leading engineering company in the region providing a wide spectrum of generic as well as niche products. PSI Incontrol Sdn Bhd is also accredited & certified for the ISO9001 : 2008 standards by KEMA. PSI Incontrol Sdn Bhd is a wholly owned subsidiary of PSI AG whom has a strong presence in Germany & most part of Europe.

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TEL: +603 61578050 FAX: +603 6157 8060 EMAIL: info_KUL@psi-incontrol.com WEB: www.psi-incontrol.com

Rail Directory

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Policy & Regulatory

Construction Industry Development Board Malaysia (CIDB)	Established under the Construction Industry Development Board Act (Act 520) to undertake functions related to construction industry and to develop the capacity and capability of the construction industry	Level 10, Menara Dato' Onn, Putra World Trade Centre (PWTC), No 45, Jalan Tun Ismail, 50480 Kuala Lumpur	**T:** 603 4047 7000 **F:** 603 4047 7070 **W:** www.cidb.gov.my
Department of Skills Development (DSD)	Responsible for the implementation and supervision of competency-based learning and training	Level 7 - 8, Block D4, Complexs D, Federal Government Administrative Centre, 62530 Putrajaya	**T:** 603 8886 5000 **F:** 603 8889 2423 **W:** www.dsd.gov.my
Economic Planning Unit (EPU)	Formulate policies and strategies for socioeconomic development for long and medium term plans	Prime Minister's Department, Block B5 & Block B6, Federal Government Administrative Centre, 62502 Putrajaya	**T:** 603 8872 3333 **F:** 603 8888 3755 **W:** www.epu.gov.my
Federal Department of Town and Country Planning Peninsular Malaysia	Plan, control and co-ordinate development, land use and land conservation through an effective implementation of the Town and Country Planning Act (Act172) and related acts	Ground Floor, Tanjung Block, Jalan Cenderasari, 50640 Kuala Lumpur	**T:** 603 2699 2111 **F:** 603 2692 9994 **W:** www.townplan.gov.my
Malaysia External Trade Development Corporation (MATRADE)	Assist Malaysian companies to establish their presence overseas and raise their profiles in foreign markets	Menara MATRADE, Jalan Khidmat Usaha, Off Jalan Duta, 50480 Kuala Lumpur	**T:** 603 6207 7077 **F:** 603 6203 7037 **W:** www.matrade.gov.my
Malaysian Investment Development Authority (MIDA)	Provide information on the opportunities for investments, as well as facilitating companies which are looking for joint venture partners	MIDA Sentral, No.5, Jalan Stesen Sentral 5, Kuala Lumpur Sentral, 50470 Kuala Lumpur	**T:** 603 2267 3633 **F:** 603 2274 7970 **W:** www.mida.gov.my
Ministry of Finance (MOF)	Provide funding for GLC company	No. 5, Persiaran Perdana, Presint 2, Federal Government Administrative Centre, 62592, WP Putrajaya	**T:** 603 8000 8000 **F:** 603 8882 3893 / 603 8882 3894 **W:** www.treasury.gov.my
Ministry of Industrial Trade & Industry (MITI)	Plan, formulate and implement policies on industrial development, international trade and investment.	Block 10, Government Offices Complex, Jalan Duta, 50622 Kuala Lumpur	**T:** 603 8000 8000 **F:** 603 6201 2337 **W:** www.miti.gov.my
Ministry of Transport (MOT)	Managing KTMB's assets and liabilities and to finance KTMB's infrastructure development through Railway Asset Corporation	Block D5, Parcel D, Federal Government Administrative Centre, 62616 Putrajaya	**T:** 603 8000 8000 **F:** 603 8889 1569 **W:** www.mot.gov.my

Performance Management & Delivery Unit (PEMANDU)	Oversee the implementation, assess the progress, facilitate as well as support the delivery and drive the progress of the Government Transformation Programme (GTP) and the Economic Transformation Programme (ETP)	Prime Minister's Department, 3rd Floor, East Block,Perdana Putra Building, Federal Government Administrative Centre, 62502 Putrajaya	**T:** 603 8872 7237 **F:** 603 8888 7107 **W:** www.pemandu.gov.my
Railway Assets Corporation (RAC)	Established under Railway Act 1991 (Act 463), RAC is responsible in management of all assets and liabilities owned and liable by KTMB and to execute the development and redevelop the railway infrastructures	No.29G, Blok B, Jalan TKS1, Kajang Sentral Business Park, 43000 Kajang, Selangor	**T:** 603 8733 2020 **F:** 603 8733 2222 / 603 8733 6018 **W:** www.rac.gov.my
Royal Malaysian Customs Headquarters	Responsible in revenue collection, trade facilitation and import/export law enforcement	Ministry Of Finance Complex, No. 3, Persiaran Perdana, Precinct 2, 62596 Putrajaya	**T:** 603 8882 2100/2300/2500 **F:** - **W:** www.customs.gov.my
SIRIM Berhad	SIRIM plays an active role in international standards development and coordinate the country's participation in international standardisation activities	No.1, Persiaran Dato' Menteri,Section 2, P.O.Box 7035, 40700 Shah Alam, Selangor	**T:** 603 5544 6000 **F:** 603 5544 6694 **W:** www.sirim.my
Small and Medium Enterprise Corporation Malaysia (SME Corp. Malaysia)	Responsible in coordination of SME policies and programmes across all sectors, centre of advisory and information, managing SME database and providing business support to SME	Level 6, SME 1, Block B, Platinum Sentral, Jalan Stesen Sentral 2, Kuala Lumpur Sentral, 50470 Kuala Lumpur	**T:** 603 2775 6000 **F:** 603 2775 6001 **W:** www.smecorp.gov.my
Suruhanjaya Pengangkutan Awan Darat (S.P.A.D)	Mandated by Act 714, to ensure safe, reliable, accessible, efficient, planned, integrated and sustainable land public transport	Suruhanjaya Pengangkutan Awam Darat (S.P.A.D.), Block D, Platinum Sentral, Jalan Stesen Sentral 2, Kuala Lumpur Sentral, 50470 Kuala Lumpur	**T:** 603 2726 7000 **F:** 603 2726 7100 **W:** www.spad.gov.my
Unit Peneraju Agenda Bumiputera (TERAJU)	Lead, coordinate and drive Bumiputera Agenda aimed at boosting the majority of its economy	Jabatan Perdana Menteri, 5th Floor, Surian Tower, No. 1, Jalan PJU 7/3, Mutiara Damansara, 47810 Petaling Jaya, Selangor	**T:** 603 7839 8000 **F:** 603 7839 8100 **W:** www.teraju.gov.my
Manpower Department (Ministry of Human Resource)	To prepare and carry out pre-employment skills training programs to fulfil the industrial sector need in Malaysia and improving the standard of skills among workers in the industrial sector	Level 6, Block D4, Complex D Federal Government Administrative Centre 62530, Putrajaya	**T:** 603 8886 5555 **F:** 603 8889 2417 **W:** www.jtm.gov.my

Rail Operator & Asset Owners

Express Rail Link (ERL) Sdn Bhd	Rail operator that connect Kuala Lumpur International Airport to Kuala Lumpur Sentral	Level 2, KL City Air Terminal, KL Sentral Station, 50470 Kuala Lumpur	**T:** 603 2267 8000 **F:** 603 2267 8910 **W:** www.kliaekspres.com
Keretapi Tanah Melayu Berhad (KTMB)	Main rail operator in Peninsular Malaysia.	Corporate Headquarters, Jalan Sultan Hishamuddin, 50621 Kuala Lumpur	**T:** 603 2263 1111 **F:** 603 2710 5500 **W:** www.ktmb.com.my
Mrails International Sdn Bhd	Assigned to Melaka Trams project	L13-0, Level 13, Pavilion Tower, 75 Jalan Raja Chulan, 50200 Kuala Lumpur	**T:** 603 2118 2200 / 603 2118 2201 **F:** 603-2118 2255 **W:** mrailsinternational.com
MRT Corporation Sdn Bhd	Manage Mass Rapid Transit (MRT) system in Klang Valley/Kuala Lumpur	Tingkat 5, Menara I & P 1, No. 46, Jalan Dungun, Bukit Damansara, 50490 Kuala Lumpur	**T:** 603 2095 3030 **F:** 603 2095 2121 **W:** www.mymrt.com.my
Rapid Rail Sdn Bhd	Operator of Kuala Lumpur's two light rail transit (LRT) lines, the largest stage bus (regular or trunk bus route) and feeder bus service in Kuala Lumpur	No.1 Jalan PJU 1A/46, Off Jalan Lapangan Terbang Sultan Abdul Aziz Shah, 47301 Petaling Jaya, Selangor	**T:** 6037650 7788 **F:** 6037625 6669 **W:** www.myrapid.com.my
Sabah State Railway Department	Provide efficient, reliable, competitive modern rail service in Sabah	Beg Berkunci 2047, 88999 Kota Kinabalu, Sabah	**T:** 6088-254611 **F:** 6088-236395 **W:** www.railway.sabah.gov.my
Syarikat Prasarana Negara Berhad	Facilitate, undertake and expedite public infrastructure projects approved by the Government. Prasarana and its group of companies are also asset-owners and operators of several public transport providers, namely the Ampang and Kelana Jaya lines, KL Monorail system, as well as bus operations in Klang Valley and Penang	B-20-1, Level 20, Menara UOA Bangsar, No. 5, Jalan Bangsar Utama 1, 59000 Kuala Lumpur	**T:** 603 2299 1999 / 603 2287 5959 **F:** 603 2299 1919 **W:** www.prasarana.com.my
River and Coastal Development Corporation Malacca	The Malacca Monorail is covering 1.6km from Taman Rempah to Kampung Bunga Raya Pantai with a tourism concept.	Aras 9, Bangunan Graha Maju, Jalan Graha Maju, 75300 Melaka	**T:** 606 281 4322/23 **F:** 606 281 4325 **W:** www.ppspm.gov.my
Railway Assets Corporation	To manage, administer and maintain all property and rights of the Malayan Railway Administration; and to undertake projects for the development or redevelopment of any railway infrastructre or facilities.	No 29G, Block B Jalan TKS 1 Kajang Sentral Business Park 43000, Kajang Selangor	**T:** 603 8733 2020 **F:** 603 8733 2222/6018 **W:** www.rac.gov.my

Design, Manufacturing & Assembly (DMA)

Ansaldo STS (Malaysia) Sdn Bhd	Design, supply, assembly, installation, testing, commisioning & maintenance service of signalling communication, automation & control system and equipment for railway & mass transit industry	Level 10, Plaza Pengkalan, 3rd Mile, Jalan Ipoh, 51100 Kuala Lumpur	**T:** 603 4145 8000 **F:** 603 4045 8990 **W:** www.ansaldo-sts.com
Apex Communications Sdn Bhd	Supply & installation of telecommunication and broadcasting equipment, construction & investment holding	12th Floor, Menara Hap Seng, Jalan P. Ramlee, 50250 Kuala Lumpur	**T:** 603 2148 8810 **F:** 603 2142 6003 **W:** www.apex.com.my
Ara Rails Technology Sdn Bhd	Project and design management, engineering, procurement, construction, testing and commissioning, operations and maintenance services for rail sector	Lot No. 29, Jalan Sungai Pinang 4/8, Pulau Indah Industrial Park Phase 2, 42920 Pulau Indah, Selangor	**T:** 603 3101 2717 **F:** 603 3101 3717 **W:** www.aragroupco.com/ara_rails.html
Atiqs Sdn Bhd	Manufacture and supply carbon and graphite components for industry and producing both electrical and mechanical parts	88 Jalan Penerbit U1/43 Temasya Industrial Park 40150 Shah Alam Selangor	**T:** 603 5569 5752 **F:** 603 5569 5750 **W:** www.atiqs.com.my
Balfour Beatty Rail International Design Centre Sdn Bhd	Setting up global railway electrification design hub specialising in catenary systems and power systems	B-2-02, SME Technopreneur Centre II 2260 Jalan Usahawan 1 63000, Cyberjaya Selangor	**T:** **F:** **W:** www.bbrail.com
Colas Rail Asia Sdn Bhd	Developing permanent way (slab track and ballasted), electrification (sub-stations, overhead lines), signalling, control, communications, electrical & power systems for conventional and high speed line	Tower-A-23A-6, Menara UOA Bangsar 5, Jalan Bangsar Utama 1, 59000 Kuala Lumpur	**T:** 603 2302 1533 **F:** 603 2302 1538 **W:** www.colasrailasia.com.my
CMC Engineering Sdn Bhd	Provide total solution for tunnels, ground-to-train communication and integrated supervision & control	D3-D06-G & D3-D06-1, Pusat Perdagangan Dana 1, Jalan PJU 1A/46, 47301, Petaling Jaya Selangor	**T:** 603 2035 5411 **F:** 603 7843 6009 **W:** www.cmce.com.my
CTRM Composites Engineering Sdn Bhd	Design & manufacture of non-aerospace composite component	No 7006, Jalan PBR 42, Kawasan Perindustrian Bukit Rambai, 75250, Melaka	**T:** 606 353 2900 **F:** 606 353 2901 **W:** www.ctrm.com.my

Design, Manufacturing & Assembly (DMA) (continued)

CTRM Systems Integration Sdn Bhd	Design, research & development of aircraft avionics and the production & marketing of mission systems equipment & services	d/a PUSPEKA, Pangkalan Udara Subang, 40000 Shah Alam, Selangor	**T:** 603 7831 0809 **F:** 603 8313 5111 **W:** www.ctrm.com.my
DK Composites Sdn Bhd	Manufacturer of exterior and interior composite components such as nose-cab and ceiling panels for trains.	Composites Tech City, Batu Berendam Airport, 75357 Melaka	**T:** 606 317 7928 **F:** 606 317 7929 **W:** www.dkcomposites.com
Fiberail Sdn Bhd	Fiber optic network provider and network solution provider	7th Floor, Wisma TM, Jalan Desa Utama, Pusat Bandar Taman Desa, 58100 Kuala Lumpur	**T:** 603 7980 9696 **F:** 603 7980 9900 **W:** www.fiberail.com.my
Global Rail Sdn Bhd	Design, supply, delivery, installation, testing & commisioning of railway system	No. 35-3 Jalan Wangsa Delima 13 D'Wangsa Wangsa Maju 53300 Kuala Lumpur	**T:** 603 4149 8033 **F:** 603 4149 8103 **W:** www.globalrail.com.my
GMT GUMMI Metall Technik (M) Sdn Bhd	Manufacturer of rubber and rubber to metal-bonded parts specialized in anti-vibrations products for railway applications	Industrial Estate, P.O. Box 82, 33000 Kuala Kangsar, Perak	**T:** 605 776 1742 **F:** 605 776 5700 **W:** www.gmt.com.my
Hartasuma Sdn Bhd	Development, construction, operation and maintennace of infrastructure project	36, Jalan Tanjung SD 13/2 Sri Damansara,52200 Kuala Lumpur	**T:** 603 6277 1717 **F:** 603 6277 2727 **W:** www.aragroupco.com/hartasuma
Hopetech Transportation Systems Sdn Bhd	Transport industry information technology services	58-1, Jalan Presiden F U1/F, Accentra Glenmarie, 40150 Shah Alam, Selangor	**T:** 603 5569 4955 **F:** 603 5569 5455 **W:** www.hopetech.com.my
Industronics Berhad	Design, provision and integration of high technology systems and products (Intelligent Transport Systems)	No.9, Jalan Taming 3, Taman Tanming Jaya, Off Jalan Balakong, 43300 Seri Kembangan, Selangor	**T:** 603 8961 3024 **F:** 603 8961 6409 **W:** www.industronics.com.my
Innoglass Sdn Bhd	Glass manufacturer	Lot 763, Jalan Monorel, Sungai Choh, 48000 Rawang, Selangor	**T:** 603 6091 9222 **F:** 603 6091 9216 **W:** www.innoglass.com.my
Intercoach Sdn Bhd	Manufacturing of commercial vehicle bodies	Lot 1758, Jalan Telipot 4, Seksyen BS 9, Bukit Sentosa, 48300 Rawang, Selangor	**T:** 603 6092 7695 **F:** 603 6092 7746 **W:**

IRIS Corporation Berhad	Technology consulting, implementation of digital identity and business solution	IRIS Smart Technology Complex Technology Park Malaysia Bukit Jalil 57000 Kuala Lumpur	**T:** 603 8996 0441 **F:** 603 8996 0449 **W:** www.iris.com.my
Malnaga Sdn Bhd	Offers a comprehensive trackwork, rolling stock and maintenance engineering services	Suite E-05-10, Plaza Mont' Kiara 2, Jalan Kiara Mont' Kiara, 50480 Kuala Lumpur	**T:** 603 6203 1628 **F:** 603 6203 5718 **W:** www.malnaga.com.my
Morgan Carbon (M) Sdn Bhd	Manufacturing & trading of electrical carbon	No. 8, Jalan Saudagar Satu U1/16A, Seksyen 1, Hicom-Glenmarie Industrial Park, 40000, Shah Alam, Selangor	**T:** 603 5569 3990 **F:** 603 5569 3995 **W:** www.morgancarbon.com.my
M-Pol Precision Products Sdn Bhd	Manufacturer & sale of molded, extruded and other custom made rubber products	Plot 11 & 12, Non Free Trade Zone, 11900 Bayan Lepas, Pulau Pinang	**T:** 604 644 7055 **F:** 604 643 4887 **W:** www.mpol.com.my
Opus International (M) Berhad	Management of the planning, design & construction of infrastructure project & provision of facilities maintenance management services	Menara 2, Faber Towers, Jalan Desa Bahagia, Taman Desa, 58100 Kuala Lumpur	**T:** 603 7627 2788 **F:** 603 7981 0968 **W:** www.opusbhd.com
PSI Incontrol Sdn Bhd	Train traffic monitoring & control system, communication system, PIS, emergency help point	No. 15, Jalan BRP 9/1D, Perusahaan Bukit Rahman Putra, 47000 Sungai Buloh, Selangor	**T:** 603 6157 8050 **F:** 603 6157 8060 **W:** www.psi-incontrol.com
Rolling Stocks Consultant Sdn Bhd	Specializes in automation and mechatronics system development, component supply, brakes systems, doors systems and air supply systems	36-1, Jalan PJU 7/16, Mutiara Damansara, 47810 Petaling Jaya, Selangor	**T:** 603 7728 4484 **F:** 603 7722 4484 **W:** www.rollingstock.com.my
Scomi Rail Berhad	Design,fabrication and integration of the monorail rolling stock and related electro-mechanical systems	Lot 795, Jalan Monorel, Sungai Choh, 48000 Rawang, Selangor	**T:** 603 6099 8666 **F:** 603 6099 8778 **W:** www.scomirail.com.my
Selia-Tek Sdn Bhd	Supplying, commisioning & installation of electrical equipment	41A, Jalan SS 22/23, Damansara Jaya, 47400 Petaling Jaya, Selangor	**T:** 603 7729 7168 **F:** 603 7727 6980 **W:** www.selia-tek.com

Design, Manufacturing & Assembly (DMA) (continued)

Shamawar Elektrika Sdn Bhd	Manufacturing of low & high voltage electrical hardware	No. 30, Jalan Pekaka 8/4, Seksyen 8 Kota Damansara, 47810 Petaling Jaya, Selangor	**T:** 603 6141 8364 **F:** 603 6141 8367 **W:** www.shamawar.com.my
SMH Rail Sdn Bhd	Provide re-engineering and maintenance for locomotive and maintenance and refurbishment for wheelset, axle drive, gear box and EMUs	A3-01-02, Jalan Dutamas 1, Solaris Dutamas, 50480 Kuala Lumpur	**T:** 603 6207 8585 **F:** 603 6207 8558 **W:** www.smhrail.com
Sutera Teknik Sdn Bhd	Manufacturer and assembly of air-conditioning units and mobile refrigeration for local coach/body builders and transports operator	Lot 142, Jalan 28/10A, Kawasan M.I.E.L, Taman Perindustrian IKS, Mukim Batu, 68100 Batu Caves, Selangor	**T:** 603 6188 1866 **F:** 603 6188 2866 **W:** www.sutera.com.my
System Consultancy Services Sdn Bhd	System engineering services & consultancy	No 36, Jalan Wangsa Delima 6 Pusat Bandar Wangsa Maju Wangsa Maju 53300 Kuala Lumpur	**T:** 603 4149 1919 **F:** 603 4149 2121 **W:** www.scs.my
Teras Teknologi Sdn Bhd	Providing solution for transportation system, secure access, revenue collection and integrated smart control for public transportation, parking and commercial building	Annexe 3, Persada PLUS Persimpangan Bertingkat Subang KM 15, Lebuhraya Baru Lembah Klang, 47301 Petaling Jaya, Selangor	**T:** 603 7650 7500 **F:** 603 7650 7600 **W:** www.terasworld.com
Thales International (M) Sdn Bhd	Supplying intelligent rail signalling system and after sales services	1st Floor, Wisma Genting, Jalan Sultan Ismail, 50250 Kuala Lumpur	**T:** 603 2178 3800 **F:** 603 2161 6390 **W:** www.thalesgroup.com
Tranz-i Technology (M) Sdn Bhd	Supplying components part for commuter train	30, Jalan 4/76C, Desa Pandan, 55100 Kuala Lumpur	**T:** 603 9200 2879 **F:** 603 9200 2085 **W:** www.tranz-i.com

Maintenance, Repair & Overhaul (MRO) and Support Services

Ansaldo STS (M) Sdn Bhd	Design, supply, assembly, installation, testing, commissioning & maintenance service of signalling communication, automation & control system and equipment for railway & mass transit industry	Level 10, Plaza Pengkalan 3rd Mile, Jalan Ipoh, 51100 Kuala Lumpur	**T:** 603 4145 8000 **F:** 603 4045 8990 **W:** www.ansaldo-sts.com/en/about-us/ansaldo-around-world/our-companies/ansaldo-sts-malaysia
ARA Rails Technology Sdn Bhd	Contractor & project management consultant for rail transportation	Lot No. 29, Jalan Sungai Pinang 4/8, Pulau Indah Industrial Park Phase 2, 42920 Pulau Indah Selangor	**T:** 603 3101 2717 **F:** 603 3101 3717 **W:** www.aragroupco.com
Asia Communication & Electronic Sdn Bhd	Railway track & signal	No 102, 3rd Floor, Lorong Mamanda 2, Ampang Point, 68000 Ampang, Selangor	**T:** 603 4256 5788 **F:** 603 4253 2494 **W:** www.asiakom.com.my
Balfour Beatty Rail Sdn Bhd	Design, construction, installation, commission & maintaining fixed rail infrastructure	Plaza Flamingo, Lot 1E & 1G, 1st Floor, No 2 Tasik Ampang, Jalan Hulu Kelang, 68000 Ampang, Selangor	**T:** 603 4252 7366 **F:** 603 42524 088 **W:** www.bbrail.com
Colas Rail Asia Sdn Bhd	Involved in developing permanent way, electrification, signalling, control, communications and power systems	Tower A-23A-6, Menara UOA Bangsar, 5 Jalan Bangsar Utama 1, 59000 Kuala Lumpur	**T:** 603 2302 1533 **F:** 603 2302 1538 **W:** www.colasrailasia.com.my
CSR Kuala Lumpur Maintenance Sdn Bhd	Appointed as maintenance provider by MOT and KTMB to implement EMU & ETS maintenance industry using CSR's specialised rail transit equipment technology to support MRO of commuters	EMU & ETS Maintenance Depot No 2 Off Jalan Strachan, Sentul West 51100 Kuala Lumpur	**T:** 603 4040 0051/0131 **F:** 603 4040 0134 **W:**
CTRM System Integration Sdn Bhd	Design, research & development of aircraft avionics and the production & marketing of mission systems equipment & services	d/a PUSPEKA, Pangkalan Udara Subang, 40000 Shah Alam, Selangor	**T:** 603 7831 0809 **F:** 603 8313 5111 / 603 8313 5112 **W:** www.ctrm.com.my
Emrail Sdn Bhd	Design, construct and develop railway track	Lot 1296, Batu 5 Jalan Ipoh, 51200 Kuala Lumpur	**T:** 603 6257 0812 **F:** 603 6257 7512 **W:** www.emrail.com/

Maintenance, Repair & Overhaul (MRO) and Support Services (continued)

ERL Maintenance Support (E-MAS) Sdn Bhd	Provider of maintenance services for Express Rail Link (ERL)	Bandar Baru Salak Tinggi,43900 Sepang,Selangor	**T:** 603 2267 7676 **F:** 603 2267 7667 **W:** www.emskliaekspres.com
EXPG Engineering Sdn Bhd	Specialising in electrical, instrumentation & control and mechanical systems mainly in industrial and power plant sectors	Level 3-06, Plaza Seri Setia, No 1, Jalan SS9/2, Seri Setia, 47300 Petaling Jaya, Selangor	**T:** 603 7874 5212 / 5242 **F:** 603 7874 5028 **W:** www.expg.com.my
Extra Built (M) Sdn Bhd	LED lighting (for driver cap and passenger coach)	Off 2 & 3, Lot 3, Wisma Little,Jalan Halba 16/16, Seksyen 16,40200 Shah Alam, Selangor	**T:** 603 5511 8980 / 1745 **F:** 603 5511 8407 **W:** www.extrabuilt.com
Fiberail Sdn Bhd	Telecommunications provider	7th Floor, Wisma TM, Jalan Desa Utama, Pusat Bandar Taman Desa, 58100 Kuala Lumpur	**T:** 603 7980 9696 **F:** 603 7980 9900 **W:** www.fiberail.com.my
Gamuda Engineering Sdn Bhd	Engineering expertise covers highways and expressways, bridges, tunnels, dams and hydropower generation, hydraulic engineering and water treatment, railways and mass-rapid transit systems	Menara Gamuda, D-16-01, Block D, PJ Trade Centre, No. 8, Jalan PJU 8/8A, Bandar Damansara Perdana, 47820 Petaling Jaya, Selangor	**T:** 603 7491 8288 **F:** 603 7728 9811 **W:** www.gamuda.com.my
Global Rail Sdn Bhd	Design, supply, delivery, installation, testing & commissioning of railway system	No. 35-3, Jalan Wangsa Delima 13, D'Wangsa, Bandar Wangsa Maju, 53300 Kuala Lumpur	**T:** 603 4149 8033 **F:** 603 4149 8103 **W:** www.globalrail.com.my
Hartasuma Sdn Bhd	Development, construction, operation and maintenance of infrastructure project	No. 36, Jalan Tanjung SD 13/2, Bandar Sri Damansara, 52200 Kuala Lumpur	**T:** 603 6277 1717 **F:** 603 6277 2727 **W:** www.aragroupco.com/hartasuma.html
Hopetech Transportation Systems Sdn Bhd	Transport industry information technology services	58-1, Jalan Presiden F U1/F, Accentra Glenmarie, 40150 Shah Alam, Selangor	**T:** 603 5569 4955 **F:** 603 5569 5455 **W:** www.hopetech.com.my
HUBER+SUHNER (M) Sdn Bhd	Marketing, sales & distribution of electric, radio frequency microwave & fiber optic cable, connectors & component including assembles and as a technical and commercial support centre	No. 2, Jalan Pensyarah U1/28, HICOM Glenmarie Industrial Park, 40150 Shah Alam, Selangor	**T:** 603 5035 3333 **F:** 603 5035 3335 **W:** www.hubersuhner.com.my

Ingress Corporation Berhad	Provide technological expertise in the diverse range of services spanning from planning, designing, integration and project management in the field of power and electrification, track works, signalling and asset management	Lot 2778, 5th Floor, Jalan Damansara, Sungai Penchala, 60000 Kuala Lumpur	**T:** 603 7725 5565 **F:** 603 7725 5560 **W:** www.ingresscorp.com.my
IRIS Corporation Berhad	Technology consulting, implementation of digital identity and business solution	IRIS Smart Technology Complex, Technology Park Malaysia,Bukit Jalil, 57000 Kuala Lumpur	**T:** 603 8996 0788 **F:** 603 8996 0449 **W:** -
Kejuruteraan Yun Loong Sdn Bhd	Provision of motor rewinding and electrical engineering services and trading in electrical hardware	No. 5, Jalan Jasmine 4, Seksyen BB10, Bandar Bukit Beruntung, 43000 Rawang, Selangor	**T:** 603 6028 2890 / 1826 **F:** 603 6028 1823 **W:** www.yunloongsb.com
Leader Cable Industry Berhad	Manufacture & sales of telecommunication cable and low & high voltage power cable and copper and aluminum conductors for domestic and export market	Lot 1385, Tikam Batu Industrial Estate, Tikam Batu, 08600 Sungai Petani, Kedah	**T:** 604 438 9988 **F:** 604 438 8497 **W:** www.leadercable.com.my
Majestic Engineering Sdn Bhd	Supply & maintenance for rolling stock spares & machineries and supply and rehabilitation of rail tracks	Unit B-1-3, Megan Avenue 1, 189, Jalan Tun Razak, 50400 Kuala Lumpur	**T:** 603 2164 8811 **F:** 603 2162 2177 **W:** www.majesticengineering.com.my
Malnaga Sdn Bhd	Offers a comprehensive track work, rolling stock and maintenance engineering services	Suite E-05-10, Plaza Mont' Kiara, 2, Jalan Kiara, Mont' Kiara,50480 Kuala Lumpur	**T:** 603 6203 1628 **F:** 603 6203 5718 **W:** www.malnaga.com.my
Minconsult Sdn Bhd	Provide engineering & consultancy service with technical expertise in railway	Lot 6, Jalan 51A/223, 46100 Petaling Jaya, Selangor	**T:** 603 7952 5757 **F:** 603 7954 7373 **W:** www.minconsult.com
Multi Discovery Sdn Bhd	Engineering services for the power and utility industry and solar power	4th Floor, Bangunan Ingress Auto, 2779, Jalan Damansara, Sungai Penchala, 60000 Kuala Lumpur	**T:** 603 7722 5767 **F:** 603 7722 5594 / 603 7725 5161 **W:** www.ingresscorp.com.my/division/company/4
PSI In-control Sdn Bhd	Train traffic monitoring & control system, communication system, PIS, emergency help point	No. 15, Jalan BRP 9/1D, Perusahaan Bukit Rahman Putra, 47000 Sungai Buloh, Selangor	**T:** 603 6157 8050 **F:** 603 6157 8060 **W:** www.psi-incontrol.com
SCOMI Rail Bhd	Design, manufacturing & supply of monorail trains and provisions of related engineering work & services	Level 1, Reception CP Tower, No 11, Section 16/11 Jalan Damansara 46350 Petaling Jaya Selangor	**T:** 603 6099 8666 **F:** 603 6099 8778 **W:** www.scomirail.com.my

Maintenance, Repair & Overhaul (MRO) and Support Services (continued)

SCOMI Special Vehicles Sdn Bhd	Provide consultation, design services, problem solving assistance and technical support, operation and trouble-shooting training and MRO	Lot 9683, Kawasan Perindustrian Desa Aman, Batu 11, Desa Aman, 47000 Sungai Buloh, Selangor	**T:** 603 2267 7676 **F:** 603 2267 7770 **W:** www.scomigroup.com.my
Siemens (Malaysia) Sdn Bhd	Offer broad range of rail vehicle business, from electric and diesel locomotive & EMUs, propulsion, bogies, electrical equipment and maintenance services for rolling stock, systems and infrastructure	142, Jalan 28/10A, Kawasan MIEL, Taman Perindustrian IKS, Mukim Batu, 68100 Batu Caves Selangor	**T:** 603 7952 5555 **F:** 603 7955 1155 **W:** http://www.siemens.com.my
SMH Rail Sdn Bhd	Provide re-engineering and maintenance for locomotive and maintenance and refurbishment for wheelset, axle drive, gear box and EMUs	A3-01-02, Jalan Dutamas 1, Solaris Dutamas, 50480 Kuala Lumpur	**T:** 603 6207 8585 **F:** 603 6207 8558 **W:** www.smhrail.com/
Sutera Teknik Sdn Bhd	Manufacture and assembly of air-conditioning units and mobile refrigeration for local coach/body builders and transport operator	Lot 142, Jalan 28/10A, Kawasan M.I.E.L, Taman Perindustrianh IKS, Mukim Batu, Batu Caves 68100 Kuala Lumpur	**T:** 603 6188 1866 **F:** 603 6188 2866 **W:** www.sutera.com.my
System Consultancy Services (SCS) Sdn Bhd	System engineering services & consultancy	No 36, Jalan Wangsa Delima 6, Pusat Bandar Wangsa Maju,53300 Kuala Lumpur	**T:** 603 4149 1919 **F:** 603 4149 2121 **W:** www.scs.my
Teras Teknologi Sdn Bhd	Providing solution for transportation system, secure access, revenue collection and integrated smart control for public transportation, parking and commercial building	Annex 3, Persada PLUS, Persimpangan Bertingkat Subang, KM 15, Lebuhraya Baru Lembah Klang, 47301 Petaling Jaya, Selangor	**T:** 603 7650 7500 **F:** 603 7650 7600 **W:** www.terasworld.com
Thales International (M) Sdn Bhd	Supplying intelligent rail signalling system and after sales services	Wisma Genting, 15, Jalan Sultan Ismail, 50540 Kuala Lumpur	**T:** 603 2178 3800 **F:** 603 2161 6390 **W:** www.thalesgroup.com
Universal Cable Berhad	Manufacture & sales of telecommunication & power cables and aluminum rods	33, Jalan Tiran, Kangkar Tebrau, P O Box 119, 80701 Johor Baru	**T:** 607 355 3333 **F:** 607 355 5298 **W:** www.ucable.com.my
Vas Aero (M) Sdn Bhd	Supplying engineering parts, repair & maintenance component for railway	No. 100, Jalan Kapar 27/89, Megah Indah Industrial, Taman Alam Megah, 40000 Shah Alam, Selangor.	**T:** 603 5191 1333 / 603 5192 9133 **F:** 603 5191 9433 **W:** www.vasaero.com
Waris Bumi Gajah Sdn Bhd	Specialising in hardware, excavators and heavy equipment, railway track sleepers and signalling products, radio and electronic products, telecommunications equipment	102, Lorong Mamanda 2, Ampang Point, 68000 Kuala Lumpur	**T:** 603 4256 5788 **F:** 603 4256 9478 **W:** www.bumigajah.com

Education & Trainings

Akademi Binaan Malaysia (ABM)	Akademi Binaan Malaysia (ABM) is an initiative by the CIDB Malaysia established to provide wide and comprehensive construction training in fulfilling the nation's human capacity building.	Lot 8, Jalan Chan Sow Lin, 55200 Kuala Lumpur	**T:** 603 9200 2008 **F:** 603 9200 2009 **W:** www.akademibinaan.com.my
International College of Automotive (iCAM)	An institution to upgrade the skills and knowledge of current automotive workers and as private college that produce skilled professionals to join the workforce for the automotive sector,	DRB-HICOM Automotive Complex, Peramu Jaya Industrial Area, P.O. Box 8, 26607 Pekan, Pahang	**T:** 609 4242 400 **F:** 609 4242 500 **W:** www.icam.edu.my
KLIA Professional & Management College	Provide diploma in Railway Management	Kompleks KLIA Holdings, Jalan KLIA 1/70, 64000 Sepang, Selangor.	**T:** 603 8783 1006 / 1002 / 5031 / 5678 **F:** 603 8783 1040 **W:** www.kliacollege.edu.my/
Majlis Amanah Rakyat (MARA)	Spearheading the fields of entrepreneurship, education and investment to enhance equity holding of Bumiputera.	Bhgn Pendidikan Tinggi MARA, Tingkat 12, Bangunan Medan MARA, Jalan Raja Laut, 50609 Kuala Lumpur	**T:** 603 9179 5000 **F:** 603 9179 5001 **W:** www.mara.gov.my
UniKL Malaysia France Institute (MFI)	Advanced technical training center in the fields of engineering technology specializing in automation, electrical, mechanical and maintenance	Section 14, Jalan Teras Jernang, 43650 Bandar Baru Bangi, Selangor	**T:** 603 8913 2800 **F:** 603 8925 8845 **W:** www.unikl.edu.my/web/unikl-mfi/home
Malaysia Institute of Transport (MITRANS)	MITRANS is Malaysia's advisory transportation institute and is responsible for transportation research, consultancy and training.	Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor	**T:** 603 5544 2343 /2348 /2351 **F:** 603 5544 2344 **W:** mitrans.uitm.edu.my
Malaysian Railway Academy (MyRA)	Managed by Keretapi Tanah Melayu Berhad (KTMB), MyRA offers programmes in Operational & Technical, Management, Development and Safety.	KTMB Complex,31000 Batu Gajah,Perak	**T:** 605 362 6700 **F:** 605 362 6760 **W:** www.myra.com.my
MIGHT-METEOR Advanced Manufacturing (MMAM)	Recognised human capital development centre, established within the organisation of MIGHT to cater for Human Capital Development, Technology Services and Technology Management, particularly in high technology-related industry	Ground Floor, MIGHT Building, 3517, Jalan Teknokrat 5, 63000 Cyberjaya Selangor	**T:** 603 8315 7996 **F:** 603 8315 7999 **W:** www.ami.net.my
National Occupational Skills Standard (NOSS)	Developing the specification of the competencies of skilled worker for an occupational area and level with industrial experts	Level 7 & 8, Block D4, Complex D, Federal Government Administrative Centre, 62530 Putrajaya	**T:** 603 8886 5000 **F:** 603 8889 2423 **W:** www.dsd.gov.my

Education & Trainings (continued)

Rapid Rail Academy	Offers NOSS-accredited courses on urban rail sector, with content focusing on specific aspects of RapidKL's business such as monorail operation and automated fare collection	No. 1, Jalan PJU 1A/46, Off Jalan Lapangan Terbang Subang, 47301 Petaling Jaya, Selangor	**T:** 603 7650 7788 **F:** 603 7625 6669 **W:** www.myrapid.com.my
UniKL British-Malaysian Institute (BMI)	Providing entrepreneurial technopreneurs in the Electrical, Electronics, Medical Engineering and Telecommunication sectors.	Batu 8, Jln Sg Pusu, 53100 Gombak, Selangor	**T:** 603 6184 1000 **F:** 603 6186 4040 **W:** www.bmi.unikl.edu.my
German-Malaysian Institute (GMI)	Offers diverse training programmes and services consisting of full time diploma programmes, a pre-university programme(A-Level), skills upgrading technical courses, train-the-trainers programmes, and industrial consultancy and services.	Jalan Ilmiah, Taman Universiti, 43000 Kajang, Selangor	**T:** 603 8921 9000 **F:** 603 8921 9001 **W:** www.gmi.edu.my
Universiti Kuala Lumpur Institute of Product Design and Manufacturing (UniKL IPROM)	Offering six degree programmes in Engineering technology; Product Design, Industrial Design, Tool & Die, Manufacturing Systems, Business Management and, Supply Chain Management	119, Jalan 7/91, Taman Shamelin Perkasa, 3.5 Miles, 56100 Cheras, Kuala Lumpur	**T:** 603 9179 5000 **F:** 603 9179 5001 **W:** iprom.edu.my/v1/
Universiti Kuala Lumpur Malaysian Institute of Industrial Technology (UniKL MITEC)	Offers Diploma and Bachelor programmes in Industrial Logistics and Quality Engineering	Jalan Persiaran Sinaran Ilmu, Bandar Seri Alam, 81750 Masai, Johor	**T:** 607 3812 400 **F:** 607 3812 500 **W:** www.mitec.unikl.edu.my
Universiti Teknologi MARA (UiTM) - Faculty of Electrical Engineering	Offer courses in various disciplines specifically in Electrical Engineering at Bachelor Degree, Masters and PhD levels	Faculty of Electrical Engineering Universiti Teknologi MARA (UiTM) 40450 Shah Alam Selangor	**T:** 603 5543 5027 **F:** 603 5543 5077 **W:** fke.uitm.edu.my
Universiti Teknologi MARA (UiTM) – Faculty of Mechanical Engineering	Offer courses in various disciplines specifically in Mechanical Engineering at Masters and PhD Levels.	Faculty of Mechanical Engineering Universiti Teknologi MARA (UiTM) 40450 Shah Alam Selangor	**T:** 603 5543 5161 **F:** 603 5543 5160 **W:** fkm.uitm.edu.my
Universiti Tun Hussein Onn Malaysia (UTHM)	Offers Masters in Railway Engineering courses	Beg Berkunci 101, Parit Raja, 86400 Batu Pahat, Johor	**T:** 607 453 7000 / 7025 **F:** 607 453 6337 **W:** www.uthm.edu.my

Scomi Engineering

Engineered solutions. Shaped from technology, knowledge and innovation.

Scomi Engineering is a leading provider of public transportation solutions through the designing and manufacturing of coaches, rail wagons, monorail systems and special purpose vehicles. Its monorail SUTRA (Scomi Urban Transit Rail Application), is the answer to fast-growing cities where transit corridors are limited in space and dense in nature.

The straddle-type SUTRA Monorail System complies with the highest international standards of safety and reliability. It is a modern urban transport system where the cars move on a single beam in an elevated corridor. The design makes it possible to execute the project at a fast pace as it requires a small foorprint and facilities implementation with minimal demolition of structures. Other advantages include greater reliability, high manoeuverability, lower cost and an eco-friendly design.

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