NANOMALAYSIA BERHAD STRATEGIC REPORT 2019

REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

This Strategic Report is available online at **www.nanomalaysia.com.my**

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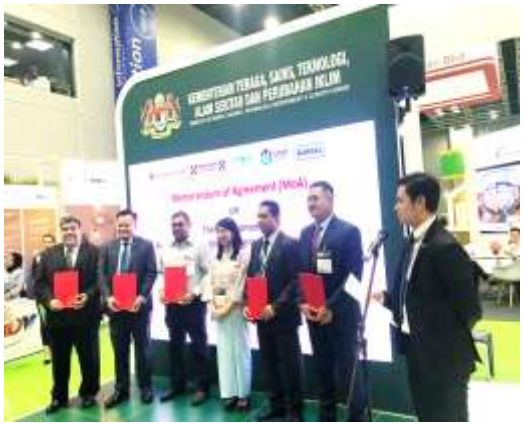

ABOUT THIS REPORT

NanoMalaysia Berhad's (NanoMalaysia) Strategic Report 2019 has been prepared with the aim of providing our ecosystem of stakeholders with transparent and accountable disclosures on our activities to advance the sustainable growth of Malaysia's nanotechnology sector. As NanoMalaysia's inaugural Strategic Report, our aim is to clearly demonstrate to our stakeholders how we are creating value through our spectrum of programmes and initiatives, as guided by our strategy.

Report Boundary and Scope

This Strategic Report provides an account of activities conducted and outcomes achieved as at 31 December 2019, unless otherwise indicated. The report covers the primary activities of our core nanotechnology programmes. Disclosures within this report adhere to requirements of the which NanoMalaysia is mandated to conduct the following activities:

- Act as a business entity entrusted to focus on the commercialisation and development of nanotechnology.
- Plan and coordinate the commercialisation of research and development (R&D) of nanotechnology in high-impact areas of focus such as electrical and electronics, food and agriculture, energy and environment, and health and medicine
- Plan and manage activities that contribute to the development of nanotechnology-based industries
- Strategise the positioning of nanotechnology industry of Malaysia in the global supply and value chain
- Facilitate investment in nanotechnology commercialisation
- Facilitate the development of human capital (scientists and engineers, researchers and professionals) in the nanotechnology industry

Approval by the Board of Directors

This report has been prepared in accordance with our commitment to maintain the highest levels of governance and ethics, under the oversight and guidance of our Board of Directors (Board). In approving the content of this Strategic Report, the Board acknowledges its responsibility to ensure the integrity of this report.

Forward Looking Statements

Forward looking statements contained within this report should be taken with a degree of caution as they are reliant on various events, risks, uncertainties and other factors beyond our control. These statements can be identified through the use of key words such as "believes", "intend", "will", "plans", "outlook" and other similar words in conjunction with discussions on future operating or financial performance. In the coming years, we will be able to report with more comprehensive data and better assess our focus areas.

Feedback

We welcome all constructive comments, thoughts and remarks.
These can be directed to:

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CHAIRMAN'S MESSAGE

PROFESSOR EMERITUS DATO' IR. DR. MOHAMAD ZAWAWI BIN ISMAIL

Dear Stakeholders ,

On behalf of the Board of Directors, I am pleased to present NanoMalaysia Berhad's (NanoMalaysia) inaugural Strategic Report for the year 2019.

I must congratulate our management team that has successfully steered NanoMalaysia from its early struggling years – promoting awareness of the technology while creating its identity and image – to what it is today a vibrant organisation that works together with industry partners in many exciting projects that can potentially contribute to national wealth creation. At the same time, we have expanded our local and international networks to enhance our visibility and credibility.

At the end of 2018, NanoMalaysia has developed 55 Intellectual Property (IPs), 10 patents, 4 copyrights and one utility innovation, which have been filed with MyIPO. As a result of our strategically focused industry programmes and platforms, a total of 64 products have been developed by industry and 113 products commercialised. NanoMalaysia remains steadfast as Malaysia's lead agency to commercialise nanotechnology.

As we move into 2019 and beyond into the Fourth Industrial Revolution, NanoMalaysia will remain on course to drive the revolution towards the Internet of Nano Things (IoNT) through our REVOLUTIoNT strategy. We believe our strategic approach puts us in a strong position to achieve long-term business sustainability.

On behalf of the Board of Directors, I take this opportunity to express our sincere appreciation to our staff, for their dedicated efforts. We are also thankful for the continued support from our various stakeholders, project partners, academia and industry players. I also extend my deepest gratitude to my colleagues on the Board for their unstinting support and commitment.

Prof. Emeritus Dato' Ir. Dr. Mohamad Zawawi Bin Ismail,
Chairman of NanoMalaysia Berhad

CEO'S MESSAGE

DR REZAL KHAIRI AHMAD

Dear Friends of NanoMalaysia,

2019 proved to be another exciting year of achievements for NanoMalaysia in catalyzing the country towards a technologically advanced economy. In the year before, we started a shift from commodity-based nanotechnology products to systems-based nanotechnology solutions for local industries to up-take to jump on the 4th Industrial Revolution growth curve.

Greater focus is placed on nanotechnology enhanced Internet of Things and Clean Energy systems for a variety of applications in sectors relevant to Malaysia's strategic interests, industrial needs and market demands. The idea is always aligning the sciences, technologies and innovations behind nanotechnology to the requirements of the end users.

The world saw the launch of NanoMalaysia's flagship Hydrogen Paired Electric Racer (HyPER) project as an aggregation of technologies developed by different SMEs assisted by NanoMalaysia and crucially serving as a catalyst for Hydrogen Economy. This is truly an example of the company's venture builder model adopted to build a conducive ecosystem for high technology commercialization.

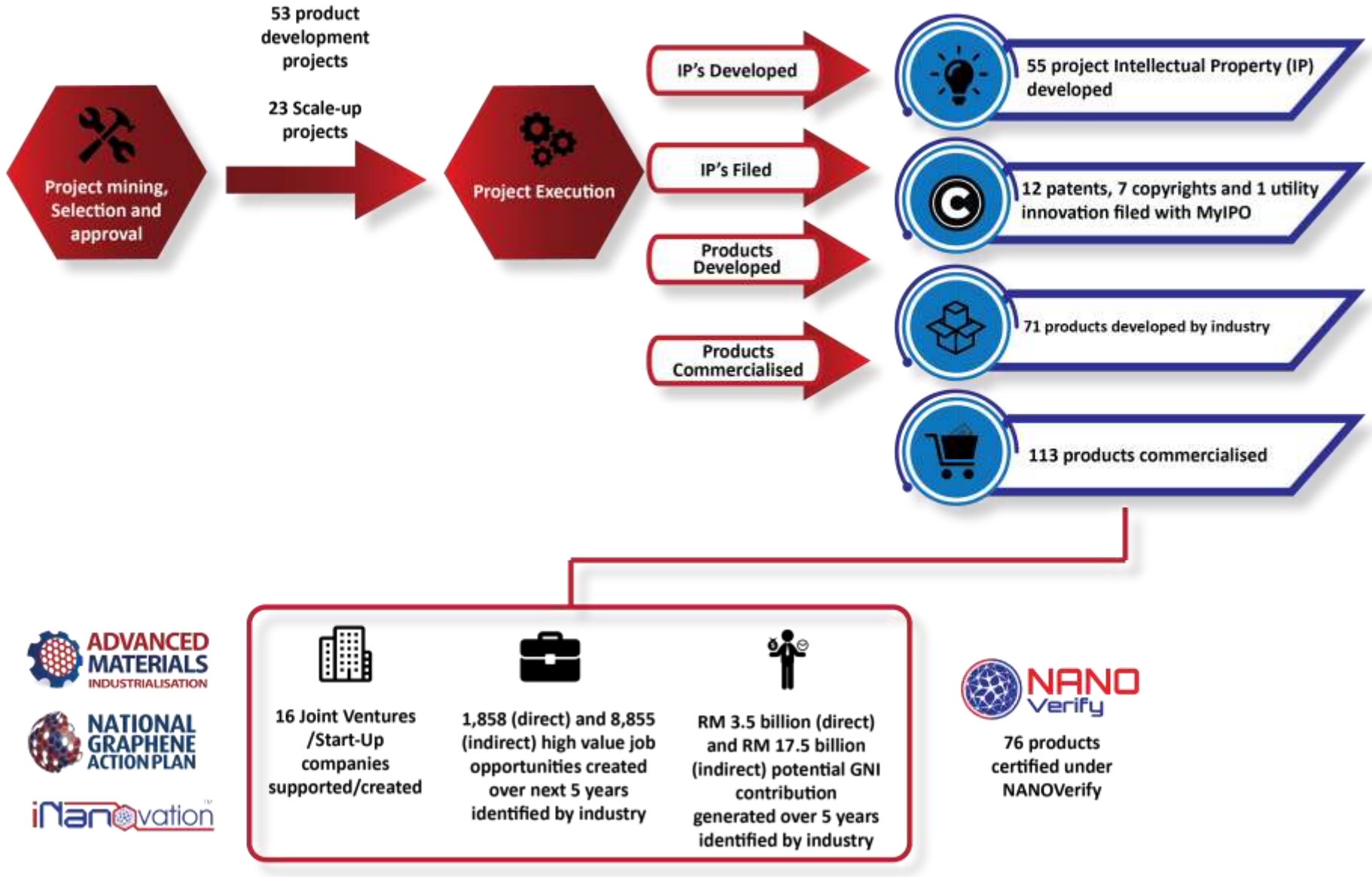
Both National Graphene Action Plan and iNanovation continued to activate 11 new projects connecting industry and the research community and 40 nanotechnology products were certified under NanoVerify Programme with reported significant positive economic impacts on participating companies.

The new level of success in 2019 was made possible with balanced contributions from every single member of NanoMalaysia, equitable participation from our valued partners from the industry, research and consumer groups and support from stakeholders namely the then MESTECC, and EPU. Thank you. May we rise to new challenges 2020 presents.

Rezal Khairi Ahmad
Chief Executive Officer

AT A GLANCE 1

2016-2019 ACHIEVEMENTS SNAPSHOT



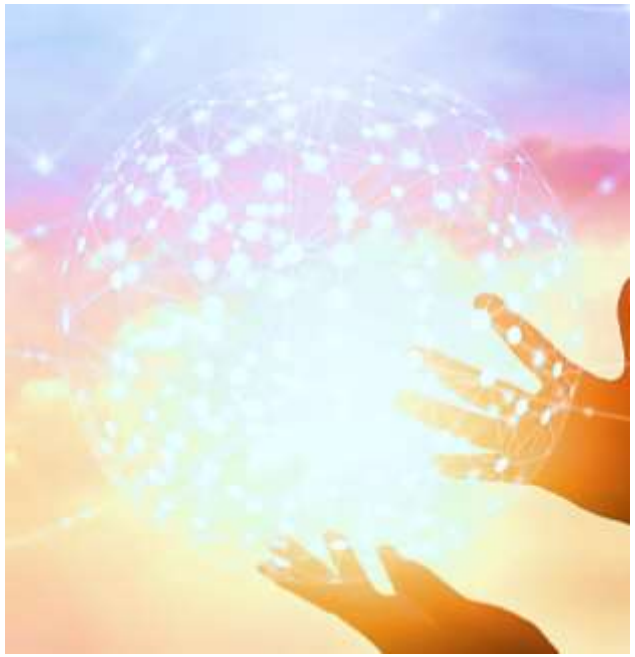
REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

Nanotechnology has provided enhanced and efficient solutions to various applications in agriculture, medical, electronic & devices, and energy & environment. The Internet of Nano Things (IoNT) is the interconnection of nanosensors and nanodevices with the Internet.

NanoMalaysia Berhad believes that IoNT will be the core driver of the Industrial Revolution (4.0), catalysing the revolutionary changes in the industry, business, and society. NanoMalaysia aims to continue to energise and re-energise industries and innovation in Malaysia through successful development and commercialisation of nanotechnology.

A REVIEW OF THE GLOBAL MARKET



Global IR4.0 market size will be growing in an exponential trend in 2021 until 2025. The market revenue of the global market was valued at USD 87 billion in 2019 and is expected to grow with a CAGR of 32.1% over the forecast period of 2020-2025.

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

One of the technological subsets of the IR4.0 market which is the Connected Industry Building Blocks (CIBB) will be taking a huge chunk of the share and we will witness the largest growth over the forecast period. The revenue for CIBB was value at USD 67.5 billion in 2019 and is expected to reach USD 404.0 billion in 2025 with a CAGR of 34.1%. The CIBB consists of 6 components which are Applications, Cloud, Platform and Analytics, Connectivity, Hardware, Cyber Security and System Integration.

The other technological subset of the IR4.0 market is the IR4.0 Supporting Technologies which consists of Additive Manufacturing, Augmented & Virtual Reality, Collaborative Robotics, Connected Machine Vision, Drones/UAVs and Self Driving Vehicles. These supporting technologies albeit smaller in market share, are pivotal to ensure full adoption of IR4.0. The market revenue for the Supporting Technologies was valued at USD 19.5 billion in 2019 and is expected to reach USD 74.2 billion in 2025 with a CAGR of 23.7% over the forecast period.

Source: [1] IOT Analytics.

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A REVIEW OF THE GLOBAL MARKET

The APAC region holds the most market share of the global IR4.0 market in 2019 with an amount of USD 30.6 billion. This trend is expected to continue throughout the forecast period with a CAGR of 33% amounting up to USD 184.7 billion in 2025. The IR 4.0 in APAC will continue to dominate the global market beyond the forecast period.

The second largest market is the North American market consisting of the United States and Canada with a total market revenue of USD 26.35 billion in 2019 and is expected to be valued at USD 151.1 billion in 2025 growing at a rate of 32.6%.

The European market including European Russia was valued at USD 23.7 billion in 2019 and is expected to grow at a pace of 31.2% through the forecast period ending with an amount of USD 115.7 billion.

Source: [1] IOT Analytics.

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2020 Vs 2025 Landscape: A Glimpse on the 4IR Future[1]

APAC and North American region will grow at a CAGR of 33% and 32% respectively. Both regions will fortify their foothold globally in 2025. Europe and the rest of the world will share smaller slice of pie by the end of the forecast period

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A REVIEW OF THE GLOBAL MARKET

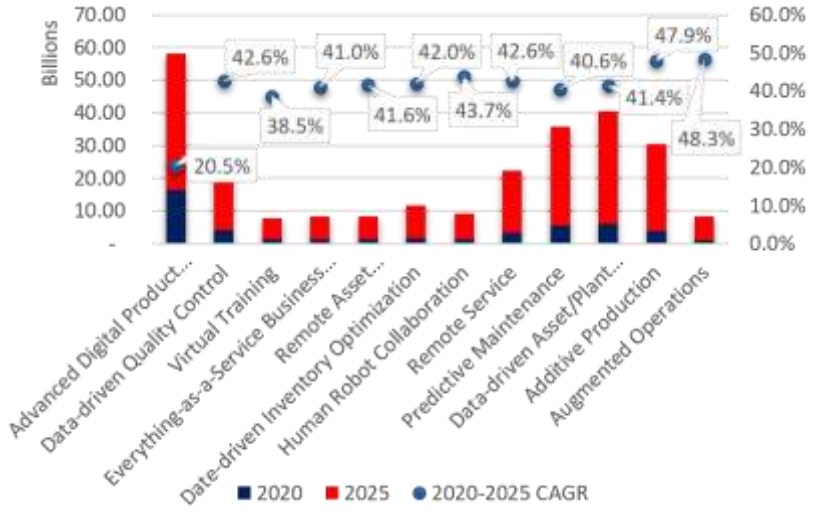
The bar chart on the right shows the 12 use-cases of IR4.0, highlighting the vast differences in terms of growth and market share over the next 5 years (2020-2025). The biggest revenue maker for the next five years is the Advanced Digital Product Development where it makes USD 16.4 billion in 2020 and is expected to reach USD 41.7 billion in 2025. However, the growth rate of the use-case is the least amongst the rest of the use-cases. It will remain the largest market share over the next 10-15 years if the current trend continues.

The second use case is Data-driven Asset/Plant Performance Optimization, with a revenue of USD 6.11 billion in 2020 and expected to reach USD 34.5 billion in 2025 with a CAGR of 41.4%. The third largest revenue maker is Predictive Maintenance where it makes USD 5.5 billion in 2020 and is expected to be valued at USD 30.3 billion in 2025 with a CAGR of 40.6%.

In terms of growth rates, Additive Production and Augmented Operations will see significant growth over the next 5 years with a CAGR of 47.9% and 48.3% respectively. However, the market share for these use-cases are still amongst the lowest in 2020. It still uncertain how these use-cases will be shaping up the future.

Source: [1] IOT Analytics.

4IR Use Cases (2020 Vs 2025) (1)



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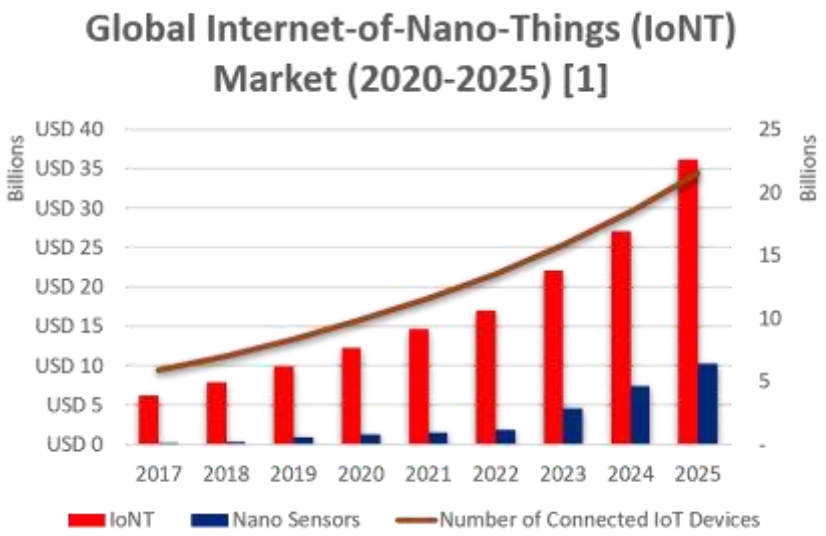
A REVIEW OF THE GLOBAL MARKET



Source:
[1] IOT Analytics.
[2] BCC Research.

The chart shows how the Global Internet of Nano-Things would be shaping up in the next five years. With the advancements in the nano sensors industry, this would further increase the advancements of IoNT exponentially. The number of connected IoT Devices will also increase in the coming years where it is expected the number of connected devices will increase from 9.9 billion devices to 21.5 billion devices in 2025.

Nano sensors market is to be valued at USD 1.2 billion in 2020, and will be witnessing a growth rate of 53.58%, and expected to reach USD 10.26 million in 2025 [2]. With the increasing number of nano sensors in the market, IoNT market would also be stimulated, increasing the value in 2020 of USD 12.78 billion to an amount of USD 36.17 billion in 2025 with a CAGR of 24.12%.

Other technology such as Nano Positioning Systems will also benefit from this growth from an amount of USD 119 million in 2020 to USD 277.3 million in 2025 with a CAGR of 18.39%.

This trend would continue over the forecast period with introduction of new technologies and further adoption of IoNT amongst B2B and B2C.

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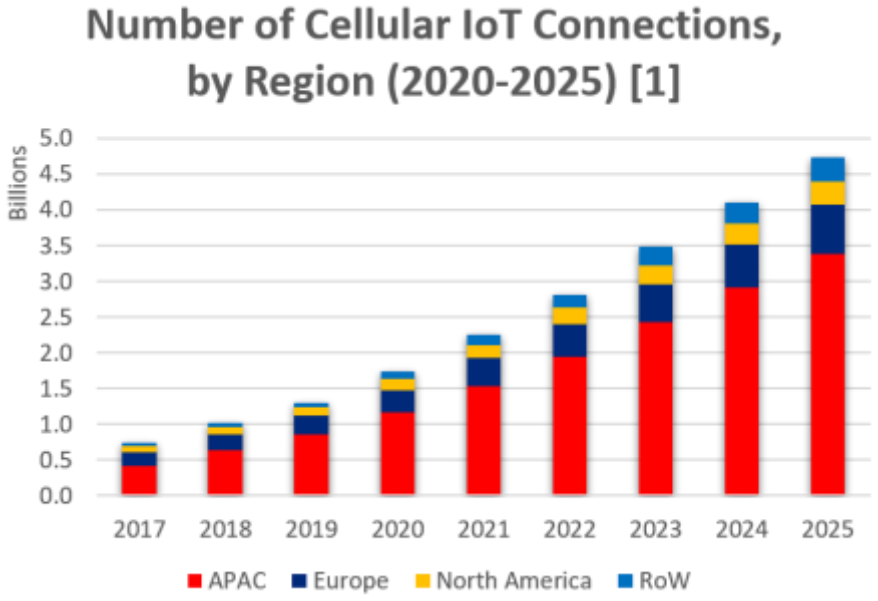
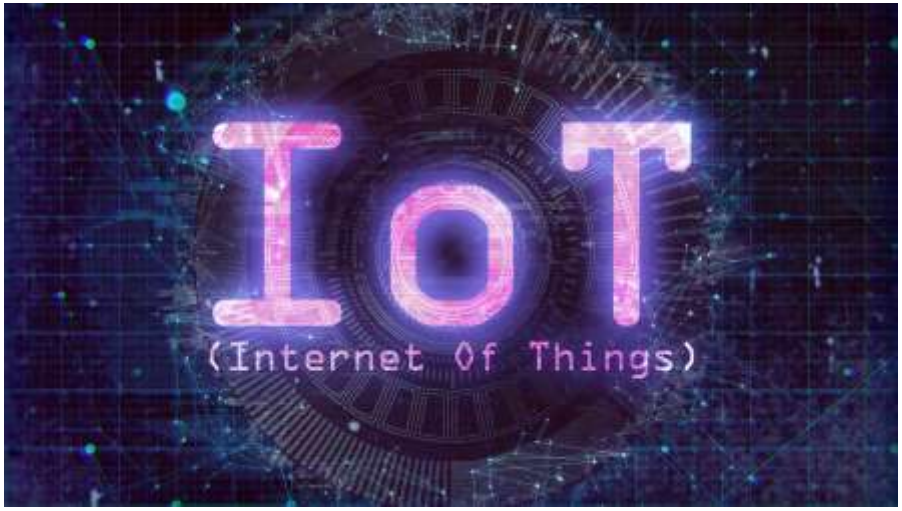
A REVIEW OF THE GLOBAL MARKET



Source: [1] Data derived from Ericsson Mobility Report.

This chart shows how the global market would be shaped up due to the increase of adoption of IoNT in the future. In a study conducted by Ericsson in 2018 shows that IoT connections would be increased correlated with the market. APAC will be the most promising region to look up in the future where it holds the largest share in 2020 and will remain so in the next 5 years. This is due to the larger population in the area and the number of economic powerhouses in that region. APAC registered 857.14 million Cellular IoT Connections in 2019.

The numbers would increase to 3.39 billion in 2025 with a growth rate of 23.8% during the forecast period of 2020-2025.
The region with second largest IoT connections is Europe where the number of connections are 260.3 million in 2020 and is expected to reach 678 million in 2025 with a CAGR of 16.9%. The growth rate of Europe is similar to North America but the region has lower number of connections with an amount of 127 million in 2019 and 331.2 million in 2025.



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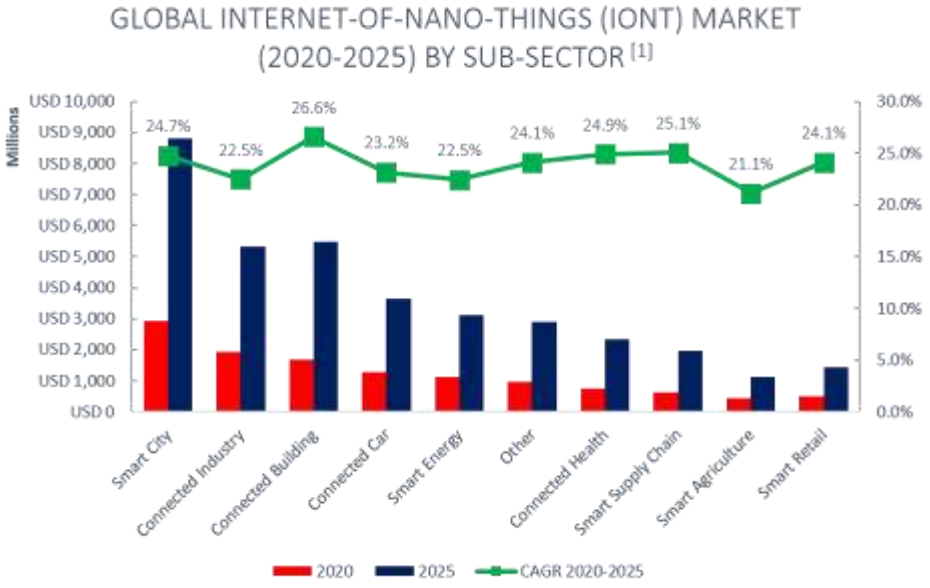
A REVIEW OF THE GLOBAL MARKET

The Smart City sub-sector was valued at USD 2.32 billion in 2019 and is expected to reach USD 8.81 billion in 2025 with a CAGR of 24.7%. The second largest sub-sector is Connected Industry where it makes USD 1.61 billion in 2019 and is expected to reach USD 5.3 billion in 2025 with a CAGR of 22.5%.

However, in 2025 will be expected to be overtaken by Connected Building sub-sector. Connected Building is one of the sub-sectors with the highest growth rate, which is 26.6%. The revenue of Connected Building in 2020 is slightly lower than Connected Industry but will overtake it in 2024.

The trend amongst Smart City, Connected Industry and Connected Building will be the largest as it is considered as Business Segment, subject to the amount of investment by government and corporate entities.



Source: [1] Data derived from Ericsson Mobility Report.

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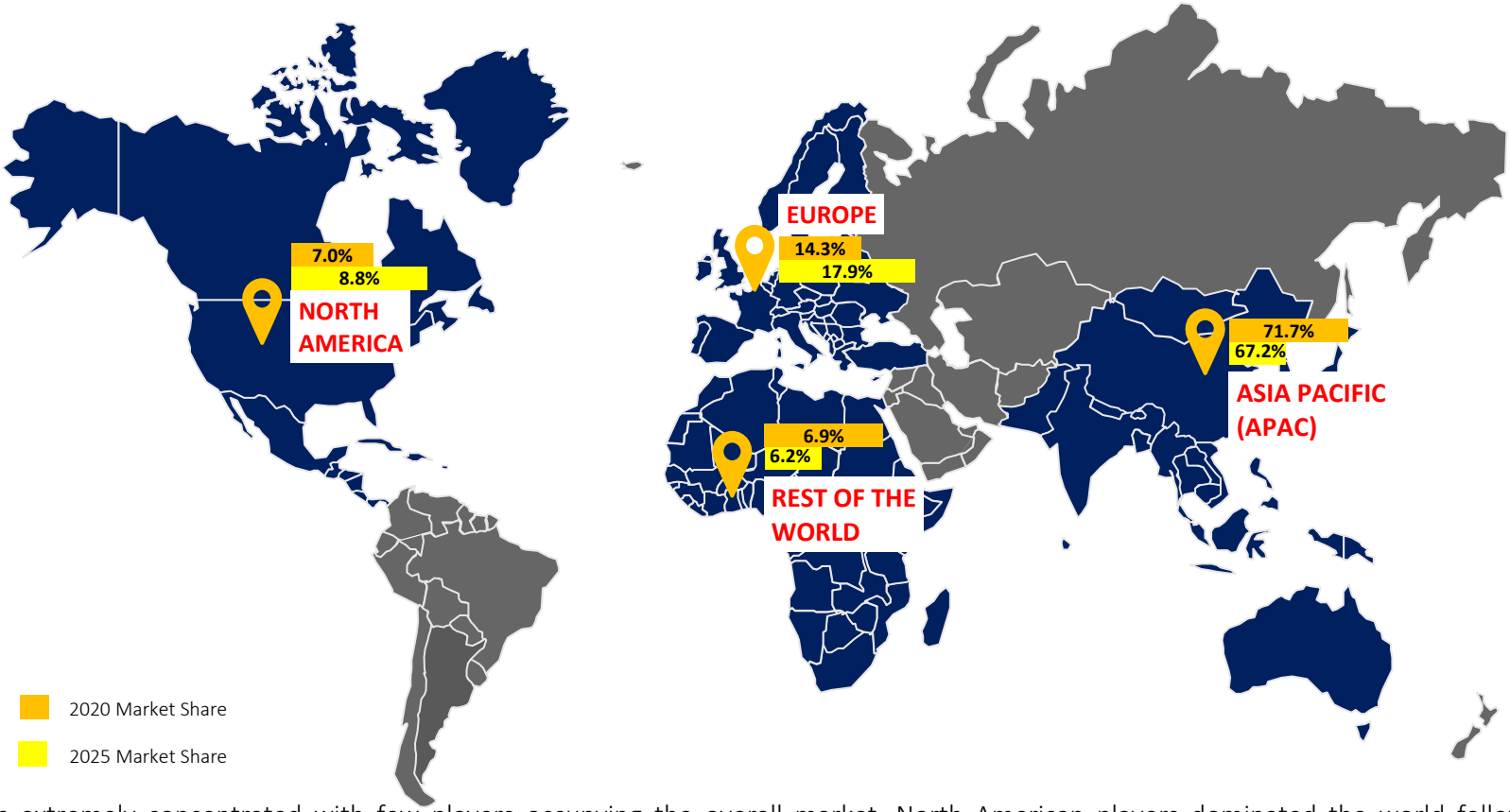
2020 Vs 2025 Landscape: A Glimpse on the IR4.0 Future[1]



The market is extremely concentrated with few players occupying the overall market. North American players dominated the world followed by European players. However, due to an increased market revenue in APAC, more market players from APAC will participate in the global race to dominate the IoNT market.

APAC and the rest of the world will enjoy an increased amount of market revenue contributed by a high growth rate. North American and European market share will be shrinking over the forecast period due to higher revenue in APAC and the rest of the world

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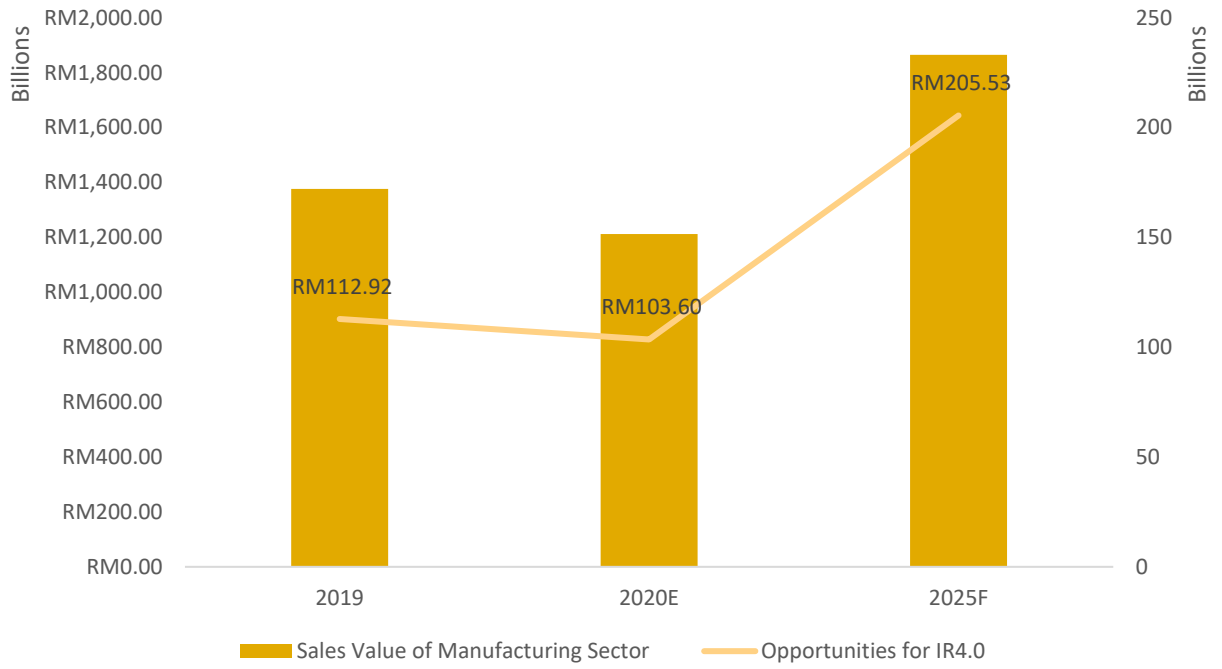
Malaysian 4IR Market Insight (2020-2025) [1][2][3]

The Malaysian manufacturing sector recorded RM 1.376 trillion of total sales in 2019. We estimated that in 2020 the total sales will go down to RM 1.212 trillion due the COVID-19 pandemic. However, we forecast that the market will rebound post-COVID-19 in 2021 up until 2025 where the market revenue will reach RM 1.864 trillion. The COVID-19 pandemic will shift the Malaysian manufacturing sector towards high-technology, innovative and high value-added industries in years to come namely Electrical & Electronics, Machine & Equipment, Chemicals and Medical Devices in-line with Industry*4WRD.*

The market opportunities for IR4.0 will be expected to increase to RM 205.5 billion in 2025 due to transformation and scale up of SMEs to remain competitive by capturing the benefits of disruptive technologies and innovation.



Source: [1] IOT Analytics.
[2] Industry4WRD National Policy
[3] Jabatan Statistik Negara

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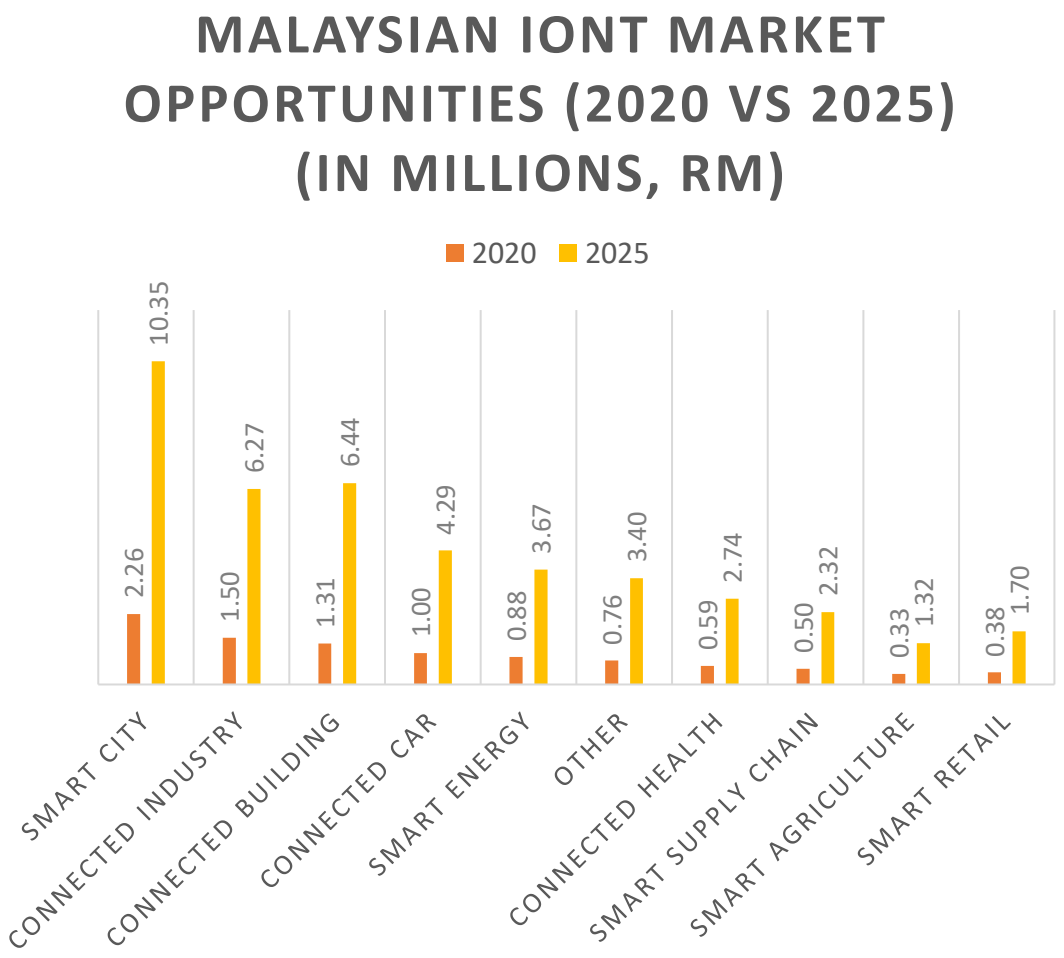
Malaysian 4IR Market Insight (2020-2025) [1][2]



The IoNT market opportunities will be forecasted to reach RM 42.5 billion in 2025 compared to our 2020 estimation which is RM 9.5 billion. With an improved ICT infrastructure as well as breakthrough on nanosensors technology, this paved the way for Malaysia to embrace the technology in the future. Smart cities will be holding the majority of shares with 24.3% of the total IoNT market due to increasing number of high-tier urban area. This were further accompanied by the increasing number of connected industry, connected building and connecting cars making up RM17.05 billion of the total IoNT market in Malaysia.

Smart energy will be required to cater the demands for better energy supply by the means of nano-enhanced battery as well as the power management system, making up RM3.67 billion of market revenue for IoNT market. IoNT will open up a new era of medical industry with an additional revenue of RM 2.74 billion. Smart supply chain and smart retail will be part of the new ecosystem, opening up a market of RM4.02 billion in 2025.

Lastly, to increase our self-sufficiency level (SSL) for an increasing Malaysian population in 2025 and further limited by the number of agricultural land, the only option is to increase the crop yield in terms of quantity and quality through smart agriculture which will be valued at RM 1.32 billion in 2025.

Source: [1] IOT Analytics.
[2] Industry4WRD National Policy
[3] Jabatan Statistik Negara

PROJECT HIGHLIGHTS

Onboard Generated Hydrogen Fuel Cell

Internet of Things (IoT)
Data pairing with GPS module

BENEFITS

Longer endurance up to 4 times longer Li-on batteries. On-board fuel generation system – eliminates compressed hydrogen delivery Lightweight UAV (Fuel Cell vs. Li-on battery). "Plug and Play" and Customisable to fit UAV design

Smart configuration

Connected and Automated dispersion of fertilizer and organic nanotech enhancer infused with graphene and carbon nanotubes for better plant nutrient and mineral intake

Precision Plantation Services
Mapping by a drone powered by a fuel cell with onboard hydrogen generation system

PROJECT HIGHLIGHTS

Project HyPER – Hydrogen-Paired Electric Race car


Lotus Super 7 kit car
Vehicle (technology validation) platform

MoA exchange ceremony on 28 Oct 2019 witnessed by YB Yeo Bee Yin, MESTECC Minister


Fuel Cell Stack


Hybrid Energy Storage System (HESS)


Electric Motor


Tyres

BENEFITS

To produce a locally developed electric vehicle powered by NanoMalaysia's "Hydrogen-paired Hybrid Energy Storage System" (H2SS)

Methodology

Deploy H2SS into a high performance automotive platform

Project Partners

Nano Malaysia Berhad

1. Overall coordination, project management & complimentary funding
2. Liaison between projects partners and Governemnt or private investors

MNA Energy

1. Hybrid Energy Storage System (HESS) composed of graphene-based ultracapacitors & Li-Ion batteries

Pulsar UAV Sdn. Bhd.

1. Onboard generated hydrogen with fuel cell stack
2. Power system integration with HESS to produce H2SS

Handal Energy Berhad

1. Chasis engineering and machining works

Wheelspin Motorsports

1. Vehicle platform providers
2. Promotion within motorsports industry

Universiti Teknologi Malaysia

1. Electric motor system provider

PROJECT HIGHLIGHTS

Remote Wireless Charger

Graphene-based contactless and wireless safe radio frequency (RF) mobile phone charger

Achieved properties:
- Allow long range (few meters and tunable for longer ranges)
- Non-inductive mobile phone charging

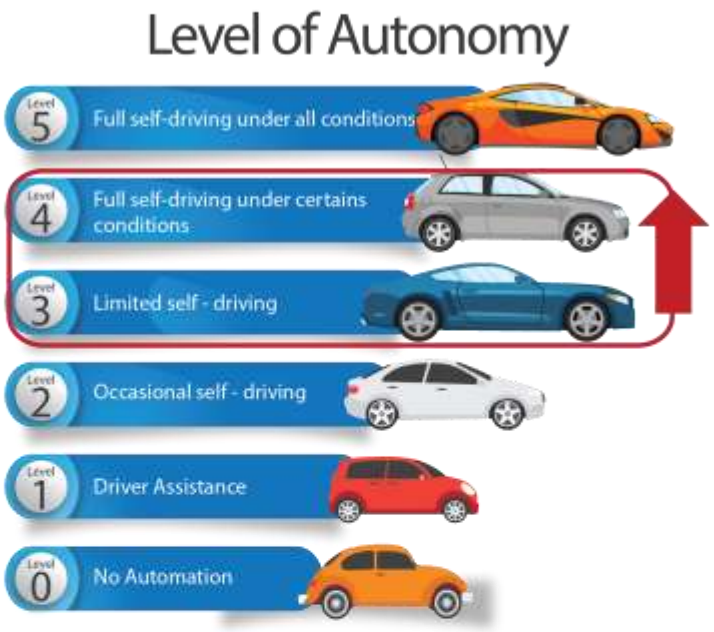
PROJECT HIGHLIGHTS

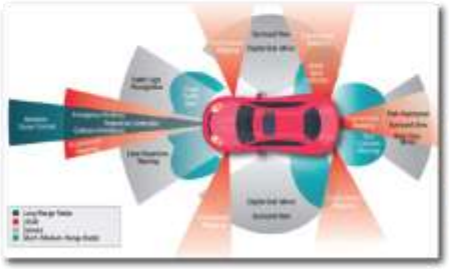
NanoMalaysia Autonomous Vehicle (NAVi)

Combining the best of Li-Ion battery storage and ultracapacitors.

-Li-ion batteries can operate for longer durations, optimally at steady energy output.

-Graphene-based ultracapacitors are used for high power/torque conditions, such as motor starting or moving up an incline





NATIONAL GRAPHENE ACTION PLAN HIGHLIGHTS

Graphene Adoption in Nanofluids for Oil & Gas and Automotive Sectors

Advanced hybrid graphene engine oil
- Lower wear and friction
- Higher heat transfer capacity
- Lower oil volatility
- Lower fuel consumption

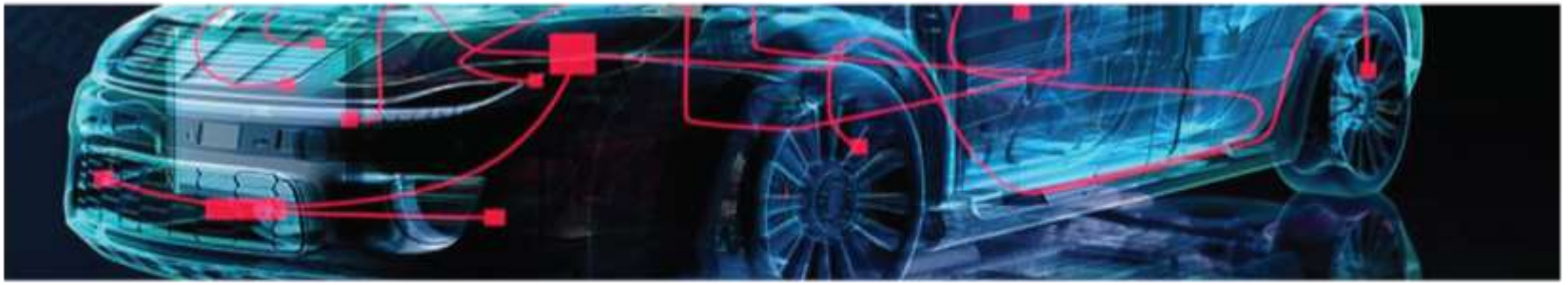
Graphene-based oil absorbent for water treatment applications
- Selective absorption i.e. absorb oil and repel water
- Excellent absorbent reusability

Graphene nanofluid for cooling systems
- Lower specific heat capacity
- Lower energy consumption
- More efficient chilled water air system

Graphene-enhanced engine oil
- Lower frictional wear
- Lower volatility at high heat condition, therefore better engine protection

Graphene-based fluid loss control additive for drilling fluid
- Improve rheological, filtration loss properties, drilling efficiency, cost reduction, green technology

Graphene based emulsion solution for waste oil recovery
- Break emulsion, remove water and wax, reduce viscosity, cloud point and pour point



NATIONAL GRAPHENE ACTION PLAN HIGHLIGHTS

Graphene Adoption in Energy Storage for Transportation, Power Utility, Telco and Mobility Sectors

4IR BUILDING-BLOCK PROJECTS FROM RMK-11

4IR BUILDING-BLOCK PROJECTS FROM RMK-11

Graphene Adoption in Rubber Applications

GRAPHENE MASTERBATCH

- Improve mechanical strength
- Improved hardness, tensile, longation at break and abrasion loss/resistance
- Low loading quantity of graphene as additive
- Reduced material cost

FORKLIFT GRAPHENE TIRES

- 1.5 times better than the virgin tires
- High abrasion rate
- 10% improvement in compression set and high tensile strength while being 30% cheaper than conventional tires

GRAPHENE ESD LATEX GLOVE

- Comfort and less fatigue
- Higher tensile strength and elongation
- Sustainability and biodegradability

4IR BUILDING-BLOCK PROJECTS FROM RMK-11

4IR BUILDING-BLOCK PROJECTS FROM RMK-11

REVOLUTIoNT

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Graphene-based conductive inks for printed circuit board
- Improved conductivity
- 20% on average cost reduction

Graphene-based printed flexible circuit for electronic application
- Improved conductivity and flexibility
- 10-30% cost reduction

COMMERCIALISATION

Graphene-based wireless radio frequency (RF) mobile phone charger for building and public transport
- Long range charging (ohm-m)
- Non-inductive mobile phone charging
- Applicable toEV charging

Graphene-based E. Colisensor for water quality measurement
- Compact, in-situ detection, cost effective, light weight, user friendly

ABOUT NANOMALAYSIA 2

WHO WE ARE

NanoMalaysia Berhad (NanoMalaysia) is Malaysia's lead agency responsible for the commercialisation of nanotechnology in the country. NanoMalaysia was incorporated by the Government of Malaysia in 2011, as the special purpose vehicle to spearhead the growth of the national nanotechnology sector. Nanotechnology was identified under the New Economic Model (2011 – 2020), as a crucial new growth engine and a key enabler to drive innovations across all technology-based sectors.

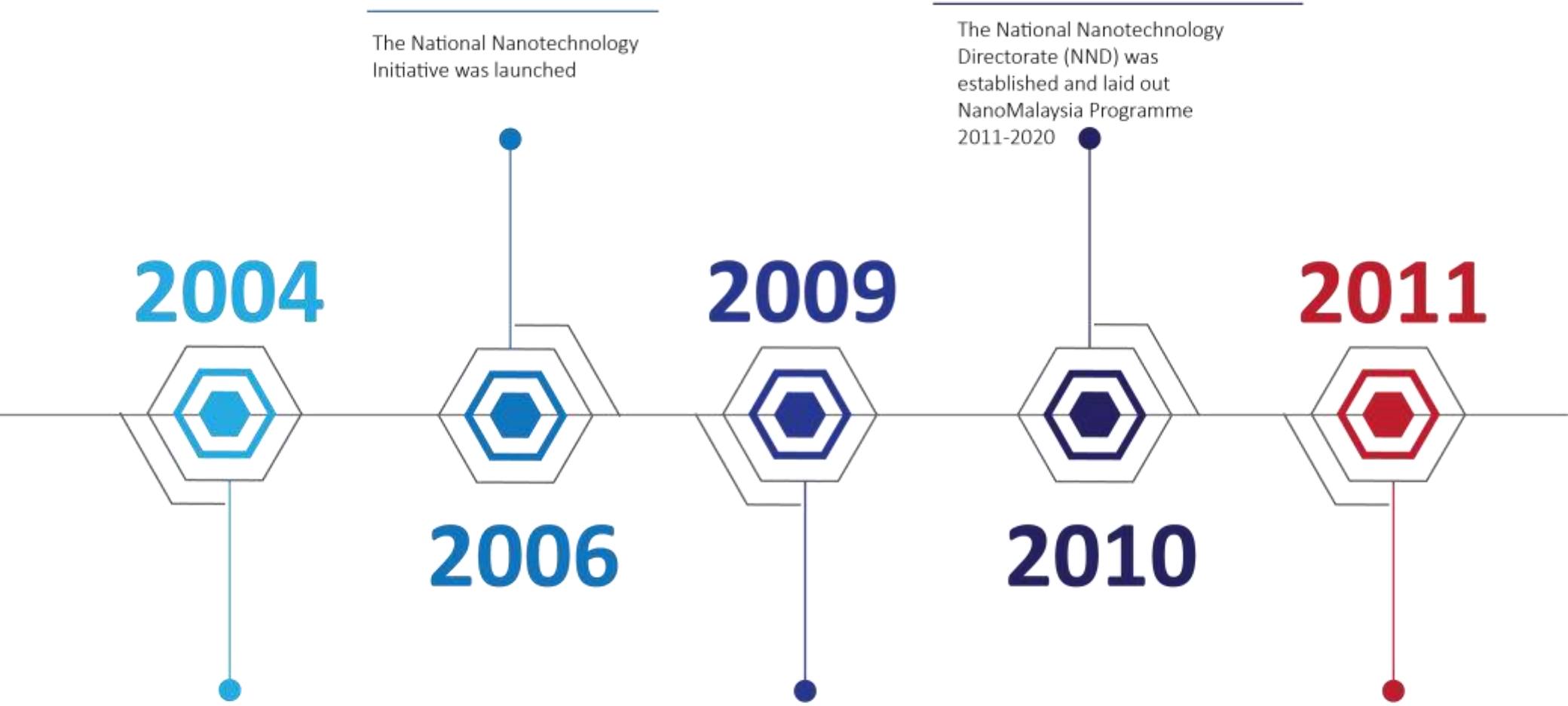
NanoMalaysia's role is to provide support for commercial entities within the nanotechnology industry, to achieve targeted outcomes in moving towards an innovation-driven economy. Our support ecosystem includes global marketing activities, helping build sectoral talent, providing financial and infrastructure resources, assisting with technology and knowledge transfers, and catalysing product innovations leveraging on nanotechnology.

Consequently, NanoMalaysia Berhad was incorporated as a company limited by guarantee (CLBG) under the then Ministry of Science, Technology and Innovation (MOSTI), which has now become the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC).

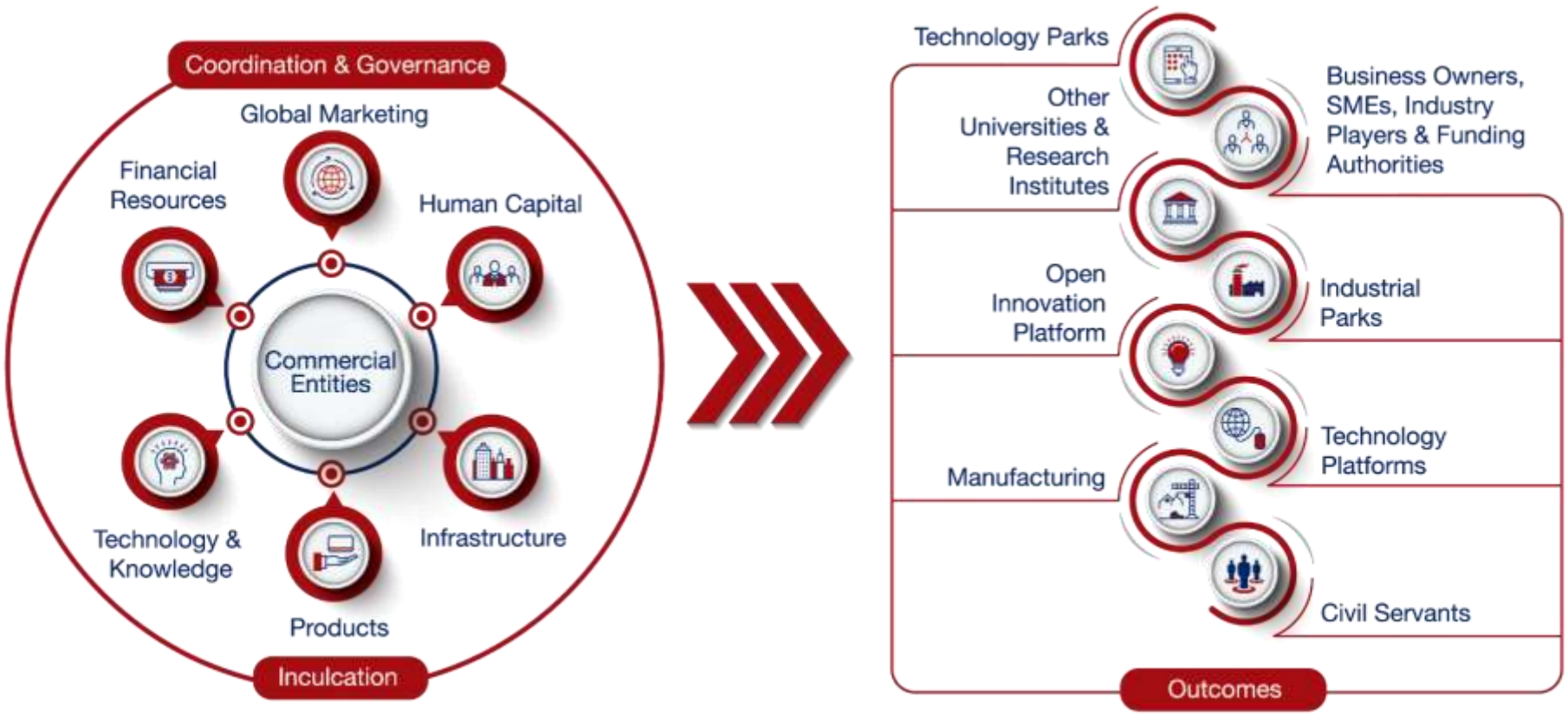
NanoMalaysia has been entrusted with being the leading business entity in Malaysia, to advance nanotechnology commercialisation in the country.

Among its roles are:
- Commercialisation of nanotechnology research and development
- Industrialisation of nanotechnology
- Facilitating investments in nanotechnology
- Furthering human capital skills development in nanotechnology.

Our goal is to catalyse the growth of Malaysia's strategic industrial sectors with nanotechnology, through the various initiatives and programmes we have in place, towards creating a thriving innovation-driven national economy.


2004
Malaysia joined Asia Nano Forum
2006
The National Nanotechnology Initiative was launched
2009
The National Innovation Council identified Nanotechnology as an important growth engine for Malaysia's New Economic Policy
2010
The National Nanotechnology Directorate (NND) was established and laid out NanoMalaysia Programme 2011-2020
2011
NanoMalaysia was mooted during the National Innovation Council (NIC) meeting and incorporated as a Company Limited by Guarantee (CLBG) in August 2011 under section 14(2)(c) of the Companies Act 1965

OUR ECOSYSTEM



VISION

To be a global leader in nanotechnology commercialisation

MISSION

Energising Industries and Catalysing Economic Growth

Deployment and Adoption of Nanotechnology in Industries

Business Growth and Sustainable Development

Cutting Edge Technological Leadership and Creating True Values

COMPANY INFORMATION

Board of Directors:

- Prof. Emeritus Dato' Ir. Dr Mohamad Zawawi Bin Ismail
  Chairman
- Dato' Sri Ir. Dr. Judin Abdul Karim
  Director
- Tan Sri Dato' Seri Dr. Salleh Bin Mohd Nor
  Director
- Dato' Prof. Dr. Rujhan Bin Mustafa
  Director
- Dato' Ahmad Shukri Bin Hj. Tajuddin
  Director
- Prof. Madya Ts. Dr. Ramzah Dambul
  Director
- Dr. Rezal Khairi bin Ahmad
  Director

Company Secretary:

- Puan Shahrizat binti Othman
  AAJ Management Services Sdn Bhd

Registered Office:

- NanoMalaysia Berhad (955265-P)
  Suite C-5-4, Wisma Goshen
  Plaza Pantai, Jalan Pantai Bharu
  59200 Kuala Lumpur

Official Address:

- A-2-2 & A-2-3, Level 2,
  157 Hampshire Place Office,
  No. 1 Jalan Mayang Sari,
  50450 Kuala Lumpur

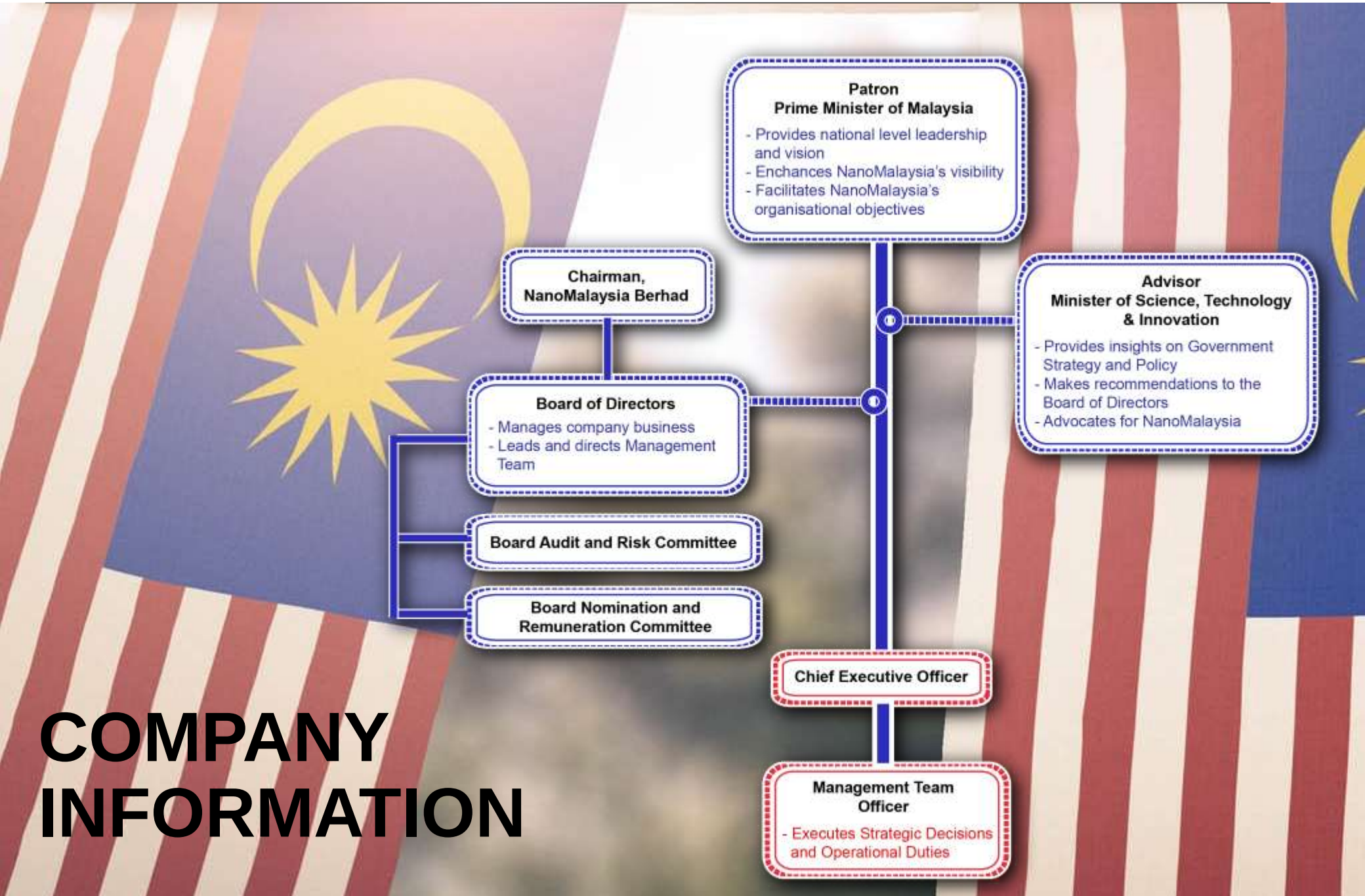
Website:

- www.nanomalaysia.com.my

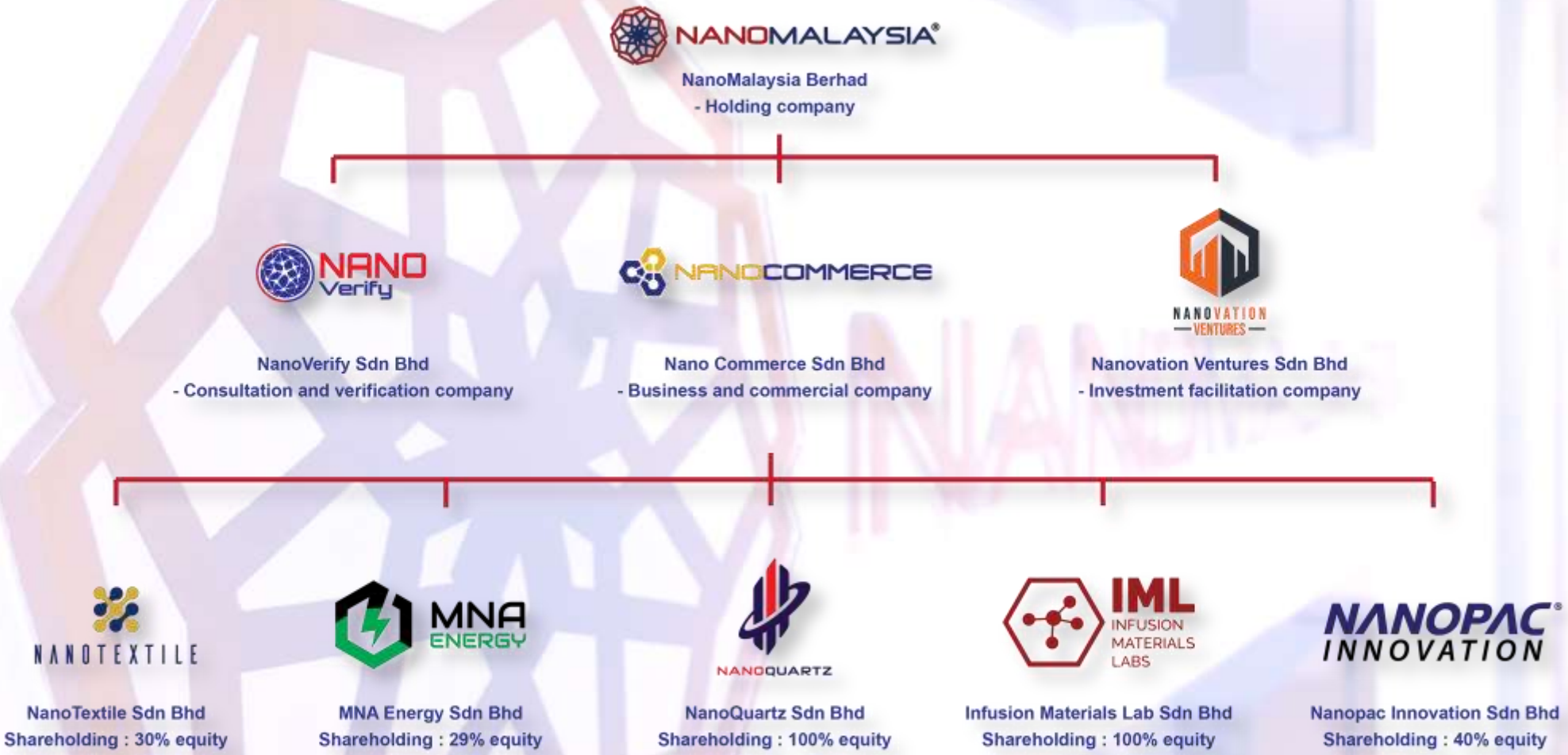
Auditors:

- A Razak & Co

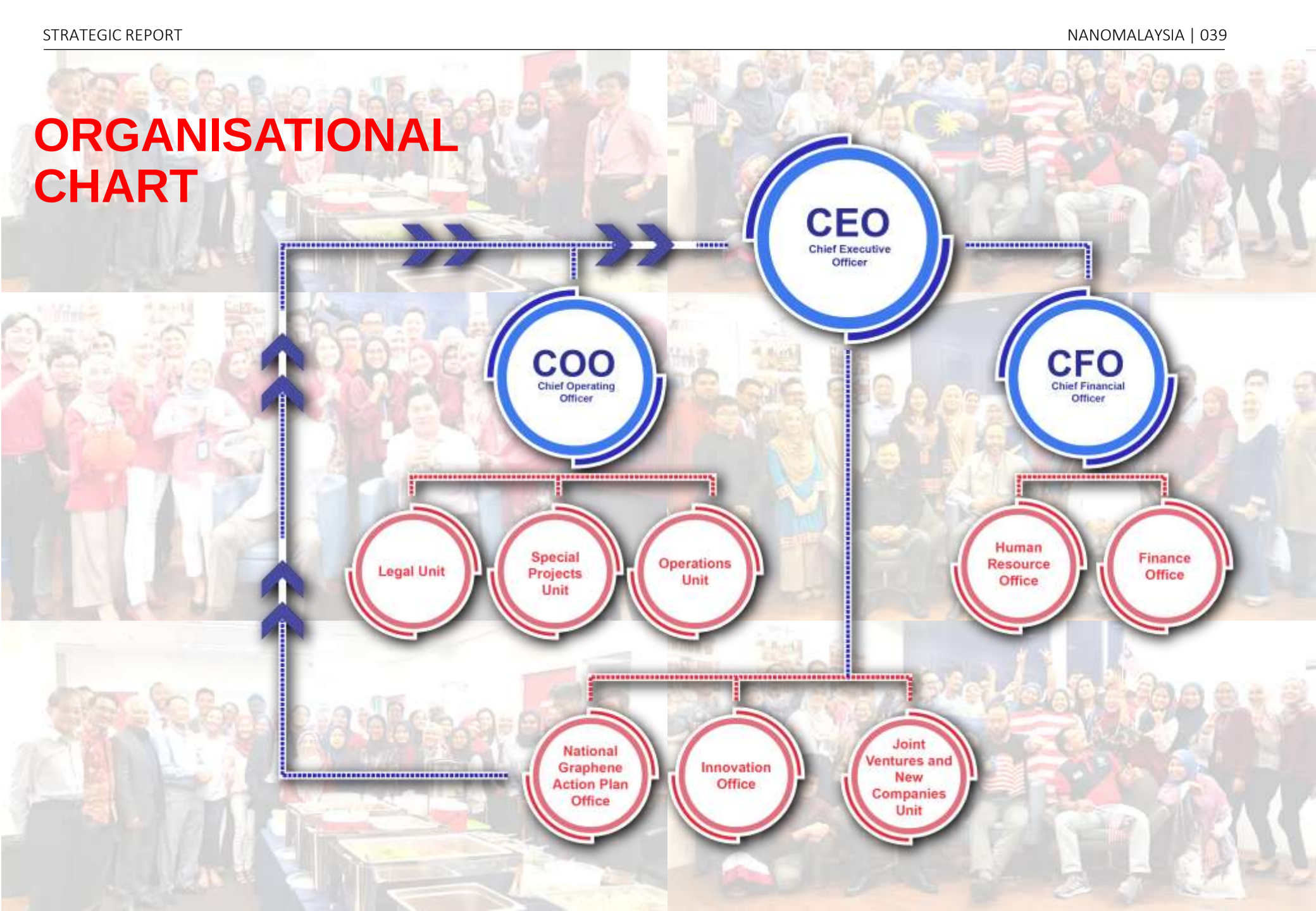
COMPANY INFORMATION



CORPORATE STRUCTURE



ORGANISATIONAL CHART



BOARD MEMBERS

PROFESSOR EMERITUS DATO' IR. DR. MOHAMAD ZAWAWI BIN ISMAIL

CHAIRMAN

Dr. Zawawi became Chairman of the board on 25 Nov 2011. He was the founding Vice-Chancellor of Universiti Malaysia Sarawak, UNIMAS, the Dean of Engineering, and Deputy Vice-Chancellor of Universiti Kebangsaan Malaysia (UKM) and also the Founding Director of Commerce Leadership Institute of CIMB Group, and one of the founders of Mimos Berhad. Dr. Zawawi had once served the Board of Malaysia Qualifications Agency MQA, Chairman of the Higher Education APEX Committee, Board Member of International Medical University, Board Member of National Defence University, Board Member of Razak School of Government, Chairman of Universiti Sains Malaysia and Chairman of Universiti Kebangsaan Malaysia. He had served several national bodies including National Information Technology Council, National Aerospace Council, National Scientific Research and Development Council, and National Higher Education Council. He was once advisor to both the National Science Centre and National Planetarium. Dr. Zawawi gained both his bachelor and doctorate degrees from the University of Leeds. He is a Foundation Fellow of the Academy of Sciences Malaysia, a Member of the Institute of Engineers Malaysia, and an Honorary Fellow of The Institute of Physics Malaysia for which he once served as its President (1976-79).

DATO' PROFESSOR DR. RUJHAN BIN MUSTAFA

CHAIRMAN OF BOARD NOMINATION AND REMUNERATION COMMITTEE

Dr. Rujhan is a Board Director since 25 November 2011. He is also the Chairman of Board Nomination and Remuneration Committee. Dr. Rujhan received his Ph.D. and Masters Degree in International Economics from Ritsumeikan University, Japan. He is a Council Member of the Malaysian Qualifications Agency and The National Council for Science and Research. He is currently the Chief Executive Officer of Education Malaysia Global Services (EMGS) and the Chief Executive Officer, Education Performance and Delivery Unit.

BOARD MEMBERS

DATO' SRI IR. DR. JUDIN ABDUL KARIM

Dr. Judin is a Board Director since 25 November 2011. He received his Masters of Science in Structural Engineering and Ph.D. in Civil Engineering from the University of Southern California. A former Director General of the Public Works Department, Dr. Judin is a Fellow of IStructE, United Kingdom, a Fellow of the Institution of Engineers Malaysia (IEM), and Fellow of Academy of Sciences Malaysia. He is also the President of Board of Engineers Malaysia (BEM) and the Chairman of the World Road Association (PIARC) for Technological Exchanges and Development Commission. Dr. Judin is currently the Chairman of CIDB Holdings Sdn Bh

DATO' AHMAD SHUKRI BIN HJ. TAJUDDIN

MEMBER OF BOARD AUDIT COMMITTEE

Dato' Ahmad Shukri is a Board Director since 25 November 2011 and a member of the Board Audit Committee. He has over 25 years' experience in various capacities in the private and government sector and has accumulated vast experience in property, construction, business and technology development. Dato' Ahmad Shukri is an Advisory Panel Member on Innovation to Malaysian National Productivity and was Technical Advisor and Head of Study Team, Government of Zambia for the setting up of Industrial Park in Zambia. He obtained his MBA from Greenwich University, Australia and is currently the Chief Executive Officer (CEO) and member of board of Senai Hi-Tech Park. He was also the former CEO an member of board of Kulim Hi-Tech Park.

TAN SRI DATO' SERI DR. SALLEH BIN MOHD NOR

MEMBER OF BOARD AUDIT COMMITTE

Dr. Salleh is a Board Director since 25 November 2011 and a member of the Board Audit Committee. A respected conservationist and academician, Dr. Salleh has played a major role in the protection of the Malaysian environment and the conservation of nature and natural resources, particularly via his position as the First Director-General of the Forest Institute of Malaysia (FRIM) and the President of Malaysian Nature Society (MNS). A Merdeka Award recepient and one of the 50 "Tokoh Malaysia" award winners, Dr. Salleh received his Ph.D. and Masters Degree from Michigan State University. Dr. Salleh chairs the Antarctica Task Force and has visited Antarctica twice and is currently the Pro-Chancellor of Universiti Teknologi Malaysia.

BOARD MEMBERS

PROF. MADYA TS. DR. RAMZAH DAMBUL
MESTECC'S REPRESENTATIVE

Dr. Ramzah is the Deputy Secretary General (Science, Technology & Industry) of the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC). He received his Ph.D. in Climatology from the University of East Anglia in 2007. His niche areas include long-term prediction,seasonal monsoon forecasting and the relationship between large-scale air circulation and local climate. Dr. Ramzah is a certified consultant under the Energy Information Administration (Climate Change, Land Use) and has received many international recognitions in the academic field such as the Chevening Fellowship in 2008. He was appointed as a Research Fellow at the Centre for Climate Change Research, King Abdul Aziz University, Jeddah from 2012 to 2014 and has received many international and local research and innovation awards since 2008 and has been involved in 18 academic publications so far. Dr. Ramzah is a Board Director since 11 May 2016.

DR. REZAL KHAIRI AHMAD

Dr. Rezal was appointed as the Chief Executive Officer of NanoMalaysia in January 2013 and is a Board Member since 16 July 2014.He is the architect of NanoMalaysia's Commercialisation Modul and Programme under the 11th Malaysia Plan including NGAP2020. He serves as Chairman of Advanced Materials Investment Advisory Panel Working Group under Malaysian Investment Development Authority (MIDA), Treasurer for Asia Nano Forum (ANF) and Chairman of Commercialisation Working Group under Asia Nano Forum. In September 2017, he was appointed as International Advisor to China Graphene Industry Alliance (CGIA) linking Malaysia's National Graphene Action Plan 2020 (NGAP2020) and mutual economic benefits. Dr Rezal holds a Ph.D. in Nanotechnology, Electronic/Electrical Engineering from London Centre for Nanotechnology, University College London as the first Khazanah PhD Scholar from 2007 to 2010 with publications in high impact journals.

MANAGEMENT TEAM

DR. REZAL KHAIRI AHMAD

CHIEF EXECUTIVE OFFICER

Dr. Rezal was appointed as the Chief Executive Officer of NanoMalaysia in January 2013. Dr Rezal holds a Ph.D. in Nanotechnology, Electronic/Electrical Engineering from London Centre for Nanotechnology, University College London as the first Khazanah Ph.D. Scholar. As NanoMalaysia's first employee, he crafted the company structure and developed the business model and corporate positioning strategy relative to like-minded government agencies and relevant industries. Between August 2012 and February 2013, Dr. Rezal also served as Acting Under Secretary of National Nanotechnology Directorate, Ministry of Science, Technology and Innovation (MOSTI). From June 2012 to May 2014, he came under secondment from Khazanah Nasional, an investment arm of the Government of Malaysia. Prior to that, he was a Manager at GEMS Sdn. Bhd. and Business Development Manager in a local ICT private company from 2000 to 2001.

MANAGEMENT TEAM

MOHAMAD HAFIZ BIN ZOLKIPLI

CHIEF OPERATING OFFICER

Mr. Hafiz was appointed as Chief Operating Officer in August 2018. He joined NanoMalaysia as the Senior Vice President, Operations, in 2016. Prior to joining NanoMalaysia, he was with Petroliam Nasional Berhad (PETRONAS) where he served as Head of Business Process Advisory and Solutions in the Malaysia Petroleum Management division and Head of Risk Planning and Governance in the Project Delivery and Technology division. He has also worked in various manufacturing and business processes functions across a wide range of industries; from manufacturing at Western Digital and Flextronics as a process engineer, to banking at CIMB Group as Manager of Business Process Engineering. Mr. Hafiz is a certified Lean and Six Sigma practitioner and has completed a wide range of process improvement activities and reengineering projects within Malaysia and abroad. He obtained his Bachelor of Mechanical Engineering from University College London, United Kingdom.

MANAGEMENT TEAM

ANASNUDIN HJ. ABDULLAH

CHIEF FINANCIAL OFFICER

Mr Anasnudin was appointed as Chief Financial Officer of NanoMalaysia in June 2012. He holds a combined studies degree in Accounting from De Montfort University, Leicester, United Kingdom and an Advanced Diploma from the Chartered Institute of Management Accountants (CIMA), United Kingdom. Prior to his appointment to NanoMalaysia, Mr Anasnudin was appointed as the Financial Controller with a Class A construction company in Kuala Lumpur and later as a Finance Manager at Carimin Sdn Bhd. In 2010, he was the Chief Financial Officer, and led to the setting up of UKM Technology Sdn. Bhd. - a wholly-owned technology transfer company of Universiti Kebangsaan Malaysia (UKM).

MANAGEMENT TEAM

DR. DANIEL BIEN CHIA SHENG
VICE PRESIDENT, INNOVATION OFFICE

Dr. Daniel was appointed as Vice President, Innovation Office in March 2015. He was previously with MIMOS Berhad, as the Head of Nanoelectronics Centre of Excellence, where he focused in driving the National Nanoelectronics Roadmap. Prior to that, Dr. Daniel was the R&D Specialist at Philips Lumileds Lighting Company Sdn Bhd, overseeing all developments of silicon based LED products in Malaysia. He has chaired the National Mirror Committee for the International Electrotechnical Committee, IEC TC-113 on Nanotechnology Standardisation for Electrical and Electronic Product and Systems for Malaysia from 2010 to 2015 and has filed more than 50 international patents and technical publications respectively. Dr. Daniel has a Ph.D in Electrical and Electronics Engineering from Queen's University, Belfast, United Kingdom.

MURNI ALI
VICE PRESIDENT, NATIONAL GRAPHENE ACTION PLAN

With more than 10 years' experience in the field of Business Development and Marketing, Ms Murni is currently heading the National Graphene Action Plan 2020 Office since 2015. She started her career with Pharmaniaga and brings with her diverse experience in operations and managerial functions in business development and marketing. She holds an MBA in International Business from the University of East London and she has been involved in various business-development disciplines showing expertise in engaging with decision makers and devising winning sales strategies and solutions exercises. Ms Murni brings a deep understanding of the business-technology interface and the capacity to identify and align clients' emerging technology needs with products and services.

S. FRANCIS XAVIER
ASSISTANT VICE PRESIDENT JOINT VENTURE & NEW COMPANIES

Mr. Francis was appointed as Assistant Vice President, Legal Unit in 2013 was appointed as Assistant Vice President, Joint Venture & New Companies in November 2017. Prior to that, he was with Bank Utama (M) Berhad (later merged with RHB Bank Berhad), where he managed consumer and commercial credit portfolios, including Corporate Planning & Strategic Management. With more than sixteen years of banking experience in both consumer and commercial credit, Mr. Francis brings diversified banking experience to Joint Venture and New Companies t0 support the business development and growth of nanotechnology businesses, particularly in the commercialisation of nanotechnology intellectual property and nanotechnology products through various collaboration models with potential nanotechnology enabled industries, including through joint venture exercise and licensing agreements. He holds the Diploma of Laws from the University of London.

MANAGEMENT TEAM

RAJA RIZNAL RAJA ABIDIN
VICE PRESIDENT, CORPORATE AFFAIRS OFFICE

Raja Riznal joined NanoMalaysia in March 2018 as Vice President, Corporate Affairs Office. Previously he started up Allworks Distribution Sdn Bhd and Futsalworks Sdn Bhd, where he managed all matters related to communications, branding, sales as well as the creative designs for the companies. He was also with DISITU Holdings where he assisted in setting up Odyssey Prestige Coaches and Compass Coaches. From 2000 to 2005, Raja Riznal was at PETROSAINS Sdn. Bhd, where he has developed, coordinated and implemented marketing, branding and communication strategies and initiatives of PETROSAINS. He has also coordinated external and internal events, activities and programmes working with the Corporate Affairs Unit (CAU) and the Motorspors Division within PETRONAS to reach out the general public through their F1 and CSR activities. He has a B.A. in Film & Video from the Arts Institute of Bournemouth, United Kingdom.

RAJA ANIS AZYARINA BINTI RAJA ISKANDAR
VICE PRESIDENT, LEGAL UNIT

Ms. Raja Iskandar is the Head of the Legal Unit of NanoMalaysia since November 2018 Prior to joining NanoMalaysia, she served as group legal manager of Media Prima Berhad where she was responsible for the legal affairs of its subsidiaries' businesses under various platforms, i.e. radio, content, film, digital media and intellectual property licensing and merchandising. Before Media Prima Berhad, she was in-house legal counsel for Payments Network Sdn Bhd and Unilever Malaysia Holdings Sdn Bhd. She has had extensive experience in intellectual property licensing and commercialisation, IT, e-commerce, legal department management, and personal data protection issues. She was called to the Malaysian Bar in year 2000. She holds a law degree with honours from National University of Malaysia and earned a master's degree in management from the University of Durham, Durham Business School, United Kingdom.

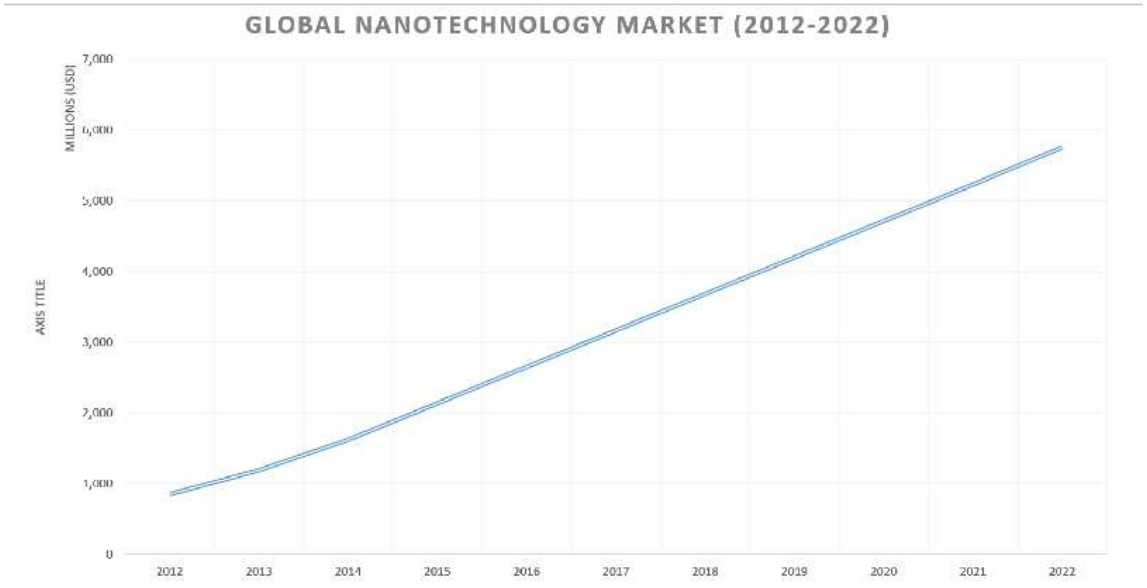
THE NANOTECH INDUSTRY

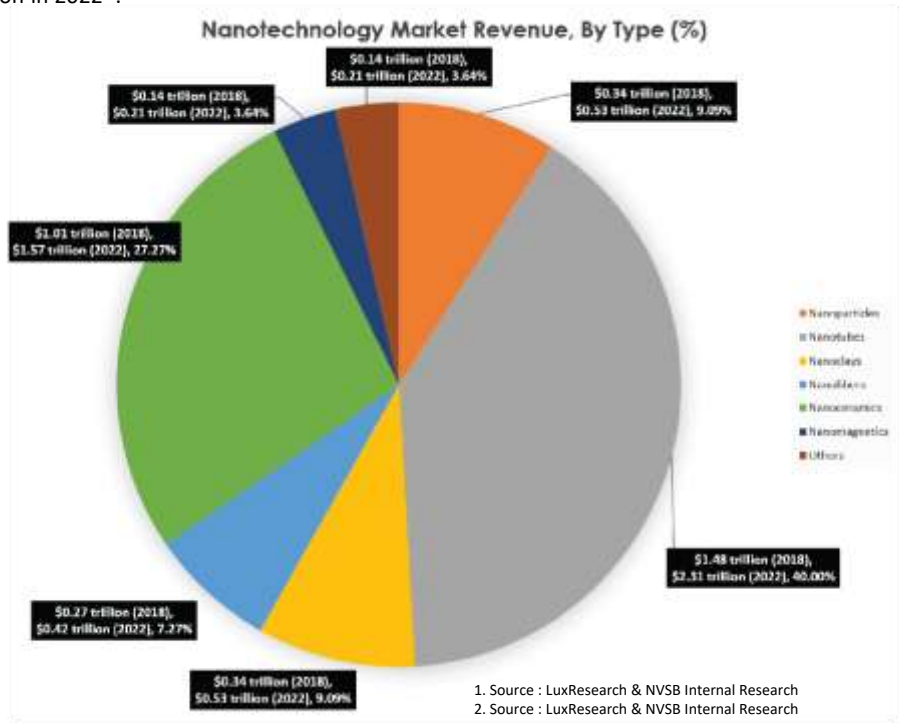
3

THE GLOBAL NANOTECH INDUSTRY

Although relatively new, the global nanotechnology sector will be one of the greatest needle shifting industries within the next five years, with far reaching implications on the way we live, work and play. The international nanotechnology market is expected to hit the USD5.76 trillion mark by 2022, from USD3.68 trillion in 2018, denoting a double-digit Compound Annual Growth Rate (CAGR) of 11.8% within the forecast period of 2018 till 2024[1].

Europe and Asia are expected to register the greatest growth in market share, followed closely by the United States. Asia's market share is expected to grow from USD1.3 trillion in 2018, to USD2 trillion in 2022, while Europe's market share is forecasted to increase from USD1.33 trillion in 2018, to USD2 trillion in 2022[2].





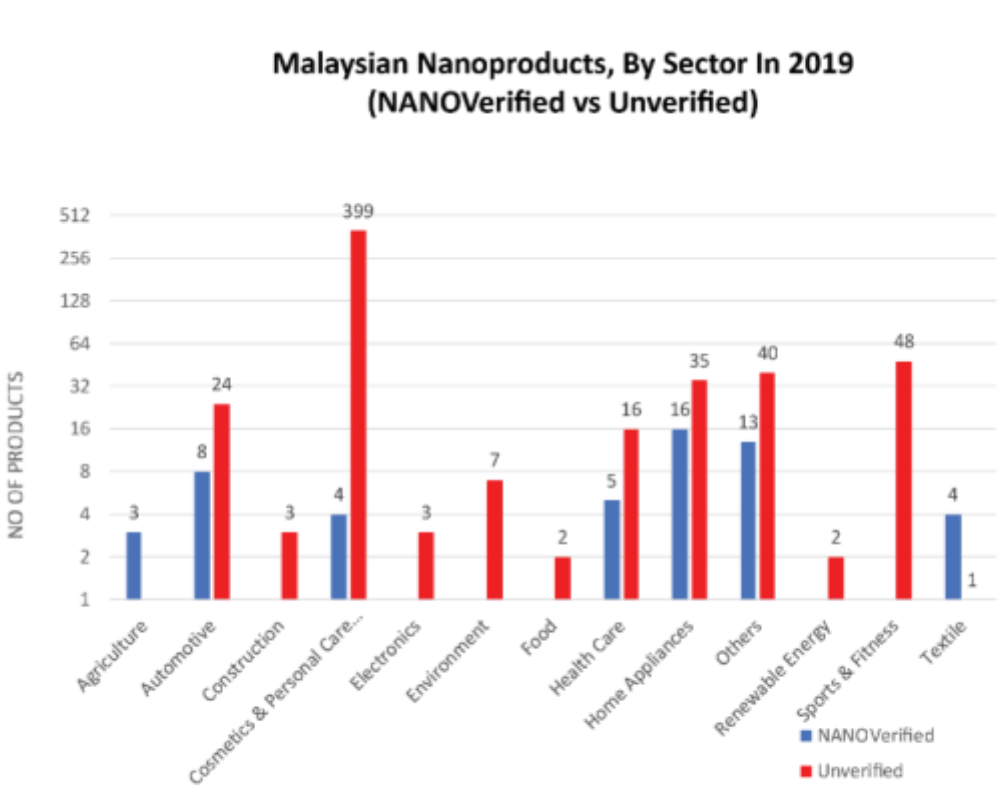
1. Source : LuxResearch & NVSB Internal Research
2. Source : LuxResearch & NVSB Internal Research

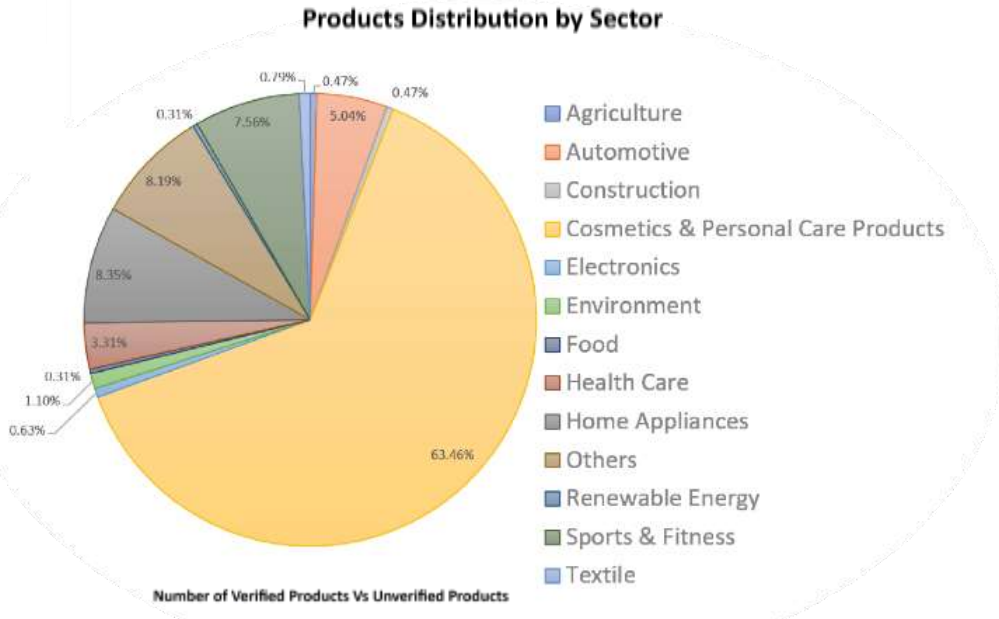
The explosive growth in nanotechnology will primarily be driven by rapidly growing advancements in potential applications within sectors such as healthcare, cosmetics, energy and agriculture. Significant developments have been observed within the past few years in the electronics, energy and biomedical sectors.

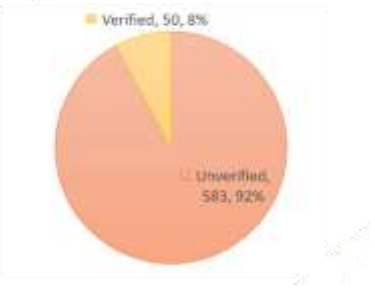
Specifically, it has been projected that nanotubes will capture the greatest market share, with demand driven by the electronics, energy storage and automotive sectors. The second highest market share is expected to be held by nanoceramics, with growing demand from the electronics and biomedical sectors. Over 70% of the global nanotechnology market share will be held by nanotechnology applications within materials and manufacturing, electronics and information technology, and healthcare and life sciences.

MALAYSIAN NANOTECHNOLOGY LANDSCAPE

To capture greater market share, industry players globally are expected to invest significantly in research and development (R&D) activities, to cater to the rising demand for nanotechnology based devices and equipment. Challenges exist in the form of the high cost of nano based devices. This could potentially hamper the growth of Small and Medium Enterprises (SMEs) which may not have the funds or specialised skills to venture into this space, unless they are given the required support to do so. As well as that, there is a lack of skilled professionals in this field, and more efforts will need to be expended towards building sectoral human resource capacities.







EMERGING NANOTECHNOLOGY APPLICATIONS

Next Generations Power Semiconductors

Accelerated development has increased in wide-gap semiconductors substrates and devices using Silicon Carbide (SiC) or Gallium Nitride (GAn) aimed at early implementation

Next-generation Electricity Storage Devices

Heightened anticipation for nest generation high performance batteries, such as all-solid-state, multivalent cation, metal-air, and Lithium-Sulphur (Li-S) batteries.

Bio-Fabrication

The emergence of 3D bio-printing for freely arranging biomaterials and cells paves the way for applications in constructing tissues and organs, discovery of new drugs and regenerative medicine

Neuroimaging

Remarkables advances in technologies to electrically or optically measure brain activity has led to the development of elucidating mechanisms for deciphering brain functions and data processing.

IoT enabled Artificial Intelligence (AI) devices

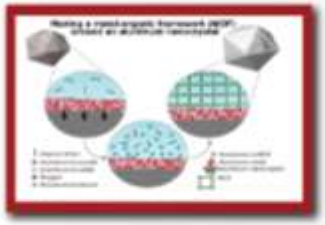
Hugely anticipated arrival of an IoT Smart Society based on AI abd Deep Learning technologies.

Quantum Computing

Super-fast computations through quantum mechanics and quantum gate and quantum annealing systems are expected to have applications in AI.

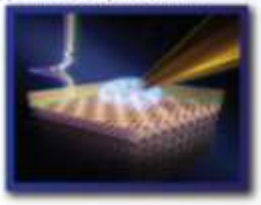
Porous Frameworks (PCP, MOF and COF)

These compounds have controllable nanospaces that could be used for highly selective adsorption /desorption fields, electronic / ionic conductivity and specific reactions.



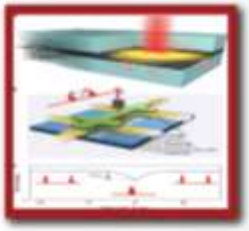
Topological Insulators

A candidate for next-generation electronic devices, exhibiting a unique metallic state at its boundaries (surface in 3D and edge in 2D systems) but no its interior (insulators), and supplies non-dissipative current.



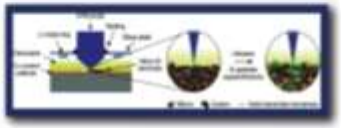
Ohonon Engineering

More focused research on the creation of new materials and devices that treats heat at the nanoscale as phonons and controls heat at origin.



Operando Measurements

There is much interest in the development of operando measurements ranging from materials to organisms.



NANOMALAYSIA PROGRAMMES 4

FOCUSING ON 4 KEY STRATEGIC JUMPSTART SECTORS




Food and Agricultural

- Nanofiber, Nanocellulose (Forestry Nanotechnology, Filtration system)
- Food processing and management (smart packaging)
- Nanofertiliser (Bio-active ingredient detection and database)

Wellness, Medical and Healthcare

- Drug delivery (Nanomedicine, biosensors)
- Packaging and systems (Nanonetworks for healthcare applications, RFID)
- Antimicrobial applications (Antimicrobial assays)

Energy and Environment

- Li-ion battery anode / ultra-capacitors (Power system)
- Advanced materials (Nanogenerators, Nanochip)
- Green energy and power technology (Sensors for alternative power sources)

Electronic Devices and Systens

- Nanosensors (Scalar sensors & system)
- Nanoelectronics (Processors, NEMS)
- Nanodevices (Phones, cameras etc.)

NANOMALAYSIA RMK-11 PROGRAMMES

NanoMalaysia has in place a number of programmes which form the thrust of our strategy to drive the growth of the Malaysian nanotechnology sector. In our bid to re-energise industries through nanotechnology commercialisation, we have identified four key strategic sectors which present the greatest growth opportunities in the medium to long-term. These sectors are Electronic Devices and Systems, Food and Agriculture, Energy and Environment, and Wellness, Medical and Healthcare.

Our programmes are the National Graphene Action Plan 2020 (NGAP2020), and the Advanced Materials Industrialisation Programme. NGAP2020 is a commercialisation programme which focuses on graphene applications in five identified areas, namely, lithium-ion battery anodes/ultracapacitors, conducive links, rubber additives, plastic additives, and nanofluids. The Advanced Materials Industrialisation Programme enables nanotechnology adoption by industry through various focused support services and platforms.

To ensure that nanotechnology products and applications developed by SMEs in Malaysia adhere to global best practice expectations and requirements, we have collaborated with SIRIM QAS International, and obtained the advisory of Standards Malaysia, to conduct the voluntary nanotechnology certification programme, NANOVerify. Our focused efforts through our various programmes have resulted in a number of key achievements, which have contributed to the growth and expansion of the nascent nanotechnology sector in Malaysia.

One of our core programmes is iNanovation which supports and empowers Small and Medium Enterprises (SMEs) to establish a foothold in the industry and grow their market share. The primary means by which this is achieved is through the introduction of new nanotechnology enabled processes and materials, to enable the transformational shift from conventional industries to nanotechnology enabled industries.

NANOMALAYSIA PROGRAMMES SECTORS

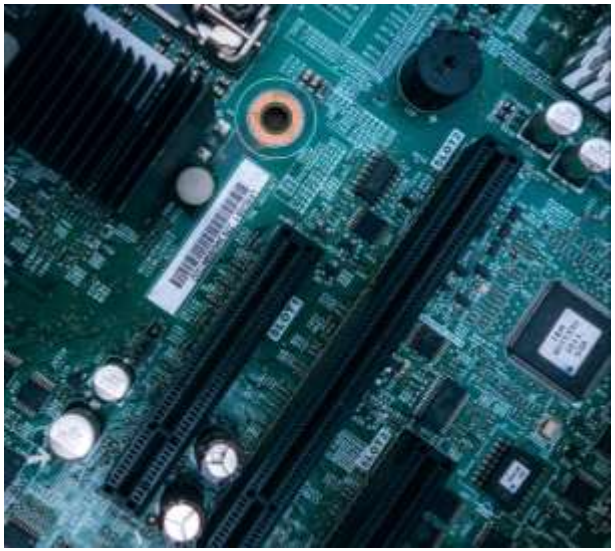
Electronic Devices And Systems

The Electronics and Electrical (E&E) industry is one of the major sub-sectors of the manufacturing sector in Malaysia. E&E primarily consists of two main industry components – computer, electronic and optical products; and electrical equipment. An important contributor to the national economy, in 2017 alone, E&E was Malaysia's largest export earner at RM343 billion, accounting for 36.7% of the country's total exports[1].

The added value of the E&E sub-sector stood at RM67.7 billion in 2017, an 8.2% increase from the previous year. The increase in the sector's value is attributed to an industry shift from low value-added activities, to high-value operations to enhance the local sector's competitiveness within the international business landscape.

Employment within the E&E sector has grown substantially through the years to consist of 19.9% of the total manufacturing workforce comprising of 485,000 workers as at end 2017[2]. Robust global demand for E&E products is driving industry growth, and by 2020, it is expected that the sector will generate a Gross National Income (GNI) impact of RM53.4 billion, and create a further 157,000 jobs[3].

There is tremendous potential for the E&E sector to move up the manufacturing value chain and thus propel its growth by adopting nanotechnology within its manufacturing processes. Opportunities for growth and expansion are fuelled by the advent of new breakthrough discoveries in nanotechnology such as nanoelectronics and nanophotonics, as well as the rise of the Internet of Nano Things (IoNT).



Malaysian Nanotechnology Market Size

Electronic devices and systems in Malaysia was valued at RM 576.9 billion in 2019 where 60% (RM 346.6 billion) are exported goods. Electronic integrated circuits and microassemblies made up a large chunk of the shares with a total trade value of RM 317.8 billion. The electrical and electronics (E&E) manufacturing industry in Malaysia employs 562,778 paid employees in 2019. Nanotechnology complements the E&E industry by through 2D materials such as graphenes and carbon nanotubes which provides better performance compared to conventional counterparts. It is expected that the nanotechnology market for electronic devices and systems to be estimated at RM 1.78 billion in 2025.

1. Source : 25th Productivity Report 2017/2018, published by Malaysia Productivity Corporation in 2018
2. Source : 25th Productivity Report 2017/2018, published by Malaysia Productivity Corporation in 2018
3. 2018 Malaysian American Electronics Industry (MAEI) Survey Report

NANOMALAYSIA PROGRAMMES SECTORS

Malaysian Nanotechnology Market Size

The Malaysian trade performance for food and agricultural industry was valued at RM 157.4 billion 2019 where RM 69.6 billion stands for export and RM 7.786 billion of imported goods. Currently, the national policy focused on increasing our self-sufficient level (SSL) to 90-100% where currently we are standing at 60-70%. Hence, to address this issue, our strategy now is to optimize yield from available lands instead of acquiring and developing new fields which are costly and limited. New technologies are developed particularly in precision agriculture technology to optimize crop yield in terms of quantity and quality. Nanotechnology plays a pivotal role in precision farming especially in formulation of nano-fertilizers which delivers promising results. It is expected that if the nano-fertilizers could penetrate 28.63% of Malaysian paddy fields, it could increase our SSL to 71.81% with an increased revenue of RM 1.73 billion. Based on our study, we expect that the total nanotechnology market size in food and agriculture to reach RM 1.31 billion in 2025

Food and Agriculture

Two main types of agriculture dominate this sector in Malaysia – plantation and food production. Traditionally, plantation agriculture formed the main thrust of Malaysia's economic growth and still remains one of the major contributors to GNI.

In 2017, the agriculture sector contributed RM96.0 billion, or an equivalent of 8.2%, to Gross Domestic Product (GDP). Of this, oil palm was the largest contributor at 46.6%, followed by other agriculture at 18.6%, livestock at 11.4%, fishing at 10.5%, rubber at 7.3%, and forestry and logging at 5.6%[4].

While our plantation production capacities, especially in oil palm exports, remain strong, our food production capacities lag behind our neighbours.

Taking into consideration the increasing prevalence of the occurrence of natural disasters such as earthquakes, tsunamis, storms and droughts which are impacting the planet's ecosystem, food security has become a pressing issue in current times.

Nanobiotechnology could potentially play a critical role in increasing agricultural productivity, boost pest resistance, and improving food quality. The application of nanobiotechnology to agricultural food production can help avert major food crises globally.

NANOMALAYSIA PROGRAMMES SECTORS

Energy And Environment

Malaysia is blessed with an abundance of natural energy sources such as solar energy, biomass from plantation agricultural by-products, petroleum and natural gas reserves, as well as tidal wave and wind energy. In line with the need to combat the effects of climate change, the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) has committed to a national target of achieving 20% in renewable energy as the nation's electricity source by 2030.

To achieve this goal, we need to consider innovative new ways to transfer energy from its source to consumers in the most cost-effective, safe and convenient means. The focus is on generating a higher degree of portability, longer usage periods, higher energy outputs and more sustainable sources of energy supply.

With conventional technology having reached the limits of its energy processing and storage capacity, we are now turning to nanotechnology to boost energy capacities and optimise processes. Nanotechnology can be used to enhance energy efficiency across the board, by embedding state of the art technological solutions to optimise energy production. Using nanotechnology also presents a greener and more sustainable energy solution for the longer term.

Malaysian Nanotechnology Market Size

The Malaysian trade performance for energy and environment was valued at RM 16.33 billion in 2019 where 66.7% (RM16.82 billion) are imported goods. Batteries constitute RM 2.718 billion in 2019. Based on a report by Sustainable Energy Development Authority (SEDA), The total approved Net Energy Energy Meeting (NEM) Programme quota stands at 108MW, where a large portion of it comes from the industry (75.01MW). Nanotechnology plays an important part in Energy and Environment due to its application in supercapacitors, fuel cells, solar cells and lithium-ion batteries. It is expected that the nanotechnology market size in energy and environment will reach RM 2.1 billion in 2025.

4. Source : Department of Statistics Malaysia, published on 31 December 2018
5. Source : 25th Productivity Report 2017/2018, published by Malaysia Productivity Corporation in 2018

NANOMALAYSIA PROGRAMMES SECTORS

Malaysian Nanotechnology Market Size

The Malaysian health and wellness trade performance was valued at RM 39.9 billion in 2019 where imports and exports are balanced. A large portion of the total trade came from medical instruments and devices with a total trade value of RM11.4 billion. Pharmaceutical products manufacturer employs 21,320 pad employees in 2019 and is expected to increase due to the demand during COVID-19 pandemic where the number of employees have increased to 23,413 in May 2020. Through nanotechnology, health and wellness products can be enhanced such as the use of nanosilver to provide anti-bacterial properties, the use of nanoparticles in drug delivery system, use of nanoparticles in medical imaging and the use of graphenes to enhance sensitivity of sensors especially in glucometers. The total addressable market for nanotechnology application in health and wellness is expected to reach RM 1.93 billion in 2025.

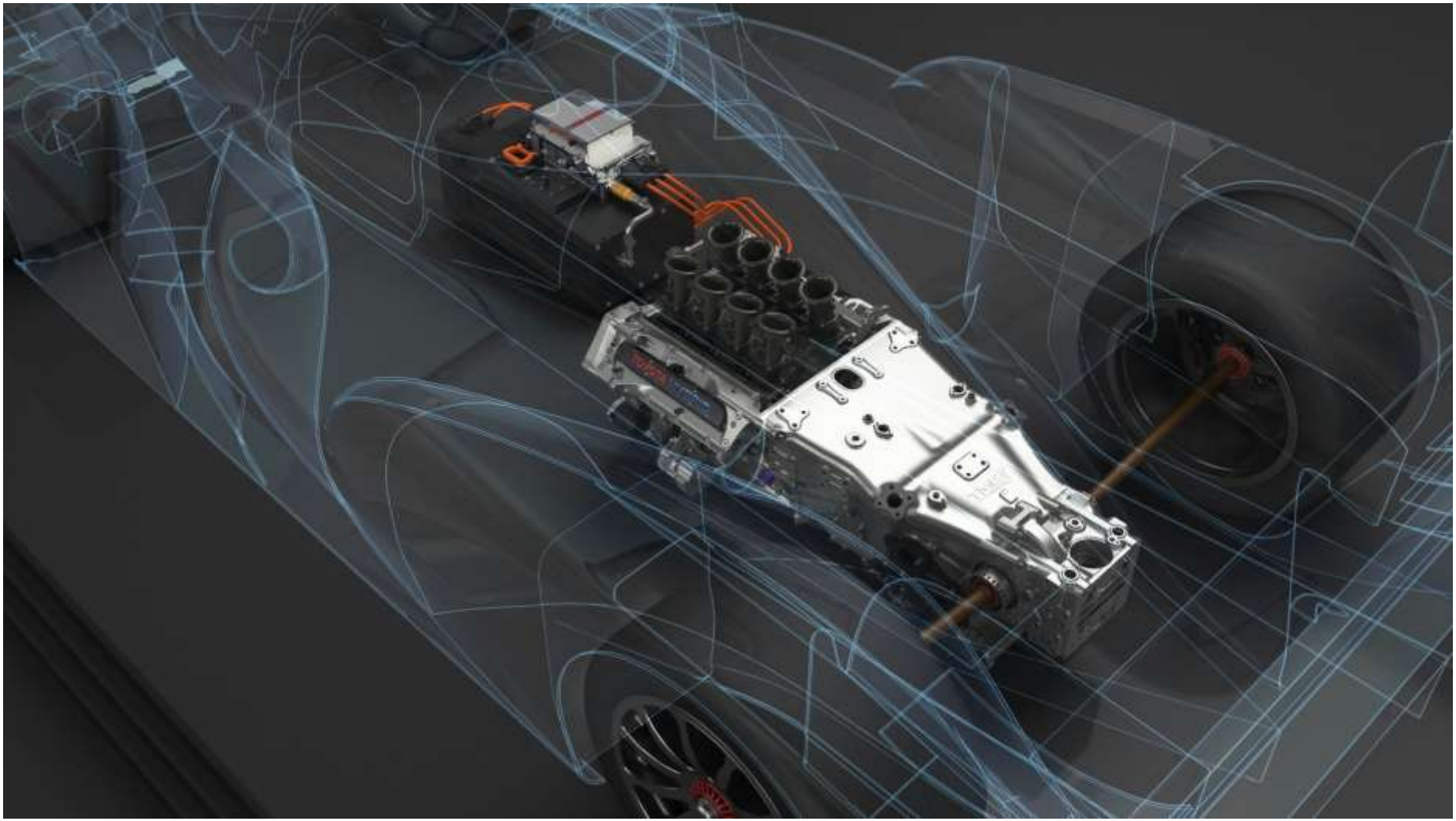
Wellness, Medical and Healthcare

In recent years, the wellness, medical and healthcare sector in Malaysia has been one of the most dynamic, recording rapid growth and development, especially within the private healthcare sub-sector. Due to extensive Government support in terms of investment in hospital medical infrastructure, the sector has significantly improved over the past decade. Malaysia's healthcare sector today is on par with developed nations, with highly trained and skilled medical staff, complemented by excellent hospital facilities.

Malaysia's healthcare sector has received international recognition as being among the best in the world, thus creating global awareness of our healthcare system's strengths. In 2019, Malaysia was ranked first in the Best Healthcare in the World category of the 2019 International Living Annual Global Retirement Index. The previous year, in 2018, the International Medical Travel Journal recognised Malaysia as the Medical Tourism Destination of the Year, the third time it had done so. Consequently, healthcare tourism is booming, with over 920,000 medical tourists arriving in Malaysia for the year 2017/2018, leading to a medical tourism sub-sector value of RM7.4 billion in 2017[5].

Healthcare delivery is transforming on the back of digital healthcare trends as a result of Industry 4.0 applications. The digital healthcare market is estimated to exceed USD379 billion by 2024. Recognising its tremendous growth potential, the Malaysian Government has identified healthcare equipment as one of the focus sectors of the National Policy on Industry 4.0. A clear way forward lies in leveraging on breakthrough nanotechnology products and solutions, especially within areas such as drug delivery systems and anti-cancer treatment.

NATIONAL GRAPHENE ACTION PLAN



NATIONAL GRAPHENE ACTION PLAN

NANOMALAYSIA

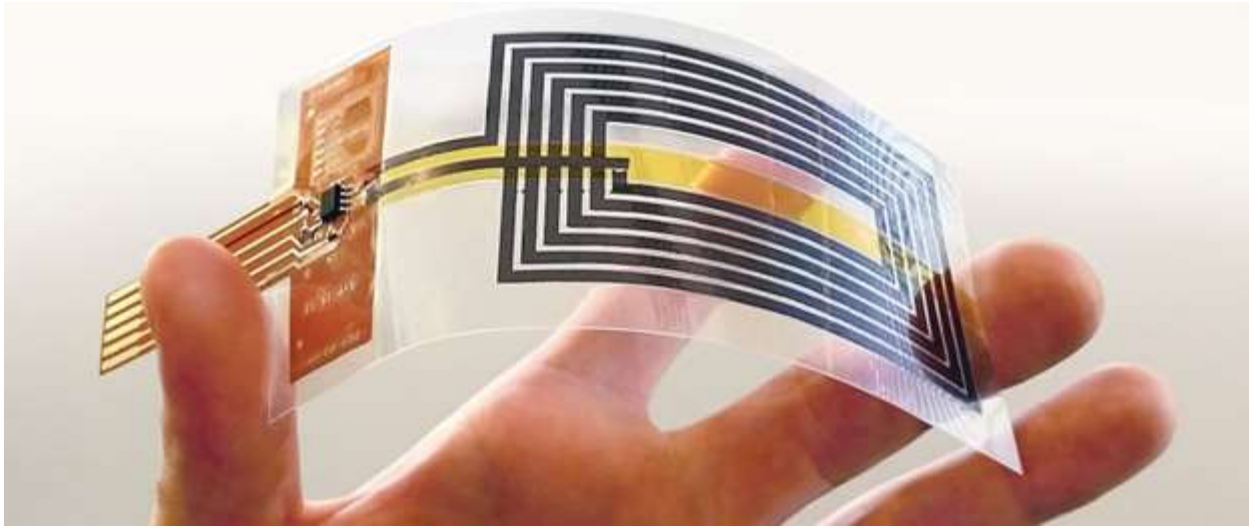
Role in effecting National Graphene Action Plan

- Awareness Building
- Project Execution
- Scale-up Support
- Cordination and Monitoring

Referred to as the "wonder material" of the 21st century, graphene is a carbon-based material which is the strongest known material currently. It consists of a lightweight honeycomb sheet of carbon atoms, is almost transparent and flexible, yet highly conductive to heat and electricity. Its properties make it an attractive proposition for nanotechnology applications.

To make the most of the value of graphene, the National Graphene Action Plan 2020 (NGAP2020) was initiated in July 2014. NGAP2020 is a commercialisation programme which focuses on graphene applications and high value-add graphene enabled manufacturing processes with IPs in five key application areas. The end goal is to enable a local graphene ecosystem to accelerate downstream adoption within Malaysian industries. By 2020, NGAP2020 is estimated to contribute more than RM20 billion in GNI, and add create a further 9,000 jobs.

Within the short-term future, we plan to extend our collaborations under the NGAP2020 to radio frequency (RF) electronics, rubber additives and conductive ink applications, by helping companies pilot their production lines for these nano products and applications.



WHAT WE DO

1. Building Awareness

As graphene is a relatively new and unknown material, and the nanotechnology industry is in its infancy in Malaysia, creating awareness within the greater ecosystem on the benefits of the commercialisation of graphene nanoproducts is critical to drive sectoral expansion and growth. Most Malaysian SMEs remain unaware of the vast potential graphene holds, and how to leverage on product development within specific niches with tremendous potential.

As the lead agency implementing NGAP2020, one of NanoMalaysia's key roles is to conduct continuous outreach efforts with SMEs, in order to generate greater awareness and understanding on graphene's potential applications. We have also been facilitating partnerships and collaborations between various stakeholders in the ecosystem. These include promoting synergies between industry and academic, and between upstream and downstream producers.

Six Application Areas

2. Project Execution

NanoMalaysia's focus on effectively executing projects identified with high growth potential has resulted in quantifiable outcomes which support our progress in this space. Our services are related to assisting companies in the later stages of R&D and prototyping projects, to support companies, partnerships and joint ventures that explore potential graphene enabled applications.

Under National Graphene Action Plan (NGAP) 2020, we have been focusing on 5 focus areas which are Lithium-ion battery anodes / ultracapacitors, Conductive Inks, Rubber Additives, Plastics Additives and Nanofluids. Up until now, the number of projects that have been executed under these focus areas are:

- Lithium-ion battery anodes / ultracapacitors : 7 projects
- Conductive Inks: 6 projects
- Rubber Additives : 8 Projects
- Plastics Additives : 9 Projects
- Nanofluids : 9 Projects

From 2016 until 2019, there were 29 completed projects and 15 ongoing projects under NGAP facilitations. This year we have extended our focus area to others (e.g: Sensors, Radio Frequency (RF), Lasers, etc.). There were 1 completed project and 4 ongoing projects under this area.

Commercialized product as at end of 2019:

- Penchem Technologies Sdn Bhd
- MNA-Research Sdn Bhd
- Scomi Chemicals Sdn Bhd

WHAT WE DO

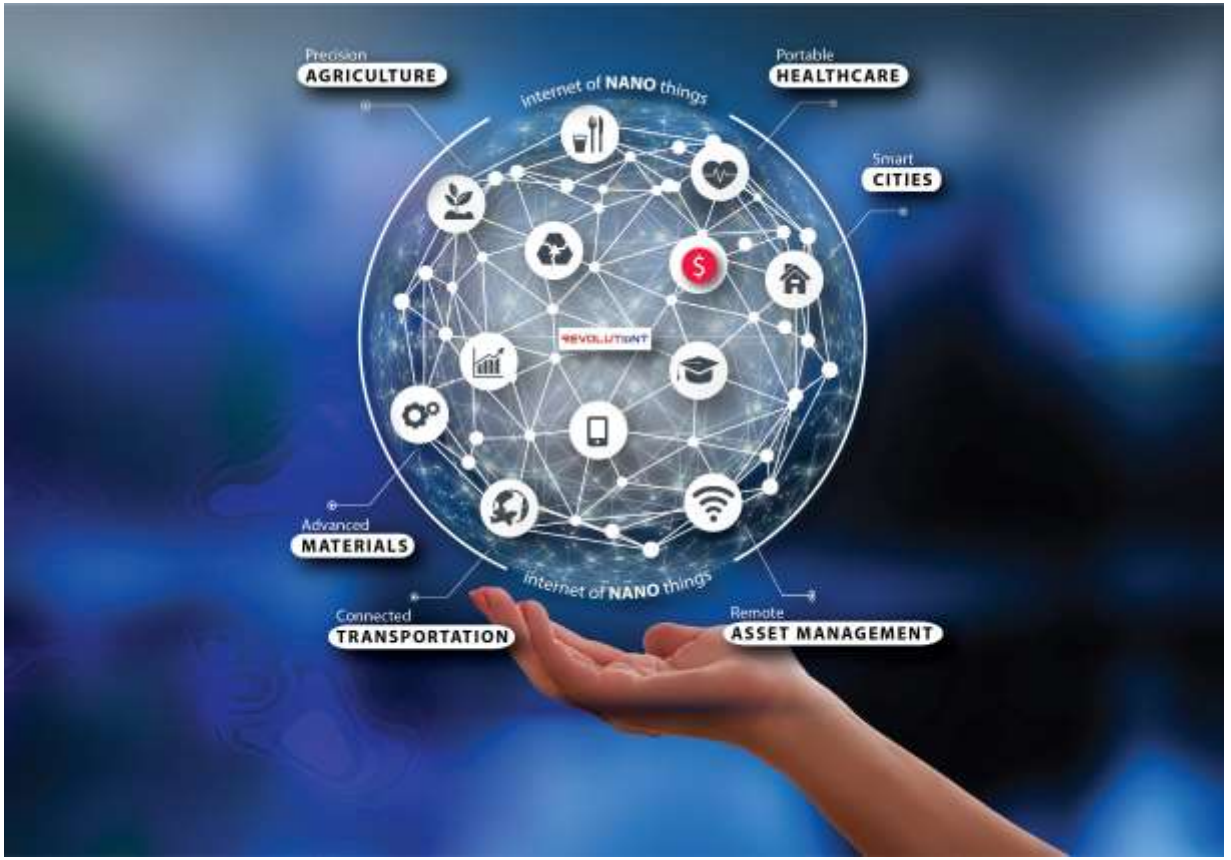
3. Scale Up Support

NanoMalaysia's role in providing scale-up support comes into effect at the product commercialisation stage. We provide companies identified with the support they require to build up production scale facilities. NanoMalaysia also facilitates synergistic partnerships between relevant Government agencies and industry players, whereby business entities are able to access available resources, tax incentives and Entry Point Projects to support them in the scale-up.

4. Coordination & Monitoring

NanoMalaysia is responsible for tracking and monitoring the progress and development of each of the five application areas identified. This process is done by diligently tracking the progress of the project, especially when public funds are utilised for R&D and scale-up purposes. We also look into the potential impacts of the project, especially in terms of GNI contribution, investments and job creation.

NATIONAL GRAPHENE ACTION PLAN



WHAT WE DO

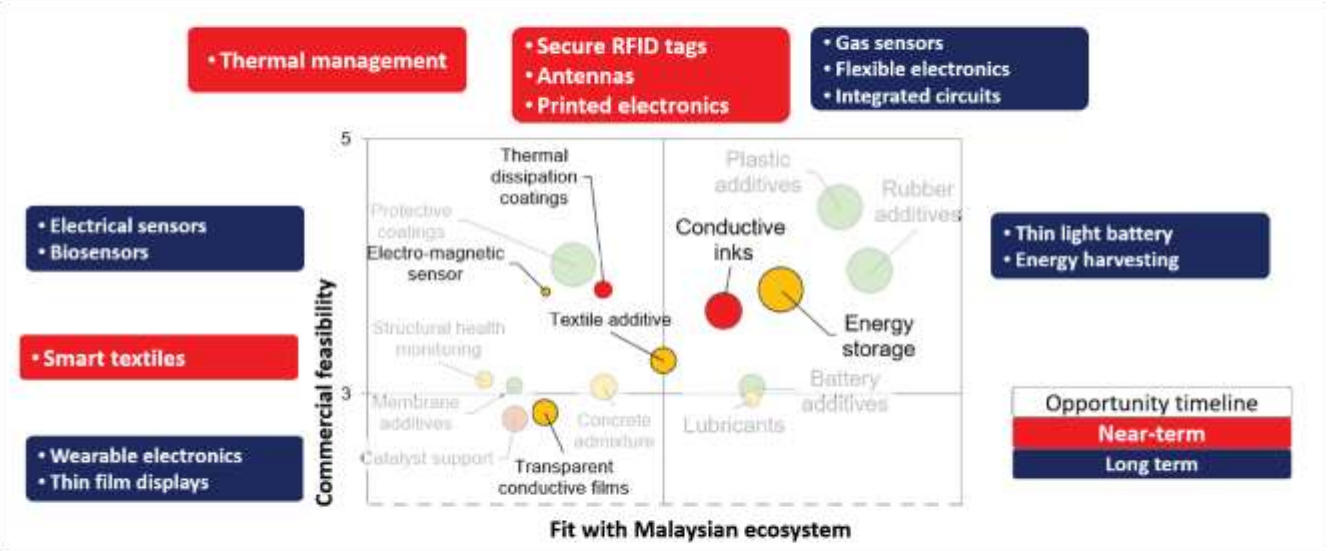
National Graphene Action Plan 2020 Review

In March 2018, NanoMalaysia appointed LuxResearch to conduct a mid-term review of our progress on NGAP2020. By analyzing the global graphene market landscape, Lux found that graphene had faced considerable hype, and that commercialisation has been much more challenging than expected. Lux identified 30 proposed graphene applications, and the top five applications critical to drive economic growth through graphene innovation. Lux analysed the commercial feasibility of these applications, and its fit with Malaysia's public and private ecosystem.
As a result of the review, Lux confirmed the following national priorities with regards to NGAP2020 applications:

- Plastic additives, especially in composites, have a strong developer community, and fit with Malaysia's aerospace composite expertise
- Rubber additives can enhance performance in particular for higher-value rubber products, which is a key strategic priority for Malaysia
- Energy storage is a large, longer-term opportunity, which aligns well with Malaysia's strong road and rail transportation industries
- Conductive inks for high-value devices give strong inroads to IoT
- Lubricants connects with Malaysia's strong local oil and gas industry

The review also found that Malaysia is well positioned to build graphene manufacturing capability and to capitalise on graphene's recent commercial uptick. Graphene's biggest commercial bottlenecks are manufacturing challenges. The review recommended that NanoMalaysia focus our near-term efforts on solidifying Malaysia's position in the graphene value chain by targeting applications with clear commercial feasibility and strong fit with the Malaysian ecosystem. With effective the NGAP2020 execution, Malaysia had the capacity to build critical expertise needed in global graphene supply chain management and quality control.
Graphene offers multiple inroads to building differentiated applications in consumer and industrial IoT markets, yet these applications are critically dependent on high graphene quality and cost-reductions. By building a strong supplier network for high-quality graphene and developing expertise in handling and manufacturing graphene, Malaysia is well-positioned to capitalise on IoT.

Graphene gives Malaysia multiple avenues to develop use cases in IoT and 4 IR



COMMERCIALISATION HIGHLIGHTS

LITHIUM-ION BATTERY ANODES / ULTRACAPACITORS
COMPANY: MNA RESEARCH SDN BHD

Recent developments in the field of energy storage materials are paving the way towards more sustainable solutions to overcome challenges related to energy density and storage. The ever increasing demand for next generation portable and miniaturised electronic devices has resulted in greater efforts expended in exploring nanoscale and lightweight energy storage devices. Under the NGAP2020 initiative, NanoMalaysia is supporting MNA Research Sdn Bhd in its development of a graphene based quantum cell, My Power Pack. My Power Pack can be used as a backup storage application, and is aligned with the Malaysian Government's policy on renewable and efficient energy systems.

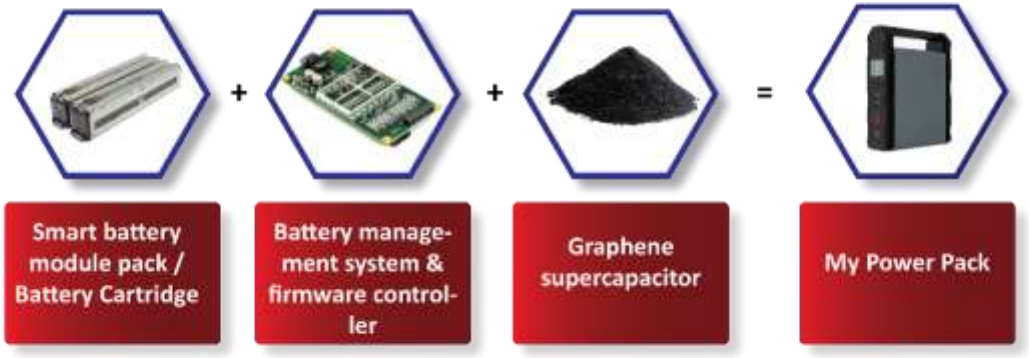
Compared to conventional solutions used for solar, telco tower and emergency power supply applications, My Power Pack provides a more energy efficient and environmental friendly means of power supply. It is long lasting and can withstand extreme temperatures, both features which make is an attractive product.

Company:

- MNA Research Sdn Bhd

Production of Backup Storage Graphene-Based Quantum Cell (BSGQC)

Benefits:
- Fast charging
- High capacity energy storage for off-grid infrastructures



COMPONENTS OF MY POWER PACK

COMMERCIALISATION HIGHLIGHTS

CONDUCTIVE INKS
COMPANY: PENCHEM TECHNOLOGIES SDN BHD

Penchem Technologies Sdn Bhd designs, manufactures and supplies advanced polymers and composite materials to the electronic and medical industries. The company's current business focus is on LEDs in the form of epoxy and silicone encapsulants, and thermal interface materials (TIM); fiber optics in terms of ultraviolet (UV) and heat curable adhesives; and photovoltaics in the form of silicone coatings and conductive interconnects.

NanoMalaysia has assisted Penchem under the auspices of the NGAP2020 initiative to successfully develop graphene-based conductive inks for flexible circuits.

Company:

- Penchem Technologies Sdn. Bhd

Graphene-based conductive inks for printed circuit board

Benefits:

- Graphene-based conductive i ink reduces resistance by a factor of 10 – enablin energy efficient circuitry and devices

APPLICATION FOR GRAPHENE-BASED CONDUCTIVE INKS

COMMERCIALISATION HIGHLIGHTS

NANOFLUIDS
COMPANY: SCOMI CHEMICALS SDN BHD

Scomi Chemicals Sdn Bhd is involved in the processing, distributing, and trading in chemical products like inhibitors and demulsifier chemicals, and oil and gas production chemicals. Under the NGAP2020 initiative, NanoMalaysia was been working with Scomi Chemicals to develop a graphene enhanced transformer oil for the power generation industry.

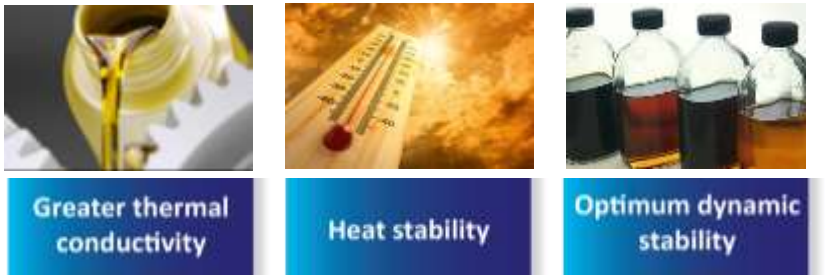
Utilising the technology, graphene will be dispersed in the transformer oil at certain loading parameters to produce additive for lubricants.

Company:

- Scomi Chemicals Sdn Bhd

Graphene-based lubricant additive for automotive

Benefits:
Reduced engine friction improves fuel efficiency and lowers emissions



BENEFITS OF GRAPHENE ENHANCED TRANSFORMER OIL

NEW COMPLETED PROJECTS UNDER NATIONAL GRAPHENE ACTION PLAN

APPLICATIONS	COMPANIES		PROJECT AND PRODUCT DESCRIPTION	BENEFITS
 Rubber Additives	**B2B Rubber Industries Sdn Bhd**		Graphene-enhanced Green Solid rubber for forklift tires	• Superior rolling, abrasion and thermal resistance
	Bonric Sdn Bhd		Graphene-based nitrile glove for cleanroom application	• Thin, tear-proof, high elasticity of gloves and reduced electrostatic
 NanoFluids	**MY Synergy Factors Sdn Bhd**		Graphene-based fluid loss control additive for drilling fluids	• Enhance and stabilise rheology properties of product • Decrease the amount of fluid loss
	Blue Snow Engineering Sdn Bhd		Graphene nanofluids to enhance the energy efficiency of commercial and industrial liquid based cooling systems	• Enhance thermal properties & reduce energy consumption
	DNA Petrochem		Graphene-enhanced engine oil for automotive	• Improves thermal conductivity properties in engine

NEW COMPLETED PROJECTS UNDER NATIONAL GRAPHENE ACTION PLAN

APPLICATIONS	COMPANIES		PROJECT AND PRODUCT DESCRIPTION	BENEFITS
 Plastics Additives	**Ominent Sdn Bhd**		Graphene-based coating for automotive application	• Lower corrosion rate, improved anti fouling, anti scratching and abrasion resistance
	Metro Koats Technology		Graphene-based absorbent spill kit for oil spill application	• Increase absorption capacity of the absorbent and its reusability
 Others	**Preston GeoCEM Sdn Bhd**		Portable graphene-based Escherichia Coli (E-Coli) sensor for water quality measurement	• Compact, in-situ detection, cost effective, light weight and user friendly
	Enhance Track Sdn Bhd		Graphene-based wireless radio frequency (RF) mobile phone charger	• Non-inductive mobile phone charging • Long range charging
	InLAZER Dynamics Sdn Bhd		Graphene-based saturable absorber (SA) for ultrashot pulse fiber lasers	• Flexible wavelength operation and high laser performance

Malaysia has the right elements in place to develop a graphene-enhanced composites center of excellence

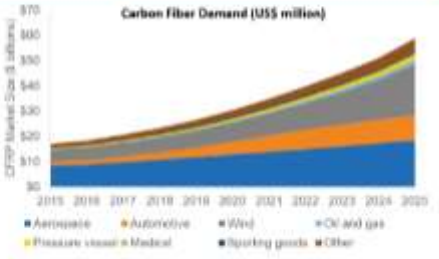
	GNI impact	Job creation	Malaysia's government role
Plastic additives	RM 1,450 million	650 jobs	Attract graphene developers targeting aerospace composites

Hexcel, Boeing expand Aerospace Composites Malaysia facility

Composites World, November 2015

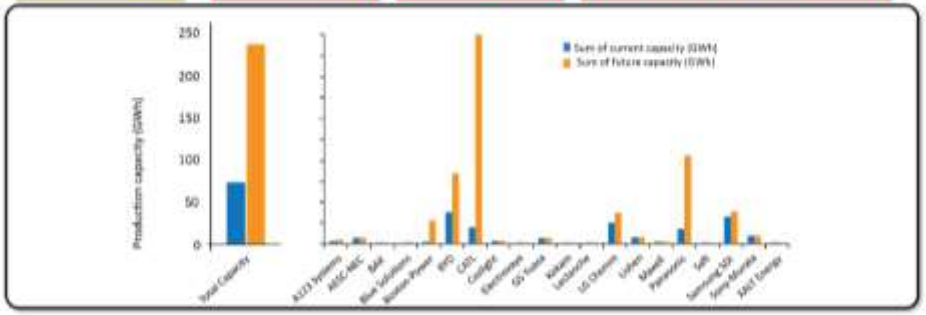
Spirit AeroSystems to expand Malaysia Facility, Hire Additional Workers

Aviation Week, June 2017



Within a rapidly growing battery market, Malaysia can drive graphene development by incentivising the local market

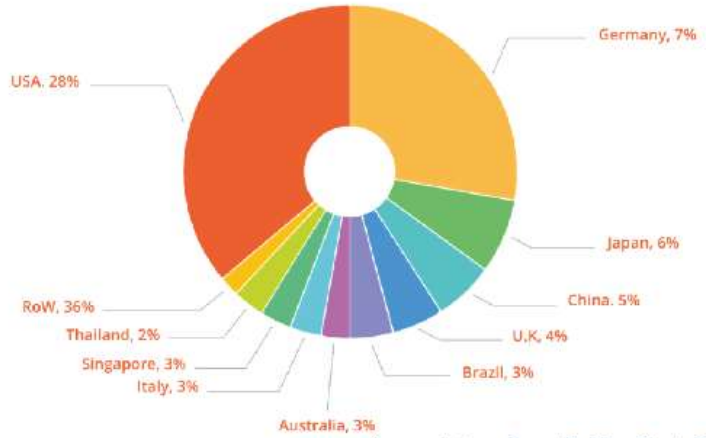
	GNI impact	Job creation	Malaysia's government role
Energy storage	RM 150 million	100 jobs	Drive adoption by incentivising local energy storage market



Malaysia's focus on higher-value rubber products is very well aligned with the performance benefits of graphene

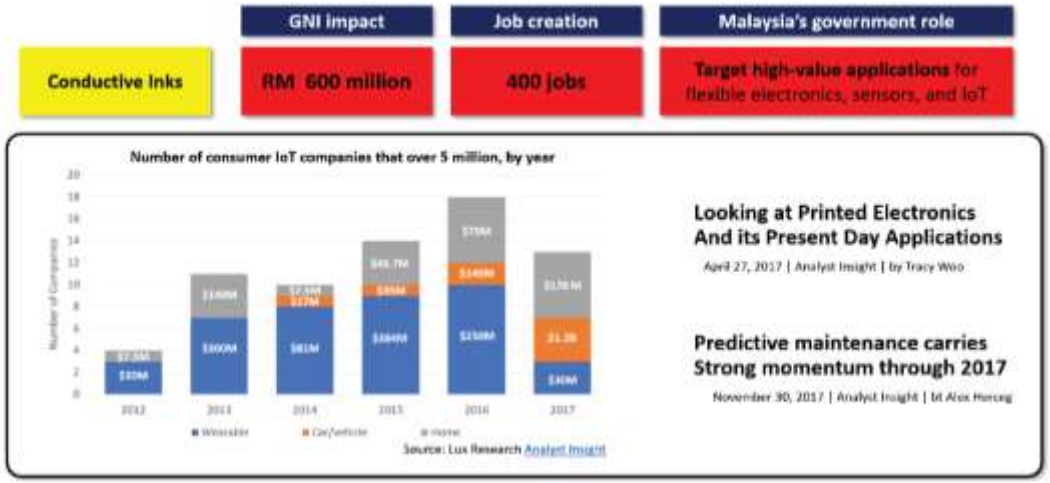
	GNI impact	Job creation	Malaysia's government role
Rubber Additives	RM 2900 million	2000 jobs	Connect industry to **high-quality graphene master-batch** supply

Battery production capacity: current and announced for 2020

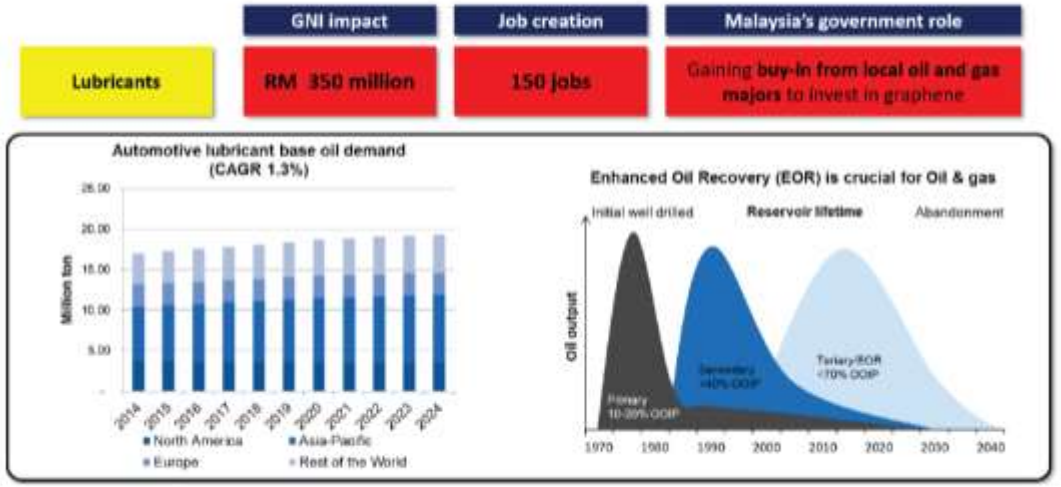


Source: International Rubber Study Group

Higher-value conductive ink applications opens the door for Malaysia's to capitalise on IoT market growth



Graphene-enhanced lubricants can offer Malaysia's O&G sector a differentiated advantage in a competitive market



By 2020, Malaysia can add RM 5,450 million to GNI and create 3,300 Malaysian jobs with potential to grow further onwards to 2025

	GNI Impact	Job creation	Malaysia's government role
 Lithium-ion Battery & Ultracapacitors	RM 1,450 million	650 jobs	Attract graphene developers targeting aerospace composites
 Rubber Additives	RM 2,900 million	2000 jobs	Connect industry to high-quality graphene master-batch supply
 NanoFluids	RM 150 million	100 jobs	Drive adoption by incentivizing local energy storage market
 Conductive Inks	RM 600 million	400 jobs	Target high-value applications for flexible electronics, sensors, and IoT
 Plastics Additives	RM 350 million	150 jobs	Gaining buy-in from local oil and gas majors to invest in graphene

iNanovation™

iNanovation is NanoMalaysia's flagship SME programme which provides enterprises and start-up companies in the nanotechnology space with the support they require to grow their business. These include mechanisms to ensure SMEs are able to establish market share through the introduction of new processes or materials, and to successfully effect a shift from current conventional processes, to cutting edge nanotechnology enabled operations.

The iNanovation platform comprises of three key verticals, namely, iNanovation Push, iNanovation Pull and iNanovation Switch. Each of these verticals provide facilitation schemes to assist SMEs and start-ups expand their business presence in the nanotechnology industry. These include the provision of venture funds and soft loans, business partnership, and technology expertise and support.

Our focused support of businesses within the nanotechnology space is conducted via our investments and equity stake holding. Deliverables obtained from the projects we spearhead, along with the profits earned from our joint ventures are fed back into iNanovation. This ensures that we have a virtuous cycle of funds and expertise which we can avail of to further invest in new nanotechnology ventures. Our approach ensures that we are able to stay ahead of the curve in the Malaysian nanotechnology scene.

iNanovation™

iNANOVATION ACHIEVEMENTS AS AT END 2019 IN THE E&E AND FOOD, AGRICULTURE SECTOR

Company	Nanotechnology Products	Application	Advantages
Nanoverify Sdn Bhd	Products related to National Pharmaceutical Regulatory Association (NPRA) and HALAL databases	For products in the HALAL and NPRA database to be verified and prevent false nanotechnology elements claim	- Verification of nano-elements existence in commercial products - Prevents false claim in nanotechnology based products.

iNANOVATION ACHIEVEMENTS AS AT END 2019 IN THE ENERGY AND ENVIRONMENT SECTOR

Company	Nanotechnology Products	Application	Advantages
Nano Commerce Sdn. Bhd	Fuel Cell Kit with Nanotechnology-based Proton Exchange Membrane (PEM).	1. Battery - Energy Storage. 2. Electrical & Electronic Circuit Board.	Accelerate the flow of electrical charges through nanocellulose based PEM which is robust and green.
Pulsar UAV Sdn. Bhd.	A high endurance drone powered by a fuel cell with onboard hydrogen generation system	• Precision farming services via UAV landscaping for fertilizer dispersion with organic plant nano-enhancer	- Long hours of flight mapping purposes - Lighter in mass - On-board hydrogen generator can solve the hydrogen infrastructure issues
Nanoverify Sdn Bhd	Products related to National Pharmaceutical Regulatory Association (NPRA) and HALAL databases	• For products in the HALAL and NPRA database to be verified and prevent false nanotechnology elements claim	- Verification of nano-elements existence in commercial products - Prevents false claim in nanotechnology based products.

iNANOVATION ACHIEVEMENTS AS AT END 2019 IN THE WELLNESS, MEDICAL AND HEALTHCARE SECTOR

Company	Nanotechnology Products	Application	Advantages
Farmasia Sdn. Bhd.	Chitosan-CNC Composite Gel	Wound healing and care	Effective wound care product that shorten wound healing duration.
Puspamara Sdn. Bhd.	Nanotechnology functionalised apparel	Textile Industry in sectors below:- • Hygienic clothing • Military clothing • Sports attire	- Reduce the medical and hygiene issue related to bacteria and fungi growth. - Antibacterial and odor resistance
Nanoverify Sdn Bhd	Products related to National Pharmaceutical Regulatory Association (NPRA) and HALAL databases	For products in the HALAL and NPRA database to be verified and prevent false nanotechnology elements claim	- Verification of nano-elements existence in commercial products - Prevents false claim in nanotechnology based products.

INTELLECTUAL PROPERTIES

INTELLECTUAL PROPERTIES

NANOTECHNOLOGY AND INTELLECTUAL PROPERTY

Among the emerging technologies, nanotechnology is one of the most prominent examples and it raises high expectations in a wide range of areas affecting daily life. Nanotechnology is a science which operates at an extremely small scale, as it uses the size of a so-called nanoscale, which is approximately between 1 and 100 nanometres, or 1 to 100 billionths of a meter. There are two main ways of applying nanotechnology so far: one is the top-down approach, whereby structures are made smaller and smaller until they reach a nanometric scale. The other approach is the bottom-up approach, by which elements at the nanoscale are chosen and assembled to form some sort of matter or mechanism. This way of manipulating matter at the atomic level obviously bears the potential of enormous developments.

While commercialization of nanotechnology products so far has been relatively modest, recent and current research activities allow to forecast extraordinary results for the benefit of humankind in a foreseeable future. While inventions in the field of nanotechnology would, as a general rule, appear to qualify for patent protection, subject to the fulfilment of the relevant conditions of patentability, there are a number of issues that may need further consideration, including the granted claims are overly broad, due at least in part to a lack of available prior art, which could allow patent holders to lock up huge areas of technology. In this context, there is also a perceived risk of overlapping patents.

Nanotechnology advancements and trends are impacting the way Intellectual Property (IP) is defined and administered. Questions relating to how to classify these new technologies, and how to protect a company's interest in nanotechnology inventions are among the issues which weigh the most heavily on the minds of industry players. Within a relatively new nanotechnology industry, the commercialisation of nanotechnology products have remained relatively modest. However, future potential in terms of applications and business growth, have resulted in increasing number of patent protection applications for nanotechnology enabled products.

PATENTS

Patents are applicable to new inventions that solve a specific problem in any field of technology or industry. To protect against competitors exploiting an individual or business' work product, it is prudent to have the invention patented. In order to qualify for a patent, Section 11 of the Patents Act 1983 provides that an invention is patentable if it is new, involves an inventive step and is industrially applicable.

UTILITY INNOVATIONS

Utility Innovations protect new technical inventions by granting an exclusive right to prevent others from commercially exploiting the protected inventions without consents. In particular, Utility Innovations protect inventions that make small improvements to, and adaptations of, existing products or that have a short commercial life. The requirement to obtain protection is less stringent than patent protection, as the need of inventive step is omitted.

TRADE SECRETS

A trade secret is information that includes a formula, pattern, compilation, program, device, method, technique or process. It must be used in business, and gives an opportunity to obtain an economic advantage over competitors who do not know or use it. As it is information that is not known to the public, the owner of a trade secret can undertake reasonable efforts to maintain secrecy.

COPYRIGHT

Copyright is something we see in our lives each day, such as books and works of art. Authors of works covered by copyright have rights over their literary and artistic works. This extends only to expressions, and not to ideas, procedures, methods of operation or mathematical concepts.

TRADEMARKS

A trademark is registered to protect a brand, a name of a product or a service. Registration of a trademark gives an exclusive right to the use of the registered trademark by its owner or licensed to another party.

INTELLECTUAL PROPERTY

Capitalising Intellectual Property

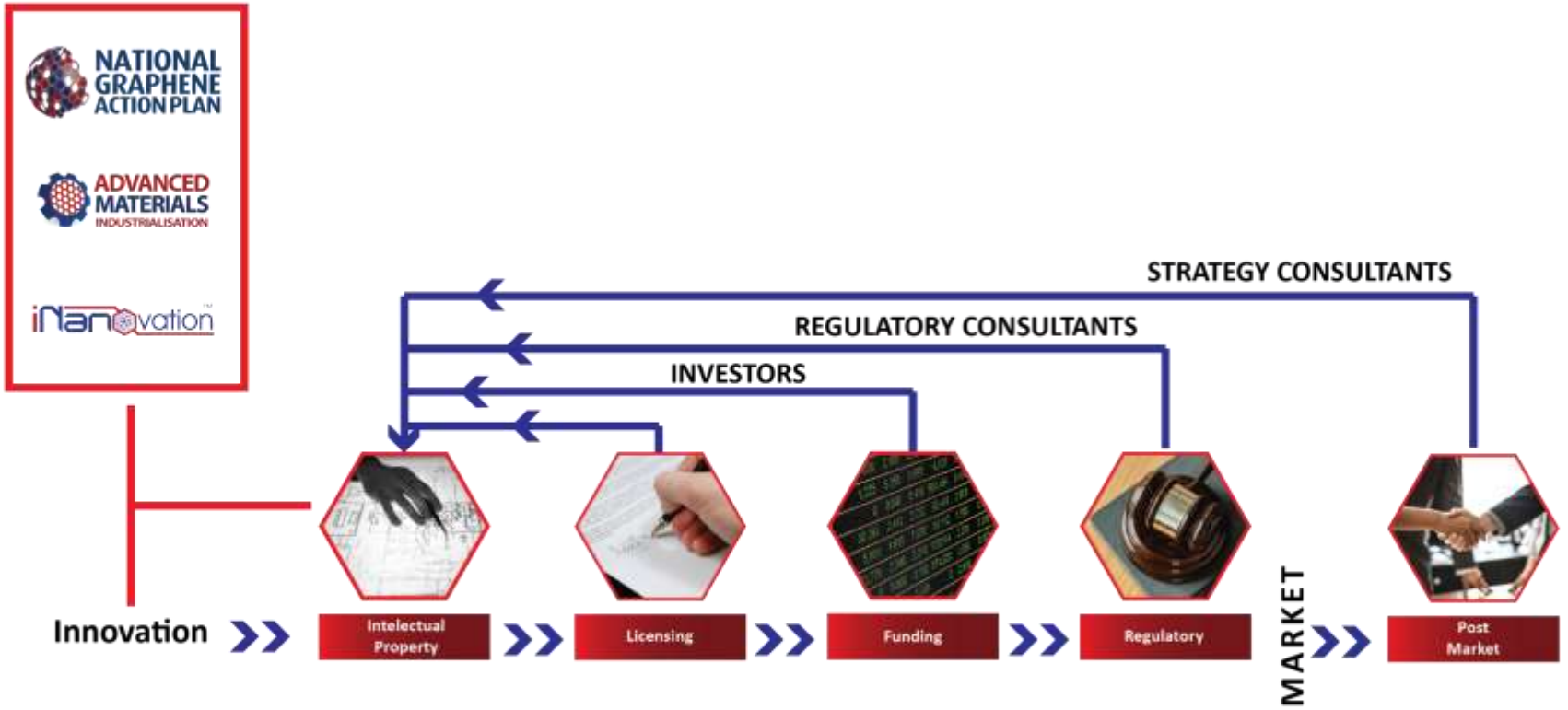
Essentially, nanotechnology centres on the capitalisation of IP. Nanotechnology products or processes which have IP can be developed or further commercialised for future projects, enabling continuous cycles of licensing, funding, market penetration and market expansion.

IP Achievements As At End 2018

7 Patents

1 Utility Innovation

4 Copyrights



INDUSTRY PARTNERS

BUSINESS PARTNERS

TECHNOLOGY COLLABORATORS (RESEARCH INSTITUTES & RESEARCH UNIVERSITIES)

MONETISING NANOTECHNOLOGY

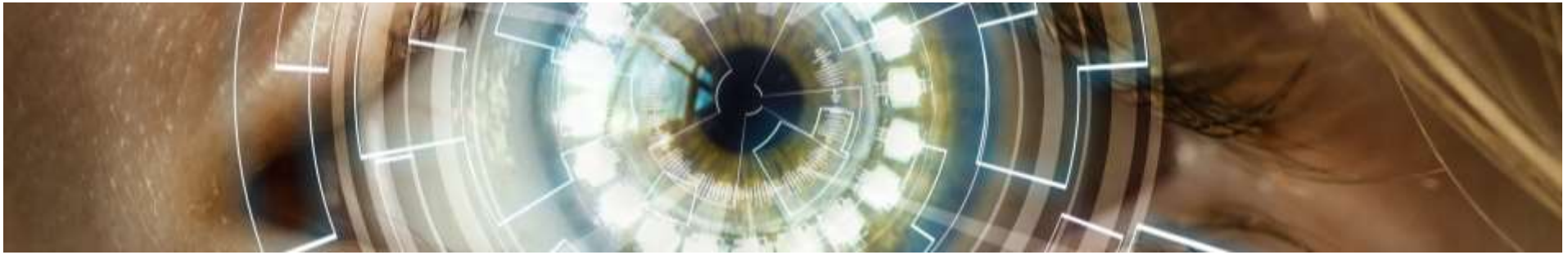
5

OUR BUSINESS OBJECTIVES

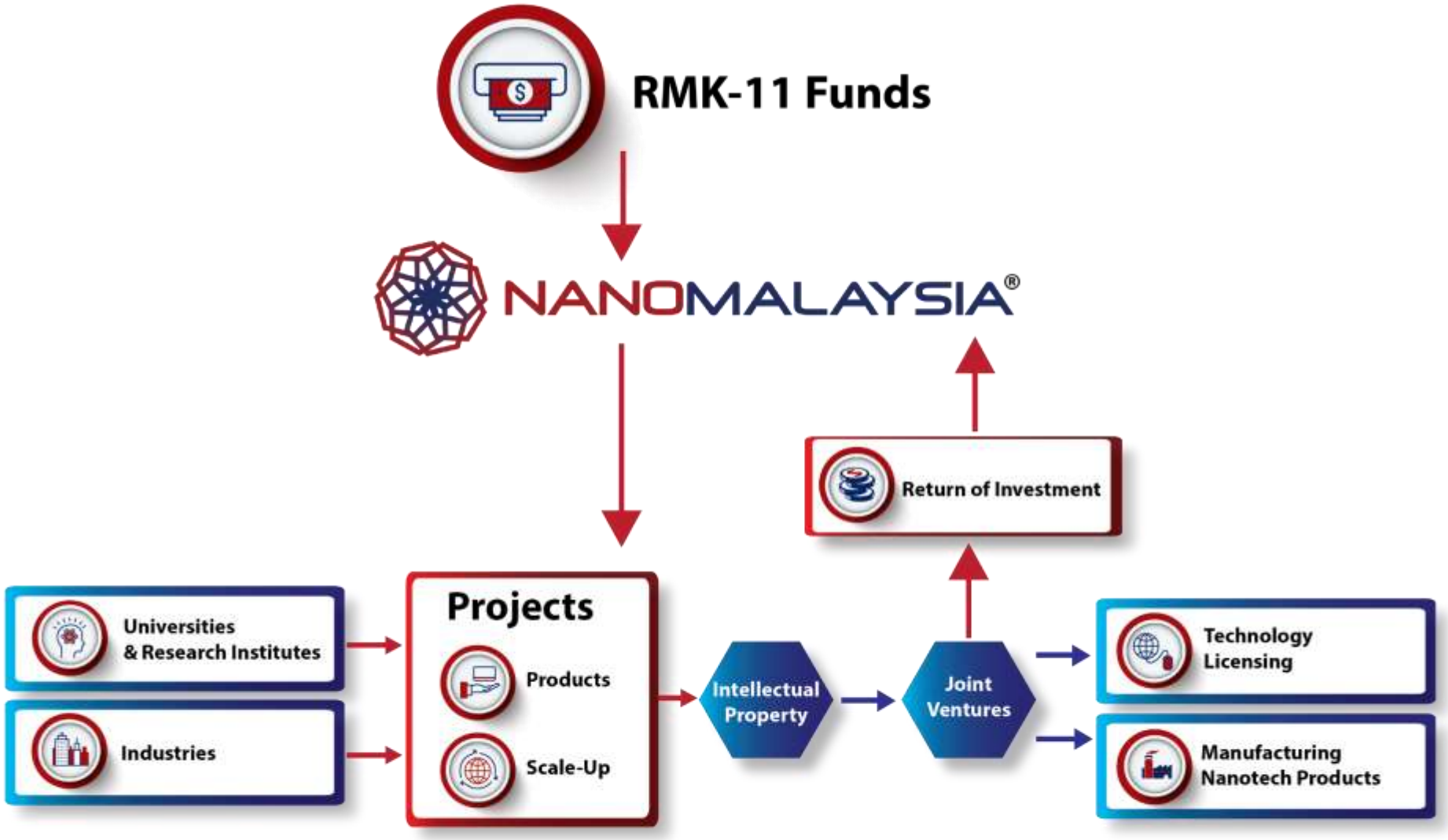
*Note : Based on NanoMalaysia Berhad's Memorandum of Association

Our six core business areas are focused on generating long-term sustainable growth within the four key strategic Jumpstart sectors identified as providing the greatest potential for value creation and profitability.

We actualise our strategic intent through the business activities we conduct throughout the year. In order to ensure that we are able to maximise value creation and generate outcomes which are aligned with our objectives, we have in place a comprehensive and structured project management workflow process. Our disciplined commitment to remain on course with executing our strategy through our comprehensive business model has contributed towards our robust business fundamentals and the long-term resilience of our business.



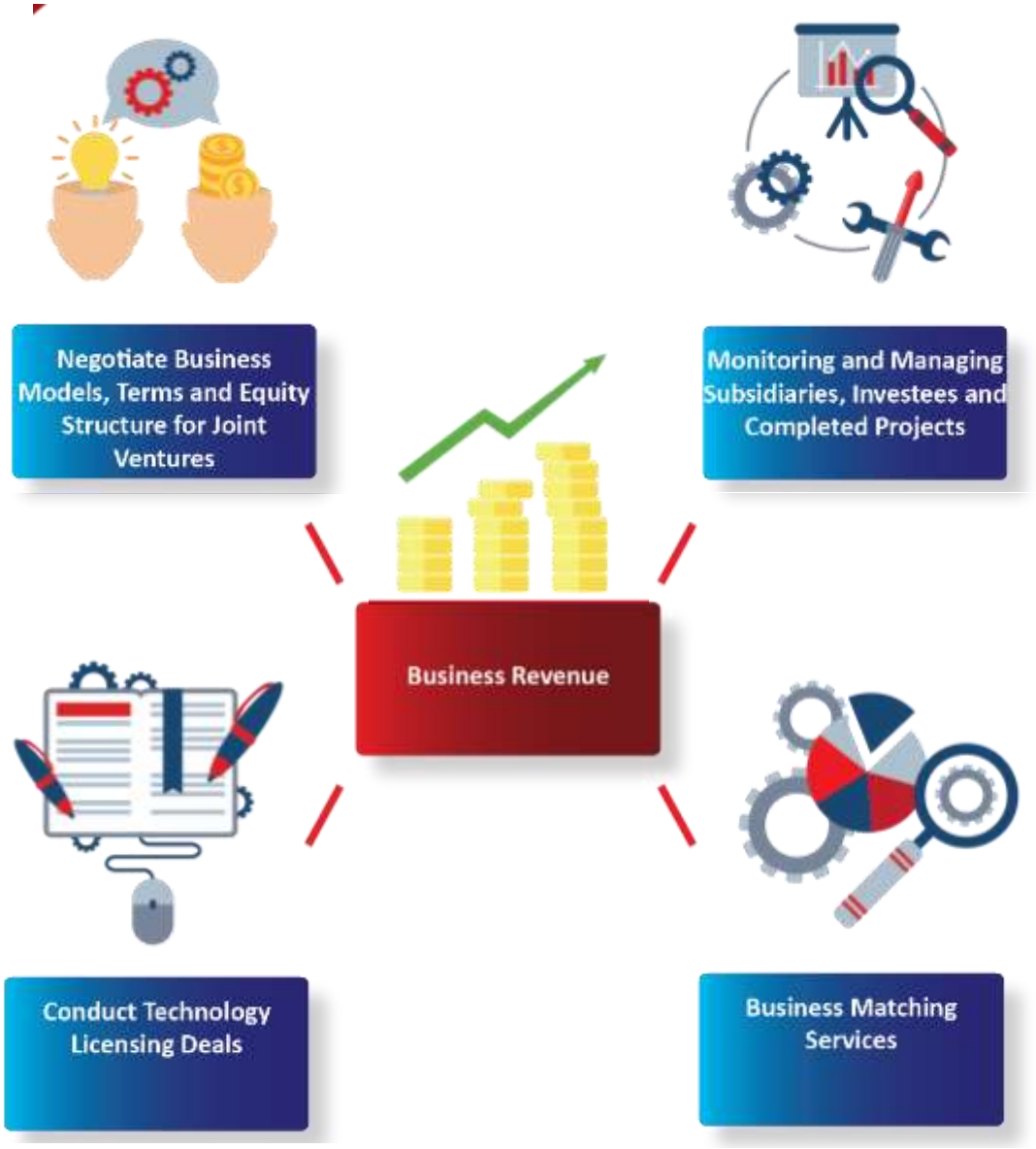
OUR BUSINESS MODEL



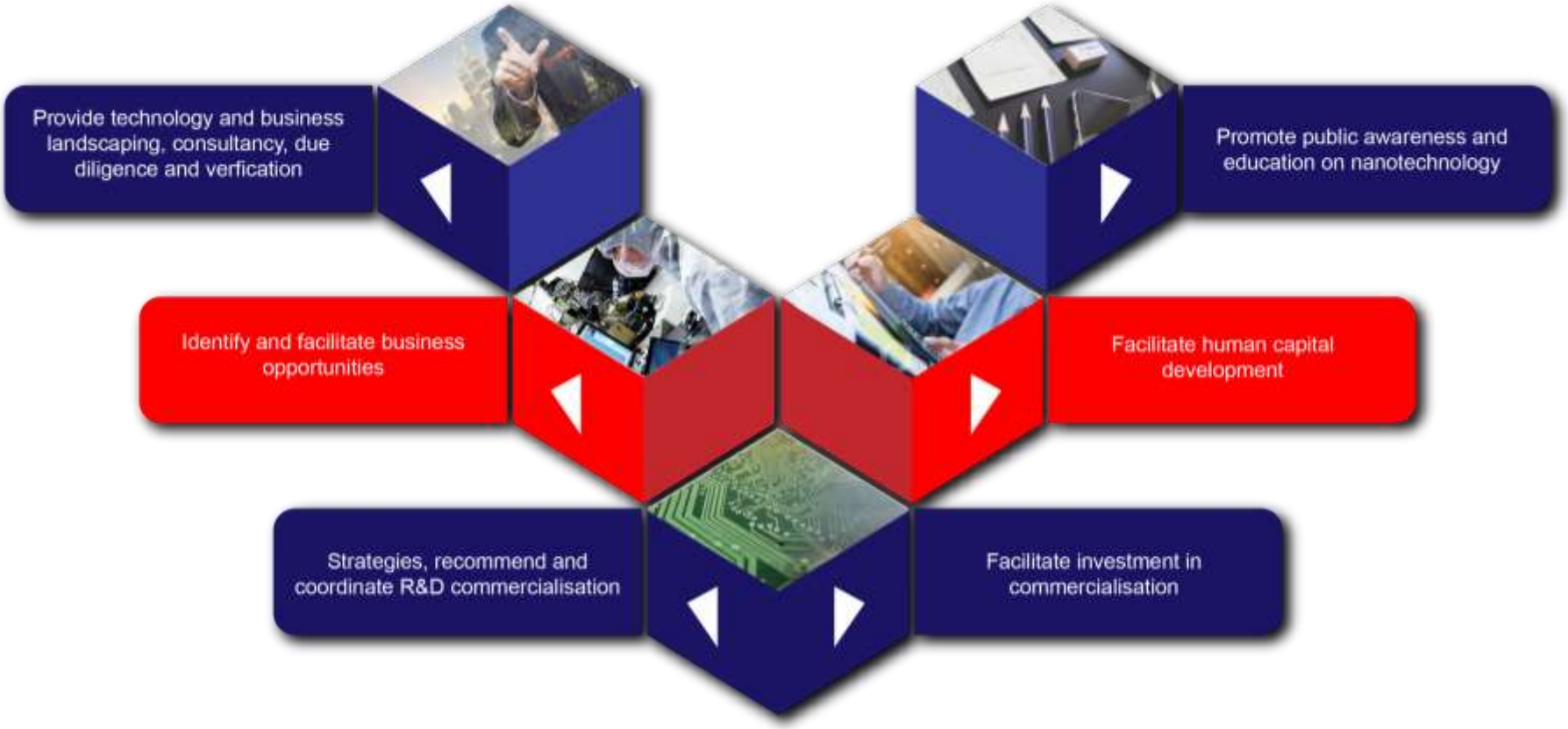
ENABLING GROWTH THROUGH STRATEGIC PARTNERSHIP

Through various collaborations and joint ventures, NanoMalaysia has successfully delivered on commercialisation activities which are contributing to our business revenue and the ongoing sustainable development of the local nanotechnology sector.

For more information on our various programmes and commercialisation activities, as well as their outcomes, please refer to the section titled "NanoMalaysia Programmes" in this Strategic Report.



OUR CORE BUSINESS



KEY ACTIVITIES

NANOMALAYSIA'S PHASES OF GROWTH

6

NANOMALAYSIA'S PHASES OF GROWTH

PHASE 01

Positioning and Branding

Since inception, NanoMalaysia has been through two distinct phases of growth. Our first phase spanned the period between 2011 and 2014. In this phase, we focused on building our brand and refining our market positioning to build strong foundations for our business and ensure the long-term resilience of our business.

PHASE 02

Creating Economic Value

In the first half of the 11th Malaysia Plan, our second phase of growth encompassed the period between 2015 and 2018. During there years, our focus was on creating economic value to ensure long-term growth and profitability through our various strategic programmes and collaborative partnerships with leading international nanotechnology agencies and compnaies

PHASE 03

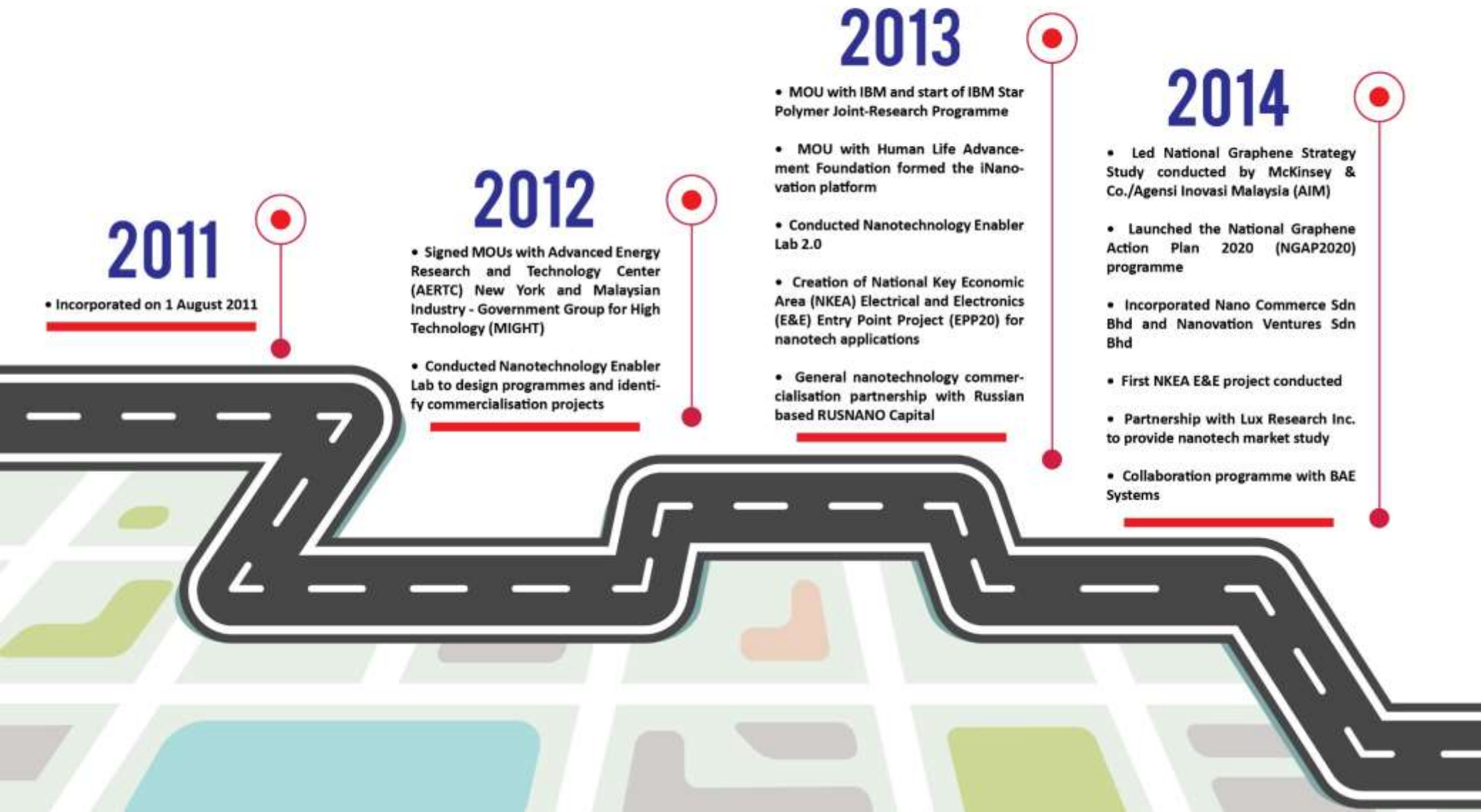
2019 & Beyond

REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

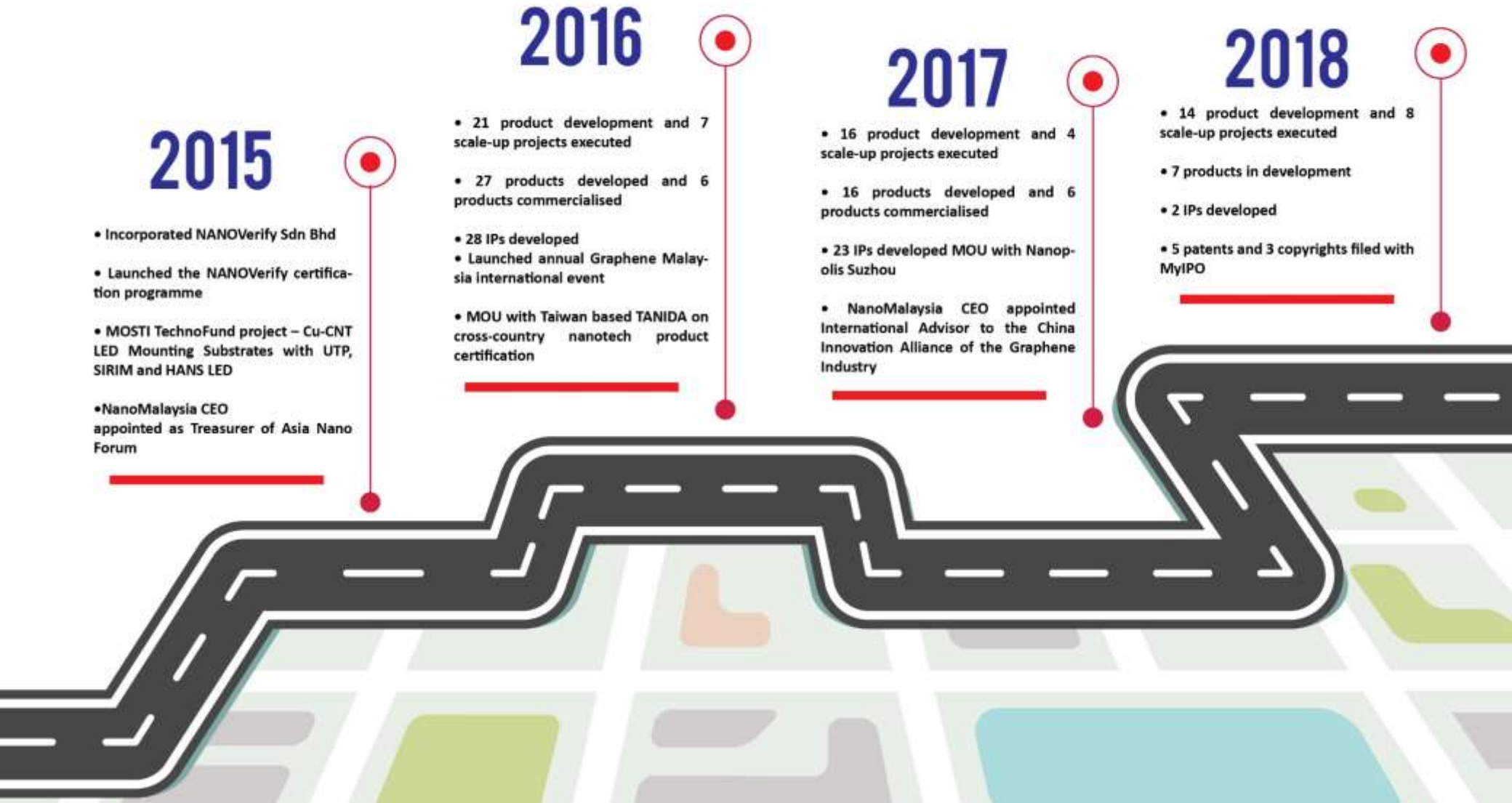
Moving into our next phase of growth in the second half of the 11th Malaysia Plan, our focus is on spearheading the Nanotechnology Revolution in Malaysia through our Fourth Industrial Revolution (4IR) Internet of Nano Things (IoNT) driven REVOLUTiONT strategy. Our goal in our third phase of growth is to achieve financial independence, and ensure the long term sustainability of our business.

PHASE 1: POSITIONING & BRANDING



PHASE 2: CREATING ECONOMIC VALUE

11th MALAYSIA PLAN NANOTECHNOLOGY COMMERCIALISATION PROGRAMME




PHASE 3
2019 AND BEYOND
REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

OUR 4TH INDUSTRIAL REVOLUTION STRATEGY

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OUR STRATEGY BEYOND RMK-11

NanoMalaysia was founded as Malaysia's lead agency for the commercialisation of nanotechnology. In ensuring that we achieve our business objectives, we are providing the industry with technology and business leadership crucial for the sustainable long-term development of the nanotechnology industry.

NanoMalaysia's strategic growth ambitions are guided by our strategy which leverages on the opportunities available as a result of the Fourth Industry Revolution's (4 IR) Internet of Nano Things (IoNT). IoNT refers to the interconnection of nanosensors and nanodevices with the Internet which has led to the development of next-generation standards based on the Internet of Things (IoT). NanoMalaysia's strategy is premised on our strong belief that IoNT will be the core driver of 4 IR, and catalyse transformational and revolutionary changes in industry, business and society.

Our primary goal is to capture revenue streams associated with nanotechnology and IoNT Ienabled products and applications. We do this by focusing our financial and human resource investments into business ventures and projects that are feasible and offer realistic and high value returns in the medium to long-term. We also stress the importance of national agendas relating to job creation, as well as an environmentally greener future.

In the short to medium-term future, our focus is on our RevolutIoNT strategic campaign as the key driving force to mobilise the local industry, in line with our ambition to Spearhead the Nanotechnology Revolution in Malaysia. Our RevolutIoNT strategic blueprint takes into account the myriad benefits nanotechnology has provided through enhanced and efficient solutions within various applications in food and agriculture; wellness, medical and healthcare; electronic devices and systems; and energy and the environment.

In order to generate returns for our stakeholders which are aligned with our identified goals and targets, we have in place programmes to catalyse the growth and development of the fledging nanotechnology sector in Malaysia. Through our core programmes of the National Graphene Action Plan 2020 (NGAP 2020), iNanovation and Advanced Materials Industrialisation, we are providing support for large local and multinational companies based in Malaysia, as well as local Small and Medium Enterprises (SMEs).

These programmes were developed under the 11th Malaysian Plan (11MP) which had identified the commercialisation of nanotechnology has a potential high growth sector to drive national economic growth. We are driving nanotechnology commercialisation through product development and scale-up projects.

OUR STRATEGY

SHARED PROSPERITY VISION 2030

JKPDA JAWATANKUASA PELABURAN DANA AWAM

SUSTAINABLE DEVELOPMENT GOALS


2019
HIGHLIGHTS

JANUARY 2019 Nano Tech Japan 2019, in Tokyo

First day of Nanoweek 2019, NanoMalaysia's Pavilion was officially inaugurated by His Excellency (H.E) Dato' Kennedy Jawan, Ambassador of Malaysia to Japan, at NanoTech Japan 2019, in Tokyo

JANUARY 2019 Asia Nano Forum, in Tokyo

NanoMalaysia attended the Asia Nano Forum (ANF) Exco Meeting during the second day of NanoTech 2019 at Tokyo Big Sight, Odaiba . NMB's CEO, Dr Rezal Khairi Ahmad presenting his report as Treasurer for ANF and meeting was also attended by NanoMalaysia's Chairman Prof Emeritus Dato Dr Ir Zawawi and En Hafiz Zolkipli, COO of NanoMalaysia.

JANUARY 2019 Malaysian Embassy, Japan

NanoMalaysia paid a courtesy call to H.E. Dato Kennedy Jawan,Ambassador of Malaysia to Japan,at Malaysia Embassy in Tokyo .

JANUARY 2019 Nano Week 2019, in Tokyo

NanoMalaysia participated in the 1&2D Materials International Conference and Exhibition 2019 in conjunction with Nano Week 2019 held at Tokyo Big Sight, Odaiba. Dr Rezal Khairi Ahmad was invited to present on the National Graphene Action Plan (NGAP) at one of the parallel sessions.

FEBRUARY 2019 Nano Week 2019, in Tokyo

NanoTech 2019 witness MoUs signed between NanoMalaysia and NanoNextNL from Netherlands.

FEBRUARY 2019 Monthly Staff Gathering

NanoMalaysia's monthly Staff Gathering started with updates and speech from CEO, Dr Rezal Khairy Ahmad. This was followed with some fun session where staff have to guess who they are by asking yes or no questions about themselves.

FEBRUARY 2019 PJ Startup Festival, Petaling Jaya

NanoMalaysia participated at the PJ Startup Festival which concluded on Sunday 24 Feb 2019 at Dewan Sivik Petaling Jaya. NanoMalaysia's COO, En Hafiz represented NanoMalaysia during the panel session titled "Nanotechnologay, IoT and IR4.0 Now".

FEBRUARY 2019 Delegate visit from Nanotech Indonesia

NanoMalaysia hosted a delegate visit from Nanotech Indonesia which included Prof. Dr Nurul Taufiqu Rochman (Chairman of Indonesian Society for Nano and a senior scientist in Lipi) as well as Bapak Radyum Ikono, the CEO of Nanotech Indonesia and Bapak Suryandaru, Executive Director of Nano Centre Indonesia.

The visit enhances the partnership between NanoMalaysia and Nanotech Indonesia following an MOU signed earlier between the two parties.

MARCH 2019 International Women's Day

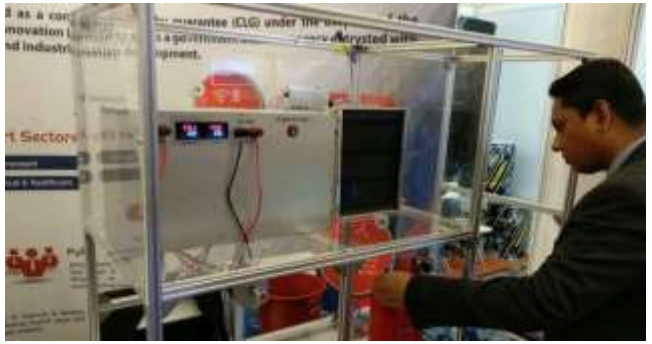
Happy International Women's Day from NanoMalaysia!

Thank you to all the women out there for making the world a brighter place, especially to the wonderful team here at NanoMalaysia - we wouldn't be where we are now without your contribution, passion, dedication and commitment. Do you know that nearly half of the team at NanoMalaysia are women?

APRIL 2019

Agreement between Prasarana Malaysia Berhad and Scomi Transit Projects Berhad

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, attended the signing ceremony of agreement between Prasarana Malaysia Berhad and Scomi Transit Projects Berhad for the completion of the KL Monorail Project. The ceremony was witnessed by the Minister of Transport, YB Tuan Anthony Loke Siew Fook. NanoMalaysia is the project partner for Scomi in the development of the Internet of Nano-Things applications and high performance nano-devices and systems in the transportation sector.



APRIL 2019 Malaysia Autoshow 2019, Serdang

NanoMalaysia's booth at the Malaysia Autoshow 2019 located at Hall D, MAEPS Serdang. Together with our partners, Pulsar UAV and MNA Research, displaying a demo unit of the hybrid energy storage system (H2SS) blending graphene ultracapacitors, Li-Ion batteries and on-site hydrogen generated fuel cell which can provide extended range for Electric Vehicles (EV).

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad was the moderator for the MVCA: VC2E – ITEX 2019 Path To Successful Enterprise session organised by MVCA (Malaysian Venture Capital & Private Equity Association) at ITEX'19 held at KLCC Convention Centre today. The interactive and hands-on session provided an understanding of how venture capital (VC players) choose to fund businesses.

MAY 2019

Innovation & Technology Exhibition (ITEX'19), Kuala Lumpur Convention Centre

30th International Invention, Innovation & Technology Exhibition (ITEX'19) at Kuala Lumpur Convention Centre from 2 to 4 May 2019. NanoMalaysia displayed a Graphene-based energy storage device for industrial and residential use developed by our partner, MNA Research.

MAY 2019

Asia Nano Forum Summit, Manila

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, presented Malaysia's Country Presentation at the 16th Asia Nano Forum Summit (ANFoS 2019) in Manila, Philippines

MAY 2019 International Nanotechnology Conference In Philippines

MAY 2019 Happy Eid Mubarak from NanoMalaysia Berhad

JULY 2019 37th Conference of the Malaysia-Japan Economic Association (MAJECA) and Japan-Malaysia Economic Association (JAMECA

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, attended the 37th Conference of the Malaysia-Japan Economic Association (MAJECA) and Japan-Malaysia Economic Association (JAMECA) which was held on 1 July 2019 at EQ, Equatorial Plaza, Kuala Lumpur.

Dr Rezal spoke on “Malaysia’s Nanotechnology Ecosystem Supporting Smart Cities, Manufacturing and Green Agenda" during the Plenary Session 2 on Investment Collaboration in Innovative Technologies at the event.

JULY 2019 Launch of Sunway University's Graphene and Advanced 2D Materials Research Lab

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad attended the official launch of Sunway University's Graphene and Advanced 2D Materials Research Lab on 9th July 2019. The Graphene and Advanced 2D Materials Research Lab comprises with leading-edge equipment and facilities that worth RM3.5 million, which will be the place to synthesise and perform different researches on 2D materials and its analogues for industry application.

JULY 2019 Distributor Signing Ceremony of IGL Coatings at MEEC, Menara MATRADE Kuala Lumpur

Dr Rezal Khairi Ahmad attended the Distributor Signing Ceremony of IGL Coatings at MEEC, Menara MATRADE Kuala Lumpur.

IGL Coatings is a Malaysian manufacturing company pioneering in eco-friendly nanotechnology ceramic coatings which are also verified by NanoVerify Sdn Bhd.

The Distributors Signing Ceremony included distributors from the US, Canada, Australia, Brunei, Thailand, India, Vietnam, Taiwan, Philippines and Mauritius.

JULY 2019 Launching Ceremony of Poney Garments Sdn Bhd's Baby Essential Extra Care, Kuala Lumpur

NanoMalaysia led by CEO. Dr Rezal Khairi Ahmad, attended the launching ceremony of Poney Garments Sdn Bhd's on the Baby Essential Extra Care, the new range of kids' wear.

The launching ceremony was held in conjunction of the opening of Poney's new boutique at Central i-City, Shah Alam, Malaysia.

Poney ventured into nanotechnology and technical textile with NanoTextile Sdn. Bhd. NanoTextile is an investee company of NanoMalaysia and the first company in Malaysia to offer wide span of nanotechnology in textile industry. This partnership between Poney and NanoTextile represents the first all Malaysian affair and a step ahead in commercialisation of nanotechnology in Malaysia's textile industry.

AUGUST 2019 NanoMalaysia Berhad 8th Anniversary

AUGUST 2019 DT New Material, China Visit to MIMOS Berhad

NanoMalaysia visited MIMOS and toured its laboratories which included MIMOS Wafer Fabrication, Nano & MEMS Laboratory, Failure Analysis Laboratory, and the Test & Reliability Laboratory. The delegation led by the National Graphene Action Plan (NGAP) Office also included companies under the NGAP programmes as well as representatives from DT New Materials, Ningbo (China). Thank you to Dr. Lee Hing Wah, Head of Electronics, MSSB for the tour of the facilities!

AUGUST 2019 Checkered Friday at NanoMalaysia

AUGUST 2019 **The NanoSummit Malaysia Conference & Expo (MyNano 2019) and Graphene Malaysia 2019 at Putrajaya Marriott Hotel, Putrajaya, Malaysia**

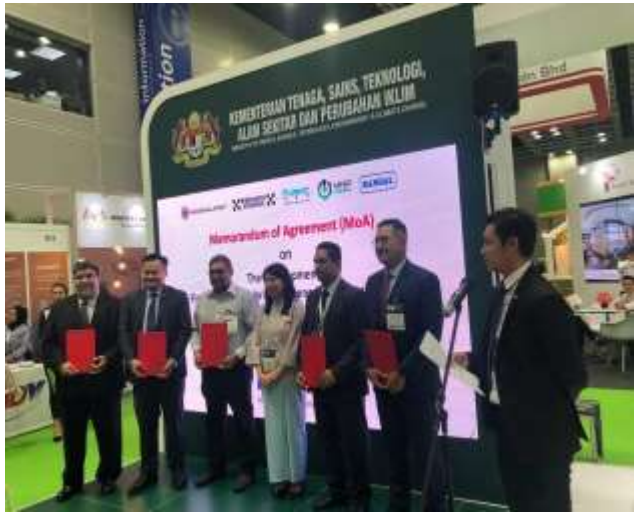
AUGUST 2019 62nd Merdeka Celebration at NanoMalaysia

OCTOBER 2019 Graphene Flagship, Helsinki Finland

SEPTEMBER 2019 Cities 4.0 Conference & Exhibition, Hotel Istana Kuala Lumpur

YB Zuraida Kamaruddin, Minister of Housing and Local Government, visited NanoMalaysia's booth at the Cities 4.0 Conference & Exhibition today at Hotel Istana, Kuala Lumpur.

OCTOBER 2019 Memorandum Of Agreement To Develop The First Fuel Cell-powered Electric Vehicle (EV), 10th International Greentech & Eco Products Exhibition & Conference Malaysia (IGEM 2019), Kuala Lumpur Convention Centre



NanoMalaysia and four other strategic partners exchanged a Memorandum of Agreement (MoA) to develop the first fuel cell-powered Electric Vehicle (EV) for use in the motorsports industry in Malaysia at the 10th International Greentech & Eco Products Exhibition & Conference Malaysia (IGEM 2019) in the Kuala Lumpur Convention Centre. The exchange was witnessed by the Minister of Energy, Science, Technology, Environment and Climate Change (MESTECC), YB Yeo Bee Yin. The four strategic partners are Pulsar UAV Sdn Bhd, Handal Energy Solutions Sdn Bhd, MNA Energy Sdn Bhd and Wheelspin Motorsport.

OCTOBER 2019 International Conference on Industry 4.0 at Segi University

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, was a panellist in the session, "IR4.0: Challenges of Implementing Industry 4.0" at the International Conference on Industry 4.0 at Segi University. The conference was held at Segi University, Kota Damansara from 14th o 16th October 2019.

OCTOBER 2019 Industry4WRD Summit, MITEC, Kuala Lumpur

NanoMalaysia joined Industry4WRD Summit where we focus more about nanotechnology commercialisation and industrialisation, and it's role in Industry 4.0 in Malaysia. Industry4WRD Summit was held on 30th and 31st October 2019 at MITEC, Kuala Lumpur.

OCTOBER 2019 MoU between China Innovation Alliance of the Graphene Industry (CGIA), Shanghai Industrial Technology Centre of Graphene, and NanoMalaysia Berhad, China

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, attended the signing of MoU between China Innovation Alliance of the Graphene Industry (CGIA), Shanghai Industrial Technology Centre of Graphene, and NanoMalaysia at the 2019 China- EU Yangtze River Delta Graphene Innovation Summit in Shanghai, China.

OCTOBER 2019 Deepavali Celebration at NanoMalaysia

OCTOBER 2019 The Transfer Of Technology Between Malaysia And The Guangxi Autonomous Region Meeting, MESTECC

NanoMalaysia attended a meeting arranged by the International Division, Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC) with representatives from the Department of Science and Technology of Guangxi Autonomous Region of The P.R of China. The meeting discussed on the transfer of technology between Malaysia and the Guangxi Autonomous Region.

NOVEMBER 2019 Meeting with Tenaga Nasional Berhad CEO

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad met with the President/CEO of Tenaga Nasional Berhad, Datuk Seri Amir Hamzah Bin Azizan, at Tenaga Nasional HQ, Jalan Bangsar.

The meeting was to discuss nanotech-based energy solutions that can benefit consumers and end-users in Malaysia.

NOVEMBER 2019 Theme Friday dress code was "Rugby" In conjunction of Rugby World Cup 2019's final

NOVEMBER 2019 Carbon Tech, Shanghai China

NanoMalaysia through the National Graphene Action Plan (NGAP) participated at the 4th International Carbon Materials Conference and Exhibition CarbonTech 2019 held in Shanghai, China. During the conference, the Vice President of NGAP, Ms Murni Ali, presented on the National Graphene Action Plan commercialisation efforts and activities in Malaysia.

NOVEMBER 2019 International Conference on Emerging Technologies For Achieving Sustainable Development Goals, Hotel Istana Kuala Lumpur

NanoMalaysia participated in the International Conference on Emerging Technologies For Achieving Sustainable Development Goals. The conference was organised by the Asian and Pacific Centre for Transfer of Technology of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, presented the topic of Nanotechnology for achieving Sustainable Development Goals to the delegates.

NOVEMBER 2019 Testing and Commissioning Phase for NAVi

NanoMalaysia Autonomous Vehicle, or NAVi, underwent testing at Technology Park Malaysia (TPM) with Enermag Sdn Bhd. Enermag specialises in mechanical and electrical engineering work and has been involved in the engineering works for the first version of NAVi.

The test marks the beginning of the testing and commissioning phase for NAVi, which will be conducted entirely at TPM with the support of Technology Park Malaysia Corporation Sdn Bhd.

NAVi, along with NanoMalaysia's Hydrogen Paired Electric Racecar or HyPER, are one of NanoMalaysia's C.A.S.E. (Connected, Autonomous, Sharing & Electric) initiatives to produce a locally developed Level 4 Autonomous Vehicle and eventually an autonomous electric vehicle.

NOVEMBER 2019 Graphene & 2DM Singapore Summit, Singapore

NanoMalaysia Berhad attended the Graphene & 2DM Singapore Summit held on 11 & 12 Nov 2019 in Singapore. NanoMalaysia's CEO, Dr Rezal Khairi Ahmad, presented on the National Graphene Action Plan and NanoMalaysia's efforts in commercialising graphene applications in Malaysia.

NOVEMBER 2019 SME CEO Forum 2019, Pullman Bangsar, Kuala Lumpur

DECEMBER 2019 Yayasan Canselor UNITEN (YCU) Dinner, UNITEN

NanoMalaysia donated to Yayasan Canselor University Tenaga Nasional (UNITEN) at the "Realizing Dreams- Generating Excellence" themed dinner at Dewan Seri Sarjana , UNITEN on 5th December 2019. YCU was formed to assist students especially those with B40 income in their studies through scholarships and financial support.

DECEMBER 2019 CEO's Interview session with Bernama Radio

BUILDING TRUST: NANOVERIFY PROGRAMME

8

NANO Verify

Over the past few years, nanotechnology enabled products have made inroads into daily consumer goods. Product manufacturers have found that the introduction of small amounts of nanomaterials into their existing product line can lead to significant enhancements of existing properties, or even result in new properties. These provide consumer goods manufacturers with a unique selling point for their products, thus differentiating them in the marketplace. Applications cover items such as clothing, to food packaging materials.

While consumers have much to gain from this market trend, the overriding concern is ensuring that these nanotech products are credible and reliable. As nanotechnology is still a relatively new area, it is vital to protect consumers from unscrupulous manufacturers who may claim that their product incorporates nanotechnology enabled benefits, when in actuality is does not. It was with this in mind that NanoMalaysia embarked on the NANOVerify Programme.

NANOVerify

The NANOVerify programme is a voluntary nanotechnology certification programme, jointly implemented by NanoMalaysia's subsidiary NANOVerify Sdn Bhd (NVSB) and SIRIM QAS International, and under advisement from Standards Malaysia. The NANOVerify programme certifies processes and products which have incorporated nano elements within the 1 to 100 nanometre range. The programme also certifies functionality enhancements obtained as a result of embedding nano elements, covering mechanical, surface and electrical properties.

Launched on 22 May 2015, NANOVerify is the first voluntary nanotechnology certification programme in Malaysia, and only the sixth of its kind in the world. NANOVerify provides Malaysian nanotechnology products and applications with independent and credible quality assurance. This strengthens local SMEs' abilities to successfully market their nanotechnology enabled products both within the country, as well as overseas. Since its launch, the programme has verified a spectrum of nanotechnology products, ranging from daily use items such as cosmetics, fertiliser and clothing, to more specialised technology related applications such as technology wafers with carbon nanotubes.

NANOVerified is the endorsement mark awarded to processes and products which have successfully completed the programme. Moving into the future, NVSB has in place the NANOVerify Enhancement Programme, a five-year plan focusing on developing functionality for the NANOVerify programme within the areas of mechanical, electrical and surface properties.

Smart Partnerships For A Robust Nanoverify Certification Platform

NanoMalaysia has entered into smart partnerships with several Government Ministries and agencies, in order to ensure that the programme practices the highest levels of international governance and compliance with regards to the certification of nanotechnology enabled products and applications. Our direct engagement ensures a robust certification platform, which offers applicant companies the value proposition of international recognised certification standards which they can rely on to drive their business growth and expansion.

NANOVerify

Creating Industry Awareness

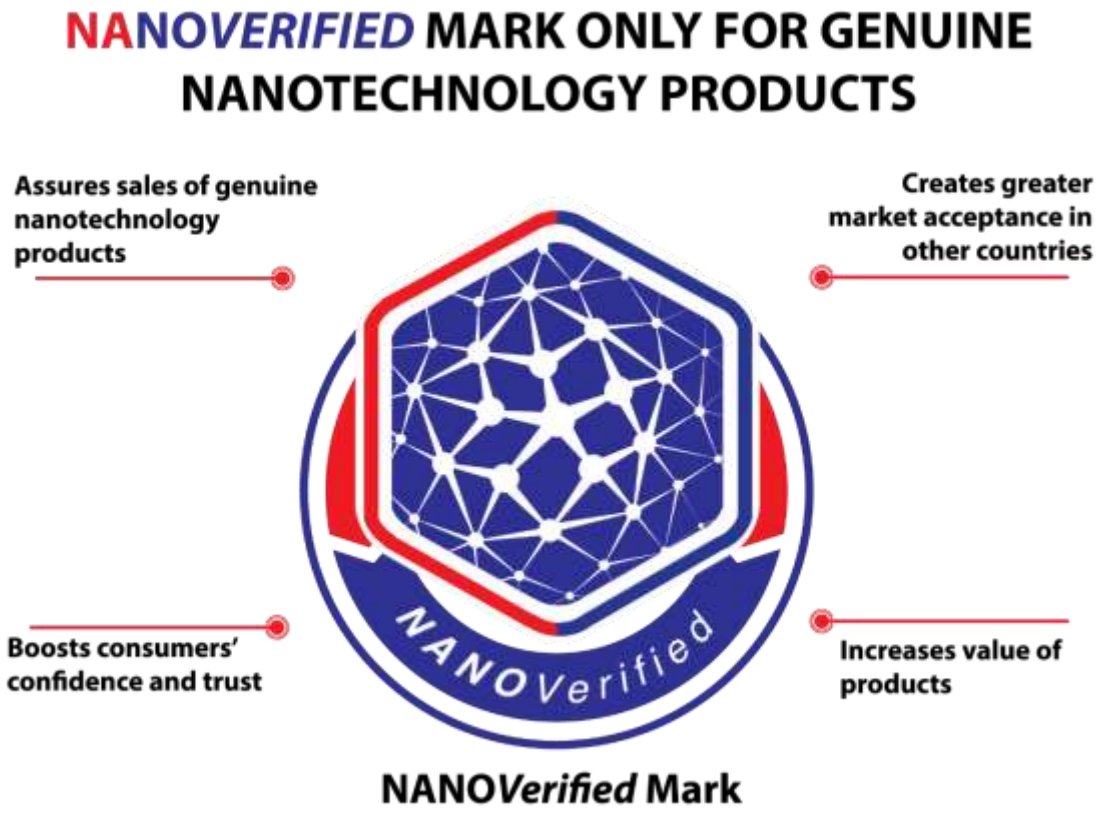
To create greater awareness within the industry on the NANO*Verify* programme and its benefits, we have in place a comprehensive media and public relations plan. Our communication plan focuses on spreading the word on NANO*Verify* both within traditional media, as well as social and digital media. These involve conducting frequent interviews on television shows and news programmes, as well as interviews with print media and business publications. We also collaborate with other Government agencies to conduct cross marketing activities. To garner wider industry exposure, we conduct ongoing workshops and conferences, which disseminates information on NANO*Verify* to industry players.

NANO*Verify* Achievements As At End 2019

- 53 companies certified
- 90 NANO*Verified* products
- Average of 3.2 companies certified per month

Highlights of Brand and Certification Coverage

- Nano Stretch Film by TG Plastic Technologies Sdn Bhd
- NanoSocks by Nanotextile Sdn Bhd
- Microwell Bio Solution Sdn Bhd (a subsidiary of JCorp)
- Products under the purview of HALAL Development Corporation (HDC)
- Products under the purview of the National Pharmaceutical Regulatory Agency (NPRA)



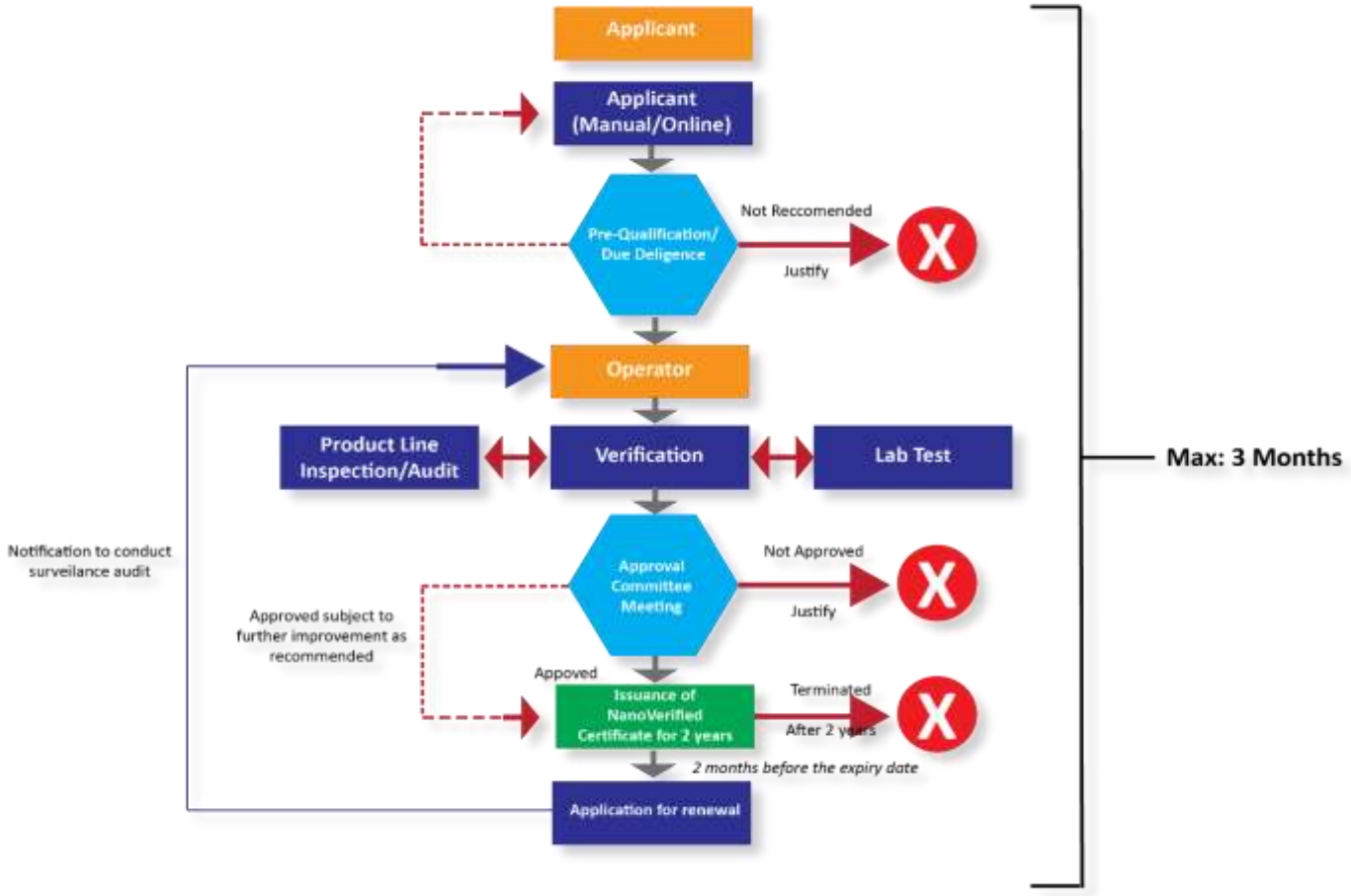
NANO*Verified* Mark

NANOVERIFY CERTIFICATION PROCESS

To apply for the NANOVerify Programme, companies submit their application forms and payment receipts to the programme manager, NVSB. NVSB then conducts a pre-qualification and due diligence study to ensure the eligibility of the product to be verified. Upon satisfactory completion of the due diligence process, a memo is issued to the company, and the application is forwarded to the programme operator, SIRIM, to initiate the product certification process.

SIRIM will then conduct an audit at the applicant's factory to witness the incorporation of nanomaterials in the product. SIRIM collects samples of the product to be tested at an ISO accredited laboratory to characterise and test the functionality of nanomaterials in the product. Upon receiving the lab report and clearing any non-compliance issues, the application is then brought to the attention of the Approval Committee for review and approval.

Applicants will receive their certificate and will be permitted to use the NANOVerify mark upon approval. The certificate is valid for two years and needs to be renewed to maintain the use of the NANOVerified mark.



OUTCOMES OF THE NANO*VERIFY* CERTIFICATION PROGRAMME

PRODUCT CERTIFICATION FACILITATED

RM 1.45 MILLION

2015-2019 Certifications

CURRENT LOCAL MARKET PENETRATION

13%

90 Certified Products out of 672

INCREASE OF REVENUE

RM 126.2 MILLION

2015-2018 NANOVerified Companies

NANOVERIFIED PRODUCTS (2015-2019)

90

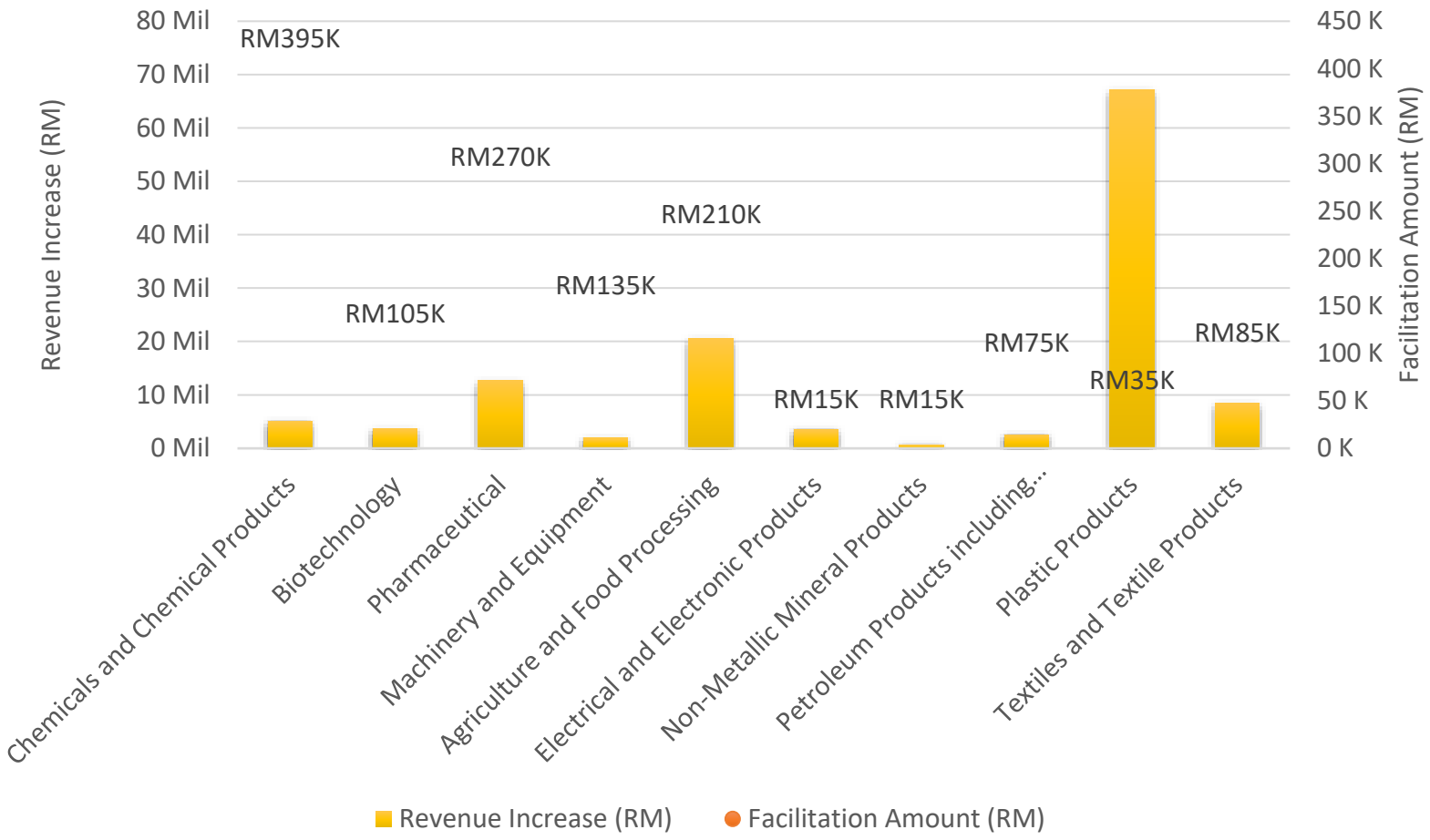
Include 40 new certifications in 2019

OVERALL IMPACT ON REVENUE

104%

2015-2018 NANOVerified Companies

REVENUE INCREASE (2015-2019) AND FACILITATION AMOUNT (2015-2019), BY INDUSTRY



IMPACT ON REVENUE, BY INDUSTRY

2015-2019 NANO*Verified* Companies

3%
PHARMACEUTICAL

102%
CHEMICALS AND CHEMICAL PRODUCTS

8%
PLASTIC PRODUCTS

264%
MACHINERY AND EQUIPMENT

199%
TEXTILES AND TEXTILE PRODUCTS

115%
BIOTECHNOLOGY

72%
NON-METALLIC MINERAL PRODUCTS

6%
AGRICULTURE AND FOOD PROCESSING

10%
ELECTRICAL AND ELECTRONIC PRODUCTS

23%
PETROLEUM PRODUCTS INCLUDING PETROCHEMICALS

NANO*VERIFIED* COMPANIES

CREATING VALUE

ECONOMIC, ENVIRONMENTAL AND SOCIAL

9

CREATING VALUE: ECONOMIC, ENVIRONMENTAL AND SOCIAL

OVERVIEW

NanoMalaysia's sustainability commitments are grounded in our desire to contribute positively to the continuing socioeconomic development of communities and the nation, bearing in mind the need to balance economic objectives against social and environmental imperatives. Our corporate social responsibility agenda is borne through outcomes we aspire to achieve within the Economic, Environmental and Social (EES) spheres.

We believe that the long-term sustainability of our business is inextricably linked to our ability to embed the triple bottom line into our business. Our projects and initiatives are geared towards helping to bring about a greener planet, whilst ensuring economic growth and contributing to development of underprivileged communities. In doing so, we are cognisant of aligning our EES outcomes with the 17 principles of the United Nations Sustainable Development Goals.

CREATING ECONOMIC VALUE

Nanotechnology is a powerful tool which companies from various industries can leverage on to expand their growth and capture greater market share. At NanoMalaysia, we have focused on the monetisation of nanotechnology through our investments in SMEs we have identified with promising potential for growth and future profitability.

	Number of Companies	GNI Contribution over 5 years	Job creation over 5 years
Electronic Devices and Systems	26 companies	RM 1.47 billion	504 jobs
Energy and Environment	30 companies	RM 1.43 billion	700 jobs
Food and Agricultural	9 companies	RM 0.05 billion	36 jobs
Wellness, Medical and Healthcare	14 companies	RM 0.56 billion	531 jobs

CREATING ENVIRONMENTAL VALUE

Nanopac (M) Sdn Bhd

Commercial deployment of Nano Light Energy Panels

Benefits:
- Higher effective efficiency solar energy generation
- Not limited to solar or placement angle
- Maximizes building surfaces for energy generation

NanoSiltech Sdn Bhd

Production of nano-silica from rice husk

Benefits:
- Sustainable waste-to-wealth concept of producing nano-silica
- No emission of harmful gases

Nanopac (M) Sdn Bhd

Commercial deployment of Nano Light Energy Panels

Benefits:
- Higher effective efficiency solar energy generation
- Not limited to solar or placement angle
- Maximizes building surfaces for energy generation

Malawira Sdn Bhd

Nanofibre and Nanocellulose from Oil Palm Empty Fruit Bunches

Benefits:

Sustainable waste-to-wealth concept of producing nano-fibres and nanocellulose for various applications:
- Wound management
- Technical textiles
- Oil recovery

As we witness the effects that climate change on our planet's ecosystems, it is becoming even more critical for all individuals, organisations and Governments throughout the world to do their part in mitigating and adapting to climate change. NanoMalaysia believes that we can play an important role in ensuring a more sustainable approach towards the environment, by supporting the commercialisation of projects which promote a greener future for us all.

Our stable of nanotechnology projects include those which practice the sustainable waste-to-wealth concept that helps conserve valuable natural resources and energy, and reduces environmental damage caused by socioeconomic development. These include collaborations which utilise waste from oil palm empty fruit bunches and rice husks which would otherwise be discarded by plantations and paddy farmers, by transforming them into innovative nanotechnology value added products and applications. We are also championing more sustainable energy production and consumption patterns by engineering efficient nanotechnology enabled solar energy and fuel applications.000

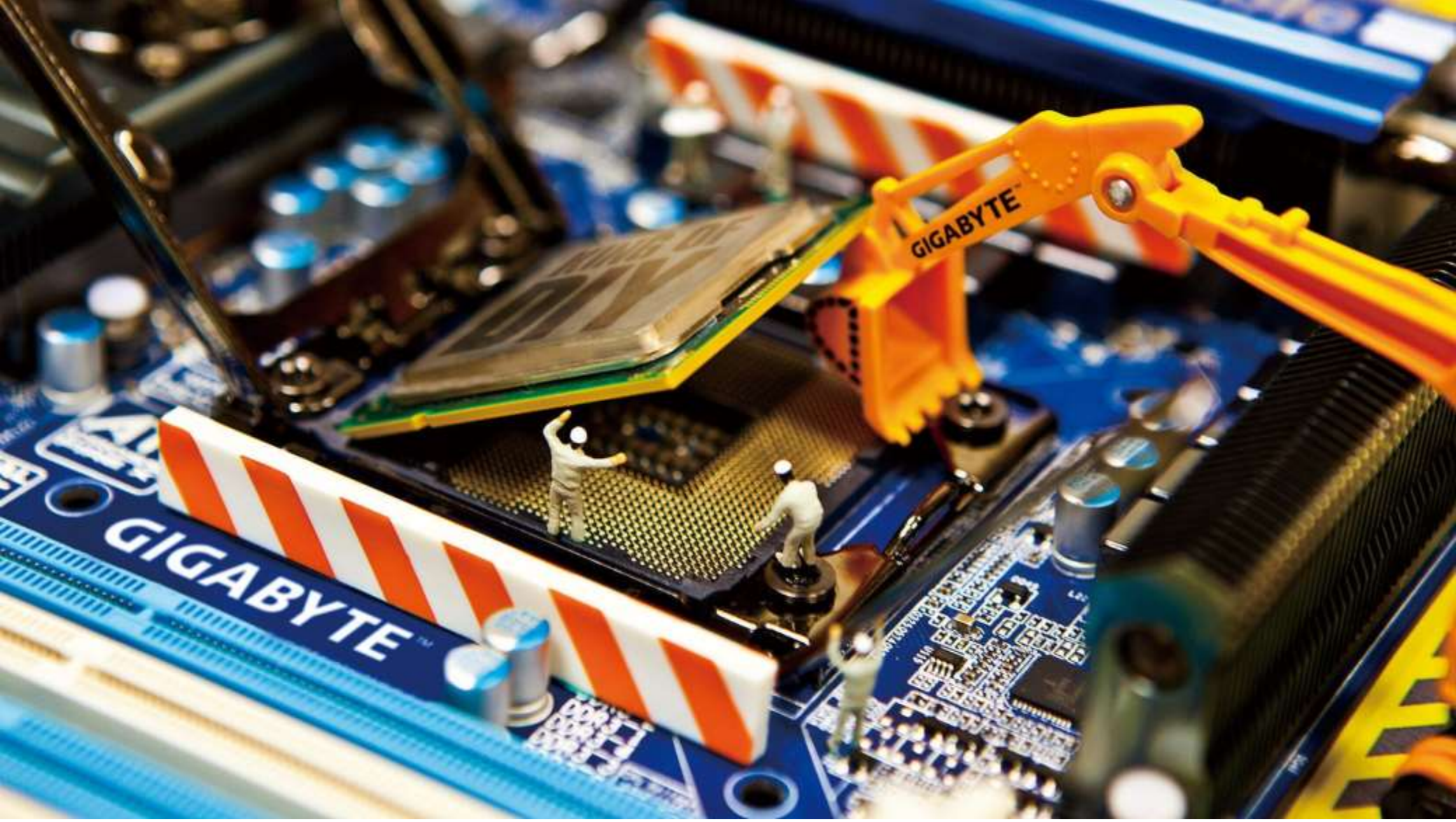
CREATING SOCIAL VALUE

In 2019, NanoMalaysia Berhad contributed to the Yayasan Canselor Universiti Tenaga Nasional (UNITEN) or YCU. Yayasan Canselor UNITEN was set up in Universiti Tenaga Nasional (UNITEN) in 2009 to develop, enlightening and empower individuals through education – especially from those within the B40 income group. YCU aims to achieve its fundamentals to acquire, administer and distribute funds to facilitate educational opportunities for deserving Malaysians. NanoMalaysia's contribution was handed over to YCU by CEO Dr Rezal Khairi Ahmad during the fund's annual Endowment Fundraising Dinner "Realising Dreams- Generating Excellence" at Dewan Seri Sarjana, UNITEN on 5 December 2019.

NanoMalaysia's Chief Executive Officer (CEO), Dr Rezal Khairi Ahmad also joined the International Islamic University Malaysia (IIUM) CEO @ Faculty Programme 1.0 for 2019 – 2020. The CEO Industry and University Programme was created in 2015 by the Ministry of Education (MOE) to engage expertise from the industry to contribute towards the enrichment of the academia's teaching and learning environment and to increase graduate employability. Fourteen public universities in Malaysia including International Islamic University Malaysia (IIUM) participated in the programme.

NanoMalaysia Berhad through Dr Rezal Khairi Ahmad is also a member of the Industry Advisory Council for Universiti Teknologi PETRONAS (UTP). The Industry Advisory Panel is a valuable resource to empower UTP with essential industry perspectives. Since 2007, the panel has been ensuring that the standard of education remains relevant to industrial practices, and provides a gateway to forging a strong alliance with industry players. The panel consists of twenty-four senior industry practitioners, all with vast experience and expertise in their respective fields to assist in the planning and continuous quality improvement of the programmes offered in UTP.

Panel members meet heads of departments annually to fine-tune UTP's academic curriculum, teaching methodology, facilities and practices, ensuring all aspects of learning is in-tune with emerging needs of the industry. Dr Rezal is a member of the Applied Chemistry and Applied Physics panel.



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A Revolution 4.0 the Internet of Nano-Things

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