NANOMALAYSIA BERHAD STRATEGIC REPORT 2020

REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

NANOMALAYSIA®

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

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ABOUT THIS REPORT

Purpose of The Report

The content included in NANOMALAYSIA Strategic Report 2020 combines a straightforward and responsible disclosures to provides a comprehensive overview for our stakeholders. **With this report, our aim is to provide our stakeholders a consolidated review on our spectrum of programmes and initiatives to enable sustainable growth of Malaysia's nanotechnology sector as guided by our strategy.**

Reporting Scope and Boundaries

This Strategic Report presents the performance of NanoMalaysia's value-creating activities accomplished as at 31st December 2020. Unless otherwise indicated, data presented encompasses all NanoMalaysia business units unless stated otherwise. The reporting principles and methodology continue to remain in accordance with requirements of the which NanoMalaysia is ordained 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

Board of Directors Approval

In favouring the substance of this Strategic Report, the Board recognizes its obligation for overseeing the preparation, presentation and integrity of the Strategic Report. The Board confirms that it has collectively reviewed the contents of the Integrated Report and is satisfied that this Strategic Report is a fair representation of NanoMalaysia performance his 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

This report contains forward-looking statements that are not guarantees of the future developments and results outlined therein. These are dependent on a number of factors; they involve various risks and uncertainties; and they are based on assumptions that may not prove to be accurate. These statements can be identified through the use of key words such as " anticipates", "estimates", "believes", "intend", "will", "plans", "outlook" and other similar words in conjunction with discussions on future operating or financial performance. We are under no obligation to update either these forward-looking statements, or the historical information presented in this Report. For years to come, we will be able to report with more extensive data on our focus area.

Feedback

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

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CHAIRMAN'S FOREWORD

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 2020.

The unprecedented impact of the COVID-19 crisis has significantly impaired all aspects of life around the world as well as the global economy. I would like to express my deep appreciation for our management and staff for the exceptional ways in which they have responded. The strength of the business combined with the professionalism and resilience of our management team have enabled us, in 2020, to deliver a strong operational performance during these challenging times.

At the end of 2020, NanoMalaysia developed 57 Intellectual Properties (IPs); 24 patents; 18 copyrights; 5 trademarks; 4 trade secrets; and 6 utility innovations, 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 the industry and 166 products commercialised. NanoMalaysia remains steadfast in its role as Malaysia's leading agency in commercialising nanotechnology.

As we move into 2021 and beyond into the Fourth Industrial Revolution, NanoMalaysia will remain on its 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 busines 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, academic partners, 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 OVERVIEW

DR REZAL KHAIRI AHMAD

This year has seen exceptional challenges with COVID-19 significantly affecting the daily lives of people all around the world. The individual and collective responses of people, communities and businesses have been remarkable in the face of such adversity. Nevertheless, we have successfully shifted from commodity-based nanotechnology products to systems-based nanotechnology solutions for local industries to uptake to jump on the Fourth 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 the Hydrogen Economy. This is truly an example of the company's venture builder model adopted to build a conducive ecosystem for high technology commercialisation.

Both National Graphene Action Plan and iNanovation continued to activate 20 new projects connecting the industry and research community, and 118 nanotechnology products were certified under the NanoVerify Programme with reported significant positive economic impacts on participating companies.

The new level of success in 2020 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, MOSTI and EPU. Thank you. May we rise to new challenges that 2021 presents.

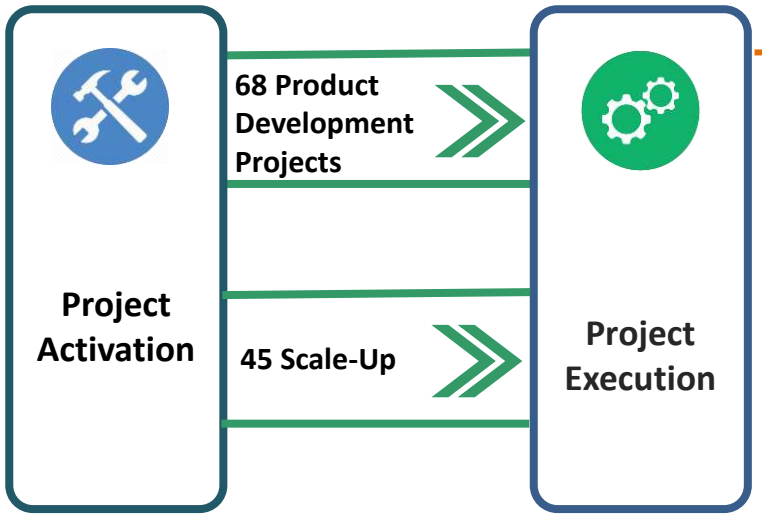
Rezal Khairi Ahmad

Chief Executive Officer

01

REPORTS HIGHLIGHTS

2016-2020 ACHIEVEMENTS SNAPSHOT



IPs Developed

57 project IPs developed

IPRs Filed

24 patents, 18 copyrights, 5 trademarks and 6 utility innovations filed with MyIPO, **4 trade secrets** with NMB

Products Developed

77 products developed by industry

Products Commercialised

166 products commercialised

NATIONAL GRAPHENE ACTION PLAN

iNanovation

ADVANCED MATERIALS INDUSTRIALISATION

75 JV/Start-Up companies supported/created

5,126 (direct) and 25,370 (indirect) high value job opportunities created over next 5 years identified by industry

RM 5.73 billion (direct) and RM 28.35 billion (indirect) potential GNI contribution generated over 5 years identified by industry

Nano Verify

118 products certified under NANO*Verify*

REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

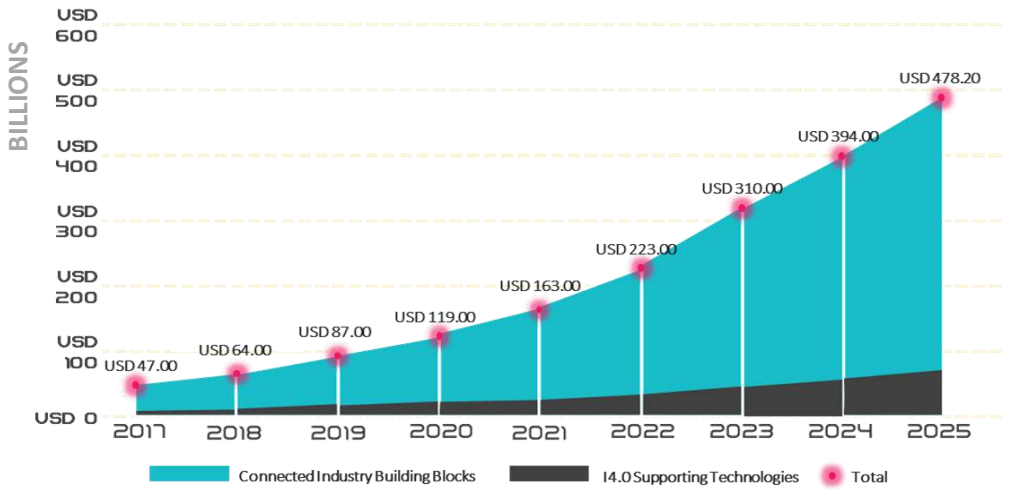
Nanotechnology helps to considerably improve, even revolutionise, technologies and industry sectors: information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, among many others. The Internet of Nano Things (IoNT) is a network of nanosensors and nanodevices, that are connected to 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 aim to pursue vitalization of industries and innovation through successful development and commercialisation of nanotechnology in Malaysia.

GLOBAL MARKET REVIEW

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

Global 4IR Market Size 2017-2025(1)

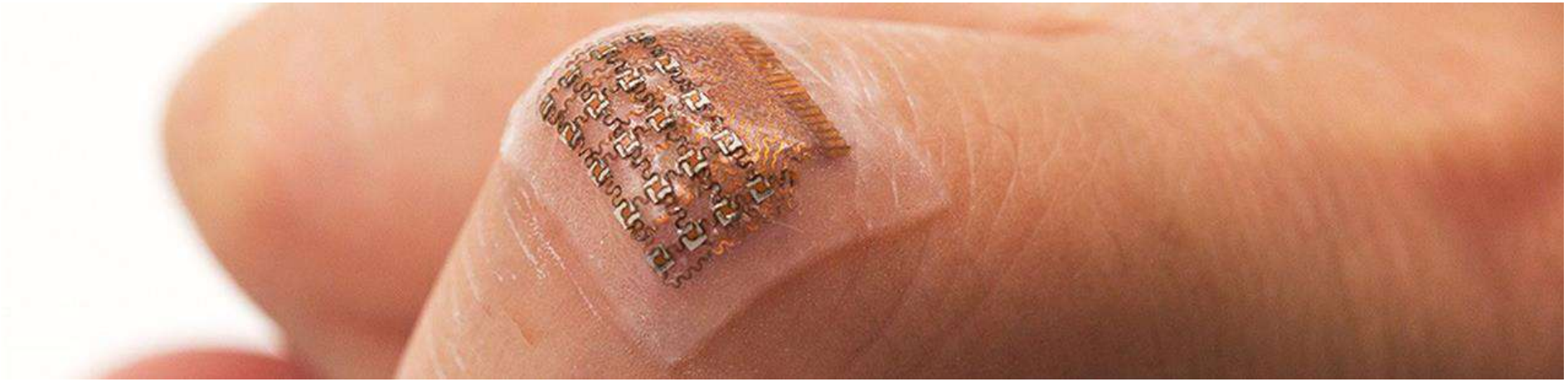


The Global IR4.0 market size will exhibit a significant growth in 2021 till 2025. The market revenue estimated to be valued at USD 87 billion in 2019 and is expected to grow with a CAGR of 32.1% over the forecast period of 2020-2025.

The Connected Industry Building Blocks (CIBB) subset of the IR4. 0 market will be taking a massive portion 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 anticipated to get to USD 404.0 billion in 2025 with a CAGR of 34.1%. The CIBB is further broken down into the 6 building blocks which are cloud platform & analytics, hardware, connectivity, applications, cybersecurity, system integration.

The technological subset of the IR4.0 market is the IR4.0 Supporting Technologies which comprises 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 forecast to reach a projected market size of USD 74.2 billion in 2025 with a CAGR of 23.7% over the forecast period.

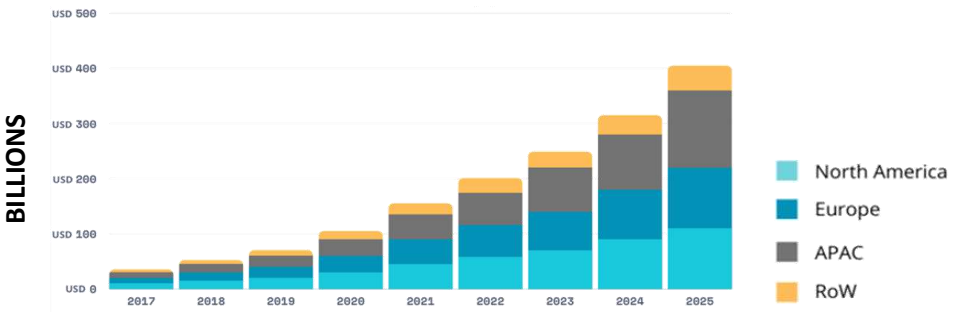
Source: (1) IOT Analytics



GLOBAL MARKET REVIEW

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

Global 4IR Market Size 2017-2025, By Region [(1)]



Region wise, APAC is expected to hold largest market share of the global IR4.0 market in 2019 with an estimated amount of USD 30.6 billion. This trend is poised to grow by USD 184.7 billion in 2025 progressing at a CAGR of 33% . The IR 4.0 in APAC will continue to influence the global market beyond the forecast period.

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

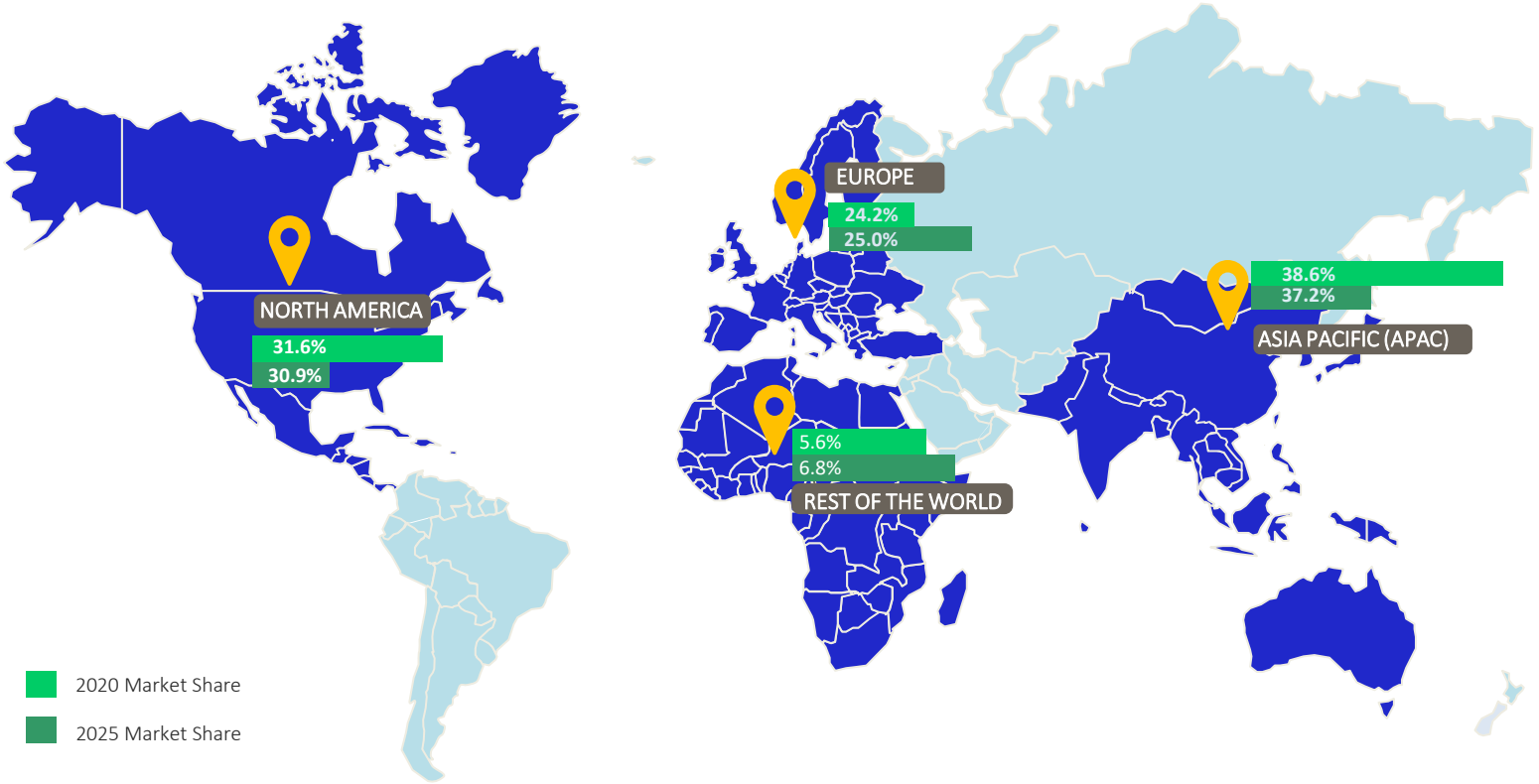
The European market including European Russia was valued at USD 23.7 billion in 2019 and is projected to rise at a pace of 31.2% through the forecast period ending with an amount of USD 115.7 billion.

Source: (1) IOT Analytics

REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

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



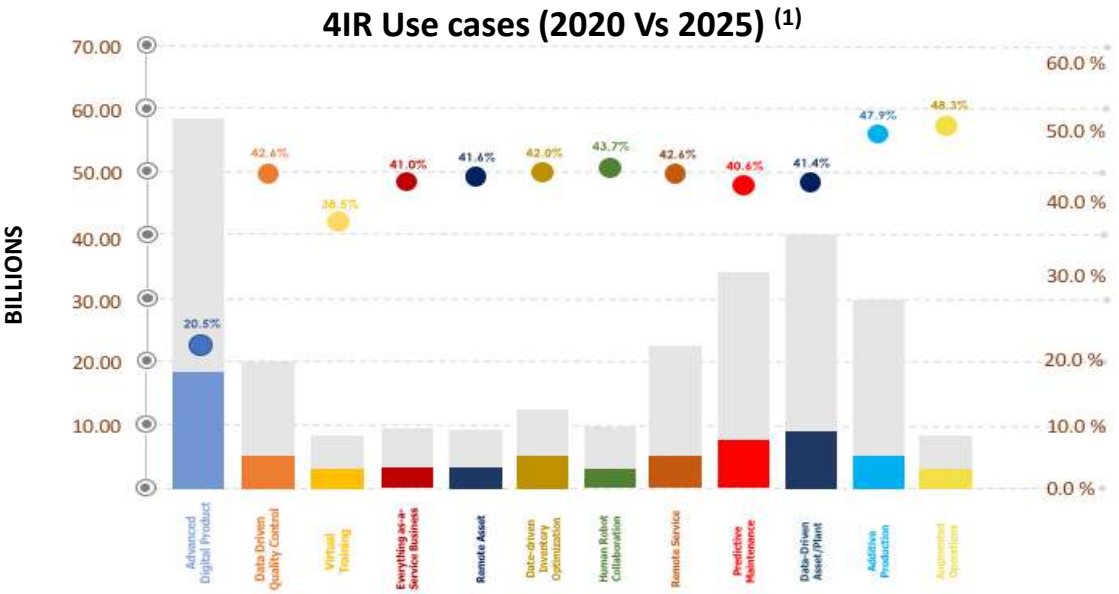
APAC and North American region is expected to expand at a CAGR of 33% and 32% respectively. Both regions will strengthen their position globally in 2025. Europe and the rest of the world will share smaller slice of pie by the end of the forecast period

Source: (1) IOT Analytics

GLOBAL MARKET REVIEW

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

Source: (1) IOT Analytics



The bar chart shows the 12 use-cases of IR4.0, underlining extensive differences in terms of growth and market share over the next 5 years (2020-2025). The Advanced Digital Product Development are the largest revenue maker for the next 5 years where it generates 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.

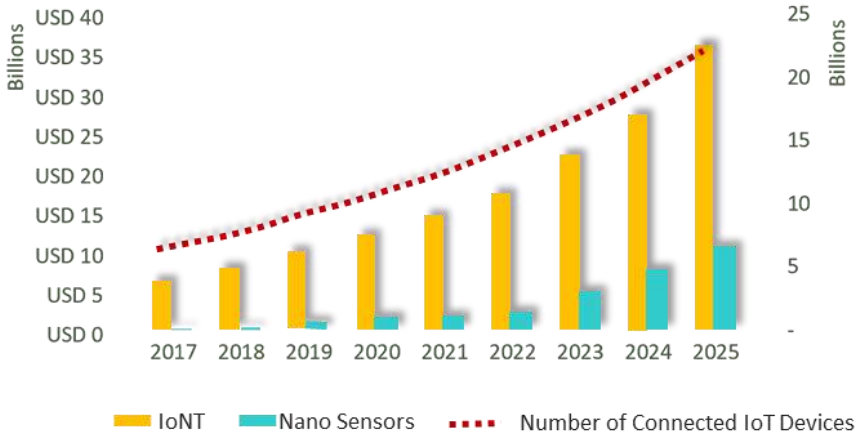
The second use case is Data-driven Asset/Plant Performance Optimization, was valued at USD 6.11 billion in 2020 and is anticipated to witness a CAGR of 41.4%. The Predictive Maintenance are the third largest revenue maker with a total market revenue of USD 5.5 billion in 2020 and is expected to be valued at USD 30.3 billion in 2025 with a CAGR of 40.6%.

The Additive Production and Augmented Operations is expected to propel 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 is still amongst the lowest in 2020. It is still unclear exactly how these use-cases will be shaping up the future.

GLOBAL MARKET REVIEW

Source: (1) IOT Analytics (2) BCC Research

Global Internet of-Nano-Things (IoNT) Market (2020-2025) (1)(2)



The chart shows how the global market would be shaped up by Internet of Nano-Things in the next five years. The growing advancement in the nano sensors industry would further increase the advancements of IoNT exponentially. The number of connected IoT Devices is projected to increase rapidly in the coming years where it is expected the number of connected devices will grow from 9.9 billion devices to 21.5 billion devices in 2025.

The nano sensors market was valued at USD 1.2 billion in 2020, trailing a CAGR of 53.58% with forecast grow of USD 10.26 million in 2025 [2]. IoNT market would also be stimulated by growing demand in application industries driven by increasing number of nano sensors in the market jumping 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 technological subset which is Nano Positioning Systems will be taking advantage 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%.

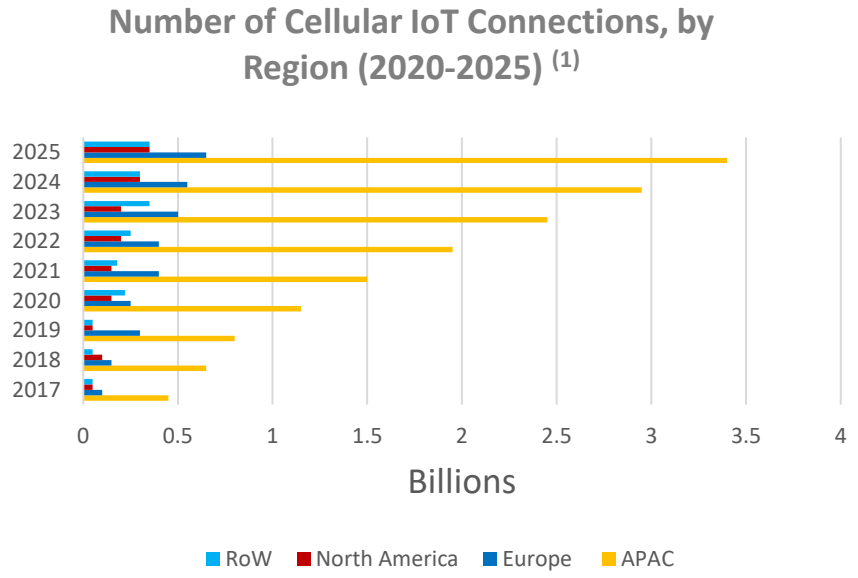
The introduction of new technologies and further adoption of IoNT amongst B2B and B2C will significantly affect continuous trend over the forecast period.

GLOBAL MARKET REVIEW

The chart shows how increased adoption of IoNT in the future would be shaping up the global market. According to research by Ericsson in 2018 describes how IoT connections would be increased correlated with the market. APAC holds the largest share in 2020 and will be the most promising region to look up in the future and will remain so in the next 5 years. This is due to the vast size of 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 are expected to grow to 3.39 billion in 2025 with a growth rate of 23.8% during the forecast period of 2020-2025.

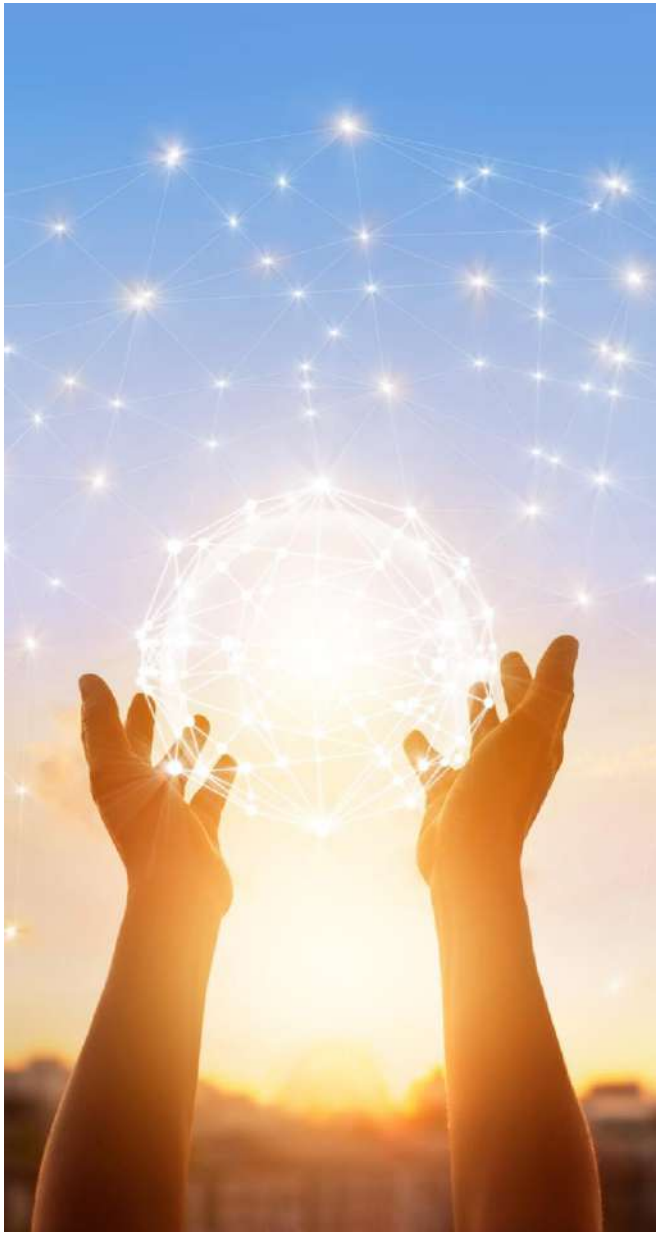
Europe are the region with second largest IoT connection where the number of connections are 260.3 million in 2020 and is expected to reach 678 million in 2025 with a CAGR of 16.9%. The growth rate of Europe is similar to North America but the region has lower number of connections with an amount of 127 million in 2019 and 331.2 million in 2025.

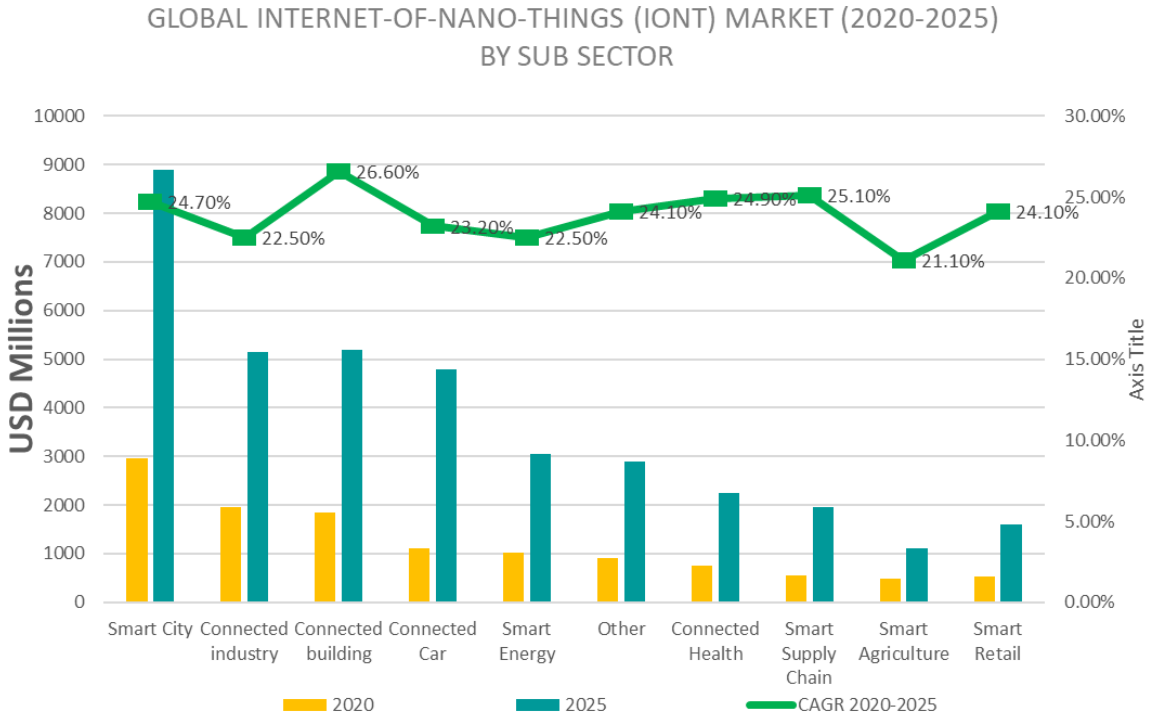


Source: (1)Ericsson Mobility Report

GLOBAL MARKET REVIEW

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things





The Smart City sub-sector was valued at USD 2.32 billion in 2019 and is expected to reach USD 8.81 billion by 2025 expanding at 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%.

Nevertheless, in 2025 will certainly be anticipated to be surpassed 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.

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

Source: (1)Ericsson Mobility Report

REVOLUTIoNT
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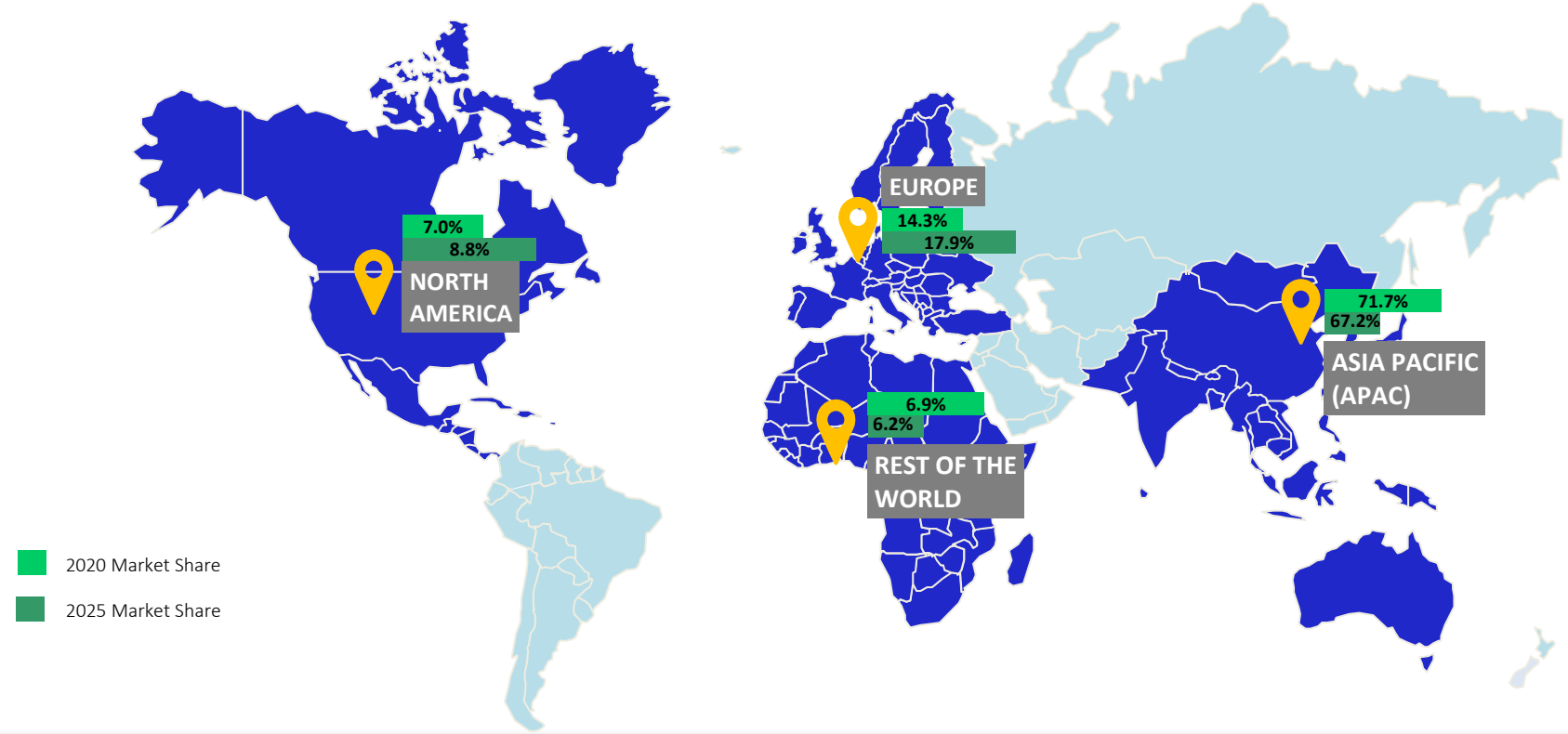
2020 Vs 2025 Landscape: A Glimpse on the IR4.0 Future(1)



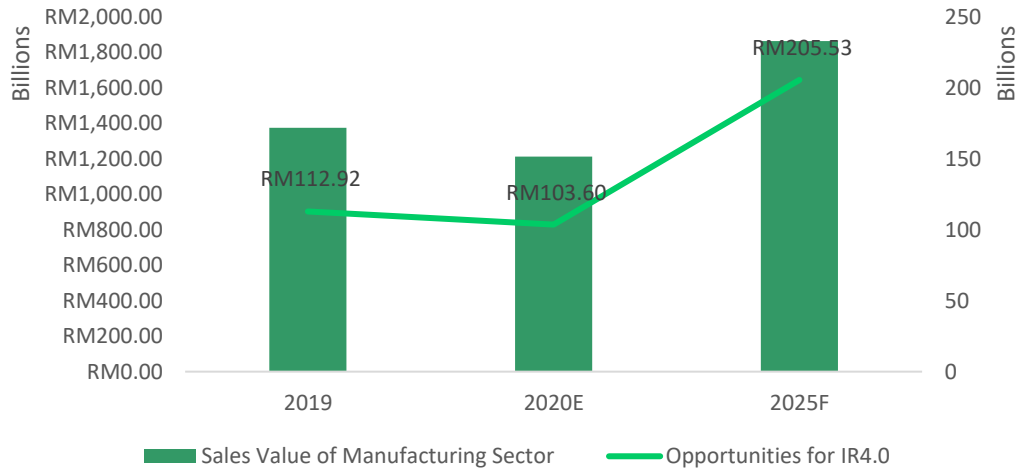
The market is extremely concentrated with few players occupying the overall market. North American players dominated the world followed by European players. However, due to an increased market revenue in APAC, more market players from APAC will participate in the global race to dominate the IoNT market.

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

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

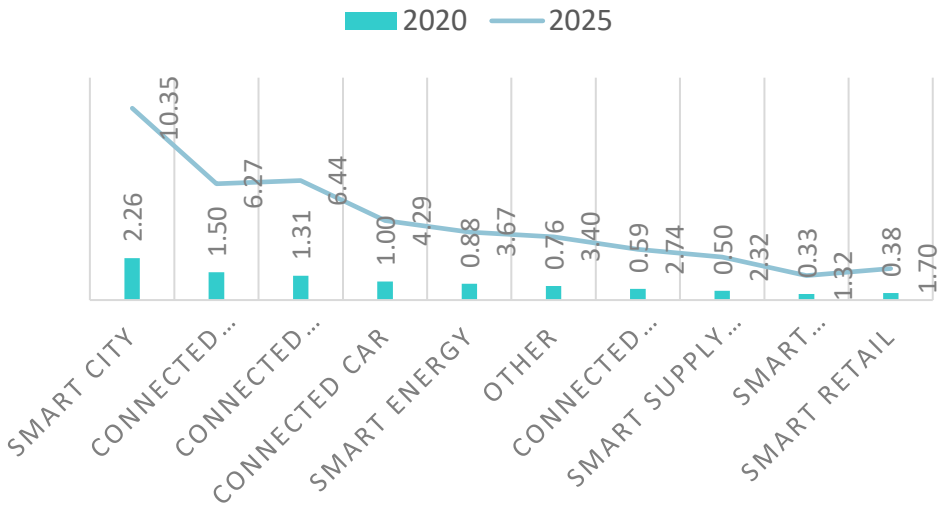
GLOBAL MARKET REVIEW

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.

MALAYSIAN IONT MARKET OPPORTUNITIES (2020 VS 2025) (IN MILLIONS, RM)[1][2]



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

PROJECT HIGHLIGHTS

Internet of Things (IoT)
Data pairing with GPS module

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

PROJECT HIGHLIGHTS

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

METHODOLOGY

FUEL CELL STACK

HYBRID ENERGY STORAGE SYSTEEM

ELECTRIC MOTOR

TYRES

Lotus Super 7 kit car Vehicle (technology validation) platform

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

PROJECT PARTNERS

01

Nano Malaysia Berhad

- Overall coordination, project management & Complimentary funding
- Liaison between project partners and government or private investor

02

EV Connection and UM Power Energy Dedicated Advanced Centre (UMPEDAC)

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

03

Pulsar UAV Sdn Bhd

- Onboard generated hydrogen with fuel cell stack
- Power system integration With HESS to produce H255

04

Wheelspin Motorsports

- Vehicle platform Providers
- Promotions within Motorsports industry

PROJECT HIGHLIGHTS

eclimo®

ES11

ELECTRIC SCOOTER

Available in 7 candytone colors, the ES-11 brings back the fun of scooting around town and fits any lifestyle and personality.

GENERAL SPECIFICATIONS	
Weight:	155kg
Tyres:	130 / 60-13in
Front Brakes:	Hydraulic Disc Brake
Rear Brakes:	Hydraulic Disc Brake
Front / Rear Suspension:	Hydraulic (Oil / Gas)
Dimensions (mm):	1945 x 720 x 1140
Wheelbase (mm):	1410
Ground Clearance (mm):	150
Payload (kg):	212

BATTERY	
Battery Type:	Lithium Ion
Capacity:	3078WH
Battery Weight:	50kg
Battery Life:	1,000 cycles
Charging Voltage (input):	110V / 240V
MOTOR	
Motor Type:	11in Radial Hub
Max Power:	6,000W
Continuos Power:	5,000W
Torque:	110Nm

100 km/h Top Speed

20% Climbing Capacity

100 km Range Per Full Charge*

*Range is based on average speed of 50km/h

The ES-11 electric scooter was built as an inner-city runaround vehicle. It's futuristic-chic exterior was styled to complement its inner power, with clean curves and resilient materials.

FAST CHARGING

FULLY ELECTRIC

ECO FRIENDLY

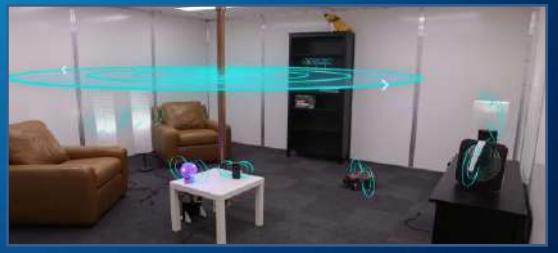
PROJECT HIGHLIGHTS

PROTOTYPE DEMO

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

PIVOTABLE TO OTHER APPLICATIONS – ELECTRIC VEHICLES, BUILDINGS



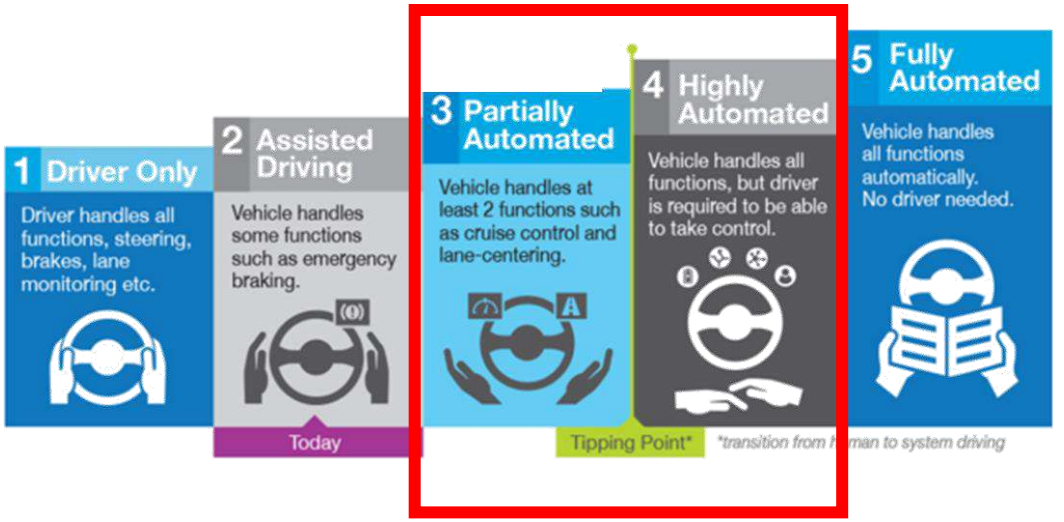
PROJECT HIGHLIGHTS

NanoMalaysia Autonomous Vehicle initiative (NAVi)

- Developed Autonomous Driving technologies to achieve **Visual based Autonomy** able to navigate and operate within a closed environment (outside of public roads). Currently the car is sandboxing in Technology Park Malaysia.

- NAVi achieving Level 3 Autonomy leverages on a visual-based approach specifically towards lane tracking and turning via image detection of predefined markers such as QR codes and signs.

LEVEL OF AUTONOMY



Other autonomous vehicles adopts the 'open road' approach while NAVi focuses on a 'controlled environment' use case. With the 'controlled environment' approach, including the vehicle itself there are certain elements of the environment that can be manipulated/ controlled in order for the vehicle to perform its autonomous functions compared to the 'open road'. At a component level, NAVi utilizes custom hardware modules for steering and braking via actuators. The technology developed is highly based on marker-based image detection via cameras which allows for the AI system to receive, decipher and execute instructions.

NATIONAL GRAPHENE ACTION PLAN

GRAPHENE ADOPTION IN NANOFLUID APPLICATIONS

$ 23.5 BILLION

CAGR 5.6%

Asia Pacific Engine Oil Market Forecast (2024)

RM 6.95 MILLION

Estimated Graphene based Engine Oil in the Malaysian Market (2025)

$ 59.2 MILLION

Estimated APAC Market for fluid Loss Additive for Drilling Fluids (2025)

1. Graphene-enhanced engine oil

- Lower frictional wear
- Lower volatility at high heat condition better engine protection

2. Advanced hybrid graphene engine oil

Infinoil

- Lower wear and friction
- Higher heat transfer capacity
- Lower oil volatility
- Lower fuel consumption

3. Graphene-based emulsion solution for flow assurance in crude oil

- Reduced crystallization tendency which leads to improved fluid flow
- Reduced drag between crude oil and the pipeline internal surfaces

4. Graphene based fluid loss control additive for drilling fluids

- Improved rheological and filtration loss properties
- Improved overall drilling efficiency
- Improved thermal conductivity properties

INDUSTRY

Automotives Industries

Oilfield Applications

Drilling Fluid Industries

Oil & Gas Industries

GRAPHENE ADOPTION IN ENERGY STORAGE APPLICATIONS

$ 15.93 BILLION

CAGR 5.6%

APAC Li-ion Energy Storage Market Revenue Forecast 2025

RM 821.6 BILLION

Malaysian Li-ion Energy Storage Market Revenue Forecast (2025)

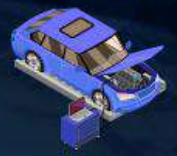
Graphene-based quantum cell (My Power Pack) for backup Storage application	• Lightweight • Outstanding lifecycle and discharge time
Graphene-based redox flow battery for energy storage	• Improved electrical and mechanical stability and energy efficiency • High surface to volume ratio
High Energy Density Graphene-based lithium ion battery	• Significant improvement on battery • Reduced charge-discharge cycle • Significant reduction on charging time

INDUSTRY

Food Trucks & Night Market

Outdoor Activities

Telcotower Grid



Vehicle Jumpstart

NATIONAL GRAPHENE ACTION PLAN

GRAPHENE ADOPTION IN RUBBER APPLICATIONS

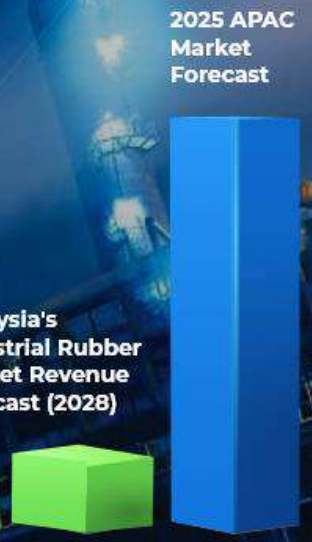
$ 55.4 BILLION

CAGR 5.6%

2025 APAC Market Forecast

RM 1.7 BILLION

Malaysia's industrial Rubber Market Revenue Forecast (2028)



INDUSTRY

Semiconductors& electronics industries

Forklift

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 biodegradibility

NATIONAL GRAPHENE ACTION PLAN

GRAPHENE ADOPTION IN INTERNET OF NANO-THINGS (IONT)

RM 410.4 MIL	$ 1.76 BILLION	$ 21.12 BILLION
Total Malaysian Addressable Market for Wireless Charger (2026)	RF Wireless Charger Market Share (2026)	Total Malaysian Addressable Market for Wireless Charger (2026)

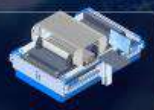
1. Graphene-based conductive inks for printed circuit

- Improved conductivity
- 20% on average cost reduction

2. Graphene-based wireless radio frequency (RF) mobile phone charger for building and public transport

- Long range charging (ohm-m)
- Non-inductive mobile phone charging

3. Graphene-based printed flexible circuit for electronic application



- Improved conductivity and flexibility
- 10-30% cost reduction

4. Graphene-based E. Coli sensor for water quality measurement

- Compact, in-situ detection
- Cost effective
- Light weight & user friendly

INDUSTRY

Electronics

Telecommunication

Water Treatment

4IR BUILDING-BLOCK PROJECTS FROM RMK-11

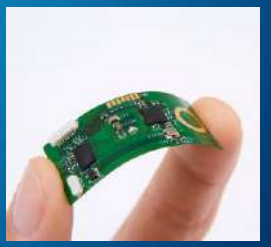
REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things













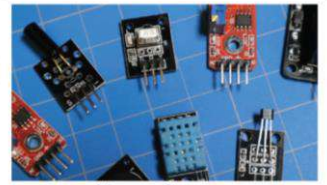

4IR BUILDING-BLOCK PROJECTS FROM RMK-11

Nanotech Smart City

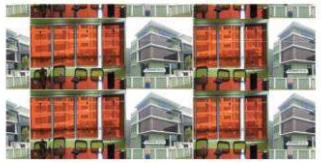
Autonomous Vehicle

SmartSwap Energy Station
Standardised Battery Exchange Platform for Malaysia-made Electris Motorcycle

Wireless chargers

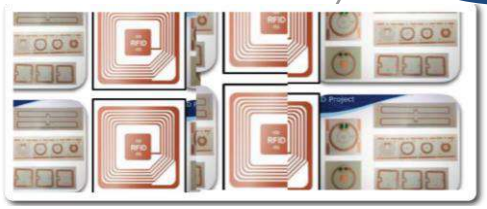


Nano Sensors



Window solar panel

Towards Connected Nano Devices & System or Internet of Nano-Things (IoNT)



MyPowerPack
Rechargeable Mobile Energy Storage Device

Green Energy Generators
No-Fuel Generators (NFG)
Graphene Electrical Generators (GeG)
Solar Hybrid Graphene Electrical Generators (SHGeG)

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

02

ABOUT NANOMALAYSIA

WHO WE ARE

NANOMALAYSIA®

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 Ministry of Science, Technology and Innovation (MOSTI).

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
JOINS
ASIAN NANO
FORUM
THE
NATIONAL
NANOTECH
INITIATIVE
WAS LAUNCHED
2006
2009
THE
NATIONAL
INNOVATION
COUNCIL
IDENTIFIED
NANOTECH
AS AN IMPORTANT
GROWTH ENGINE
FOR MALAYSIA'S NEW
ECONOMIC POLICY
THE
NATIONAL
NANOTECH
DIRECTORATE (NND)
WAS ESTABLISHED AND
LAID OUT
NANOMALAYSI
A PROGRAMME
2011-2020
2010
2011
NANOMALAYSI
A
WAS MOOTED DURING THE
NATIONAL
INNOVATION
COUNCIL (NIC)
MEETING AND
INCORPORATED
AS A COMPANY LIMITED BY
GUARANTEE (CLBG)
IN AUGUST 2011 UNDER

OUR CORE BUSINESS

Provided technology and business landscaping, consultancy due diligence and verification

Identify and facilitate business opportunities

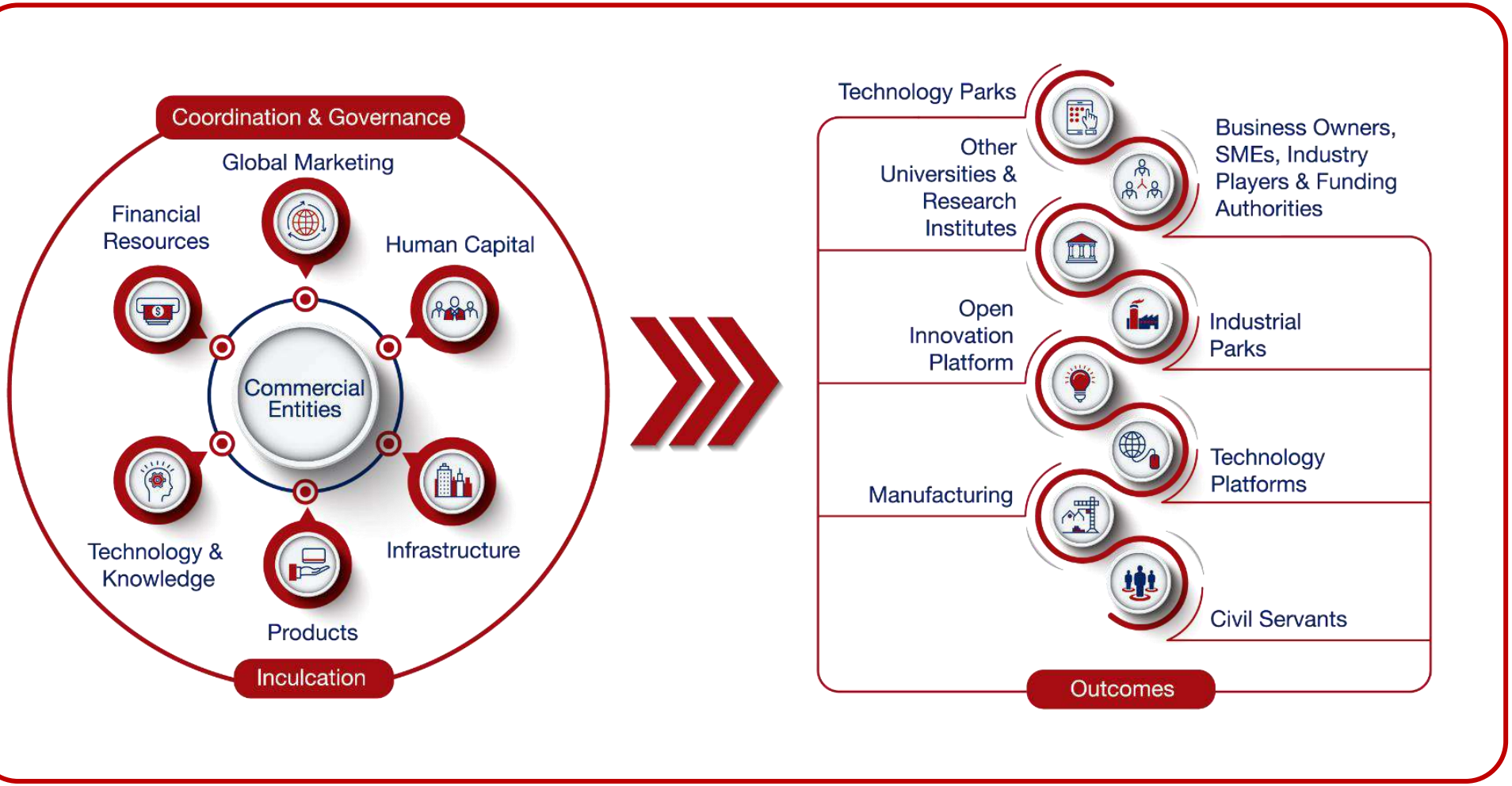
Facilitate investment in commericialisation

Strategies, recommend and coordinate R&D commercialisation

Facilitate humane capital development

OUR ECOSYSTEM

NANOMALAYSIA®



OUR VISION

To be a global leader in Nanotechnology commercialisation

NANOMALAYSIA®

OUR 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

NANOMALAYSIA®

NANOMALAYSIA®

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
- Mohd Yusof Bin Hussian
  Director
- Dr. Mohd Nor Azman Bin Hassan
  Director
- Dr. Rezal Khairi bin Ahmad
  Director

Company Secretary:
- Wong Youn Kim
  HMC Corporate Services Sdn Bhd (83556-P)

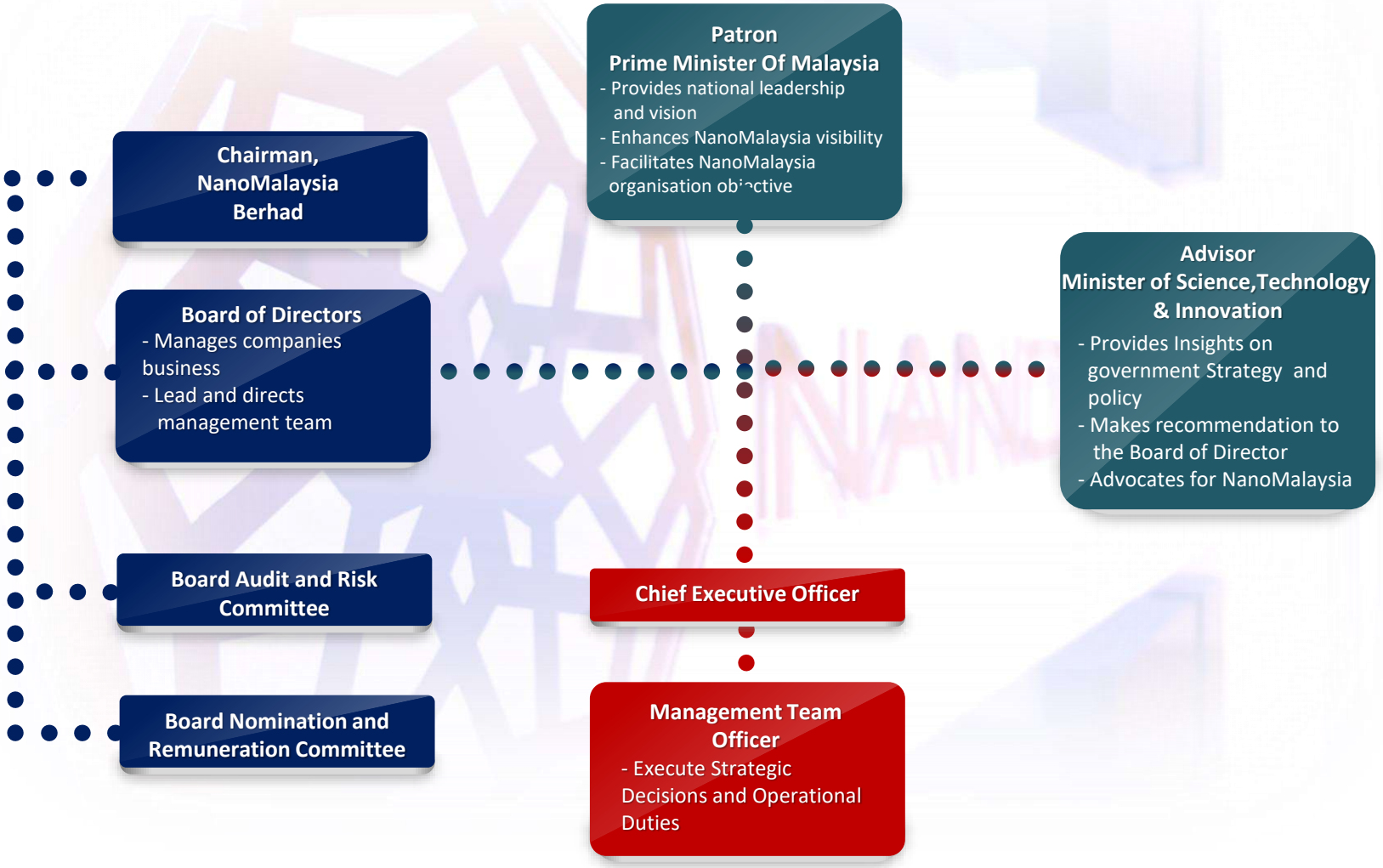
Registered Office:
- NanoMalaysia Berhad (955265-P)
  Suite C-5-4, Wisma Goshen
  Plaza Pantai, Jalan Pantai Bharu
  59200 Kuala Lumpur

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

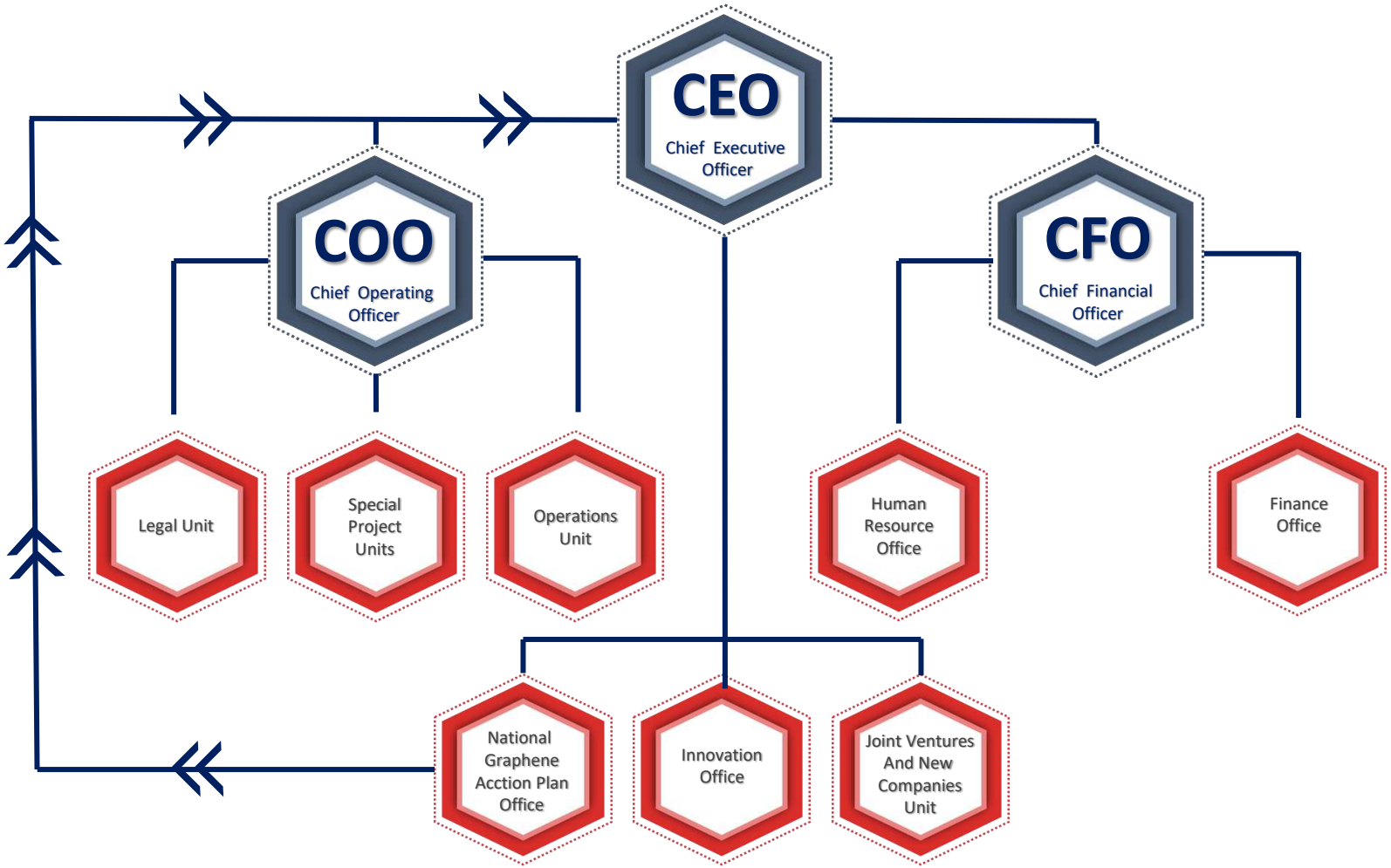
Auditors:
- A Razak & Co

GOVERNANCE STRUCTURE



CORPORATE STRUCTURE

ORGANISATIONAL CHART



BOARD MEMBERS

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

Dr. Zawawi joined NanoMalaysia in 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).

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.

BOARD MEMBERS

DATO' SRI IR. DR. JUDIN ABDUL KARIM

MEMBER OF BOARD AUDIT & RISK COMMITTEE

Dr Judin joined NanoMalaysia in 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 Bhd

DATO' AHMAD SHUKRI BIN HJ. TAJUDDIN

MEMBER OF BOARD AUDIT & RISK COMMITTEE

Dato' Ahmad Shukri joined NanoMalaysia in 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 & RISK COMMITTEE**
- **MEMBER OF BOARD NOMINATION & REMUNERATION COMMITEE**

Dr. Salleh joined NanoMalaysia in 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 recipient 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

DATO' PROFESSOR DR. RUJHAN BIN MUSTAFA

CHAIRMAN OF BOARD NOMINATION & REMUNERATION COMMITTEE

Dr. Rujhan joined NanoMalaysia in 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.

MR. MOHD YUSOF BIN HUSSAIN

- **CHAIRMAN OF BOARD AUDIT & RISK COMMITTEE**
- **MEMBER OF BOARD NOMINATION & REMUNERATION COMMITTEE**

Mr. Mohd Yusof bin Hussian, CA (Malaysia), FCCA (UK), MCIPS (UK), CFP (USA), is currently the Non Executive Chairman of Tune Insurance Malaysia Berhad, an associate Company of Air Asia Group i.e. (the largest public-listed subsidiary company under Tune Protect Group Berhad. He is also currently an independent non-executive director (INED) of Boilermech Holdings Berhad (a public-listed associate Company of QL Resources Berhad) where he is a member of the Audit and Nomination Committees. Yusof is also an independent non-executive director of Proton-Commerce, a joint-venture Sdn Bhd between Proton and CIMB. In January 2019, Yusof latest appointment was as an INED, Chairman of BAC and member of NRC of NanoMalaysia Berhad a public company limited by Guarantee and fully owned by the Government.

DR. MOHD NOR AZMAN BIN HASSAN

- **MOSTI'S REPRESENTATIVE**
- **MEMBER OF BOARD AUDIT & RISK COMMITTEE**

Dr. Mohd Nor Azman Hassan is currently the Deputy Secretary General (Science) of the Ministry of Science, Technology and Innovation (MOSTI). He oversees the policies and development of science, technology and innovation ecosystem to support the socio-economic development of the country. His previous positions were in the areas of higher education, policy and technological development including industrial related technologies such as renewable energy, advanced materials and manufacturing, biotechnology and nanotechnology. He had extensive engagements with the industry especially the SMEs, in particular to communicate government's policies relating to STI. Dr. Azman holds a doctoral degree from Carnegie Mellon University, Pittsburgh, USA in the field of renewable energy technology and is trained in conducting Life Cycle Analysis (LCA). Dr Azman is also a registered Technologist with the Malaysian Board of Technologist.

DR. REZAL KHAIRI AHMAD

CHIEF EXECUTIVE OFFICER

Dr. Rezal Khairi Ahmad was appointed as the Chief Executive Officer in January 2013 under a secondment from Khazanah Nasional. He is also a Board Member of NanoMalaysia and Nano Commerce Sdn Bhd, Founding Chairman of NanoVerify Sdn Bhd and Founding Director of Nanovation Ventures Sdn Bhd. Currently, he serves as Chairman of Advanced Materials Investment Advisory Panel Working Group under Malaysian Investment Development Authority, Treasurer for Asia Nano Forum, Chairman of Commercialization Working Group under Asia Nano Forum and Member of the Board of Governors for Malaysia Laboratories for Academia-Business Collaborations (MyLAB). In September 2017, he was appointed the International Advisor to China Graphene Industry Alliance (CGIA), linking Malaysia's National Graphene Action Plan 2020 for mutual economic benefits. Formerly attached to the College of Engineering, Universiti Tenaga Nasional as an academician and Head of Semiconductor Group from 1998 to 2007, he was also an engineer at Tenaga Nasional ICT in 2003. In 2000, he cofounded Malaysia-Events Sdn Bhd, a start-up for an e-commerce platform. Recently in 2020, he was appointed as Adjunct Professor at Universiti Teknologi Malaysia (UTM). In 2021, He was also appointed as a member of the Malaysian Petroleum Resources Corporation Industry Advisory Panel (IAP) to provide guidance on new energy opportunities in the oil and gas sector. He holds a PhD in Nanotechnology, Electronic/Electrical Engineering from the London Centre for Nanotechnology, University College London as the first Khazanah PhD Scholar from 2007 to 2010 with publications in high impact journals. In 2014, he was instrumental in crafting out Malaysia's National Graphene Action Plan 2020 and co-authored chapters pertaining to innovation under the 11th and 12th Malaysia Plan. He is also the architect of the nanotechnology commercialization ecosystem in Malaysia. In 2017, he was listed as one of Malaysia's key business influencers by International Business Review and since 2019, he is Malaysia's Top 100 LinkedIn Icons. His current endeavors include renewable energy solutions including latest PV, hydrogen and battery technologies, projects on Internet of NanoThings and blockchain applications for high technology management towards the 4th Industrial Revolution.

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.

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

SENIOR 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

SENIOR 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.

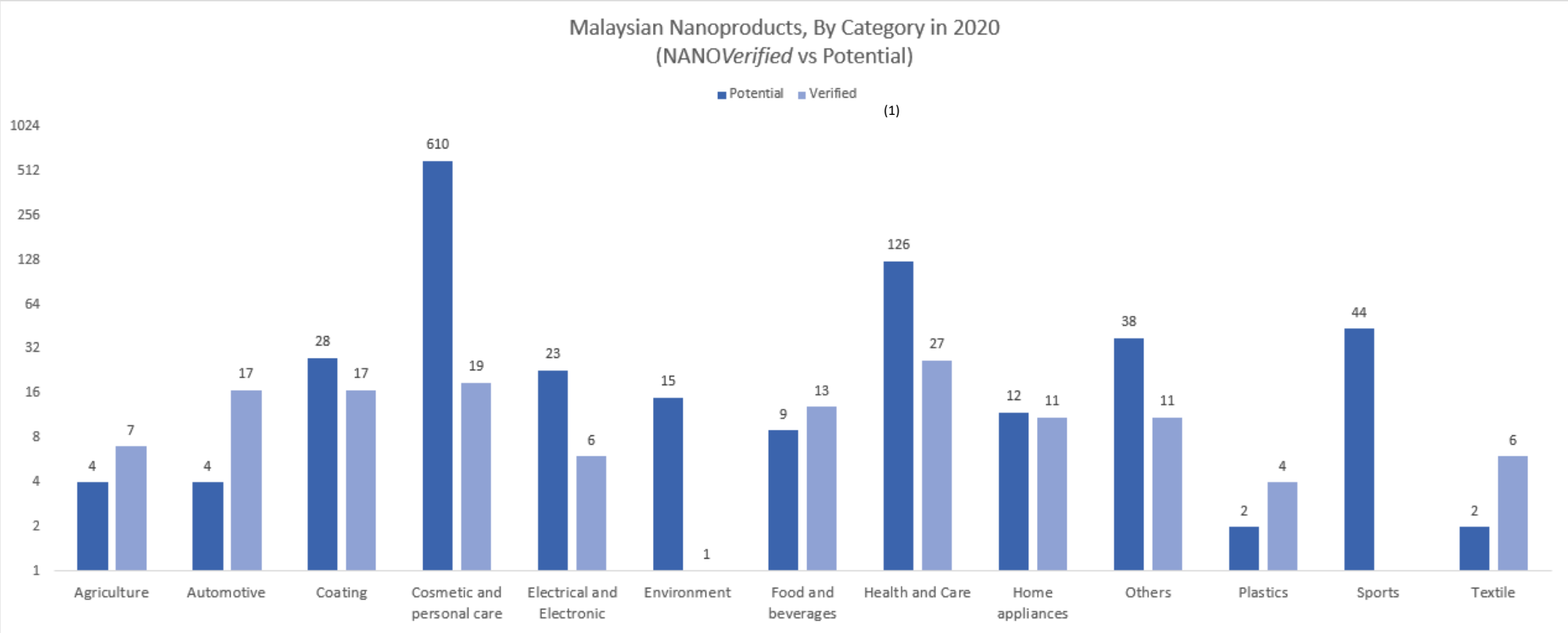
RAJA ANIS AZYARINA BINTI RAJA ISKANDAR
VICE PRESIDENT, LEGAL UNIT

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 honors from National University of Malaysia and earned a master's degree in management from the University of Durham, Durham Business School, United Kingdom.

03

THE NANOTECH INDUSTRY

MALAYSIAN NANOTECHNOLOGY LANDSCAPE

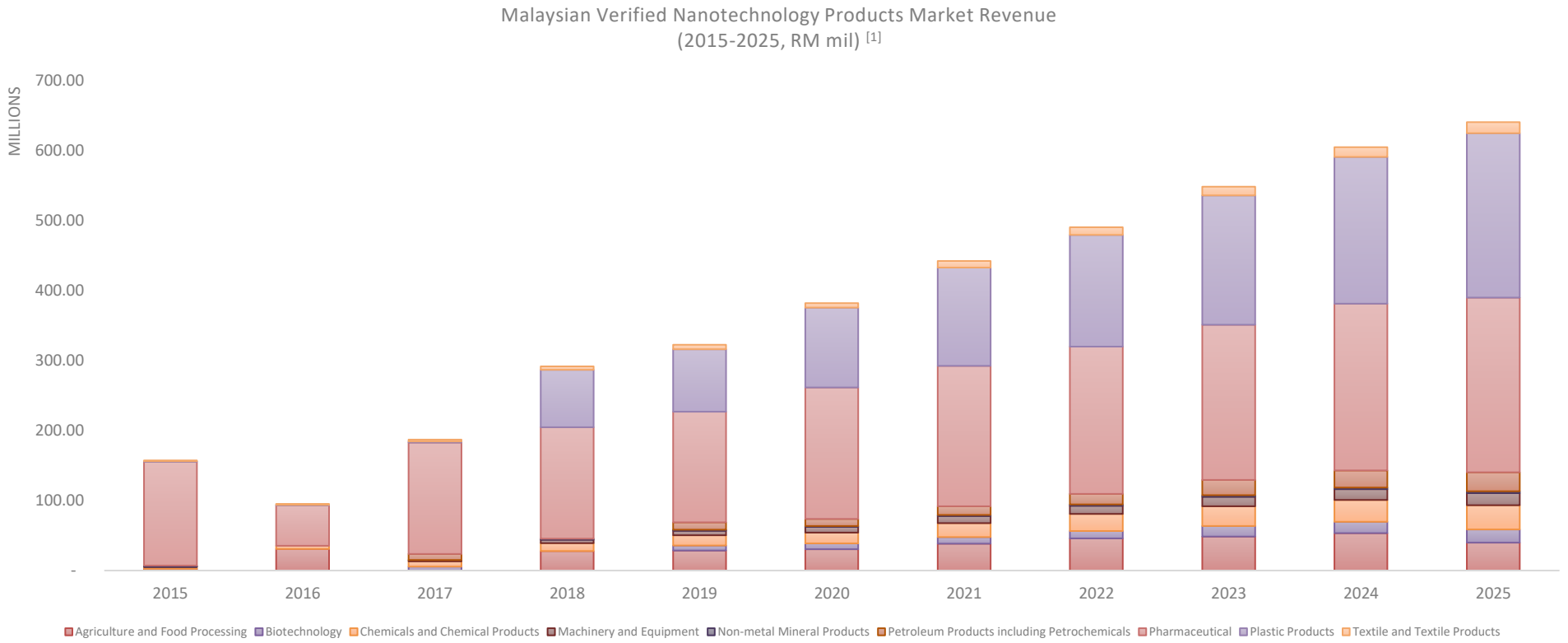


Sources:
[1] NVSB Research – Malaysian Nanotechnology Landscape

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

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.

MALAYSIAN NANOTECHNOLOGY LANDSCAPE



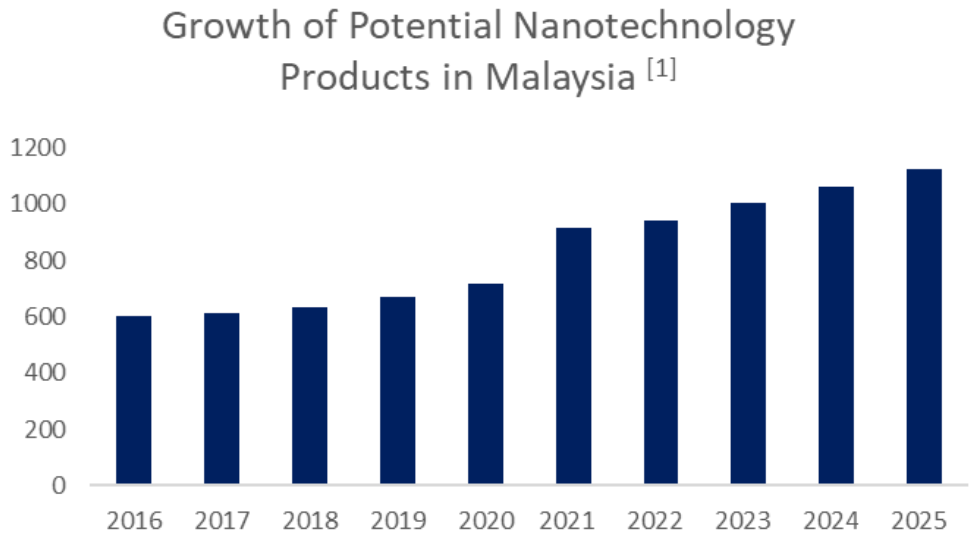
Malaysian nanotechnology products market revenue were valued at RM 322.307 mil in 2019 and is expected to grow steadily amid COVID-19 pandemic. This is due to the fact that nanotechnology serves as a technology-enabler to combat COVID-19. Nanomaterials play a pivotal role as disinfectant and other preventive measures from SARS-CoV-2. For these reasons, we expect that the revenue from biotechnology, chemical, pharmaceutical, plastic and textile manufacturers to soar despite the challenges ahead.

We expect that the local nanotechnology scene to register healthy CAGR of 10.9% for the forecast period of 2020-2025 where pharmaceutical and plastic products will dominate the Malaysian market with each of them registering RM 249.46 million and RM 234.72 million respectively.

As the number of verified companies increase via NANOVerify Programme over the next 5 years, we expect that the revenue and participations from more sectors will be increasing.

Sources: [1] Lux Research & NVSB Internal Research

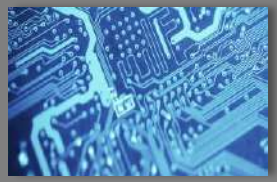
GROWING NUMBER OF CERTIFIED MALAYSIAN NANOTECHNOLOGY PRODUCTS



Sources:
[1] NVSB Research – Malaysian Nanotechnology Landscape

Due to the importance of certification in the Malaysian market, NVSB aims to increase the number of certifications for 2021. Currently, **139** out of **1,056** products **(13.2%)** have been certified under the NANO*Verify* Programme [1]

FORESIGHT: 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 next generation high performance batteries, such as all solid state, multivalent cation, metal-air and lithium-Sulphur (Li-S) batteries.

Bio - Fabrication

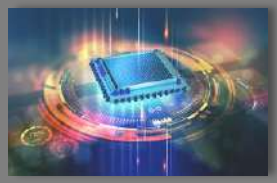
The emergence of 3D bio-printing for freely arranging biomaterials and cells paves the way for application in constructing tissues and organs, discovery of new drugs and regenerative medicine.

Neuroimaging

Remarkable 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.

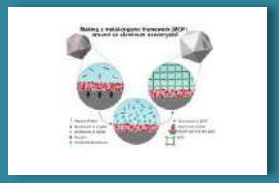
IoT enabled Artificial Intelligence (AI) devices

Hugely anticipated arrival of an IoT smart society based on AI abd Deep Learning Technologies.



Quantum Computing

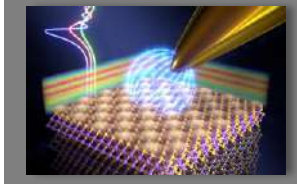
Super-fast computations through quantum mechanics and quantum gate and quantum annealing systems are expected to have application in AI.



Porous Frame works (PCP, MOF and COF)

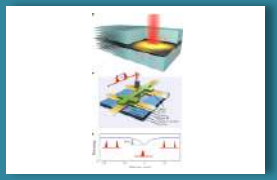
These compounds have controllable nano spaces that could be used for highly selective adsorption/

desorption fields, electronic/ iconic conductivity and specific reactions.



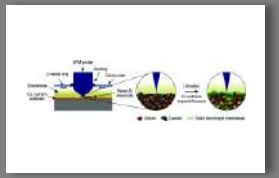
Topological Insulators

A candidate for next-generation electronic device, exhibiting a unique metallic state at it's boundaries (surface in 3D and edge in 2D systems) but no it's 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

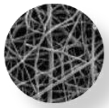
There is much interest in the development of operando measurements ranging from materials to organisms.

04

NANOMALAYSIA PROGRAMMES

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

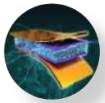
Drug delivery (Nanomedicine, biosensors)

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 System

Nanosensors (Scalar sensors & system)

Nanoelectronics (Processors, NEMS)

Nanodevices (Phones, cameras etc.)

NANOMALAYSIA RMK-11 PROGRAMME

FOCUSING ON 4 KEY STRATEGIC JUMPSTART SECTORS

Food and Agricultural | Wellness, Medical and Healthcare | Energy and Environment | Electronic Devices and System

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.

SECTOR: 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 2020, E&E was Malaysia's largest export earner at RM368.1 billion, with 3.5% increase despite the COVID-19 pandemic[1].

The added value of the E&E sub-sector stood at RM75.9 billion in 2020, an 5.6% 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.

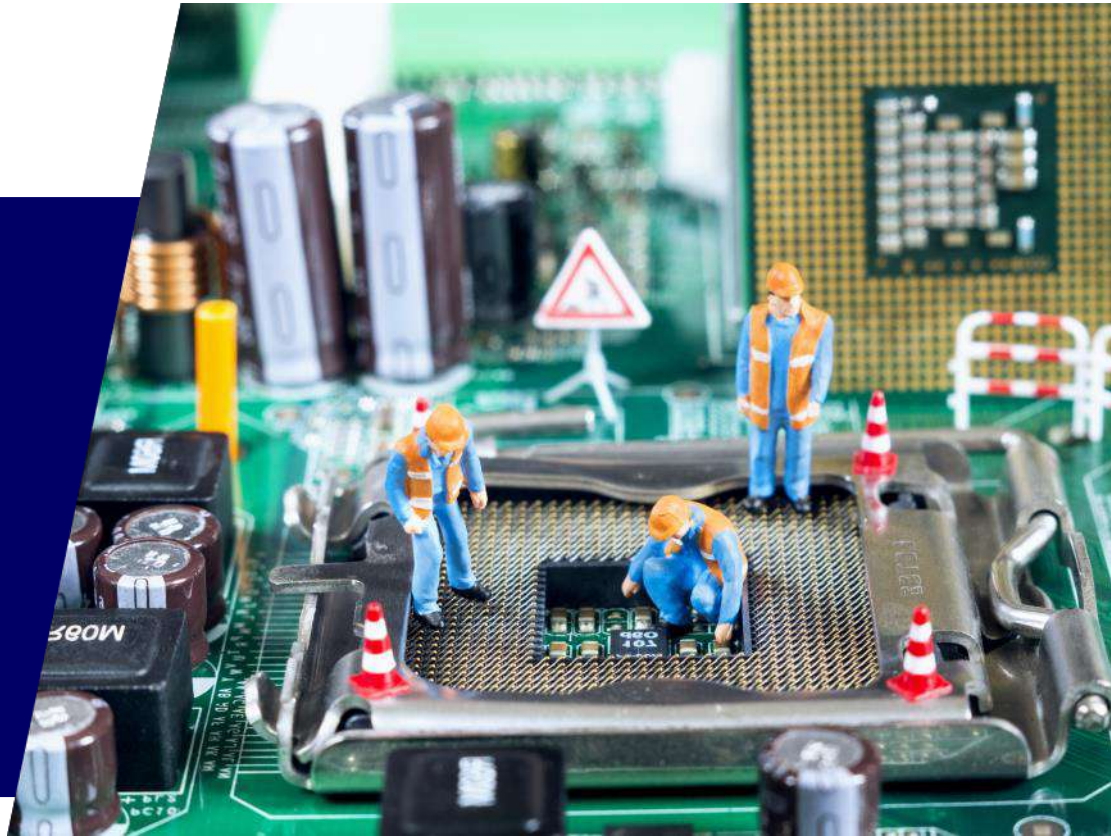
Employment within the E&E sector has seen a decrease of the total manufacturing workforce by -1.2% comprising of 556,223 workers as at end 2020[2]. The manufacturing sector is forecast to rebound by 7% in 2021[3].

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 fueled by the advent of new breakthrough discoveries in nanotechnology such as nanoelectronics and nanophotonic, as well as the rise of the Internet of Nano Things (IoNT).

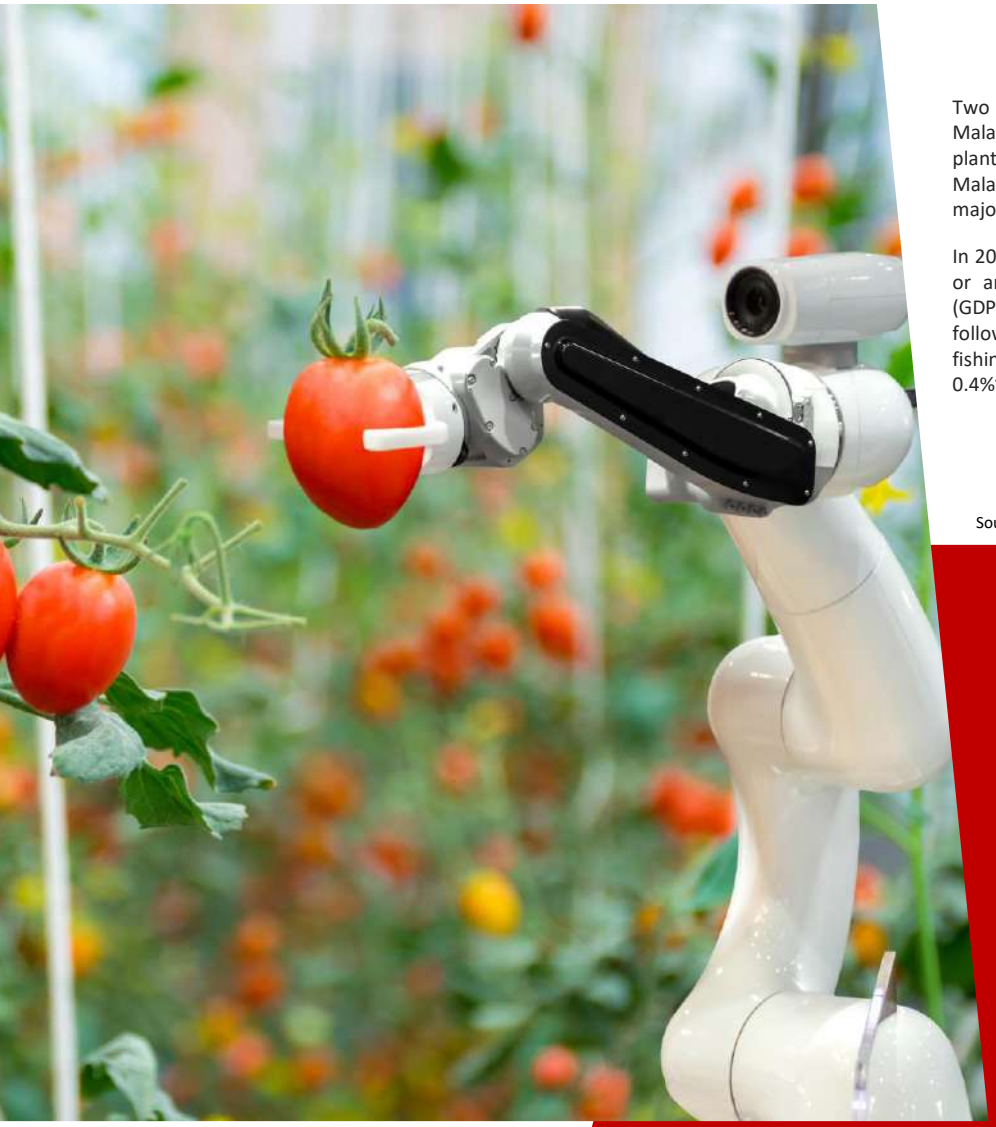
Sources:
(1) Department of Statistics Malaysia
(2) Economy Outlook 2021- Ministry of Finance

Malaysian Nanotechnology Market Size

Electronic devices and systems in Malaysia was valued at RM 620.9 billion in 2020 where 59.2% (RM 368.1 billion) are exported goods. Electronic integrated circuits and micro assemblies made up a large chunk of the shares with an export value of RM 368.1 billion. The electrical and electronics (E&E) manufacturing industry in Malaysia employs 556,223 paid employees in 2020. Nanotechnology complements the E&E industry by through 2D materials such as graphene 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.



SECTOR: 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 2020, the agriculture sector contributed RM99.4 billion, or an equivalent of 8.2%, to Gross Domestic Product (GDP). Of this, oil palm was the largest contributor at 3.6%, followed by other agriculture at 1.9%, livestock at 1.2%, fishing at 0.8%, rubber at 0.2%, and forestry and logging at 0.4%[4].

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

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.

Sources: (4) Department of Statistics Malaysia

Malaysian Nanotechnology Market Size

The Malaysian trade performance for food and agricultural industry was valued at RM 134.9 billion 2020, a decrease of 7% compared to 2019. 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

SECTOR: 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 Science, Technology and Innovation 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 45.72 billion in 2020 where 69.9% (RM31.97 billion) are exported goods. Batteries constitute RM 3.05 billion in 2020. Based on a report by Sustainable Energy Development Authority (SEDA), The total approved Net Energy Meeting (NEM) 3.0 Programme quota stands at 500MW, where a large portion of it comes from the industry (300MW). 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.

SECTOR: WELLNESS, MEDICAL AND HEALTHCARE

Malaysian Nanotechnology Market Size

The Malaysian health and wellness trade performance was valued at RM 12.48 billion in 2020 where imports and exports are balanced. In the other hand, medical instruments and devices with a total trade value of RM18.9 billion. Pharmaceutical products manufacturer employs 23,344 employees in 2020, an increase of 9.5% from 2019 due to the demand during COVID-19 pandemic. 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.

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.

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

- Building Awareness
- Project Execution
- Scale-Up Support
- Coordination And Monitoring

The National Graphene Action Plan 2020 (NGAP 2020) was launched in July 2014 as a result of an extensive and potent collaboration between the government, private sectors, research institutes and academia to assess how Malaysia can benefit from the potential downstream applications of graphene. NGAP2020 is a commercialisation programme focusing on graphene applications and high value-add graphene enabled manufacturing processes with IPs in five key application areas. In 2020, NGAP2020 has contributed 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

Creating awareness within the greater ecosystem on the benefits of the commercialisation of graphene nanoproducts is crucial to drive sectoral expansion and growth as graphene is a relatively new and unknown material. 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 : 6 projects
- Conductive Inks: 4 projects
- Rubber Additives : 8 Projects
- Plastics Additives : 13 Projects
- Nanofluids : 13 Projects

From 2016 until 2020, there were 30 completed projects and 23 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 8 projects under this area.

Commercialized product as at end of 2020:

- Bonric Sdn Bhd
- MNA-Research Sdn Bhd
- IDC Global Sdn Bhd
- Penchem Technologies 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.

WHAT WE DO

National Graphene Action Plan 2020 Review

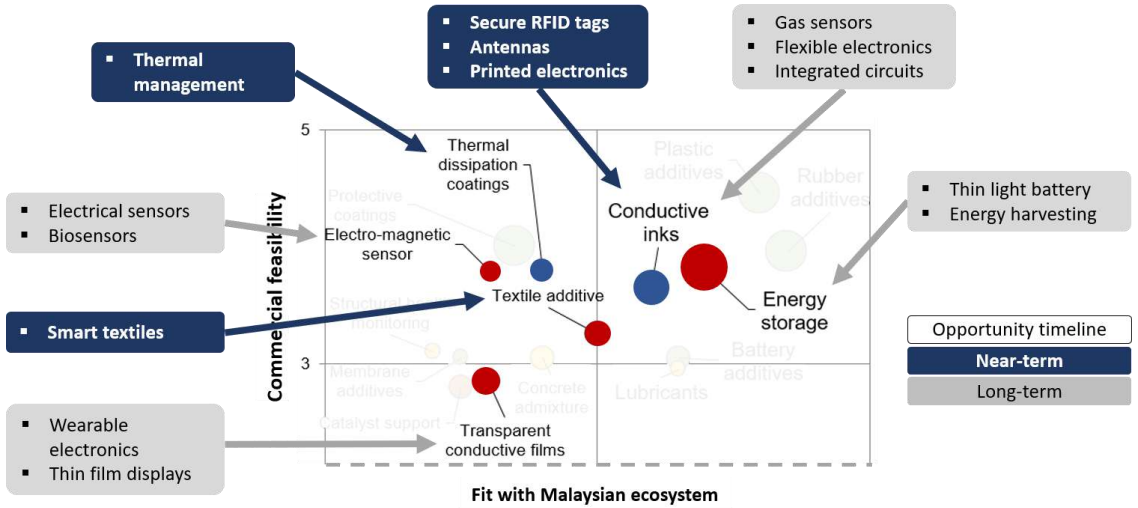
In March 2018, NanoMalaysia appointed LuxResearch to conduct a mid-term review of our progress on NGAP2020. By analyzing the global graphene market landscape, Lux found that graphene had faced considerable hype, and that commercialisation has been much more challenging than expected. Lux identified 30 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.



Mid Term Review in 2017/18: Building graphene capability gives Malaysia avenues to shift into the Internet-of-NanoThings & 4th Industrial Revolution

COMMERCIALIZATION HIGHLIGHTS

The development and commercialization of energy storage technology are paving the way towards more sustainable solutions to overcome challenges related to energy density and storage. The increasing energy demand for next generation portable and miniaturised electronic devices has sparked intensive interest to explore micro-scale 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.

My Power Pack provides a more energy efficient and environmental friendly means of power supply compared to conventional solutions used for solar, telco tower and emergency power supply applications.

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

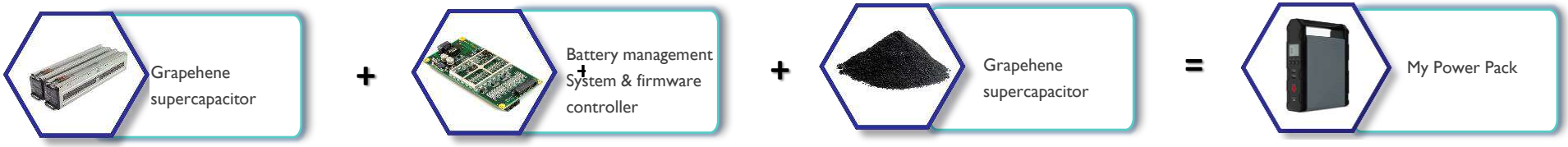
Company:

MNA Research Sdn Bhd

Production of Back up Storage Graphene-Based Quantum Cell (BSGQC)

Benefits:

- Fast charging
- High capacity energy storage for off-grid infrastructure



COMMERCIALIZATION HIGHLIGHTS

Company:

Panchem Technologies Sdn Bhd

PENCHEM

Graphene-based conductive inks for printed circuit board

Benefits :

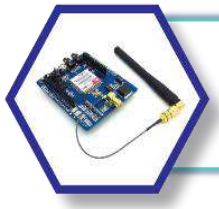
- Graphene-based conductive inks reduces resistance by a factor of 10- enabling energy efficient circuitry and devices

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.

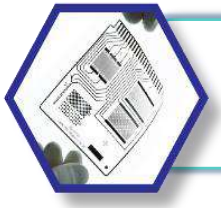
NanoMalaysia has assisted Penchem under the auspices of the NGAP2020 initiative to successfully develop graphene-based conductive inks for flexible circuits.

CONDUCTIVE INKS
COMPANY: PENCHEM TECHNOLOGIES SDN BHD

Radio frequency Identification (RFID), e.g SmartTAG



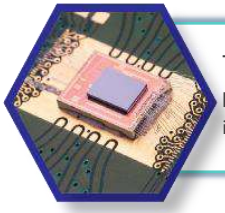
Antennae e.G Smart Cards



Inkjet Conductive Ink

Flexible circuit and sensors

Printed heaters



TIM for high performance integrated circuits

COMMERCIALIZATION HIGHLIGHTS

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.

NANOFLUIDS
COMPANY: SCOMI CHEMICALS SDN BHD

Company:

Scomi Chemicals Sdn Bhd

Graphene-based lubricant additive for automotive

Benefits :

- Reduced engine friction
- Improves fuel efficiency and lowers emissions

Greater thermal conductivity

Heat stability

Optimum dynamic stability

COMMERCIALIZATION HIGHLIGHTS

RUBBER ADDITIVES
COMPANY: BONRIC SDN BHD

The Malaysian market demand for ESD gloves is set to grow following the recent announcement of the 12th Malaysia Plan which will focus on the development of high growth industries – one of them being advanced electrical and electronics. Under the NGAP2020 initiative, NanoMalaysia is supporting Bonric Sdn Bhd in its development of graphene infused latex glove. These latex ESD gloves have been enhanced with nanotechnology – making them thinner, tear-proof, biodegradable, and less susceptible to Type IV chemical allergy. This allows extensive application in numerous industries such as electronic disk drive; semiconductor; avionics; space technology; and even healthcare.

The integration of nanotechnology in rubber gloves will open new lateral commercial opportunities in other and adjacent markets that require improved and different glove performances. All these opportunities are poised to generate new high value jobs and high technology supply chains in Malaysia.

Company:

Bonric Sdn Bhd

Graphene ESD Latex Gloves

Benefits :

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

PLASTIC ADDITIVES

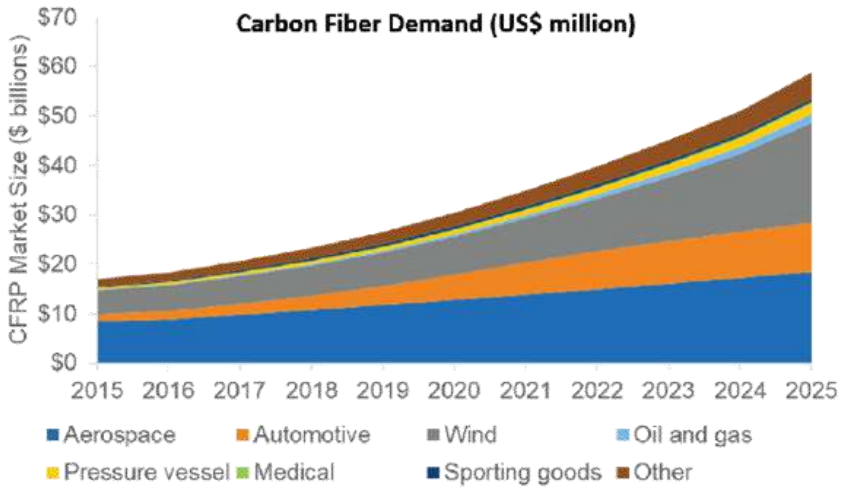
Malaysia has the right elements in place to develop a graphene-enhanced composites center of excellence

Hexcel, Boeing expand Aerospace Composites Malaysia facility

Composites World, November 2013

Spirit AeroSystems to expand Malaysia Facility, Hire Additional Workers

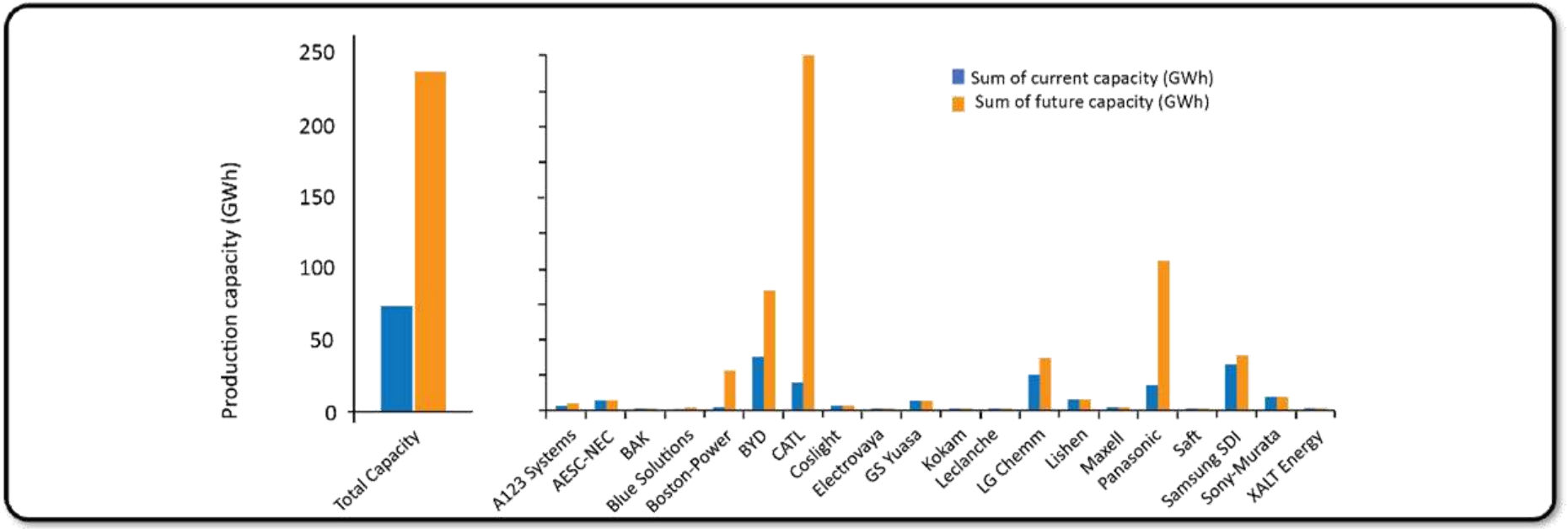
Aviation Week, June 2017

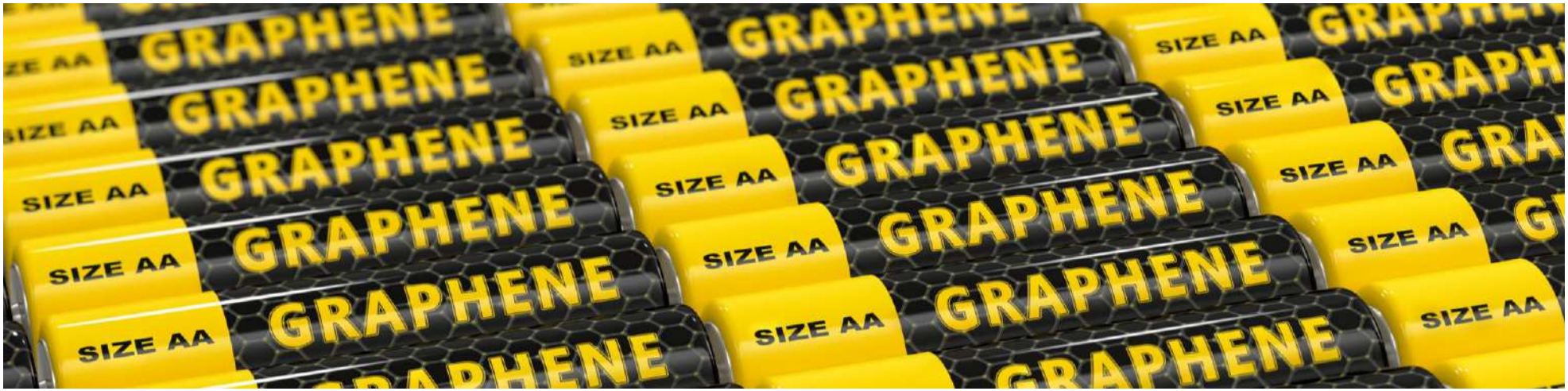


Source: Lux Research Carbon Fiber Update 2017

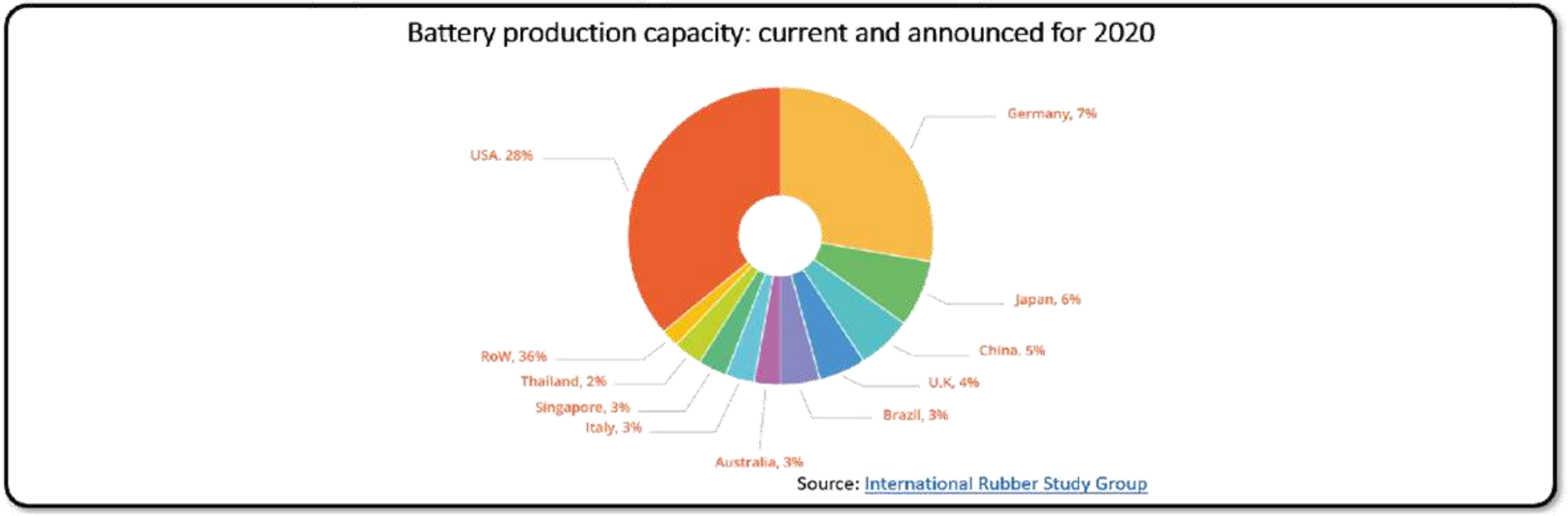
ENERGY STORAGE

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





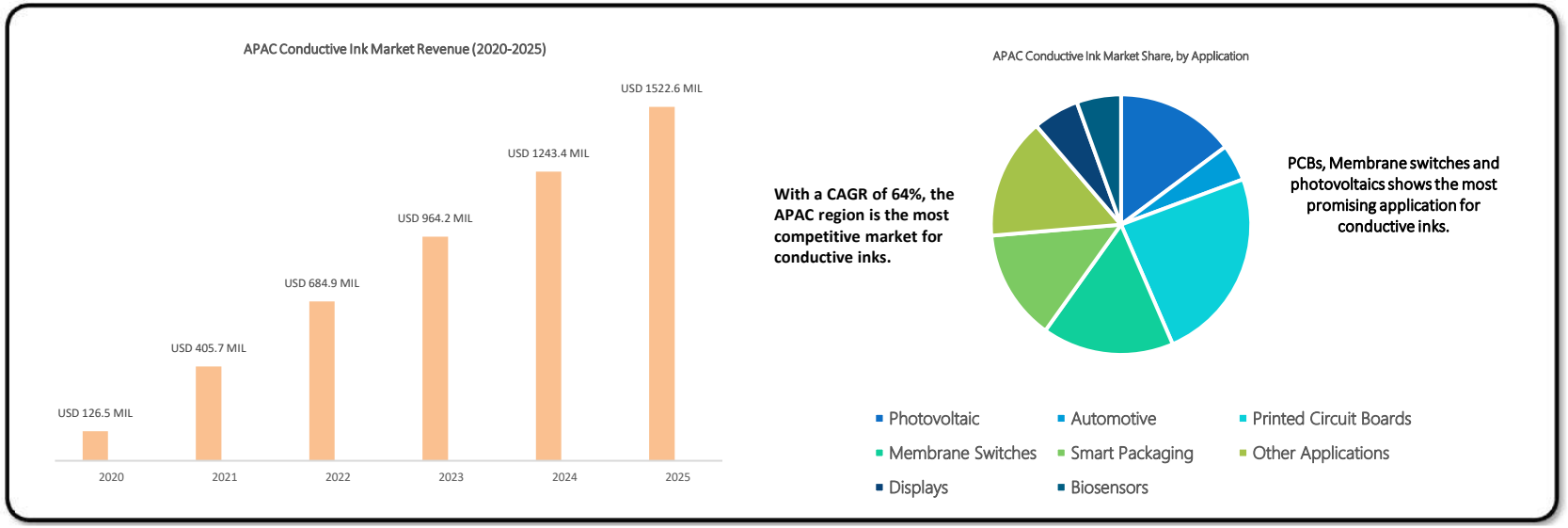
RUBBER ADDITIVES

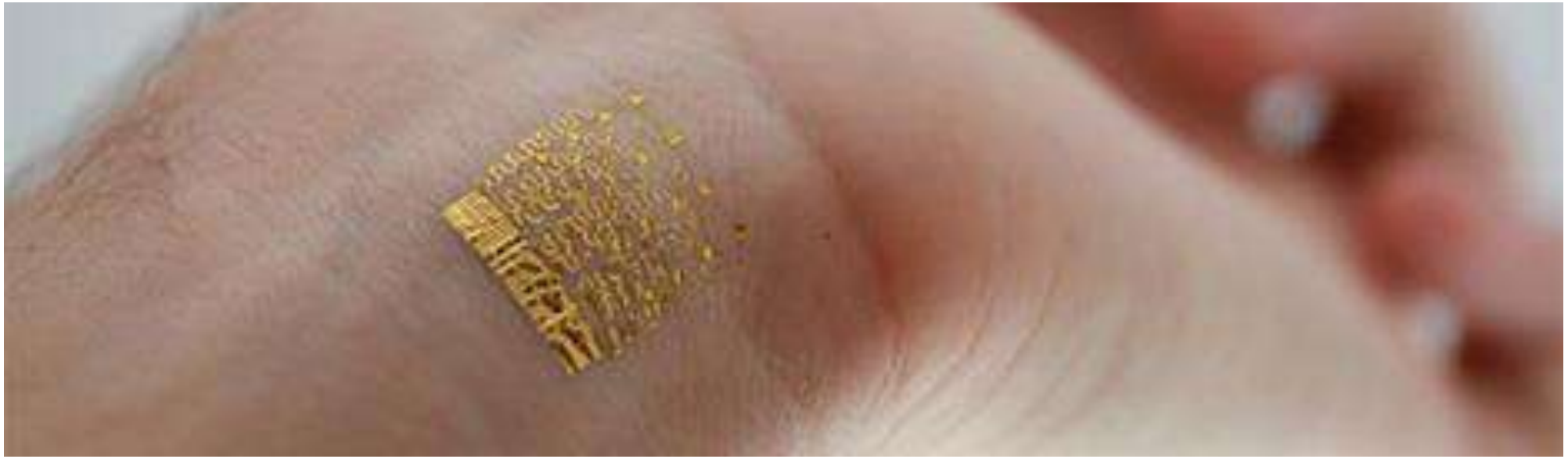


Malaysia's focus on higher-value rubber products is very well aligned with the performance benefits of graphene

CONDUCTIVE INK

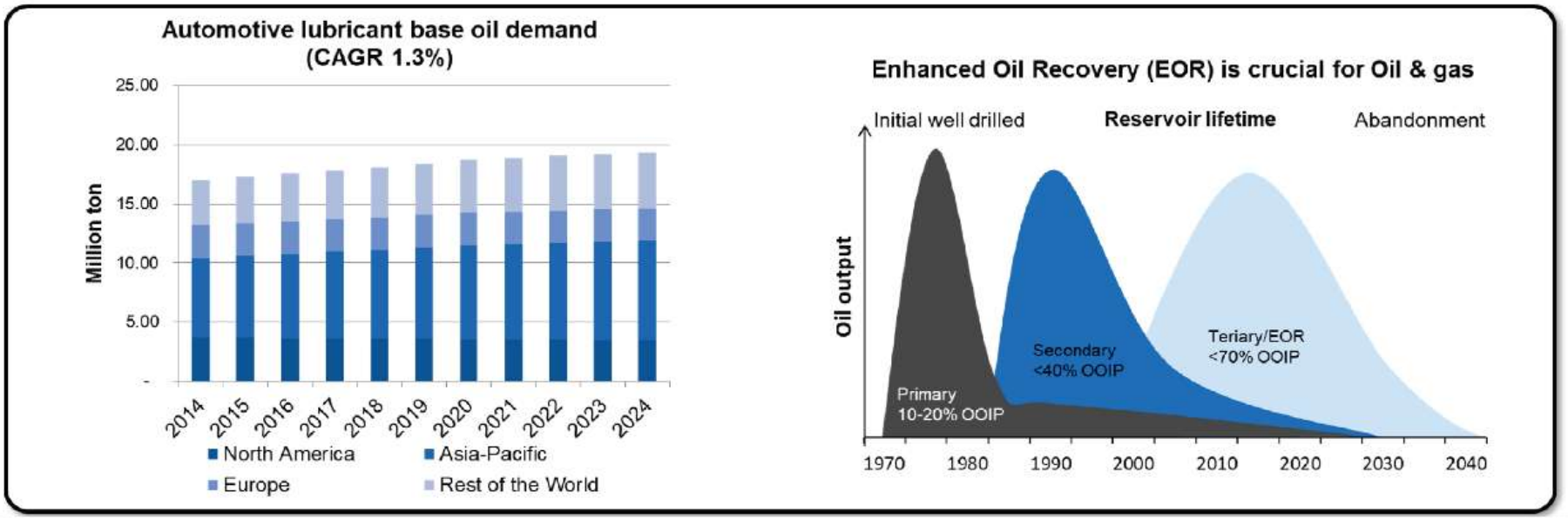
Higher value conductive ink applications opens the door for Malaysia to capitalise on IoT market growth





LUBRICANTS

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



ECONOMIC IMPACT OF NATIONAL GRAPHENE ACTION PLAN

	GNI Impact	Job creation	Malaysia's government role
 Lithium-Ion Battery &Ultracapacitors	RM 2,080 million	3,685 jobs	Attract graphene developers targetting aerospace composites
 Rubber Additives	RM 3,450 million	3,660 jobs	Connect industry to high-quality graphene master-batch supply
 NanoFluids	RM 5.3 billion	2,625 jobs	Drive adoption by incentivizing local energy storage market
 Conductive Inks	RM 2,990 million	700 jobs	Target high- value applications for flexible electronics, sensors, and IoT
 Plastics Additives	RM 1,195 million	1,120 jobs	Gaining buy-in from local oil and gas majors to invest in graphene

In 2020, Malaysia added RM 14.7 billion to GNI with multiplier effect over 5 years and create 11,790 Malaysian jobs with spillover effects and potential to grow further onwards to 2025

Food and Agriculture

18 Projects

Electronic Devices and Systems

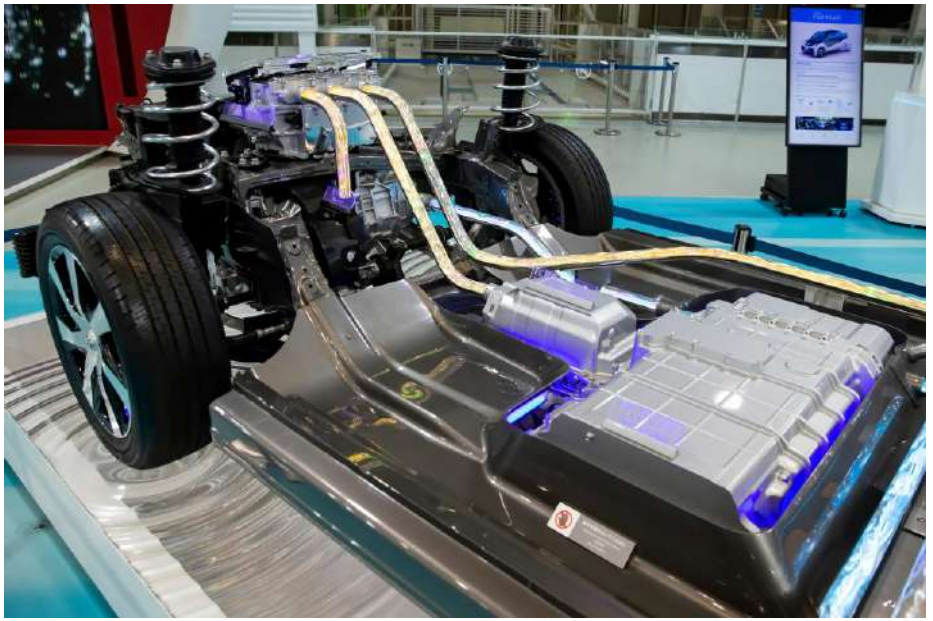
22 Projects

Energy and Environment

23 Projects

Wellness. Medical and Healthcare

14 Projects



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 ACHIEVEMENTS AS AT END 2020 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.
Green Eklan Sdn Bhd	Smart Urban Farming & Aquaponics System (SURF X1)	Urban Farming	▪ NLEP enables electrical energy production via natural or non-natural light for a sustainable system ▪ IoNT Sensor Platform Sensors provides real time monitoring of diverse parameters (e.g. water temperature)
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

iNANOVATION ACHIEVEMENTS AS AT END 2020 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).**	▪ **Battery - Energy Storage.** • **Electrical & Electronic Circuit Board.**	**Accelerate the flow of electrical charges through nanocellulose based PEM which is robust and green.**
Eclimo Sdn Bhd	**Battery monitoring system**	• **Transportation**	• **Eco friendly (Less air and noise pollution)** • **Fast charging** • **Fully electric**
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 2020 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.
MDT Innovations Sdn Bhd	IoNT Solution for Linen Management	• Hospitality • Healthcare • Education	• Enhanced connectivity • Data analytic and processing • Cloud-based storage of data • Linen management and monitoring system

INTELECTUAL 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.

INTELECTUAL PROPERTIES

IP Achievements as at end 2020

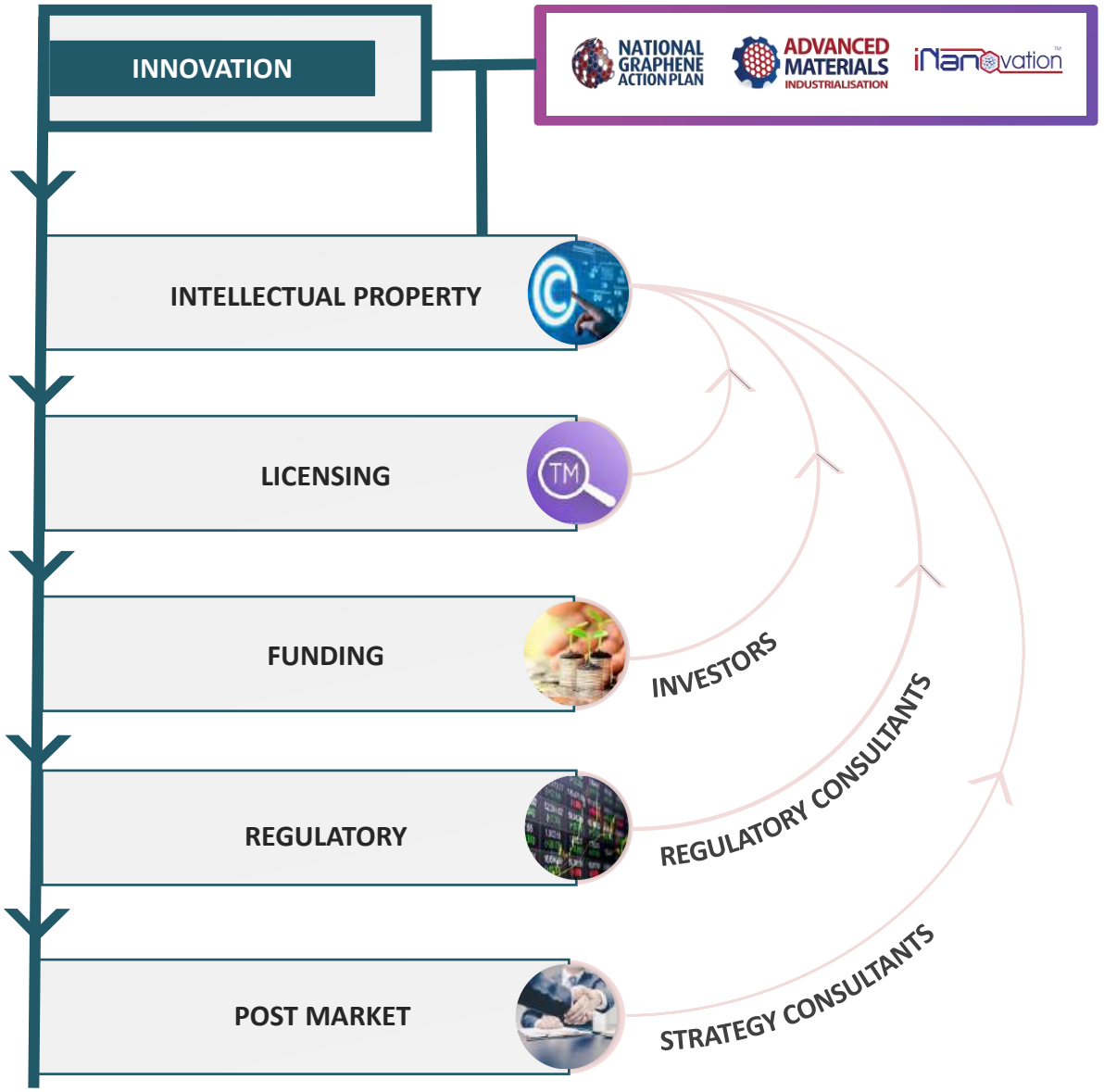
- 24 Patents
- 6 Utility Innovation
- 18 Copyrights
- 5 Trademarks
- 4 Trade Secrets

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.

Top 30 Malaysian Patent Filers of 2020

NanoMalaysia's Group Legal Office has been selected as one of the finalists in the Technology, Media and Telecommunications In-House Team of the Year category for the ALB Malaysia Law Awards 2021 by the Asian Legal Business (ALB). The awards pay tribute to the outstanding performance of private practitioners and in-house teams in Malaysia and around the region.



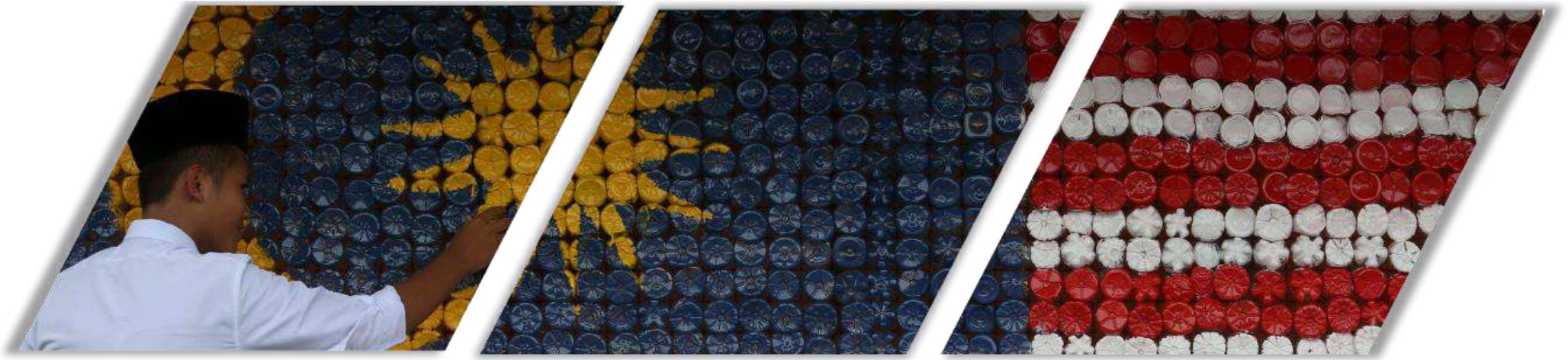
INDUSTRY PARTNERS

BUSINESS PARTNERS

TECHNOLOGIES COLLABORATORS
(RESEARCH INSTITUTES & RESEARCH UNIVERSITIES)

05 MONETISING TECHNOLOGY

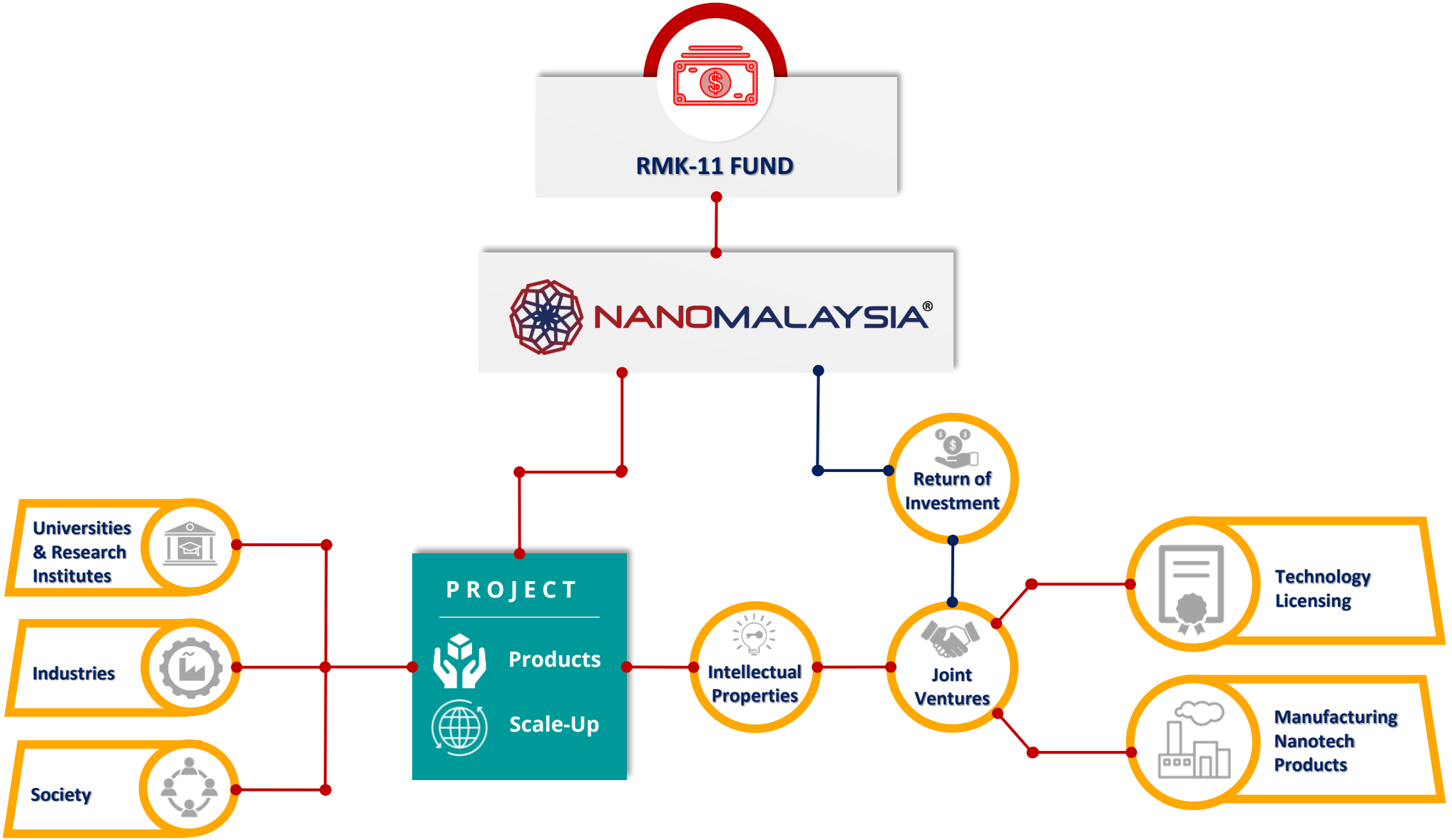
OUR BUSINESS OBJECTIVE



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.

KEY ACTIVITIES

06

NANOMALAYSIA PHASES OF GROWTH

NANOMALAYSIA PHASES OF GROWTH

Phase 01

2012 - 2015 : Positioning and Branding

Since inception, Nano Malaysia has been through two distinct phase 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

2016 - 2019 : 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 these year, 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 companies

Phase 03

2020 & Beyond

Moving into our next phase ofgrowth in the final year of the 11thMalaysia plan as early preparation for the 12th Malaysia Plan. Our focus is on spearheading the Nanotechnology Revolution in Malaysia through our fourth industrial Revolution (4IR) internet of Nano things(l0NT) driven REVOLUTION strategy our goal in our third phase of growth is to achieve financial independence and ensure the long term sustain ability of our business.

POSITIONING & BRANDING

2011

- Incorporated on 1 August 2011

2012

- Signed MOUs with Advanced Energy Research and Technology Centre (AERTE) New York and Malaysian Industry – Government group for High Technology(MIGHT).
- Conducted Nanotechnology Enabler Lab to design programmes and identify commercialisation projects.

2013

- MOU with IBM and start of IBM star polymer joint research programme.
- MOU with Human life Advancement Foundation formed the iNanovation platform.
- Conducted Nanotechnology Enabler Lab 2.0
- Creation of National Key Economic Area (NKEA) Electrical and Electronics (E&E) Entry point project (EPP20) for nanotech applications.
- General nanotechnology commercialisation partnership with Russian based RUSNANO capital

POSITIONING & BRANDING

2014

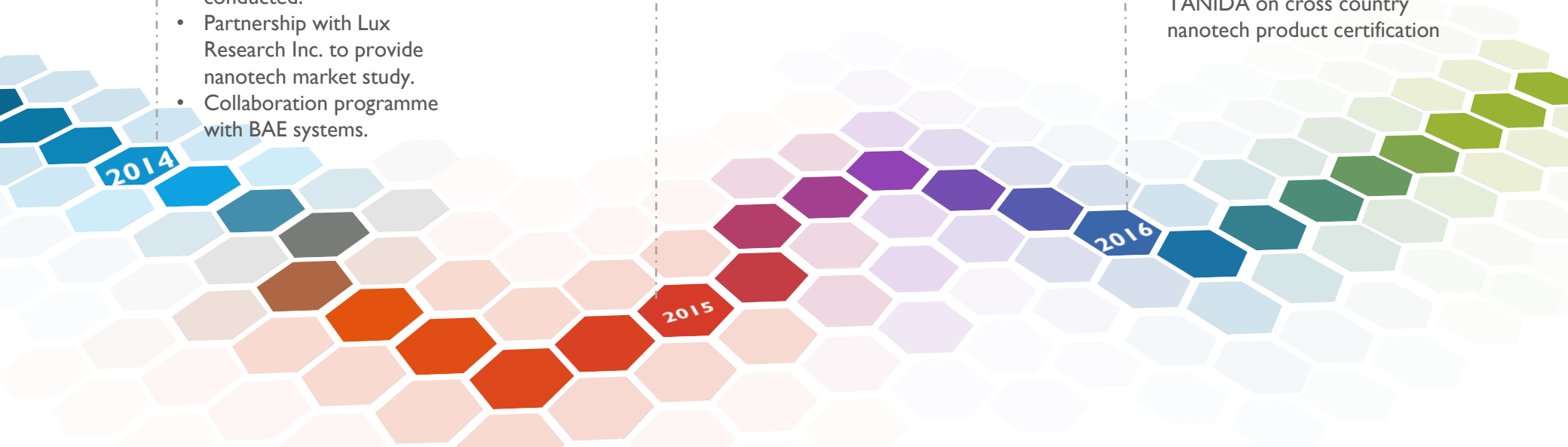
- Led National Graphene Strategy study conducted by Mckinsey & co./ Agensi Inovasi Malaysia (AIM)
- Launched The National Graphene Action plan 2020 (NGAP2020) programme.
- Incorporated Nano commerce Sdn Bhd and Nanovation Ventures Sdn Bhn.
- First NKEA E&E project conducted.
- Partnership with Lux Research Inc. to provide nanotech market study.
- Collaboration programme with BAE systems.

2015

- Incorporated NANOverify Sdn Bhd
- Launched the NANOverify certification programme.
- MOSTI Techno Fund project – Cu- CNT LED Mounting subtrates with UTP, SIRIM and NANS, LED.
- Nano Malaysia CEO appointed as treasure of Asia Nano Forum

2016

- 21 product development and 7 scale up projects executed
- 27 products developed and 6 products commercialised
- 28 IPs developed
- Launched annual Graphene Malaysia international event
- MOU with Taiwan based TANIDA on cross country nanotech product certification



CREATING ECONOMIC VALUE

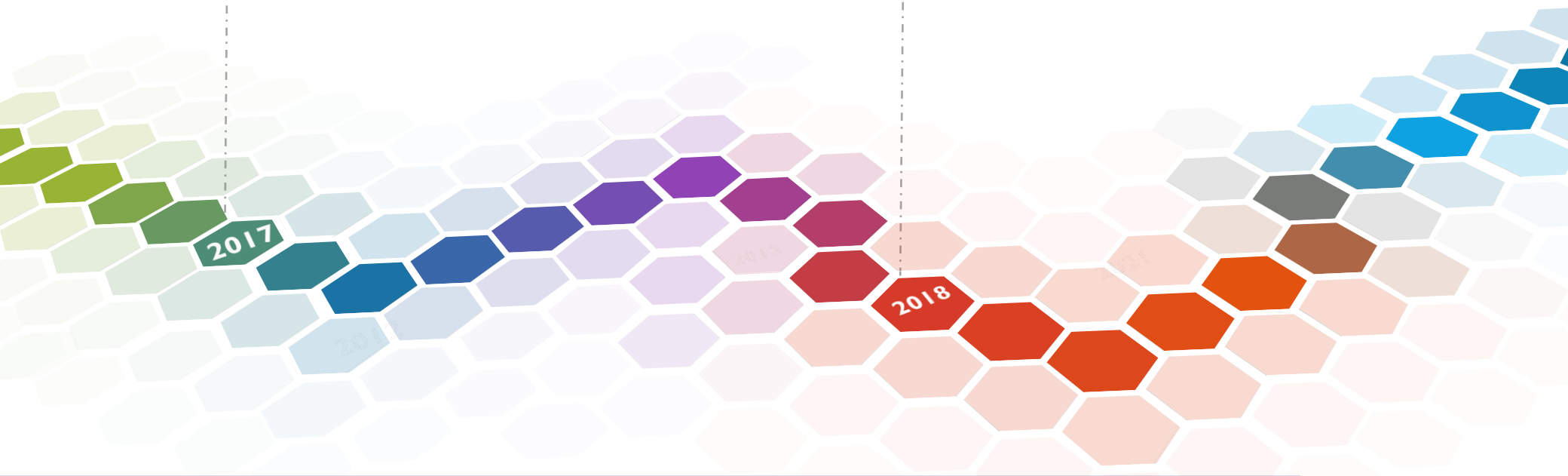
11th Malaysia Plan Nanotechnology Commercialisation Programme

2017

- 16 product development and 4 scale up projects executed
- 16 products developed and 6 products commercialised
- 1 patent and 2 copyrights filed by MyIPO
- 23 Ips developed MOU with Nanopolis Suzhou
- NanoMalaysia CEO appointed International Advisor to the China Innovation Alliance of the Graphene Industry

2018

- 14 product development and 8 scale up projects executed
- 7 products in development
- 2 IPs developed
- 8 patents, 1 utility innovation and 1 copyright filed with MyIPO



2020 & BEYOND

PHASE 3

REVOLUTIoNT

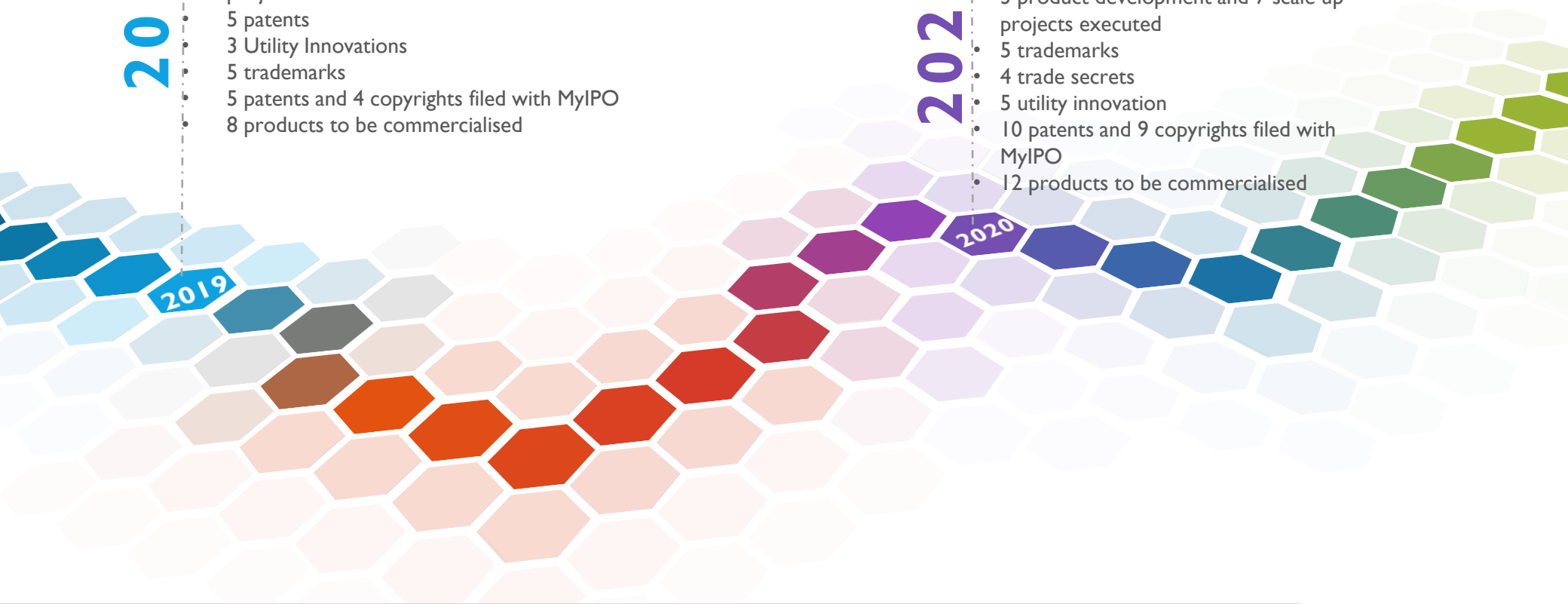
A Revolution 4.0 the Internet of Nano-Things

2019

- 5 product development and 14 scale up projects executed
- 5 patents
- 3 Utility Innovations
- 5 trademarks
- 5 patents and 4 copyrights filed with MyIPO
- 8 products to be commercialised

2020

- 3 product development and 7 scale up projects executed
- 5 trademarks
- 4 trade secrets
- 5 utility innovation
- 10 patents and 9 copyrights filed with MyIPO
- 12 products to be commercialised



07

OUR 4TH INDUSTRIAL REVOLUTION STRATEGY

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 enabled 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

NanoMalaysia Programmes

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things

NATIONAL GRAPHENE ACTION PLAN

National Graphene Action Plan
- Product development and commercialisation programme
- Produces Intellectual Property and products
- Focuses on 5 Key Applications:
  - Lithium-ion battery
  - Conductive inks
  - Rubber additives
  - Plastic additives
  - Nanofluids
- Experimental and Rapid R&D

iNanovation

iNanovation
- Product development and commercialisation programme based on broader nanotech innovation
- Produces Intellectual Property and products
- Focuses on 4 Jumpstart Sectors:
  - Electronic Devices and Systems
  - Food and Agriculture
  - Energy and Environment
  - Wellness, Medical and Healthcare
- Experimental and Rapid R&D

NANO Verify

NANOVerify Certification Programme
- Strengthen product reputation and credibility in local and international markets by creating positive brand association
- Increase consumer awareness

4th Industrial Revolution
[Internet of Nano Things (IoNT)]

REVOLUTIoNT
A Revolution 4.0 the Internet of Nano-Things
RevolutIoNT Strategic Blueprint

Capturing opportunities with NanoMalaysia programmes via product development /scale up projects and commercialisation activities

People, Planet, Profit


2020
HIGHLIGHTS

JANUARY 2020

Asia Nano Forum, Japan

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad attended the Asia Nano Forum ExCo Meeting held at Nanotech 2020 Japan. Asia Nano Forum (ANF) is a network organisation in nanotechnology covering 15 economies in Asia. Dr Rezal is currently the Treasurer of Asia Nano Forum.

JANUARY 2020

NanoTech Japan

NanoMalaysia Berhad continues to re-energise industries and innovation through successful development and commercialisation of nanotechnology in Malaysia by presenting Malaysian nanotech companies at Nanotech 2020. The NanoMalaysia - MIDA Malaysia Pavilion was launched by the ambassador of Malaysia to Japan, Dato' Kennedy Jawan at Tokyo Big Sight, Japan.

FEBRUARY 2020

Asia-Pacific Economic Cooperation (APEC2020), Putrajaya

NanoMalaysia Berhad's CEO, Dr Rezal Khairi Ahmad moderated the second discussion session entitled "Enterprising Future Technologies Through Public-Private Partnership" during the APEC Public-Private Dialogue on Science, Technology and Innovation: Capitalise on Research and Development. The event was held in conjunction with the APEC 2020 Malaysia First Senior Officials's Meeting (SOM 1) and Related Meetings at Putrajaya.

FEBRUARY 2020

2020 The 10th Creation, Innovation, Technology & Research Exposition (CITREx 2020), Universiti Malaysia Pahang (UMP)

The 10th Creation, Innovation, Technology & Research Exposition (CITREx 2020) at Universiti Malaysia Pahang (UMP) Gambang Campus saw the signing and exchange of a Memorandum of Understanding (MoU) between NanoMalaysia Berhad and UMP. The MoU is in capacity building for technology commercialisation especially for the East Coast of Peninsular Malaysia.

NanoMalaysia was represented by CEO Dr Rezal Khairi Ahmad and UMP was represented by Deputy Vice-Chancellor Prof Dr Kamal Zuhairi Bin Zamli.

MAY 2020

Covid-19 Screening Booth (CSB) Putrajaya

The Science, Technology and Innovation Ministry (MOSTI) handed over one COVID-19 Screening Booth (CSB) to the Putrajaya District Health office on Wednesday, 13 May 2020.

The ministry, in a statement here, said the CSB was aimed at minimising the use of personal protective equipment (PPE) as well as contact between frontliners and patients to reduce the risk of COVID-19 infection.

The cubicle was developed by Syarikat iDeria Sdn Bhd, a subsidiary of Universiti Malaysia Perlis (UniMAP), and in collaboration with MOSTI, the Ministry of Health (MOH) with funding received from the Ministry of International Trade and Industry (MITI).

The effort was also supported by the National Nanotechnology Centre and NanoMalaysia Berhad.

JUNE 2020

NanoTech Talk 2020, Facebook

NanoMalaysia Berhad organized a series of webinar sessions called NanoTechTalk 2020 on Facebook starting from the 4th of June until the 9th of June 2020.

This webinar focuses on the opportunities and facilitation services offers by NanoMalaysia to industries and SMEs that would like to venture into the Nanotechnology world.

JUNE 2020

Delegate visit from Ministry of Science, Technology & Innovation (MOSTI)

A delegation by the Ministry of Science, Technology & Innovation (MOSTI) led by Minister YB Khairy Jamaluddin, visited NanoMalaysia Berhad on an official work visit.

NanoMalaysia's Chairman, Prof. Emeritus Dato' Ir. Dr. Mohamad Zawawi Bin Ismail, and NanoMalaysia's CEO, Dr Rezal Khairi Ahmad presented and shared NanoMalaysia's efforts and activities in the industrialisation and commercialisation of nanotechnology in Malaysia.

During the visit, YB Khairy was shown some of the products that have been commercialised as well as on-going projects by NanoMalaysia's partners. The delegation also included Deputy Minister of Science, Technology & Innovation, YB Tuan Haji Ahmad Amzad Bin Hashim, Secretary General Datuk Ir Dr Siti Hamisah Binti Tapsir and Deputy Secretary General (Science, Technology & Innovation) Dr Mohd Nor Azman Bin Hassan.

JULY 2020

Selamat Pagi Malaysia, RTM

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.

JUNE 2020

Smart Urban Farming Kit (SMURF), Petaling Jaya

Dr Rezal Khairi Ahmad, CEO of Nanomalaysia Berhad, and Dzuleira Abu Bakar, CEO of MaGIC visited the Smart Urban Farming Kit (SMURF) pilot project developed by the Malaysian Red Crescent Society and powered by NanoMalaysia Berhad.

NanoMalaysia is providing the Internet of Nano-Things (IoNT) solutions and monitoring to the aquaponics system through power generated from Nano Light Energy Panels (NLEP).

The project located at SK Kg Tunku, Petaling Jaya is intended to provide self-sufficient food supply to the B40s, and also acts as a project for Standard 6 students.

SEPTEMBER 2020

Collaborative Investment Agreement (CIA) with VNI Scientific Sdn Bhd

NanoMalaysia Berhad, NanoCommerce Sdn Bhd (a subsidiary of NanoMalaysia) and VNI Scientific Sdn Bhd have signed a Collaborative Investment Agreement (CIA) to develop and commercialise crystalline nano cellulose (CNC) based cosmeceutical products using local nanosized herbs. VNI Scientific is an OEM manufacturer specialising in producing halal cosmetic products. The GMP certified company located in Senawang offers a wide range of services from conception to the manufacturing of final products.

SEPTEMBER 2020

World EV Day, Universiti Malaya

In conjunction with World EV Day,the team behind HyPER tested the EV aspect of the vehicle at Wisma R&D Universiti Malaya.

HyPER stands for Hydrogen Paired Electric Racecar and is Malaysia's first locally developed electric motorsports vehicle.

HyPER is powered by NanoMalaysia's Hydrogen and Hybrid Energy Storage System (H2SS). This storage system is a hybrid energy storage system with Li-Ion batteries and graphene-based ultracapacitor, and a fuel cell stack with on-board Hydrogen generation system.

Hydrogen is generated on-board the vehicle eliminating the hassle of fuelling and storage, converted to electricity via the fuel cell which powers the motor while the ultracapacitor makes for an even faster-charging process.

SEPTEMBER 2020

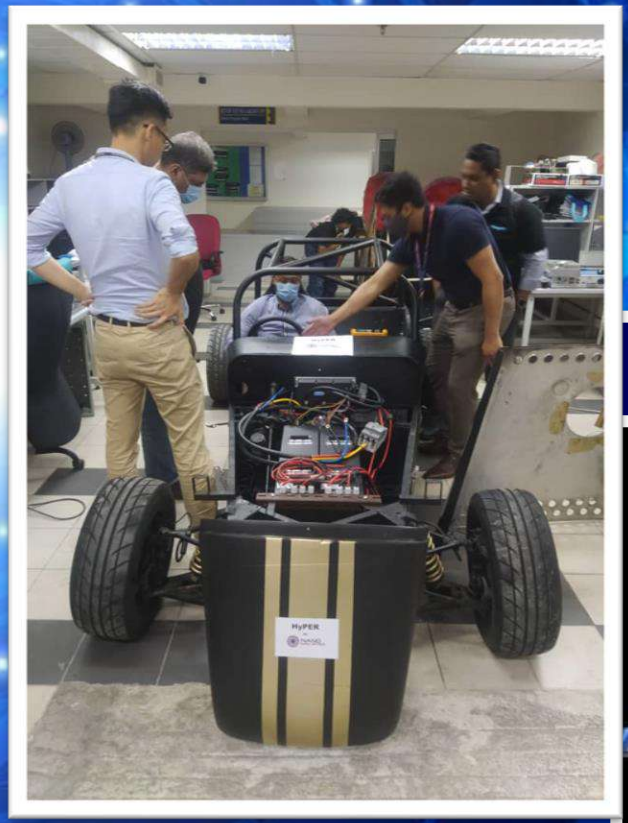
Enhance Track Sdn Bhd And Nanomalaysia Berhad Launch Malaysia's First Nanotech Wireless Charger, Kuala Lumpur

Enhance Track Sdn Bhd and NanoMalaysia Berhad in the drive for the commercialisation of nanotechnology launched the Malaysia Energy Transmission Technology, known as METT – which is Malaysia's first wireless mobile phone charger. It allows remote contactless non-inductive charging over a range of a few metres and has the ability to power 5V-based mobile devices.

METT can be used with all phones and tablets. The launch was officiated by the Minister of Science, Technology and Innovation, Yang Berhormat Khairy Jamaluddin Abu Bakar and Secretary General of the Ministry of Science, Technology and Innovation, Yang Berbahagia Datuk Ir Dr Siti Hamisah Binti Tapsir.

METT operates on a range of radio frequency waves and is made up of two components: the transmitter and receiver. The transmitter will need to be connected to a power point (socket) and the receiver that contains the charging system has to be attached to the mobile device. The charging system will then pick up the RF signal and convert it into electrical energy to charge the battery. Principally, it is similar to how our phones catch radio waves from telco towers and change it into sound on the speaker. To put it simply, with this system in place, one could walk into any zone with wifi and their phone would automatically charge.

YB Khairy Jamaluddin said: "The launch of METT is not only a milestone in the nanotechnology industry – it is also a step in the right direction for the country as it is in line with Malaysia's vision of becoming an Industry 4.0 nation. To further support this vision, the National Technology and Innovation Sandbox (NTIS) was recently introduced by MOSTI with the goal of reviving the country's economic growth through innovative and disruptive technologies."

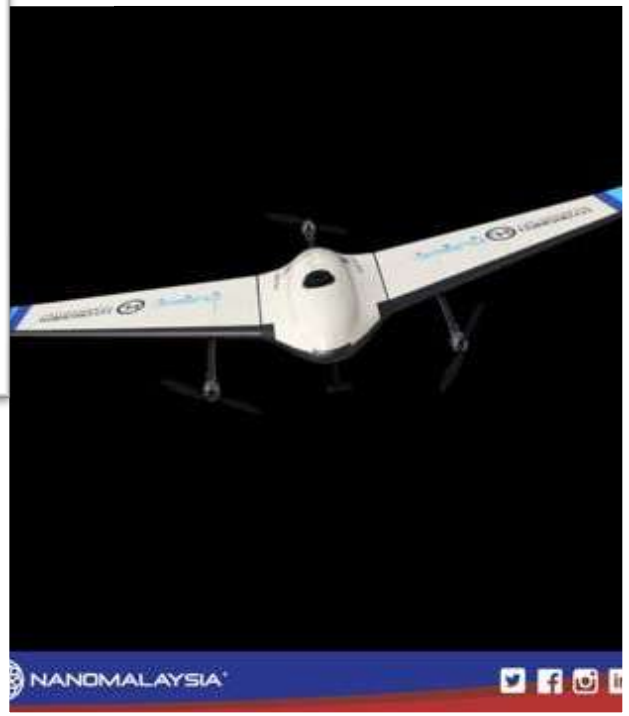


OCTOBER 2020
2020 NanoMalaysia's HyPER (Hydrogen-Paired Electric Racecar)

NanoMalaysia' HyPER (Hydrogen-Paired Electric Racecar) conducted it's dyno test to test on speed and data collection for individual systems and to test the integration of the Graphene Ultracapacitor. The test was conducted at NAZA College and was attended by NanoMalaysia (including CEO, Dr Rezal Khairi Ahmad), EV Connections and Wheelspin Motorsports.

OCTOBER 2020
World Hydrogen Day

On 8th October 2020 we celebrate the most basic element - Hydrogen! Here at NanoMalaysia we're working on hydrogen-fueled generator system to power our next level drone technology. Imagine a Hydrogen cell convert electricity to charge up drones over longer distances more efficiently than normal battery supplied drones. NanoMalaysia brings you the technology in this World Hydrogen Day!



NOVEMBER 2020

Ambassador Extraordinary & Plenipotentiary of the Islamic Republic of Iran visit to Malaysia

NanoMalaysia's CEO, Dr Rezal Khairi Ahmad met with the Ambassador Extraordinary & Plenipotentiary of the Islamic Republic of Iran to Malaysia, H.E. Ali Asghar Mohammadi, to discuss matters of co-operation, technology transfer and commercialisation in nanotechnology between NanoMalaysia and Iran.

NOVEMBER 2020

The i-Innowhizzers

NanoMalaysia Berhad's CEO, Dr Rezal Khairi Ahmad had an online meeting with students and teachers from SJKT Ladang Highlands, Klang.

The students, aged from 9 to 11 years old comprising of Mahaawin Sivamohan, Subatheshwin Sivamohan, Thanuja Kumaran and Bavatharinee Sivaguru have won several awards at innovation competitions including the Gold Award at Malaysia Young Scientists Conference and Exhibition (MYSCE) 2020 for their invention, the Eco-reuse Nanotechnology Wastewater Filter.

The i-Innowhizzers, as they call themselves, created a nano-filter to treat wastewater from kitchen sinks, which can be used in toilet flush tanks. The nano-filter was made from cigarette butts, single-use plastic bags and dried oil palm leaves (OPL).

08

BUILDING TRUST: NANOVERIFY PROGRAMME

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.

NANO*Verified* Mark

Applied on products or smallest packaging unit to signify it has been verified and characterised to indicate presence of nano-sized element(s) has been verified.

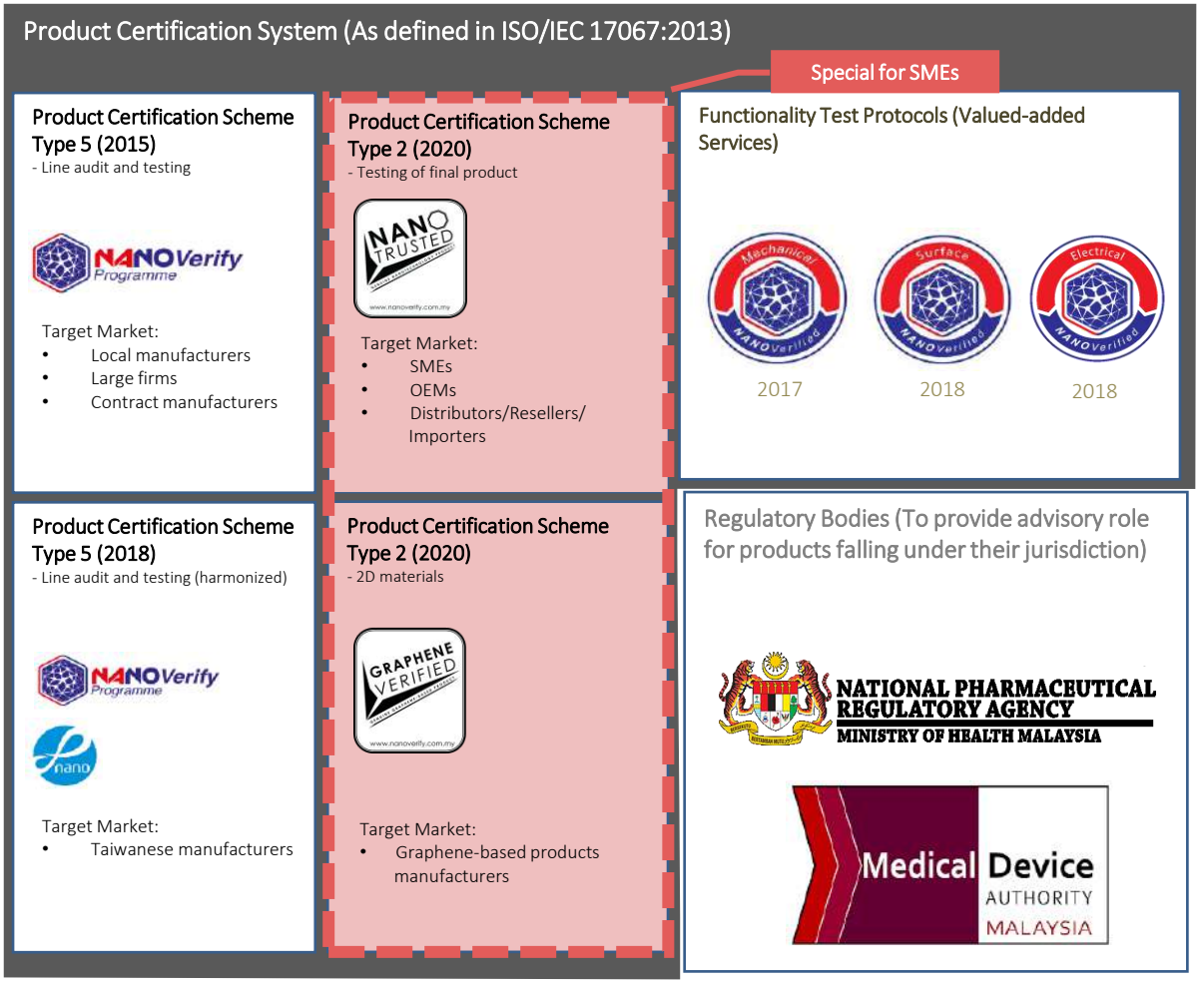
NANO*Verify* Programme

The NANO*Verify* programme is a voluntary nanotechnology certification programme. There are three (3) schemes under this programme. The schemes are; i) NANO*Verify* Programme which is jointly operated by SIRIM QAS International., ii) NANO*Trust* and iii) GRAPHENE*Verify*. The NANO*Verify* Programme certifies processes and products which have incorporated nano elements within the 1 to 100 nanometre range. Apart from size and type certification, the NANOVerify Programme offers certification on the functionality enhancements obtained as a result of embedding nano elements, covering mechanical, surface and electrical properties

Launched on 22 May 2015, NANO*Verify* is the first voluntary nanotechnology certification programme in Malaysia, and only the sixth of its kind in the world. NANO*Verify* provides Malaysian nanotechnology products and applications with independent and credible quality assurance.

Since its introduction in 2020, the GRAPHENE*Verify and* NANO*Trust* Schemes were developed *to* strengthen local SMEs' abilities to successfully market their nanotechnology enabled products both within the country, as well as overseas. Both of these programmes were developed as Type 2 Certification scheme which did not require a production line audit, instead it focuses on the testing of final product.

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. Upon certification, the products are awarded with either NANOVerified, NANOTrusted and GRAPHENEVerified Marks.



NANOVerify

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.

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.

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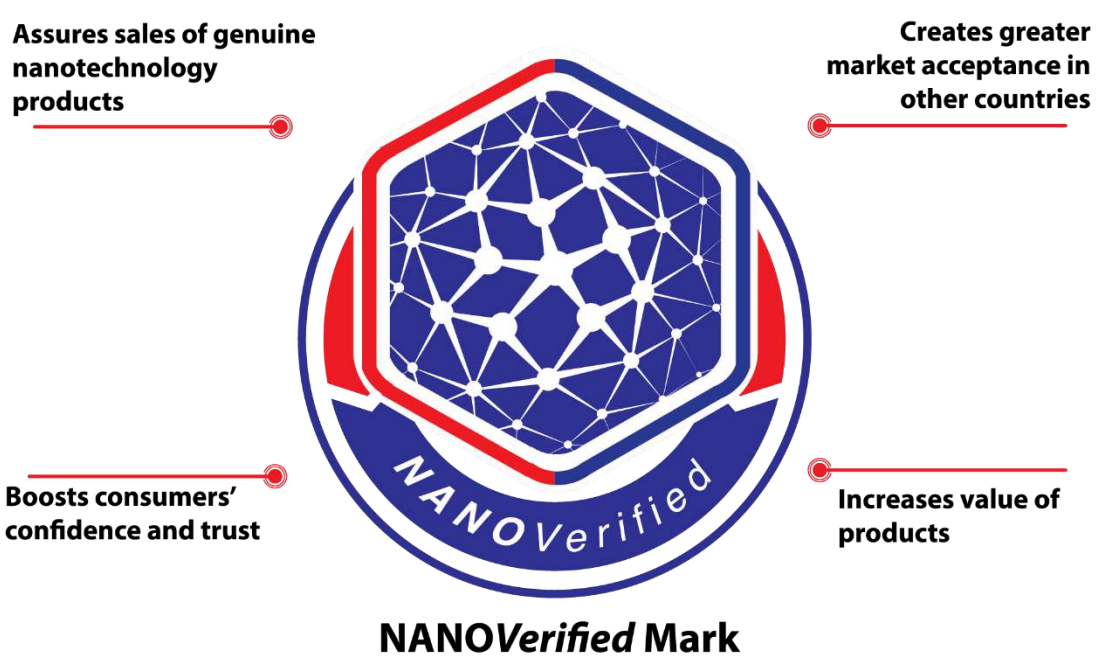
NANOVerified is the endorsement mark awarded to processes and products which have successfully completed the programme. Moving into the future, NVSB has in place the NANOVerify Enhancement Programme, a five-year plan focusing on developing functionality for the NANOVerify programme within the areas of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

NANO*Verify*

NANO*VERIFIED* MARK ONLY FOR GENUINE NANOTECHNOLOGY PRODUCTS



NANO*Verified* Mark

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.

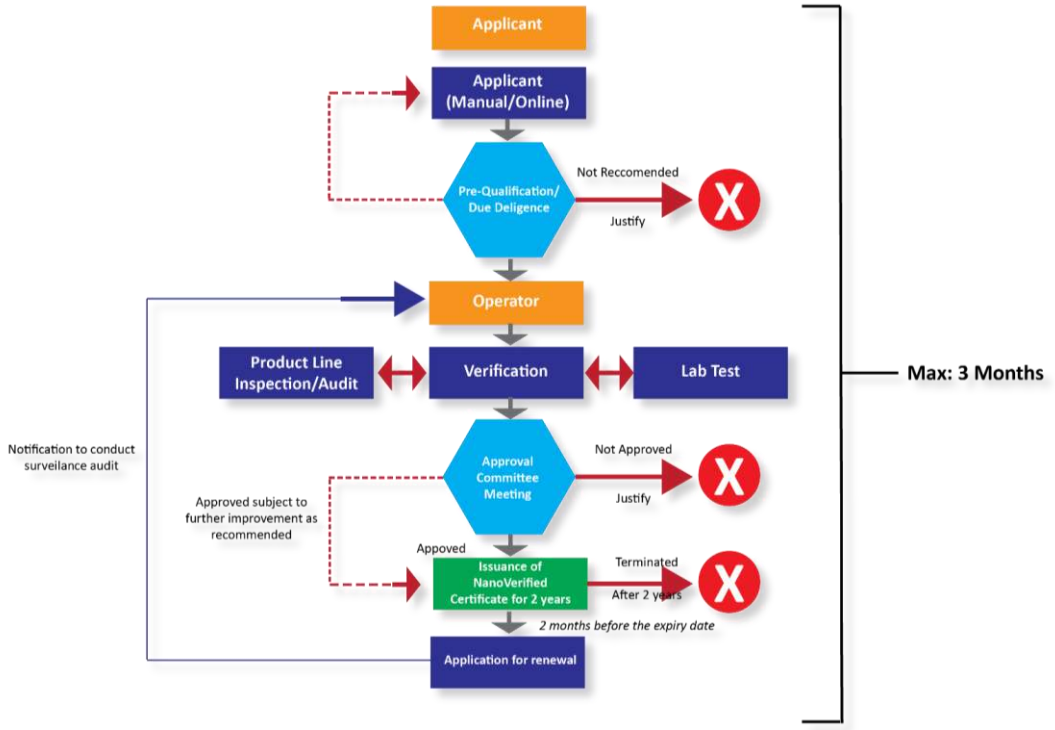
NANO*Verify* Achievements As At End 2020

- Participation of 68 companies
- 118 NANO*Verified* products (spanning over three (3) certifications schemes)

NANO*VERIFY* PROGRAMME CERTIFICATION PROCESS

The application process of the NANOVerify Programme is straightforward, companies submit their application forms and payment receipts to the programme manager. NVSB will then conducts a pre-qualification and due diligence 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.

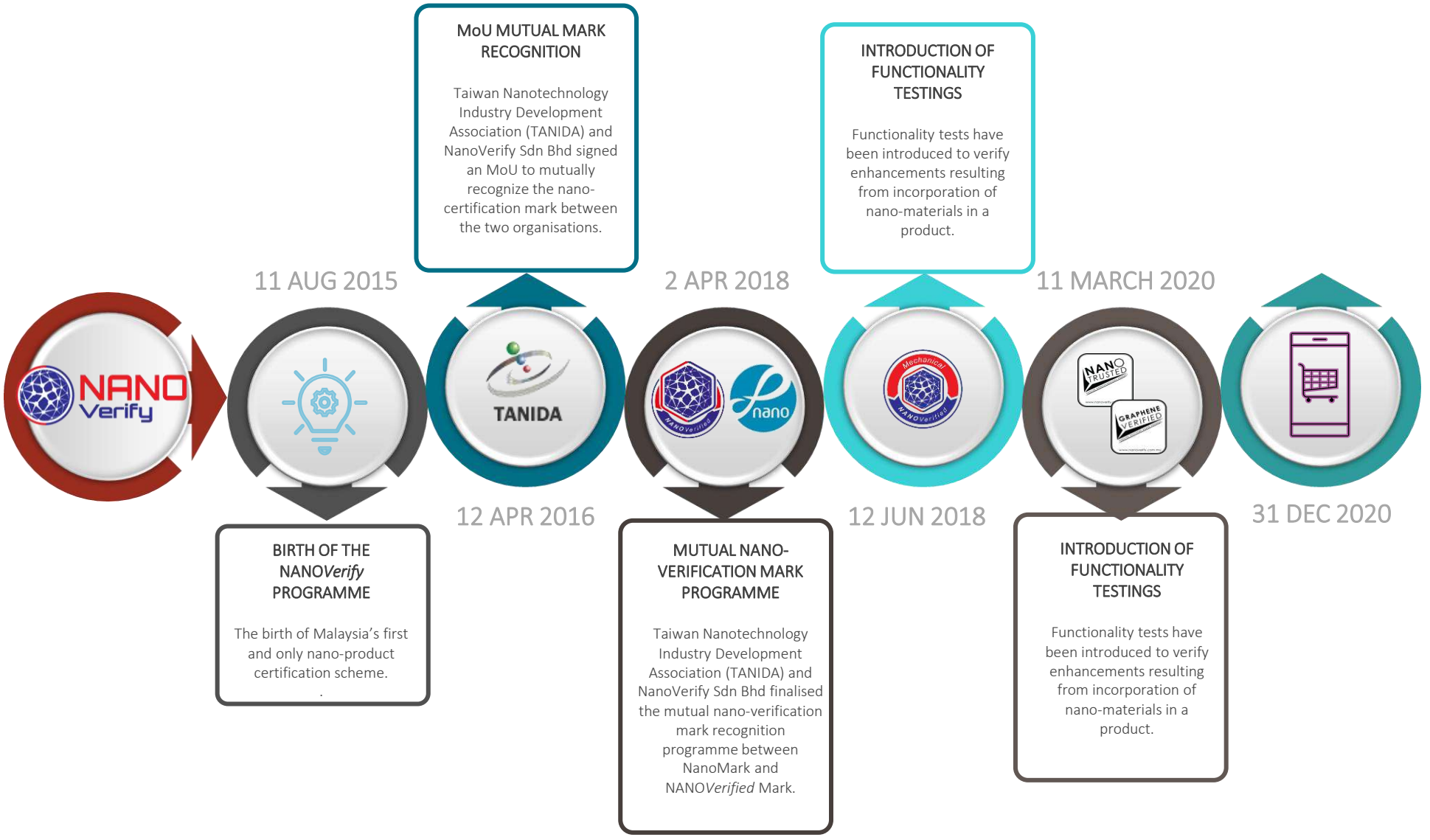
SIRIM will then conduct an audit at the applicant's factory to witness the incorporation of nanomaterials in the product. SIRIM collects samples of the product to be tested at an MS ISO/IEC 17065 accredited laboratory to characterise and test the functionality of nanomaterials in the product. Upon receiving 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 NANO*Verified* mark upon approval.



The application for the NANO*Trust* and GRAPHENE*Verify* Schemes are similar to the NANO*Verify* Type 5, initiated by submission of application forms, relevant documents and payment to NVSB. The absence of production line audits in NANOTrust and GRAPHENE*Verify*, requires a stringent and thorough testing on the end product. The test requires sizing, characterization and identification of the nanomaterial in the final product through the use of Transmission Electron Microscope (TEM) for the sizing and characterization of the nanomaterial, accompanied by Raman Spectroscopy, Gas-chromatography-mass Spectrometry (GCMS) and Dynamic Light Scattering (DLS) method to identify the composition of the nanomaterials.

Applicants will receive their certificate and permitted to use NANOTrusted and GRAPHENEVerified mark upon approval. NANO*Verified*, NANO*Trusted* and GRAPHENE*Verified* certification shall be valid for 2 years upon the receival of the mark.

5 YEARS OF THE NANO*Verify* PROGRAMME



Post reach – 12,914 per month	Followers – 6,568
Post reach – 4,826 per month	Followers – 843
Post impressions – 6,404	Followers – 124

NANOVERIFIED PRODUCTS HIGHLIGHTS

Hijrah Nature Herbs Toothpaste

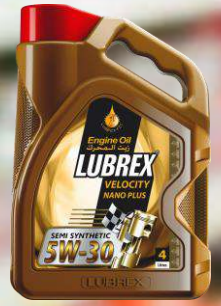
Hijrah Nature Herbs (M) Sdn Bhd

- Hijrah Toothpaste's formula contains of Bio Fs Hap based on tilapia fish scales which is good for calcium growth and sensitive teeth

Premium Floor Coating

Bonding Technology Resources Sdn Bhd

- Durable, anti-dust, anti-stains, & high gloss.
- Good for high traffic industrial floors
- Easy to apply and fast dry



Velocity Nano Plus API SN/CF SAE Lubrex

Prowheels Distributor (M) Sdn Bhd

- Outstanding thermal and oxidation stability
- Quick cold weather starting and fast protection helps extend engine life

Smart Coat

Titanium World Technology Sdn Bhd

- Long Lasting Antimicrobial Nano Coating

DASC Organic Emulsion Mist

DASC International Sdn Bhd

- A type of micellar water with real plant extract micelles
- Works best as hydrating face mist & an excellent pores cleanser

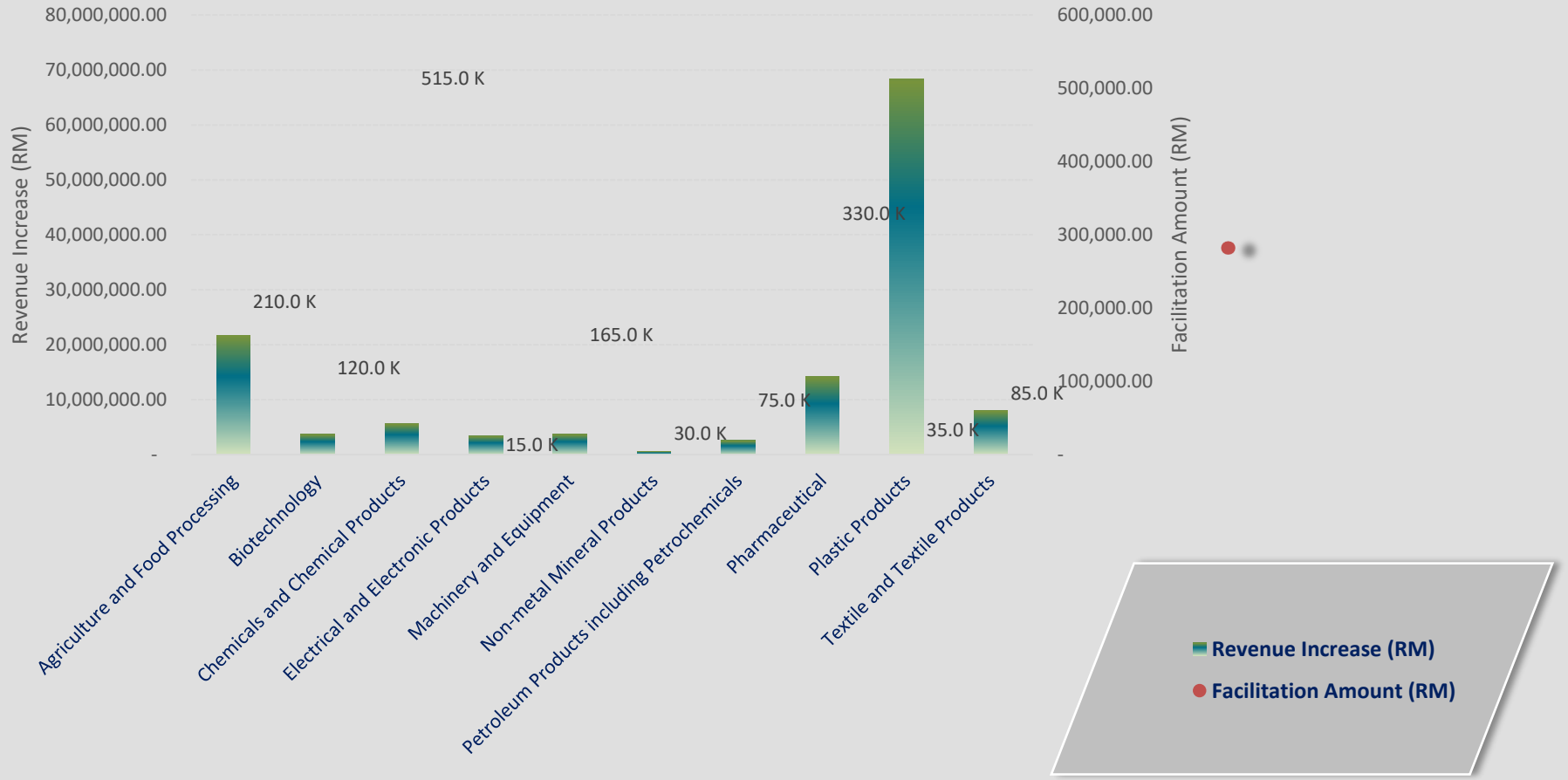
Antimicrobial Coating

STOIKA Sdn Bhd

- Kills 99.999% germs & effective against Covid-19 Virus
- Non-toxic, non-alcoholic & no heavy metal
- Applicable to any types of surfaces

OUTCOMES OF THE NANO *Verify* CERTIFICATION PROGRAMME

REVENUE INCREASE (2015-2020) AND FACILITATION AMOUNT (2015-2020), BY INDUSTRY



IMPACT ON REVENUE, BY INDUSTRY
2015-2020 NANO*Verified* COMPANIES

11%
PHARMACEUTICAL

75%
CHEMICALS & CHEMICAL PRODUCTS

PLASTIC PROUCTS
12%

MACHINERY AND EQUIPMENTS
171%

199%
TEXTILES AND TEXTILE PRODUCTS

BIOTECHNOLOGY
115%

72%
NON-METALLIC MINERAL PRODUCTS

AGRICULTURE & FOOD PROCESSING
14%

10%
ELECTRICAL AND ELECTRONICS PRODUCTS

23%
PETROLEUM AND PETROLEUMS PRODUCTS

NANO*VERIFIED* COMPANIES

09

CREATING VALUE: ECONOMIC, ENVIRONMENTAL AND SOCIAL

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

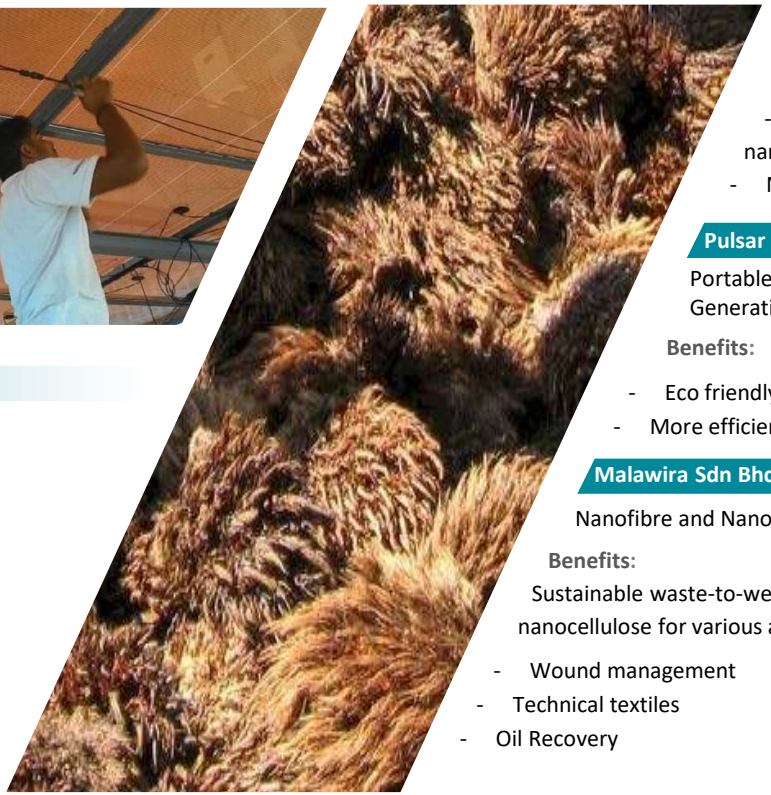
	Numbers of Companies	GNI Contribution over 5 years	Job creation over 5 years
 Electronic Devices and Systems	50 Companies	RM 7.50 billion	6,520 jobs
 Energy and Environment	45 Companies	RM 4.2 billion	4,970 jobs
 Food and Agricultural	23 Companies	RM 0.95 billion	1,395 jobs
 Wellness, Medical and Healthcare	25 Companies	RM 1 billion	965 jobs

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.

CREATING ENVIRONMENTAL VALUE

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



Nanopac (M) Sdn Bhd

Commercial development of Nano Light Energy Panel

Benefits:

- Higher effective efficiency solar energy generation
- More efficient compared to conventional solar panel system.
- Relatively inexpensive to produce
- Durable and require less maintenance.
- Use environmental friendly substance

NanoQuartz Sdn Bhd

Production of nano-silica from rice husk

Benefits:

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

Pulsar UAV Sdn Bhd

Portable Power Generator with On-Board Hydrogen Generation Reactor

Benefits:

- Eco friendly (reduce environmental pollution)
- More efficient than combustion engine

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

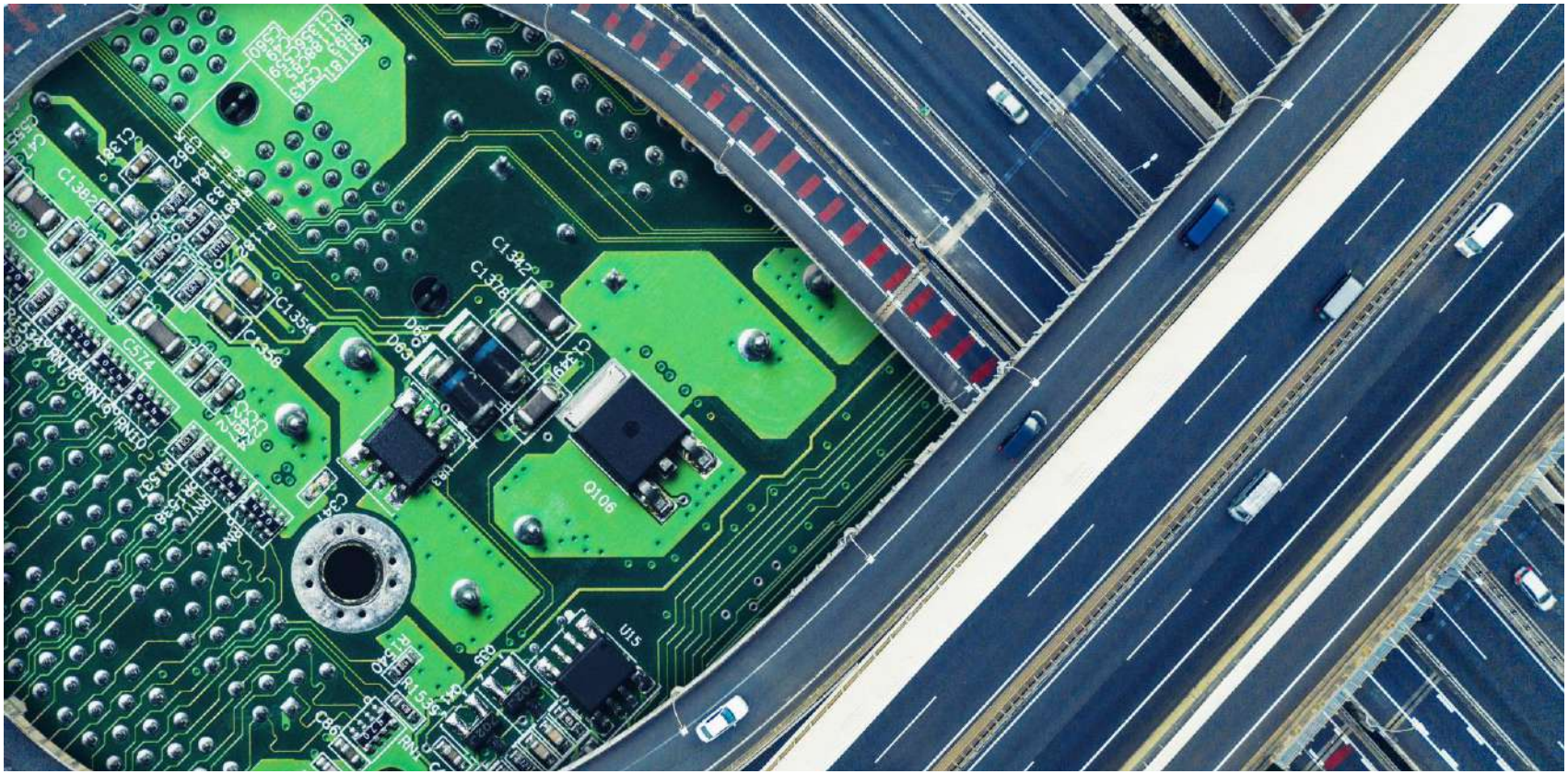
CREATING SOCIAL VALUE

COVID19 Screening Booth is deployed at Pusat Kesihatan Daerah (District Health Center) Putrajaya on May 2020 it was set to aimed at minimising the use of personal protective equipment (PPE) as well as contact between frontliners and patients to reduce the risk of COVID-19 infection. This project is implemented by the National Nanotechnology Center and NanoMalaysia Berhad which the cubicle was developed by Syarikat iDeria Sdn Bhd, a subsidiary of Universiti Malaysia Perlis (UniMAP).

The screening cubicle was one of eight units developed in the first phase to be placed in selected hospitals and district health offices, the statement read. The COVID-19 screening booth is equipped with a positive pressure chamber with the Nanotech based HEPA filter system for healthcare personnel, a wall surface with anti-viral nano-coating and a separation chamber between the patient and the healthcare worker. Nanotechnology Anti-Viral coating is applied to our COVID-19 Screening Booths for reduced transmission probability on frequently contacted surfaces.The anti-viral properties are proven to work against the H1N1 virus belonging to the coronavirus family, categorised as gramme negative of which body is very thin and fragile. SAR-COV-2 (the virus causing CoVid19) being a gramme negative coronavirus should be deactivated by the same nano-coating.

On June 2020, another effort set to work in which the deployment of COVID-19 Screening Booths was completed with the handover of the I3S Screening Booth at Klinik Kesihatan Section 7, Shah Alam. The booth was developed by a group of healthcare professionals from The Malaysian Medical Mythbusters, Awfa Clinic in Kotasas, architects and biomedical engineers from Universiti Teknologi Malaysia (UTM) including the Facebook Community 'Ini Sains Beb'

Both efforts are jointly supported by the Ministry of Science, Technology & Innovation (MOSTI), the Ministry of Health (MOH) with funding received from the Ministry of International Trade and Industry (MITI).



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

REVOLUTIoNT

A Revolution 4.0 the Internet of Nano-Things

by

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