

## 8. IMR REPORT



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Date: 25 March 2024

The Board of Directors

**3REN BERHAD**

No. 9, Jalan Industri Tangkas 1  
Taman Industri Tangkas  
14000 Bukit Mertajam  
Penang.

Dear Sirs,

**Independent Market Research (“IMR”) Report on the Integrated Circuit (“IC”) Design, Assembly and Test Segments of the Semiconductor Industry, Automated Manufacturing and Digitalised Solutions Industry, and Semiconductor and Electronics Industries in conjunction with the Proposed Listing of 3REN BERHAD and its subsidiaries (collectively referred to as “3REN GROUP”) on the ACE Market of Bursa Malaysia Securities Berhad**

PROVIDENCE STRATEGIC PARTNERS SDN BHD (“**PROVIDENCE**”) has prepared this IMR report on the IC Design, Assembly and Test Segments of the Semiconductor Industry, Automated Manufacturing and Digitalised Solutions Industry, and Semiconductor and Electronics Industries for inclusion in the Prospectus of 3REN BERHAD.

PROVIDENCE has taken prudent measures to ensure reporting accuracy and completeness by adopting an independent and objective view of these industries within the confines of secondary statistics, primary research and evolving industry dynamics. We believe that this IMR report presents a balanced view of the industries within the limitations of, among others, secondary statistics and primary research, and does not purport to be exhaustive.

No part of this publication may be copied, reproduced, published, distributed, transmitted or passed, in whole or in part, without prior express written consent from PROVIDENCE.

For and on behalf of PROVIDENCE:

A handwritten signature in black ink, appearing to read 'Melissa Lim', with a long horizontal flourish extending to the right.

MELISSA LIM  
EXECUTIVE DIRECTOR

**About PROVIDENCE STRATEGIC PARTNERS SDN BHD:**

*PROVIDENCE is an independent research and consulting firm based in Petaling Jaya, Selangor, Malaysia. Since our inception in 2017, PROVIDENCE has been involved in the preparation of independent market research reports for capital market exercises. Our reports aim to provide an independent assessment of industry dynamics, encompassing aspects such as industry performance, demand and supply conditions and competitive landscape.*

**About MELISSA LIM:**

*Melissa Lim is the Executive Director of PROVIDENCE. She has more than 10 years of experience in market research for capital market exercises. Melissa Lim holds a Bachelor of Commerce (Double major in Marketing and Management) from Murdoch University, Australia.*

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3REN Berhad and its subsidiaries (collectively referred to as “3REN Group” or “the Group”) is an automation solution and engineering service provider. 3REN Group’s principal business activities are in the provision of engineering support services for IC assembly and testing; design, development and sale of digitalised solutions; provision of product engineering services; and design, development and sale of automated equipment. During the Financial Periods Under Review, its main market was Malaysia, as well as overseas countries including Thailand, Singapore, the United States of America (“USA”), People’s Republic of China (“China”), Vietnam, the Philippines, Canada, Costa Rica, India and Taiwan. As such, this IMR report focuses on the following:

- **The IC design, assembly and test segments of the semiconductor industry (Global and Malaysia)**, as these are the segments of the semiconductor industry which 3REN Group supports with its engineering support services and product engineering services segments;
- **The automated manufacturing and digitalised solutions industry (Global and Malaysia)**, which is the industry in which 3REN Group operates in with its digitalised solution and automated equipment segments; and
- **The semiconductor and electronics industries**, which are major end-user markets to the abovementioned industries.

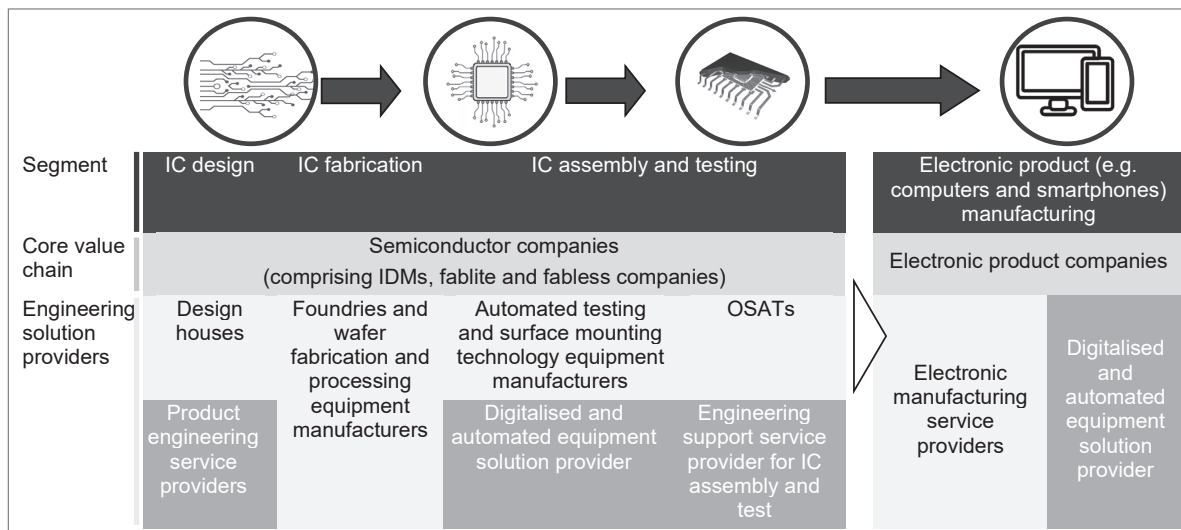
## 1 THE IC DESIGN, ASSEMBLY AND TEST SEGMENTS OF THE SEMICONDUCTOR INDUSTRY (GLOBAL AND MALAYSIA)

### INTRODUCTION

Semiconductor products refer to microchips and advanced semiconductor packaging, which are sets of miniaturised ICs comprising electronic components such as transistors, diodes, capacitors and resistors that are layered on a thin wafer, substrate or printed circuit board. These microchips and advanced semiconductor packaging are technology enablers for electronic products such as computers, smartphones, electric vehicles, aerospace equipment, high-end testers, medical equipment and automotive electronics.

The diagram below illustrates the semiconductor industry value chain:

**Semiconductor industry value chain**



Note:

■ Denotes 3REN Group’s role in the semiconductor industry

Source: PROVIDENCE

The semiconductor industry comprises companies involved in the following core segments:

- **Design:** The design segment comprises 2 main processes, i.e. design conceptualisation and design verification. Design conceptualisation refers to the conceptualisation and design of IC functions and architecture. Meanwhile, design verification refers to the verification of the IC’s functionalities on the IC prototype or simulation to ensure the ICs manufactured meet the required functional specifications of the IC design under different operating conditions;
- **Fabrication:** Upon completion of the design of ICs, the ICs are then mass-produced and fabricated. The IC fabrication process is where semiconductor components are formed on a semiconductor wafer/substrate (which is a thin silicon-based material) based on the IC design; and

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- Assembly and testing:** The fabricated ICs then undergo a series of assembly processes wherein the main processes are die cutting to cut semiconductor wafers into individual chips (die), die attaching to attach the die onto a substrate, wire bonding, encapsulating die with a metal or ceramic lid, and attaching the die onto a printed circuit board to form a microchip or advanced semiconductor packaging. The assembly process protects the ICs, enable heat dissipation from ICs and facilitate integration of ICs into electronic systems in electronic products.  
 Thereafter, the microchip or advanced semiconductor packaging will undergo a series of testing which will include burn-in tests to detect early issues and defects of ICs and class tests which involves the execution of various test programmes. Examples of class tests include parametric tests (to determine if there are any variations in electrical parameters of the ICs), scan tests (to analyse output based on test patterns used on the IC), functional tests (to test if the functionality of the IC is as per design), performance tests (to test performance of the ICs) and power tests (to measure power consumption and efficiency of the ICs).

In the past, integrated device manufacturers (“IDMs”), which are typically brand owners or intellectual property (“IP”) owners of ICs for various electronic devices, undertake all of the abovementioned processes in-house. Over the years, rapid technology advancement and product innovation have increased the complexity in IC production, leading to the outsourcing of some or all of the abovementioned processes to companies specialised in specific activities within the semiconductor industry. As a result, IDMs presently may either undertake all or some of the abovementioned processes. There are also some brand owners or IP owners of ICs which outsource all of the abovementioned processes, based on their conceptualised IC design. Such companies are known as “fablite or fabless companies”.

In particular, the design processes can be outsourced to IC design houses and product engineering service providers. IC design houses are focused on undertaking the design of ICs, which includes both front-end (which refers to the functionality design of an IC) and back-end (which refers to the design of the physical implementation of an IC such as the physical design and layout of an IC). Meanwhile, product engineering service providers can undertake the following services:

- Product conceptualisation – which involves the generation of ideas and concepts for new products based on research and feasibility studies;
- Solution architecture and design – which involves the front-end and back-end design of an IC;
- Pre-silicon validation – which involves validation of the functionality of a chip design before a prototype is manufactured in its individual block form or as a sub-system or as a system on chip;
- Post silicon validation – which involves the validation of the prototypes to ensure the functionality of the prototype meets the intended design specifications;
- Software development – which involves the architecture, design and development of software applications that can be used either to integrate with the IC or as a support tool in the product engineering process; and
- New product introduction – which refers to the manufacturing and testing of products in a high volume manufacturing environment, but in an engineering environment and at a smaller scale. This is to develop test programmes, discover potential issues with the tools, designs and processes, and estimate potential yields and run rates and determine if quality targets are meeting the projections.

IC fabrication can be outsourced to foundries, while assembly and test processes can be outsourced to outsourced semiconductor assembly and test companies (“OSAT”) and engineering support service providers. While both OSATs and engineering support service providers support semiconductor companies in undertaking IC assembly and testing processes, the following are the key differences between OSATs and engineering support service providers:

OSATs	Engineering support service providers
<ul style="list-style-type: none"> <li>Engaged for IC assembly and testing processes to deliver a final semiconductor product</li> </ul>	<ul style="list-style-type: none"> <li>Engaged only to undertake a particular or several IC assembly and test process(es)</li> </ul>
<ul style="list-style-type: none"> <li>Operate in their own facility and may invest in machinery and equipment to perform IC assembly and testing in-house</li> </ul>	<ul style="list-style-type: none"> <li>Typically operate in the customers' facility using the customers' machinery and equipment</li> </ul>

Semiconductor products are ultimately sold to electronic product companies or electronic manufacturing service providers. Such companies are involved in the manufacturing of electronic products such as mobile and wireless devices, automobile and consumer electronics.

3REN Group supports various facets of the semiconductor industry value chain. The Group provides product engineering services for the IC design segment of the semiconductor industry and provides engineering support

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services to support the IC assembly and testing segment of the semiconductor industry. The Group also designs and develops customised digitalised solutions and automated equipment used to support semiconductor and electronic product companies.

**INDUSTRY SIZE, PERFORMANCE AND GROWTH**

The industry revenue size for product engineering services in Malaysia, in terms of product engineering service revenue, grew from RM480.7 million in 2020 to RM691.8 million in 2022 and further grew to RM844.0 million in 2023, registering a compound annual growth rate (“CAGR”) of 20.6%.<sup>1</sup> Meanwhile, the global industry size for product engineering services, in terms of product engineering service revenues, grew from USD778.3 million (RM3.3 billion<sup>2</sup>) in 2020 to USD1.1 billion (RM4.8 billion<sup>2</sup>) in 2022, and further grew to USD1.2 billion (RM5.5 billion<sup>2</sup>) in 2023. The global product engineering services industry registered a CAGR of 15.5% between 2020 and 2023.<sup>1</sup> PROVIDENCE forecasts the product engineering service industry in Malaysia to grow by 19.7% between 2024 and 2026 to reach RM1.2 billion by 2026, and the global product engineering service industry to grow by 15.4% between 2024 and 2026 to reach USD2.0 billion (RM9.1 billion<sup>2</sup>) by 2026.

Meanwhile, the industry size for IC assembly and test services in Malaysia grew from RM15.0 billion in 2020 to RM17.4 billion in 2022 and RM19.2 billion in 2023, registering a CAGR of 8.6% between 2020 and 2023.<sup>3</sup> The global industry size for IC assembly and test segment increased from USD30.1 billion (RM126.5 billion<sup>2</sup>) in 2020 to USD32.5 billion (RM143.0 billion<sup>2</sup>) in 2022 and USD33.9 billion (RM154.8 billion<sup>2</sup>) in 2023, recorded a CAGR of 4.0%.<sup>3</sup> PROVIDENCE forecasts the IC assembly and test services industry in Malaysia to grow by 10.2% between 2024 and 2026, to reach RM23.3 billion in 2026. PROVIDENCE also forecasts the global IC assembly and test services industry to grow at a CAGR of 4.5% between 2024 and 2026, to reach USD37.0 billion (RM168.9 billion<sup>2</sup>) in 2026.

**COMPETITIVE OVERVIEW**

As 3REN Group is focused on the provision of product engineering services (specifically post-silicon validation, software development and new product introductions) and engineering support services for IC assembly and testing within Malaysia, PROVIDENCE has identified 8 industry players, including 3REN Group on the basis that:

- (i) They are involved in the provision of product engineering services and/or engineering support services for IC assembly and testing. Engineering support service providers for printed circuit boards ;
- (ii) They are based in Malaysia; and
- (iii) They have a revenue of RM1.0 million and above, based on their latest audited financial year end (“FYE”).

These identified industry players<sup>(a)</sup> are as detailed below:

Company name	Product engineering services (b)	IC assembly and test engineering support services (b)	Digitalised solutions and automated equipment (b)	Latest available FYE	Revenue (RM'000)	Gross Profit (“GP”) (RM'000)	Profit After Tax/Loss After Tax (“PAT /LAT”) (RM'000)	GP Margin (c) (%)	PAT/ LAT Margin (d) (%)
3REN Group	✓	✓	✓	31 December 2022	65,869 <sup>(e)</sup>	10,798 <sup>(e)</sup>	12,066 <sup>(f)</sup>	16.4	18.3 <sup>(g)</sup>
Dreamedge Sdn Bhd	✓	-	✓	31 December 2022	17,801	9,518	(1,649)	53.5	-
IC Microsystems Sdn Bhd	✓	-	-	31 December 2022	701	(553)	(432)	-	-

<sup>1</sup> Source: Zion Market Research, PROVIDENCE analysis

<sup>2</sup> Exchange rates from USD to RM were converted based on average annual exchange rates extracted from published information from Bank Negara Malaysia for:  
2020: USD1 = RM4.2016  
2022: USD1 = RM4.4005  
2023: USD1 = RM4.5653

Exchange rates from USD to RM for 2024 and 2026 were converted based on average annual exchange rates extracted from published information from Bank Negara Malaysia for 2023 at USD1 = RM4.5653

<sup>3</sup> Source: Market Research Future

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Company name	Product engineering services (b)	IC assembly and test engineering support services (b)	Digitalised solutions and automated equipment (b)	Latest available FYE	Revenue (RM'000)	Gross Profit ("GP") (RM'000)	Profit After Tax/Loss After Tax ("PAT /LAT") (RM'000)	GP Margin (c) (%)	PAT/ LAT Margin (d) (%)
Infinecs System Sdn Bhd	✓	✓	-	31 December 2022	12,185	2,505	1,147	20.6	9.4
Key ASIC Berhad <sup>(h)</sup>	✓	-	-	31 May 2023	20,816	7,329	(5,368)	35.2	-
NCS Global Technology Sdn Bhd	✓	-	✓	31 December 2022	20,968	8,006	5,618	38.2	26.8
Nityo Infotech Services Sdn Bhd	-	✓	-	31 December 2022	185,015	46,048	13,552	24.9	7.3
Oppstar Berhad <sup>(h)</sup>	✓	-	-	31 March 2023	57,904	33,512	20,274	57.9	35.0
Symmid Corporation Sdn Bhd	✓	-	-	31 December 2019	9,777	3,438	(5,010)	35.2	-
UST Global (Malaysia) Sdn Bhd	✓	-	✓	31 March 2023	166,606	23,913	19,317	14.4	11.6

## Notes:

- (1) <sup>a</sup> The list is not exhaustive. It contains information based on publicly disclosed information as at 25 March 2024 and excludes exempt private companies
- (2) <sup>b</sup> Based on publicly available information
- (3) <sup>c</sup> GP margin is computed based on GP over revenue
- (4) <sup>d</sup> PAT / LAT margin is computed based on PAT/ LAT over revenue
- (5) <sup>e</sup> Based on segmental financial information for product engineering services and engineering support services for IC assembly and test
- (6) <sup>f</sup> Based on consolidated financial information as segmental information for product engineering services and engineering support services for IC assembly and test is not available
- (7) <sup>g</sup> PAT margin is based on consolidated PAT over consolidated revenue for the Group as the segmental PAT for product engineering services and engineering support services is not available
- (8) <sup>h</sup> The company is a listed company on Bursa Malaysia.

Although OSATs are also involved in the provision of IC assembly and testing services, these companies are not comparable to engineering service support service providers as they generate revenues based on the production of final semiconductor products as opposed to provision of services and they have their own facilities, and may invest in machineries and equipment. Thus, they have not been included in the list above.

**MARKET SHARE**

In 2022, 3REN Group garnered an industry revenue share of 0.8% of the product engineering services industry in Malaysia, based on the industry size for product engineering services in Malaysia of RM691.8 million in 2022 and its revenue from the product engineering services of RM5.7 million for FYE 2022. 3REN Group also garnered an industry revenue share of 0.2% of the IC assembly and test services industry in Malaysia based on the IC assembly and test services industry size in Malaysia of RM17.4 billion and its revenue from engineering support services for IC assembly and test of RM39.2 million for FYE 2022.

## 2 THE AUTOMATED MANUFACTURING AND DIGITALISED SOLUTIONS INDUSTRY (GLOBAL AND MALAYSIA)

**INTRODUCTION*****Introduction to automated manufacturing and digitalised solutions***

Automated manufacturing and digitalised solutions refer to purpose-built solutions and are typically used in the factories to enable manufacturing processes as well as non-manufacturing processes such as procurement, inventory management and warehousing.

8. IMR REPORT (cont'd)

**PROVIDENCE**

The different types of automated manufacturing and digitalised solutions are as follows:

**Automated equipment**, which refers to standard equipment or custom-built equipment that can perform specific roles or tasks. This equipment is customised to perform a particular process of a manufacturing activity, such as testing and inspection, transfer and loading, laser drilling and packaging. It can operate on a standalone basis without being integrated as part of a production line system.



**Digitalised solutions**, which are solutions that enable and manage the digitalisation of processes and services to allow for internet of Things ("IoT"), which facilitates the real-time interconnectivity and data exchange between equipment and devices. This includes **smart solutions**, which are collaborative manufacturing solutions that respond and adapt to real-time changes on the factory floor. Examples include autonomous material transfer which can work with production systems to arrange and transfer inventories, components or finished products during the manufacturing process, as well as analytics systems to enhance efficiency of the manufacturing processes. Artificial intelligence ("AI") is utilised to control and monitor the system, especially to predict and prevent issues which cause downtime.



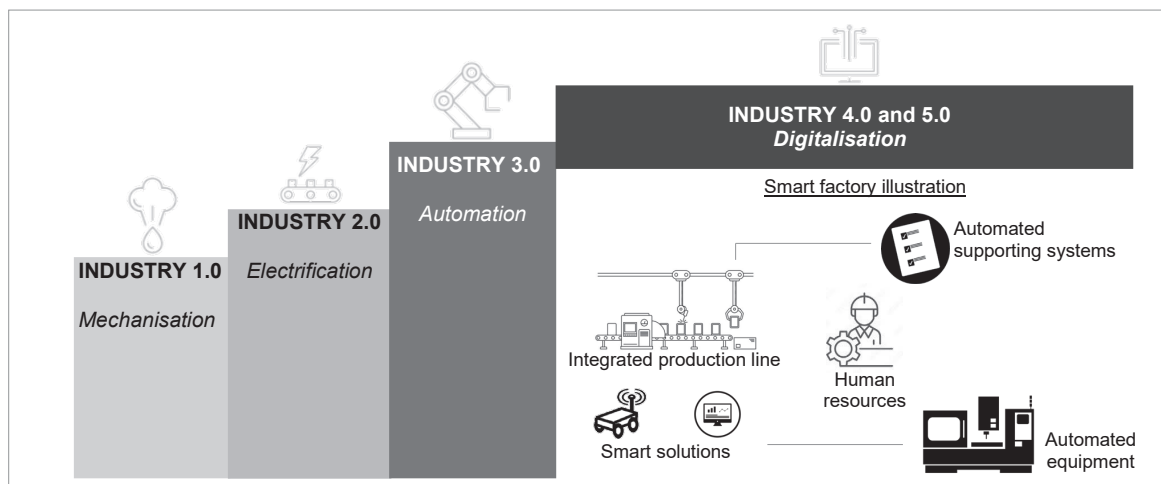
Source: PROVIDENCE

Automated equipment and digitalised solutions can be integrated to set up a smart factory. Smart factories refer to production facility environments that are highly digitalised where machinery and equipment are interconnected using IoT technology. The factory environment is interconnected on a real-time basis, where the monitoring and management of processes may be performed remotely. This includes every process on the factory floor, and is not limited to manufacturing processes.

**Industrial technology revolution**

The technologies used in manufacturing processes have evolved and advanced over time. Industry 1.0 occurred in the 1780s when the steam engine was invented and used to power machines used in manufacturing processes. During Industry 2.0 which occurred in the 1870s, electrical technology was developed and thus, the machines developed for manufacturing processes were electrical-based. The emergence of computer-controlled machines used for manufacturing processes in the 1960s marked the birth of Industry 3.0.

Technologies used in manufacturing processes have shifted to Industry 4.0, where machineries used are able to integrate and communicate with one another to form a seamless integrated production line. These include automated manufacturing and digitalised solutions. There is also a concurrent move towards Industry 5.0, which aims to harness the cognitive ability of human resources to maximise use of machineries, in order to create a sustainable manufacturing environment. With the automation and real-time interconnection of processes other than manufacturing activities performed in the factory, this will form smart factories.



**INDUSTRY PERFORMANCE, SIZE AND GROWTH**

The global automated manufacturing and digitalised solutions industry grew at a CAGR of 8.2%, from USD275.9 billion (RM1.2 trillion<sup>2</sup>) in 2020 to USD321.2 billion (RM1.4 trillion<sup>2</sup>) in 2022 and then to USD349.2 billion (RM1.6 trillion<sup>2</sup>) in 2023.<sup>4</sup> Moving forward, PROVIDENCE estimates that the global automated manufacturing and digitalised solutions industry will grow at a CAGR of 8.7% between 2024 and 2026 to reach USD448.6 billion (RM2.0 trillion<sup>2</sup>) in 2026.

<sup>4</sup> Source: Allied Market Research, PROVIDENCE analysis

**8. IMR REPORT (cont'd)**

The automated manufacturing and digitalised solutions industry in Malaysia grew at a CAGR of 15.8% between 2020 and 2023, from RM7.5 billion in 2020 to RM10.3 billion in 2022 and then to RM12.1 billion in 2023.<sup>4</sup> Moving forward, PROVIDENCE estimates that the automated manufacturing and digitalised solutions industry in Malaysia will grow at a CAGR of 13.1% to RM17.4 billion in 2026.

**COMPETITIVE OVERVIEW**

3REN Group is involved in the design and development of digitalised solutions and automated equipment, and is based in Malaysia. As such, PROVIDENCE has identified the following industry players on the basis that:

- They are involved in the design and development of automated equipment, but excludes companies that only design and develop automated test equipment for testing and packaging equipment of ICs and printed circuit boards; and/or
- They are involved in the design and development of digitalised solutions; and
- They are based in Malaysia.

These identified industry players<sup>(a)</sup> are as detailed below:

Company name	Automated equipment	Digitalised solutions	Latest available FYE	Revenue (RM'000)	GP (RM'000)	PAT/LAT (RM'000)	GP Margin <sup>(b)</sup> (%)	PAT/LAT Margin <sup>(c)</sup> (%)
3REN Group	✓	✓	31 December 2022	37,729 <sup>(d)</sup>	13,395 <sup>(d)</sup>	12,037 <sup>(e)</sup>	35.5	11.6 <sup>(f)</sup>
BBS Automation Penang Sdn Bhd	✓	✓	31 December 2022	47,810	3,907	(9,013)	8.2%	-
Cardos Automation System Sdn Bhd	-	✓	31 December 2022	3,501	1,276	(643)	36.4	-
DNC Automation (M) Sdn Bhd	✓	✓	31 December 2022	12,117	5,034	(176)	41.5	-
DOEKA Asia Sdn Bhd	✓	-	31 December 2022	4,709	2,194	(115)	46.6	-
ECA Integrated Solutions Berhad <sup>(g)</sup>	✓	✓	31 October 2022	27,530	11,730	7,806	42.6	28.4
Elliance Sdn Bhd	-	✓	31 July 2021	3,260	1,958	(28)	60.0	-
<b>Epsilon Group</b>								
Epsilon Automation Sdn Bhd	✓	-	31 December 2022	2,401	577	(400)	24.0	-
Epsilon Technology (M) Sdn Bhd	✓	-	28 February 2023	4,638	465	3,960	10.0	85.4
Fuka Packaging Solutions Sdn Bhd	✓	-	30 September 2022	1,978	481	125	24.3	6.3
Genetec Technology Berhad <sup>(g)</sup>	✓	-	31 March 2023	294,591	98,434	67,887	33.4	23.0
IMA Automation Malaysia Sdn Bhd	✓	-	31 December 2022	47,076	13,529	2,732	28.7	5.8
JM Automation Solution Sdn Bhd	✓	✓	31 December 2022	776	306	(143)	39.4	-

**8. IMR REPORT (cont'd)**

Company name	Automated equipment	Digitalised solutions	Latest available FYE	Revenue (RM'000)	GP (RM'000)	PAT/LAT (RM'000)	GP Margin <sup>(b)</sup> (%)	PAT/LAT Margin <sup>(c)</sup> (%)
Kinetec Automation (M) Sdn Bhd	-	✓	30 April 2023	5,924	1,358	(354)	22.9	-
MMS Ventures Berhad <sup>(g)</sup>	✓	-	31 December 2022	52,867	18,095	9,047	34.2	17.1
Neptrix Sdn Bhd	-	✓	31 December 2022	1,188	1,028	(163)	86.5	-
Pentamaster Corporation Berhad <sup>(g)</sup>	✓	✓	30 June 2023	342,187	99,494	70,874	29.1	20.7
Sky-Tag Robotics Sdn Bhd	✓	✓	30 September 2022	28,643	1,485	(2,430)	5.2	-
TT Vision Holdings Berhad <sup>(g)</sup>	✓	-	31 December 2022	52,983	22,622	10,202	42.7	19.3
TTOT Sdn Bhd	✓	-	31 December 2022	8,565	13	(2,616)	0.2	-
UBCT Industrial Solution Sdn Bhd	-	✓	30 September 2022	23,577	9,465	(936)	40.1	-
Xtrotech Sdn Bhd	✓	-	31 December 2022	2,458	1,341	236	54.6	9.6
XTS Technologies Sdn Bhd	✓	-	31 December 2022	8,310	593	(4,209)	7.1	-
YNY Technology Sdn Bhd	-	✓	31 December 2022	13,201	10,389	588	78.7	4.5

## Notes:

- (1) <sup>a</sup> The list is not exhaustive. It contains information based on publicly disclosed information as at 25 March 2024 and excludes exempt private companies
- (2) <sup>b</sup> GP margin is computed based on GP over revenue
- (3) <sup>c</sup> PAT / LAT margin is computed based on PAT/ LAT over revenue
- (4) <sup>d</sup> Based on segmental financial information for digitalised solutions and automated equipment
- (5) <sup>e</sup> Based on consolidated financial information as segmental information for digitalised solutions and automated equipment is not available
- (6) <sup>f</sup> PAT margin is based on consolidated PAT over consolidated revenue for the Group as the segmental PAT for digitalised solutions and automated equipment is not available
- (7) <sup>g</sup> The company is a listed company on Bursa Malaysia.

Source: Various company websites, Companies Commission of Malaysia, PROVIDENCE

**MARKET SHARE**

Based on an industry size for automated manufacturing and digitalised solutions in Malaysia of RM10.3 billion in 2022 and 3REN Group's combined revenue from automated equipment and digitalised solutions of RM37.7 million in the FYE 2022, 3REN Group garnered an industry revenue share of 0.4% in 2022.



## 8. IMR REPORT (cont'd)



### 3 KEY DEMAND DRIVERS AND SUPPLY CONDITIONS

#### KEY DEMAND DRIVERS

##### **Growth in the semiconductor and electronics industries and manufacturing-related industries**

The IC design, assembly and test segment of the semiconductor industry and automated manufacturing and digitalised solutions industry are generally driven by the increase in manufacturing activities undertaken in the semiconductor and electronics industry as well as other manufacturing-related industries.

Specifically, the semiconductor and electronics industries has been growing as indicated in Chapter 4 of this IMR report. The rising worldwide demand for semiconductor and electronic products has been largely driven by:

- (i) the technological revolution with 5G adoption and the emergence of 6G to increase network speed from 20 gigabits per second to 1 terabyte per second, IoT, AI, machine learning and big data analytics, have resulted in the emergence of new electronic products. New electronic products that have been introduced to the market as a result of these technologies include smart factories (where machinery, equipment and tools are fully interconnected), autonomous cars (which are self-driving or driverless cars) and smart home devices (such as smart lighting, door locks and home appliances). This technological revolution of semiconductor and electronic products is expected to continue driving new developments in the semiconductor and electronics industry to produce more advanced semiconductor and electronic products in terms of performance, capacity and technology; and
- (ii) rapid technological advancements which have led to continuous introductions of new product innovations and advancements. Electronic products, especially consumer electronic products, are subject to relatively shorter product lifecycles, given that consumers are highly receptive to new product innovations and advancements.

The rise in demand for electric vehicles (“EV”) and solar energy is also expected to boost the demand for semiconductor chips. An EV is a vehicle that is powered by electricity. Instead of using fuel-related components in the vehicle to power the motor of the vehicle, EVs use batteries to power the motor and the batteries must be charged to function. Sales of electric vehicles in Malaysia grew at a strong CAGR of 459.5%, from 58 units sold in 2020 to 10,159 units sold in 2023.<sup>5</sup> The EV market has been, and is expected to continue to be, driven by government incentives to promote EV sales, lower battery costs for EVs and increase in manufacturing of EVs by vehicle manufacturers.

##### **Modernisation and transformation of manufacturing facilities towards Industry 4.0 and 5.0 technology to enable smart factories and sustainable operations**

There is a continuous need for manufacturers to reduce cost and achieve economies of scale, in order to remain competitive. There is also a move towards more sustainable operations by optimising the usage of energy and introducing Industry 5.0 to encourage collaboration between human resources and machineries. In order to do so, these companies are shifting towards full automation of processes to increase operational efficiency and reduce operational costs with less human resources required. As such, smart factory solutions which enable Industry 4.0 and 5.0 production facility environments (or smart factories) have become increasingly popular.

The interconnectivity of machinery and equipment in smart factories enables automation of not only the semiconductor and electronics manufacturing process but also all other processes in the production facility, from the receipt of raw materials and supplies to the production and assembly of end-products. As a result, minimal human intervention is required in the production facility. Workers can remotely supervise the status of various machinery and equipment throughout the entire production facility in a control room, as well as to monitor and control the operations of the semiconductor and electronics manufacturing solutions.

Further, smart factory solutions also provide visibility over the entire organisation, as interconnected processes throughout an entire system would mean that data can be shared throughout the organisation. Data collected from smart factory solutions can be used to make better business decisions, identify areas of concern or improvement as well as under-utilised resources.

As more semiconductor and electronic product companies transition to smart factories, this is expected to bode well for the growth of the automated manufacturing and digitalised solutions industry.

Further, there is also increased awareness and focus on environmental, social and governance as well as sustainability practices. This is expected to encourage manufacturing companies to digitalise their operations in order to reduce greenhouse gas emissions and carbon footprint. Consequently, this is expected to drive demand for automated manufacturing and digitalised solutions.

##### **Increased outsourcing and relocation of manufacturing activities to Southeast Asia**

Southeast Asia has become a destination for foreign multinational companies to set up their production facilities, due to the favourable exchange rate, availability of manpower and strategic location. Many major multinational

<sup>5</sup> Source: Malaysian Automotive Association

## 8. IMR REPORT (cont'd)



semiconductor and electronics companies have established production facilities in Southeast Asia countries such as Malaysia, Thailand and Vietnam.

The establishment of production facilities in these countries has resulted in many local and multinational OSATs and electronic manufacturing services emerging in the country. Further, while the Russia-Ukraine war could impact new manufacturing facilities being set up in these 3 countries, multinational companies are still expected to set up their facilities in Southeast Asia.

In light of this, semiconductor and electronics manufacturing solution industry players have also emerged in these countries in order to cater for the growing need of the industry. Examples of such expansions include Intel Corporation who intends to invest approximately USD7.0 billion (approximately RM30.0 billion) in a new chip packaging and testing factory in Malaysia<sup>6</sup>, as well as Infineon Technologies AG which will be investing EUR5.0 billion (approximately RM24.9 billion) to expand its operations in Malaysia.<sup>7</sup> In particular, exports of electrical and electronics products from Malaysia grew from RM386.1 billion in 2020 to RM575.5 billion in 2023 at a CAGR of 14.2%.<sup>8</sup>

As such, the outsourcing and relocation trend has, and is expected to continue to, support the growth of the IC design, assembly and test segment of the semiconductor industry as well as automated manufacturing and digitalised solution industry in Malaysia.

### Government initiatives to develop the automated manufacturing and digitalised solution industry

In October 2018, the Ministry of International Trade and Industry launched the National Policy on Industry 4.0 (“**Industry4WRD**”) to drive digital transformation of the manufacturing industry and its related services. The policy’s goals are to increase labour productivity, increase the manufacturing sector’s contribution to the economy, increase innovation and increase the number of high-skilled jobs. The Industry4WRD Readiness Assessment programme is designed to help small and medium enterprises (“**SMEs**”) to assess their capabilities and readiness to adopt Industry 4.0 technologies and processes, identify areas for improvement and develop feasible strategies to perform outcome-based intervention projects.

In February 2021, the Government of Malaysia launched MyDIGITAL, a national initiative which aims to transform Malaysia into a digitally-driven, high income nation and a regional leader in digital economy. The Malaysia Digital Economy Blueprint maps out the strategies which will be undertaken in 3 phases (2021-2022, 2023-2025 and 2026-2030) to achieve the targeted outcomes of MyDIGITAL. The key thrusts in the Malaysia Digital Economy Blueprint pertaining to the IT infrastructure and cybersecurity industries are:

- (i) Build enabling digital infrastructure – providing access to extensive and high-quality digital infrastructure (such as broadband, data centres and cable landing stations) to better enable people, businesses and the Government of Malaysia to participate in the digital economy; and
- (ii) Build trusted, secure and ethical digital environment – creating a conducive environment for businesses and society to reap the benefits of digital services without compromising safety, data security, privacy, reliability and ethical standards.

Under Budget 2024, the Government of Malaysia aims to strengthen competitiveness among MSMEs via the utilisation of technology and digitalisation. Through Budget 2024, the Government intends to allocate RM900 million loan fund under Bank Negara to encourage SMEs to improve business productivity via automation and digitalisation. Further, under the budget, the Government plans to reduce dependency on foreign workers and build on local talent. As such, a special fund will be implemented for the utilisation of automation and training of local workers. Additionally, automation tax incentives will be expanded to cover the commodities sector in order to improve the productivity of plantation products and to reduce foreign labour dependency through mechanisation and automation such as drones and self-driving vehicles.

These Government initiatives are expected to further increase awareness and adoption of smart factory solutions, which will contribute to the growth of the semiconductor and electronics manufacturing solutions industry.

## SUPPLY CONDITIONS

### Availability of hardware and software and semiconductor chip supply

Hardware and software are critical components of automated manufacturing and digitalised solutions, and semiconductor chips are integral components of hardware. During the COVID-19 pandemic, there was a shortage of semiconductor and certain hardware parts (caused by a shortage of semiconductor chips) which was attributable to the surge in demand for consumer electronic products and restrictions in manufacturing activities of semiconductor chip manufacturers caused by the COVID-19 pandemic. In 2022, the global semiconductor chip shortage situation turned into oversupply in some semiconductor segments such as in the memory and data centre segments, and this situation persisted in 2023.

<sup>6</sup> Source: “Intel to invest USD7 billion in chip packaging facility in Malaysia”, The Economic Times, 14 December 2021

<sup>7</sup> Source: “Infineon to invest RM8bil to build wafer fab in Kulim, set for completion by 3Q24”, The Star, 7 July 2022

<sup>8</sup> Source: Department of Statistics Malaysia

## 8. IMR REPORT (cont'd)



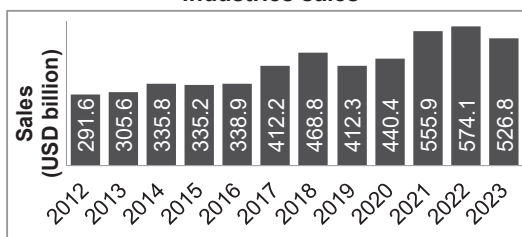
### Availability of human resources

A critical element of being able to provide automated manufacturing solutions is the availability of qualified and experienced talent. It is essential that industry players offering engineering support services, product engineering service, digitalised solutions and automated equipment are able to hire, train and retain talented employees with the required technical skills and engineering capabilities. Generally, there is no shortage of skilled resources in the engineering sector. According to the Department of Statistics Malaysia, the number of persons employed in the electrical, electronics and optical industry increased from 575,000 in 2020 to 632,000 in 2022.

## 4 THE SEMICONDUCTOR AND ELECTRONICS INDUSTRIES

The global semiconductor and electronics industries is cyclical, influenced by factors such as market demand and supply as well as macroeconomic conditions. Despite the cyclical nature of the semiconductor and electronics industries, the global semiconductor and electronics industries size grew from USD291.6 billion (RM901.0 billion<sup>9</sup>) in 2012 to USD526.8 billion (RM2.4 trillion<sup>2</sup>) in 2023, registering a CAGR of 5.5% over the period.<sup>10</sup> From 2012 to 2016, the global semiconductor and electronics industries increased from USD291.6 billion (RM901.0 billion<sup>9</sup>) to USD338.9 billion (RM1.4 trillion<sup>9</sup>), despite a temporary dip in 2015 caused by currency fluctuation and market cyclicality.

Global semiconductor and electronics industries sales



Source: Semiconductor Industry Association

In 2017, the global semiconductor and electronics industries recorded USD412.2 billion (RM1.8 trillion<sup>9</sup>), driven by rapid technology advancement such as IoT. In 2019, as a result of decreased demand for memory chips market which had led to oversupply and excessive inventory as well as cyclicality in product pricing, the global semiconductor and electronics industries decreased to USD412.3 billion (RM1.7 trillion<sup>9</sup>). Despite the COVID-19 pandemic and supply chain disruptions, the global semiconductor and electronics industries continue to grow in 2020 and 2021. This growth was primarily driven by the surging demand for semiconductors in electronic devices and equipment. In 2023, the global semiconductor and electronics industries decreased to USD526.8 billion (RM2.4 trillion<sup>2</sup>) as a result of decrease in demand for consumer electronics due to excess inventory stocks of consumer electronics in the first-half of 2023. Nevertheless, the global semiconductor and electronics industries are began to rebound towards the later part of 2023, driven by demand for AI applications. The global semiconductor and electronics industries is expected to rebound further in 2024 and is forecast to grow by 11.6% to reach USD588.0 billion (RM2.7 trillion<sup>2</sup>) in 2024.<sup>10</sup> This is expected to be driven by demand for ICs for AI and high-performance computing and EV as well as government initiatives in China to support semiconductor production.<sup>10</sup>

The semiconductor and electronics industries are expected to be driven by rapid technological developments for product innovations and advancements in the market, and the technological revolution with 5G adoption and the emergence of 6G, IoT, artificial intelligence, machine learning and big data analytics, which have resulted in the emergence of new electronic product. This is elaborated in Chapter 3 of the IMR report.

## 5 PROSPECTS AND OUTLOOK FOR 3REN GROUP

As an industry player in the IC design, assembly and test segment in Malaysia as well as in the automated manufacturing and digitalised solution industry in Malaysia, 3REN Group stands to benefit from the positive outlook of these industries, which will be driven by the growing semiconductor and electronics industry as well as manufacturing related industries. In this respect, the Group stands to benefit from the technological revolution with the emergence of 6G, IoT, AI, machine learning and big data analytics which is expected to result in the emergence of new final electronics products, as well as rapid technological advancements which have led to continuous introductions of new product innovations and advancements. In addition, the modernisation and transformation of manufacturing facilities towards Industry 4.0 and 5.0 and sustainable operations, increased outsourcing and relocation of manufacturing activities in Malaysia, and government initiatives to develop the automated manufacturing and digitalised solution industry are also expected to drive the growth of the industries in which 3REN Group operates in.

<sup>9</sup> Exchange rates from USD to RM were converted based on average annual exchange rates extracted from published information from Bank Negara Malaysia for:

2012: USD1 = RM3.0898

2016: USD1 = RM4.1457

2017: USD1 = RM4.3008

2019: USD1 = RM4.1427

<sup>10</sup> Source: Semiconductor Industry Association