

# PRECISION ENGINEERING | INDUSTRY DIGITAL PLAN

A Guide for Small and Medium Enterprises (SMEs) to Assess Their Digital Readiness and Opportunities to Go Digital



AUTONOMOUS ROBOTS



ADDITIVE MANUFACTURING



MACHINING DYNAMICS



In collaboration with:



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ENGINEERING INDUSTRY

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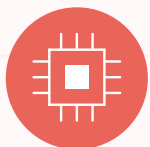
# THE PRECISION ENGINEERING INDUSTRY

Precision Engineering industry is one of the key pillars in Singapore's manufacturing ecosystem. It plays a crucial role in supplying precision parts & components, as well as machinery and equipment to support and improve manufacturing processes.



## Industries That Precision Engineering Supports

Precision Engineering embraces capabilities like precision machining, elastomeric and polymeric molding, and stamping, serving a wide range of industries such as:



Semiconductors



Automotive



Medical  
Technology



Aerospace



Electronics



# TRENDS IMPACTING THE PRECISION ENGINEERING INDUSTRY



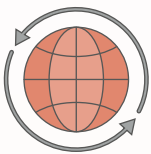
## Changing Consumer Demand

Increasing interest in demand for high quality, customised goods and services via digital channels as future of work and play becomes remote



## Innovation & Digitalisation

Acceleration of Industry 4.0 (I4.0) and digital platforms; growth of connected devices, e-services; flow of data, services and innovation surpasses flow of goods



## Reshaping of Global Trade

Collective shift of business interest in global trading, bifurcation supply chains and COVID-19; rise in multi-shoring and Just-In-Case (JIC) for business resiliency and efficiency



## Climate Change & Sustainability

Growing global focus on sustainable practices, products and services; increasing importance of circular economy

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## Industry Transformation Map (ITM)

The Precision Engineering (PE) Industry Transformation Map (ITM) was launched in 2016 to identify new growth areas and strategies to adopt for companies in the digital manufacturing era.

To ensure the continued growth of Singapore's key manufacturing pillar, companies in the PE industry can leverage digital manufacturing technologies and platforms to innovate and deliver competitive products/services for global markets.



Click [here](#) or scan this QR code for more details on the Precision Engineering ITM



## SMEs GO DIGITAL

Aligned to the ITM, the Industry Digital Plan (IDP) is part of the SMEs Go Digital Programme that helps to make going digital simple for SMEs.



SMEs GO DIGITAL

# 3 STEPS TO GO DIGITAL



**For more information**

Scan the QR code or visit  
[www.imda.gov.sg/SMEsGoDigital](http://www.imda.gov.sg/SMEsGoDigital)

### Support available

- Industry Digital Plans
- Pre-Approved Solutions
- Start Digital Pack
- Grow Digital
- Government Grants (e.g. Productivity Solutions Grant (PSG); SkillsFuture Enterprise Credit (SFEC))
- Advanced Digital Solutions
- Consultancy Services (SME Digital Tech Hub)

1

#### Is your business digital-ready?

Find out using the Industry Digital Plan (IDP) for your sector.

2

#### How do you get started?

Take up pre-approved solutions with grant support.

3

#### Where can you get help?

Contact your nearest SME Centre for support.

### SMEs GO DIGITAL COMPRISES THE FOLLOWING:

#### Industry Digital Plan (IDP)

Guide on digital solutions and training required for each stage of your business growth.

#### Start Digital Pack

Foundational digital solutions for new SMEs, to help you get a head start in going digital.

#### Grow Digital

Business-to-Business (B2B) and Business-to-Consumer (B2C) e-commerce platforms you can leverage to go global.

#### Consultancy Services (SME Digital Tech Hub)

Expert advice you can tap on, to transform your business using digital technologies.

#### Pre-Approved Solutions

Proven SME-friendly digital solutions pre-approved by IMDA to meet your business needs. Government grants, e.g. Productivity Solutions Grant (PSG), are available for the adoption of these solutions.

#### Advanced Digital Solutions

Advanced and integrated digital solutions to help you strengthen business continuity and build longer term resilience.



# DIGITAL ROADMAP

This digital roadmap serves as a guide for your company as you embark on your digital journey.

## STAGE 01

### GETTING READY FOR THE DIGITAL ECONOMY

Improved Efficiency,  
Streamlined Operations



Asset Monitoring  
and Manufacturing  
Data Collection



Computer-aided  
Design and  
Manufacturing  
(CAD-CAM)



Machining  
Dynamics



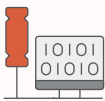
eProcurement



Manufacturing  
Operations  
Management



Autonomous  
Mobile Robot



Probing System



Product Process  
Configuration



Quality  
Management



Production  
Resource Planning  
(Scheduling and  
Tracking)

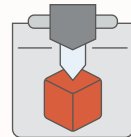
## STAGE 02

### GROWING IN THE DIGITAL ECONOMY

Enhanced Service Quality,  
Connected Ecosystem



Logistics  
Management



Additive  
Manufacturing

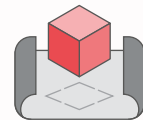


Predictive Asset  
Monitoring and  
Maintenance

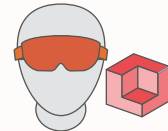
## STAGE 03

### LEAPING AHEAD

Digital Manufacturing,  
Intelligent Business



3D Visualisation  
and Simulation



Augmented/  
Visual Reality



Autonomous  
Robot

## BUSINESS CAPABILITIES

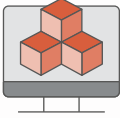

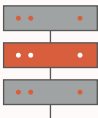

Accounting Management, Customer Relationship Management, Cybersecurity and Human Resource Management

**STAGE**  
**01**

# GETTING READY FOR THE DIGITAL ECONOMY

## Improved Efficiency, Streamlined Operations

Streamline and integrate your business operations to enhance productivity

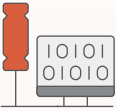
DIGITAL SOLUTION	DESCRIPTION	BENEFITS
 <p>Asset Monitoring and Manufacturing Data Collection</p>	<p>Monitor usage and movement of assets across the supply chain. This enables businesses to optimise the usage, and track the status of individual assets.</p> <p>Provide real-time insights on the performance and status to enable maintenance scheduling.</p>	<ul style="list-style-type: none"> <li>• Improve real-time visibility of operation status, movement and location of assets</li> <li>• Optimise asset maintenance process remotely</li> <li>• Minimise unscheduled production downtime</li> </ul>
 <p>Computer-aided Design and Manufacturing (CAD-CAM)</p>	<p>CAD-CAM software is used to design and manufacture prototypes, finished parts, and production runs.</p> <p>CAM software uses the models and assemblies created in CAD software to generate toolpaths that enable machine tools to convert designs.</p> <p>Allow close integration between the design and manufacturing processes.</p>	<ul style="list-style-type: none"> <li>• Reduce the gap between the design and manufacturing processes, thus improving the efficiency of the machines</li> <li>• Improve control over the production process</li> <li>• Produce prototypes and finished products quickly</li> </ul>
 <p>Machining Dynamics</p>	<p>Create scientific information on manufacturing parameters that generate stability lobes to estimate the vibration resistance of the machines.</p> <p>Enable build up of libraries for machines, materials, tools and manufacturing parameters.</p>	<ul style="list-style-type: none"> <li>• Improve productivity and quality of products</li> <li>• Provide quick report on condition of machine</li> <li>• Reduce error (e.g. calculation measurements etc.)</li> <li>• Improve overall processing time</li> </ul>
 <p>eProcurement</p>	<p>Facilitate and automate sales and purchase of supplies, through a B2B platform.</p> <p>Consolidate components of supply management (e.g. materials, equipment and supplies) on a centralised platform with integration to sales and contract management (e.g. purchase orders, e-invoicing and e-payment).</p>	<ul style="list-style-type: none"> <li>• Improve productivity by reducing the need for manual searches and processing of orders, enabling employees to focus on higher-skilled tasks</li> <li>• Improve budgeting process and monitor operational expenditure</li> <li>• Reduce processing time and potential errors in the procurement process</li> </ul>

**STAGE**  
**01**

# GETTING READY FOR THE DIGITAL ECONOMY

## Improved Efficiency, Streamlined Operations

Streamline and integrate your business operations to enhance productivity




DIGITAL SOLUTION	DESCRIPTION	BENEFITS
 <p>Manufacturing Operations Management</p>	<p>Provide an overview of the operations of manufacturing plants, including maintenance tracking, workforce planning, employees' activities and safety.</p> <p>Automate the creation, tracking and closing of incidents upon notification from sensors, with verification from employees.</p> <p>Provide real-time overview of operations' resources utilisation and performance.</p>	<ul style="list-style-type: none"> <li>• Improve overall visibility and management of operations and its related activities using electronic logging devices on a consolidated platform</li> </ul>
 <p>Autonomous Mobile Robot</p>	<p>Transport of materials across the factory floor, with built-in sensors to detect the surroundings and navigate through an optimal route, using localisation and mapping technologies.</p>	<ul style="list-style-type: none"> <li>• Ensure timely delivery of material to enhance operational productivity</li> <li>• Enable employees to focus on higher-skilled tasks</li> </ul>
 <p>Probing System</p>	<p>Use for dimensional measurement on Co-ordinate Measuring Machines (CMMs) to provide accurate and repeatable geometric data.</p> <p>Interrogate and obtain data throughout the manufacturing process to ensure components remain within conformance limits.</p>	<ul style="list-style-type: none"> <li>• Automate and speed up the processing of parts</li> <li>• Shorter process time, increase accuracy and improve quality</li> </ul>

**STAGE**  
**01**

# GETTING READY FOR THE DIGITAL ECONOMY

## Improved Efficiency, Streamlined Operations

Streamline and integrate your business operations to enhance productivity


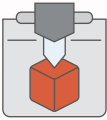

DIGITAL SOLUTION	DESCRIPTION	BENEFITS
 <p>Product Process Configuration</p>	<p>Act as a reference point for information on the sequence of processes and the technical drawing of components and materials. The solution includes information on tools, equipment, manpower and instructions used in each process. Manage revisions to product design and enable fluid changes to the manufacturing process and configuration.</p>	<ul style="list-style-type: none"> <li>• Minimise risk of production failure</li> <li>• Improve processes over time</li> <li>• Support highly flexible and adaptable manufacturing process</li> </ul>
 <p>Quality Management</p>	<p>Enable the identification and collection of quality data. Alert and highlight issues that are out-of-specification to the Quality Check (QC) officer. Record the causes and actions when issues are raised to provide clearer insights with data analytics.</p>	<ul style="list-style-type: none"> <li>• Increase customer loyalty</li> <li>• Gain new customers</li> <li>• Boost competitiveness in the market</li> <li>• Improve safety of workplace</li> <li>• Contribute to overall positive branding of your product</li> </ul>
 <p>Production Resource Planning (Scheduling and Tracking)</p>	<p>Facilitate project management and resource planning, including the planning and coordination of materials and equipment usage. Create and dispatch daily work orders, including execution sequence, work instructions and resources. The solution provides an overview of daily work orders and information of each task. Track and display real-time work completion status, based on data collected from shopfloor.</p>	<ul style="list-style-type: none"> <li>• Improve productivity with real-time visibility of projects and workflows</li> <li>• Improve efficiency with streamlined project scheduling, to improve communication with clients</li> <li>• Optimise usage of materials and equipment, thereby reducing operation costs</li> <li>• Alert technician when production equipment requires maintenance, which allows in-time mitigation and preventive actions for optimised safety operation</li> </ul>

**STAGE**  
**02**

**GROWING IN THE DIGITAL ECONOMY**

**Enhanced Service Quality, Connected Ecosystem**

Connect digitally and innovatively to optimise business value

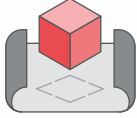
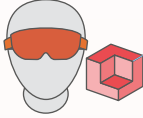

DIGITAL SOLUTION	DESCRIPTION	BENEFITS
 <p>Logistics Management</p>	<p>Provide detailed planning to streamline operations and implementation in store and deliver goods and services to the customer.</p> <p>Enhance the performance of operation to achieve desired outcomes in the deliverables.</p>	<ul style="list-style-type: none"> <li>• Better visibility on data to promote better decision-making by reducing costs and maximising operational efficiency</li> </ul>
 <p>Additive Manufacturing</p>	<p>Enable the production of lighter, stronger materials and parts.</p> <p>Use CAD software or 3D object scanners to direct hardware to deposit material, layer upon layer, in precise geometric shapes to create an object.</p>	<ul style="list-style-type: none"> <li>• Improve flexibility and efficiency of the manufacturing operations</li> </ul>
 <p>Predictive Asset Monitoring and Maintenance</p>	<p>Track and forecast overall performance of equipment and machines. Using predictive analytics and monitoring systems, businesses can minimise operational lapses, machine defects and failures and reduce energy costs.</p> <p>Integrated with Internet of Things (IoT) and Artificial Intelligence (AI) solutions to enhance predictive capabilities and optimise performance of machines.</p>	<ul style="list-style-type: none"> <li>• Reduce time spent on equipment maintenance</li> <li>• Reduce asset downtime and maintenance costs</li> <li>• Enable strategic and pre-emptive maintenance, and reduce the need to stock additional spare parts</li> </ul>

**STAGE**  
**03**

# LEAPING AHEAD

## Digital Manufacturing, Intelligent Business

Automate and use advanced technologies to drive smart business

DIGITAL SOLUTION	DESCRIPTION	BENEFITS
 <p>3D Visualisation and Simulation</p>	<p>Integrate project information with 3D visualisations, enabling users to view simulations of the project, onsite activities and hypothetical scenarios to pre-empt potential technical errors.</p> <p>Simulate loading and unloading operations and equipment handling and movement during the manufacturing processes.</p>	<ul style="list-style-type: none"> <li>• Minimise project risks and accelerate completion time</li> <li>• Enhance planning for a safer worksite</li> <li>• Improve employees' problem-solving skills</li> <li>• Intuitive identification of potential faults to enable early-stage corrections</li> <li>• Reduce human errors and increase productivity of site workers by having accurate measurements and dimensions on hand</li> </ul>
 <p>Augmented/ Visual Reality</p>	<p>Train employees in manufacturing operations using augmented reality technology.</p> <p>Provide visualisation of the entire manufacturing operation process, with modifications to overlay on the real environment to field test and adjust planned redesign measures.</p> <p>Identify manufacturing operations problems quickly, reduce production downtime and resolve issues, while keeping services and processes ongoing.</p>	<ul style="list-style-type: none"> <li>• Train and practice in a virtual environment that mirrors an actual operating facility</li> <li>• Provide hands-free intuitive digital support for workers during manufacturing operations</li> <li>• Support and reduce the cost of warehouse redesign and planning</li> <li>• Reduce production downtime and resolve issues quickly</li> <li>• Increase productivity, reliability, accuracy and safety in handling of process tasks</li> </ul>
 <p>Autonomous Robot</p>	<p>Automate high-volume and repetitive processes to assist with intricate tasks.</p> <p>Execute components of manufacturing processes such as lifting, holding and moving heavy pieces.</p>	<ul style="list-style-type: none"> <li>• Reduce margins of error to negligible rates</li> <li>• Reduce instances of errors and accidents due to fatigue or negligent behaviour</li> </ul>



# DIGITAL SKILLS & TRAINING

To meet the demands of a changing digital manufacturing landscape, different job roles will need digital skills at varying level of proficiency.

## All Users

Broad-based digital literacy and awareness

### "TECH BASICS" COURSES

#### Broad-based innovation mindset and digital literacy/awareness

SkillsFuture Singapore (SSG) funded broad-based courses - e.g. SkillsFuture for Digital Workplace

#### Solution-specific user level digital skills

Vendor solution-specific training

## Advanced Users

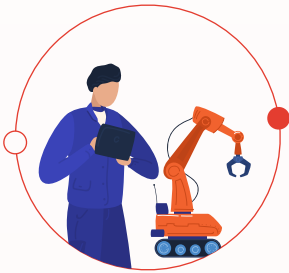
Higher proficiency level digital skills

### "TECH ADVANCED" COURSES

#### Higher proficiency level digital skills

Training mapped to the Skills Framework for Precision Engineering and Infocomm Communication Technology (ICT)

## Job Roles (Examples)



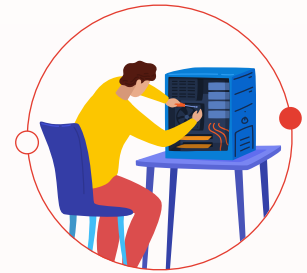
### Automation Coordinator

oversees the performance and status of automated equipment used in manufacturing process.



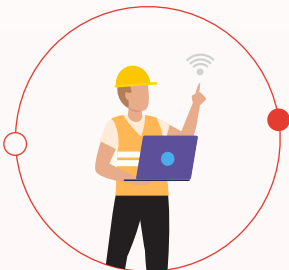
### Process Specialist

coordinates day-to-day operations of a production team, ensuring compliance with workplace safety and health procedures.



### Production Technician

operates equipment to fabricate components and parts, adhering to standard procedures of the operation.



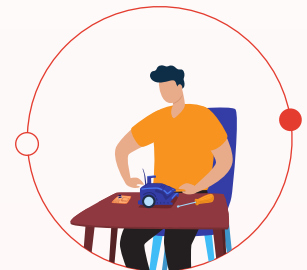
### Engineer

applies engineering principles to resolve technical issues and simplify projects using prototypes generated through machinery.



### Master Craftsman

resolves technical issues encountered in the manufacturing process and provides advisory on techniques, in optimisation of the production.



### Product Designer

designs and develops new products to ensure commercial viable product lines to fulfil objective of business.



# DIGITAL SKILLS NEEDED: DIGITAL ROADMAP ON TRAINING

This training roadmap serves as a guide to prepare companies and their workforce to adopt digital solutions at each stage of growth

	STAGE 01	STAGE 02	STAGE 03
<b>“TECH BASICS”</b> All employees in the industry	<b>GETTING READY FOR THE DIGITAL ECONOMY</b> <ul style="list-style-type: none"> <li>• Operations Management Innovation™ (OMNI™)</li> <li>• Implement LEAN Manufacturing</li> <li>• Digital Leadership</li> <li>• Real-time OEE for Industry 4.0</li> <li>• Improve Quality Monitoring and Management through Digitalisation</li> <li>• Improve Machining Productivity through Dynamics Analysis and Simulation</li> <li>• Enhance Control Performance of Precision Machines</li> <li>• Digitalisation of Business Process Workflow</li> <li>• Resource Scheduling for Service Industries</li> <li>• Introduction to Shopfloor Digitalisation</li> <li>• Manufacturing Process Simulation</li> <li>• An Introduction to 3D CAD Modelling</li> </ul>	<b>GROWING IN THE DIGITAL ECONOMY</b> <ul style="list-style-type: none"> <li>• Smart Additive Manufacturing System</li> <li>• Review Powder-bed Additive Manufacturing Processes for Complex Functional Metallic Components</li> <li>• Review High Speed Additive Manufacturing Processes for Metallic Components</li> <li>• Review Polymer-based Additive Manufacturing Processes for Flexible Mass Customisation</li> </ul>	<b>LEAPING AHEAD</b> <ul style="list-style-type: none"> <li>• Plant Simulation and Manufacturing Process Analysis for the Smart Factory</li> <li>• Automation Components and Systems for Advanced Manufacturing</li> <li>• Control in Automation Systems</li> <li>• Automation Design and Simulation</li> </ul>
<b>Vendor Solution-Specific Training</b>			
<b>“TECH ADVANCED”</b> Employees that use or are exploring advanced tech in their work / organisation	<ul style="list-style-type: none"> <li>• Digital Transformation &amp; Innovation™</li> <li>• Apply Robotics for Manufacturing Automation</li> <li>• Strategic Technology and Operation RoadMapping (STORM)</li> <li>• Industry 4.0 CyberSecurity Management for C-Suite Level / Operational Level</li> <li>• Advanced Smart Machining Technology</li> <li>• Data Analytics Driven Inventory Planning / Inventory Management for Smart Manufacturing &amp; Services</li> <li>• Production Planning &amp; Scheduling for Smart Manufacturing</li> <li>• Machine Learning for Supply Chain Analytics and Operations Management</li> </ul>	<ul style="list-style-type: none"> <li>• Data-driven Predictive Maintenance and Optimal Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Apply Robotics for Manufacturing Automation</li> </ul>
Training programmes aligned to <b>Skills Framework</b> and emerging areas under <b>SkillsFuture Series</b>			



# GET STARTED TODAY

You will be supported at every stage of your digital journey, through three simple steps:



## 1

### Is your business digital-ready?

- Find out if you are digital-ready by using the IDP resources [here](#) or scan the QR code



Precision Engineering IDP



## 2

### How do you get started?

- Visit [GoBusiness Gov Assist](#) to search for digital solutions and solution providers. If funding support is required, apply for the Productivity Solutions Grant (PSG) on the [Business Grants Portal](#), before purchasing and implementing the digital solutions.

You can also apply for training subsidies under the [SkillsFuture Enterprise Credit \(SFEC\)](#).



GoBusiness Gov Assist



Business Grants Portal



SFEC



## 3

### Where can you get help?

- Make an appointment with a Business Advisor at your nearest [SME Centre](#) for digital advice, or be referred to the Principal Consultants at the SME [Digital Tech Hub](#) for more advanced digital needs



SME Centre



Digital Tech Hub



# ADDITIONAL INFORMATION

## FOR SMES

### Digital Solutions

#### SMEs Go Digital

<https://imda.gov.sg/SMEsGoDigital>

#### GoBusiness Gov Assist

<https://www.gobusiness.gov.sg/productivity-solutions-grant/>

#### Be Safe Online

[https://www.csa.gov.sg/~media/csa/documents/publications/be\\_safe\\_online/be\\_safe\\_online\\_han\\_dbook.pdf](https://www.csa.gov.sg/~media/csa/documents/publications/be_safe_online/be_safe_online_han_dbook.pdf)

#### Better Data Driven Business

<https://www.imda.gov.sg/programme-listing/Better-Data-Driven-Business>

### Business Advisory & Digital Consultancy

#### SPETA DASH (Digitalisation, Advance Smart Manufacturing and Industry 4.0):

<https://speta.org>

#### SME Centres managed by Trade Associations:

- SME Centre@ASME
- SME Centre@SCCCI
- SME Centre@SICCI
- SME Centre@SMCCI
- SME Centre@SMF

#### Enterprise Infoline

<https://www.enterprisesg.gov.sg/contact/overview>

Enterprise Infoline: +65 6898 1800

#### SME Digital Tech Hub

<http://www.digitaltechhub.sg>

## FOR INDIVIDUALS

### Capability Upgrading and Career Facilitation

#### SkillsFuture Credit

<https://www.skillsfuture.gov.sg/credit>

#### SkillsFuture for Digital Workplace

<https://www.skillsfuture.gov.sg/digitalworkplace>

#### Skills Framework

<https://www.skillsfuture.gov.sg/skills-framework>

#### TechSkills Accelerator (TeSA)

<https://www.go.gov.sg/TeSA>

#### WSG's Careers Connect

<http://www.wsg.gov.sg/career-services.html>

#### WSG's Professional Conversion Programme

<http://www.wsg.gov.sg/programmes-and-initiatives/professional-conversion-programmes-individuals.html>

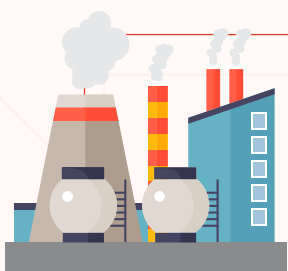
#### e2i Centres

<http://e2i.com.sg/app>

## FOR ICM VENDORS

### SMEs Go Digital

<https://imda.gov.sg/icmvendors>



This Industry Digital Plan is part of the SMEs Go Digital programme. For programme information and feedback: <https://www.imda.gov.sg/SMEsGoDigital>



# #SGDIGITAL

Singapore Digital (SG:D) is a nation-wide movement to unify Singapore's digitalisation efforts. Whether it is help for different industries to start their digitalisation journeys, or creating new ecosystems, opportunities and capabilities for the future, SG:D is set to take us ahead as a leading digital global node. The :D smiley face icon in the logo signifies the optimism of Singaporeans advancing together with digital innovation. As we progress into the digital economy, it is all about the people – the heart of all we do.



[imda.gov.sg/sgdigital](https://imda.gov.sg/sgdigital)  
[enterprisesg.gov.sg](https://enterprisesg.gov.sg)



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[facebook.com/enterprisesg](https://facebook.com/enterprisesg)



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[youtube.com/enterprisesingapore](https://youtube.com/enterprisesingapore)



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[linkedin.com/company/IMDAsg](https://linkedin.com/company/IMDAsg)  
[linkedin.com/company/enterprisesg](https://linkedin.com/company/enterprisesg)



[t.me/SMEsGoDigital](https://t.me/SMEsGoDigital)