

ENVIRONMENTAL SERVICES | INDUSTRY DIGITAL PLAN

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

INTEGRATED
MANAGEMENT



BLOCKCHAIN FOR
WASTE MANAGEMENT



AUTOMATED
RECYCLABLES
PICKING

FLEET
MANAGEMENT



Sector lead:



Supported by:



In support of:



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01

OUR ENVIRONMENTAL SERVICES INDUSTRY

The Environmental Services industry provides essential cleaning, waste and pest management services to safeguard public hygiene and cleanliness.



SUB-SECTORS



Cleaning

- Offices and Commercial Buildings
- F&B Establishments
- Conservancy



Waste Management

- Waste Collection
- Sorting and Recycling
- Treatment and Disposal



Pest Management (NEW)

- Office and Commercial Buildings
- F&B Establishments
- Conservancy
- Residential Premises

02

TRENDS IMPACTING ENVIRONMENTAL SERVICES



INCREASING DEMAND AND EXPECTATIONS

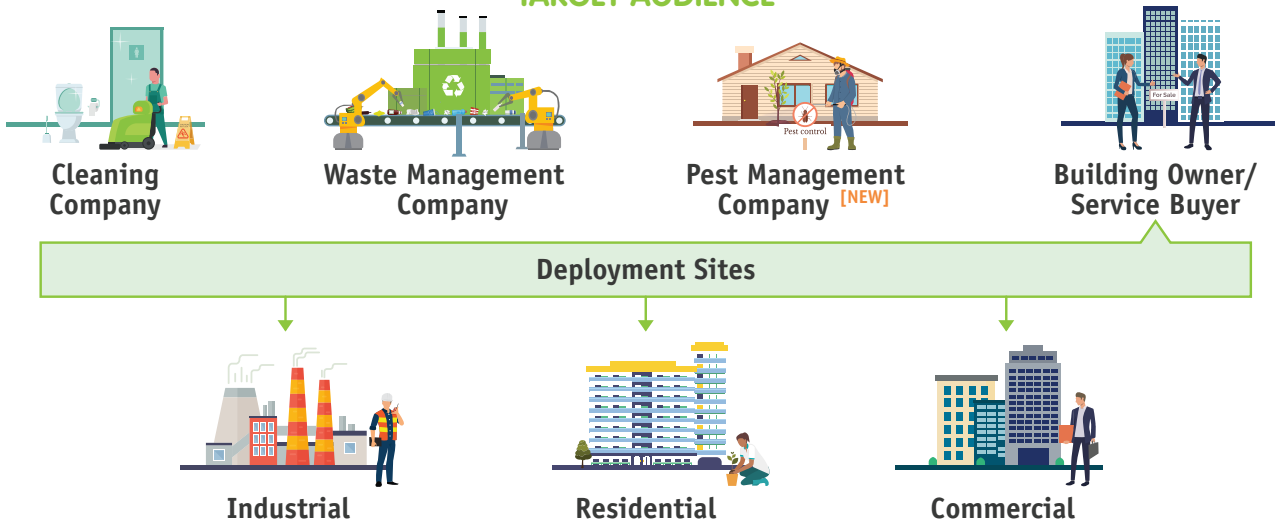
Singapore's demand for environmental services continues to rise, driven by increased economic sophistication, urbanisation and population growth. The expectations have also risen given Singapore's international reputation as a City in Nature.



EDUCATED WORKFORCE WITH HIGHER ASPIRATIONS

The Environmental Services industry faces stiff competition from other sectors when attracting employable workers into the local workforce. This is due to the working hours, work environment and conditions of the Environmental Services industry, and expectations for higher pay as locals become better educated.

TARGET AUDIENCE



INFRASTRUCTURE NEEDED FOR DIGITAL SOLUTIONS

Digital solutions are increasingly used to improve productivity and service quality in the Environmental Services industry. Fixed powerline and internet connectivity are required for digital solutions such as Smart Toilets to facilitate the remote monitoring of operations at multiple sites. Premise owners and managers, solution providers and service providers for environmental services need to work together to set up the necessary infrastructure prior to implementing the digital solutions.

ENVIRONMENTAL SERVICES INDUSTRY TRANSFORMATION MAP

The Environmental Services Industry Transformation Map (ITM) was launched in 2017 for the cleaning and waste management sectors, and has since incorporated the pest management sector from 2019. By integrating the efforts of the three sectors under the Environmental Services ITM, the industry as a whole can look forward to a more employable workforce, i.e. multi-skilled professionals who are able to move across various sub-sectors. Businesses can also synergise cleaning, waste management and pest management services to reap greater efficiency and productivity.

As demand for environmental services continues to rise, increasing manpower is not sustainable given Singapore's manpower constraints. Transforming the industry is thus critical to improve productivity, promote growth as well as to create stronger businesses and better jobs.

Adoption of digital technology will enable SMEs to be more productive and efficient, as digitalisation helps to optimise resources and overcome constraints.



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

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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. The IDP provides guidance to SMEs on the digital solutions to adopt, and the relevant skills training for their employees at different stages of their digital readiness.

IMDA INFOCOMM MEDIA DEVELOPMENT AUTHORITY | **SMEs GO DIGITAL**

3 STEPS TO GO DIGITAL

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?**
Access the CTO-as-a-Service for support.

For more information
Scan the QR code or visit www.imda.gov.sg/SMEsGoDigital

Support available

- Chief Technology Officer-as-a-Service (CTO-as-a-Service)
- Industry Digital Plans
- Pre-Approved Solutions
- Start Digital
- Grow Digital
- Advanced Digital Solutions
- Government Grants e.g. Productivity Solutions Grant (PSG)

SMEs GO DIGITAL COMPRISES THE FOLLOWING:

<p>CTO-as-a-Service</p>	<p>START DIGITAL</p>
<p>Assess your digital readiness, explore digital solutions and request for digital advisory and project management services.</p>	<p>Foundational digital solutions for new SMEs to get a head start in going digital.</p>
<p>INDUSTRY DIGITAL PLANS (IDP)</p>	<p>GROW DIGITAL</p>
<p>Step by step guide on digital solutions and training required at each stage of your business growth.</p>	<p>Leverage Business-to-Business (B2B) and Business-to-Consumer (B2C) e-commerce platforms to go international, without a physical presence overseas.</p>
<p>PRE-APPROVED SOLUTIONS</p>	<p>ADVANCED DIGITAL SOLUTION</p>
<p>Proven off-the-shelf 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.</p>	<p>Advanced and integrated digital solutions to help you strengthen business continuity and build longer term resilience.</p>

04

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
Digital Systems,
Optimised Resources



Asset/Inventory Management



Bin Fill Monitoring



Fleet Management



Pest Inspection/Monitoring



Service Quality Audit



Smart Toilet



Waste Tonnage Monitoring



Workforce Management

STAGE 02

Growing in the Digital Economy
Integrated Systems,
Autonomous Operations



Augmented Reality (AR)/
Virtual Reality (VR) Training



Automated Recyclables Picking



Bin Collection Robotics



Cleaning Robotics (e.g. Autonomous Scrubbers)



Integrated Management (e.g. SCADA, Transport Management)



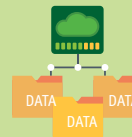
Surveillance and Inspection Robots

STAGE 03

Leaping Ahead
Data Sense-Making,
Intelligent Business



Blockchain for Waste Management



Centralised Platform with Data Analytics

*The digital roadmap is developed primarily for SMEs in the Environmental Services industry. However, larger enterprises in the industry may also use it to guide their digitalisation plans.



Business Capabilities

Human Resource Management and Accounting Management



Note: Companies can adopt digital solutions from any stage in the roadmap. This Roadmap will be updated over time as digitalisation of the industry progresses and new technologies are introduced to the industry.

GETTING READY FOR THE DIGITAL ECONOMY

Digital Systems, Optimised Resources

Build core digital capabilities and optimise the use of resources

DIGITAL SOLUTION

SOLUTION DESCRIPTION

BENEFITS



Asset/Inventory Management

Track the location and/or monitor the status of assets/inventories at multiple worksites to determine operational usability.

- Reduce the time taken to locate the assets, and optimise the usage of assets
- Reduce asset downtime through preventive maintenance



Bin Fill Monitoring

Measure bin/compactor fill-level in real-time to trigger waste removal actions.

- Increase the productivity of waste removal
- Ease the tracking of service delivery through on-demand collection
- Provide real-time visibility of bin fill-levels across multiple sites



Fleet Management

Enable real-time visibility and control of the company's fleet of vehicles.

- Enhance visibility through real-time access to the fleet's location and utilisation
- Improve fleet utilisation through effective planning
- Reduce fleet downtime through preventive maintenance



Pest Inspection/Monitoring

Inspect or monitor pest location and activity through the use of sensors. Data is stored and analysed, to assist operators to identify targeted mitigation measures.

- Provide operators with real-time information on pest activity on-site
- Provide operators with data-driven recommendations on targeted mitigation measures such as strategic placement of smart pest traps

DIGITAL SOLUTION

SOLUTION DESCRIPTION

BENEFITS



Service Quality
Audit

Perform quality audits of cleaning, waste collection and pest management performance in compliance with service standards and follow-up actions.

- Reduce manual efforts to track service quality
- Prevent disputes with quantitative audit trails
- Generate performance and management reports



Smart Toilet

Track toilet odour level, traffic, user feedback and consumables replenishment needs with data collation and reporting functions.

- Assist cleaning crew in the management of the toilets
- Improve the visibility of toilet status including consumables replenishment needs
- Improve service delivery



Waste Tonnage
Monitoring

Measure and transfer data on waste tonnage. Calculate haulage and related fees based on pre-set parameters.

- Optimise the measurement and transfer of waste tonnage data
- Improve efficiency and transparency of waste reporting and haulage calculations



Workforce
Management

Track and schedule workforce for deployment at multiple sites.

- Improve workforce productivity
- Assist supervisors in the management of workers
- Enhance recruitment capabilities

DIGITAL SOLUTION

SOLUTION DESCRIPTION

BENEFITS



AR/VR Training

Use AR and VR tools for training on demand. Data can be analysed to provide users with qualitative training assessment.

- Simulate real-world situations realistically in a safe and controlled environment
- Provide training at the convenience of the workers
- Provide qualitative training assessment using analytics



Automated Recyclables Picking

Integrate sensors, cameras and Artificial Intelligence (AI) functions to pick and sort recyclables.

- Divert recyclables sorting manpower to perform higher value-added tasks
- Provide system status updates to operators remotely via off-site monitoring function
- Reduce system downtime through preventive maintenance



Bin Collection Robotics

Deploy machines to collect and transport waste/recycling bins, and return assets to their original locations autonomously.

- Divert waste collecting manpower to perform higher value-added tasks
- Provide system status updates to operators remotely via off-site monitoring function
- Reduce system downtime through preventive maintenance

GROWING IN THE DIGITAL ECONOMY

Integrated Systems, Autonomous Operations

Integrate and streamline key processes along the value chain

DIGITAL SOLUTION

SOLUTION DESCRIPTION

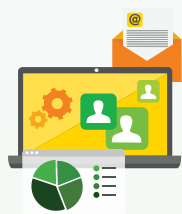
BENEFITS



Cleaning Robotics
(e.g. Autonomous
Scrubbers)

Deploy machines to conduct cleaning activities autonomously (e.g. autonomous scrubbers, sweepers and vacuum).

- Divert cleaning manpower to perform higher value-added tasks
- Provide system status updates to operators remotely via off-site monitoring function
- Reduce system downtime through preventive maintenance



Integrated Management
(e.g. SCADA, Transport
Management)

Provide ease of planning, monitoring and control for users through a common digital platform integrated with multiple singular function software.

- Ease supervisory planning, monitoring and control across multiple applications
- Provide real-time situational awareness
- Simplify operation processes



Surveillance and
Inspection Robots

Deploy robots or drones to augment surveillance and inspection tasks over challenging terrain or hard-to-reach areas. Provide operator with live footage streaming.

- Augment the capability to conduct surveillance and inspection tasks over challenging terrain
- Increase workplace safety of inspection workers

LEAPING AHEAD

Data Sense-Making, Intelligent Business

Leverage data analytics and advanced technology to optimise resources and improve overall service quality

DIGITAL SOLUTION

SOLUTION DESCRIPTION

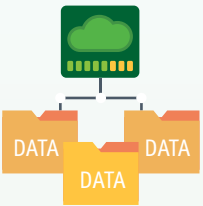
BENEFITS



Blockchain for Waste Management

Track the transfer and transport of waste and recyclables via a digital ledger across the waste management value chain.

- Provide accurate decentralised tracking of waste and recyclables
- Enable responsible disposal and transfer of waste and recyclables



Centralised Platform with Data Analytics

Integrate multiple software applications onto a common digital platform for applications in monitoring, control, data analytics and AI.

- Ease supervisory monitoring and control across multiple applications in multiple locations through a single platform
- Enable correlation of data to gather insights and optimise operations planning to increase workers' productivity
- Augment decision-making by both service provider and client, using AI

05

DIGITAL SKILLS NEEDED

Environmental Services job roles will evolve to meet the changing needs of customers and support the growth of companies. Upskilling of workers is key to enable companies to harness the potential of digital technologies, and remain competitive and relevant.

ALL USERS

Require broad-based digital literacy and awareness

“TECH BASICS” SKILLS

Broad-based innovation mindset and digital literacy/awareness

SkillsFuture Singapore (SSG) funded broad-based courses – e.g. SkillsFuture for Digital Workplace, Introduction to Digital Technologies in Environmental Services, Digitalising Environmental Services

Solution-specific training provided by vendor

Examples of job roles:



Urban Hygiene Associate



Supervisor



Operations Manager

ADVANCED USERS

Require higher proficiency digital skills

“TECH ADVANCED” SKILLS

Higher proficiency level digital skills

Training mapped to the Skills Framework for Environmental Services and Infocomm Technology (ICT)

Examples of job roles:



Operations Director/General Manager



Data Analyst



Environmental, Health and Safety Specialist/Manager

05

DIGITAL ROADMAP ON TRAINING

This training roadmap serves as a guide to prepare companies' workforce to adopt digital solutions at each of the three stages of growth.

	STAGE 01	STAGE 02	STAGE 03
<p>“TECH BASICS”</p> <p>All employees in the industry</p>	<p>GETTING READY FOR THE DIGITAL ECONOMY</p> <p>Environmental Services Tech Basic 1.1: Introduction to Digital Technologies in Environmental Services</p> <ul style="list-style-type: none"> • Digitisation, Internet of Things (IoT) and Smart Systems • Robotics and Automation • Cleaning Management Software <p>Digitalising Environmental Services 1</p> <ul style="list-style-type: none"> • Workforce Scheduling and Management • Quality Audit and Report • Asset Tracking <p>SkillsFuture for Digital Workplace</p> <ul style="list-style-type: none"> • Usage of Mobile Digital Devices • Accessing Government Portals with SingPass • Basic Cybersecurity • Modes of Digital Payment 	<p>GROWING IN THE DIGITAL ECONOMY</p> <p>Environmental Services Tech Basic 2.1:</p> <ul style="list-style-type: none"> • Automated Recyclables Picking • Bin Collection Robotics • Surveillance and Inspection Robots • AR/VR Training 	<p>LEAPING AHEAD</p> <p>Course details will be available soon</p>
	Vendor Solution-Specific Training		
<p>“TECH ADVANCED”</p> <p>Employees who use or are exploring advanced tech in their work/organisation</p>	<p>Environmental Services Tech Advanced 1.2:</p> <ul style="list-style-type: none"> • Hands-On Data Protection Officer Training Programme • Introduction to Data Analytics and Data Exploration • Understanding of IoT • Data Analytics for Workplace • Improving Work Processes with Technology 	<p>Environmental Services Tech Advanced 2.2:</p> <ul style="list-style-type: none"> • Core Foundations for Data Science • Data Analytics and IoT Usage • Statistical Analysis and Data Visualisation • AR/VR Technology 	<p>Environmental Services Tech Advanced 3.2:</p> <ul style="list-style-type: none"> • Robotic Process Automation • Introduction to Python Programming and other Data Manipulation Programmes • Data Science I and II • Blockchain Networks
These training programmes are aligned to the Skills Framework and emerging areas under the SkillsFuture Series			

06

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.



Environmental Services IDP

2 | How do you get started?

- Tap on [CTO-as-a-Service](#) to complete your Digital Readiness Self-Check in the web app and select from the recommended digital solutions that best meet your business needs.
- If funding is required, apply for the [Productivity Solutions Grant \(PSG\)](#) via the Business Grant Portal, before purchasing and implementing digital solutions.
- Apply for training subsidies under the [SkillsFuture Enterprise Credit \(SFEC\)](#)



CTO-as-a-Service



SFEC

3 | Where can you get help?

- Tap on [CTO-as-a-Service](#) for digital consultancy and project management services.
- Visit [SME Centre](#) if you require business advisory.



SME Centre



FOR SMEs

Digital Consultancy and Solutions

CTO-as-a-Service

go.gov.sg/CTOaaS

SMEs Go Digital

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

GoBusiness Gov Assist

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

Be Safe Online

https://www.csa.gov.sg/~media/csa/documents/publications/be_safe_online/be_safe_online_handbook.pdf

Business Advisory

SME Centres managed by Trade Associations:

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

<https://www.enterprisesg.gov.sg/smecentre>

Enterprise Infoline: +65 6898 1800

FOR ICM VENDORS

SMEs Go Digital

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

FOR INDIVIDUALS

Capability Upgrading and Career Facilitation

Institute of Higher Learning

Ngee Ann Polytechnic:

<https://www.np.edu.sg/lifelonglearning/Pages/Industry-Digital-Plan.aspx>

Institute of Technical Education:

<https://www.ite.edu.sg/courses/course-finder/course/coc-in-introduction-to-digital-technology-in-environment-services>

Course Directory

<https://www.myskillsfuture.gov.sg/content/portal/en/training-exchange/course-landing.html>

Fundamentals for Future Economy

<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

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

e2i Centres

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

#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
nea.gov.sg



twitter.com/IMDAsg
twitter.com/nea_sg



facebook.com/IMDAsg
facebook.com/NEASingapore



youtube.com/IMDAsg
youtube.com/NEAsg



linkedin.com/company/imdasg
linkedin.com/company/national-environment-agency



instagram.com/IMDAsg
instagram.com/nea_sg



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The content of this guide is provided for informational purposes only and is correct as of February 2022.