

**DIGITAL CAPACITY BUILDING FOR OWN-ACCOUNT
WORKERS IN SINGAPORE**

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October 2024
IPS Working Papers No. 58

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**DIGITAL CAPACITY BUILDING FOR OWN-ACCOUNT
WORKERS IN SINGAPORE**

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October 2024

This study is supported by SkillsFuture Singapore under the
Workforce Development Applied Research Fund (GA20-06).

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
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CONTENTS

<i>Executive Summary</i>	4
<i>Sections</i>	
1. Digital Upskilling for Own Account Workers	16
1.1 Elevating Own Account Work in Singapore	16
1.2 Own-Account Workers in Singapore	19
2. Digital Skills for Own-Account Workers	22
2.1 Baseline and Intermediate Skills	23
2.2 Occupation-Specific Skills	25
2.3 Digital Skills Framework for Own-Account Workers in Singapore	32
3. Impact of Training	36
3.1 Training Improved Ability for Using Digital Skills	37
3.2 Increase in Overall Skill Use	39
3.3 Training Improved Task Performance	40
3.4 Increased Confidence in Using Technology at Work	43
3.5 “One And Done” Attitude Towards Upskilling	44
4. Challenges Faced by Own-Account Workers When Upskilling	46
4.1 Lukewarm Attitude and Low Self-Efficacy	46
4.2 Not Knowing What They Do Not Know	49
4.3 Not One-Size-Fits-All	50
4.4 Not Knowing What to Learn	52

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

	3
4.5 Train and So What?	55
4.6 Lacking Support	57
5. Recommendations	61
5.1 Facilitate Self-Assessment	62
5.2 Enhance Resources and Close Delivery Gaps	73
5.3 Strengthen Ecosystem Support	79
<i>Appendices</i>	
Appendix A: Phase One — Literature Review and Web Scraping	90
Appendix B: Phase Two — Focus Group Discussions and In-Depth Interviews	105
Appendix C: Phase Three — Digital Skills Framework Pilot Study	109
Appendix D: Existing Support	119
Appendix E: About the Authors	122

DIGITAL CAPACITY BUILDING FOR OWN-ACCOUNT WORKERS IN SINGAPORE

Executive Summary

Own-account workers are self-employed persons who engage in a trade or business without employing any paid workers. Own-account workers are not only delivery riders and private-hire car drivers but are also real estate and property agents, information and communication technology professionals, science and engineering professionals, and freelancers in the arts, media, creative, entertainment and sports industries. Without a singular long-term employer that can help to facilitate or support their upskilling, own-account workers are left to navigate the complexities of upgrading their skillsets to remain competitive in the workforce on their own. Despite own-account workers making up a third of the global workforce, research on the role technology plays in their work and their digital upskilling needs remains scarce. This research study, funded by SkillsFuture Singapore (SSG), investigates the following:

1. How digitally ready are Singapore's own-account workers? What factors influence their digital readiness?
2. What is a baseline set of job-ready digital skills that own-account workers need to meet the demands of the digital economy?
3. What can be done to better match the supply of digital skills training with the needs of the less digitally literate own-account workers?

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

To answer these questions, we embarked on a three-phased study comprising (1) a systematic literature review, (2) focus group discussions and in-depth interviews with own-account workers, and (3) a pilot study to test the digital skills framework developed for own-account workers.

Digital skills for own-account workers

In Phase One of our study, we identified the skills that own-account workers needed to thrive in a global digital economy and developed a tiered skills framework to support their digital skill acquisition. In Phase Two, we refined this framework with input from local own-account workers and those who worked with own-account workers or had experience training own-account workers. The final framework comprises three tiers — baseline digital skills, intermediate digital skills and occupation-specific skills. A fourth category of skills — non-digital contextual skills — supports the usage of digital skills across the three tiers.

Baseline digital skills are essential skills for all workers of the 21st century. We identified six baseline digital skills for own-account workers: (1) basic digital operations, (2) communication and collaboration skills, (3) organisation and project management, (4) safety and security, (5) optimising profile, and (6) pricing services and products.

Intermediate digital skills are digital skills applied at a more advanced level than baseline digital skills. These skills enable own-account workers to harness digital technology more efficiently, so they remain competitive in the workforce or transit to other industries more easily. The four intermediate skills are: (1) information management and processing, (2) content and product creation, (3) data analysis and visualisation, and (4) programming fundamentals.

Occupation-specific skills are examples of digital skills required by those who work in: (1) science and engineering, (2) creative and multimedia, (3) professional services, (4) business and administration, (5) software and development, and (6) transportation and delivery. Two skills — programming fundamentals and cloud computing — are important to all sectors, except for the transportation and delivery sector.

Contextual skills are non-digital skills used in tandem with the baseline, intermediate, occupation-specific digital skills and help workers perform more effectively in their work. Here we identified six contextual skills: (1) problem solving, (2) critical thinking, (3) analytical thinking, (4) learning to learn, (5) adaptability, and (6) ethical awareness

Contextual skills are non-digital skills used in tandem with the baseline, intermediate, occupation-specific digital skills and help workers perform more effectively in their work.

There were six contextual skills identified:

- (1) problem solving
- (2) critical thinking
- (3) analytical thinking
- (4) learning to learn
- (5) adaptability;
- (6) ethical awareness

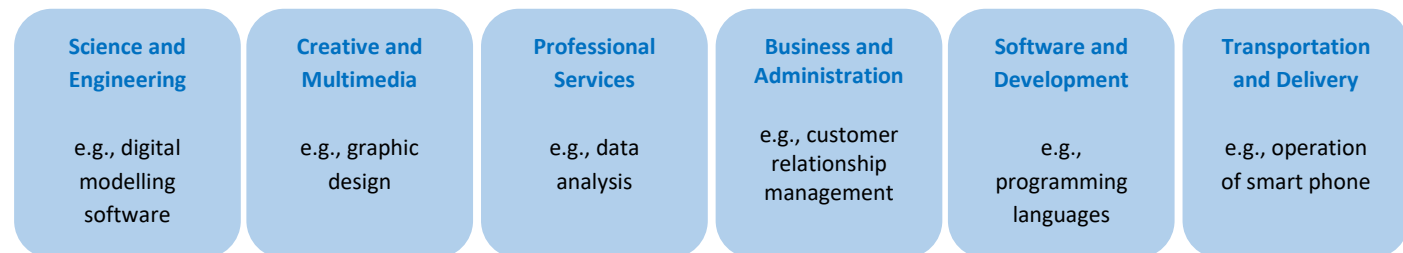
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Occupation-specific skills are examples of digital skills required by those who work in the six main own-account occupation groups.



IPS Working Papers No. 58 (October 2024):

Impact of training on own-account workers

To understand the impact of training, we tested the digital skills framework that we developed in Phase Three of the study among 52 participants. Half of the participants did Creative and Multimedia work while the other half held occupations related to Sales and Marketing. The two groups were taught a total of 12 skills in the digital skills framework: 11 common digital skills and one occupation-specific skill according to their occupation group. We surveyed participants before training, immediately after training and six months after training.

Training improved reported ability in digital skills taught

Participants reported significant improvements in their ability for 10 out of 11 common digital skills taught. Across both groups, seven of these skills improved immediately after training and plateaued after six months while the other three common skills improved gradually over six months. The results suggest that the improvements were likely due to the training programme but there was no further self-directed improvement after six months, in the absence of training.

We also compared the two groups of workers. The Creative and Multimedia group reported improvements in more skills than the Sales and Marketing group, suggesting the former could have found the training more useful.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Training increased frequency of skill use for more advanced digital skills

Participants reported a significant increase in their frequency of use for six out of 11 common skills taught. The skills which did not see an increase in frequency of usage are the baseline skills which were already frequently being used before the training programme.

The Sales and Marketing group reported significant increases in their frequency of using seven out of the 11 common skills. However, most of the increases happened immediately after training, without further increases after six months. It is possible that frequency of skill usage among the Sales and Marketing group plateaued because it was limited by the number of opportunities they had in using these skills at work during the six-month lapse. The Creative and Multimedia group reported a significant increase in using only four out of the 11 common skills after training. The skills with reported increases among this group are the more technical and advanced digital skills (e.g., “data analysis and visualisation”). Thus, it is possible that the Creative and Multimedia own-account workers had fewer opportunities in using these skills at work, and their usage frequency increased with time when they had more opportunities to apply the skills.

Training improved reported ability of performing almost all tasks taught

At the end of the study, participants reported that the training programme effectively improved their ability in performing 15 out of the 16 specific tasks.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

However, their reported ability in performing these tasks plateaued during the six-month lapse. These findings emphasise the need for continuous learning or training to maintain and improve skills, especially for more advanced or complex ones.

The training also seems to have improved the reported ability in more tasks among the Creative and Multimedia group. There were no statistically significant differences in this measure between the Sales and Marketing group and the Creative and Multimedia group before the training. Thus, the findings suggest that the Creative and Multimedia group could have found the training programme more useful in raising their reported ability in performing these tasks.

Increased confidence in using digital technology at work after training

We observed significant improvements in participants' confidence in using digital software (e.g., Microsoft Word, Google Sheets, various internet browsers, etc.) and digital services (e.g., internet banking services, online job-matching platforms) for work. We also observed a significant increase in participants' belief that digital technology helps them find work more easily.

Own-account workers might have a “one and done” attitude towards upskilling

There was a negative change in participants' attitudes towards digital upskilling. Participants were less likely to look for opportunities to develop new digital skills and knowledge and less willing to invest their time in developing their digital skills by the end of the study despite seemingly positive training outcomes.

Challenges and barriers to upskilling

In Phase Two, to better understand the experiences of own-account workers in upskilling, we conducted focus group discussions and in-depth interviews with local own-account workers, training providers with experience in training own-account workers, and employers who engage own-account workers. Their challenges comprise findings from Phase Two and Phase Three. We noted that the challenges faced by own-account workers could be sorted into three broad categories: (1) individual, (2) environment and (3) ecosystem.

Individual: Lukewarm attitudes towards formal training, low self-efficacy and difficulties identifying skill gaps

A common barrier to upskilling for the own-account workers is the high cost of formal training courses. Many own-account workers noted there was no need for in-person courses as free online resources or on-the-job learning often suffice. Often, own-account workers also report feeling overwhelmed by the endless challenge of keeping pace with rapid technological advancements, IPS Working Papers No. 58 (October 2024):

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and B. Tan

even when viewing upskilling positively. Own-account workers also have difficulties deciding on what skills to learn as they were sometimes ignorant to their own skill gaps.

Training environment: No one-size-fits-all solution and difficulties in navigating the MySkillsFuture portal

Own-account workers find existing guidance and resources too general. Instead, they hope for personalised course recommendations that are tailored to their career aspirations, level of education and current digital skill levels. Own-account workers also face difficulties in navigating the MySkillsFuture portal to find the information they need when deciding on which courses to take.

Ecosystem: Opportunity cost and lack of support

Own-account workers are often reluctant to spend time on training, especially when they could be taking on more jobs to earn more income instead. Thus, these workers tend to prefer training programmes that are bundled with tangible opportunities to apply their new skills in a professional setting. In addition, employers who engage own-account workers view them as ad hoc workers or freelancers, and typically do not provide training or provide support for the upskilling of own-account workers. While own-account workers might receive slightly more tailored support from training providers, the type and level of support vary among training providers.

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Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Addressing the challenges faced by own-account workers

To address the various challenges faced by own-account workers, we propose three main buckets of recommendations: (1) facilitate self-assessment, (2) enhance resources and close delivery gaps, and (3) strengthen ecosystem support.

Individual challenges: Lukewarm attitudes towards training, low efficacy, difficulties identifying skill gaps

Recommendations: Facilitate self-assessment

- Digital skills framework and self-assessment tool
- Strengthen communication of skills relevance and application

To help own-account workers better identify their skill gaps, we developed a digital skills framework to give these workers a better idea of the digital skills they require as an own-account worker. Additionally, this digital skills framework can be used to refine existing self-evaluation tools to assess one's digital skills level. To ensure that training is seen as relevant and applicable, trainers and trainees can also work together on planning how to apply the skills learned at work. Lastly, a centralised source of information that allows time-starved own-account workers to easily find out what type of upskilling support is available to them.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Challenges with training environment: No one-size-fits all solution, lack of information and gaps in delivery

Recommendations: Enhance resources and close delivery gaps

- Personalised recommendations
- Centralised source of information, one-stop portal

Own-account workers are a diverse group of workers who have varying needs and career aspirations. A tailored approach in recommending courses or training programmes would be useful for these workers instead of making broader, more general recommendations. Also, to help own-account workers better decide what courses to take, MySkillsFuture should standardise type of information and level of detail training providers list on the platform.

Ecosystem barriers: Opportunity cost, lack of support

Recommendations: Strengthen ecosystem support

- Collective for own-account workers

A multi-stakeholder collective for own-account workers can support the upskilling of different types of own-account workers. Such a collective can help to consolidate and communicate information about skills requirements, courses,

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Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

trends and grants that are applicable to own-account workers. In addition, a collective can create networking opportunities for own-account workers and help facilitate the recognition of certain courses or training programmes that own-account workers attend.

DIGITAL CAPACITY BUILDING FOR OWN-ACCOUNT WORKERS IN SINGAPORE

1. DIGITAL UPSKILLING FOR OWN ACCOUNT WORKERS

1.1 Elevating Own Account Work in Singapore

The COVID-19 pandemic disrupted the economy and impacted the livelihoods of Singaporeans while also accelerating digitalisation across industries. As a result, digital intermediaries¹ and technology providers are playing larger roles in local and global markets. During the pandemic, many workers turned to gig jobs to either supplement their income or make up for lost income (McKinsey Global Institute, 2021). The pandemic sped up the adoption of remote work and today, Singaporean workers face not only local competition, but also regional and global competition for jobs as the world becomes increasingly interconnected due to digitalisation.

Today, gig economy workers make up a third of the global workforce globally (McKinsey Global Institute, 2021). When we think about gig economy workers, platform workers like delivery riders and private hire car drivers come to mind most readily. However, gig workers make up a larger group of self-employed people known as own-account workers. Defined as own-account workers by

¹ There are three main types of digital platforms: (1) capital platforms that connect customers with products and assets, (2) labour platforms that connect customers with service providers, and (3) knowledge-centric platforms that focus on consultancy services (McKinsey Global Institute, 2021).

IPS Working Papers No. 58 (October 2024):

the Ministry of Manpower (MOM), they are “self-employed persons who are engaged in a trade or business without employing any paid workers” (MOM, 2018, p.1). While some take on own-account work as a preference, others do so as a stop-gap measure while they seek to go back to full-time work. This group of active jobseekers includes those who were retrenched and caregivers who want to return to the workforce.

Contemporaneous remote work was demonstrated to be feasible during the pandemic and will remain an option (PwC, 2021). Technologies like artificial intelligence (AI), big data and digital platforms will continue to create new work structures (Wood et al., 2018; Wood et al., 2019). To keep pace with rapid technological developments, workers need to constantly upgrade their digital skills.

To this effect, the Singapore government has been rolling out initiatives to promote continuous education and training to improve workers’ employment resilience. Digital skills were the key focus of upskilling initiatives introduced by SkillsFuture Singapore (SSG) in 2021. Mrs Josephine Teo, Minister for Communications and Information, highlighted how technical expertise of varying levels were in high demand, including “tech-lite” jobs that may offer those with basic digital skills a foot into the information and communications industry (Yeo, 2021). In response to the increasing prevalence of technologies like AI, SSG’s 2023 programmes addressed disruptive technology and cybersecurity risks (Tan, 2023).

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

The comprehensive digital blueprints outlined by Singapore's government requires periodic assessments, considering the rate of change in workplace trends. Existing schemes that support own-account workers' training needs feature programmes that facilitate transitions from informal to formal employment. These include career coaching and job matching services through Workforce Singapore's Careers Connect and the National Trade Union Congress' (NTUC) Employment and Employability Institute (e2i) centres.

While the Digital Economy Framework for Action, launched under the Digital Economy pillar of Singapore's Smart Nation goals (Smart Nation and Digital Government Office, n.d.), recognises the potential of digital platforms in disrupting conventional market trends, the needs and competency of own-account workers who are increasingly dependent on digital platforms for work have yet to be investigated.

With support from Workforce Development Applied Research Fund, we embarked on a research study to determine the following:

- 1. What digital skills do own-account workers need to meet the demands of the digital economy?**
- 2. What impact does training have on own-account workers and what challenges do they face when upskilling?**
- 3. How can we better meet the needs of own-account workers with the supply of digital skills training?**

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

1.2 Own-Account Workers in Singapore

While own-account workers currently make up about 10 per cent of the local workforce, the number of own-account workers in Singapore has increased by almost 30 per cent from 2016 to 2022 (MOM, 2023). According to the annual Labour Force Supplementary Survey conducted by MOM, the number of own-account workers rose for the third consecutive year in 2022 and was estimated to be about 257,300 in that same year (MOM, 2023). However, in 2023, for the first time since the pandemic, the number of own-account workers decreased, to 221,800 (MOM, 2024). This number includes primary own-account workers who engage in own-account work as a primary form of employment and secondary own-account workers who take up informal or contractual work on the side.

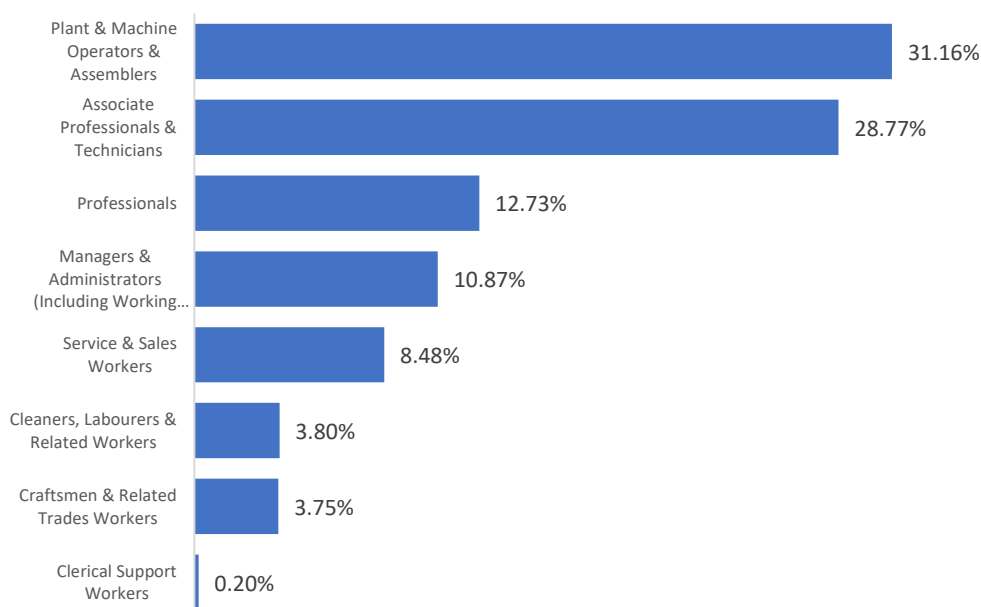
Current policy discourse and research focus on location-based platform labour like platform drivers, as seen in Boston Consulting Group's [BCG] 2021 report on India's gig economy and Cedefop's 2020 report on the online platform economy (BCG & Michael & Susan Dell Foundation, 2021; Cedefop, 2020). However, research conducted in Europe shows that own-account work is very diverse and encompasses both blue-collar and white-collar jobs. Nearly a quarter of own-account workers in Europe are professionals, and nearly a fifth are made up of skilled agricultural, forestry and fishery workers (European Commission, 2020).

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

In Singapore, own-account workers take up jobs in a wide range of occupational groups. Notably, plant and machine operators and assemblers — which include taxi drivers, private-hire car drivers and car and light goods delivery drivers according to the Singapore Standard Occupational Classification (SSOC) — made up slightly less than a third of own-account workers in 2023 (see Figure 1). This group was closely followed by associate professional and technicians, which made up 28.8 per cent of own-account workers. The three occupational groups that followed — managers and administrators, professionals, and service and sales workers — made up approximately 32 per cent of own-account workers in Singapore.

Figure 1: Percentage of Own-Account Workers by Occupational Groups, 2023



Source: Adapted from Ministry of Manpower (2024, January), Labour Force in Singapore 2023, https://stats.mom.gov.sg/iMAS_PdfLibrary/mrsd_2023LabourForce.pdf

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Even though the size of the own-account workforce is growing, research focusing on the role of technology in their work and their digital competencies and digital skills needs is nascent. To determine the digital skills that own-account workers need, the impact of training on them and the challenges they face when upskilling, we conducted a study over three phases.

In **Phase One**, we conducted a landscape study on the trends and developments in own-account work, and the general and sector-specific digital skills required by these workers to thrive in a changing employment landscape. Our collaborators from the Living Analytics Research Centre (LARC) at the Singapore Management University analysed job postings from MyCareersFuture portal to identify the in-demand digital skills in Singapore.

In **Phase Two**, we conducted focus group discussions and in-depth interviews with own-account workers from different sectors, employers who engaged own-account workers, and training providers who worked with own-account workers. The discussions and interviews helped us contextualise the digital skills that own-account workers in Singapore need and shed light on their motivations and the challenges they face when upskilling.

In **Phase Three**, through a pilot study, we examined the effectiveness of digital skills training on own-account workers.

See Appendices A, B and C for more details on the methodology used in each phase.

2. DIGITAL SKILLS FOR OWN-ACCOUNT WORKERS

“Gig literacies” are essential skills that help gig economy workers navigate the online space, its imposed structures and control mechanisms (Sutherland et al., 2020). These literacies ran the gamut from knowing how to build one’s reputation online, self-presentation, building relationships with other professionals and employers through remote and face-to-face interactions, to maintaining work-life balance and productivity.

The majority of analyses in academia and the private sector address workers in general, and not own-account workers specifically. However, given the breadth and depth of these analyses on the necessary skills for workers to participate fully in the economy and fortify themselves from future disruptions, they provide a valuable starting point that informs the development of a skills framework for own-account workers in Singapore.

We summarise the process for developing the digital skills framework for own-account workers in Singapore below:

We first identified baseline, intermediate and sector-specific digital skills from a landscape scan of international frameworks by AlphaBeta the Burning Glass Institute, Cedefop, ECORYS, LinkedIn, van Laar et. al. (2017) and World Skills UK in Phase One; (see Appendix A Table A1 for a summary of the scope of the skills review).



We then supplemented these findings with data that LARC extracted from job postings on MyCareersFuture to better understand the skills of non-permanent workers that Singapore employers value.



Finally, we elicited feedback on the digital skills framework from own-account workers, employers and training providers through the focus group discussions and in-depth interviews in Phase Two (see Appendix B for details).

2.1 Baseline and Intermediate Skills

Globally, workers in the two highest wage quintiles spent a lot less time on basic cognitive skills and physical and manual skills (ranging from 10 to 20 per cent of the time), compared to the three lowest wage quintiles who used those skills 48 to 68 per cent of the time (McKinsey Global Institute, 2021). Own-account

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

workers too are moving away from manual skills to digital and cognitive skills that are necessary to their survival in the digital economy.

Baseline skills that are required by all workers to perform optimally include digital skills and contextual skills. A report published by Economist Impact (2023, p.11) that surveyed over 1,000 employees from Asia-Pacific revealed that three in four employees (73.9 per cent) thought that basic digital skills are a “must-have”.

These skills span from handling and operating basic digital software and hardware, using technology for project management, communication and collaboration, harnessing technology creatively in problem solving, to critical thinking. From the data collected from MyCareersFuture by LARC, we found that skills in the Microsoft suite of applications (e.g., Microsoft Excel, Microsoft PowerPoint and Microsoft Word) were needed across job postings for ICT and non-ICT jobs alike, suggesting that there is an expectation for most workers to have some proficiency in this software suite.

Intermediate skills comprise platform-related skills (e.g., using a platform, optimising profile, pricing products and services, and managing finances) and digital skills that are applied at a more advanced level than baseline digital skills (e.g., information management and processing, safety and security, digital content and product creation). Gig workers need to develop skills that help them to obtain work on a platform, such as making sense of information and features

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

provided by the platform to obtain and optimise work (Cedefop, 2020). Platform-related skills will help them gain an edge over others, especially since digital platforms are not constrained by geographical boundaries.

Workers also need to acquire and develop intermediate skills that will enable them to perform better and transition to other industries more easily, upgrade the economic contribution they make and improve their remuneration. For instance, digital content creation and product creation are no longer skills required only by the creative and multimedia industry, but also in business and administration jobs.

Contextual skills such as cultural awareness, ethical awareness and lifelong learning are also critical for optimal performance of a worker. This is particularly pertinent for own-account workers who lack institutional support and mentorship structures.

2.2 Occupation-Specific Skills

While the previous sections focus on skills that own-account workers need regardless of the sector they work in, Burning Glass Technologies, ECORYS UK and Cedefop also highlighted the importance of occupation-specific digital skills. In our study, we focused on the digital skills required by workers from key occupational sectors in the global gig economy and in the local own-account work landscape.

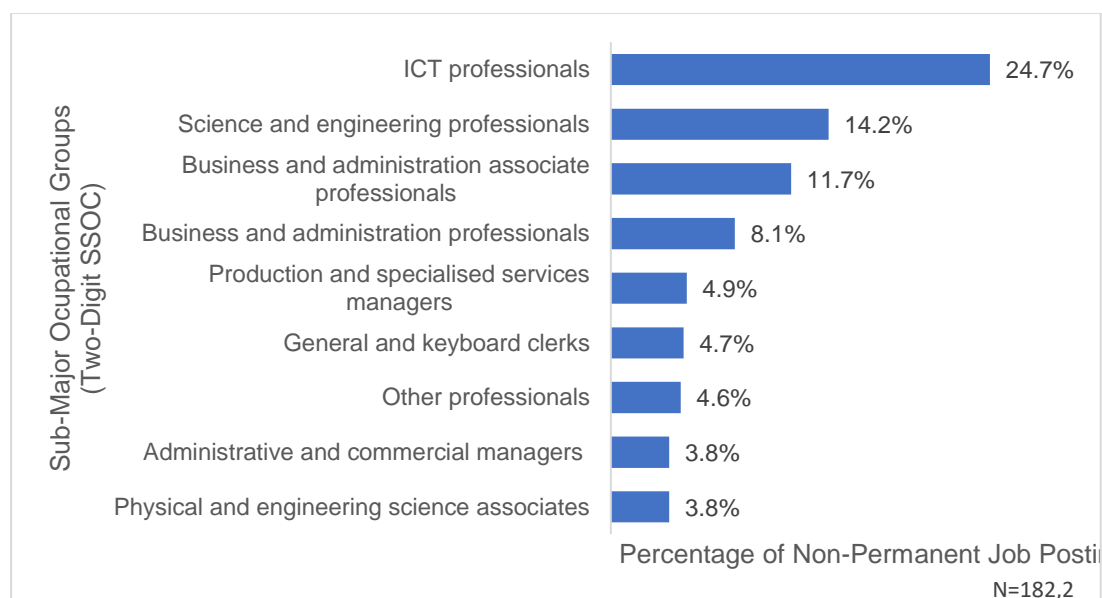
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To deepen our understanding of the skills needed by own-account workers in the local context, LARC analysed the skills listed on non-permanent job postings on MyCareersFuture. The majority of non-permanent job postings (80 per cent) were found in nine occupational groups (see Figure 2). The top three non-permanent occupational sub-major groups were: (1) ICT professionals [e.g., software developers, cloud specialists, and data centre engineers], (2) science and engineering professionals [e.g., physicists, geologists, statisticians, engineers, and urban planners] and (3) business and administration associate professionals [e.g., accounting associates, buyers, auctioneers, and police inspectors].

Figure 2: Top Non-Permanent Job Postings by Occupational Groups (Two-Digit SSOC)



SSOC: Singapore Standard Occupational Classification

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

The data indicates that non-permanent job postings on MyCareersFuture were higher-skilled ICT, science and engineering, and business and administration work, which are typically associated with office jobs or digital work. This mirrors the dominant global gig job categories in the Online Labour Index (Stephany et al., 2021). However, the largest group of own-account workers in Singapore currently hold location-based jobs in non-ICT industries — private-hire car drivers and taxi drivers are the two most popular own-account occupations (MOM, 2021). These workers would not be looking for jobs on platforms like MyCareersFuture.

We thus focused on these key occupational sectors: (1) software development and technology, (2) engineering and manufacturing, (3) sales and marketing, (4) creative and multimedia, (5) professional services, and (6) transportation and delivery.

The job descriptions for these job postings were then analysed to determine if they required digital skills. Researchers from LARC used skills recognition and linking software to parse each job description so as to determine the digital skills that were required by the job. The software recognised 1,560 distinct digital skills mentioned in the job descriptions and linked them to the respective Wikidata entries and Wikipedia articles.

Figure 3 shows the top 10 occupational groups by order of the number of distinct digital skills required. Besides contributing to the greatest number of

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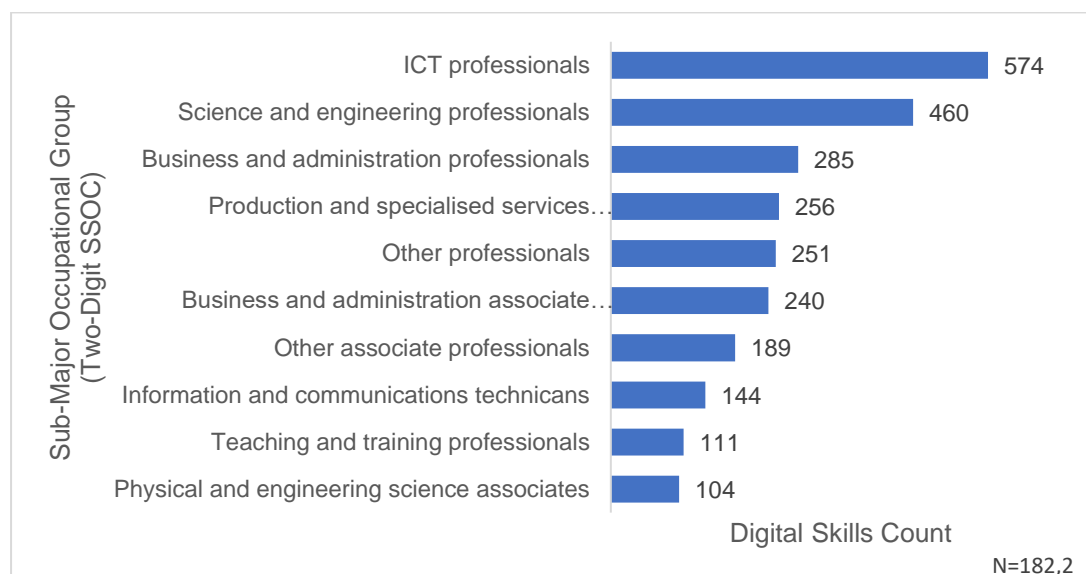
and B. Tan

non-permanent job postings on MyCareersFuture, the work done by ICT professionals and science and engineering professionals also required the greatest spread of digital skills, as follows:

- (i) ICT professionals, with 574 distinct digital skills mentioned in the job postings;
- (ii) Science and engineering professionals, with 460 distinct digital skills mentioned in the job postings

In comparison, business and administration associate professionals, the third most popular non-permanent jobs on MyCareersFuture, required only 240 digital skills, a much smaller number than ICT and science and engineering professionals. Among ICT job postings, ICT professionals had more stringent qualifications than ICT technicians. A total of 574 digital skills were mentioned in the job postings for the former, compared to the 144 digital skills that were mentioned in the job postings for the latter. This could be attributed to the difference in job scope — ICT professionals undertake more analytical work and problem solving spanning across multiple types of technology, while ICT technicians undertake more work relating to the operation and maintenance of specific equipment and systems.

Figure 3: Top 10 Occupations Groups by Digital Skills Count on MyCareersFuture



SSOC: Singapore Standard Occupational Classification

Based on the job postings from MyCareersFuture, we found that:

1. A wide range of digital skills is required across various occupations and industries, with specific skills tailored to the nature of the job, such as design and computing.
2. Despite the diversity of digital skills, most non-permanent jobs assume that applicants have a minimum proficiency with word processing, presentation and spreadsheet tools, suggesting that such skills were essential and baseline. As such, potential own-account workers seeking entry into white-collared contractual jobs must equip themselves with these basic digital skills before undertaking training for a specialised digital skill set.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

3. The strong demand for professionals and associates in non-permanent job postings point to opportunities for own-account workers, so long they have a minimum level of digital skills.

Table 1 summarises the various skills workers in different occupational sectors might need in their work based on our literature review and LARC's analysis.

Table 1: Examples of Occupation-Specific Skills

Occupational sector	Core skills	Examples of skills needed
Software development and technology	- Cloud computing and data analytics skills	- Cloud platforms (e.g., AWS, Azure, Google Cloud) - Programming languages (e.g., Python, JavaScript, Java) - Data analysis - Database management (e.g., SQL)
Science and engineering	- Highly advanced programming skills	- Digital modelling software (e.g., AutoCAD, Altium, CANape) - Programming frameworks and tools (e.g., React, Node, Angular, VUE) - Advanced programming skills (e.g., Java, Python, R, C++) - Computer engineering
Sales and marketing	- Customer relationship management and marketing skills	- Customer relationship management (e.g., Salesforce, Microsoft Dynamics) - Digital marketing (e.g., Mailchimp, Adobe Suite) - Analytics (e.g., Google Analytics)

IPS Working Papers No. 58 (October 2024):

Creative and multimedia	<ul style="list-style-type: none"> - Digital marketing, human-computer interaction and visualisation skills 	<ul style="list-style-type: none"> - Digital marketing (e.g., branding) - Human computer interaction (e.g., UX, UI) - Web development - Social media (e.g., Twitter, Facebook, TikTok) - Information management - Data visualisation - Graphic design (e.g., logo design, typography)
Professional services	<ul style="list-style-type: none"> - Digital analytics and visualisation skills; 	<ul style="list-style-type: none"> - Data analysis (e.g., Microsoft Excel) - Programming skills (e.g., SQL, Python) - Data visualisation - Machine learning - Leadership and management
Transportation and delivery	<ul style="list-style-type: none"> - Digital transactions and communication skills 	<ul style="list-style-type: none"> - Operation of smartphone - Information management (e.g., keeping client contact information private) - Communication (e.g., reporting problems via digital platform) - Critical thinking and problem solving (e.g., using online map to plan most efficient route) - Electronic payment (e.g., banking apps, platform payment options)

Secondary data in the literature review were obtained from these sources:

- AlphaBeta (2021): “Unlocking APAC's Digital Potential”
- Burning Glass (2019): “No Longer Optional: Employer Demand for Digital Skills”
- Contra (2021): “The State of Independence”
- Coursera (2021): “Global Skills Report”
- International Telecommunication Union (2020): “Digital Skills Insights 2020”
- Stack Overflow (2021): “Stack Overflow Developer Survey 2021”
- World Economic Forum (2020): “Future of Jobs”

Except for the transportation and delivery sector, all other occupational sectors place a premium on **programming fundamentals and cloud computing**, making these skills essential for most own-account work sectors. This was supported by the data collected by LARC — skills in cloud-based software Microsoft SharePoint and Adobe Creative Cloud were required for non-ICT roles while skills in Microsoft Azure and Oracle databases were needed for ICT roles.

2.3 Digital Skills Framework for Own-Account Workers in Singapore

To contextualise our findings from the landscape study to Singapore, we asked local own-account workers, employers who hire own-account workers and trainers with experience training own account workers about the importance of

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

the skills we identified from the landscape review and LARC's analysis. Based on their feedback, we refined the different tiers of skills to better reflect the experience and needs of local own-account workers. See Table 2 for the refined skills framework.

Baseline digital skills range from basic digital operations, using technology for project management and communication and collaboration, to optimising profile and pricing products and services. These skills are essential skills for all workers of the 21st century. In addition, obtaining work on a platform has become an essential for own-account workers who are seeking jobs in the borderless digital marketplace. Skills such as optimising their profiles and pricing their products and services are critical for own-account workers to attract and grow their client base.

Intermediate digital skills are digital skills applied at a more advanced level than baseline digital skills. These skills enable own-account workers to harness digital technology more efficiently, so they remain competitive in the workforce or transit to other industries more easily.

Occupation-specific skills are digital skills required by those who work in: (1) science and engineering, (2) creative and multimedia, (3) professional services, (4) business and administration, (5) software and development, and (6) transportation and delivery jobs. Except for transportation and delivery, the research conducted in Phase One and Phase Two found that programming

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

fundamentals and cloud computing skills are important to all occupational sectors.²

Contextual skills are non-digital skills that complement digital skills and help workers perform more effectively in their work (van Laar et al., 2017). As such, contextual skills should be used in tandem with digital skills across all three tiers. These contextual skills include problem solving, critical thinking, analytical thinking, learning to learn and adaptability. See Table A2 in Appendix A for the description of these contextual skills.

² AlphaBeta. (2021). Unlocking APAC's digital potential: Changing digital skill needs and policy approaches. <https://alphabeta.com/our-research/unlocking-apacs-digital-potential-changing-digital-skill-needs-and-policy-approaches/>

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Table 2: Digital Skills Framework for Own-Account Workers

Contextual I Skills: Problem solving, critical thinking, analytical thinking, learning to learn, adaptability, ethical awareness	Digital skill		Description				
	Baseline Skills	Basic digital operations	Basic use of digital devices (e.g., smartphones, computers), including connecting to wifi, taking and uploading photos, receiving app notifications, using GPS for navigation, searching for and filtering information online, opening and viewing files of various formats (e.g., photos, PDF documents, word documents), using job-matching applications or platforms (e.g., delivery apps), digital payment apps				
		Communication and collaboration skills	Using digital tools such as instant messaging applications (e.g., WhatsApp, Telegram, Facebook Messenger), video conferencing platforms (e.g., Zoom, Microsoft Teams), email and cloud-based storage (e.g., Google Drive, SharePoint) to communicate and collaborate with others Etiquette for communication (e.g., when to use email or text message with work partners)				
		Organisation and project management	Plan schedules, stick to deadlines and track payments, with the help of digital tools like digital calendars (e.g., phone calendars, Google Calendar), Excel, or customer relationship management tools (e.g., Notion, Microsoft Access, Enterprise Resource Planning systems)				
		Safety and security	Setting access rights on online shared drives, password protecting files, setting up firewalls, reminding clients of security issues, being aware that the cloud can be hacked easily, understanding how to protect personal data				
		Optimising profile	Publishing and developing their profile (e.g., experience, track record, skillsets) to publicise their services, and products in online platforms to gain visibility and traction				
		Pricing services and products	Only essential for those selling products or services Setting and adjusting prices of service or products on online platforms e.g., e-commerce platforms,				
Intermediate Skills	Information management and processing	Use digital tools to process and present text and data in various formats (e.g., Word, Excel, PowerPoint, KeyNote, Tableau)					
	Content and product creation	Generate novel content or repurpose existing content using digital design tools (e.g., Photoshop, Canva, Gimp, etc.) to create simple images and graphics (e.g., web banners, IG stories, Facebook posts etc.) to attract new clients or engage existing clients online					
	Data analysis and visualisation	Tracking and analysing data about sales income, monthly or annual sales level, costs of supplies and services, performance of online advertisements and profiles Visualising data using Excel, Power BI and Tableau					
	Programming fundamentals	Basic understanding of HTML and CSS for making minor edits to personal profiles or business websites					
Occupation-Specific Skills	Science & Engineering	Creative & Multimedia	Professional Services	Business & Administration	Software Development & Technology	Transportation & Delivery	
	<ul style="list-style-type: none"> - Digital modelling software (e.g., AutoCAD, Altium, CANape) - Advanced programming frameworks and tools (e.g., React, Node, Angular, VUE) - Advanced programming skills (e.g., Java, Python, R, C++, advanced HTML and CSS) - Computer engineering 	<ul style="list-style-type: none"> - Digital marketing (e.g., branding) - Human computer interaction (e.g., UX, UI) - Web development - Social media (e.g., Twitter, Facebook, TikTok) - Information management - Data visualisation - Graphic design (e.g., logo design, typography) 	<ul style="list-style-type: none"> - Data analysis (e.g., Microsoft Excel) - Programming skills (e.g., SQL, Python) - Data visualisation - Machine learning - Leadership and management 	<ul style="list-style-type: none"> - Customer relationship management (e.g., Salesforce, Microsoft Dynamics) - Digital marketing (e.g., Mailchimp, Adobe Suite) - Analytics (e.g., Google Analytics) 	<ul style="list-style-type: none"> - Cloud platforms (e.g., AWS, Azure, Google Cloud) - Programming languages (e.g., Python, JavaScript, Java) - Data analysis - Database management (e.g., SQL) 	<ul style="list-style-type: none"> - Operation of smartphone - Information management (e.g., keeping client contact information private) - Communication (e.g., reporting problems via digital platform) - Critical thinking and problem solving (e.g., using online map to plan most efficient route) - Electronic payment (e.g., banking apps, platform payment options) 	

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

3. IMPACT OF TRAINING

To understand the impact of training, we tested the digital skills framework that we developed in the final phase of the study. Together with our training partners, CreativesAtWork, we developed a five-day training programme based on the framework. A total of 52 own-account workers from two occupational sectors participated in the study: (1) 26 creative and multimedia workers and (2) 26 sales and marketing workers.³ See Appendix C, Table C1 for the breakdown of the participants by various demographic factors (e.g., age, gender, ethnicity).

The training programme was conducted in April and May 2023 and a total of 12 digital skills were taught to each participant. The skills were made up of 11 common digital skills that were taught to all participants: six baseline skills (e.g., “basic digital operations”, “communication and collaboration skills”, “organisation and project management” and “safety and security”); four intermediate skills (e.g., “content and product creation” and “programming fundamentals”); and one common occupation-specific skill (i.e., “digital marketing”). The training programme also covered a unique occupation-specific skill for each occupation group (i.e., “social media” for the creative and multimedia workers and “analytics” for the sales and marketing workers). See Appendix C, Table C2 for the summary of digital skills taught to the participants.

³ These two groups of own-account workers were identified together with the funder, SkillsFuture Singapore.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

We administered surveys before training (T1), immediately after training (T2) and six months after training (T3) to determine⁴:

1. What is the impact of training on own-account workers' digital skills?
2. What is the impact of the training programme on own-account workers' attitudes towards digital technology?
3. What are the effects of training on own-account workers' attitudes towards upskilling?

3.1 Training Improved Ability for Using Digital Skills

The participants reported significant improvements in their ability for 10 digital skills (out of 11 common digital skills taught) by the end of the study. However, the significant improvement was mostly registered immediately post training, and there was a plateauing of reported ability for seven of these skills (e.g., “optimising profile”, “programming fundamentals”).

⁴ The survey data was analysed using IBM SPSS software version 29 (IBM Corp, Armonk, NY, US): (1) descriptive statistics to provide the top-line frequencies for each variable and to highlight emerging patterns in the data, (2) repeated measures ANOVA to determine if there was a significant overall effect of the training programme, considering pre-training scores, immediate post-training outcome and lagged post-training outcomes (contrast analyses allowed us to determine if there were statistically significant differences among the three time points), and (3) paired t-tests to determine the net effect of the training, immediate effects of the training and lagged effects of the training for (a) all participants (n=52) and (b) for participants split by occupation group (n=26 for creative and media group and n=26 for sales and marketing group). These tests allow for detailed comparisons of the responses from each participant at the three time points: pre-training, immediately post-training, and six months after training — to evaluate the effectiveness of our training programme.

IPS Working Papers No. 58 (October 2024):

The results suggest that the improvements were likely attributable to the training programme, but there was no further self-directed improvement after six months in the absence of training. This finding suggests the need for regular efforts to upskill in order to maintain proficiency in digital skills and remain competitive in a rapidly changing technological environment. Regular formal training is key to skills enhancement.

The participants made gradual improvements for the other three skills (e.g., “basic digital operations”, “information management and processing”) from the start to the end of the study period (i.e., from T1 to T3). These improvements may not be directly attributable to the training programme. A possible explanation is that the participants’ self-reported ability in using the skills increased naturally over time as they continued to use the skills covered during the training programme.

We also compared the two groups of own-account workers. On the whole, the creative and multimedia workers reported significant improvements in their self-reported ability for more skills, compared to the sales and marketing group. This could be because the creative and multimedia group found the training more useful.

See Appendix C Table C3 and Table C4 for the summary of changes in perceived ability at different time periods.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

3.2 Increase In Overall Skill Use

The participants reported a significant increase in their use of six out of the 11 skills that were taught (e.g., “safety and security”, “content and product creation” and “digital marketing”) six months after completing training. The frequency of use for all six of these skills increased immediately after training (from T1 to T2) but also plateaued during the timelapse (from T2 to T3). There is convergence in the skills for which participants reported significant improvements and their frequency of use. Most of these skills are intermediate skills.

Immediately after training (from T1 to T2), the sales and marketing group reported significant increases in their use of skills compared with the creative and multimedia group. The former reported increases in use for seven out of 12 digital skills (e.g., “safety and security”, “data analysis and visualisation”, “analytics”). However, during the six-month time lapse, this group did not report any further increase or change in frequency of using the digital skills. The immediate increase in frequency of skills usage is likely attributable to the training programme and the lower baseline for use in their professions. It is possible that frequency of skill usage among the sales and marketing group plateaued due to relatively limited opportunities they had in using these skills at work during the six-month timelapse.

On the other hand, the creative and multimedia group reported significant increases in the frequency of use for only four skills (out of 12) immediately after

training (e.g., “safety and security”, common occupation-specific skill “digital marketing”). This group reported significant gradual increases in their frequency of using three skills (i.e., “data analysis and visualisation”, “programming fundamentals” and “social media”). These three skills were more technical and advanced. It is possible that the creative and multimedia own-account workers had fewer opportunities in using these skills at work, and that their usage frequency increased with time when there were more opportunities to apply the skills.

Both groups did not report significant increases in their frequency of using five digital skills, most of which were baseline skills (e.g., “organisation and project management”). Since participants already used these skills frequently before they started training, the training programme did not have further impact on the participants’ frequency of skill use (non-significant findings likely due to ceiling effects).

See Appendix C Table C5 and Table C6 for the summary of changes in frequency of skill use at different time periods.

3.3 Training Improved Task Performance

By the end of the study, there were significant improvements observed in the self-reported ability of participants in performing 15 out of 16 tasks taught to all participants during the training programme. The only task for which participants

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

did not report significant improvements in ability performing was the contextual task “problem solving (search engine)”. Of these 15 skills, we observed a plateauing of their ability during the six-month timelapse for nine (out of 16) tasks. There were two baseline tasks (i.e., “basic digital operations [cloud platforms]” and “communication and collaboration [videoconferencing]”), which improved immediately after training (from T1 to T2) and also during the timelapse (from T2 to T3).

These findings highlight the effectiveness of the training programme in improving the participants’ reported ability in performing the specific tasks taught. These therefore point to the need for continuous learning or training for the ability to keep on improving, especially for the more advanced or complex skills.

There were five (out of 16) tasks that improved gradually over the duration of the study. These were mostly baseline tasks (e.g., “communication and collaboration [presenting information]”) and one intermediate task (i.e., “content and product creation [different formats]”). As the reported significant improvements in these tasks did not occur immediately after training, they are not immediately attributable to the training programme. However, it is also possible that the effects of training on these tasks were delayed as participants needed more time to practise and apply their skills.

Including the three unique occupation-specific tasks taught to each occupation group, the creative and multimedia group reported increased ability for more tasks, compared to the sales and marketing group, by the end of the study (i.e., from T1 to T3). For example, the creative and multimedia group reported significant increased ability for 11 tasks immediately after training (i.e., from T1 to T2), compared to the sales and marketing group who reported significant increased ability in only four tasks. There were only five (out of 19) tasks that did not improve by the end of the study for the creative and multimedia participants, compared with 10 tasks for the sales and marketing group.

The training appears to have improved the reported ability in more tasks among the creative and multimedia group. As that there were no statistically significant differences between the pre-training skill levels reported by the two groups of workers in the independent t-tests, the findings suggest that the creative and multimedia group possibly found the training programme more useful in raising their reported ability in performing these tasks.

See Appendix C Table C7 and Table C8 for the summary of changes in performance of tasks taught at different time periods.

3.4 Increased Confidence In Using Technology At Work

We observed significant improvements in participants' confidence in using digital software⁵ (e.g., Microsoft Word, Google Sheets, Internet Browsers, etc.) for work. They also felt significantly more confident in using digital services⁶ (e.g., internet banking services, online job-matching platforms) for work (see Table 3). This shows that training improved own-account workers' efficacy in deploying technology at work.

By the end of the study, there was a significant increase in participants' belief that digital technology has helped them find work more easily.⁷ They learned more effective ways to optimise their profiles on job-matching platforms or social media and to apply those skills in their work to attract more potential clients and business.

⁵ There was a significant increase from T1 (M=4.33, SD=0.71) to T3 (M=4.63, SD=0.53), $t(51) = 3.16$, $p=0.003$.

⁶ There was a significant increase from T1 (M=4.10, SD=0.80) to T3 (M=4.56; SD=0.57); $t(51) = 3.81$, $p<0.001$.

⁷ There was a significant increase from T1 (M=3.79, SD=0.83) to T3 (M=4.13, SD=0.72); $t(51) = 2.90$, $p=0.005$.

Table 3: Summary of Paired Samples T-Test for Attitudes Towards Digital Technology

Item	T1	T3	Difference	t	p
I feel confident using digital software (e.g., Microsoft Word, Google Sheets, Internet Browsers, etc.) for work	4.33	4.63	0.31	3.16	0.003
I feel confident using digital services (e.g., internet banking services, online job-matching platforms) for work	4.1	4.56	0.46	3.81	<0.001
Digital technology has helped me find work more easily	3.79	4.13	0.35	2.90	0.005

3.5 “One And Done” Attitude Towards Upskilling

We observed a negative change in participants’ attitudes towards digital upskilling. After training (from T1 to T3), they were less likely to look for opportunities to develop new digital skills and knowledge⁸ and less willing to invest their time in developing their digital skills⁹ (see Table 4).

⁸ There was a significant decrease from T1 (M=4.46, SD=0.65) to T3 (M=4.29, SD=0.50); $t(51) = -2.02$, $p=0.049$.

⁹ There was a significant decrease from T1 (M=4.56, SD=0.67) to T3 (M=4.25, SD=0.76); $t(51) = -3.298$, $p=0.002$.

Table 4: Summary of Paired Samples T-Test for Learning Goal Orientation

Item	T1	T3	Difference	t	p
I look for opportunities to develop new digital skills and knowledge	4.46	4.29	-0.17	-2.02	0.049
I think learning and developing digital skills is important	4.63	4.58	-0.06	-0.77	0.444
I am willing to invest my time in developing my digital skills	4.56	4.25	-0.31	-3.30	0.002
I am willing to spend money on developing my digital skills	3.75	3.75	0.00	0.00	1.000

A possible explanation for the slight decrease in participants' seeking out new opportunities and willingness to spend time on developing their digital skills, could be that they do not feel the need to upskill so soon after completing the training programme. The same can be said for the importance of learning and developing digital skills, even though the decrease for this item was not significant.

SSG should monitor the prevalent "one and done" attitude among Singaporeans, where individuals undergo training once and expect it to yield sustained benefits in the long run. In today's rapidly evolving digital landscape, there is an urgent need to embrace a culture of lifelong learning that extends beyond mere rhetoric. Singaporeans need to cultivate a mindset of continuous learning to stay competitive in their careers, enhance their job contributions, and thrive in the dynamic global economy.

4. CHALLENGES FACED BY OWN-ACCOUNT WORKERS WHEN UPSKILLING

This section focuses on own-account workers' attitudes towards upskilling and the difficulties they encounter when doing so. From the data gathered from the focus group discussions and in-depth interviews, (Phase Two) and the pilot test (Phase Three), we grouped the challenges faced by own-account workers when upskilling into three types:

- Individual challenges — lukewarm attitudes towards training and low self-efficacy
- Training environment — uncertainties around training and no one-size-fits-all training
- Ecosystem barriers — lack of support

4.1 Lukewarm Attitude and Low Self-Efficacy

Through the focus group discussions and in-depth interviews, we found that own-account workers fell mainly into two main groups: those who did not see the importance of upskilling, and those who found upskilling important but were stuck in inaction as they felt overwhelmed and lost. Among those in the first group, upskilling was not seen as a priority despite digital technology being part of their work and businesses. During the pilot study, “lack of incentives or motivation to upskill” was one of the top three reasons participants gave when asked about the barriers they faced when considering whether or not to upskill.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

The focus group discussions and in-depth interviews shed light on what might be the reasons behind their lackadaisical attitude. While some were hesitant to pick up new skills or software because they were worried that their new skills would soon become obsolete in the face of rapid technological developments, others thought they could outsource tasks that they were not able to do themselves. There were also those who were held back by what they perceived to be high course fees. There is a general perception among this group that it was not necessary to rely on “expensive” in-person courses. Online courses for self-improvement or “self-learn” would suffice (in the words of a participant who was a lighting technician).

The second group of own-account workers had a more positive attitude towards upskilling as they understood the importance of upskilling. The top three reasons for upskilling given by the two groups of own-account workers who took part in the training in Phase Three were: (1) improving one’s professional knowledge, (2) keeping up with technological developments and (3) learning new things and challenging oneself.

Nearly half of the own-account workers interviewed during Phase Two said their knowledge and usage of technology had improved since they started on own-account work. This points to on-the-job learning by own-account workers to meet job requirements, like navigating a new platform and learning new data analytical tools. For example, a gelato e-commerce business owner learned how to set up a website for his business and a digital marketer took up digital

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

marketing courses for her work. A participant who was a systems integrator picked up automation skills after leaving full-time employment.

“Definitely there is improvement. In my previous job, I didn’t do programming, customised automation and office automation. I used to go to the customer’s site, and do break-and-fix kind of job ... [Now] I would say I almost have a different skill set.” — **systems integrator**

Both own-account workers who were ambivalent towards upskilling and those who had a more positive attitude and were on the look-out for training opportunities felt wary and overwhelmed due to the endless challenge of having to keep learning new tools, given the rapid and incessant advancement of technology. An e-commerce business owner said there was a general “fear or being left behind” as technology moved at an “exponential pace”, while people like him were “struggling to grasp with TikTok, cryptocurrency and NFTs”.

A digital marketer said that she was “trying to keep up... in order to stay employable or increase [her] value as an employee”. On the other hand, a graphic designer shared his struggles with encountering “a new learning curve”, each time he learns a new software to better cater to his clients’ needs, “throw[ing] away” his experience with a software he is more familiar with.

Even among those who expressed keen interest in attending training, they said it was difficult for them to catch up with new tools introduced in the market. Such concerns and reservations were expressed even by experienced IT professionals, a group of own-account workers who would be more technologically-savvy than other groups (e.g., delivery riders, real estate agents and content producers). For example, an IT network administrator spoke about having to, in his own words, “unlearn” and “relearn” continuously.

4.2 Not Knowing What They Do Not Know

While many own-account workers agreed that upskilling was important, most of them did not know what they did not know — that is, they were not aware of the skills they lacked and correspondingly, what skills they should improve on or learn. Their sentiments echoed observations made by experts who said there were currently few avenues for adult to identify the skills that they lacked and needed (Ng, 2022).

As an IT network administrator noted, own-account workers “don’t know what they don’t know”. Similarly, an accounts payable clerk said, “You don’t know about some things, so you don’t see what you want to improve on.” Additionally, participants often faced an overwhelming number of options on the MySkillsFuture course portal and that would compound their confusion. The sentiments expressed by a freelancer writer were shared by many participants.

“When I went to the SkillsFuture website, I find many courses, and there are a lot of things I feel like doing. But I'm not sure which one I should commit my time to.” — **freelance writer**

A digital skills map will also be useful for own-account workers seeking career transitions back into full-time employment. Knowing the digital skills needed for their future careers will provide them with a clearer direction for upgrading their skillsets.

“It would be helpful for freelancers like us if we know what are the skills and knowledge required for someone who is employed full-time.... It makes it easier for freelancers who are looking to go back to the traditional environment where we're employed full-time.” — **business and strategy consultant**

4.3 Not One-Size-Fits-All

The participants suggested that course recommendations can be tailored by occupation, career goals or educational qualifications. An insurance agent said that the course listings on the MySkillsFuture portal can be “industry-specific”, and recommendations based on occupations can be given to people seeking training like her: “Telling us, for insurance agents, these are the courses you can take. For real estate agents, these are the courses.” Her suggestion was

echoed by a freelance writer who said that a list of relevant skills by job role would be helpful.

“For the different roles that we are in, it would be good to know what kind of skills or what kind of trending skills or updated skills we need to be equipped with. This can be done through a platform or a portal. For example, for a digital marketing role, here are the skills you need to be equipped with. This will be useful for people to want to grow their skills or people who want to start a new role in another industry.” — **freelance writer**

Besides personalising course recommendations by sectors or occupations, participants also said it would be useful to tailor recommendations by educational qualifications, aspirations and current digital skills level.

“If SkillsFuture can customise in such a way [that] when we input our educational qualification, what we are doing now, and what our aspirations are, we can get a personalised roadmap. Like this is something that you can consider doing based on your current skill set and your qualification.” — **web designer and developer**

“There should be a criteria to say, ‘Do you have the basic digital skills? If you do, great... then, this course plus this works for you. If you don’t,

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

then let me suggest you a course where you do a bit of both.’ So, it won’t overwhelm [users], and I think it would help.”— **tourist guide employer**

A web designer also suggested leveraging an AI chatbot to provide course recommendations to interested learners. Users could simply type the skill they were interested to learn into the online chat, and the automated chatbot could pull out a list of relevant courses.

“It can be just like a bot kind of system. So, you go into digital marketing, what courses are there, then after that it will tell you this is the course, how much SkillsFuture [credits] you have. The interface itself can be AI. So, that it is the kind of system I feel SkillsFuture will be much suited for.”

— **web designer**

4.4 Not Knowing What To Learn

As for the own-account workers who had some idea of what skills they needed, they faced difficulties in selecting relevant and suitable courses. Digital skills courses and some certifications require time and money, and own-account workers were sometimes unwilling to invest their time or money attending a course when they were not sure about its scope, offerings and attendant benefits. Participants cited challenges like bare course descriptions, aggravated by the experience of training providers not responding to their queries on the courses.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

“Some service providers do not update their profiles and courses on the SkillsFuture website.... If you want to make an inquiry or seek updates on course information, the information is missing. And sometimes, the service provider doesn’t get back to you. So, we are kind of stuck, I don’t know if the course is still ongoing, cancelled or postponed. Sometimes the class timings are not featured on the course page. It’s not up-to-date.... I do not know which courses are still running and which ones are no longer available.” — **digital solutions project manager**

Course information is critical to help potential learners decide what courses they want to attend. Due to limited information for some courses, some own-account workers made the decision not to spend time and SSG credits on training. To help them decide which course provider to sign up with, own-account workers suggested that the portal publishes more comprehensive and detailed course descriptions.

Information that will help them make a decision include the structure and outline of the course, learning objectives and expected outcomes. Several participants suggested including a session-by-session outline of topics that would be covered in course descriptions. For example, an assistant film director chose

to take courses online on Skillshare,¹⁰ an online subscription-based learning community, as it provided her with the learning schedule and access to all of the course content beforehand, so she knew what to expect from each lesson.

Other information that participants thought would be useful include the eligibility criteria and course previews. These include the minimum educational requirements for the programme or requirements to meet to receive financial assistance scheme. A few own-account workers suggested publishing course previews and trial lessons, similar to those provided on Udemy, so that learners can have a preview of the course before committing their resources to the course.

“Maybe if I have a trial lesson, we can see if that’s useful for us. Because it’s not cheap and there are many digital courses. So, if we have a trial lesson, we will know if this is what we want.... If you want, then you can sign up for the course.” — **assistant film director with side business**

Table 5 presents a summary of the suggestions and examples provided by own-account workers.

¹⁰ Skillshare.com is an American subscription-based online learning community, which costs S\$7.50 per month. Courses range from arts to programming and are not accredited by any external organisation. Members are able to access education videos as well as earn money from create educational videos.

IPS Working Papers No. 58 (October 2024):

Table 5: Summary of Suggestions for Improving the MySkillsFuture Portal

Course information to be provided	Example
Course objectives	<ul style="list-style-type: none"> - Course deliverables - Expectations of commitment - Course target learner
Course structure	<ul style="list-style-type: none"> - Outline of programme schedule - Time or number of lessons allocated per topic
Course eligibility requirements	<ul style="list-style-type: none"> - Minimum education requirements - Eligibility for funding
Preview of course content	<ul style="list-style-type: none"> - Trial lesson - Brief introduction to topic before enrolment (e.g., trailer video)

4.5 Train And So What?

It is important for own-account workers to be able to monetise what they are learning. They were cautious about wasting time that they spent on training that could have been spent on taking on more jobs and earning more income. As summed up by an employer who participated in the study, time is money for freelancers who have to “weigh” the opportunity cost of training and compare “the amount of time that they lose versus how much they will gain when they sign up for training”. Similarly, a participant who was a private hire car driver

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

did not see the value of attending a course to learn skills that he would not apply in his current job.

The value one derives from undergoing training is connected to opportunities to apply the knowledge and skills they acquire from training. Hence, applicability and relevance of skills learnt is a key consideration for own-account workers when they consider upskilling. A business consultant who aspired to transit out of freelance work, suggested that courses could be “packaged with an internship or orientation”. That would “guarantee” her opportunities to apply what she learnt as well as provide networking opportunities for career enhancement. Similarly, a real estate agent hoped there would be at least a “short internship” after a course ends so that he would “have a chance to practise” the skills learnt during the course, especially if it was in a different field from his existing work.

Thus, it is unsurprising that career transition programmes like the SGUnited Skills (SGUS) programme by SSG — that support mid-career individuals by providing a training allowance, the chance for workplace immersion and employment facilitation — received positive feedback from own-account workers. For instance, after being unemployed for six months, a participant completed an SGUS course in digital marketing and made a “career switch” to her current line of work as a digital marketer.

Other participants signed up for SGUS to pick up digital skills relevant to their jobs. A web designer had just completed a web development course under SGUS and completed his transition to a web design job, from his previous insurance job. The internship placement programme received positive feedback. A digital marketer also felt that the SGUS programme was very helpful as it enabled her to meet new clients even before she graduated from the programme. Those connections helped her to “secure” projects that are “associated with [her] training”.

In general, what own-account workers want most out of upskilling is job opportunities. Thus, programmes with guaranteed internships opportunities upon completion are very attractive to them as they enable own-account workers to get a foot in the door. Upskilling programmes that are bundled with an internship or traineeship enable own-account workers to test their fit with the industry they are exploring transiting to. A participant who was a real estate agent said that an internship or traineeship would “help those intending to switch industries know whether it [the industry] is suitable” for them.

4.6 Lacking Support

A 2022 survey by NTUC revealed that employers reported positive changes in workers who have attended training, including performing better at work, having more knowledge, and being able to take on new or more responsibilities (NTUC, 2022).

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

However, the employers who took part in our study do not provide company-based training for own-account workers, whom they commonly refer to as “freelancers”. If they provide training, it is part of on-the-job induction for those they hire for specific tasks. For example, an employer from a business and accounting consultancy said his company schedules training and develops training manuals for both freelance and full-time staff to help them learn how to use the company’s digital systems and software.

This is because employers generally feel that when own-account workers choose flexible ad hoc employment over structured formal employment, they have already chosen to take on the responsibility of self-learning and self-upgrading that comes with being self-employed. This, there is a general expectation among employers of freelancers (i.e., own-account workers) to come into the job adequately skilled for the tasks they are hired to do.

For an employer from an IT company, having to train freelancers “defeats the purpose of hiring a freelancer” who already “cost [them] a premium” to hire due to their short-term engagement. Similarly, an employer from an advertising agency and an employer from a business and accounting consultancy said they would hire someone who was more skilled, instead of training freelancers. These employers would terminate contracts with own-account workers whose performance were unsatisfactory.

These considerations of cost minimisation by employers should prompt own-account workers to take ownership of their skills upgrading. In their chosen mode of employment, the general sentiment is that no one owes own-account workers a living.

On the other hand, training providers have a different relationship with own-account workers compared to the employers due to their function as service providers to these workers. The role training providers play makes them well-placed to provide feedback to own-account workers during their training sessions. The tailored guidance covers a few aspects, namely, course selection, course design and course delivery. Training providers also provide in-course assessments for their learners to test their understanding of the course material.

In terms of course selection, training providers shared how they recommended courses based on own-account workers' needs and objectives. Among those who were unclear of the needs, a trainer we interviewed said they tapped course consultants to understand the profiles and assess workers' "training requirements" before making recommendations on which courses to take. Similarly, a digital marketing trainer assessed learners' occupational positions and goals, such as whether they were looking for new employment or were business owners, before advising them on which course to register for.

Courses were also recommended based on mapping relevant courses for a learner's career, through a "roadmap". A training provider shared that these

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

roadmaps could be found on their websites or through their course consultants. The roadmaps include the relevant courses and the external certifications one should complete.

“We basically take the role, for example, cybersecurity or data analyst, and recommend the courses that we think are good for you. We publish the information on the website and if they need more information, they can talk to the course consultant or the account manager. The advice would include what external certification might be necessary for them. Of course, it’s optional whether the learners want the external certification.” — **ICT training provider**

In terms of course content, a training provider shared how his trainers tailored training sessions for each learner, an aspect that own-account workers could take advantage of. For example, learners were tasked to use their own businesses as case studies during lessons to test out digital marketing tools, ideas and receive immediate feedback.

“A lot of our courses involve individual projects and case studies which are very useful. For individual projects, at the start of the task, we get them to choose their own companies to work on for the project. It doesn’t matter if it is a fictitious company.” — **digital marketing training provider**

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

5. RECOMMENDATIONS

Our study confirms the importance of upskilling to ensure workers' skills stay relevant in an ever-changing workforce. It also notes the positive impact of training on own-account workers' ability and confidence in using digital skills. Workers in formal employment can rely on their companies for organisational support in their upskilling but own-account workers are bereft of institutional support and guidance.

Since the COVID-19 pandemic, Singapore has launched several initiatives to help workers, some of which are accessible to own-account workers. While most are spearheaded by government offices, a few are developed through public-private collaborations, including private companies which worked with large numbers of own-account workers (e.g., ride-hailing companies). We categorised the nature of these initiatives into: (1) financial assistance, (2) provision of digital skills courses, (3) course recommendation guides, and (4) career transition programmes. See Appendix D for some of these initiatives.

Based on the data collected from the focus group discussions and in-depth interviews, and analysing them against existing schemes, we propose the following recommendations to address the three types of challenges own-account workers face. Table 6 summarises these recommendations.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Table 6: Summary of Recommendations to Address Challenges Faced by Own-Account Workers

	Challenges	Recommendations
Individual	<ul style="list-style-type: none"> • Lukewarm attitudes towards training • Low efficacy • Not knowing what they do not know 	Facilitate self-assessment <ul style="list-style-type: none"> • Digital skills framework and self-assessment tool • Strengthen communication of skills relevance and application
Environment	<ul style="list-style-type: none"> • Not one-size-fits all • Not knowing what to learn 	Enhance resources and close delivery gaps <ul style="list-style-type: none"> • Personalised recommendations • Centralised source of information, one-stop portal
Ecosystem	<ul style="list-style-type: none"> • Train and so what? • Lack of support 	Strengthen ecosystem support <ul style="list-style-type: none"> • Collective for own-account workers

5.1 Facilitate Self-Assessment

5.1.1 Self-Assessment Tool and a Clear Digital Upskilling Journey

Through our interviews, we found that many participants were interested in upskilling but unsure of what exactly to learn. Our findings echo those of a recently published NTUC report that outlined recommendations for various groups of workers, including vulnerable workers which comprises low-wage

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

workers and self-employed persons (NTUC, 2023). The most recent NTUC report highlights the issues these vulnerable workers are facing, which include the “lack of awareness and availability of training and career progression opportunities” and the “absence of clear pathways... to upskill in relevant and complementary skillsets” (NTUC, 2023, p.88–89).

As presented in Section 4 (see 4.1 and 4.2), own-account workers often feel overwhelmed and lost in the milieu of rapid technological advancement. Thus, we developed the digital skills framework to help own-account workers better navigate their acquisition of essential digital skills. Based on our review of international skill frameworks, data collected from MyCareersFuture and interviews, we developed a digital skills framework that details the digital skills requirements of own-account workers that comprised tiers of skills. See Table 2 on page 22 for our proposed digital skills framework.

Through the interviews and focus groups we conducted, we found that own-account workers needed and wanted help in identifying their skill gaps. Their sense of helplessness in the face of relentless technological advancement discouraged them from going for training. The tiered framework that we developed seeks to ameliorate some of these anxieties as it identifies the different skill levels own-account workers should have. For instance, those who

were in need of entry-level skills could focus on acquiring the basic digital skills and advance to intermediate skills during their skills upgrading journey.¹¹

Apart from detailing important skills for own-account workers, our proposed digital skills framework can be used to refine existing self-evaluation tools for the assessment of one's digital skills level. In addition, given that neither employers nor own-account workers themselves systematically assessed the latter's capability in using official metrics or assessments, there is a need for tools that help own-account workers monitor their progression in digital skills acquisition.

Currently, SSG has a self-assessment tool that can be accessed from the "Resources" on MySkillsFuture portal menu bar (MySkillsFuture, n.d.).¹² There are three components in the self-assessment tool: (1) career interests, (2) skills confidence, and (3) work values (see Figure 4). Upon completion of the assessment, users receive their results and "related job information" that detail specific occupations that are suited to them. For the skills confidence assessment tool, learners can rate themselves on five levels, with level one

¹¹ In May 2023, the government launched a 12-month long pilot for a Skills Profiler in collaboration with JobKred to help small and medium enterprises (SMEs) identify skills gaps and identify suitable courses for training (Teng, 2023). It is unclear what the platform contains as the contents have yet to be made available to the public at the time of writing this report.

¹² The self-assessment tool used by SSG is the widely used and researched RIASEC profiling tool, also known as the Holland Occupational Themes. The tool categorises people into six personality types that, in theory, affects their vocational preferences and interests (Schneider, 2020).

being “cannot do at all” to level five being “completely certain can do” (see Figure 5).

Figure 4: Screenshot of SSG’s Self-Assessment Tool

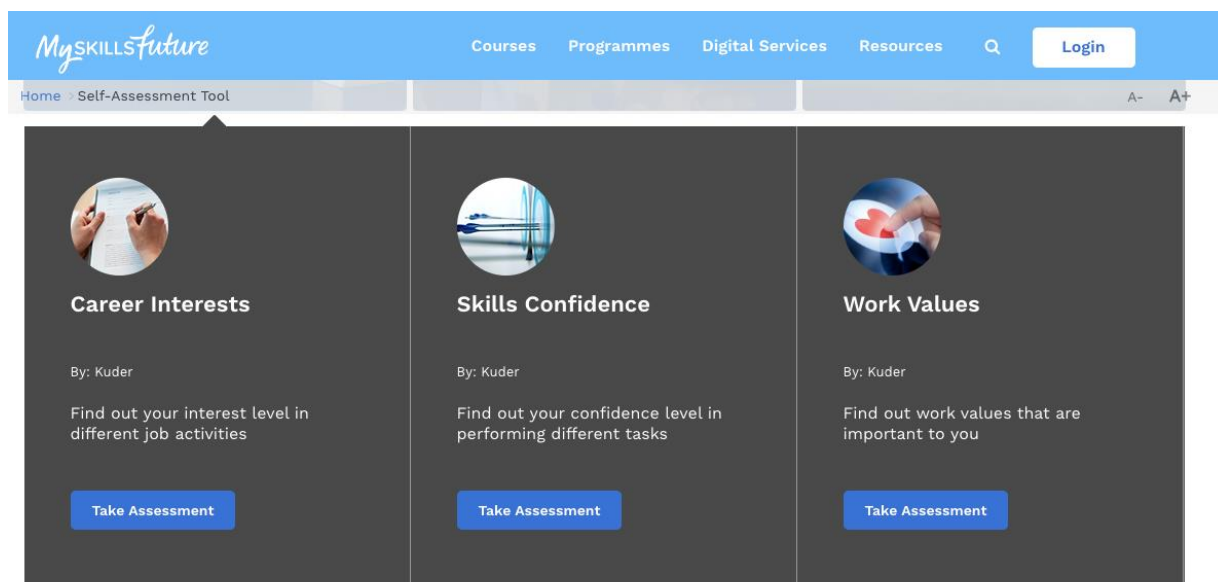


Figure 5: Screenshot of “Skills Confidence” Measurements of SSG’s Self-Assessment Tool

SKILLS CONFIDENCE

If you had the opportunity to engage in each of the following activities, how would you rate your confidence level in accomplishing each activity?

0% Complete

Operate machines to make and repair tools.

Cannot Do At All
Slightly Certain Can Do
Moderately Certain Can Do
Very Certain Can Do
Completely Certain Can Do

[Next](#)

Create graphics for a website.

Cannot Do At All
Slightly Certain Can Do
Moderately Certain Can Do
Very Certain Can Do
Completely Certain Can Do

[Previous](#)
[Next](#)

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

The questions in SSG's current self-assessment tool are not tailored to or personalised to the user's existing and target occupations. Moreover, an own-account worker will answer the same set of questions as a full-time employee. In addition, the questions on skills confidence are centred on occupation-specific skills. From our interviews, we found that while some own-account workers were aware of the occupation-specific skills they needed, they were less certain about the types of contextual skills and digital skills they required to thrive in their existing work. Thus, self-assessment tools like this one should be updated with tried-and-tested digital skills frameworks to improve its precision and efficacy.

Developers and policymakers can take a leaf from tools used in Europe that are designed around DigComp 2.1, the Digital Competence Framework used in the European Union (Carretero et al., 2017) for the next iteration in development. In addition to five competence areas (see Table 7), it provides assessment on eight levels (see Table 8).

Table 7: Competence areas outlined in DigComp 2.1

Competence areas	Description of competence
1. Information and data literacy	1.1 Browsing, searching and filtering data, information and digital content 1.2 Evaluating data, information and digital content 1.3 Managing data, information and digital content
2. Communication and collaboration	2.1 Interacting through digital technologies 2.2 Sharing through digital technologies 2.3 Engaging in citizenship through digital technologies 2.4 Collaborating through digital technologies 2.5 Netiquette 2.6 Managing digital identity
3. Digital content creation	3.1 Developing digital content 3.2 Integrating and re-elaborating digital content 3.3 Copyright and licences 3.4 Programming
4. Safety	4.1 Protecting devices 4.2 Protecting personal data and privacy 4.3 Protecting health and well-being 4.4 Protecting the environment.
5. Problem solving	5.1 Solving technical problems 5.2 Identifying needs and technological responses 5.3 Creatively using digital technologies 5.4 Identifying digital competence gaps

Table 8: Competency levels outlined in DigComp 2.1

Skill level	Skill tier	Elaboration
1	Foundation	I can solve simple tasks with guidance
2	Foundation	I can solve simple tasks with autonomy and guidance where needed
3	Intermediate	I can solve well-defined routine tasks and deal with straightforward problems on my own
4	Intermediate	I can solve tasks and deal with non-routine independent and according to my own needs
5	Advanced	I can solve many different tasks and problems and help guide others
6	Advanced	I can select the most appropriate tasks and am able to adapt solutions in a complex context.
7	Highly specialised	I can resolve complex problems with limited solutions and contribute to the personal practice
8	Highly specialised	I can resolve complex problems with many interacting factors and propose new ideas and processes to the field

There are a few digital skills self-assessment tools in Europe that were developed based on the DigComp 2.1 framework, like those in Spain, Lisbon, Italy and Denmark (see Centre for Digital Dannelsen, n.d.; DigComp, n.d.; Smartivemap, n.d.; Andalucía Vuela, n.d.). Besides self-assessment of one's digital skills, some of these tools also include self-assessment for different job roles.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

As part of the Ikanos digital skills self-assessment tests in Spain, these digital competence profiles specify the type and level of knowledge needed for a range of occupations using the dimensions and skills levels outlined in DigComp 2.1 (Ikanos, n.d.). A screenshot of a sample profile for medical professionals is shown below (Figure 6).

Figure 6: Screenshot of Ikanos' Digital Competence Profiles for Medical Professionals

Perfil Digital Profesional para Profesionales de Medicina

Área	Competencia	Nivel Básico		Intermedio		Avanzado		Experto	
		A1	A2	B1	B2	C1	C2	D1	D2
Información	1.1 Navegar, buscar y filtrar la información	○	○	○	○	●	○	○	○
	1.1.1 Utilizar servicios de información clínica internos	○	○	○	○	●	○	○	○
	1.1.2 Utilizar servicios de información clínica externos	○	○	○	○	●	○	○	○
	1.2 Evaluar la información	○	○	○	○	●	○	○	○
	1.2.1 Valorar la calidad de la información clínica (PILAR)	○	○	○	○	●	○	○	○
	1.2.1 Valorar Apps de pacientes	○	○	○	●	○	○	○	○
	1.3 Almacenar y recuperar la información	○	○	○	○	●	○	○	○
	1.3.1 Conocer y mantener Sistema de Gestión Integrado	○	○	○	○	●	○	○	○
	1.3.2 Ordenar y borrar versiones de documentos	○	○	○	●	○	○	○	○
	1.3.3 Curación de contenidos	○	○	○	○	●	○	○	○
Comunicación	2.1 Interactuar mediante tecnologías	○	○	○	○	○	○	○	○
	2.2.1 Hacer videoconferencias con Lync	○	○	○	○	○	○	○	○
	2.2.2 Compartir información y contenidos	○	○	○	○	○	○	○	○
	2.2.1 Compartir documentos mediante Osabox	○	○	○	○	○	○	○	○
	2.2.2 Utilizar Osabegi para compartir información	○	○	○	○	○	○	○	○
	2.3 Participación en línea								
	2.4 Colaborar a través de canales digitales	○	○	○	○	○	○	○	○
	2.4.1 Gestionar conocimiento mediante Jakinsarea	○	○	○	○	○	○	○	○
	2.4.2 Colaborar en proyectos mediante Osagune	○	○	○	○	○	○	○	○
	2.4.3 Incrementar la relación online con los pacientes	○	○	○	○	○	○	○	○
2.5 Netiquette	○	○	○	○	○	○	○	○	
2.6 Gestionar la identidad digital	○	○	○	○	○	○	○	○	
Creación de Contenido	3.1 Desarrollo de contenidos	○	○	○	○	○	○	○	○
	3.2 Integración y Reelaboración de Contenidos	○	○	○	○	○	○	○	○
	3.3 Copyright y Licencias	○	○	○	○	○	○	○	○
	3.4 Programación	○	○	○	○	○	○	○	○
Seguridad	4.1 Protección de los dispositivos	○	○	○	○	○	○	○	○
	4.2 Protección de datos personales	○	○	○	○	○	○	○	○
	4.3 Protección de la salud	○	○	○	○	○	○	○	○
	4.4 Protección del entorno	○	○	○	○	○	○	○	○
Solución de Problemas	5.1 Resolver problemas técnicos	○	○	○	○	○	○	○	○
	5.2 Identificar necesidades y resp. tecnológicas	○	○	○	○	○	○	○	○
	5.3 Innovación y uso creativo de la tecnología								
	5.4 Identificar brechas en la competencia digital	○	○	○	○	○	○	○	○

● Competencias Centrales
● Competencias Transversales
● Competencias Complementarias

Source: <https://ikanos.eu/wp-content/uploads/2020/08/PDProf.png>

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Currently, SSG publishes course guides and recommendations for specific occupations as well as Skills Frameworks for select sectors on its portal.¹³ Each skill outlined is then mapped to various courses offered on the MySkillsFuture portal. However, own-account workers would have to search for these online guides and roadmaps on the portal to find out what the digital skills requirements for each job are and the courses they should sign up for.

For a more efficacious digital skills self-evaluation tool that makes personalised course recommendations would encompass such a user journey: **(1) first identify their goals, (2) take the skills self-assessment and (3) receive recommendations for a personalised training roadmap and course recommendations to help them achieve their goals.**

As presented in Section 4, some own-account workers have the “good enough” or “just in time” attitude when it comes to upskilling. They are more likely to upskill if they see the relevance of specific skills to their daily work and career development. They need to be made aware of how a particular skill is required for the immediate or near future. Self-assessment will help own-account workers identify their needs and skill gaps, uncover skills that they may not think

¹³ For example, an article on the Jobs-Skills Insights section of the MySkillsFuture portal recommends skills that creative and media freelancers should learn, such as design thinking, personal branding, problem solving, UX and UI design, data science, digital marketing, live streaming production, creative writing, global perspective, and storytelling (SSG, 2021).

IPS Working Papers No. 58 (October 2024):

are relevant to their work but are important, as well as provide insight to the actions they should take to close their skill gaps in the short term and long term.

5.1.2 Strengthen Communication of Skills Relevance and Application

It was evident from our study that own-account workers place emphasis on skills being relevant and applicable to their work. This is a deal maker when it comes to own-account workers' decision-making regarding upskilling and training. In Phase Two, a major pain point for the own-account workers we interviewed was that the skills they learned during other courses they attended were not relevant or applicable to their existing line of work.

These pain points encountered in one's upskilling journey were reiterated by the findings from the pilot study in Phase Three. In general, skills that participants used more frequently after training were also the skills in which they reported increased confidence. Despite the positive outcomes we observed in terms of self-reported ability and frequency of skill use, participants did not report significant improvements in their job effectiveness.

Additionally, in the open-ended section of the post-training feedback form, participants frequently mentioned the relevance of the skills taught during the programme regardless of whether the feedback was positive or negative. For example, as reasons for recommending the training programme to others, a

participant in the creative and multimedia group noted that the course was “relevant to [their] work experience and [they] learnt many new things”.

The findings suggest a missing link between training and the application of skills taught to improve work productivity. To encourage the formation of the virtuous cycle of life-long learning, making the connection for own-account workers is critical. This will not only benefit the workers who are learning these skills, but also Singapore’s economy. Once workers realise that upskilling can translate to better productivity, and returns on the time and money invested, they are more likely to continue to invest in more training instead of seeing training as a one-and-done deal.

Although factors such as the quality and ability of the trainers could have shaped participants’ training experience, it is evident that participants want to learn skills that are relevant and applicable to their work. Highlighting the relevance and applications of skills should be done not only during training, but also continuously so that learners do not lose sight of valuable skills.

Close to the end of training, trainers and the trainees can jointly formulate a plan on how to apply the skills acquired to their work. Doing so would help learners who might have difficulties relating the skills learned to their work. There could also be a follow-up session with trainers six months later to reassess how the skills can further be improved on or incorporated into the learners’ workflow.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

5.2 ENHANCE RESOURCES AND CLOSE DELIVERY GAPS

5.2.1 Personalise Training Recommendations

In Phase Three, we observed differences between the two groups of workers we studied. For example, the creative and multimedia group reported a higher number of significant increases in their ability in using digital skills and ability in performing the specific tasks taught during the training programme than the sales and marketing group overall. Many of these improvements occurred immediately after the training programme, suggesting that they were attributable to the training. The differences between the two groups suggests that while the training had positive effects on both groups, the training benefitted the creative and multimedia group more.

The participants generally scored the perceived importance of the skills in our framework highly and the majority (43 out of 52 participants) reported that the training was “useful or “very useful” immediately after training, regardless of their profession. These findings suggest that the skills being taught were relevant and applicable to both groups of workers studied. Thus, it is possible that the sales and marketing group might have needed more time to pick up and apply the skills taught during the training programme. A tailored training programme that places more emphasis and focus on certain skills or provides more occupation-specific examples for the sales and marketing workers could hold more benefits for this group.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

The qualitative feedback that we gathered immediately after the training programme shows that the training was perceived quite differently among the participants. Some participants found the course “too basic” while others found certain portions of the course “too difficult”. These findings echo what we have found in Phase Two of the study. A participant from the sales and marketing group, who found the course too basic, wrote, “[I] felt that the content was too basic, or rather most of the participants lack basic foundation [*sic*] knowledge.” On the other hand, another participant from the sales and marketing group found the course difficult as it was a “challenge to understand and catch up with the trainer” when it came to the more technical and data-driven parts of the course. Several participants also highlighted the need for more tailored training programmes based on their type of occupation.

“The module for basics of the online communication module is too easy while the module for sales & marketing analytics is too technical.... Instead of attending a generic course for all creative freelancers, we should have customised courses for different creative tracks. For instance, I am from the creative track and have limited exposure to data analytics. It will be ideal if the data module is tailored for people with little exposure to data, focusing more on a theory about how to think about data and use data in our business and less on technical execution like formulas.” — **participant from the sales and marketing group**

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Clearly, own-account workers are a diverse group with varying skill levels and learning needs. To provide training that is relevant and effective to different workers, the level of difficulty must be pitched at an appropriate level with the right amount of specificity. Sector- or occupation-specific advice, as well as self-assessment tools would help own-account workers better understand the next steps they should take in upskilling as well as be able to more accurately assess their needs. Self-assessment tools like the one proposed in Section 5.1 will increasingly play an important part in helping own-account workers understand their existing strengths, the areas for improvement and specific courses to take that would fill their skills gaps.

Furthermore, the information that course providers publish on the MySkillsFuture portal should be more comprehensive and standardised. Many of the own-account workers we interviewed cited that they did not have enough information to help them decide on whether or not to enrol in a course. The information that most of our participants said was important include: (1) course objectives, (2) course structure and schedule, (3) course eligibility requirements or target audience, and (4) short previews of course content. Additionally, the mode of course delivery should be made explicit on the course information page. Users should also be able to accurately find courses by their preferred course mode through search filters on the site. Course providers should ensure that the above-mentioned course information is updated across all platforms, whether it is their own website or an online portal like MySkillsFuture.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

5.2.2 Centralised Source of Information via a More User-Friendly One-Stop Portal

The own-account workers who participated in our study generally had a high level of awareness of the various sources of funding, particularly the SkillsFuture credits, NTUC UTAP and NTUC training fund for self-employed persons. However, they have a lower level of awareness of financial assistance initiatives from other government agencies and other SSG initiatives.

Subsidies are one of the main strategies implemented by the government to encourage higher take-up of digital skills courses. While the information on various types of funding is available through a search on Google, own-account workers might find the number of separate webpages they have to navigate overwhelming and onerous. Own-account workers can benefit from a one-stop portal that is user-friendly and provides easy access to all the information they need relating to funding and financial assistance. While the current SSG portal includes course information and support schemes, the feedback gathered from participants sheds light on user difficulties. The one-stop portal should include the comprehensive slate of training support and schemes, updated on a regular basis.

Another pain point for the participants in our study is certification and accreditation, particularly the additional costs of certification on top of course fees. While participants did not name the certificates and courses they were interested in, examples of certifications that require a considerable sum of

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

money include certifications from international organisations like the Project Management Institute ¹⁴ and SAP ¹⁵, as well as certificates from local educational institutions such as the Singapore Management University (SMU) Professional Certificate in Digital Marketing (priced at \$1161.60), and the Equinet Certified Digital Marketing Strategist bundle of courses and certificates (priced from \$1971.36, after applying the SkillsFuture subsidy).

However, there are many certifications from large international tech companies that participants can obtain at no cost, which participants might not know about. Also, those who take up certification courses from SMU and Equinet can use their SkillsFuture credits on top of the SSG subsidy and the SkillsFuture Mid-Career Enhanced Subsidy (MCES)¹⁶. The top concerns surfaced by own-account workers on certification and eligibility for different subsidies can also be directly addressed through consolidating information on this one-stop portal, which could be integrated with the own-account worker collective.

¹⁴ The Project Management Institute (PMI) is the leading professional association for project management, and the authority for a growing global community of millions of project professionals and individuals who use project management skills. They offer certifications for project managers with varying levels of experience. The cost of PMI's certification examinations ranges from US\$225 to US\$1,000.

¹⁵ SAP is a multinational enterprise software company that offers certifications in the various modules of their widely used software. Certification costs range from S\$279 to S\$698.

¹⁶ The SkillsFuture Mid-Career Enhanced Subsidy is a subsidy for Singapore citizens aged 40 and above which provides (1) up to 90 per cent subsidy on course fees for courses offered by the SkillsFuture Singapore-appointed Continuing Education and Training Centres, (2) at least a 90 per cent subsidy on programme costs for Ministry of Education-subsidised full-time and part-time courses at institutions like autonomous universities, polytechnics and the Institute of Technical Education, and (3) up to 70 per cent subsidy on course fees for certifiable-skills training courses.

Several participants also suggested rewarding course completion instead of simply providing funding for training. A training provider suggested that funding be tied to specific course outcomes, to encourage learners to take ownership for their learning. Some of these suggestions are already part of existing SSG and non-SSG initiatives.¹⁷ Even though the suggestions from our participants are similar to existing initiatives, participants were not aware of these initiatives or might not have been eligible for these initiatives.

As seen from the responses of our interviewees, there is clearly a gap in awareness when it comes to funding from different government agencies, the conditions for funding and co-funding. There is also a need for more easily accessible information on eligibility requirements of financial assistance schemes from SSG. One way to do this would be through a one-stop portal that was suggested earlier. The portal will provide own-account workers information about the various avenues of funding available to them and help improve last-mile delivery.

¹⁷ For instance, financial assistance from SSG like the SSG grant and MCEs do not completely cover the learner for their course fees. As for rewarding completion of courses instead of merely for signing up for courses, the Workfare Skills Support scheme (WSS) gives self-employed persons S\$500 for completing a course. However, the WSS scheme is targeted at low-wage workers who earn under S\$2,300 on average, meaning that at least 40 per cent of local own-account workers would not be eligible for this incentive to complete courses or training (MOM, 2022a). Another example of rewarding course completion is the SkillsFuture Qualification Award, which provides a cash award of up to \$1,000 for the completion of a full WSQ qualification (SSG, 2021). The SkillsFuture Qualification Award is set to be phased out by March 2023, and will only reward Singaporeans with qualifications obtained before 31 December 2022.

5.3 STRENGTHEN ECOSYSTEM SUPPORT

5.3.1 Collective for Own-Account Workers

In recent years, the government has rolled out initiatives and programmes targeted at the small but growing group of own-account workers. For example, the Advisory Committee on Platform Workers set up in August 2021 that comprises representatives from government, labour movement (from the National Taxi Association and National Private Hire Vehicles Association), industry and academia, developed a set of recommendations for delivery workers, private-hire car drivers and taxi drivers that have been accepted by the government (MOM, 2022c). Additionally, the Tripartite Workgroup on Representation for Platform Workers aims to propose a framework for a representative body for platform workers, a dispute management framework and a scope of issues that can be negotiated by the representative body and a platform company (MOM, 2022b). These initiatives target own-account workers from the driving and delivery sector.

However, as our study has shown, own-account workers are not limited to just the driving and delivery sector. Own-account workers include those who hold occupations in a wide range of roles and industries, such as those who participated in this study. A multi-stakeholder collective for own-account workers can help to consolidate information and create an environment that supports the upskilling of different types of own-account workers.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Currently, NTUC's Freelancers and Self-Employed Unit support freelancers and self-employed persons by working closely with stakeholders to strengthen their income security, occupational safety and health, and skills mastery. Even as the initiative seeks to assist a wide range of workers — i.e., taxi drivers, private hire drivers, food delivery or package delivery workers, coaches and instructors (in the field of sports and outdoor learning, fitness and wellness, visual and performing arts, and enrichment), and creative professionals — our study highlights the pressing need to extend the collective approach to a more comprehensive range of own-account workers.

As own-account work is being severely affected by technological advancements — especially among those offering professional services, the collective could look into how best to involve various stakeholders in training and evaluating own-account workers' digital competencies. The proposed collective will serve as a one-stop place for any matters and concerns relating to own-account workers, including but not limited to:

- Information about skills requirements, courses, programmes, grants
- Certifications and assessments that are recognised by clients
- Networking opportunities
- Information about different industries and trends

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

The collective should be a multi-stakeholder collaboration among own-account workers, employers, training providers and the government. Besides facilitating the sharing of information among the various stakeholders, the collective can match mentors with own-account workers.

Australia recently announced its intention to create a National Skills Passport to help job seekers share verified qualifications with potential employers (Visentin, 2023). Although the scope, outcomes and benefits of the National Skills Passport is currently still being defined by the Australian Government in consultation with industry players, such a passport aims to make lifelong learning more easily attainable as it can help Australians more accurately demonstrate their skills proficiencies to employers (Commonwealth of Australia, 2023).

This is similar to what has already been launched in Europe. In 2021, the European Commission launched the Digital Skills and Jobs Platform in Europe, a one-stop online platform that offers free courses, career advice, and job opportunities for citizens and organisations in Europe (European Commission, 2021). To cater to the multilingualism of the region, the courses and resources available on the platform are available in different languages. It was launched by the Digital Skills and Jobs Coalition, which was established in 2018 after the development of the DigComp 2.1 framework (European Commission, 2022).

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

The development of an intra-national digital competence framework and assessment tools have also highlighted the need for standardised assessment and certifications across European countries. Under the Digital Education Action Plan (2021-2027), EU Member States will jointly develop a European Digital Skills Certificate that will be recognised by governments, employers and other stakeholders across Europe (European Commission, n.d.). The certificate would allow Europeans to display their proficiency level based on the competence areas outlined by DigComp 2.1. To ensure that other skills can be recognised across Europe, the European Union is also working on the Europass Digital Credentials Infrastructure, which would serve as a regional authenticator of various certifications (Europass, n.d.).

Since the completion of this study, the trajectory of job skills requirements is already pivoting towards AI technologies. This shift has driven demand for specialised AI-related skills such as machine learning, natural language processing, and AI application development. A recent report by PwC revealed that the skills required changed 25 per cent faster in AI-exposed occupations (PwC, 2024). The same report points to the acceleration of AI penetration, with the growth in AI jobs outpacing all other jobs (PwC, 2024). As businesses continue to harness AI to gain competitive advantages, workers will need to upskill and adapt to emerging trends in AI-driven innovation. To remain competitive in spite of rapidly changing skill demands, skills upgrading should be a norm, not a one-time event. Although this report focuses specifically on own-account workers, the importance of regularly upskilling applies to everyone

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

and not just own-account workers. We must ingrain a national psyche of lifelong learning to not only withstand the tsunami of change that is upon us but to thrive in its wake.

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APPENDIX A: PHASE ONE — LITERATURE REVIEW AND WEB SCRAPING

Systematic Literature Review

To understand what digital skills are essential to own-account workers, we conducted an in-depth literature review that spanned academic research, consultancy research, policy research, intergovernmental research, press releases and news publications. The review was conducted between June and October 2021.

The keywords that were used for the review were grouped under three broad categories: (1) digital, (2) occupational, and (3) geographical. First, the digital aspect covered various related keywords such as “digital literacy”, “digital competencies”, and “digital upskilling”, with an emphasis on digital skills for the workplace. Second, due to the scant research on own-account workers, the review was expanded to include digital upskilling measures targeted to people in related occupations, such as independent workers and gig workers. Finally, the literature search encompassed relevant and current research done in Singapore and the rest of the world — both prominent countries in the region and developed countries worldwide. Table A1 summarises the studies reviewed for our paper.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Table A1: Summary of Digital Skills Studies

Publisher (Title)	Summary of Report	Scope	Classification of Skills
AlphaBeta (APAC Digital Skills Framework)	<ul style="list-style-type: none"> - Examines digital skill needs in six APAC economies - Focuses on the digital skills that different groups of workers will need to gain by 2025 	<ul style="list-style-type: none"> - Based on inputs from policymakers, HR professionals, digital technology experts, and business leaders 	<ul style="list-style-type: none"> - 28 digital skills spanning eight digital competence areas and four proficiency levels - Competence areas comprise four horizontal and four vertical competencies - Four proficiency levels: digital learner, user, integrator, innovator
Burning Glass Technologies (APEC Closing the Digital Skills Gap Report)	<ul style="list-style-type: none"> - Examines demand and supply of digital skills in APEC economies - Focuses on digital skills for employment 	<ul style="list-style-type: none"> - Based on 40 million job postings from 45,000 sources found in their Burning Glass' database 	<ul style="list-style-type: none"> - Baseline skills and six specialised areas of digital skills
Cedefop (Developing and Matching Skills in the Online Platform Economy)	<ul style="list-style-type: none"> - Identify skills developed by crowdworkers, who are mainly online freelancers 	<ul style="list-style-type: none"> - Based on a survey with crowdworkers and interviews with 	<ul style="list-style-type: none"> - Digital skills span computer literacy, platform-related skills,

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

	engaging in platform work	crowdworkers and stakeholders (e.g., platform owners, policymakers, learning providers)	and technical skills - Non-digital skills include communication and analytical skills that are mediated by digital technology
ECORYS UK (Digital Skills for the UK Economy)	<ul style="list-style-type: none"> - Examines demand and supply of digital skills in UK - Focuses on digital skills for the population and businesses 	<ul style="list-style-type: none"> - Based on literature review and inputs from key stakeholders (e.g., policymakers and training academies) to test the findings from the literature review 	<ul style="list-style-type: none"> - Baseline skills - Workforce (intermediate) skills - Professional skills
LinkedIn (APEC Closing the Digital Skills Gap Report)	<ul style="list-style-type: none"> - Examines demand and supply of digital skills in APEC economies - Focuses on digital skills for employment 	<ul style="list-style-type: none"> - Based on digital skills listed on LinkedIn profiles across ten APEC economies 	<ul style="list-style-type: none"> - Basic skills - Applied skills - Software and hardware skills - Disruptive skills
van Laar et.al. (The Relationship Between 21st-	<ul style="list-style-type: none"> - Identify skills needed in digital environment 	<ul style="list-style-type: none"> - Systematic literature review on 21st-century 	<ul style="list-style-type: none"> - Core 21st-century digital skills

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Century Skills and Digital Skills)	<ul style="list-style-type: none"> - Define relation between 21st-century skills and digital skills - Provide framework of 21st-century digital skills 	skills and digital skills	- Contextual 21st-century digital skills
World Skills UK (Disconnected? Exploring the Digital Skills Gap)	<ul style="list-style-type: none"> - Examines young people and digital skills - Highlights importance of basic and foundational digital skills 	<ul style="list-style-type: none"> - Based on surveys for HR decision-makers, young people in the UK and a focus group with employers from eight key sectors of the UK economy 	- Essential digital skills

The literature pointed to various contextual skills which can be used in tandem with digital skills across the baseline, intermediate and occupation-specific tiers. Table A2 summarises the description of these contextual skills.

Table A2: Description of Contextual Skills Included in the Digital Skills Framework for Own-Account workers

Contextual skills	Description
Problem solving	Using ICT skills to understand and solve digital and non-digital problems. ¹⁸
Critical thinking	Using ICT to make informed judgements and choices. ¹⁹
Analytical thinking	Ability to analyse and evaluate the impact of ICT in social, economic and cultural contexts. ²⁰
Learning to learn	Using ICT to create useful knowledge, continually improving one's capabilities. ²¹
Adaptability	Flexibility and adaptability to changing ICT environment. ²²
Ethical awareness	Ability to behave in a socially responsible way when using ICT. ²³

¹⁸ AlphaBeta. (2021). *Unlocking APAC's digital potential: Changing digital skill needs and policy approaches*. <https://alphabeta.com/our-research/unlocking-apacs-digital-potential-changing-digital-skill-needs-and-policy-approaches/>; ECORYS UK. (2016). *Digital skills for the UK economy*. GOV.UK

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492889/dcmsdigitalskillsreportjan2016.pdf; van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behaviour*, 72, 577-508. <http://dx.doi.org/10.1016/j.chb.2017.03.010>

¹⁹ Ibid.

²⁰ van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behaviour*, 72, 577-508. <http://dx.doi.org/10.1016/j.chb.2017.03.010>

²¹ Ibid.

²² Cedefop. (2020, September). *Developing and matching skills in the online platform economy*. https://www.cedefop.europa.eu/files/3085_en.pdf; van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behaviour*, 72, 577-508. <http://dx.doi.org/10.1016/j.chb.2017.03.010>

²³ van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behaviour*, 72, 577-508. <http://dx.doi.org/10.1016/j.chb.2017.03.010>

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Collecting Data on Digital Skills Required in Own-Account Work

Researchers from LARC collected data on the types of own-account that were available and the digital skills required in those work from the MyCareersFuture jobs portal in June and July 2021. On MyCareersFuture, job applicants can filter job search results by employment type. As own-account work is likely to be project-based and contractual in nature, we extracted all non-permanent job postings for the following categories:

- Part-time
- Contract
- Flexi-work
- Temporary
- Freelance
- Internship/traineeship

As of July 2021, there was a total of about 182,000 non-permanent job postings that were listed on the MyCareersFuture portal. Using the Singapore Standard Occupational Classification (SSOC), these job postings were tagged by their major occupational group (i.e., one-digit SSOC codes) and sub-major groups (i.e., two-digit SSOC codes). In total, there were nine major groups and 41 subgroups. The job postings were also classified according to the Singapore Standard Industry Classification (SSIC) by division. See Tables A3 to A5 for a breakdown of the SSOC and SSIC codes, their descriptions, and the disaggregation of non-permanent job postings by occupations and industries.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Researchers from LARC then used skills recognition and linking software to determine the digital skills that were required by the job. The software recognised 1,560 distinct digital skills mentioned in the job descriptions and linked them to the respective Wikidata entries and Wikipedia articles.

Table A3: Major Occupational Groups (One-Digit SSOC)

Major Occupational Group (One-Digit SSOC)	Description	Percentage of Non-Permanent Job Postings
2	Professionals	55.30%
3	Associate professionals and technicians	21.06%
4	Clerical support workers	10.36%
1	Legislators, senior officers and managers	9.92%
5	Service and sales workers	1.59%
8	Plant and machine operators and assemblers	0.78%
7	Craftsmen and related trades workers	0.60%
9	Cleaners, labourers and related workers	0.38%
6	Agricultural and fishery workers	0.01%

Table A4: Sub-Major Occupational Groups (Two-Digit SSOC)

Sub-Major Occupational Groups (Two-digit SSOC)	Description	Percentage of Non-Permanent Job Postings	Total Digital Skills Count
25	Information and communications technology	24.70%	574
21	Science and engineering professionals	14.18%	460
33	Business and administration assoc. Professionals	11.74%	240
24	Business and administration professionals	8.08%	285
13	Production and specialised services managers	4.94%	256
41	General and keyboard clerks	4.74%	58

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

29	Other professionals not elsewhere classified	4.55%	251
12	Physical and engineering science associate	3.81%	104
31	Administrative and commercial managers	3.81%	91
43	Numerical and material-recording clerks	3.12%	35
39	Other associate professionals not elsewhere classified	2.45%	189
42	Customer services officers and clerks	2.43%	18
23	Teaching and training professionals	1.50%	111
26	Legal, social and cultural professionals	1.27%	58
22	Health professionals	1.01%	20
35	Information and communications technicians	1.00%	144
36	Teaching associate professionals	0.85%	13
52	Sales workers	0.79%	10
34	Legal, social, cultural and related associate	0.78%	13
11	Legislators, senior officials and chief executives	0.67%	53
83	Drivers and mobile machinery operators	0.53%	6
14	Hospitality, retail and related services managers	0.51%	18
51	Personal service workers	0.45%	6
32	Health associate professionals	0.42%	8
71	Building and related trades workers, excluding	0.28%	6
53	Personal care workers	0.23%	4
81	Stationary plant and machine operators	0.19%	5
91	Cleaners and related workers	0.15%	1
74	Electrical and electronic trades workers	0.11%	2
54	Protective services workers	0.10%	6
93	Labourers and related workers	0.10%	3
72	Food processing, woodworking, garment, leather	0.09%	2
75	Metal, machinery and related trades workers	0.09%	1
96	Waste and recyclables collection workers	0.08%	3
44	Other clerical support workers	0.06%	4
82	Assemblers and quality checkers	0.06%	6
94	Food preparation and kitchen assistants	0.05%	2
73	Precision, handicraft, printing and related trades	0.02%	10

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

40	Service workers not elsewhere classified	0.01%	0
59	Agricultural workers	0.01%	0
61	Clerical supervisors	0.01%	0

Table A5: Industry Classifications of Non-Permanent Job Postings

SSIC Code	Description	Percentage of Jobs
Others	Non-ICT / science industries	51.29%
58–63, 69–75	ICT and science industries	48.71%

The following word clouds provide deeper insights into the popular digital skills needed in each sub-major occupation group. In general, ICT-related jobs required more programming skills, such as Java, JavaScript, Structured Query Language (SQL), C++ and Python, which are generally more advanced (see Figure A1). Knowledge of operating systems (e.g., Linux, Unix) was also a common prerequisite.

Figure A3: Word Cloud of Digital Skills Needed by Business and Administration Associate Professionals



Figure A4: Word Cloud of Digital Skills Needed by Business and Administration Professionals



As shown in Figure 2 of the main report, there was a difference between the number of distinct digital skills identified in the job postings of ICT professionals and technicians — 574 digital skills identified from the former and 144 digital

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

APPENDIX B: PHASE TWO — FOCUS GROUP DISCUSSIONS AND IN-DEPTH INTERVIEWS

Focus Group Discussions (FGDs)

The recruitment of participants for the FGDs was conducted by a third-party research vendor. FGDs 1 to 4 consisted of own-account workers who held occupations in different sectors and FGD 5 was made of employers and training providers who worked with and trained own-account workers, respectively. The five groups were formed with inputs from the funder, SSG. See Table B1 for the descriptions of the FGD groups.

Table B1: Composition of the FGD groups

FGD no.	Group description
FGD 1	Own-account workers who are private-hire car drivers, car and light goods delivery drivers, taxi drivers, hawkers and stall holders
FGD 2	Own-account workers who are real estate and property agents, insurance agents and tourist guides
FGD 3	Own-account workers who are information and communication technology (ICT) professionals, science and engineering professionals, business and administrative associate professionals, and business and administrative professionals
FGD 4	Own-account workers who are freelancers in the arts, media, creative, entertainment and sports industries
FGD 5	Employers and training vendors who work with or train own-account workers

We recruited own-account workers (i.e., workers who were self-employed with no employees) whose own-account work was their primary source of income. The focus groups participants were also recruited for occupational diversity. Steps were taken to ensure that participants for each group were diverse in

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

terms of their age, gender and ethnicity, as much as possible. Training providers were required to have a track record of training own-account workers, and employers either supervised or made decisions concerning own-account workers' job scope and deployment in their organisations.

The five FGDs involved a total of 50 participants — 40 own-account workers who held different occupations, and 10 employers and training providers. The own-account worker participants ranged from 24 to 54 years old, with more than three-quarters of the own-account worker participants aged between 30 and 49 years old. There were 16 females (40 per cent) across the four own-account worker FGDs. As shown in Table B2, there was a good mix of participants in terms of ethnicity. Demographic data was not tabulated for employers and trainers.

Table B2: FGD Participants by Age, Gender and Ethnicity

Demographics		Number of own-account workers (Total: 40)
Age	< 25	1
	25–29	4
	30–39	13
	40–49	18
	> 50	4
Gender	Female	16
	Male	24
Ethnicity	Chinese	29
	Malay	4
	Indian	6
	Others	1

The FGDs lasted between 120 and 150 minutes and were conducted online over Zoom between 13 and 20 January 2022.

In-Depth Interviews (IDIs)

While the FGDs enabled us to identify similarities and differences among own-account workers who held different occupations, the IDIs elicited a more nuanced picture of each individual own-account worker's motivations and challenges in upskilling, that are connected to his or her lived experiences and employment aspirations. The IDIs also elicited feedback and suggestions for our proposed digital skills framework.

We conducted in-depth interviews with 30 participants — 20 own-account workers and 10 employers and trainers. Twenty-five of the IDI participants were recruited from the group who participated in the FGDs and gave their consent to be re-contacted to participate in the IDIs.

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

Table B4: IDI Participants by Age, Gender and Ethnicity

Demographics		Number of own-account workers (Total: 20)
Age	< 25	0
	25–29	4
	30–39	8
	40–49	7
	> 50	1
Gender	Female	8
	Male	12
Ethnicity	Chinese	15
	Malay	3
	Indian	1
	Others	1

The interviews were conducted between 1 March 2022 and 22 April 2022 over Zoom due to prevailing pandemic conditions. Each interview lasted between 60 and 180 minutes.

APPENDIX C: PHASE THREE — DIGITAL SKILLS FRAMEWORK PILOT STUDY

Table C1: Number of Participants by Citizenship, Age Group, Gender, Ethnicity and Education

Demographic data		Number of participants	Percentage (%) of participants
Citizenship	Singapore Citizens	47	90.4
	Permanent Residents	5	9.6
Gender	Male	25	48.1
	Female	27	51.9
Age	25–29	13	25.0
	30–34	5	9.6
	35–39	6	11.5
	40–44	12	23.1
	45–50	16	30.8
Ethnicity	Chinese	44	84.6
	Malay	1	1.9
	Indian	6	11.5
	Others	1	1.9
Education	Secondary	2	3.8
	Post-Secondary (Non-Tertiary)	1	1.9
	Diploma and Professional Qualification	13	25.0
	University and above	36	69.2

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

and B. Tan

Table C2: Summary of Digital Skills Taught to Participants

Skill level	Skill name
Baseline skill	1. Basic digital operations
	2. Communication and collaboration skills
	3. Organisation and project management
	4. Safety and security
	5. Optimising profile
	6. Pricing products and services
Intermediate skill	1. Information management and processing
	2. Content and product creation
	3. Data analysis and visualisation
	4. Programming fundamentals
Occupation-specific skill	1. Digital marketing*
	2. Social media (Creative and Multimedia skill)**
	3. Analytics (Sales and Marketing skill)**

*Note: Skill was taught to both groups of participants

**Note: Skill was only taught to one group of participants

Table C3: Summary of Repeated Measures ANOVA for Ability in Using Digital Skills

Skill	T1				T2				T3				Within-subject contrast					
	N	Mean	SE	95% CI		N	Mean	SE	95% CI		N	Mean	SE	95% CI		F	P (linear)	Partial Eta Squared
				Low	High				Low	High				Low	High			
Adaptability	52	4.12	0.11	3.90	4.33	52	4.19	0.09	4.02	4.37	52	4.15	0.10	3.95	4.36	0.12	0.735	0.00
Ethical awareness	52	4.58	0.08	4.42	4.74	52	4.52	0.08	4.37	4.67	52	4.63	0.08	4.47	4.80	0.29	0.595	0.01
Analytical thinking	52	4.29	0.09	4.10	4.47	52	4.44	0.08	4.29	4.59	52	4.23	0.10	4.03	4.43	0.23	0.636	0.00
Problem solving	52	4.46	0.10	4.27	4.66	52	4.50	0.09	4.32	4.68	52	4.54	0.09	4.36	4.72	0.72	0.399	0.01
Critical thinking	52	4.25	0.12	4.01	4.49	52	4.27	0.10	4.07	4.47	52	4.46	0.09	4.28	4.65	2.54	0.117	0.05
Learning to learn	52	4.38	0.11	4.17	4.60	52	4.40	0.10	4.21	4.60	52	4.29	0.11	4.07	4.50	0.86	0.358	0.02
Basic digital operations	52	4.44	0.09	4.26	4.63	52	4.46	0.09	4.28	4.64	52	4.65	0.08	4.49	4.82	4.45	0.040	0.08
Communication and collaboration	52	4.48	0.09	4.29	4.67	52	4.63	0.08	4.48	4.79	52	4.65	0.08	4.50	4.81	3.12	0.083	0.06
Organisation and project management	52	3.94	0.13	3.68	4.20	52	4.15	0.12	3.91	4.40	52	4.33	0.13	4.06	4.59	8.12	0.006	0.14
Safety and security	52	3.62	0.14	3.33	3.90	52	4.06	0.12	3.83	4.29	52	4.21	0.11	4.00	4.43	16.68	<.001	0.25
Optimising profile	52	3.65	0.15	3.35	3.96	52	4.13	0.10	3.93	4.34	52	4.27	0.11	4.06	4.48	16.65	<.001	0.25
Pricing products and services	52	3.35	0.16	3.03	3.67	52	3.77	0.13	3.52	4.02	52	3.90	0.13	3.65	4.16	10.46	0.002	0.17
Information management and processing	52	3.77	0.13	3.52	4.02	52	3.85	0.12	3.62	4.08	52	4.15	0.12	3.92	4.39	5.74	0.02	0.10
Content and product creation	52	3.58	0.17	3.24	3.91	52	4.15	0.12	3.92	4.38	52	4.15	0.11	3.93	4.38	12.86	<.001	0.20
Data analysis and visualisation	52	2.79	0.17	2.45	3.13	52	3.44	0.12	3.20	3.69	52	3.46	0.14	3.18	3.74	13.74	<.001	0.21
Programming fundamentals	52	2.44	0.18	2.08	2.80	52	3.29	0.15	3.00	3.58	52	3.12	0.17	2.77	3.46	17.30	<.001	0.25
Digital marketing	52	3.12	0.15	2.82	3.41	52	3.94	0.10	3.74	4.14	52	3.69	0.12	3.44	3.94	10.94	0.002	0.18
Social media	26	3.08	0.24	2.59	3.56	26	4.15	0.11	3.93	4.37	26	3.96	0.15	3.65	4.27	10.46	0.003	0.30
Analytics	26	2.96	0.19	2.57	3.35	26	3.38	0.19	2.57	3.35	26	3.15	0.19	2.57	3.35	0.80	0.38	0.03

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

Table C4: Summary of Paired Samples t-test (Before and Immediately After the Training Programme, Split by Occupation Group)

Skills	Creative and Multimedia group					Sales and Marketing group				
	T1	T2	Difference	t	p	T1	T2	Difference	t	p
Adaptability	4.15	4.23	0.08	0.63	0.538	4.08	4.15	0.08	0.63	0.538
Ethical awareness	4.62	4.54	-0.08	-0.57	0.574	4.54	4.50	-0.04	-0.33	0.746
Analytical thinking	4.31	4.42	0.12	0.65	0.523	4.27	4.46	0.19	1.73	0.096
Problem solving	4.42	4.73	0.31	2.31*	0.029	4.50	4.27	-0.23	-1.44	0.161
Critical thinking	4.23	4.35	0.12	0.68	0.502	4.27	4.19	-0.08	-0.49	0.627
Learning to learn	4.54	4.50	-0.04	-0.20	0.846	4.23	4.31	0.08	0.46	0.646
Basic digital operations	4.46	4.58	0.12	0.77	0.449	4.42	4.35	-0.08	-0.53	0.603
Communication and collaboration	4.58	4.77	0.19	1.73	0.096	4.38	4.50	0.12	0.77	0.449
Organisation and project management	4.00	4.15	0.15	0.61	0.548	3.88	4.15	0.27	1.49	0.148
Safety and security	3.62	4.12	0.50	2.05	0.051	3.62	4.00	0.38	1.79	0.086
Optimising profile	3.65	4.15	0.50	2.39*	0.025	3.65	4.12	0.46	2.00	0.056
Pricing products and services	3.38	3.85	0.46	1.85	0.076	3.31	3.69	0.38	1.33	0.195
Information management and processing	3.69	3.73	0.04	0.18	0.862	3.85	3.96	0.12	0.59	0.559
Content and product creation	3.62	4.38	0.77	3.00	0.006	3.54	3.92	0.38	1.79	0.086
Data analysis and visualisation	2.77	3.35	0.58	1.96	0.061	2.81	3.54	0.73	2.91	0.008
Programming fundamentals	2.46	3.27	0.81	2.91*	0.007	2.42	3.31	0.88	2.85	0.009
Digital marketing	2.88	4.04	1.15	4.95*	<.001	3.35	3.85	0.50	1.79	0.085
Social media	3.08	4.15	1.08	4.35*	<.001	-	-	-	-	-
Analytics	-	-	-	-	-	2.96	3.38	0.42	1.90	0.069

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

Table C5: Summary of Repeated Measures ANOVA for Frequency of Using Digital Skills

Skill	T1				T2				T3				Within-subject contrast					
	N	Mean	SE	95% CI		N	Mean	SE	95% CI		N	Mean	SE	95% CI		F	P (linear)	Partial Eta Squared
				Low	High				Low	High				Low	High			
Basic digital operations	52	4.42	0.10	4.22	4.62	52	4.42	0.10	4.21	4.63	52	4.46	0.10	4.26	4.66	0.10	0.755	0.00
Communication and collaboration	52	4.52	0.09	4.35	4.69	52	4.58	0.09	4.39	4.76	52	4.64	0.09	4.46	4.81	0.10	0.755	0.00
Organisation and project management	52	3.98	0.14	3.70	4.27	52	4.10	0.13	3.84	4.36	52	4.08	0.14	3.80	4.35	0.37	0.546	0.01
Safety and security	52	3.08	0.17	2.74	3.41	52	3.81	0.13	3.56	4.06	52	3.79	0.15	3.49	4.09	13.34	<.001	0.21
Optimising profile	52	3.17	0.17	2.83	3.51	52	3.87	0.13	3.61	4.12	52	3.69	0.14	3.41	3.98	10.07	0.003	0.17
Pricing products and services	52	2.69	0.17	2.36	3.03	52	2.94	0.11	2.72	3.17	52	2.89	0.16	2.56	3.21	1.07	0.307	0.02
Information management and processing	52	3.33	0.17	2.99	3.66	52	3.60	0.13	3.34	3.85	52	3.69	0.15	3.38	4.00	3.10	0.084	0.06
Content and product creation	52	3.06	0.17	2.72	3.40	52	3.71	0.14	3.44	3.98	52	3.62	0.15	3.32	3.91	21.24	<.001	0.29
Data analysis and visualisation	52	2.21	0.17	1.86	2.56	52	2.85	0.16	2.53	3.16	52	2.85	0.18	2.50	3.20	12.41	<.001	0.20
Programming fundamentals	52	1.92	0.16	1.61	2.24	52	2.40	0.16	2.09	2.72	52	2.46	0.18	2.10	2.82	10.00	0.003	0.16
Digital marketing	52	2.83	0.17	2.48	3.17	52	3.64	0.15	3.33	3.94	52	3.48	0.15	3.17	3.79	12.09	0.001	0.19
Social media (Creative and Multimedia only)	26	2.92	0.25	2.40	3.45	26	2.92	0.25	2.40	3.45	26	3.42	0.21	2.99	3.85	4.45	0.045	0.15
Analytics (Sales and Marketing only)	26	2.19	0.20	1.78	2.61	26	2.85	0.22	2.39	3.30	26	2.65	0.19	2.26	3.05	2.65	0.043	0.15

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

Table C6: Summary of Paired Samples t-test (Before and Immediately After the Training Programme, Split by Occupation Group) for Frequency of Using Digital Skills

Skills	Creative and Multimedia group					Sales and Marketing group				
	T1	T2	Difference	t	p	T1	T2	Difference	t	p
Basic digital operations	4.58	4.58	-0.23	0.00	1.000	4.27	4.27	0.00	0.00	1.000
Communication and collaboration	4.58	4.65	0.00	0.57	0.574	4.46	4.50	0.04	0.21	0.832
Organisation and project management	4.04	3.88	0.15	-0.64	0.527	3.92	4.31	0.38	2.00	0.057
Safety and security	3.04	3.69	0.81	.00*	0.012	3.12	3.92	0.81	3.43	0.002
Optimising profile	3.19	3.65	0.62	.57*	0.037	3.15	4.08	0.92	4.63	<.001
Pricing products and services	2.92	3.00	0.00	-0.64	0.753	2.46	2.88	0.42	1.90	0.069
Information management and processing	3.35	3.54	0.35	0.00	0.539	3.31	3.65	0.35	1.74	0.095
Content and product creation	3.15	3.77	0.42	.57*	0.029	2.96	3.65	0.69	4.22	<.001
Data analysis and visualisation	2.23	2.58	0.62	-0.64	0.265	2.19	3.12	0.92	3.93	<.001
Programming fundamentals	2.00	2.19	0.58	0.00	0.511	1.85	2.62	0.77	2.9	0.007
Digital marketing	2.96	3.42	0.58	.57*	0.008	2.69	3.85	1.15	6.36	<.001
Social media (Creative and Multimedia only)	2.92	3.27	0.50	-0.64	0.095	-	-	-	-	-
Analytics (Sales and Marketing only)	-	-	-	-	-	2.19	2.85	0.65	2.95*	0.007

Table C7: Summary of Repeated Measures ANOVA for Learning Outcomes, Creative and Multimedia Group

Skill	Task	N	T1			T2			T3			Within-subject contrast					
			Mean	SE	95% CI		Mean	SE	95% CI		Mean	SE	95% CI		F	p (linear)	Partial Eta Squared
					Low	High			Low	High			Low	High			
Problem solving	Use search engines (e.g., Google, Bing, Yahoo) to help solve problems in your work	26	4.69	0.12	4.44	4.94	4.65	0.11	4.43	4.88	4.85	0.07	4.70	5.00	1.64	0.212	0.06
Basic digital operations	Use instant messaging platforms (e.g., WhatsApp, Telegram, Facebook Messenger) as a business communication tool	26	4.58	0.18	4.21	4.94	4.65	0.12	4.40	4.91	4.89	0.06	4.75	5.02	3.51	0.073	0.12
	Use cloud platforms (e.g., Google Drive, Microsoft SharePoint) to do and store work	26	4.50	0.13	4.24	4.76	4.54	0.15	4.23	4.85	4.69	0.16	4.35	5.03	1.50	0.232	0.06
Communication and collaboration	Use videoconferencing tools (e.g., Zoom, Microsoft Teams) to conduct virtual meetings	26	4.50	0.15	4.19	4.81	4.65	0.14	4.38	4.93	4.69	0.11	4.47	4.91	2.40	0.134	0.09
	Use digital tools (e.g., Microsoft Word, Google Sheets, Tableau) to process and present text and data to business partners or clients	26	3.77	0.22	3.32	4.22	4.12	0.17	3.77	4.46	4.31	0.19	3.92	4.70	8.39	0.008	0.25
Organisation and project management	Use project management tools (e.g., Notion, Trello, Asana) to plan and manage project timelines	26	3.12	0.27	2.56	3.67	3.89	0.20	3.48	4.29	3.73	0.21	3.30	4.17	4.72	0.04	0.16
	Use digital finance tools (e.g., Xero, Books, Lyte Pay) to track payments from clients	26	2.39	0.27	1.82	2.95	3.65	0.21	3.23	4.08	3.50	0.22	3.04	3.96	11.13	0.003	0.31
Safety and security	Identify best practices for digital safety and security	26	3.42	0.22	2.98	3.87	3.85	0.17	3.49	4.20	4.15	0.19	3.76	4.54	11.92	0.002	0.32
Optimising profile	Use components of an effective profile to edit or update my online profile to attract potential clients	26	3.85	0.21	3.42	4.27	4.12	0.17	3.77	4.46	4.39	0.14	4.10	4.67	6.62	0.016	0.21
Pricing products and services	Set appropriate prices for my products and services so that my business is sustainable	26	3.31	0.20	2.90	3.72	3.69	0.14	3.40	3.99	4.04	0.15	3.73	4.35	13.82	0.001	0.36

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

Content and product creation	Create different formats of content (e.g., images, videos) to attract potential clients to your business profile using design platforms and software (e.g., Canva, Adobe Photoshop)	26	3.65	0.27	3.10	4.21	4.35	0.14	4.07	4.63	4.23	0.15	3.92	4.54	5.36	0.029	0.18
Information management and processing	Collect and process data for your work or business using digital tools (e.g., Microsoft Power BI, Tableau, HootSuite)	26	2.50	0.26	1.96	3.04	3.15	0.16	2.82	3.49	3.19	0.24	2.69	3.69	4.48	0.044	0.15
Programming fundamentals	Identify basic components of HTML and CSS	26	2.65	0.27	2.11	3.20	3.08	0.20	2.67	3.49	3.04	0.25	2.53	3.54	2.18	0.153	0.08
Digital marketing	Craft a brand story	26	3.00	0.24	2.52	3.49	3.85	0.20	3.44	4.25	4.04	0.21	3.60	4.47	15.59	<.001	0.38
	Create a marketing audience persona	26	3.04	0.20	2.62	3.46	3.89	0.19	3.50	4.27	3.96	0.18	3.59	4.33	16.36	<.001	0.40
	Create a cross-channel digital marketing strategy for a business	26	2.69	0.22	2.24	3.15	3.65	0.19	3.26	4.05	3.85	0.18	3.47	4.22	20.91	<.001	0.46
Social media (Creative and Multimedia only)	Identify the most suitable social media channel(s) to promote a business	26	3.38	0.20	2.97	3.80	4.31	0.13	4.03	4.58	4.27	0.15	3.96	4.58	13.16	0.001	0.35
	Create different types of video content (e.g., livestreaming, short videos) for various social media channels (e.g., TikTok, Instagram)	26	3.62	0.21	3.19	4.04	4.15	0.15	3.84	4.47	4.08	0.17	3.74	4.42	4.87	0.037	0.16
	Create a social media strategy for a brand or campaign using insights from social media metrics and tools (e.g., Google Trends, TikTok Creative Centre, Hubspot, Mention)	26	2.89	0.24	2.38	3.39	3.58	0.18	3.21	3.94	3.81	0.20	3.40	4.22	11.11	0.003	0.31

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

Table C8: Summary of Repeated Measures ANOVA for Learning Outcomes, Sales and Marketing Group

Skill	Task	N	T1			T2			T3			Within-subject contrast					
			Mean	SE	95% CI		Mean	SE	95% CI		Mean	SE	95% CI		F	p (linear)	Partial Eta Square d
					Low	High			Low	High			Low	High			
Problem solving	Use search engines (e.g., Google, Bing, Yahoo) to help solve problems in your work	26	4.42	0.19	4.04	4.81	4.50	0.13	4.24	4.76	4.65	0.14	4.38	4.93	1.21	0.282	0.05
Basic digital operations	Use instant messaging platforms (e.g., WhatsApp, Telegram, Facebook Messenger) as a business communication tool	26	4.65	0.12	4.40	4.91	4.42	0.14	4.14	4.71	4.73	0.13	4.46	5.00	0.16	0.691	0.01
	Use cloud platforms (e.g., Google Drive, Microsoft SharePoint) to do and store work	26	4.35	0.16	4.02	4.67	4.39	0.13	4.13	4.64	4.69	0.11	4.47	4.91	6.55	0.017	0.21
Communication and collaboration	Use videoconferencing tools (e.g., Zoom, Microsoft Teams) to conduct virtual meetings	26	4.46	0.13	4.20	4.72	4.27	0.12	4.03	4.51	4.69	0.09	4.50	4.88	2.37	0.136	0.09
	Use digital tools (e.g., Microsoft Word, Google Sheets, Tableau) to process and present text and data to business partners or clients	26	3.85	0.18	3.47	4.22	4.08	0.17	3.74	4.42	4.31	0.17	3.95	4.67	4.27	0.049	0.15
Organisation and project management	Use project management tools (e.g., Notion, Trello, Asana) to plan and manage project timelines	26	3.15	0.26	2.62	3.69	3.73	0.20	3.33	4.14	3.65	0.18	3.28	4.03	3.65	0.068	0.13
	Use digital finance tools (e.g., Xero, Books, Lyte Pay) to track payments from clients	26	2.73	0.24	2.24	3.22	3.65	0.21	3.23	4.08	3.39	0.17	3.04	3.73	5.80	0.024	0.19
Safety and security	Identify best practices for digital safety and security	26	3.42	0.19	3.04	3.81	3.69	0.16	3.35	4.03	3.81	0.16	3.48	4.13	2.99	0.096	0.11
Optimising profile	Use components of an effective profile to edit or update my online profile to attract potential clients	26	3.73	0.17	3.38	4.08	4.00	0.14	3.72	4.28	4.04	0.15	3.73	4.35	4.55	0.043	0.15

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

Pricing products and services	Set appropriate prices for my products and services so that my business is sustainable	26	3.46	0.19	3.06	3.86	3.54	0.18	3.17	3.90	3.77	0.18	3.40	4.14	2.86	0.103	0.10
Content and product creation	Create different formats of content (e.g., images, videos) to attract potential clients to your business profile using design platforms and software (e.g., Canva, Adobe Photoshop)	26	3.42	0.21	2.99	3.85	3.73	0.18	3.36	4.10	3.81	0.18	3.43	4.19	3.68	0.067	0.13
Information management and processing	Collect and process data for your work or business using digital tools (e.g., Microsoft Power BI, Tableau, HootSuite)	26	2.81	0.22	2.37	3.25	3.35	0.17	3.01	3.69	3.19	0.16	2.87	3.52	3.98	0.057	0.14
Programming fundamentals	Identify basic components of HTML and CSS	26	2.08	0.21	1.64	2.52	3.19	0.22	2.75	3.64	2.92	0.22	2.47	3.38	10.25	0.004	0.29
Digital marketing	Craft a brand story	26	3.04	0.24	2.55	3.53	3.73	0.14	3.44	4.02	3.54	0.18	3.17	3.90	4.01	0.056	0.14
	Create a marketing audience persona	26	3.08	0.27	2.52	3.64	3.77	0.15	3.46	4.08	3.65	0.19	3.26	4.05	4.67	0.041	0.16
	Create a cross-channel digital marketing strategy for a business	26	2.92	0.23	2.45	3.39	3.65	0.15	3.35	3.96	3.46	0.20	3.05	3.88	5.17	0.032	0.17
Analytics (Sales and Marketing only)	Identify business problems and sources of data	26	3.27	0.20	2.86	3.67	3.54	0.17	3.19	3.89	3.58	0.17	3.23	3.92	4.55	0.043	0.15
	Make sense of data and answer business problems using data	26	3.31	0.21	2.88	3.73	3.58	0.16	3.25	3.90	3.54	0.15	3.23	3.85	2.08	0.161	0.08
	Present and compare data using various forms of visual representation (e.g., Pivot Tables, dashboards)	26	2.89	0.24	2.40	3.37	3.31	0.21	2.88	3.73	3.46	0.16	3.13	3.79	5.64	0.026	0.18

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew and B. Tan

APPENDIX D: EXISTING SUPPORT

Table D1: Support Accessible by Own-Account Workers in Singapore

Type of Support	Examples
Financial assistance	<ul style="list-style-type: none"> - SkillsFuture credits (a one-time deposit of \$500 for all Singaporeans above 25 years of age) - SkillsFuture Level-Up Programme for mid-career workers (announced in February 2024, for Singaporeans aged 40 and above) <ul style="list-style-type: none"> - \$4,000 SkillsFuture Credit top-up in May 2024 - From 2025, Singaporeans aged 40 and above can apply for a training allowance when taking selected full-time, long-form programmes of up to 50 per cent of their average income over the past year, capped at \$3,000 for up to 2 years - Enhanced subsidies of up to 90 per cent of course fees for SSG-supported courses and MOE-subsidised courses from 2025 - COVID-19 SkillsFuture credit top up (in October 2020, Singaporeans above 25 years of age received \$500, additional \$500 for Singaporeans aged 40 to 60) - SkillsFuture Study Award (discontinued as of April 2022, \$5,000 monetary award to defray out-of-pocket course expenses for mid-career Singaporeans) - Workfare Skills Support (WSS) Scheme (SEPs aged above 30 whose average gross monthly income is less than \$2,500 can receive \$6 for each hour of self-funded training attended and

IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew
and B. Tan

	<p>up to a \$1000 cash reward for completing training²⁴)</p> <ul style="list-style-type: none"> - NTUC Training Fund (discontinued as of 31 March 2022, SEPs received between \$7.50 and \$11 for every hour of training attended) - IMDA T-Assist (discontinued as of 31 March 2021, up to \$3,000 worth of course subsidies for Singaporeans) - NTUC's Union Training Assistance Programme (helps NTUC members defray up to \$500 for up to 50 per cent of the course fees remaining after applicable government subsidies such as SkillsFuture credits)
<p>Digital skills course portals and digital upskilling programmes</p>	<ul style="list-style-type: none"> - MySkillsFuture Course Portal (one-stop online portal that helps Singaporeans make informed learning and career choices) - SkillsFuture for Digital Workplace 2.0 (updated syllabus and courses from any of SSG's training partners to learn digital skills for a particular sector) - Google Skills Ignition (digital skills course portal) - Twitter Flight School (digital skills course portal) - Upskill with Facebook Singapore (digital marketing certification programs targeted at students, job seekers, working professionals, academics and businesses) - Coursera (digital skills course portal) - Udemy (digital skills course portal)

²⁴ Note: The eligibility criteria have been updated in 2023 to increase the income cap by \$200 and cash reward by \$500, the age requirement has also been lowered by five years. There are also limitations on the type and number of properties the worker lives in and owns, as well as the property that their spouse lives in and/or owns, if the worker is married.

<p>Course recommendations guides</p>	<ul style="list-style-type: none"> - SkillsFuture and JobKred Skills Profiler (a self-assessment and training recommendation platform for small and medium enterprises that is currently being piloted, it is not available to the public or own-account workers who have not registered their business) - SkillsFuture Job-Skills Insights (resources that provides information and insights into the in-demand skills and job for the future economy) - SkillsFuture Skills Framework (provides key information on different sectors, career pathways, job roles, as well as existing and emerging skills required for the job roles) - SkillsFuture RIASEC Profiling Tool (profiling tool that describes a person's career interests)
<p>Career transition programmes</p>	<ul style="list-style-type: none"> - SkillsFuture Career Transition Programme (three- to six-month training programme with job search opportunities through a talent advisory) - SGUnited Mid-Career Pathway Programme (replaced by SkillsFuture Career Transition Programme as of April 2022) - IMDA Tech Immersion and Placement Programme (convert non-ICT professionals into industry-ready ICT professionals through a placement in tech job roles, after undergoing a short intensive and immersive training programme) - #GetReadySG initiative (upskill 1,000 early-career and mid-career Singaporeans for tech job) - Grab Academy (digital onboarding, refresher courses and ICT courses for Grab Drivers) - Free courses for certain Foodpanda drivers (access to Gnowbe learning platform)

APPENDIX E: ABOUT THE AUTHORS

Carol SOON is Principal Research Fellow at the Institute of Policy Studies (Lee Kuan Yew School of Public Policy, National University of Singapore) where she heads the Society and Culture department. Her research interests include false information, media regulation, digital inclusion, and public engagement. She has published her research in books and peer-reviewed journals such as the *Journal of Computer-Mediated Communication*, *Asian Journal of Communication and Public Integrity*. Carol is also Associate Director of the Asia Journalism Fellowship and Vice Chair of Singapore's Media Literacy Council.

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IPS Working Papers No. 58 (October 2024):

Digital Capacity Building for Own-Account Workers in Singapore by C. Soon, H.E. Chew

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