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FACTORS INFLUENCING FUTURE WORKFORCE READINESS FOR DIGITAL TRANSFORMATION AMONG SCM STUDENTS: A STUDY AT POLYTECHNIC SEBERANG PERAI

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ABSTRACT

The supply chain industry is experiencing pressure to integrate digital technologies into its operations, creating demand for a tech-savvy and future resilient workforce. This study investigates the readiness of Malaysia's Technical and Vocational Education and Training (TVET) students for digital transformation in logistics and supply chain field. As the industry revolution reshapes the workforce demands, this research (1) investigates the level of digital literacy skill, (2) examines the relationship of digital literacy skills, training development, and curriculum towards future workforce readiness, (3) analyses the significant differences of future workforce readiness among different group of students. A purposive sampling technique and self-administrated questionnaire was employed to collect data of 174 students from Semester 4, Semester 5 and Semester 6 (Internship) students enrolled in the Diploma in Logistics and Supply Chain Management at Polytechnic Seberang Perai, Penang. Descriptive analyses revealed, that student have high level of digital literacy skill. Pearson's correlation analysis indicated a strong positive relationship between digital literacy skills, training development and curriculum towards workforce readiness. Analysis of variance (ANOVA) results showed no statistically significant differences across group of students, indicating workforce readiness is not influenced by different semester level. The findings of this research suggested that there is a need to strengthen digital literacy skills development, regularly update of curriculum, and provide continuous access to digital learning infrastructure. This study contributes to TVET institutions and policy-makers by providing empirical evidence to develop strategies which provide technology access, aligns curriculum with skill development to produce a resilient supply chain workforce.

Keywords: Future Workforce Readiness, Digital Literacy Skills, Talent Development, TVET

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ABSTRAK

Industri rantaian bekalan mengalami tekanan untuk menyepadukan teknologi digital ke dalam operasi, sekali gus mewujudkan permintaan terhadap tenaga kerja yang celik teknologi dan berdaya tahan pada masa hadapan. Kajian ini bertujuan untuk menyiasat tahap kesediaan pelajar Pendidikan dan Latihan Teknikal dan Vokasional (TVET) di Malaysia terhadap transformasi digital dalam bidang logistik dan rantaian bekalan. Selaras dengan perubahan permintaan tenaga kerja disebabkan revolusi industri, penyelidikan ini (1) menilai tahap kecekapan literasi digital pelajar, (2) mengkaji hubungan antara kecekapan literasi digital, pembangunan latihan, dan kurikulum terhadap kesediaan tenaga kerja masa hadapan, (3) menganalisis perbezaan ketara kesediaan transformasi digital dalam kalangan kumpulan pelajar yang berbeza. Persampelan bertujuan dan soal selidik ditadbir sendiri telah digunakan untuk mengumpul data 174 pelajar semester 4, semester 5 dan semester 6 (latihan industri) dalam program Diploma Logistik dan Pengurusan Rantaian Bekalan di Politeknik Seberang Perai. Hasil analisis deskriptif mendedahkan, tahap kesediaan pelajar adalah tinggi. Analisis Korelasi Pearson mendapati hubungan positif yang signifikan antara kecekapan literasi digital, pembangunan latihan dan kurikulum terhadap kesediaan tenaga kerja. Keputusan Analisis varians (ANOVA) menunjukkan tiada perbezaan yang signifikan secara statistik antara kumpulan pelajar yang berbeza, menandakan tahap kesediaan tenaga kerja tidak dipengaruhi oleh tahap semester yang berbeza. Dapatan kajian ini mencadangkan bahawa terdapat keperluan untuk memperkukuhkan kecekapan literasi digital, serta memastikan penyelarasan kurikulum dengan industri dilaksanakan secara berkala. Selain itu, kajian ini juga mencadangkan bahawa penyediaan akses secara berterusan kepada infrastruktur pembelajaran digital perlu diberi perhatian. Kajian ini memberi sumbangan kepada institusi TVET dan pembuat dasar dengan memberikan bukti emprikal dalam merangka strategi untuk pembentukan tenaga kerja yang berdaya tahan dalam industri rantaian bekalan.

Kata Kunci: Kesediaan Tenaga Kerja, Kecekapan Literasi Digital, Pembangunan Bakat, TVET

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LIST OF ABBREVIATIONS

TVET	Technical and Vocational Education and Training
AI	Artificial Intelligence
ASEAN	Association of Southeast Asian Nations
DLS	Diploma in Logistic and Supply Chain Management
DLSF	Australia's Digital Literacy Skills Framework
EFA	Exploratory Factor Analysis
ERP	Enterprise Resource Planning
ICT	Information and Communication Technology
IoT	Internet of Things
IR4.0	Industry 4.0
KMO	Kaiser-Meyer-Olkin
MIDA	Malaysian Investment Development Authority
MOHE	Ministry of Higher Education
MQF	Malaysian Qualifications Framework
PLO	Program Learning Outcomes
PSP	Polytechnic Seberang Perai
SCM	Supply Chain Management
SDG	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
UNESCO'S	United Nations Educational, Scientific and Cultural
ICT-CFT	Organization's Information and Communication Technology Competency Framework for Teachers

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CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Technological advancement has essentially reshaped the industries across the world. Since digital revolution took place, there has been a critical need for workforce with digital literacy skills. Technical and Vocational Education and Training (TVET) has been a backbone in producing future workers with these critical skills as economies shift toward automation and digitalization. Polytechnics in Malaysia, as the essential part of the TVET system, are responsible in preparing students towards the technology driven economy. Nevertheless, the concerns are on how well the institutions efficaciously prepare the students for the digitalized industries.

Smart technologies integration such as big data analytics, Internet of Things (IoT), and Artificial Intelligence (AI) are the dominant of the digital transformation in most of the sector including Supply Chain. Supply Chain operations are improved through enhanced predictive analytics, automation, and monitoring. It is recognized as a crucial element in the current global market to boost competence and resilience (Ivanov, 2024). Aligning with the need of Industry 4.0, the need for a digital competent workforce increases to ensure successful deployment of the technologies (Foroughi, 2020).

In Malaysia, technology integration is essential as the manufacturing and supply chain industries play a significant role in the country's economy. IR4.0 National Policy (Industry4WRD), is one of the policies which the government has referred to address this discrepancy of digital readiness and workforce (Ministry of International Trade

and Industry, 2018). To increase competitiveness, policy places a strong emphasis on industries implementing technologies like IoT, predictive analytics, big data, and AI. This demonstrated a disparity as the statistics of 7.9% of Malaysia graduates working in Information and Communication Technology (ICT) related positions which does not utilize their qualifications, alongside with the country's unemployment rate in May 2025, which was 3.0% (Department of Statistics Malaysia, 2025). Figure 1 shows the graduates statistics of year 2023.

Working Graduates ('000)	
4,755.8	

Gender ('000)	
Male	2,294.0
Female	2,461.8

Strata ('000)	
Urban	4,361.3
Rural	394.5

Ethnicity ('000)	
Bumiputera	3,044.6
Chinese	1,273.0
Indian	342.9
Others	95.3

Certificate ('000)	
Diploma	2,056.3
Bachelor's Degree	2,699.5

Sector ('000)	
Agriculture	83.0
Mining & Quarrying	46.8
Manufacturing	637.9
Construction	301.1
Services	3,687.0

Skills ('000)	
Skilled	3,214.9
Semi-skilled	1,489.0
Low-skilled	51.8

Age Group ('000)	
≤ 24	337.5
25-34	1,730.9
33-44	1,648.9
≥ 45	1,038.4

Employment Status ('000)	
Employer	251.4
Employee	4,156.0
Sel-employed	310.7
Unpaid Family Work	37.6

Figure 1.1
Working Graduates Statistics 2023
Source: Department of Statistics Malaysia (2025)

The challenges caused by the skills gap are clearly visible in supply chain industry. According to a report by Syslo et al. (2024), 83% of professionals from the biopharma and manufacturing sector admit that their workforce requires intensive training in digital literacy skill in order to succeed. About 53% of the organisations were unable to achieve digital transformation as there is shortage of qualified workforce (ToolsGroup B.V, 2022). Hence, this underlines the urgent need to equip Malaysian workforce with the fundamental digital literacy skills as demanded by the industry.

Consequently, through the effort of addressing this divergence, Malaysia's education and training systems, especially TVET institutions, ought to be involve. These institutions are responsible to prepare the skills which are applicable to the industry demands towards rapidly digitizing economy. However, previous studies point out that a large number of TVET graduates are lack of digital literacy skills needed for sector such as Supply Chain Management (SCM) (Rahmat et al., 2021). Malaysia Government introduced, The National TVET Policy 2030, aiming to make sure that Malaysia's workforce is digitally competent and in line with changing industry demands (National TVET Council Secretariat, 2024). Even though these policies indicate a promising step, barriers still persist, such as outdated curriculum, gaps in the integration of curriculum with corporate demands, and a lack of digital resources (Abd Hamid et al., 2023). These becomes a stonewall to the process of preparing TVET graduates for positions in industries moving towards digital transformation.

Malaysia has attempted to solve these issues by integrating global standards and principles into its TVET curriculum. Digital Literacy Skills Framework (DLSF) in Australia is one of the examples that highlights essential skills like data management and digital collaboration are vital. Whereas the European Framework for the Digital Competence of Educators (DigCompEdu) focuses on integrating digital tools into instructional strategies (UNESCO-UNEVOC, 2024). The implications of incorporating digital literacy skills into vocational education worldwide are also highlighted by United Nations Educational, Scientific and Cultural Organization's (UNESCO) TVET Strategy (2022–2029), which aims to prepare students for the demands of the digital economy (UNESCO, 2021).

Despite the strategic attempts, the gap between the policy and the hands-on implementation remains unchanged in Malaysia's TVET landscape (Amin et al.,

2023). As illustrated in Figure 1.2, a framework proposed by Zhong & Juwaheer (2024) emphasizes the roles of the key players whom are leaders, teachers and the learners in enhancing the digital competence within the TVET. According to the Malaysia Investment Performance Report (2018–2023) published by the Malaysian Investment Development Authority (MIDA) even though a significant investment in digital infrastructure has been done, the adoption of technologies such as AI, big data and automation in supply chain operations is still found to be weighed down by the skills-technology gap.

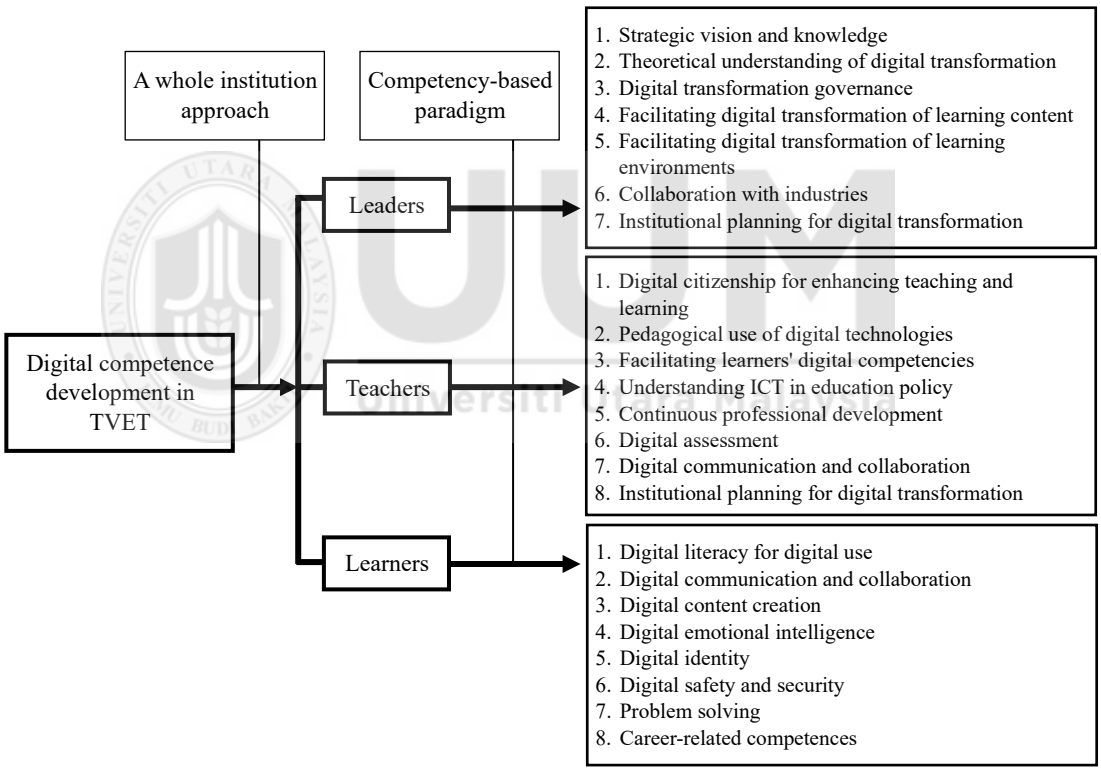

Figure 1.2
Proposed Framework of The Development of Digital Competence in The Context of TVET Source: Zhong & Juwaheer (2024).

Malaysia's TVET curriculum needs to be re-evaluated as SCM becomes more digitalized. Therefore, to ensure the graduates are possessed with adequate skills needed by the digital economy, the educational programs need to be in in line with the

industry demands. The implications of these initiatives not only focus on improving workforce preparedness, but eventually it contributes to Malaysia's competitiveness internationally (Malaysian Investment Development Authority, 2022). Although Malaysia has proven initiates to encourage digitalization in its TVET system, there persist major obstacles to overcome the issues of polytechnic student's readiness towards digitalized economy. By filling in these gaps, this study hopes to contribute useful insights to improve TVET graduates' digital readiness.

1.2 Problem Statement

Global supply chain sector is being dominated by a major transformation of Fourth Industrial Revolution (IR4.0). New technologies like automation, IoT, AI, and big data analytics are being replaced for the traditional SCM processes. These developments need a strong workforce with strong digital literacy skills in order to successfully handle the intricacies of digitalized supply chains. Being mindful with this, program such as Malaysia Digital Economy Blueprint and the RM6.8 billion allotted by the Malaysian government in the MADANI Budget 2024, showcases the importance of digital literacy skills as the top priority in the economy (Economic Planning Unit, 2021; Bernama, 2024b). By equipping the students with technical abilities to satisfy the needs of the rising development of the industry, these investments seek to establish the TVET institution as the driving factor towards workforce transformation.

However, considerable barriers do persist in the way of reaching these goals. There are still large skill gaps in the Malaysian workforce in most industries, including SCM (Rahmat et al., 2021). Research indicates that there is still a gap between TVET programs outcomes and industry demands. This is particularly in SCM student's exposure to digital tools like real-time inventory systems, blockchain technology, and

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predictive analytics (Rajamanickam et al., 2024). Moreover, another gap was found in TVET programs' alignment, where outdated curriculum causing barriers to guarantee that learning outcomes will appease industry and academic standards (Jamaludin et al., 2023). These barriers are even complicated by issues like outdated curriculum, inadequate training for instructors and limited access to technology (Keevy et al., 2021; Rikala et al., 2024).

Despite few programs like the National TVET Policy 2030 and the Malaysia Digital Economy Blueprint provides a groundwork for a shift, their practical application is still contradictory, especially in SCM education. Even supposing current solution such as modernizing the curriculum through industry partnership have been suggested, it still fail to focus on the SCM needs. According to a study by Hussein et al. (2024), examined the method of incorporating digital literacy skills, but it overlooked the specific requirements of SCM. Correspondingly, while highlighting curriculum alignment, Jamaludin et al. (2023) did not apply for SCM students. Thus, this limitation becomes a stonewall to develop training that is applicable to the real world which leads to low skilled students. Keevy et al., (2021) pointed barriers in obtaining digital literacy skills as a significant obstacle to workforce readiness. However, it is uncertain whether student preparedness in the Malaysian TVET context is genuinely affected by these barriers. This study aimed to critically examine this assumption.

This research addressed to fulfil the voids by looking into the digital literacy skills of SCM students in Malaysian TVET institutions. It assessed their digital literacy skills, evaluate TVET curriculum, and look into training development barriers to digital literacy skills acquisition. This study offers practical suggestions to educators and policy makers by concentrating on SCM students. It also ensures that graduates are

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prepared to excel in Malaysia's changing digital economy. Thus, in an overview, this study contributes to the Malaysia's goal of producing a competitive, technologically savvy workforce that can drive economic expansion and seize IR4.0 opportunities.

1.3 Research Objectives

Today the world is heading towards the fast-changing technology environment, specifically in SCM, which relies highly on the digital expertise of their employees for achieving success and staying competitive. Polytechnics in Malaysia which provide TVET programs have a vital part in training students for the digital needs of today's industry. However, the problem of the rising scarcity of digital talent in the supply chain sector presents barriers to students and companies. With that in mind, the primary goal of this research was to address the following research objectives:

a. To investigate the level of digital literacy skills of Diploma in Logistic and Supply Chain Management (DLS) students in Polytechnic Seberang Perai (PSP).
b. To examine the relationship of digital literacy skills, training development, and curriculum on future workforce readiness among DLS students.
c. To analyse the significant differences of future workforce readiness among different group of students.

1.4 Research Questions

To achieve the objective of the study, this study employed the following research questions:

a. What is the current level of digital literacy skills among DLS students in Polytechnic Seberang Perai?

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b. Is there a significant relationship between digital literacy skills, training development, and curriculum on future workforce readiness among DLS students?
c. Is there significant difference in the level of student's readiness among different PSP DLS student groups?

1.5 Significance of Study

This study increases the grasp of digital literacy skills in SCM education, specifically within PSP, a Malaysian TVET institution system. This research highlights the discrepancies found in the past studies on digital literacy skills in vocational education. Although there is an increasing number of studies focusing on digital literacy skills in different sectors, yet it happens to have limited study on how effectively TVET programs in Malaysia are equipping supply chain undergraduates for IR4.0. A study by Jia & Huang (2023), underscored the importance of digital literacy as a feature of vocational education to prepare the students for jobs in today's workplaces.

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This research addressed the emerging research gap of assessing the readiness of Polytechnic Seberang Perai's, Diploma in Logistic and Supply Chain Management (DLS) students for IR4.0 under the Malaysian Qualifications Framework (MQF) system of Malaysia. The study's primary goal with a focus on the competencies that are required at IR4.0, is to develop a research framework that shows the relationship between digital literacy skills to curriculum. This framework provides policymakers and educators with direction to enhance curriculum development and skill assessment. This study also intended to highlight the importance of equipping students with necessary digital literacy skills. The study's finding will be impactful for a wide range of stakeholders.

1.5.1 TVET Institutions

The study highlights how TVET institutions, need to restructure their curriculum to align with digital literacy skills. The primary goal of this alignment was to bridge the gap between student readiness in terms of digital literacy skills towards the enhanced digitalized world especially in supply chain industry.

1.5.2 Policymakers

Current educational policies like the National TVET Policy 2030 and the Malaysia Digital Economy Blueprint are currently dealing with the skills gap in the job market. This study pinpointed the training development related barrier encountered by PSP's DLS students in gaining digital literacy skills. This would assist in implementing more focused solutions like enhancing industry-academia collaborations and enhancing digital facilities in institutions.

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1.5.3 Industry Collaboration

This research highlights the significance of collaborating with educational institutions to ensure that the upcoming workforce possesses essential digital literacy skills. Organizations or the industry players must actively participate in collaborating with TVET institutions to give feedback on curriculum development and provide internships or training programs that expose students to practical use of digital tools.

1.5.4 TVET Students / Undergraduates

This study focused on helping TVET students particularly those at PSP, to succeed in the fast-changing SCM industry by highlighting the key digital literacy skills they need to acquire. Student's chances of finding employment could boost if they are aware of the talents that match IR4.0 standards. By doing so, it's believed that it would

contributes to their professional development and ensures that they are better prepared to meet the challenges of industry.

In conclusion, this study would contribute to create a future-ready, more competitive workforce that can thrive in the global SCM sector.

1.6 Scope of the Study

This study examined the digital literacy skills of PSP's DLS programme students and their readiness to support the digitalization supply chains. The study examined the specific digital literacy skills of these students in the context of SCM, assessing how closely these skills match the curriculum. It also highlighted the training development related barrier faced by students in acquiring necessary digital literacy skills. Recent studies found TVET graduates in Malaysia frequently demonstrate inadequate skills in technology. This is particularly in computer literacy tools and data management which are very crucial for efficient supply chain operations (Halik Bassah, 2022). Therefore, there is a comprehensive evaluation of this study to understand the current state of the student's digital literacy skills and their competencies to the evolving SCM industry.

The demand for SCM students to be ready for the industry's digital transformation is growing. The need for skilled workforce also increases as the reliance of SCM on technology increases. A report by MHI & Deloitte (2023) found the main issues in supply chains as the management of risks and readiness levels of employees. The study revealed that a large number of leaders are focusing on digital literacy skills to tackle upcoming disruptions, where many organizations are upskilling their existing workforce on the technology. Therefore, this study assessed PSP student's current

digital literacy skills, drawing attention to both their academic preparation's advantages and disadvantages.

Malaysia's economic competitiveness relies on its capacity to develop a workforce skilled in both traditional supply chain methods and digital technologies. This study evaluated how well PSP attains these two goals and also how their educational outcome relates to national policy as listed in the National TVET Policy 2030 (National TVET Council Secretariat, 2024). The findings serve as a guide for both the educators and policy makers at PSP to ensure they align with industry demands in producing digitally skilled graduates.

DLS students enrolled at PSP were the study's specific target population. Since this group of students are the future workforce of the rapidly changing SCM industry, it's vital for them to be prepared for it. Based on Malaysia's efforts to improve the effectiveness of its TVET system in support of its overall economic development plan, learning the extent to which these TVET institutions are preparing students with essential digital literacy skills is crucial.

This research utilized a quantitative methodology to systematically collect and analyse data. Questionnaire distributed to DLS students at PSP. The data collected statistically was analysed to discover and report the patterns, relationships and weaknesses in student's digital literacy skills. Hence, this perspective sheds light on the readiness of PSP students to address the challenges brought by IR4. 0.

1.7 Definition of Key Terms

The key terms employed in this study are explained in this section.

1.7.1 Digital Literacy Skill

Being skilled in digital technologies involves using devices such as computers, smartphones, and tablets proficiently to search for, assess, use, share, and generate digital materials. This concept includes various skills beyond just technical abilities, combining expertise with analytical comprehension, work ethics, and personal characteristics (Carl & Worsfold, 2021).

1.7.2 Training Development

In the context of an organization, training and development is a crucial tool used to maximize employee performance. It also promotes their advancement in terms of effectiveness, productivity, job satisfaction, motivation, and creativity (Arulsamy et al., 2023).

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1.7.3 Curriculum

Curriculum is also referred as a Learning outcome. It's defined as a written statement of what a graduate or learner is expected to be able to achieve by the end of their programme or by the time they graduate (Adam, 2004).

1.7.4 Digital Transformation

Digital transformation means enterprises using basic digital technology to transform it into enhanced technology to enhance or redesign the economic activities and improve the efficiency of resources allocation (Qin et al., 2024).

1.7.5 Future Workforce

Workforces that are prepared for anything, with the strengths and tools to flourish and steer clear of failures and barriers not yet envisioned. The future-ready workforce must be elastic, and open-minded, to deal with future inevitable changes (Deloitte, 2024).

1.8 Organization of the Thesis

This dissertation contains of five chapters. The following is the summary of the chapters:

In Chapter One, an overview of the research is provided. It includes the background of the study, problem statement, research objectives, research questions, significance and contribution of the study, scope of the study, definitions of key terms and organization of the research.

Chapter Two discusses the existing literature review as the fundamental of this research. This chapter discuss on the SCM student's digital proficiency in TVET institutions. Conceptual frameworks and theoretical fundamentals related to this research of supply chain course and the need of digital literacy skills in SCM will be reviewed. Towards the end of the chapter, gaps in the literature as the foundation for bridging the digital gaps for future workforce was addressed.

In Chapter Three, the research methodology is discussed. It consists of hypothesis developments, research design, sampling techniques, data collection and techniques of data analysis.

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Chapter Four reports the data analysis conducted using Statistical Package for the Social Sciences (SPSS) version 29.0 results. This section included pilot test results, reliability testing, descriptive statistics, Exploratory Factor Analysis, correlation to test the hypotheses and ANOVA.

Chapter Five presents the interpretation of the results based on the data analysis. It highlights the key finding such as acceptance and rejection of hypothesis, limitation of the study, implication of the research to the stakeholders, and suggestion for the future researchers.

1.9 Chapter Summary

This chapter discussed the effects of digital transformation on Malaysia's supply chain industry. The existing digital literacy skill gaps in Malaysia's workforce, and difficulties in integrating industry demands with educational outcomes were discussed. Moreover, practical and theoretical implications of enhancing digital literacy skills were taken into consideration. Finally, it highlighted the roles that policymakers, and TVET institutions play in closing these skill gaps and creating a workforce that is tech-savvy and future-proof for Malaysia's emerging digital economy.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses digital literacy skills in SCM education by examining the definitions, concepts, and research frameworks available in the past studies. The first section examined the concept of digital transformation and its importance in a variety of industries, including SCM. This chapter highlighted gaps discovered in the current literature, which served as the foundation for the study's research framework.

2.2 Digital Transformation

The advancement of technology has led to innovation in a variety of industries. The way the business operates was driven by the advancements of technology in the concept of digital transformation. The IR4.0 has significantly brought in changes in most of the industries in the global market. A process by which individuals or organization utilizes the data and digitally process it to improve operational efficiency is known as digital transformation. World Economic Forum (2020) highlighted within the next decade, digital literacy skills will be required for 90% of all global jobs. Malaysian polytechnics, as the educational institutions of Malaysia, is essential for the development of skilled workers for industries such as SCM. Yet, a significance challenges takes place in meeting the demands of IR4.0 as both industries and students are hampered by a growing digital talent shortage.

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2.2.1 Digital Transformation in Education

Education serves as a crucial responsibility in developing digital literacy skills among students, who will be a part of the future workforce. A study by Inamorato dos Santos et al. (2023) outlined graduates must equip themself with digital literacy skills in order to develop their careers and capitalize on opportunities created by technological advancement. The academician at the university plays an important role in assisting students to build digital proficiency. In the opinion of Khan et al. (2022), one of the approaches to encourage skill development is by integrating advanced learning systems as it helps to improve digital literacy.

The Malaysian government launched a number of initiatives to improve TVET under the Twelfth Malaysia Plan (RMK-12). RM1.2 billion was allocated for TVET, RM7.8 billion to empower industry partnerships and support underprivileged youth, and RM500 million through the Skills Development Fund Corporation for training in emerging fields like electric vehicles, aerospace, and AI (Bernama, 2024a). These initiatives seek to close skill gaps and create a workforce capable of thriving in the digital economy.

Two strategic plans that the Ministry of Higher Education has put forth which are the Ministry of Higher Education (MOHE) Digitalisation Strategic Plan 2021-2025 and the Malaysian Higher Education Action Plan 2022-2025 respectively handles ICT issues and enhance institutional digital delivery systems (Ministry of Higher Education, 2022). It emphasizes digital literacy skills along the curriculum, towards eliminating the digital literacy skills gap in TVET programs and building a workforce with digital literacy skills.

2.3 Digital Literacy Skill among SCM Students

Academic performances and employability are often impacted due to student's digital literacy, especially in this digital age (Khan et al., 2022). Student possessing strong digital literacy improves academic performance and are more competitive in the labour market. Furthermore, digital resilience has turn up as a critical competency in contemporary workforce environment. This emphasizes how significance it is to equip students with strong digital literacy skills so they can succeed in today's ever-changing workforce.

The need for advanced digital literacy skills is clearly visible through the shift to IR4.0 which has drastically transformed workforce requirements. Skill mismatches contributing to rising youth unemployment rates indicates that the IR4.0 shift has a direct impact on graduate employability (World Economic Forum, 2020). By 2032, it is expected that 90% of global employment will require advanced digital literacy skills. Skills like robotics and AI are reshaping industries and redefining job opportunities (Md Hani et al., 2024). With skilled employment rising from 25% in 2015 to 35% by 2025, shift to a skill-based economy was proposed by The Twelfth Malaysia Plan. In contrast, low-skilled and semi-skilled occupations are expected to decline. This highlights the urgent need for an education system that emphasizes technical and digital literacy skills (Economic Planning Unit, 2021). Figure 2.1 shows the employment by skills category which indicates the urgency for skilled workforce.

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Item	Employment by Skills Category						Average Annual Growth Rate, %	
	Actual				Target			
	2015		2020		2025		Eleventh Plan	Twelfth Plan Target
	'000 person	% to Total	'000 person	% to Total	'000 person	% to Total	2016 - 2020	2021 - 2025
Skilled	3,587.50	25.5	4,369.30	28.9	5,652.50	35	3.9	5.2
Semi-Skilled	8,534.30	60.7	8,882.00	58.8	8,721.90	54	0.8	-0.4
Low-Skilled	1,945.90	13.8	1,844.70	12.2	1,776.40	11	-1.1	-0.8
Total Employment	**14,067.70**	**100**	**15,096.00**	**100**	**16,150.80**	**100**	**1.4**	**1.4**

Figure 2.1:
Employment by Skills Category, 2015-2025
Source: Economic Planning Unit (2021b)

The proliferation of IR4.0 technologies, has led to digital literacy skill competency emerging as an increasingly critical competency in the field of SCM. For example, these can be understood as digital literacy skills used to apply relevant technological tools for improving the management of supply chains, making informed decisions, and adapt digital economy requirements. These skills are now being considered essential for producing an employable workforce equipped for participating in the digital transformation of businesses (Adnan et al., 2021).

The skills of using digital tools, systems and practices in particular professional contexts, is one example of introducing digital literacy skills. In this context, these are necessary skills to utilize within TVET programs theoretical knowledge with a practical application aimed to align with the broader objective of delivering job-ready graduates (Rajamanickam et al., 2024). However, the process of acquiring digital literacy skills is not homogeneous across institutions and is often influenced by the quality of curriculum design, institutional resources, and the impact of industry-related technologies (Hussein et al., 2024).

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Although need for digital literacy skills grows, there is still a major workforce gap. According to Bergson-Shilcock et al. (2023), 32% of workers do not have the digital literacy skills required for 80% of middle-skill jobs. This skills gap has left an estimated 13 million advanced digital positions unfilled worldwide. Even jobs with lower educational requirements now require digital literacy skills as shown in Figure 2.2, for example, 92% of job postings for high school-level positions specify at least one digital literacy skill (Bergson-Shilcock et al., 2023). The outcome emphasizes how important it is to provide a fundamental training and educate the students to bridge the discrepancies.

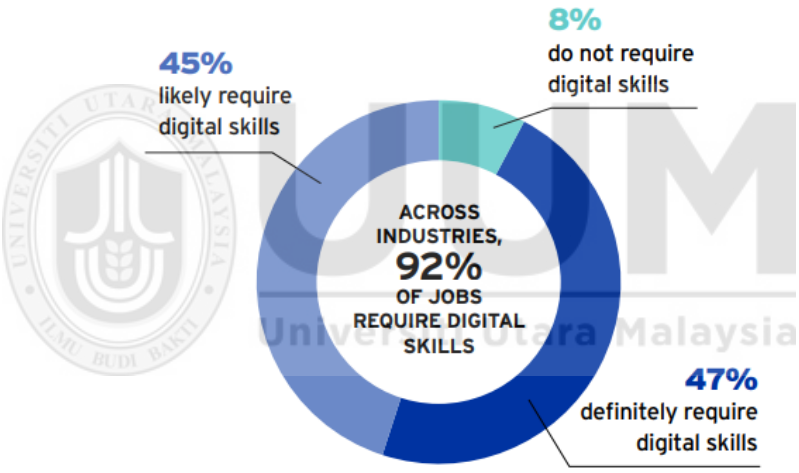

Figure 2.2:
Industry Requirement of Digital Literacy Skills
Source: *Bergson-Shilcock et al. (2023)*

Literature shows the significance of digital literacy skills in SCM education due to raising operational efficiency and competitiveness in the global market. For instance, Fadzil et al. (2022) found that SCM graduates who possess strong digital literacy skills will be more employable as organizations now prefer candidates who have proficiency in digital tools. Similarly, Shafieek et al. (2024) demonstrated high-level digital

literacy skill students are typically excellent in technology-based classes and hands-on activities, leading to increased employability.

However, noticeable gaps remain regarding the provision of skills for TVET students to instil essential digital literacy skills which are seen as predominant. These kinds of organizations have to deal with multiple layers of barriers, including poor access to modern-day technology, ageing infrastructure, and not having trained instructors who are proficient at using digital devices. Furthermore, a lack of application and practice inhibit the development of digital literacy among students (Rajamanickam et al., 2024; Keevy et al., 2021). The barriers also show a large discrepancy between the digital literacy skills imparted in TVET and what the SCM sector needs.

Aligning the digital literacy skills with the curriculum has been characterized as a significant approach to bridging this gap in Malaysia. Hussein et al. (2024), pointed out that integrating digital literacy skill outcomes in TVET curriculum enhances student's preparedness for the workforce. At the same time this will also meet the increasing need for digitally skilled professionals. However, as emphasized by Kuntadi et al. (2022), there is a demand for a more structured approach to developing industry-based digital literacy skills related to SCM domain.

2.4 Training Development

While in the current phase of IR4.0, the exponential growth of digital literacy skill demand has urged TVET institutions to focus on enhancing student's digital expertise, students are still facing apparent difficulties in building the necessary digital literacy skills specifically required by the SCM sector. Barriers restricting the possibility of digital literacy skills training in the SCM curriculum includes technological,

organizational, and individual. Addressing these issues related to training is vital to guarantee that TVET graduates are effectively equipped for the digital requirements of modern SCM.

In some cases, few institutes lack SCM tools and technologies that are essential for study. As noted by Shafieek et al. (2024), students are limited to hands-on learning experiences, because of a lack of access to current apps and devices. This is a particularly nasty problem when we consider that SCM relies heavily on digital tools such as Enterprise Resource Planning (ERP) systems, data analytics platforms, and supply chain simulation software to fix the skills gap. Without these tools, students are not receiving the practical exposure required to bridge the gap between theory and real-life practice (Rajamanickam et al., 2024).

Insufficient training and professional development of instructors is the next challenge. The issue raises when TVET institutions that recruit talent quickly as SCM demands for scalability lacks teaching staff that are tech-savvy in fast-advancing technologies and digital trends surrounding SCM. According to Keevy et al. (2021), the basic knowledge and skills to foster digital literacy skills are not found on among many educators. Digital fluency among educators leads to an outmoded curriculum that is impoverished in terms of the technology trends in the SCM domain. Moreover, the absence of professional development programs that would assist educators to adjust to new digital tools within their teaching processes also contributes to exacerbating the problem (Md Hani et al., 2024). Without qualified instructors who are also well-versed in the digital realm, an opportunity for instructor-led teaching about digital SCM tools that require practical instructions is lost. Education is the key to improve student's digital literacy. However, as noted by Badawi and Drăgoicea (2023), the lack of information technology-based educators has posed a significant challenge to the

teaching of ICT as the quality of teaching is not up to the par and this subsequently impacts negatively the students learning for ICT. UNESCO-UNEVOC (2024) also supports this statement, where they believe, in providing the finest digital education to the students, proficient and competent educators are vital, thus upskilling the educators are an important step to achieve this. Similarly, Artacho et al. (2020) and Md Hani et al. (2024) both emphasize that lack of digital competent educators leads to difficulties associated with integrating digital classrooms. Technology integration into the learning environment remains finite, despite the availability of digital tools on the market.

Fadzil et al. (2022), elaborate that the TVET institution is unable to transform the curriculum in line with the rapid development on the digital front. In many cases however, the forces of institutional structures assigned to educational institutions lead to a curriculum which is not only outdated but fails to respond to the seismic shifts in technology and pedagogy.

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2.5 Curriculum

According to Aris et al. (2022), national curriculum standards described the definition and the attributes of the minimum requirement of higher education providers in the curriculum. The framework states that the ability to use the information and digital technologies to complete a task is defined as the digital literacy skills. These skills include the ability to collect, store, process the information, use the applications to solve an issue, communicate and ethical or responsible use of digital capabilities. Information literacy, computer and technology literacy, visual literacy, and digital communication abilities were the four elements taken from the general definition. Thus, by using these guidelines, digital and numeracy skills across the wide ranges of courses and certification levels could be assessed (Dalim et al., 2023).

The development of employability skills depends on the integration of competencies outlined in the national curriculum standard into the foundational learning in every sector. National curriculum standard is a national reference point for Malaysia's higher education and defines the necessary learning outcomes, skills, and qualifications (Hussein et al., 2024). SCM education in TVET institutions requires strong alignment with industry relevant curriculum standards as the global SCM ecosystem continues to evolve rapidly. It ensures that graduates possess both the technical skills and the broader competencies needed to work in contemporary digital SCM environment (Rajamanickam et al., 2024).

According to Keevy et al. (2021), if TVET curriculums meet the national curriculum standards, then those institutions can ensure that graduates are not only qualified academically but also practically prepared for the industry collateral. This will be particularly effective in SCM, as it allows learners to gain and develop the necessary skills on how to successfully adapt to the realities in the supply chain with digital tools, systems, and processes that are now essential in our society today.

A major hurdle is to add industry relevant competencies into the curriculum without falling out of quality and program structure. Jamaludin et al. (2023), noting that "*many programs are unable to keep their curriculum up to date with new technological developments in SCM like big data, blockchain and artificial intelligence that drive digital supply chains*". Hence, as these innovative technologies on learning become more pervasive, the question remains whether the curriculum framework is strong enough to adapt and hold the changing landscape of what is learned and how it is structured.

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Another challenge takes place in the professional development of instructors. Md Hani et al. (2024), highlighted that the adoption of new technological tools and teaching methods by the educators remains as a challenge in TVET system. As the SCM trends continue to evolve, educators are required to stay updated with new teaching strategies and technologies. It can affect the overall alignment with the competency-based requirements of the curriculums. This indicates the need to regularly upskill and provide support to instructors.

2.6 Future Workforce Readiness of SCM Students

Readiness is about the ability of students to graduate from the classroom into a workspace where they can be impactful and productive players in their industries. Industry preparedness is critical for SCM, an industry that needs to provide SCM professionals that not only understand the fundamentals of SCM but also the digital tools, technologies and practices. Being one of the fastest digitizing domains, adaptation of technology by industry has become a vital part of student industry readiness coming from TVET institutes in the domain of SCM.

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Industry readiness captured much attraction in TVET education in the past years, providing relevant, practical skills to students in preparation for the workforce. For students specializing in SCM, this readiness includes not only digital literacy skills but the capacity to deal with complex SCM work that includes data analytics, automation, and supply chain optimization (Fadzil et al., 2022). However, research indicates that most TVET graduates cannot meet the employers' requirements, especially in the area of digital literacy skills. Hence, the eternal challenge of graduating students who often do not possess the technical know how to run advanced SCM systems like ERP and SCM software and systems.

In Malaysia, benchmarking is important to set as an assurance on student readiness to face the realm of industry. Every TVET program needs to be aligned to the comprehensive guideline set in the framework which linked the TVET to the industry. MQF was established to guarantee that TVET graduates have the theoretical understanding and real-world capabilities demanded by the employers. However, Jamaludin et al. (2023) noted that the gap between digital literacy skills produced in TVET programs and the evolving technology requirements of the SCM business is increasing. This discrepancy is mostly caused by the educational institute's unable to align the curriculum with the latest technologies such as IoT, big data analytics and blockchain. As a result, there is a noticeable gap that hinders them from being marketable in the industry and adapting to the SCM digitisation revolution.

Employers also worry about the preparedness of TVET graduates. According to Fadzil et al. (2022) highlighted those candidates equipped with knowledge in digital tools for analysing data, managing inventory, and optimizing processes are in high demand in SCM sector. Shafieek et al. (2024) opined that although some students are strong in SCM core competencies, they struggle to perform well in a highly digitized environment. This underscores the importance of integrating more holistic digital training into TVET programs to narrow down the skills gap and improve graduates' employability.

Furthermore, the aspect of practical experience is yet another fundamental factor of being industry ready. TVET institutions are instrumental in providing students with practical training, which allows them to apply theoretical knowledge in real-world environments. But as Keevy et al. (2021), many TVET institutions lack strong partnership with industries or internship program could expose students to

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technologies and practices adopted in the modern SCM operations. Fresh graduates may not be industry ready enough to be trained with new information technology skills, but through networking with stakeholders in industry, TVET institutions can stay updated with their needs.

2.7 Gaps in the Literature

Although considerable research has been conducted on incorporating digital literacy skills into TVET programs, several gaps remain in the literature, particularly with respect to the need for aligning TVET curriculum with the fast-changing landscape of the SCM sector. Such gaps preclude a proper answer to the extent to which existing TVET programmes prepare students with necessary digital literacy skills to succeed in the modern SCM industry.

A notable discrepancy gap in the research literature is the absence of studies on specific digital literacy skill competencies that must be developed among SCM students in TVET institutions. Although more than one study discusses the need for digital literacy skills for education in general or other industries (Hussein et al., 2024), less attention has been given to the specific needs in the SCM field. A customized approach to digital literacy skill development is needed in the emerging technology which delve into technological innovation in SCM (Rajamanickam et al., 2024). Previous studies have shown limited exploration on describing the specific level of digital literacy skills needed from the SCM professionals, and how TVET institutions can adapt to such needs.

Understanding the positioning of TVET programs aligning with curriculum, especially in SCM education is another significant gap found. Relevance within the SCM discipline remains under-investigated, though the curriculum standards offer a comprehensive framework for the assurance of educational quality. Research by Jamaludin et al. (2023), highlighted the barriers in aligning digital literacy skills with curriculum, yet there appears to be a lack of literature on the operationalization of such alignment, especially in TVET curriculum for SCM students. This gap is needed as to help us know the effectiveness of how TVET institutions are packaging students with the needed skill to meet up with both academic standards as well industry expectation.

This study intended to emphasize on barriers associated with digital literacy skill training. The actual training development related barriers faced by TVET students were explored inadequately especially in acquisition of digital literacy skills in the field of SCM education. For instance, studies by Keevy et al. (2021) and Fadzil et al. (2022) discussed broadly on online education, and they do not drill down on how these barriers present themselves in SCM programs. This includes the influence of an obsolete curriculum, inadequate technological infrastructure and insufficient digital literacy of educators which has not been investigated in the context of SCM (Shafieek et al., 2024). Such a lack of research is troubling, as knowing the ways students can be limited will help generate solutions toward enhancing digital literacy skill acquisition. Thus, in this study which concentrates exclusively on training development related barrier, fills a gap in preparing TVET students for digital transformation in the supply chain industry.

Apart from that, there is a dearth of longitudinal studies exploring the outcomes of TVET graduates moving into the SCM profession. Although there are some studies which investigate on student's preparedness as they graduated from their studies, there

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is very few studies which assess their long-term success in the working environment, particularly in relation to their digital literacy skills and capability to adapt to the technological changes in SCM (Fadzil et al., 2022) . Longitudinal data would be invaluable in understanding whether the digital literacy skills learned are sustainable over time and whether TVET programs are successful in promoting sustained career success.

2.8 Research Framework

Research framework for this study is developed through a review of the literature and identification of key variables. This framework helps in determining the level of student's proficiency in digital literacy skills, the training development, and the curriculum, which impacts the student's readiness towards a digitalized SCM industry.

The following framework links the independent variables of the study which are digital literacy skills, training development, and curriculum to dependent variable, future workforce readiness for digital transformation in SCM. These frameworks also complement each other to provide a holistic assessment of digital preparedness of SCM students and at the same time underline the training development related barrier they encounter in integrating skills. The relationship between the above-mentioned variables towards the future workforce readiness is illustrated in Figure 2.3.

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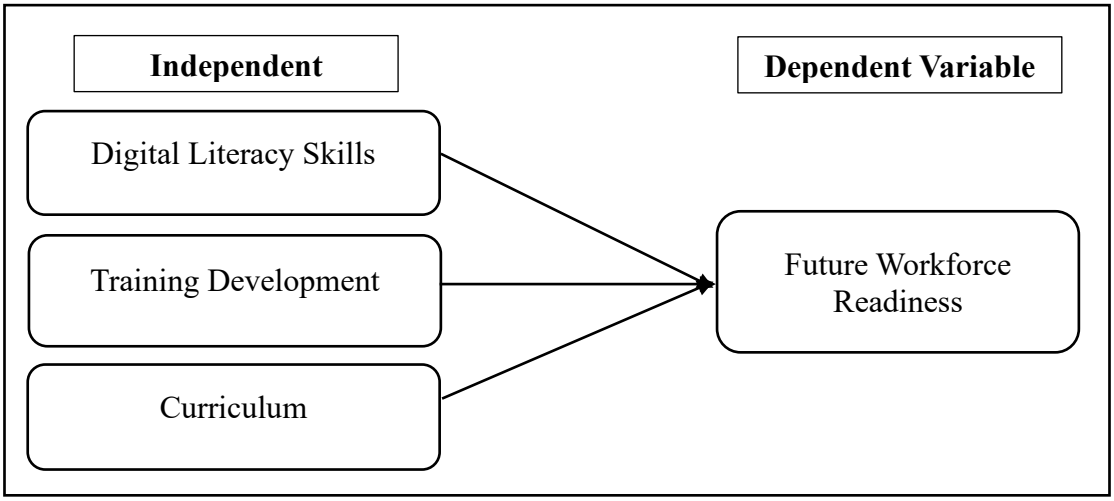

Figure 2.3
Research Framework

2.9 Summary of the Chapter

In this chapter, important literature pertinent to the digital literacy skills of SCM students in TVET institutions were reviewed. It examined the concept of digital literacy skills, the relevance of TVET curriculum and the training development barrier faced by students in obtaining these skills. It also highlighted the need for industry readiness and gaps in the literature related to specific digital literacy skills in SCM, industry partnerships, and the sustainability aspect of TVET on graduate employment. This framework served as the cornerstone for closing the digital literacy skills gap and getting a workforce ready for the future.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

The previous chapter discussed a review of the literature and the identification of gaps in the field of the study. This chapter will outline the methodology and research design of this study. Hypothesis development is described in this chapter. Following that, research instruments including data collection method, variable measurement, sampling and techniques of data analysis will be explained.

3.2 Hypotheses Development

Based on the literature review presented in Chapter Two, hypotheses in this study are developed. Hence, three hypotheses are generated to explore the relationships of independent variables towards dependant variable.

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3.2.1 Digital Literacy Skill and Future Workforce Readiness

The rise of IR4.0 technologies has made digital literacy skills as a crucial requirement in SCM. Such skills empower students to employ digital technologies and systems to make operations more efficient, enhance services, and meet the requirements of the digital economy in the case of TVET Institutions (Adnan et al., 2021). Graduates with high-level digital literacy skills are found to be more employable since they possess the necessary qualities to cope with relevant industry tools such as ERP systems and supply chain analytics (Fadzil et al., 2022). Moreover, skilled and technology-based classes promote the competence of students, allowing them to be well equipped for a job in the SCM (Shafieek et al., 2024). Still, disparities in the attainment of these

competencies exist, influenced by curriculum quality, institutional resources, and access to up-to-date technology (Hussein et al., 2024). Thus, it is evident that in a digital literacy plays an important role in preparing students for workforce readiness in a digitally driven industry.

Therefore, researcher proposed the following hypotheses:

H_1: *There is a significant relationship between digital literacy skills and future workforce readiness.*

3.2.2 Training Development and Future Workforce Readiness

TVET institutions plays a major role in producing digital competent graduates for the SCM sector. Students face training related barrier to attain these competencies. The primary challenge is the inadequacy of infrastructure and technology within the TVET institutions. Narrating how the basic tools are not available for real-life learning bridge the gap between theory and practice (Rajamanickam et al., 2024; Shafieek et al., 2024). In modern times with the industry going excessively digital, students generally are unable to cope up with the expectations because of not getting their hand on modern SCM tools. The common barriers are with the outdated training facilities, lack of access to industry-standard software during classes, and insufficient instructor expertise in digital tools (Rajamanickam et al., 2024; Keevy et al., 2021). Fadzil et al. (2022) pointed out, the establishment of bureaucratic structures and rigid curriculum restrain the incorporation of digital technologies into TVET programmes. Besides that, lack of exposure to the hands-on simulations also hinders the ability to develop the necessary skill needed by the industry (Jamaludin et al., 2023). Together, these barriers deter students from entering even the gateway to engaging with the skills and

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digital tools and processes that are key to enterprise SCM today. By considering the above statement, hypotheses are refined as:

H_2: *There is a significant relationship between training development and future workforce readiness.*

3.2.3 Curriculum and Future Workforce Readiness

Curriculum is referred as the extent where the program's learning outcome (PLO) and objectives aligns with the industry's requirement in terms of theoretical and practical skills. In line with this, aligning TVET programs with curriculum standards is of utmost importance, particularly for a field such as SCM as the global and digital transformation demands are ever-increasing. Such an alignment prepares the graduates with both technical and practical competencies that are essential for managing contemporary SCM processes such as adapting with digital tools and systems (Rajamanickam et al., 2024; Keevy et al., 2021). These eventually lead to fulfilling the demands of the industry as the TVET institutions are producing the graduates with both academic and practical readiness to face barriers in the industrial world by meeting the standards. By considering this factor, the following hypotheses has been developed:

H_3: *There is a significant relationship between curriculum and future workforce readiness.*

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3.3 Research Design

Research design is explained as the procedure of how to organize and conduct the empirical research. It includes the cross-sectional and time series data over time and space by using both qualitative and quantitative approach (Mweshi & Sakyi, 2020). This research design of this study was structured to answer the study's objectives with a reliable outcome. This research targeted to examine the relationships between the independent variables (digital literacy skills, training development, and curriculum) and dependent variable (future workforce readiness).

Aligning to the objective of this study, quantitative approach was adopted. This method emphasizes on both the descriptive analysis and hypothesis testing. Descriptive analysis provides the overview of the variables while, hypothesis testing investigates the relationships of independent variables towards dependent variable. Hypotheses were developed and tested by using the statistical technique based on data collected through quantitative method. Relationships were examined, and the results determines whether the hypothesis developed earlier are accepted or rejected.

As for that, correlational research was adopted to analyse patterns and relationships between the independent variables (digital literacy skills, training development, and curriculum) and the dependent variable (future workforce readiness). This research was conducted in a natural environment whereby the researcher's interference was minimal and there was no manipulation or control on the variables. The results obtained through correlational research was used for the purpose of forecast events based on the available knowledge and data, as well as to ensure the patterns and relationships between variables (Curtis et al., 2016).

This study was conducted on cross-sectional time horizon, and the data was collected at a single point of time. Structured questionnaires were distributed, and one-month time was allocated for the collection of data. The questionnaire elements were adopted from the previous studies (*Appendix 1*). Thus, a pre-test and pilot test were conducted with a small group of respondents to ensure the questionnaire is reliable and valid.

3.4 Population, Sample and Sampling Technique

3.4.1 Target Population

According to Tsai et al. (2023), a study's goals are to analyse the population to which the research findings can be practiced. The target population of this study comprises the students enrolled in Diploma in Logistic and Supply Chain Management (DLS) programme under the Commerce Department of Polytechnic Seberang Perai. According to Department of Student Affairs (2025), the total student population is 3,183 compromising across four departments (*Appendix 2*). About 1,550 students are from the Commerce Department, where 559 students enrolled DLS programme. Table 3.1 shows the number of students based on semester.

Table 3.1
Number of Students by Semester

2025 Semester	Total Number of Students
1	73
2	136
3	80
4	97
5	74

Table 3.1 (Continued)

2025 Semester	Total Number of Students
Internship	99

Source: Department of Student Affairs (2025)
**Note: The tabulation is based on the 2025 January Session 2 2024/2025 student headcount. The bolded numbers are the figures calculated as targeted population.*

The target population of this study is particularly emphasizing on Semester 4, Semester 5 and internship students accounting to 270 students in January 2025. The rationale of choosing these target population is because, they are the students whom are at the 2nd and 3rd year of their study. Those students are more likely to be exposed to the digital literacy skills development, training development related barrier to attain the digital literacy skills and curriculum. Moreover, as they approach towards graduation and internship, their preparedness is crucial for employability.

3.4.2 Sample Size

Sampling is identified as the process of selecting the subset of a largest target population for the research objectives (Sarstedt et al., 2024). This is conducted when it is not possible to approach every individual from the population. Krejcie and Morgan's (1970) Table was referred as a guideline to decide the right sample size to minimize discrepancies and ensure the statistical reliability of the findings (Bukhari, 2021). The target population of this research was 270 students enrolled in DLS programme at PSP. By referring to the Krejcie and Morgan's Table, with a 95% confidence level and a margin error of 5%, sample size was 159 students.

3.4.3 Sampling Technique

Sampling procedures are critical in social science and other experimental research. There are two main types of sampling techniques which are probability sampling and non-probability sampling (Rahman et al., 2022). For this study, a purposive sampling technique with inclusion filter was employed.

The population of this study was 270 students from DLS program at PSP. The inclusion criteria were, these students must be enrolled specifically in DLS and currently in Semester 4, Semester 5 and internship students. Researcher chose purposive approach so that the respondents are those who had progressed far enough to have the curriculum and digital literacy skill exposure. Thus, to have a balanced representation, the population was divided into three groups based on semester level. The sample size was determined proportionally based on the population size. The proportional allocation of the sample size of each group is shown in Table 3.2.

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Table 3.2
Sampling Fraction

Group (Semester Level)	**#of Elements (Population)**	**Proportionate (Sample Size)**
Semester 4	97	57
Semester 5	74	44
Internship	99	58
Total	**270**	**159**

3.4.4 Unit of Analysis

According to Pesämaa et al. (2021), the unit of analysis is referred to the entity a particular study is observing and analysing. The unit of analysis is the most crucial aspect of any research project, as the wrong identification of a unit of analysis in research will lead to invalid conclusions. The unit of analysis for this research is the individual students who enrolled into DLS program at PSP. The data collected from this group of respondents provides the overview of their digital literacy skill level, training development, curriculum, and their overall readiness for a digitalized supply chain environment.

3.5 Questionnaire Design Development

Marshall (2005) opined that a questionnaire is a vital instrument for a study. Researcher will be able to collect pertinent information for the study. In this study, the questionnaire was structured to investigate the relationship between the independent variables and the dependant variable.

The questionnaire design in this study was adapted from the validated items of previous studies to align with the Malaysia TVET student's demographic. The adapted questionnaire had the Cronbach's Alpha value of 0.7 and higher. To ensure the applicability and understanding of the respondents, basic adaptation of revising the context and language of the original instrument items were done.

A five-point Likert scale ranging from 'strongly disagree' to 'strongly agree' were used. Robie et al. (2022), suggested that fewer scale points will reduce the risk of frustrated respondents, increasing data quality and the response rate. This questionnaire will be divided into three sections. The first section focused on

demographic information to ensure a diverse representation of respondents. In this study, six demographic information were collected and presented through the structured questionnaire. The data consist of respondent's age, gender, educational level, the semester they are currently enrolled in, Internet accessibility and access to devices. Nominal and ordinal scale were used to evaluate all this information.

Following the demographic section, the second section was targeted on the independent variables, digital literacy skills, training development and curriculum. Digital literacy skills variable evaluated the competence of students in utilizing the basic digital tools and technologies such as Ms Excel, Google Docs, Google Sheet and more. Where else, the second variable assessed the integration of digital literacy skills through learning outcomes, assessments, and classroom applications. The third variable, training development determine the hindrance students face in acquiring digital literacy skills throughout their learning process at the institution.

Future workforce readiness, the dependent variable was addressed in the last section of the questionnaire, which will evaluate the preparedness of the students to fit into the demands of the digitalized supply chain. The items in this section emphasized on the student's ability to practice digital literacy skills, accommodate to technological advancement, and commit to digitalized supply chain. Table 3.3 shows the summary of the instrument and measurement and the sources for the questionnaire items.

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Table 3.3
Summary of Instrument and Measurement

Variables	Items	Scale	Source
Demographic	6	Nominal & Ordinal	Researcher
Digital literacy skills	10	Interval	(Tulinayo et al., 2018) (Zhao et al., 2021) (Soriano-Alcantara et al., 2024) (Tzafilkou et al., 2022)
Training development	3	Interval	(Tulinayo et al., 2018) (Alarcón et al., 2020)
Curriculum	6	Interval	(Wang et al., 2021)
Future workforce readiness	9	Interval	(Wang et al., 2021) (Abd Rahman Ahmad et al., 2019)

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3.6 Data Collection

In this study, primary and secondary data was used to provide a comprehensive analysis on the variables that influences the SCM future workforce readiness.

3.6.1 Primary Data

Data collection is one of the most critical aspects in a study as it ensures the study's objectives are achieved and provide a reliable and impactful finding. According to Ganesha and Aithal (2022),there are two types of data involved in research, which are primary data and secondary data. For this study, both primary data and secondary data were employed. The primary data is obtained directly from the respondent who are students in Semester 4, Semester 5 and internship students of DLS program at PSP.

Since this research employed a quantitative approach, a structured questionnaire was used to gather the data. This process took place for one month.

Sekaran & Bougie (2016) suggested three methods of survey data collection which are mail, electronics and conventional questionnaire. The researcher of this study adopted electronic method as known as online survey method to collect the data. Google Form was used to administer the structured questionnaire as it is convenient in terms of easy distribution, secure in data storage and the efficient data collection *(Appendix 3).* To ensure the questionnaire is understandable and reliable, pre-test was conducted with experts and pilot test was conducted with a small group of students. Ethical guidelines were followed in study by protecting participants' privacy, rights, and well-being. Prior to completing the questionnaire, participants were given an overview of the study's purpose, and confidentiality of responses. Respondents were acknowledged that they provide their consent to participate in this study by proceeding to answer the question. Personally, identifiable information was not collected to maintain anonymity.

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3.6.2 Secondary Data

Secondary data was included in the form of reference from the previous research, books, reports and articles on digital literacy skills, TVET education, and training development related barrier faced by students. Even though there are very limited studies on SCM student, researcher found that secondary information's was useful to support the findings. The secondary data was used as the foundation to validate the findings and strengthening the research framework.

3.7 Data Analysis Strategy

3.7.1 Pre-test

A pre-test was conducted prior to the actual data collection, to evaluate the validity of the research instrument. According to Blumberg et al. (2014), pre-testing is important procedure to identify the mistakes in term of the wording used, structure and the meaning of each item. Even though it is time consuming, this procedure is vital to ensure the instrument developed aligns with the objectives of the research. Similarly, Sekaran & Bougie (2016) stated pre-testing will ensure the questionnaire items were interpreted clearly by the respondents. To support this, Zikmund et al. (2019) also highlighted that the need for pre-testing to verify the instruments' reliability and its functions as intended.

Nevertheless, a pre-test is necessary even though the items were adapted from published instrument, to ensure it aligns with the research context especially TVET education alignment. According to Hair et al. (2019) a sample size of four to 30 respondents is appropriate for a pre-test, where else Lynn (1986) recommended a minimum of three content experts for content validity. Validity is the measure of the accuracy, meaning and the usability of the instrument in order for the researcher to test the hypothesis. This study employed both the respondent pre-test and expert review.

Research consulted one content expert from the industry professionals and two academicians specializing in SCM. Meanwhile, for the respondent pre-test, four respondents who have the common characteristics with the target population were chosen. The chosen respondents were excluded from the final sample of 159 respondents. Through this pre-test, researcher was able to determine the relevance of the items, clarity of the questions and identify any possible technical issues as this

instrument will be distributed through Google Form. The survey instrument was revised based on the feedback of both content experts and pre-test respondents. This is to ensure the instrument will be user-friendly and the respondents will be able to interpret the items consistently. The outcome of the pre-test helped researcher to predict the time required to complete the data collection and would guide the future research.

3.7.2 Pilot Test

Pilot study is well defined by Sekaran & Bougie (2016) as a tool to analyse the outcome of the research instrument validity and assure the questions are not obscure to the respondents. In a study by Thabane et al. (2010), the researcher did quote a proverb from Ghana's people stating "*You never test the depth of a river with both feet"*, which indicates that the primary objective of the pilot test is to assess the versatility and to avoid possibilities of adverse impact from distributing to wider population. This could probably obliterate the entire research efforts.

In this study, researcher conducted a pilot test prior to the real data collection. This is to ensure the validity and reliability of the research instrument. By performing the pilot test, researcher was able to identify the potential issues in the instrument developed in terms of language or structure and make amendments before its being distributed to the larger group of respondents. This study's target population was the students of DLS programme in Semester 4, Semester 5 and internship. The target population consist of student who are diverse in language literacy to, which strong emphasize pilot test is a must. Thus, about 30 respondents were chosen for pilot test and they were excluded from the final sample. The feedback collected from this pilot test were used to

improvise the instrument to ensure that all the survey items are comprehensible and parallel with the research objectives.

3.7.3 Reliability of the Scale

Reliability is defined as *"the extent to which measurements are repeatable when different people perform the measurement on different occasion, under different condition, supposedly with alternative instruments which measure the construct or skill*" by Drost (2011). The reliability of scale also known as the consistency of the instrument to provide an accurate and consistent finding. This analysis was performed after the pilot test in order to determine the consistency of responses for all the items by measuring the variables. Researcher of this study adopted questionnaire from the previously validated instruments, and it was adapted to align with the study's objectives. Cronbach's Alpha (α) was used to measure the internal consistency of the items in the questionnaire. To ensure the scale's reliability, the Cronbach's Alpha value of 0.7 or higher is considered satisfactory (Sekaran & Bougie, 2016). Those items that scores the value less than 0.7 was revised.

3.7.4 Time frame

Data collection for this study took place for one month, which was on 30th May till 23rd June 2025. Apart from allocating the respondent adequate time to complete the questionnaire, this time frame was believed to be sufficient for testing and improvising the questionnaire. Table 3.4 summarizes the timeline of data collection.

Table 3.4
Timeline Summary of Data Collection.

Data collection	Timeline	Number of Respondents
Pre-test	Beginning of May 2025	4
Pilot Test	Mid of May 2025	30
Main Data Collection	30th May – Mid of Jun 2025	159

3.8 Data Analysis Technique

The data collected was analysed by using SPSS version 29.0. This study employed descriptive analysis and inferential analysis.

3.8.1 The Goodness of Measure

Reliability and validity of the research instrument was examined to ensure that it precisely measures the intended constructs and provides a consistent outcome. In other word, a validity and reliability test determine the goodness of measure of the variables (Hair et al., 2019). Cronbach's Alpha was employed to evaluate the internal consistency of the instruments' reliability. A threshold value of 0.7 or greater was considered as acceptable value for each of the variables.

Validity test was conducted once the reliability test results reflected a good level of reliability. In order to ensure that the questionnaire items sufficiently cover the variables being measured, a content validity was conducted by consulting two academician and one industry professional. Construct validity was conducted by using the Exploratory Factor Analysis (EFA). According to Hair et al. (2019), EFA with loading above 0.50 was used to test the structures of the variables and its relationship with the study dimensions. The findings from the assessments were presented in Chapter Four.

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3.8.2 Descriptive Analysis

In this study, descriptive analysis was used to summarize and highlight the findings of the data, providing a summary on the respondent's demographic profiles and their responses for each of the questionnaire items. This analysis allows researcher to identify the trends, patterns, disparities in the dataset by emphasizing frequency distribution, measures of central tendencies and dispersion computed by SPSS. Respondents demographic characteristics like age, gender, semester level and access to Internet was focused on the descriptive analysis of this study. According to Zikmund et al. (2019) descriptive statistics, is used in research to summarize and present the collected data in a clear and understandable manner, enabling a complex dataset to be interpret easily.

The objective of this analysis is to provide a clear understanding of SCM student's levels of digital literacy skills, training development, curriculum, and future workforce readiness. Thus, the descriptive summary did not only help identifying the differences in data and patterns, but it did also provide a basis for hypothesis testing and effectively addresses the research objectives.

3.8.3 Inferential Analysis

3.8.3.1 Correlation Analysis

This study used Correlation analysis to investigate the strength and direction of linear relationships between the variables. In order to evaluate the relationships between the independent variables which are digital literacy skills, curriculum, and training development with the dependent variable, future workforce readiness, Pearson's Correlation Coefficient (r) was calculated using SPSS. Coefficient r range between -

1.0 and +1.0, indicate the strength between two metrics variables. Positive r values indicate a direct relationship, negative *r* value indicates an inverse relationship, and the values *r* near zero indicates no relationship. This analysis indirectly served as a foundation for further predictive analysis. As per Table 3.5 given by Cavana et al. (2001) the strength of relationships between variables was evaluated.

Table 3.5
Correlation Coefficient Range

Correlation Coefficient Range	Strength of Association
±0.50 to ±1.00	Strong
±0.30 to ±0.49	Moderate
±0.10 to ±0.29	Low

Source: Cavana et al. (2001)

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3.8.3.2 Normality Test

In this study, researcher conducted a normality test by using SPSS to make sure the distribution of data is normal since many parametric tests like correlation was performed. According to Smeeton (2016) the data is mostly concentrated within "*-1.96 and +1.96 standard deviations from two standard deviations below and above the mean*", which accounts for more than 95% of the data.

3.9 Summary

In this chapter, methodologies for this study were discussed including the research framework and summary of research hypothesis, research design, population of the study, sample size, and sampling technique. This study also included a brief on research measurement, collection of data, questionnaire design, and technique to analyse the data. Figure 3.1 illustrates the complete methodological process. The process begins from the questionnaire's adoption and modification to the final data analysis using SPSS.

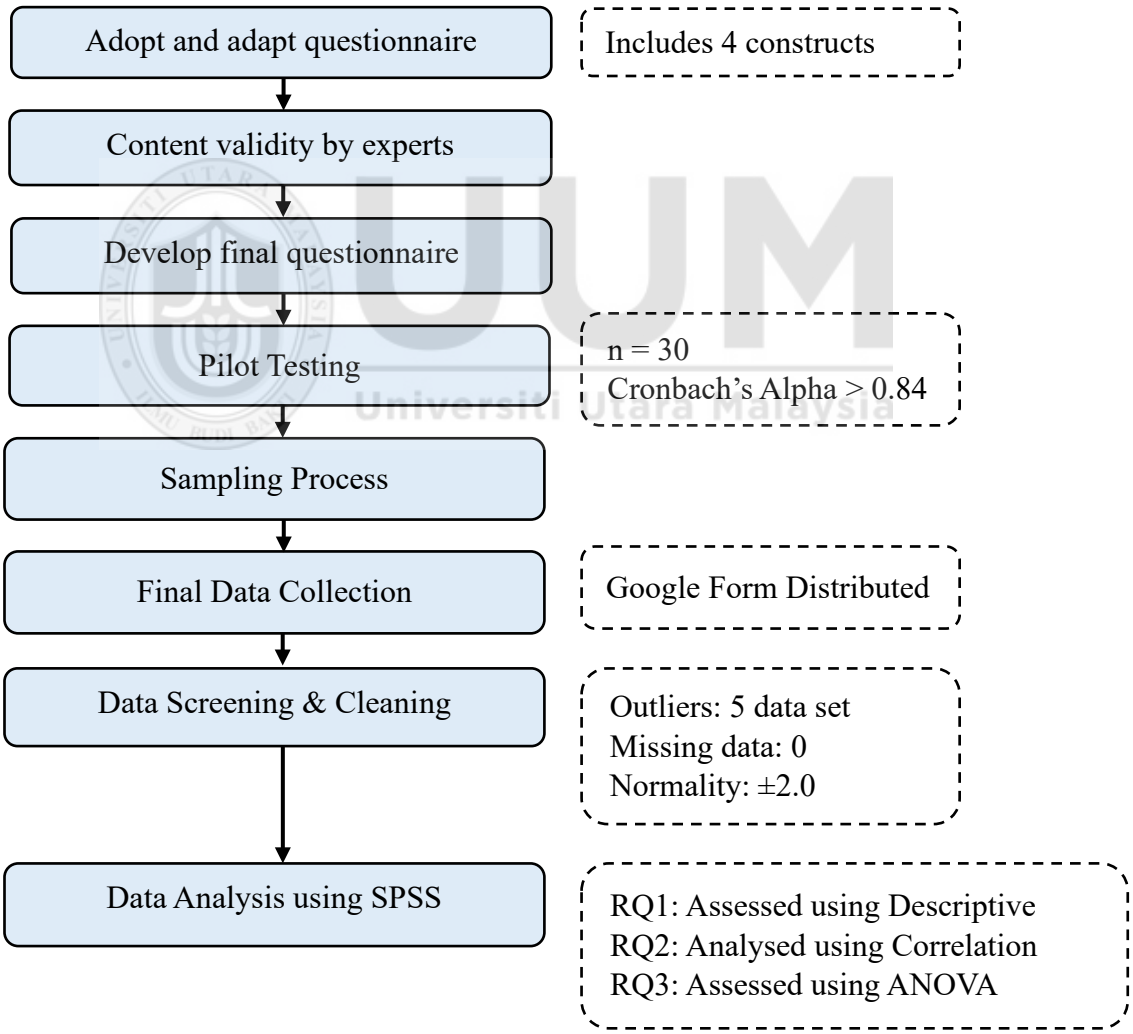

Figure 3.1
Overview of Research Process

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CHAPTER 4

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter discusses on the data analysis and conclusions drawn from the questionnaire. Pilot test results, response rate and data screening are briefed. By using SPSS 29.0 version, uniform response patterns and missing values are identified. To validate the constructs, Exploratory Factor Analysis (EFA) is performed after normality tests. Both demographic data and variables which are namely, digital literacy skills, training development, curriculum, and future workforce readiness are given descriptive statistics. The relationships between the constructs are then tested using Reliability, and Correlation analyses in accordance with the objectives of the study.

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4.2 Pilot Test Results Analysis

A pilot test was conducted prior to the actual data collection, with a sample of 30 respondents to assess the questionnaire item's clarity, internal consistency, and reliability. This pilot study was conducted to make sure the tool was appropriate for measuring the following constructs: digital literacy skills, training development, curriculum, and future workforce readiness.

4.2.1 Reliability Analysis

Reliability test was conducted with Cronbach's Alpha. As recommended by Sekaran & Bougie (2016) all constructs in this study showed acceptable internal consistency and satisfied the minimum threshold of 0.70. A few questionnaire items were revised in response to pilot responses and low item-total correlations *(Appendix 4)*. This is

done to increase construct validity and clarity. After the instrument was finalized, a larger sample size was employed for the complete data collection phase. Table 4.1 summarizes the reliability of all the variables. Hair et al. (2019) state that a Cronbach's alpha value of 0.70 or greater indicates reliability, while 0.9 is accepted for an excellent measure.

Table 4.1
Reliability Analysis for Pilot Test

Variables	**Cronbach's Alpha**	**N of Items**	**Reliability Level**
DL	.844	10	Good
TD	.759	3	Good
C	.891	6	Excellent
FW	.923	8	Excellent

Notes: Digital literacy skills (DL), Training development (TD), Curriculum (C), Future workforce readiness (FW)

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4.2.2 Validity Analysis

The data from the pilot test (N = 30) was assessed for construct validity using EFA. Each construct was analysed independently to represent the instrument's multidimensional structure. This is to prevent problems with multicollinearity that could occur when analysing all the items at once. The Kaiser-Meyer-Olkin (KMO) and Bartlett's Test were employed to evaluate each construct's adequateness. As indicated in Table 4.2, all four constructs resulted in significant Bartlett's Test results ($p < .001$) and acceptable KMO values (≥ 0.70). Acceptable construct validity was confirmed by most items loading above 0.50 on a single component. Thus, most of the items were retained for the main study with minor correction in wording (*Appendix 4*).

Table 4.2
KMO and Bartlett's Test for all Constructs

Constructs	KMO	Chi-Square	df	Sig.
DL	.722	120.269	45	<0.001
TD	.689	20.415	3	<0.001
C	.830	93.600	15	<0.001
FW	.816	176.949	28	<0.001

Notes: Digital literacy skills (DL), Training development (TD), Curriculum (C), Future workforce readiness (FW)

4.3 Field Work Study

4.3.1 Normality Analysis

In order to ensure the dataset is suitable for statistical procedure, the fieldwork dataset which consist of 174 responses was screened and cleaned before inferential analysis was conducted. In the process of validating the data and completing the measurement framework, several procedures were conducted. The preliminary review confirmed that all 27 questionnaire items had 100% valid responses and no missing values. Z-score analysis was then conducted with a threshold of ±3.0 to identify univariate outliers. Five respondents as listed in Table 4.3 had extreme response patterns as they had more than five items with Z-scores below -3.0. Thus, these cases were eliminated from the dataset, to prevent distortion in factor analysis. The final cleaned dataset consists of 169 valid responses.

Skewness and kurtosis statistics were reviewed to further evaluate the dataset's (N=169) normality. As shown in Table 4.4, all the values of skewness (ranging from -0.737 to 0.415) and kurtosis value (ranging from -0.877 to -0.029) for all 27 items fell

within the appropriate range of ±2.0 for skewness and -7 to +7 for kurtosis. (*Appendix 5*). Therefore, these results are deemed to satisfactory and supports its use for the inferential analyses.

Table 4.3
Summary of Outliers Respondent

ID	Total Number of Z-scores < -3.0
65	7
124	5
131	11
149	6
154	8

Table 4.4
Normality Test using Skewness and Kurtosis

Constructs	Skewness	Kurtosis
DL	-.683	-.029
TD	-.415	-.303
C	-.730	-.049
FW	-.344	-.877

Notes: Digital literacy skills (DL), Training development (TD), Curriculum (C), Future workforce readiness (FW)

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4.3.2 Exploratory Factor Analysis (EFA)

EFA analysis was conducted by using Varimax Rotation in Principal Axis Factoring to finalize the measurement framework. KMO indicated excellent sampling adequacy with the measure of 0.921 as presented in Table 4.5. Bartlett's Test of Sphericity (χ^2 =

2302.653, df = 351, p <.001) strongly supported the appropriateness of the correlation matrix for factor extraction.

Table 4.5
KMO and Bartlett's Test

Measure	Value
Kaiser-Meyer-Olkin (KMO) measure	.921
Bartlett's Test of Sphericity Approx. Chi-Square	2302.653
df	351
Sig.	<0.001

4.4 Data Analysis

4.4.1 Descriptive Analysis

Descriptive data for the demographic traits of the study participants are shown in this section. In order to ensure transparency with regard to the population from whom the data were gathered, the analysis will only include explicit description of the sample used in the study. Total sample size of N = 169 identified as the clean and valid dataset was used for this statistical analysis. Students enrolled in the Diploma in Logistics and Supply Chain Management program at Polytechnic Seberang Perai are the respondents for this study.

a. Respondent's Demographic Distribution of TVET Students by Gender, Age Group, and Semester

The majority of respondents for this study were female, accounting for 53.3% (n=90) of the sample from Diploma in Logistics and Supply Chain Management program at Polytechnic Seberang Perai. Conversely, as shown in Figure 4.1, male respondents compromised 46.7% (n=79). This distribution indicates that female students are the dominant group among the study's respondents.

The respondents were required to specify their age to categorize them into three groups. Figure 4.1 shows, most respondents (94.1%, n = 159) were between the ages of 20 and 22, which is common for diploma students. Meanwhile, respondents under age 20's proportion was only 1.2% (n = 2), whereas 4.7% (n = 8) represent the proportion over respondents age 22 and above. Based on this distribution, majority of participants were within the expected range for diploma level education.

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The respondents were categorized into groups according to the semester in which they were enrolled into the Diploma in Logistics and Supply Chain Management program. The largest percentage of responders (38.5%, n = 65) were enrolled in Internship, as indicated in Figure 4.1, suggesting a high representation of students nearing the end of their program. Subsequently, students in Semester 4 represented with the percentage of 35.5% (n = 60). Meanwhile, Semester 5 are the minority group of respondents with 26% (n = 44). This distribution shows equal representation across all levels of the diploma program. However, higher participation was from students being exposed to the industry.

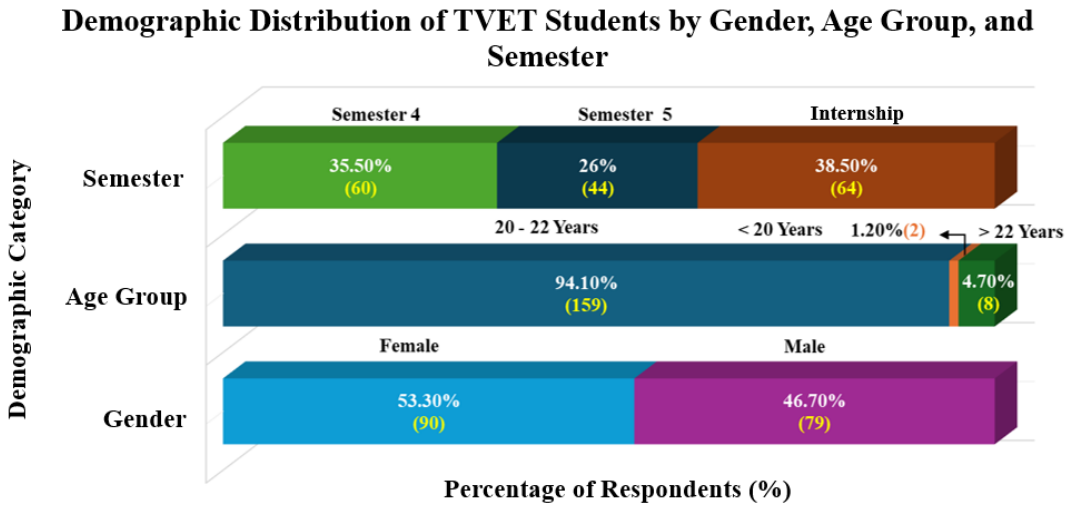

Figure 4.1

Statistics of Respondent's Demographic Distribution of TVET Students by Gender, Age Group, and Semester

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b. Respondent's Personal Device

In the setting of digital literacy skills and preparedness for digital transformation, it's important for students to have access to personal digital devices. This determines how students learn and interact with technology driven education. As shown in Figure 4.2, a large proportion of respondents (95.9%, n = 162) stated that they owned a personal device for educational purposes. Meanwhile, merely 4.1% of respondents (n = 7) said they did not have a personal device. These finding stresses that virtually most of the sample's students have access to a fundamental technology tool. It is crucial for interacting in online educational environments and developing their digital capabilities.

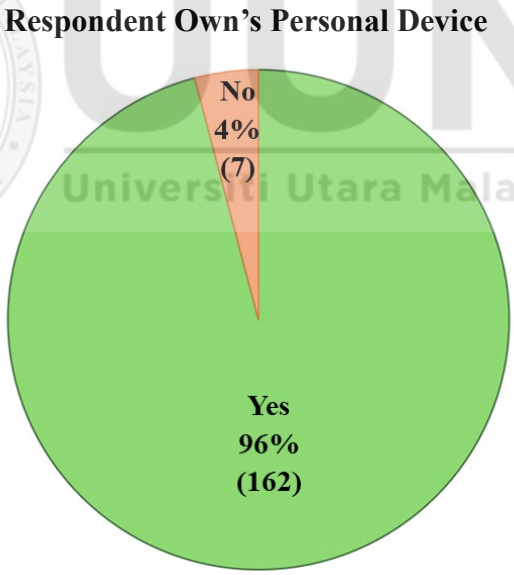

Figure 4.2
Statistics of Respondent Owning a Personal Device

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c. Respondent's Internet Accessibility

Figure 4.3 indicates that high number of respondent (68.6%, n = 116) reported of having good internet accessibility, subsequently followed by moderate access (30.2%, n = 51) and poor connectivity (1.2%, n = 2). The large percentage of students with strong internet access shows a solid ground for engaging in developing technology driven competencies. A reliable internet access is a core requirement for the student's readiness for the digitalized supply chain. Better connectivity attracts students to interact with digital tools, learning resources, and platforms thereby enhancing their readiness for a digitalized transformation workforce.

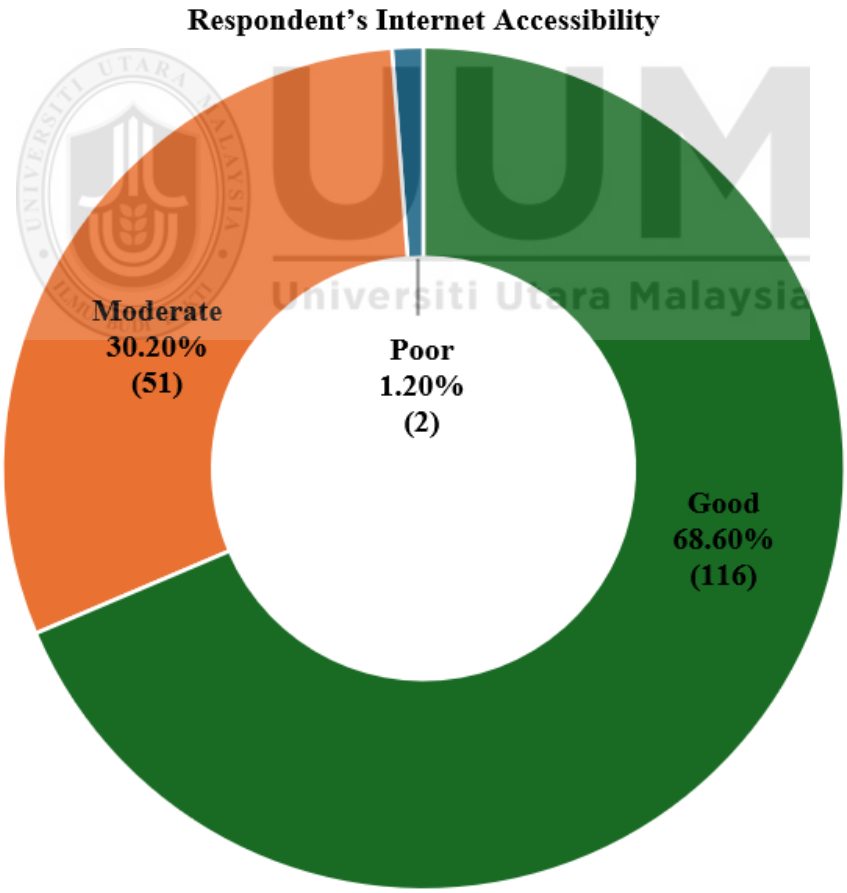

Figure 4.3
Statistics of Respondent's Internet Accessibility

4.4.2 Descriptive Analysis for Constructs

Descriptive statistics were calculated to determine the central tendency and dispersion of the four variables of this study. The highest mean score (M = 4.4625, SD = 0.4800) was recorded for curriculum as shown in Table 4.6. This indicates that students felt that the program's curriculum provides them necessary digital literacy skills that aligns with the industries demand. Future workforce readiness subsequently scored a mean of 4.3950 and indicated that students feel adequately qualified to fulfil future digitalized supply chain demand. Digital literacy skills recorded mean score of 4.2361 reflecting that generally the students perceive themselves as digitality literate. However, lowest score was observed in training development with M = 4.1321, implying that students face fewer barriers related to acquiring digital literacy skill training. This analysis reflects the research question one, which aimed to investigate the current level of digital literacy skills among DLS students in PSP. The mean values as stated above indicates PSP DLS students perceive themselves as they are confidently prepared for the digital transformation in working environments.

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Table 4.6
Descriptive Analysis for Constructs

	N	Minimum	Maximum	Mean	Std. Deviation
DL	169	2.70	5.00	4.2361	.55383
TD	169	2.33	5.00	4.1321	.62701
C	169	3.00	5.00	4.4625	.48000
FW	169	3.00	5.00	4.3950	.48246
Valid N (listwise)	169				

Notes: Digital literacy skills (DL), Training development (TD), Curriculum (C), Future workforce readiness (FW)

4.4.3 Correlation Analysis

In this analysis, the relationship between dependent variable and each independent variable as aimed in research question two is investigated using Pearson's correlation. The correlation coefficients reflect the strength of the linear relationship between both the dependent and independent variable. The Pearson correlation coefficient (r) varies from -1 to +1, indicating both negative and positive correlations. The Pearson correlation coefficient (r) was employed to understand the relationship between variables. Meanwhile, to evaluate the null hypothesis a two-tailed significance test was employed.

Table 4.7 indicates that all independent variables exhibited statistically significant and positive correlations with student readiness at the 0.01 level (2-tailed), signifying substantial bivariate associations among the constructs. The most significant correlation with digital transformation readiness was reflected by curriculum (r = .755). This indicates that students perceive a very high level of confident of digital transformation readiness. In other word, students likely recognize that the digital literacy skill and industry relevant competencies demanded by the industry are being adequately addressed in their program's curriculum. Thus, the outcome addresses that curriculum plays a vital role in shaping students towards digital transformation in the supply chain field. Therefore, the **result supports the Hypothesis (H_3) of this study.**

Digital literacy skills (r = .658) exhibited a positive correlation. This also indicates that those students who are more confident and familiar with the digital tools assume that they are well equipped for technology integrated work environment. As proposed in Hypothesis H_1, a significant positive correlation exist between digital literacy skills

and future workforce readiness towards digital transformation in SCM. Therefore, **Hypothesis H_1 is supported.**

Table 4.7
Correlation Analysis

		DL	TD	C	FW
DL	Pearson Correlation	1	.626**	.652**	.658**
	Sig. (2-tailed)		< .001	< .001	< .001
	N	169	169	169	169
TD	Pearson Correlation	.626**	1	.624**	.597**
	Sig. (2-tailed)	< .001		< .001	< .001
	N	169	169	169	169
C	Pearson Correlation	.652**	.624**	1	.755**
	Sig. (2-tailed)	< .001	< .001		< .001
	N	169	169	169	169
FW	Pearson Correlation	.658**	.597**	.755**	1
	Sig. (2-tailed)	< .001	< .001	< .001	
	N	169	169	169	169

**. Correlation is significant at the 0.01 level (2-tailed).
Notes: Digital literacy skills (DL), Training development (TD), Curriculum (C), Future workforce readiness (FW)

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Training development (r = .597) exhibited a significant positive correlation with student readiness. This suggests that students who receive more effective training are more likely to feel prepared for a digital working environment. Hence, **the results support Hypothesis (H_2),** which proposed that there is a significant relationship between training development and future workforce readiness for digital transformation in SCM.

4.4.4 Analysis of Variance (ANOVA)

The future workforce readiness scores of students from three different semester levels were compared using a one-way ANOVA. ANOVA was employed as research question three aimed to identify significant difference in the level of student's readiness among different PSP DLS student groups. However, there were no statistically significant difference across three semester levels, according to the results in Table 4.8, p =.162 and F (2, 166) = 1.838. This suggests that there is no noticeable change in the three semester groups' student readiness.

Due to unequal group sizes and possible variance differences, a Games-Howell post hoc test was conducted to further examine group differences. The findings (refer to Table 4.9) revealed that no mean differences among the groups were statistically significant ($p > .05$). These results imply the assumption of internship students would reflects a higher level of readiness; the ANOVA analysis outcome was contrary. That means regardless of the semester students are in right now, it doesn't have a major effect on how ready they feel to work. This may be due to the standardised nature of the curriculums alignment for all the levels beginning from Semester 4 itself.

Besides that, today's students are more likely to equip themselves with informal digital learnings and self-directed skill development. These behaviours often narrow the experiential gap. Moreover, the students from Semester 4 and 5 may feel overconfident in their readiness based on their self-assessment on their ability to use the fundamental digital tools and academic performance rather than the real experience. The chosen group of students also indicates a very low level of industry exposure, highlighting there might be differences if the respondents were with at least two years of working experience.

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Table 4.8
Analysis of Variance (ANOVA) Table

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.847	2	.424	1.838	.162
Within Groups	38.257	166	.230		
Total	39.104	168			

Table 4.9
Games-Howell Multiple Comparisons

(I) Semester	(J) Semester	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Semester 4	Semester 5	-.08939	.09832	.636	-.3243	.1455
	Internship	-.16474	.08139	.111	-.3579	.0284
Semester 5	Semester 4	0.8939	.09832	.636	-.1455	.3243
	Internship	-.07535	.10122	.738	-.3168	.1661
Internship	Internship	.16474	.08139	.111	-.0284	.3579
	Semester 5	.07535	.10122	.738	-.1661	.3168

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4.5 Hypotheses Overview

This section presents the overview of the hypotheses tested in this study. The following table 4.10 shows the summary of the findings from the correlation analysis.

Table 4.10
Summary of the Research Hypothesis Test Results

No	Hypothesis	Results
H_1	There is a significant relationship between digital literacy skills and future workforce readiness.	Supported
H_2	There is a significant relationship between training development and future workforce readiness.	Supported
H_3	There is a significant relationship between curriculum and future workforce readiness.	Supported

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4.6 Summary of the Chapter

As a summary, this chapter includes the data analysis conducted based on the responses collected thought questionnaire. To ensure the instrument's consistency and accuracy, a reliability test was conducted. A descriptive analysis was performed to provide an overview on the respondent's demographic profile and the distribution of all the four variables. Hypothesis testing was then proceeded to explore the relationship between the three independent variable and dependent variables. Pearson Correlation analysis was utilised to understand the relationship direction.

The results demonstrated that three variables, digital literacy skills, curriculum, and training development respectively had significant positive direction towards future workforce readiness. Researcher also conducted ANOVA analysis which resulted in no significant differences in student readiness levels across different level of semesters.

Hence, all the research objective and hypotheses have been addressed through the analyses. Chapter Five will provide the detailed justification on the key findings, provide insights on the study limitation, propose future research directions, and make practical recommendations based on the results.

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CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter is organized into five sections to discuss the findings of this study. The first section provides overview of the study's finding and followed by discussion on the hypothesis. The contribution of this research highlights the implication of the study theoretically and practically to stake holders. This chapter also outlines the limitation of the study and aims to offer valuable suggestion to future research based on the limitations. Finally, it summarizes and concludes the research work.

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5.2 Overview of Findings

A significant overview of the relationship factors affecting the future workforce readiness in SCM field among the PSP students was presented in Chapter Four. This study aimed to investigate the correlation between the research objectives and the data analysis outcomes.

5.2.1 Digital Literacy Skills Level of DLS Students in PSP

Research objective one aims to determine if PSP DLS students are digitally literate so that they can meet the expectations of a supply chain industry which is evolving in digital transformation. Descriptive analysis showed a high mean score for digital literacy skill which implies that students believe they are typically digitally literate and used with handling digital tools. Broader global trends show the need for digital

literacy skill as it being recognized as a fundamental employability skill which determines the access to job market (Đorđević et al., 2025).

Correlation analysis (H_1) showed a substantial positive association between digital literacy skill and future workforce readiness ($r = .658$, $p < 0.01$). In other terms, these findings prove that, when student possess high level of digital literacy skills, they are more likely ready to adapt the digital transformation norm at working environment. This aligns with the findings of Begum & Keerthi (2025), which states the apart from technical perspectives, the ability to adapt in the workplace, and problem-solving skill are enhanced by the high levels of digital proficiency.

Graduates' employability highly relies on their proficiency of utilizing technologies like real-time dashboards, and predictive analytics platforms especially in this phase of economy. As highlighted in the national and regional initiatives like the Association of Southeast Asian Nations (ASEAN) Digital Integration Framework and the Twelfth Malaysia Plan, to ensure graduates are competitive in global digital supply chain ecosystems, its wise for TVET programs to incorporate digital literacy training. To conclude, research objective one is achieved, and the digital literacy skill of PSP DLS students are highly notable.

5.2.2 The Relationship of Digital Literacy Skills, Training Development, and Curriculum on Future Workforce Readiness among DLS Students.

This purpose of this research objective is to determine the relationship among digital literacy skills, training development, and curriculum and future workforce readiness. The findings validated that digital literacy skills and curriculum exhibit a positive correlation with future workforce readiness, while training development shows a negative correlation. The strength of the digital literacy skills with future workforce

readiness relationship supports the hypothesis that students proficient in using digital tools like ERP systems, assumes themselves as more equipped to fit into technology based SCM employment. This was supported by the statement of research by Nuezca et al. (2024) along with Rajamanickam et al. (2024) and Fadzil et al. (2022). They concluded that digital literacy accounted in the preparedness for technology-integrated learning. These findings imply that digital literacy is not just a complementary talent but it's a fundamental skill linked to the employability in technology-driven sectors.

The curriculum and future workforce readiness relationship indicates that students feel more prepared when their curriculum aligns with industry. This aligns with Razali et al. (2021), who found that outcome-based learning enhances confidence and adaptability. Kholifah et al. (2025), also highlighted industry integrated curriculum are highly effective to equip graduates for the need of digital employment market. This alignment may be strengthened in PSP's situation by integrating useful digital technologies into assessment and providing regular exposure to industry related education throughout all semesters. The positive relationship between training development and future workforce readiness indicates that reducing the barriers and enhancing the training development can boost the readiness. The typically low training development scores in this study suggest that PSP students should benefit from solid institutional assistance, which mitigates the training development related barrier.

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Hence, the outcome of second research objective reflects, there is a significant relationship between digital literacy, training development, curriculum and future workforce readiness. These findings stress that readiness is enhanced by skill confidence and curriculum quality and effective training development. The literature confirms, to develop a future workforce for technology driven economy, it's crucial to

incorporate strong digital literacy training, matching curriculum with industry objectives, and reduce training development related barriers.

5.2.3 The Significant Differences of Future Workforce Readiness among Different Group of Students.

Research objective three investigates if there were any significant differences in future workforce readiness across the semester of DLS student. This study's analysis found that there were no major differences in future workforce readiness scores across the groups. This suggest in overall all the students are highly perceived readiness for the digitalised workforce regardless of scholastic development.

One of the reasons for these results could be is by the program's methodical integration of their curriculum with the industry-based inputs and the digital literacy skills components throughout the semesters. This is supported by Falloon (2020) who found gap between academic levels are reduced when students are exposed to competency-aligned, technologically based curriculum over an extended period of time. Moreover, the integration of the digital literacy skills through assignments, practical works and assessment in classroom over all the semester led to a sustained skill development. This shows that PSP aligns well with the UNESCO's (2018) aim on systematic digital literacy integration across curriculum ensures equitable skill development. This explains the high baseline preparedness as seen across cohorts.

Hence, there is no statistically significant evidence for research objective three. However, from the positive perspective of this finding, it’s proven that the future workforce of DLS PSP is consistently high across all student groups. Significantly it indicates that the DLS program is able to meet SCM workforce preparation goals consistently across all academic levels.

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5.3 Theoretical Implications

This study provides a significant contribution towards the theoretical understanding of the workforce readiness through the empirical validation of the framework. The framework incorporates the digital literacy skills, training development and curriculum as the determinants of future workforce readiness among the DLS students at PSP.

Previous researcher has mostly explored at these concepts individually. The training development of ICT integration, digital literacy skills in general perspective by Hussein et al. (2024) or curriculum-policy alignment with digitalization (Jamaludin et al., 2023). It has led to a disparity of theory that explain how various educational dimension relate to student's perception of their preparation for digitally enhanced industries. Thus, in order to close this gap, this study provides a framework that takes into consideration of dimensions such as educational alignment, learning barriers and student capabilities. The results indicate that the curriculum alignment alone is insufficient, unless the fair access to digital learning is complemented and also upskilling programs related to student-centric digital learning is provided.

Apart from that, this study also provides a fundamental guidance by placing the digital literacy skills frameworks in the Malaysia TVET ecosystem especially in the vocational education system. DigCompEdu or the United Nations Educational, Scientific and Cultural Organization's Information and Communication Technology Competency Framework for Teachers (UNESCO'S ICT-CFT) are those existing global models that are basically broad or rigid for regional application. A study by Yang & Wu (2024) reinforced this need, highlighting the importance to develop digital

literacy skills and the ecosystem especially in emerging economies through international engagement.

In conclusion, this study provides an overview that allows future researchers, TVET curriculum designers and policy makers to assess the student's readiness using technological, structural and competency-based predictors apart from academic achievements. In this way, it contributes to the theoretical discussion on education to employment alignment towards IR4.0 and workforce development that aligns with the SDGs.

5.4 Practical Implications

5.4.1 Implications on TVET Institutions and Lecturers

In the niche areas of supply chain courses, this study offers helpful insights for improving instructional strategies, and curriculum implementation. Thus, this implies the need for regular audits to ensure consistency with national standards and evolving industry demands. Even though, this study emphasized institution-specific, the outcome of it is applicable to the other TVET institutions. TVET curriculum develops should ensure that Program Learning Outcomes (PLOs) are not only mapped but also implemented through the digital literacy skills building exercises and evaluations.

As overall, educators are recommended to adopt technology savvy learning strategies such as data visualisation tool and real-time simulation along with conventional teaching techniques. Student's success relies on the educator's proficiency in the digital education. Therefore, in order to enable effective education, upskilling and exposure to industry tools are required.

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Moreover, curriculum alignment alone does not ensure readiness of workforce, as demonstrated by PSP's student. This could be different if students also have sufficient assistance with digital resources and accessibility. Digital inequities required investment in the software, hardware, and internet accessibility. These investments will ensure the graduates are equipped and meet the industry's demands in the digitalized era.

5.4.2 Implications for Students

The findings of this research indicate the importance to student in acquiring personal digital literacy skills as a fundamental employability advantage. As future supply chain workers, students should view digital literacy as an essential, not optional skill set. This is due to, SCM is an industry that rely more on automation, big data, and IoT which means digital literacy skills are vital. It is advisable that students to actively participate in digitally enabled assessments and engage in self-directed learning. By doing so, it fosters awareness of digital needs in supply chain operations, such as real-time tracking and AI-powered demand planning.

The study also reminds students the significance of navigating and overcoming structural barriers proactively. While PSP or any institutional assistance is important, students put in effort to check out for free or low-cost digital learning tools. There are many courses related to supply chain and analytics such as Power BI being offered lately as a supplement classroom education.

In conclusion, this study's results are a useful feedback tool to help students assess their own capability and step in for skill improvement. Meanwhile, at the institutional level, the digital literacy skills self-assessment systems may assist students to find

gaps. This will lead the students to create individualised learning paths, increasing their flexibility in a quickly changing digital job market.

5.5 Policy Implications

This study's finding has major implications for national education policy makers, particularly those forming curriculum design, TVET strategies, and digital equity policies under the Malaysia Education Blueprint (Higher Education). First, curriculum designers should ensure that there are clear and measurable digital proficiency outcomes in industry-aligned curriculum. The drawback of national curriculum standard is, it only lists general learning areas. Thus, policies need to promote the engagement of particular digital literacy skills, like data analytics, cloud-based systems, and digital communication tools that are related to logistics.

Moreover, MOHE need to strengthen the policies that institutionalise digital equity across all the TVET institutions, especially in rural and semi-urban institutions. Based on this research, student's readiness is improved when they are provided with good internet connectivity and adequate devices. Thus, by addressing these needs, it will directly provide a fair, wider and lifelong learning as mentioned in Sustainable Development Goal 4 (SDG 4), especially through the digital integration perspective.

Furthermore, there is a need to ensure continuous compliance with industry through the real-time assessment of curriculum relevance. While existing frameworks provides a strong solid foundation, they risk of becoming outdated, without regular evaluation. Through this study, it's advisable for policymakers to conduct curriculum industry audits to ensure that technical and digital components remain aligned with the contemporary supply chain needs.

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5.6 Limitations of the Study

Although this study provides valuable insights into the relationship between the variables examined among SCM students at PSP, there are some limitations should be addressed in order to clarify its conclusions and direct future research to prepare for the workforce in the future.

By using a cross-sectional quantitative design, it impacts the ability to identify the correlation. The relationship between the independent variables and dependent variables should be regarded as associated rather than its dimensions, although statistically significant. Longitudinal or mixed-methods approaches could be useful in future research to examine how these dimensions change over time or are influenced by the educational situation.

Moreover, self-reported surveys were the only way to get data in which it may introduce bias due to social desirability or exaggerated self-assessment of digital literacy skills. Subjective assessments might not accurately represent true skill levels, even though the validity and reliability of the instrument have been established. Including objective qualitative input from academics and industry key players would enhance the integration of data and external validity. Besides, the respondents were students and fresh graduates from PSP with minimal industry experience, resulting lack of exposure to industry needs.

Universality of the study might be limited as the study was carried out at a single TVET institution (PSP). As technical specialities may differ for other institutions, consideration need to be done when applying this study's insights to a wider context. Thus, future studies could widen the sample population so that the findings could be applied in a broader context.

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Finally, this study only focused on few aspects apart from statistical tools. Some core dimensions such as student motivation and educator digital pedagogy were not taken into consideration. These key elements would provide more insights for the workforce readiness towards digitally challenging employment in SCM.

5.7 Recommendations

In light of the study's limitations and findings, a number of specific recommendations are made for future researchers, and key players in order to improve TVET student's digital readiness and better match workforce development plans with SCM technology trends.

5.7.1 Recommendations for Future Research

Future research should consider using a longitudinal design to track how student's perceptions of workforce readiness and digital literacy skills change over time, particularly as curriculum inventions are implemented in Malaysian polytechnics, given the cross-sectional nature and institution-specific scope of this study. Mixed-methods approaches could also be used in future research to provide qualitative insights to quantitative data.

In addition, focus groups or in-depth interviews with students, instructors, and employers would yield a deeper knowledge of topics like perceived curricular relevance, instructional quality, and barriers to digital accessing aspects in which the self-reported surveys would not adequately capture. Besides that, the sample size of the population is recommended to be broader by including other institutions such as private institution and universities. Respondents scope should also take into consideration by including the graduates with at least two years working experience.

Future models may also consider including elements like educator's digital proficiency and student motivation to develop a more comprehensive framework in accessing the future workforce readiness.

5.7.2 Recommendations to Industry

The supply chain industry needs to take the initiative to bridge the gap between the demands of the digital labour market and academic preparation. In order to achieve that, one effective strategy is to integrate in developing the curriculum modules that aligns with the industry needs globally. This could be including simulation-based study or even implementing systems related to IoT. Moreover, industry driven lecturer upskilling efforts, that includes collaborative "train-the-trainer" initiatives, or guest training sessions would make sure that academic staff stay up to date with changing supply chain processes and technologies. As a result, instructions will be of higher quality and more in line with industry standards for educational delivery.

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5.7.3 Recommendations to Policymakers

Policymakers especially TVET agencies and MOHE, should plan on conducting audit on national digital readiness through all the polytechnics that offers SCM courses. This approach will help to a guide on closing the gap on digital access and which might also require additional funding. Moreover, it is recommended that policymakers to develop an audit committee that which, consist of industry experts to audit the curriculum. Thus, this will ensure the curriculum are align with the evolving demand in the industry.

5.8 Conclusion

This study focused on diploma-level students enrolled in DLS programs at PSP, Malaysian TVET institution. It explored the relationship between digital literacy skills, training development and the curriculum with future workforce readiness. The findings of this study highlighted future workforce is positively associated with digital literacy skills, particularly when students are exposed to fundamental exposure of the digital technologies. Likesise, training development also exhibit positive relationship with PSP student's perceptions on their readiness. This indicates that effective training development leads to the future workforce readiness. Besides, this study also found a strong relationship between curriculum criteria and workforce readiness. This shows the importance to ensure maintaining the curriculum quality by frequently having audits and continuously adapting to the evolving demands of technology-driven industry. There were no significant differences on digital transformation readiness across the semesters.

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This study theoretically offers a thorough lens and bridges the gaps in previous research in education and employment readiness in the context of digital literacy skills of the future workforce. From the practical perspective, this study provides recommendations based on evidence to enhance the digital literacy skills and curriculum alignment in TVET institutions and stakeholders. Malaysia's ambitions to become a regional hub for manufacturing, logistics and digital trade requires a strong team of workforce who are digitally competent. Thus, this study is relevant in the era of growing digitisation in the supply chain sector globally. The need for graduate to be digitally literate, outspoken, assessed by an aligned curriculum to ensure Malaysia's regional hub vision to be achieved.

In summary, this study reveals the crucial educational dimensions that are positively associated with student readiness towards digitalized employment. It helps TVET supply chain and logistics education courses to link with Malaysia's digitalized future. This leads the pathway for the workforce development that are highly competent, scalable and futuristic in the long term.

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APPENDICES

Appendix 1: Adapted and Adopted Questionnaire

Part 1 : Demography					
No.	**Item**	**Options**	**Source**	**Citation**	**Remarks**
1	Gender	Male Female	Researchers own work	N/A	Author
2	Age	Below 20 20 -22 Above 22			Author
3	Semester	Semester 4 Semester 5 Semester 6			Author
4	Own a personal device for learning	Yes No			Author
5	Internet accessibility	Excellent Moderate Poor			Author
6	How would you rate your own digital skill level?	Beginner Intermediate Advanced			Author
7	Have you taken any course subject related to digital literacy or computing in DLS program?	Yes No			Author

Part 2 : Digital Literacy Skills (DL)					
Adopt & Adapted		**Previous Studies Questionnaire Items**			**Remarks**
No.	**Item**	**Item**	**Ref.No**	**Citation**	
DL1	I use digital technologies to search for information and study materials.	I use digital technologies to search for information and study materials	11	(Tulinayo et al., 2018b)	Adopted
DL2	I apply different methods and tools to manage and store information, data and digital content for easy retrieval.	I apply different methods and tools to manage and store information, data and digital content for easy retrieval.	T3	(Zhao et al., 2021)	Adopted
DL3	I know how to navigate the Internet through links or hyperlinks.	I know how to navigate the Internet through links or hyperlinks	3.3	(Soriano-Alcantara et al., 2024)	Adopted
DL4	I know how to make simple presentations with and without templates.	I know how to make simple presentations with and without templates	6.7		Adopted
DL5	I know how to recognize different programs to create spreadsheets (Excel or Calc, google + calculation).	I know how to recognize different programs to create spreadsheets (Excel or Calc, google + calculation)	5.1		Adopted
DL6	I know how to recognize different programs to edit text (Word, Writer or WordPad, google + text).	I know how to recognize different programs to edit text (Word, Writer or WordPad, google + text)	4.1		Adopted
DL7	I can create an event and set notifications using a digital calendar (e.g., Google Calendar, Apple Calendar, Microsoft Outlook Calendar).	I can create an event and set notifications using a digital calendar (e.g., Google Calendar, Apple Calendar, Microsoft Outlook Calendar)	DAM1	(Tzafilkou, Perifanou, & Economides, 2022)	Adopted
DL8	I can apply statistical techniques using appropriate software (e.g., SPSS, R, MS Excel, Google Sheets) to make forecasting or predictions.	I can apply statistical techniques using appropriate software (e.g., SPSS, R, MS Excel, Google Sheets) to make forecasting or predictions	DAM5		Adopted
DL9	I can convert content from one format to another format.	I can convert content from one format to another format	DAM6		Adopted
DL10	I can collaborate with classmates and lecturers using various smart devices, platforms, and digital tools.	I can collaborate with people using various smart devices, platforms, and digital tools	CCS1		Adopted

Remarks : As for this section, Questionnaire from previous studies is adopted ***without any changes or repharasing of sentence***

Part 3 : Training Development (TD)					
Adopt & Adapted		**Previous Studies Questionnaire Items**			**Remarks**
No.	**Item**	**Item**	**Ref.No**	**Citation**	
TD1	My lecturers are very helpful and always address my problem using digital technologies	My lecturers are approachable and always address my difficulties regarding the use of digital technologies	5	(Tulinayo et al., 2018b)	Adapted
TD2	I have received enough training to use the different digital technologies	I have undergone enough training to use the different digital technologies	8		Adapted
TD3	PSP organises courses, conferences and workshops on the use of digital teaching tools.	My institution organises courses, conferences and workshops on the use of digital teaching tools.	25	(Alarcón et al., 2020)	Adapted
TD4	Apart from those mentioned above, what other difficulties do you encounter attempting to enhance your digital skills?	NIL	**Open ended Question - researcher own work**		Author

Part 4 : Curriculum (C)					
Adopt & Adapted		Previous Studies Questionnaire Items			Remarks
No.	Item	Item	Ref.No	Citation	
C1	I am curious of and excited to explore new opportunities where digital technologies can be applied in the field of education.	I am curious of and eager to exploit new opportunities where digital technologies can be applied in the field of education.	DC13	(Wang et al., 2021)	Adapted
C2	I clearly understand how digital technologies support my study.	I have a clear understanding of the role of digital technologies in my study.	DC14		Adapted
C3	I can decide on the digital tools that best fit for my study among a variety of options available.	I can decide on the digital technologies that are most relevant and appropriate for my study among a variety of options.	DC16		Adapted
C4	I am good at using digital technologies to improve my academic performance.	I am proficient at using digital technologies to improve my academic performance.	DC3		Adapted
C5	I am good at sharing and collaborating with others effectively in digital learning environments.	I am good at sharing and collaborating with others effectively in digital learning environments.	DC5		Adapted
C6	I use digital technologies to improve my ability of collecting and organizing quality materials for my study.	I am proficient at using digital technologies to improve my ability of collecting and organizing quality materials for my study.	DC6		Adapted

Part 5 : Future Workforce Readiness (FW)					
Adopt & Adapted		Previous Studies Questionnaire Items			Remarks
No.	Item	Item	Ref.No	Citation	
FW1	I am confident with my capability to apply digital technologies knowledge and skills towards digital transformation in Supply Chain Management.	I am confident with my capability of applying digital technologies to increase my learning effectiveness and efficiency.	DC17	(Wang et al., 2021)	Adapted
FW2	I am ready to adapt with changes during digital transformation in Supply Chain Management.	I am ready to adapt with changes during Industrial Revolution 4.0.	T4-6	(Abd Rahman Ahmad et al., 2019	Adapted
FW3	I am ready to apply technical skills in job task required during digital transformation in Supply Chain Management.	I am ready to apply technical skills in job task required during Industrial Revolution 4.0.	T4		Adapted
FW4	I am ready to learn new knowledge provided by management for digital transformation in Supply Chain Management.	I am ready to learn new knowledge provides by management for Industrial Revolution 4.0.	T4		Adapted
FW5	I am ready to do my tasks in an innovative way towards digital transformation in Supply Chain Management.	I am ready to do my tasks in an innovative way towards Industrial Revolution 4.0.	T4		Adapted
FW6	I am ready to attend further training to improve my knowledge and skills in digital transformation in Supply Chain Management.	I am ready to attend training provide by the institute for Industrial Revolution 4.0.	T4		Adapted
FW7	I have the skill in accessing spreadsheets to key in data that required in the digital transformation in Supply Chain Management.	I have the skill in accessing spreadsheet to key in data that required in the Industry Revolution 4.0.	T5		Adapted
FW8	I can adapt to different situations that occur in the industries advanced in technology 4.0 for digital transformation in Supply Chain Management.	I can adapt to different situations that occur in the industry that advanced in technology 4.0.	T6		Adapted

Appendix 2: Statistics of Polytechnic Seberang Perai Population

Statistik IEO Politeknik Seberang Perai Sesi II : 2024/2025

Bil	Nama Program	Kod Program	JS1	JS2	JS3	JS4	JS5	JS6	Jumlah
1	Diploma Kejuruteraan Elektronik (Komputer)	DTK	9	39	1	36	6	53	144
2	Diploma Kejuruteraan Elektronik (Komunikasi)	DEP		20		19		22	61
3	Diploma Kejuruteraan Elektrik & Elektronik	DEE	32	106	14	80	19	77	328
4	Diploma Kejuruteraan Mekanikal	DKM	14	92	15	88	8	119	336
5	Diploma Kejuruteraan Mekanikal (Loji)	DJL		13		31	1	29	74
6	Diploma Kejuruteraan Mekanikal (Pembuatan)	DTP	4	24		21	3	30	82
7	Diploma Kejuruteraan Mekanikal (Tekstil)	DMT		10		13		7	30
8	Diploma Akauntansi	DAT		97	16	47	15	59	234
9	Diploma Pengajian Perniagaan	DPM	73	79	43	95	35	82	407
10	Diploma Pengurusan Logistik Dan Rantaian Bekalan	DLS						1	1
11	Diploma Kewangan Dan Perbankan Islam	DIB				78	67	77	222
12	Diploma Pengurusan Logistik Dan Rantaian Bekalan	DLS	73	136	80	97	74	98	558
13	Diploma Kewangan Islam	DIF	15	85	28				128
14	Diploma Teknologi Maklumat (Teknologi Digital)	DDT			2	155	85	4	246
15	Diploma Teknologi Maklumat	DIT	56	230	46				332
		Jumlah Keseluruhan	276	931	245	760	313	658	3183

Data yang dikira ialah data pelajar yang berstatus

1. AKTIF
2. TANGGUH
3. GRADUATE - (Sekiranya statistik bukan sesisemasa)
4. GANTUNG PENGAJIAN
5. AKTIF LATIHAN INDUSTRI
6. TIDAK LAPOR DIRI
7. TUKAR KURSUS
8. AKTIF MP
9. DITAHAN KEPUTUSAN
10. TIDAK LAPOR MP
11. GAGAL BERHENTI - (Sekiranya statistik bukan sesisemasa)

** Pelajar Separuh Masa telah diambil kira dalam statistik ini

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Appendix 3: Questionnaire Survey Administered Via Google Form

FACTORS INFLUENCING FUTURE WORKFORCE READINESS FOR DIGITAL TRANSFORMATION AMONG SUPPLY CHAIN MANAGEMENT STUDENTS: A STUDY AT POLYTECHNIC SEBERANG PERAI

Thank you for your interest in participating in this research survey. My name is Kanchana Kannan, and I am a postgraduate student in the Master of Science in Supply Chain Management program at Universiti Utara Malaysia (UUM). This survey is part of my academic research project, and your responses will help deepen the understanding of Digital Competency of Future-Ready Supply Chain Management Students : A study at Polytechnic Seberang Perai . The survey is expected to take approximately **10 – 15 minutes**of your time.

By proceeding to answer this questionnaire, you are giving your consent to voluntarily participate in this study. If you meet the criteria as a student of **Diploma in Logistics and Supply Chain Management at PSP**, your input will be highly valuable to this study.

* Indicates required question

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Confidentiality and Privacy Notice

All information collected through this form will be kept strictly confidential and used solely for academic purposes. Your participation is voluntary, and you may choose to withdraw at any time without any consequences. No personally identifiable information will be shared or published. Data will be reported only in aggregate form. Only the researcher and authorized supervisors will have access to the raw data.

Data Protection and Consent

By continuing with this survey, you provide your explicit consent for your responses to be collected and analyzed for research purposes only. If you wish to withdraw your consent or have any questions regarding your data, please contact me at kanchana2694@gmail.com .

The questionnaire consists of multiple sections using a Likert scale, where you will be asked to rate your level of agreement or perception on a scale from **1 (Strongly Disagree) to 5 (Strongly Agree).** Kindly answer each question honestly based on your current understanding and experience.

Thank you for your valuable contribution to this research.

Part 1: Respondent Demography

Bahagian 1: Demografi Responden

Gender *
Jantina

- [ ] Male / Lelaki
- [ ] Female / Perempuan

Age *
Umur

- [ ] Below 20 / Bawah 20 tahun
- [ ] 20 -22 years / 20 - 22 tahun
- [ ] Above 22 / Lebih 22 tahun

Semester *
Semester Pengajian

- [ ] Semester 4
- [ ] Semester 5
- [ ] Semester 6 / Internship

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Own a personal device for learning *
Memiliki peranti peribadi untuk pembelajaran

- [ ] Yes / Ya
- [ ] No / Tidak

Internet accessibility *
Akses Internet

- [ ] Good / Baik
- [ ] Moderate / Sederhana
- [ ] Poor / Lemah

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Part 2 : Digital Literacy Skills (DL)

Bahagian 2: Kemahiran Literasi Digital (DL)

1 – Strongly Disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree

DL1 : I can use digital technologies to search for useful and accurate information and study materials. *

DL1 : Saya boleh menggunakan teknologi digital untuk mencari maklumat dan bahan pembelajaran yang berguna dan tepat.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL2 : I apply different methods and tools to manage and store information, data and digital content for easy retrieval. *

DL2 : Saya menggunakan pelbagai kaedah dan alat yang berbeza untuk mengurus serta menyimpan maklumat, data dan kandungan digital bagi memudahkan capaian semula.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL3 : I know how to navigate the Internet through links or hyperlinks. *

DL3 : Saya tahu cara melayari Internet menggunakan pautan atau hiperpautan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL4 : I know how to make simple presentations with and without templates. *

DL4 : Saya tahu cara menyediakan perbentangan ringkas dengan atau tanpa templat.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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DL5 : I am familiar with the programs I can use to create spreadsheets, such as Google Sheets and Excel. *

DL5 : Saya biasa menggunakan program untuk membuat hamparan seperti Google Sheets dan Excel.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL6 : I know how to recognize different programs to edit text (Word, Writer or WordPad, google + text). *

DL6 : Saya tahu cara mengenal pasti program yang berbeza untuk menyunting teks (Word, Writer atau WordPad, teks google +).

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL7 : I can create an event and set notifications using a digital calendar (e.g., Google Calendar, Apple Calendar, Microsoft Outlook Calendar). *

DL7 : Saya boleh mencipta acara dan menetapkan peringatan menggunakan kalendar digital (cth., Kalendar Google, Kalendar Apple, Kalendar Microsoft Outlook).

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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DL8 : I can do simple data analysis and basic prediction using programs like Excel or SPSS. *

DL8 : Saya boleh menggunakan teknik statistik dengan perisian yang sesuai (cth, SPSS, R, MS Excel, Google Sheets) untuk membuat jangkaan atau ramalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL9 : I can convert content from one format to another format. *

DL9 : Saya boleh menukar kandungan daripada satu format kepada format lain.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

DL10 : I can collaborate with classmates and lecturers using various smart devices, platforms, and digital tools. *

DL10 : Saya boleh bekerjasama dengan rakan sekelas dan pensyarah menggunakan pelbagai peranti pintar, platform dan alatan digital.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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Part 3 : Training Development (TD)

Bahagian 3: Pembangunan Latihan (TD)

1 – Strongly Disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree

TD1: My lecturers are very helpful and always address my problem using digital technologies. *

TD1 : Pensyarah saya sangat membantu dan sentiasa menangani masalah saya dalam penggunakan teknologi digital.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

TD2: I have received enough training to use the different digital technologies. *

TD2 : Saya telah menerima latihan yang mencukupi untuk menggunakan teknologi digital yang berbeza.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

TD3: PSP organises courses, conferences and workshops on the use of digital teaching tools. *

TD3 : PSP menganjurkan kursus, persidangan dan bengkel berkaitan penggunaan alat pengajaran digital.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

TD4: Apart from those mentioned above, what other difficulties do you encounter attempting to enhance your digital skills? Please explain briefly.

TD4 : Selain daripada yang dinyatakan di atas, apakah cabaran lain yang anda hadapi semasa meningkatkan kemahiran digital anda? Sila nyatakan dengan ringkas.

Your answer

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Part 4 : Curriculum (C)

Bahagian 4: Kurikulum *(C)*

1 – Strongly Disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree

C1 : I am curious of and excited to explore new opportunities where digital technologies can be applied in the field of education. *

C1 : Saya ingin tahu dan teruja untuk meneroka peluang baharu di mana teknologi digital boleh digunakan dalam bidang Pendidikan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

C2 : I clearly understand how digital technologies support my study. *

C2 : Saya memahami dengan jelas bagaimana teknologi digital menyokong pengajian saya.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

C3 : I can decide on the digital tools that best fit for my study among a variety of options available. *

C3 : Saya boleh menentukan alat digital yang paling sesuai untuk pengajian saya dalam pelbagai pilihan yang tersedia.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

C4 : I am good at using digital technologies to improve my academic performance. *

C4 : Saya mahir menggunakan teknologi digital untuk meningkatkan prestasi akademik saya.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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C5 : I am good at sharing and collaborating with others effectively in digital learning environments. *

C5 : Saya mahir berkongsi dan bekerjasama dengan orang lain dengan berkesan dalam persekitaran pembelajaran digital.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

C6 : I use digital technologies to improve my ability of collecting and organizing quality materials for my study. *

C6 : Saya menggunakan teknologi digital untuk meningkatkan keupayaan saya mengumpul dan menyusun bahan berkualiti untuk pengajian saya.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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Part 5 : Future Workforce Readiness (FW)

Bahagian 5: Kesediaan Tenaga Kerja Masa Hadapan (FW)

1 – Strongly Disagree | 2 – Disagree | 3 – Neutral | 4 – Agree | 5 – Strongly Agree

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FW1 : I am confident with my capability to apply digital technologies knowledge and skills towards digital transformation in Supply Chain Management. *

FW1 : Saya yakin dengan keupayaan saya untuk mengaplikasikan pengetahuan dan kemahiran teknologi digital dalam melaksanakan transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW2 : I am ready to adapt with changes during digital transformation in Supply Chain Management. *

FW2 : Saya bersedia untuk menyesuaikan diri dengan perubahan semasa transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW2 : I am ready to adapt with changes during digital transformation in Supply Chain Management. *

FW2 : Saya bersedia untuk menyesuaikan diri dengan perubahan semasa transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW3 : I am ready to apply technical skills in job task required during digital transformation in Supply Chain Management. *

FW3 : Saya bersedia untuk mengaplikasikan kemahiran teknikal dalam tugasan kerja yang diperlukan semasa transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW4 : I am ready to learn new knowledge provided by management for digital transformation in Supply Chain Management. *

FW4 : Saya bersedia untuk mempelajari pengetahuan baharu yang disediakan oleh pengurusan untuk transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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FW5 : I am ready to do my tasks in an innovative way towards digital transformation in Supply Chain Management. *

FW5 : Saya bersedia untuk melaksanakan tugasan saya dengan cara yang inovatif ke arah transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW6 : I am ready to attend further training to improve my knowledge and skills in digital transformation in Supply Chain Management. *

FW6 : Saya bersedia untuk menghadiri latihan lanjutan untuk meningkatkan pengetahuan dan kemahiran saya dalam transformasi digital berkaitan Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW7 : I am able to enter and manage data used in supply chain work using spreadsheets like Excel. *

FW7 : Saya mampu memasukkan dan mengurus data berkaitan kerja rantaian bekalan menggunakan hamparan seperti Excel.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

FW8 : I can adapt to different situations that occur in the industries advanced in technology 4.0 for digital transformation in Supply Chain Management. *

FW8 : Saya boleh menyesuaikan diri dengan situasi berbeza yang berlaku dalam industri berteknologi tinggi 4.0 untuk transformasi digital dalam Pengurusan Rantaian Bekalan.

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

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FW9 : What other digital skills or technologies do you think should be added to the DLS program to help students like you be more prepared for future jobs in a digital supply chain industry?

FW9 : Pada pandangan anda, apakah kemahiran atau teknologi digital lain yang patut ditambah dalam program DLS bagi membantu pelajar seperti anda lebih bersedia menghadapi kerjaya dalam industri rantaian bekalan yang semakin digital pada masa hadapan?

Your answer

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Appendix 4: Pilot Test Summary

PILOT Test Analysis Summary

Pilot Test Questionnaire Item		Pilot Test Results		Remarks	Reworded Item (Final Version)
No.	Item				
DC1	I use digital technologies to search for information and study materials.	Mean	4.97		I can use digital technologies to search for useful and accurate information and study materials.
		SD	0.183		
		Corrected Item-Total Correlation	0.158		
DC5	I know how to recognize different programs to create spreadsheets (Excel or Calc, google + calculation).	Mean	3.67	Changes needed to avoid confusion with terms as some responden did sound as so.	I am familiar with the programs I can use to create spreadsheets, such as Google Sheets and Excel.
		SD	1.028		
		Corrected Item-Total Correlation	0.643		
DC8	I can apply statistical techniques using appropriate software (e.g., SPSS, R, MS Excel, Google Sheets) to make forecasting or predictions.	Mean	3.43	Changes needed to avoid confusion with terms as some responden did sound as so.	I can do simple data analysis and basic prediction using programs like Excel or SPSS.
		SD	1.04		
		Corrected Item-Total Correlation	0.647		
FW7	I have the skill in accessing spreadsheets to key in data that required in the digital transformation in Supply Chain Management.	Mean	3.93	Changes needed to make the item simple and easy to understand.	I am able to enter and manage data used in supply chain work using spreadsheets like Excel.
		SD	0.944		
		Corrected Item-Total Correlation	0.743		

Appendix 5: Skewness and Kurtosis Analysis Results of Final Data Set

Descriptive Statistics

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
DL1	169	-1.647	.187	1.775	.371
DL2	169	-1.076	.187	.458	.371
DL3	169	-.887	.187	-.064	.371
DL4	169	-.508	.187	-.974	.371
DL5	169	-.493	.187	-.710	.371
DL6	169	-.740	.187	-.291	.371
DL7	169	-.710	.187	.054	.371
DL8	169	-.244	.187	-.715	.371
DL9	169	-.949	.187	.250	.371
DL10	169	-1.448	.187	1.823	.371
TD1	169	-1.160	.187	.469	.371
TD2	169	-.461	.187	-.413	.371
TD3	169	-.499	.187	-.180	.371
C1	169	-1.069	.187	.430	.371
C2	169	-1.203	.187	.451	.371
C3	169	-1.023	.187	1.064	.371
C4	169	-.655	.187	-.553	.371
C5	169	-.587	.187	-.620	.371
C6	169	-1.069	.187	.430	.371
FW1	169	-.555	.187	-.809	.371
FW2	169	-.622	.187	-.668	.371
FW3	169	-.453	.187	-.643	.371
FW4	169	-.834	.187	-.291	.371
FW5	169	-.540	.187	-.633	.371
FW6	169	-1.098	.187	.920	.371
FW7	169	-.758	.187	.334	.371
FW8	169	-.459	.187	-.854	.371
Valid N (listwise)	169				

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