Mismatched Talents and Industry Needs of IT Workforce in Small and Medium Enterprises (SMEs)

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Abstrak

Pendahuluan: Penelitian ini bertujuan untuk menilai kebutuhan tenaga kerja TI dan mengusulkan solusi untuk mengatasi masalah ketidaksesuaian keterampilan di Usaha Kecil dan Menengah (UKM). **Latar Belakang Masalah:** Meningkatnya permintaan akan keterampilan TI spesifik di Indonesia, seperti analis data , pemasar digital, dan pakar keamanan siber, telah menciptakan kesenjangan tenaga kerja yang signifikan. Namun, ketersediaan profesional TI gagal memenuhi permintaan ini. Hal ini memberikan peluang untuk meningkatkan keterampilan TI dan mendukung transformasi digital di UKM. Hal baru: Penelitian yang berfokus pada mengatasi kesenjangan keterampilan TI spesifik di Indonesia dan implikasinya terhadap UKM masih terbatas. Dengan menyoroti meningkatnya permintaan akan tenaga profesional TI dan menekankan kekurangan tenaga kerja yang ada, hal ini dapat menarik perhatian pada masalah inti dan memberikan solusi atas kesenjangan keterampilan TI. **Metode Penelitian:** Penelitian ini menggunakan kombinasi metodologi kuantitatif dan kualitatif. Pendekatan kuantitatif melibatkan pelaksanaan survei untuk menganalisis persyaratan keterampilan teknis UKM. Di sisi lain, metodologi kualitatif memerlukan pengumpulan wawasan yang lebih rinci dan komprehensif melalui metode Wawancara Informan Kunci (KII). **Temuan/Hasil**: badan usaha yang paling banyak membutuhkan tambahan tenaga kerja IT adalah badan usaha multisektor (5 sampai 6 orang) dan jasa elastis (4 orang). Di sisi lain, sektor konstruksi, akomodasi dan makanan, serta sektor jasa pendidikan tertentu memerlukan lebih sedikit personel TI (rata-rata 1 orang). Keterampilan yang saat ini sulit diperoleh perusahaan berbeda-beda di setiap cluster sesuai dengan jenis sektornya, namun secara umum, keahlian dalam pengembangan perangkat lunak dengan perintah JavaScript sangat dibutuhkan. Perusahaan di klaster 2 (Bandung dan Cirebon) memilih kolaborasi pihak ketiga untuk menghemat biaya staf TI. Tantangannya mencakup negosiasi upah yang sulit, kurangnya kebijakan kerja jarak jauh, serta masalah perilaku dan profesionalisme, khususnya bagi lulusan baru. Perusahaan-perusahaan di Cluster 1 (Malang dan Surabaya) kesulitan mendapatkan pekerja yang kompeten untuk menjalankan layanan e-commerce sepanjang waktu. Kesimpulan: Jumlah tenaga kerja IT masih kurang (2 sampai 3 orang). Sektor yang paling banyak membutuhkan tenaga kerja TI adalah bisnis multisektor, jasa, transportasi, pergudangan dan komunikasi, serta kesehatan. Misalnya, bisnis multisektor membutuhkan tambahan 5 hingga 6 pekerja IT, sedangkan sektor jasa membutuhkan 4 pekerja. Di sisi lain, layanan konstruksi, akomodasi dan makanan, serta layanan pendidikan tertentu hanya membutuhkan rata-rata 1 pekerja TI tambahan.

Kata Kunci:
cluster, analisis data, tenaga kerja IT, pemrograman, keterampilan.

Abstract

Introduction/Main Objectives: *The research aims to assess the requisite IT workforce and propose solutions to address the issue of skill mismatch in Small and Medium Enterprises (SMEs).Background Problems: The increasing demand for specific IT skills in Indonesia, such as data analysts, digital marketers, and cybersecurity experts, has created a significant workforce gap. However, the availability of IT professionals fails to meet this demand. This presents an opportunity to enhance IT skills and support digital transformation in SMEs.* ***Novelty:*** *There is limited research which focus on addressing the specific IT skills gap in Indonesia and its implications for SMEs. By highlighting the increasing demand for IT professionals and emphasizing the existing workforce shortage, it can grab attention to the core problem and provide solution of IT skills gap.* ***Research Methods:*** *The research employs a combination of quantitative and qualitative methodologies. The quantitative approach involves conducting surveys to analyze the technical skill requirements of the SMEs. On the other hand, the qualitative methodology entails gathering more detailed and comprehensive insights through the Key Informant Interview (KII) method.* ***Finding/Results:*** *the business entities that require the most additional IT workforce are the multi-sector (5 to 6 individuals) and elastic services (4 individuals). On the other hand, the construction, accommodation and food services, and specific educational services sectors require fewer IT personnel (an average of 1 person). The skills that are currently difficult for companies to acquire vary in each cluster according to the sector type, but generally, expertise in software development with JavaScript command is in high demand. Companies in cluster 2 (Bandung and Cirebon) opt for third-party collaborations to save on IT staffing costs. Challenges include tough wage negotiations, lack of remote work policies, and behavioral and professionalism issues, particularly fresh graduates. Cluster 1 companies (Malang and Surabaya) struggle to find competent workers for round-the-clock e-commerce service operations.* ***Conclusion:*** *The number of IT workforce is still insufficient (2 to 3 people). The sectors that require the most IT workforce are multi-sector businesses, services, transportation, warehousing and communication, and healthcare. For example, multi-sector businesses need an additional 5 to 6 IT workers, while the services sector requires 4 workers. On the other hand, construction, accommodation and food services, and specific educational services only require an average of 1 additional IT worker.*

Keywords:
Cluster; data analysis; IT workforce; programming, skills

INTRODUCTION

Covid-19 pandemic has had a significant impact on the national economy. Social restrictions have pressed business actors (including micro, small, and medium enterprises (MSMEs)) to reduce operating hours, resulting in a decrease in the number of customers and turnover. Economic digitalization, such as online product marketing, is a way adopted by business actors to adapt to the situation.

However, the current problem faced is the lack of skilled and qualified Information Technology (IT) workforce, which is not commensurate with the growing digital needs of both MSMEs and other large companies. According to research conducted by McKinsey, from 2015 to 2030, there is a gap between the demand and supply of IT workforce by 400 to 500 thousand

people. On the other hand, the Central Statistics Agency (BPS) also reported that as of February 2022, the number of unemployed in Indonesia reached 8.4 million people (5.83%).

This study uses a quantitative method (survey) involving 477 business actors in 12 cities in Indonesia as survey respondents. To enrich the study's results, 71 business actors were also involved in key informant interviews (KIIs). The findings in this study are grouped into four main categories, which are:

Company Needs in the IT Sector

Young people are the age group most needed by companies to work in their IT workforce. The majority of the required IT workforce is mid-level (33%), generally aged 25 to 35 years, followed by fresh graduates or entry-level (17%), aged 18 to 25 years. Recruiting mid-level workforce is considered more beneficial because the salaries paid are not as high as senior level, but the skills possessed already meet the company's needs.

The most needed IT skills include data administrators, IT support, IT helpdesk, and digital marketing, with an average requirement of 2 individuals per company. IT workers are also expected to master foreign languages (English). Most companies (51.7%) still accept IT workers with beginner level English proficiency, while other companies require intermediate level (41.9%) and advanced level (6.5%).

Recruitment of IT Workforce

There are several methods used by companies to disseminate job information, including through referral methods (35%), social media (32%), and via LinkedIn (13%).
Generally, companies conduct recruitment in 3 stages (33.79%), consisting of administrative selection, portfolio selection, and technical trials (technical tests). Companies also usually add an interview stage conducted by the human resource (HR) division or by users.

The need for specific skills along with the company's development (in terms of turnover) is the main consideration for companies to recruit IT workers in the next 1 to 3 years.

IT Workforce Training

Training activities for IT workers are not conducted regularly, but only when there is a need from staff or the company. 29% of companies in this study reported that they held training 1 to 3 times a year.

The budget provided by companies for training activities is generally a maximum of 3 million rupiahs, increasing with the company's turnover (followed by the need to increase the capacity of the IT workforce). 36.6% of companies choose the public training method, followed by internal training types (26.8%), hybrid training (25.2%), and in-house training (11.4%).

PROBLEM FORMULATION

Post-pandemic economic digitization currently underway has led to a high demand for skilled IT workforce. Data from the Ministry of Manpower shows that 80% of large companies in Indonesia require expertise in the digital field, especially in skills related to Data. Data from

LinkedIn (a job search platform) also indicates that technology-related skills are in the highest demand compared to other skills.

The need for data analysts and data scientists has increased by 76.59%, digital marketing by 66%, strategic planning by 62.78%, full stack engineering by 50.85%, and cybersecurity by 23.91%. The projection of the demand for IT workforce is expected to continue to increase from 2022 to 2025. The requirement is 1.23 million people in 2022, estimated to increase to 1.49 million people in 2023 and continue to rise to 1.97 million in 2025 (Ministry of Manpower, 2021).

More than 60% of companies in the Fintech sector experienced a 69.6% shortage of programming workforce and a 60.9% shortage of data analysis and programming (Survey of the Indonesian FinTech Association, 2018). Meanwhile, the need for network operation access positions is the highest (1.23 million people) in 2022, while for network operation backbone and software engineer positions, it is 235,541 and 109,047 people, respectively. Furthermore, there are 10 digital skill areas that are most needed, including content creators, data analysts, data visualization, IT managers, Artificial Intelligence (AI) / Machine Learning Engineers, application developers, social media specialists, product development, UI/UX researchers, and network developers (Ekonomi Bisnis.com).

Despite the high demand for IT workers in Indonesia, the quantity is still far from the demand, both in terms of quality and quantity. Ministry of Communication and Information Technology (Kominfo) stated that the need for IT human resources is not met in almost all categories, especially in the field of programming. Not only in terms of quantity, the quality of ICT education in Indonesia also needs to be improved as it only ranks 8th in Southeast Asia (Kominfo, 2021). The IT workforce produced by vocational schools and universities is only 300,000 per year (Ministry of Communication and Information, 2020), while the demand for IT workforce reaches 600,000 per year. McKinsey's research found that Indonesia needs 9 million digital talents during the period of 2015-2030, with a gap of around 400-500 thousand people. On the other hand, the number of unemployed in Indonesia is 8.40 million people, or 5.83% as of February 2022 (BPS, 2022). These issues can be an opportunity to equip Indonesian workforce with IT skills to increase their absorption rate[1].

Tambunan (2012) highlights key roles of MSMEs, including their extensive geographical presence promoting economic equalization, labor-intensive nature fostering employment growth, resilience during crises[2], facilitation of rural investment, and contribution

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[1] The existence of MSMEs plays an important role in absorbing labor and reducing unemployment. The Ministry of Cooperatives and SMEs reported that the number of MSMEs in Indonesia currently reaches 64.19 million (99.99% of the total business units) contributing to the GDP by 61.97% or equivalent to 8,573.89 trillion rupiahs. Among them, 63.4 million are Micro Enterprises (UMi), 783.1 thousand are Small Enterprises (UK), and 60.7 thousand are Medium Enterprises (UM). Meanwhile, Large Enterprises (UB) only amount to 5.5 thousand or 0.01% of the total business units in Indonesia (Katadata, 2021). The dominance of MSMEs in the business structure in Indonesia plays a significant role in labor absorption (97% of total employment). Formal MSMEs contribute up to 45% of total employment and 33% of Gross Domestic Product in developing countries, and the numbers could be even higher if informal MSMEs were included in the list. This proves that MSMEs are able to strengthen the structure of the national economy (Tambunan, 2005 in Raharti et al., 2020). Out of the total number of MSMEs in Indonesia, 64.13 million or 99% are MSMEs still in the informal sector, thus need to be encouraged to transform into the formal sector.

[2] In the first two years of the Covid-19 pandemic in Indonesia (2020-2021), MSMEs experienced a downturn. A survey by Bank Indonesia in March 2021 found that 87.5% of MSMEs were affected by the pandemic: 48% faced raw material problems, 77% experienced a decrease in

to state revenues through tax payments. They also play a crucial role in providing affordable necessities, adapting to economic changes, and operating across various strategic sectors, bolstering Indonesia's economic growth[3].

To boost the growth of MSMEs in Indonesia, the government plans to promote digital transformation (MSME go digital), aiming to have 30 million MSMEs go digital and participate in global markets by 2024[4].

RESEARCH OBJECTIVES

1. To conduct an assessment related to the IT needs of the industrial sector and MSMEs.
2. To provide comprehensive information regarding the technical skills in the IT field required by the industry and MSMEs.

RESEARCH QUESTIONS

1. What are the private sector and MSMEs' needs related to technical skills in the field of IT?
2. What is the overview of job opportunities related to IT in potential sectors?
3. Does the private sector have specific work regulations for young women?

RESEARCH METHOD

This research using quantitative and qualitative method. The quantitative methodology will be used to analyze the needs of the private sector and MSMEs related to technical skills, using digital surveys distributed to respondents from selected samples.

THEORETICAL FOUNDATION

A relevant theory in microeconomics concerning the demand and supply mismatch of IT workers is the theory of occupational mismatch. This theory highlights the disparity between the skills possessed by workers and the skills demanded by employers in the labor market. In the context of IT workers, this theory can explain situations where the skills possessed by IT workers do not align with the specific demands of employers, resulting in an imbalance between labor supply and demand.

The theory of occupational mismatch can be represented by the following equation:

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income, and 88% experienced a decrease in product demand, with 97% experiencing a decrease in asset value. On the other hand, 27.6% of MSMEs actually experienced increased sales due to online selling, being able to accommodate changes in people's behavior shifting to online shopping (Coordinating Ministry for Economic Affairs, 2021). A survey by UNDP and LPEM UI showed that 84.8% of recession-hit MSMEs had returned to normal operation after the pandemic, indicating that MSMEs are more resilient to economic turbulence, including the 1998 crisis and the pandemic (Coordinating Ministry for Economic Affairs, 2022).

[3] In addition to the points mentioned above, MSMEs play an important role as an economic buffer because: First, the performance of MSMEs tends to produce more productive workers; Second, they often increase productivity through investment and actively follow technological changes; Third, they are believed to have the flexibility advantage compared to large businesses (Berry et al., 2001).

[4] Efforts to integrate into the global market through the Global Value Chain (GVC) and Global E-commerce (GEC) are expected to enhance MSMEs' competitiveness. The government has initiated the "Proud of Indonesian Products" campaign, engaging millions of SMEs on various e-commerce platforms, offering incentives such as training, promotions, and loans to encourage digital adoption among MSMEs (Coordinating Ministry for Economic Affairs, 2021, 2022)[4].

$$D - S = M$$

where:
D: represents the demand for IT workers,
S: represents the supply of IT workers,and
M: represents the gap between the demand and supply,signifying the extent of the mismatch in the labor market.

This equation helps illustrate the consequences of a mismatch between the skills demanded by firms and the skills possessed by the available IT workforce. It underscores the importance of aligning the skills and qualifications of IT workers with the evolving demands of the IT industry to ensure a more efficient and effective labor market in the field of information technology. In addition to the theory of occupational mismatch, the theory of human capital by Gary Becker is relevant in understanding the dynamics of the IT labor market. Becker's theory emphasizes the role of education, training, and experience in enhancing an individual's human capital and, subsequently, their productivity and earning potential.

The human capital theory developed by Gary Becker (1964) can be represented by the Becker equation, which demonstrates the relationship between an individual's investment in education and training and their potential earnings. The equation is as follows:

$$Y = f(H, X, A)$$

where:
(Y) : represents the individual's earnings or income
(H) : represents the individual^' s level of human capital, which includes education skills,and knowledge
(X) : denotes other factors such as experience, training,and health
(A) : represents the individual^' s inherent abilitiesor attributes

This equation illustrates how an individual's investment in human capital, including education and training, can lead to higher productivity and subsequently higher earnings in the labor market. According to Becker, individuals make rational choices to invest in their education and skill development based on the expected returns on these investments, considering factors such as the costs of education, time, and effort.

In the context of IT workers, this theory underscores the significance of continuous learning and skill development to remain competitive and relevant in the ever-evolving IT industry.

Theory of asymmetric information founded by George Akerlof (1970) suggests that imbalances in information between employers and employees can lead to adverse selection and market inefficiencies. In the IT labor market, this information asymmetry can result in employers struggling to accurately assess the skills and capabilities of potential IT workers, leading to a mismatch between the skills demanded and the skills supplied.

Another George Akerlof's (1986) notable contributions to the understanding of the job market is the theory of efficiency wages. This theory can be represented by the following equation:

$$W > W* = f(U, Z, \dots)$$

where:
- W : is the actual wage paid by the employer.
- W* is the market-clearing wage,representing the equilibrium wage level determined by the intersection of labor supply and demand.
- U denotes unemployment.
- Z represents various non-monetary factors,such as worker morale,turnover costs,and productivity.

Akerlof's theory suggests that employers may choose to pay wages higher than the equilibrium or market-clearing wage, W*, to motivate workers and increase productivity. By offering wages above the market rate, employers can enhance worker morale, reduce turnover, and encourage greater effort and commitment from employees. The resulting increase in productivity can offset the additional wage costs, leading to overall cost savings for the firm[5].

Furthermore, the theory of signalling, as proposed by Michael Spence, can be applied to the IT labor market. Spence's theory suggests that individuals acquire education and credentials not necessarily for the knowledge they gain but to signal their abilities to potential employers. In the IT sector, certifications, degrees, and relevant work experience serve as signals of an individual's competence, helping to bridge the information gap between employers and IT workers.

These theories collectively contribute to understanding the complexities of the IT labor market and shed light on the factors contributing to the demand and supply mismatch in the field. They underscore the importance of addressing issues related to skill development, information transparency, and signalling mechanisms to promote a more efficient and well-functioning IT labor market.

LITERATURE REVIEW

The studies included in this literature review highlight various aspects of the relationship between education and job market dynamics. Robst (2006) emphasizes the impact of mismatches between college majors and jobs, demonstrating their influence on workers' returns to schooling. Nordin, Persson, and Rooth (2010) focus on the substantial income penalty associated with education-occupation mismatches, particularly in Sweden.

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[5] This theory emphasizes the significance of non-monetary factors in shaping labor market outcomes and highlights the role of wages in influencing worker behavior and performance. Akerlof's insights have had a profound impact on the understanding of the job market, particularly in emphasizing the importance of considering both monetary and non-monetary incentives when analysing labor market dynamics.

Blau (1999) sheds light on the evolving trends in the labor market for American women, revealing both progress and challenges in labor force participation and wages. Denny and Harmon (2000) underline the influence of family background on educational attainment and the presence of gender disparities in earnings. Alba-Ramirez (2002) discusses the implications of overeducation in the Spanish labor market, emphasizing the negative impact on worker turnover and training. Hartog (1985) examines the superiority of the assignment theory in explaining labor market phenomena, highlighting the importance of considering both worker and job characteristics.

Beduew and Giret (2010) explore the effects of educational mismatch on wages, job satisfaction, and on-the-job search in the French labor market, noting the significance of horizontal and vertical matches, as well as skill mismatches.

DATA AND METHOD

The qualitative methodology will be gathered using the Key Informant Interview (KII) method with a semi-structured questionnaire. According to Articles 35 and 36 of Government Regulation Number 7 of 2021 concerning Micro, Small, and Medium Enterprises, there are several indicators that categorize businesses into micro, small, and medium scales. To facilitate categorization and analysis per region, the research is divided into 6 clusters, and each region will have both quantitative and qualitative data collected, as detailed below:

Table 1. Respondents based on Cluster

Cluster	Number of respondents	
	Quantitative	Qualitative
Cluster 1 : Surabaya-Malang	120	11
Cluster 2 : Bandung-Cirebon	116	13
Cluster 3 : Jakarta, Bogor, Depok, Tangerang, Bekas	95	23
Cluster 4 : Yogyakarta	50	8
Cluster 5 : Bali	47	8
Cluster 6 : Makassar	49	8
Total Responden	477	71

Source: primary data (2022), processed

The respondents involved in the research are part of the IT workforce or human resources in specific sectors, so the samples taken need to refer to the existing field of business sectors. Therefore, the business field categories refer to the 13 sectors designated by BPS, which are:

Table 2. Respondent based on Sector

No	Sectors
1	Other Services
2	Construction
3	Fishery, Agriculture, Hunting, and Forestry
4	Creative Industry
5	Accommodation and Food Service Activities
6	Wholesale and Retail Trade
7	Healthcare
8	Manufacturing Industry
9	Transportation, Warehousing, and Communication
10	Education Services
11	Real Estate, Rental, and Business Services
12	Mining and Excavation
13	Others (multisector)

Source: primary data (2022), processed
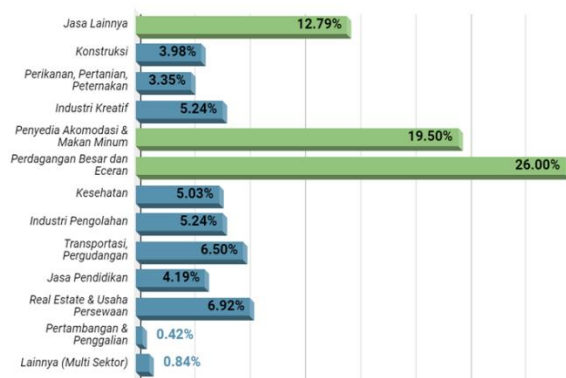
Figure 1. Respondent Categories based on Business Sectors
Source: primary data (2022), processed

A total of 477 respondents were involved in the survey as part of the quantitative research, and an additional 71 respondents were engaged in the Key Informant Interview (KII) as part of the qualitative research. The respondent samples are distributed across 6 clusters and represent the 13 MSME sectors that are the focus of the research. [6]

RESPONDENT CHARACTERISTICS

The majority of respondents are male, mostly serving as human resources division managers, business owners, specific division managers related to human resources, or company employees[7].

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[6] The sample size from the accommodation and food service activities sector and wholesale and retail trade sector is larger compared to other sectors. Both of these sectors can be considered as the main drivers of the economy in all clusters, as they are related to the basic needs of the community (wholesale and retail trade sector) and the development of tourism destinations and industries in the region (accommodation and food service activities sector).

[7] Study also indicates that the managerial level related to human resources management in a company is still predominantly male. The study found that Bali, unlike other clusters, has more women occupying managerial positions related to human resources in companies.
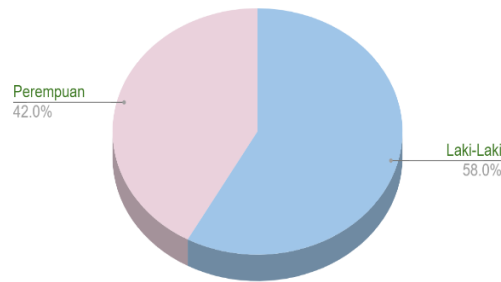
Figure 2. Respondent characteristics based on gender
Source: primary data (2022), processed.

Table 2. Respondents per Cluster

Cluster	Number of Respondents	
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Cluster 5: Bali	47	8
Cluster 6: Makassar	49	8
Respondents	477	71

Source: primary data (2022), processed.

Profile of Respondents by Business Sector

There are three dominant sectors across all research clusters, namely: (1) wholesale and retail trade, (2) accommodation and food services, and (3) other services. The accommodation and food service sector dominates in all clusters (Surabaya & Malang, Bandung & Cirebon, Jabodetabek, Yogyakarta, Bali, and Makassar). However, there are other dominant sectors in specific clusters, for example, other services are relatively thriving in Surabaya & Malang, Bandung & Cirebon, Jabodetabek, and Yogyakarta. Meanwhile, the real estate, rental, and business services sector are rapidly developing in Bali and Makassar[8].
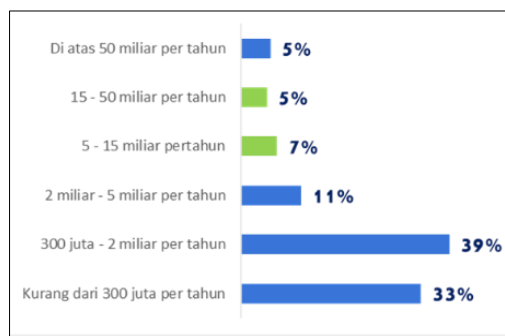
Figure 3. Respondent category based on revenue
Source: primary data (2022), processed

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[8] The business profile in Indonesia is dominated by micro-scale businesses with annual turnovers of less than 300 million Rupiah and 300 million to 2 billion Rupiah. This may indicate the emerging development of SMEs, especially in the accommodation and food service sector, wholesale and retail trade, rental businesses, and business services.

Majority (72%) of business entities in this study are micro, small, and medium enterprises (MSMEs) with an annual turnover of less than 2 billion. In addition to being the main focus of this research, MSMEs are also considered highly relevant as a source of information regarding the IT workforce needs, especially in the midst of the post-pandemic digital economic transition.
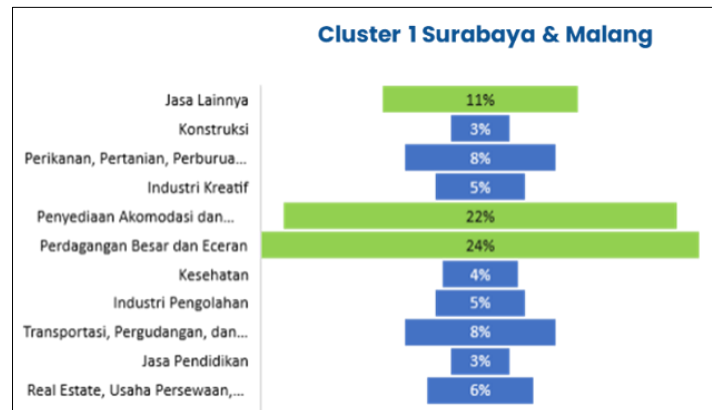

Figure 4. Respondents in Cluster 1 - Surabaya and Malang
Source: Primary data (2022) processed

Respondents from Cluster 1 (Surabaya and Malang) as well as Cluster 2 (Bandung and Cirebon) are both dominated by micro-businesses with an income of less than 2 billion Rupiah per year. Around 10% of medium and large-scale businesses (with an income above 15 billion Rupiah per year) also participated in this study.
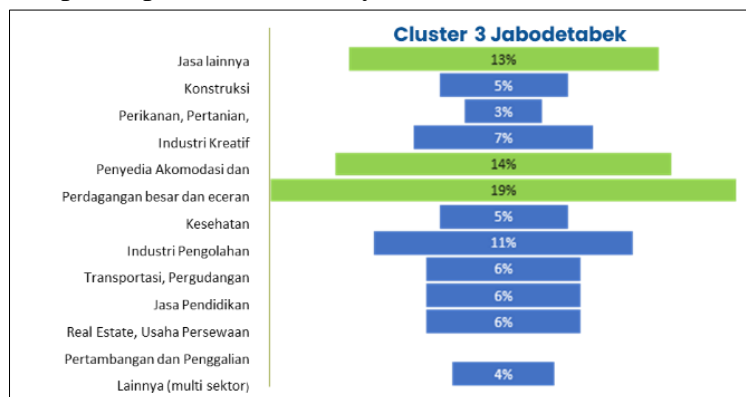
Figure 5. Respondents in Cluster 3 - Jabodetabek
Source: primary data (2022), processed

Respondents from Cluster 3 (Jabodetabek) as well as Cluster 4 (Yogyakarta) are both dominated by micro-businesses with an income of less than 2 billion Rupiah per year. Unlike other clusters, Cluster 3 has a higher proportion of medium and large-scale companies (with an income of more than 15 billion Rupiah per year) at 26%. Industrialization and the presence of numerous foreign companies in the region can be the main factors contributing to the higher number of medium and large-scale businesses in Jabodetabek.
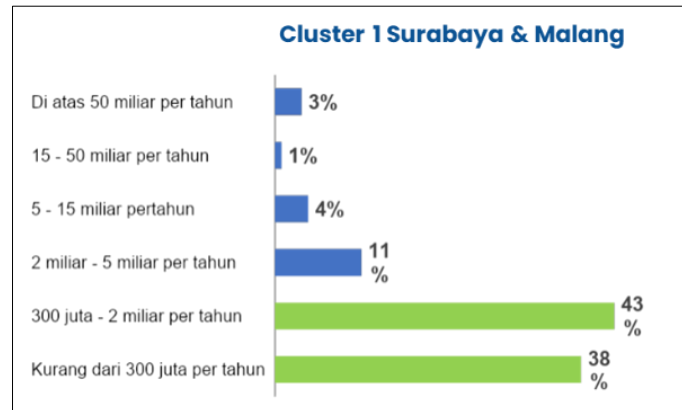
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Figure 6. Revenue by Cluster
Source: primary data (2022), processed

Respondents from cluster 5 (Bali) as well as cluster 6 (Makassar) are both dominated by micro and small businesses that have an income of less than 5 billion Rupiah per year. Cluster 6, when compared to other clusters, has the lowest proportion of micro-enterprises (revenue less than 300 million per year) (6%). In addition to the factor of random sampling method in the study, this can also indicate that micro-scale businesses in Makassar have developed into small and medium-sized enterprises.

FINDINGS

Based on the survey results from the sample in 12 cities in Indonesia, it was found that the demand for IT workers per cluster is quite high, ranging from 2 to 3 individuals, with the highest demand in Cirebon & Bandung followed by Jabodetabek. This indicates that the number of employed IT professionals will increase in line with the scale and revenue of the companies.

Companies also prefer IT workers with mid-experienced levels (including in the IT field) because they already have experience. This is because mastering IT skills takes time, so hiring experienced IT workers is considered more efficient as it can save on training costs and accelerate the adaptation process to IT work in a new company. However, fresh graduates (aged 18-25) are still needed in certain sectors. On the other hand, the majority of companies prefer fresh graduates to be non-IT employees.

The most in-demand IT skills are data administration, followed by customer support expertise. Other highly sought-after skills include digital marketing, in line with the increasing number of smartphone users who prefer to make purchases online. In carrying out their work, most respondents mentioned that a beginner level of proficiency in English is sufficient for the workforce. However, the high level of competition for jobs and business competition in the Jabodetabek and Cirebon & Bandung areas has led both regions to require an intermediate level of English proficiency.

Classification based on specific sectors also influences the required level of English proficiency, as sectors related to direct consumer services (hospitality) such as Services, Creative Industries, and providers of accommodation and dining (especially in Bali) require a

higher level of English proficiency compared to other sectors. This is also considering that the creative industry in Indonesia is largely aimed at serving the export market abroad. Meanwhile, the service sector is also required to be able to serve clients from overseas.
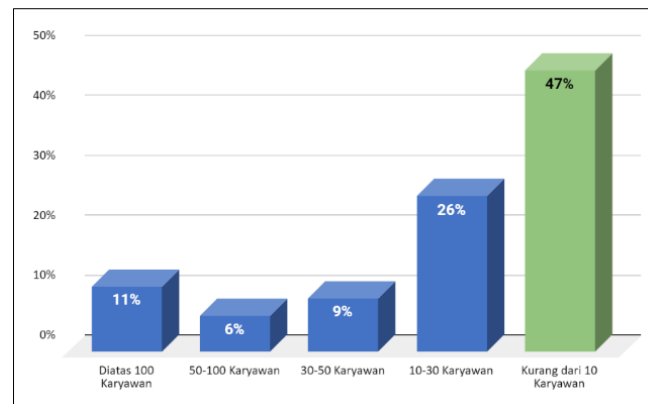

Figure 8. Number of Workforce based on Age
Source: primary data (2022), processed

The majority (47%) of the companies involved in this study are of the UMKM type, with fewer than 10 employees. Meanwhile, 26% of the companies have 10 to 30 employees. Only 11% are large-scale companies with more than 100 employees. This study found that the number of employees generally correlates with the company's revenue. Micro-businesses with annual revenues of less than 300 million Rupiah mostly have fewer than 10 employees. On the other hand, large-scale businesses (with revenues exceeding 50 billion Rupiah per year) tend to have more than 100 employees.

Number of Employees based on Cluster Area

Among all the clusters, many companies in cluster 3 (Jabodetabek) have more than 100 employees. This could be related to the presence of many large-scale companies, including foreign-owned ones, operating in the area. In the other clusters, the majority of respondents represent micro and small-scale businesses (with 10 to 30 employees).

Company Needs for IT Workforce

Cluster 2 (Bandung & Cirebon) and cluster 3 (Jabodetabek) are the clusters with the highest number of IT workers compared to other clusters. This could be due to several factors, such as the presence of medium and large-scale companies operating in these areas, the type of business, and the specific needs of the companies (typically, technology-based companies will require more IT personnel).

Average Number of IT Workforce

The multi-sector and services is the sector with the highest number of IT workers. Despite being the majority of respondents, sectors such as accommodation and food service providers only have an average of 2 IT workers. Generally, companies in this sector have internal servers that are not very complex and large, so they do not require many IT workers.

IT Workforce Demand

Most companies employ mid-level IT workers (experienced). Recruiting mid-level IT workers is considered the most value for money as the average salary offered is not as high as that for senior-level employees, but the experience they provide to the company is sufficient and meets the company's expectations. In various sectors, such as accommodation providers, food service, and sectors related to IT administration, relatively younger workers (fresh graduates) are also considered. Generally, these sectors do not require IT workers with complex technical skills.
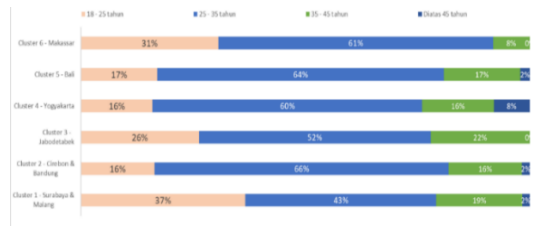
Figure 9. Age of IT Workforce per Cluster
Source: Primary data (2022), processed

Mid-level IT employees (aged 25-35) remain the most needed by most companies. Fresh Graduates (aged 18-25) are the dominant category of IT workers in the creative industry and are considered by the agriculture, accommodation & food service, and trade sectors. Unlike other sectors, health and construction sectors tend to recruit relatively more senior IT workers - this is because both sectors generally do not require the latest IT skills (which are usually mastered by fresh graduates or mid-level).
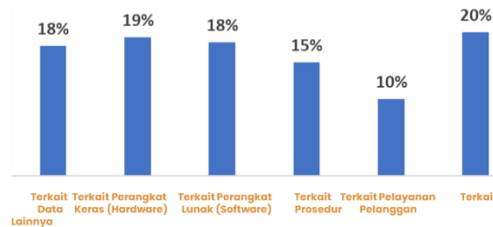
Figure 10. Demand of IT Skills
Source: Primary data (2022), processed

When compared across all types of required IT skills, the greatest demand arises for IT skills related to other skills. This skill is purely non-IT, which can be learned by those who have not even undergone any IT education. The demand for this skill continues to increase as the digitalization of the economy develops, relying on digital advertising and marketing services.
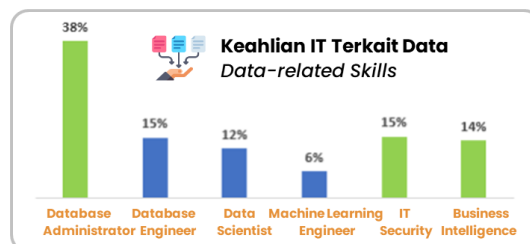
IT Skills Related to Data

Figure 11. IT Skills Related to Data
Source: primary data (2022), processed

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The most sought-after IT skills related to data are database administration, IT security, and business intelligence. These three skills are considered fundamental for any company to conduct its business and are most in demand in companies within cluster 3. This could be due to the high number of digital-based companies (or those undergoing digitalization) in the Jabodetabek area.
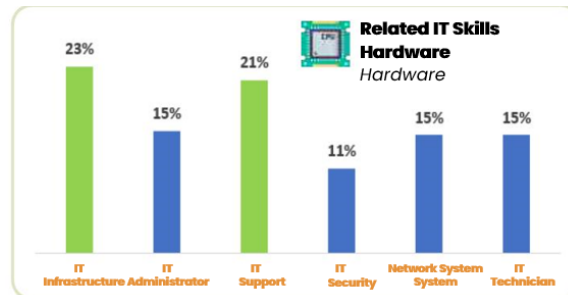
IT Skills Related to Hardware

Figure 12. IT Skills Related to Hardware
Source: primary data (2022), processed

IT administrators and IT support are the most sought-after hardware-related IT skills, with the highest demand in clusters 1 and 3. IT administrators generally handle hardware installation and maintenance, while IT support is needed for the installation of network-related hardware such as WiFi, modems, and others.
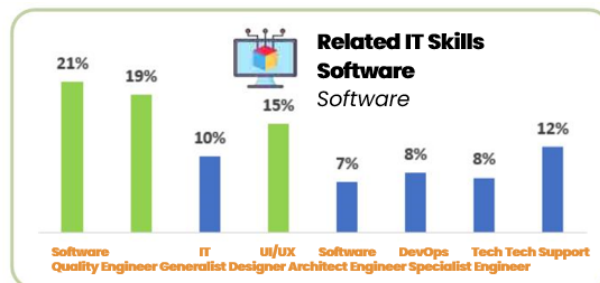
IT Skills Related to Software

Figure 13. IT Skills Related to Software
Source: primary data (2022), processed

Software quality, software engineer, and UI/UX designer are the most in-demand IT skills related to software, with the highest demand in clusters 3, 1, and 2. Software quality is generally responsible for testing and resolving issues (bugs) in software, while software engineers are involved in a series of software development processes that include design, development, and software testing. UI/UX designers, on the other hand, are generally involved in application development and closely related to the customer experience in using the application[9].

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[9] This type of expertise typically requires IT professionals to have research skills. This skill set is currently being widely developed by various e-commerce companies.
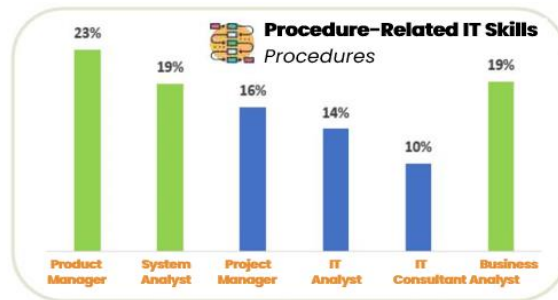
IT Skills Related to Procedure

Figure 14. IT Skills Related to Procedure
Source: primary data (2022), processed

IT skills related to procedures are generally associated with skills outside of IT. Generally, the most needed skills in this area are product manager, system analyst, and business analyst. These skills are most in demand by companies in clusters 3, 2, and 1. These three skills are commonly found in various types of technology-based companies (such as tech startups, mainly e-commerce, fintech, e-banking, and edu tech). To fill these positions, in addition to mastering basic IT knowledge, fresh graduates are also expected to master basic business and management knowledge.

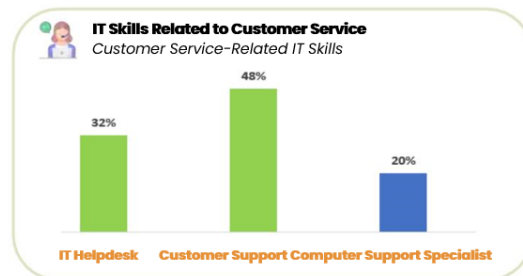**IT Skills Related to Customer Service**

Figure 15. IT Skills Related to Customer Service
Source: primary data (2022), processed

In IT skills related to customer service, customer support and IT helpdesk specialist are the two most needed skills by companies, generally from clusters 1, 2, 3, and 6. The types of customer support and IT helpdesk skills are considered quite flexible because they are generally needed in various sectors. The main tasks of IT workers with these skills are to handle complaints, solve problems, and periodically receive feedback from customers, as well as maintain customer satisfaction with a product. This IT skill is considered a vital function by companies as it directly relates to customer interaction.

Other IT-Related Skills

Other IT-related skills such as digital marketing and graphic design are also highly in demand amid economic digitization. As a digital marketer, fresh graduates will not only be required to understand the tools to be used but also need to have strong strategic and numerical skills. From this position, IT professionals can also assist companies in devising better marketing strategies. Meanwhile, to fill the graphic design position, a strong sense of creativity is also expected.
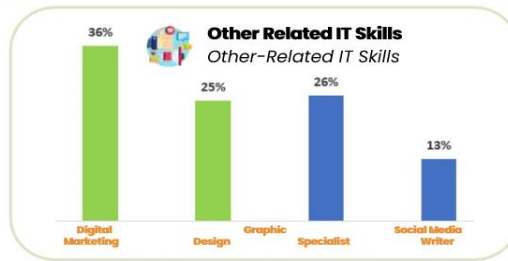
Figure 16. Other IT-Related Skills
Source: primary data (2022), processed

English Language Proficiency Level in IT per Cluster
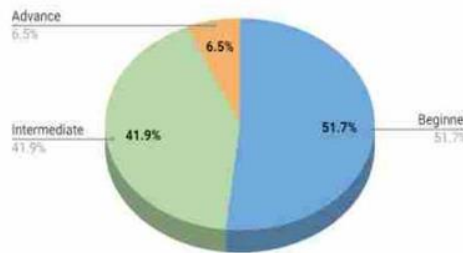

Figure 17. English Language Proficiency Level in IT per Cluster
Source: primary data (2022), processed

Most companies are open to hiring IT job applicants with beginner-level English language proficiency. This is because IT professionals generally work in the back office and do not directly interact with foreign clients or customers[10].

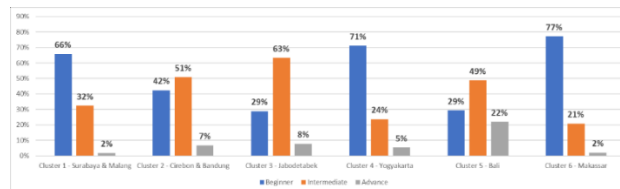**English Language Proficiency Level of IT Workers**

Figure 18. English Language Proficiency Level
Source: primary data (2022), processed
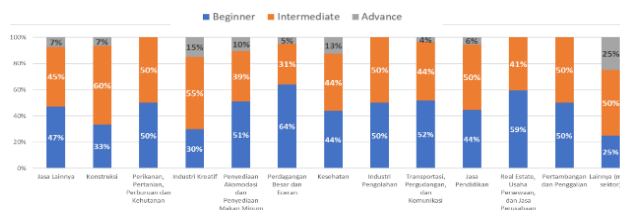

Figure 19. English Language Proficiency Level based on Cluster
Source: primary data (2022), processed

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[10] Based on the clusters, Cluster 3 (Jabodetabek) and Cluster 5 (Bali) require IT professionals with intermediate-level English proficiency. This is due to the specific characteristics of these regions, with Jabodetabek as an economic and industrial hub and Bali as a tourism destination.

All sectors are open to hiring IT workers with beginner-level English proficiency. However, some sectors such as Construction, Creative Industry, Education Services, and Mining tend to consider IT workers with intermediate-level English proficiency. This is because IT workers in these sectors have a higher frequency of direct communication with foreign clients or management personnel. The creative industry[11] currently employs many IT workers with expertise in digital marketing and copywriting, both of which require foreign language skills, such as English, to market their products.
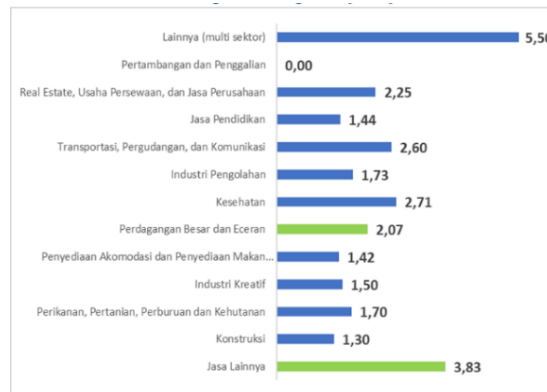
IT Workers Shortages

Figure 21. IT Worker Shortage per Sectors
Source: primary data (2022), processed

Based on their respective sectors, companies still need an average of about 2 to 3 additional IT workers. With the current digitalization processes in various types of companies and SMEs, there is ample opportunity for fresh graduates to pursue careers in IT. The sectors that require the most additional IT workers are the multi-sector (5 to 6 people) and the services sector (4 people).

Cluster 3 (Jabodetabek) has the highest shortage of IT workers in the healthcare sector (an average of 6 people). This could be attributed to the development of telemedicine services or technology-based health services in the Jabodetabek area since the COVID-19 pandemic. Meanwhile, for cluster 4 (Yogyakarta) and cluster 2 (Bandung and Cirebon), the highest demand for IT workers is in the services sector (4 to 6 people). Additionally, cluster 2 also has a higher average demand for IT workers in the transportation, warehousing, and communication sectors (5 people).

Cluster 1 (Surabaya and Malang) has a shortage of IT workers in the services sector (3 people). This is due to the growth of technology-based service sectors. On the other hand, cluster 5 (Bali) requires more IT workers for the wholesale and retail trade sector (3 people)[12].

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[11] The Creative Industry sector has a greater preference for Advanced Level English proficiency compared to other sectors.

[12] This can be attributed to the development of SME trading sectors post-pandemic, and the economic growth of the Balinese community, which supports an increase in people's purchasing power for basic needs. For cluster 6 (Makassar), the shortage of IT workers is an average of 2 people across various sectors such as trade, accommodation and food services, fisheries and agriculture, and services.

The demand for entry-level IT workers is higher because they generally perform more technical IT tasks as their daily work. Meanwhile, the demand for senior-level IT workers will generally fill managerial or supervisory positions, so their demand is not as high as entry-level. Across clusters, cluster 2 (Bandung & Cirebon) and 4 (Yogyakarta) require more entry-level IT workers above average (4 people), while cluster 3 (Jabodetabek) needs more senior-level IT workers (3 people).

Companies mention that finding skilled IT workers is relatively easy, and in some conditions, difficult. Some challenges found in the KII include the lack of IT workers whose skills meet company needs, tough wage negotiations between companies and workers, the non-implementation of remote work policies that make workers reluctant to move to other cities, and behavior (attitude) and professionalism, especially for fresh graduates who are still lacking.

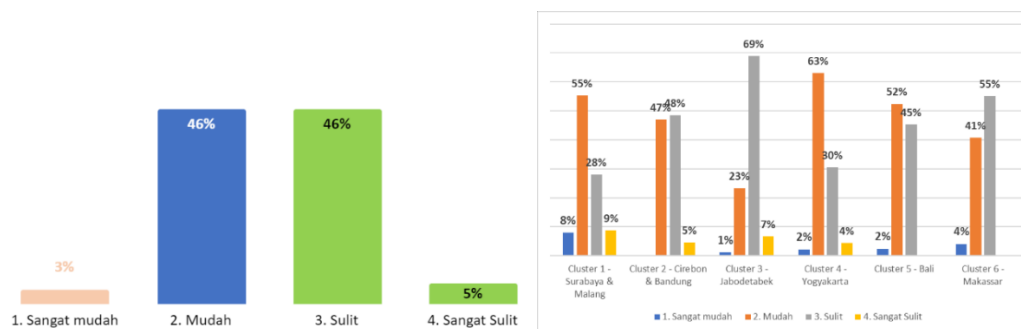**Difficulty of Recruiting IT Workers by Sector**

Figure 22. Level of Difficulty Finding IT Workers based on Cluster
Source: primary data (2022), processed

Some sectors that currently find it easy to recruit IT workers include transportation, warehousing, and communication (63%), accommodation and food services (54%), and construction (57%). This could be because these three sectors do not have complex IT management needs, and generally, the internal servers they have are not too large. Therefore, IT workers can be easily fulfilled because the required IT skills are not too advanced. Half of the respondents in the Mining sector (50%), Real Estate (50%), Creative Industry (50%), Agri (54%), and Manufacturing Industry (50%) find it difficult to recruit IT workers.

Increased Demand for IT Workers In 1-3 Years[13]

The increased demand for IT workers can be caused by several factors such as:
- The increasing size of companies, which can affect the expansion of company servers and data, and the increasing complexity of IT-related problems or risks that may be faced.
- Thus, the need for more IT workers.
- Companies undergoing digitalization - Tech-based company
- Massive internal operational system updates that require more IT workers

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[13] Surabaya-Malang, Jabodetabek, and Makassar are the main clusters that will need more IT workers in the next 1-3 years.
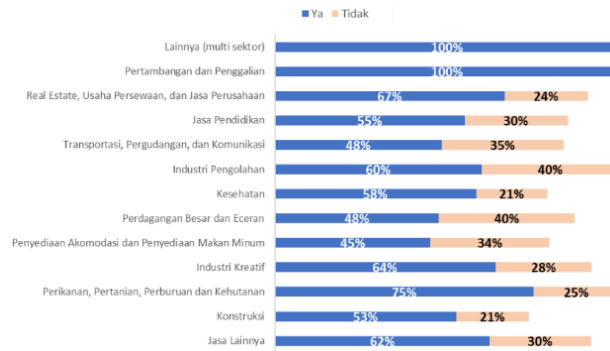
Figure 24. Increased Demand for IT Workers in 1-3 Years based on Sectors
Source: primary data (2022), processed

In general, all sectors have an increased demand for IT workers in the next 1-3 years. These sectors include mining and excavation, fisheries, agriculture, and forestry, and real estate, leasing, and business services. Companies in the Manufacturing Industry and Wholesale & Retail Trade sectors are the least in need of increased IT workforce in the next 1-3 years. The need for IT workers in the next 3 years does not automatically depict the number of IT workers needed in each company (an average need of 2 to 3 IT workers).

Implementation of IT Department Training

Most companies across all clusters do not conduct training activities for IT workers regularly. However, training is done based on seasonal needs. Needs can be submitted directly by staff or managers from the IT division. In addition, companies usually conduct training if there are internal IT system updates. Cluster 6 (Makassar) is the cluster with the most companies conducting training activities (55%). Meanwhile, cluster 1 (Surabaya, Malang) and cluster 5 (Bali) are the clusters with the fewest companies conducting training for the IT department (25-26%). In qualitative research (KII), many companies in Bali stated that training for the IT department is rarely conducted because the existing IT workforce can generally solve internal IT problems in the company, and many of the IT workers can learn independently through the IT problems encountered daily[14].
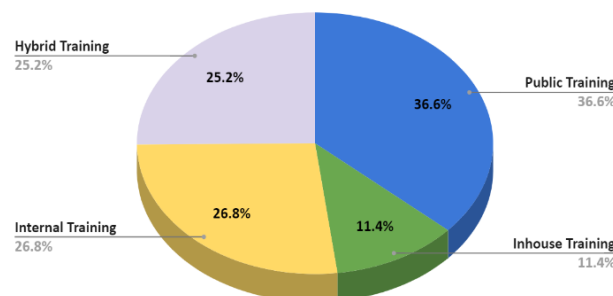
IT Worker Training Methods

Figure 27. IT Training Method
Source: primary data (2022), processed

[14] Since training is only done as needed, the majority of respondents reported no budget allocated regularly for IT department training activities. Companies that provide regular training for IT workers usually allocate a budget of 3 million rupiahs per month.

29% of companies conduct IT worker training 1-3 times a year. This is also due to the fact that the employed IT workers, who are mainly mid-level seniors with experience, do not require regular training. Regarding the method, most companies rely on public training methods (36.6%), followed by internal training methods (26.8) and hybrid training (25.2%). Only a small number of companies conduct in-house training.

Job Vacancy Information about IT Workers

The most popular methods of disseminating job vacancies are through Social Media, referrals, and LinkedIn. Referrals from internal employees account for the highest number (35%) because recommendations are considered the most valid method for initial screening and make it easier to find skilled IT workers. In addition, the use of social media (32%) is also considered effective in reaching more prospective workers due to the high number of social media users. Furthermore, various social media platforms are free, which can save recruitment costs.
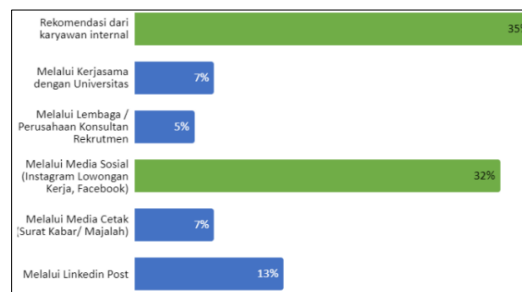

Figure 29. IT Job Vacancy Information
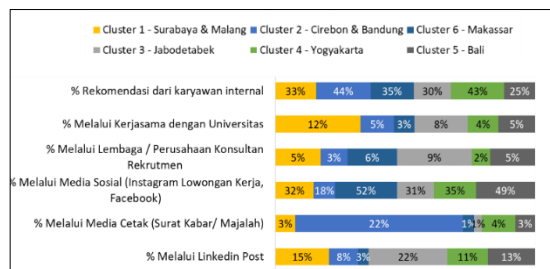**Source**: primary data (2022), processed

Figure 30. IT Job Vacancy Information based on Clusters
Source: primary data (2022), processed

Job vacancy information in Jabodetabek is mostly obtained from social media. Meanwhile, in Makassar, where the level of technological literacy and internet access is much lower, print media is still widely used as a means of disseminating job vacancy information.

Female IT Workers By Sector

The creative industry is the sector that employs the most female IT staff, with the most occupied skills being in administration, followed by skills in digital marketing, social media specialists, and graphic design. Qualitative studies also found that women tend to have better

abilities in marketing-related matters, so these positions are generally relevant for female workers[15].

Average Number of Female IT Employees

Cluster 3 (Jabodetabek) is the cluster with the highest average number of female IT employees per company (5 people). This can be attributed to the abundance of IT or non-IT[16].

Lists of Regulation for Female Staff[17]

A. Positive Regulation

1. Maternity Leave & Maternity Vacation
2. Weekly Off
3. Special Leave for Women, such as menstruation leave and reduced working hours for those menstruating
4. Flexible Working Hours (including the option to WFH)
5. No night shifts, given morning shifts

B. Negative regulation

1. Not allowed to get married during the probation period
1. No dating if single or preferably already married
2. Only hiring Muslim employees (female, adhering to Islam)
3. Dress Code, including the obligation to wear hijab

CONCLUSION

The need for IT workers is mostly mid-level aged 25-35. Companies prioritize those with experience to reduce costs and frequency of training and to expedite the transition and adaptation process in IT work. Nevertheless, fresh graduates aged 18-25 are still needed in some sectors. The average need for IT staff in each company is 2-3 people, with the main required skills being data administrators, IT support, and IT helpdesk. Meanwhile, digital marketing skills are one of the other IT skills that are most in demand.

The most popular methods of disseminating job vacancy information are through social media, referrals, and LinkedIn. The recruitment stages generally consist of 3 stages: administrative selection, portfolio selection, and technical tests. In recruiting IT workers for the

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[15] Most companies across all clusters do not have female IT staff. Findings from KII concluded that IT-related work is still considered a male-dominated field. Especially for sectors that require hardware installation, men are considered to be more proficient. It is not uncommon for IT workers' roles to also require physical strength, especially for the tourism sector, which often holds various outdoor activities that require more energy. Here, HR managers feel that men are more relevant to fill IT positions (related to hardware skills). Furthermore, the low number of female applicants makes the IT workforce still dominated by males.

[16] (still relevant to IT, such as engineering, business, and management) graduates working as IT staff (with technical and non-technical skills)

[17] In general, most companies across all clusters do not have specific rules for female employees. Almost all companies claim to follow government regulations regarding maternity leave for women. Nevertheless, some companies have specific rules for women, both positive and negative. Companies that provide positive rules for women generally do so because they have many female employees, and/or it is part of the company's vision or values.

For example, menstruation leave and flexible working hours for working mothers (with young children). Meanwhile, rules that are negative are generally related to company productivity or the characteristics of the business itself, such as requiring hijab because the company operates in the modest fashion sector.

period 1-3 years ahead, companies will consider the current needs and sufficiency of IT workers as well as the company's development projections. IT workforce training is generally not conducted regularly but as needed. This is because most companies consider that the skills possessed by their IT workers are still sufficient for the company's needs. The budget spent on IT workforce training increases with the company's turnover and scale. On average, the budget spent by companies for training is less than three million Rupiah. Most companies implement positive policies for women, including maternity leave & maternity vacation, special leave for women, flexible working hours (including remote working), and no night shift. Meanwhile, the negative policies implemented are personal and limiting, such as the obligation to wear hijab (therefore the job is only available for Muslim), a ban on dating or marriage during the probation period.

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