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A STUDY ON DIGITAL SKILLS OF HIGHER EDUCATION INSTITUTION'S STUDENTS IN INDONESIA



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■ BACKGROUND

The automation of work occurring across the globe will undoubtedly bring exceptional changes to the future of the job market. The rapid advancement of both digital and internet technologies, also known as the fourth industrial revolution or Industrial Revolution 4.0 presents a new direction in the development of industries. IR 4.0 has become a prominent topic in many countries. Even some of the least-developed countries are impacted by IR 4.0 as the world is increasingly connected through political and economic means. Indonesia, one of the countries with the highest ICT penetrationⁱ, is also struggling with the question. In 1933, John Maynard introduced the terminology of "technological unemployment"ⁱⁱ which means, the use of sophisticated technology creates a higher rate of unemploymentⁱⁱⁱ. For example, Brynjolfson & McAfee (2011) argued that the use of ICT is one of the reasons for the increased rate of unemployment. Furthermore, some scholars argued that jobs with a high level of repetition are easily replaced by a smart algorithm (Charles et al., 2013).^{iv}

A study compiled by the McKinsey Global Institute in 2017 suggests the increasing use of automation may cause displacement of up to one-third of jobs by 2030^v. The resulting rise in unemployment might lead to a chronic economic crisis if not managed appropriately and immediately. Another report published by UNESCO (2018) found that in the era of Industry 4.0, people must have some degree of digital literacy due to the digitization of all aspects of life.^{vi} The five core skill sets in using ICT, which are: information and data literacy, communication and collaboration, digital content creation, safety, as well as problem-solving.^{vii} The European Commission's Science and Knowledge Department has published the Digital Competence framework^{viii} which analyzes three levels of personal competences: basic, intermediate, and advanced, based on the competencies presented. These three levels are based on the extent to which the students can apply the competencies. The classification falls under three categories, which are basic user, independent user (intermediate), and proficient user (advanced). Other skills that are required in the era of IR 4.0 are soft skills or cross-functional skills.



■ THE MAKING INDONESIA 4.0 ROAD MAP

Anticipating the future, the Indonesian government, as demonstrated by the Ministry of Industry, has launched an initiative called "Making Indonesia 4.0".^{ix} This is a roadmap that aims to prepare and create a technology-literate workforce as a response to the demands of future industries. The budget, which was managed under the provision of the Ministry of Research, Technology, and Higher Education or Kemenristekdikti made up a meagre 0.3 percent of the country's gross domestic product (GDP) in 2018, and over 80 percent of that budget came from the central government.^x However, very few attempts to understand Indonesia's readiness to engage with the digital economy has been made. One of such rare efforts is a survey of 323 businesses, as reflected in the Indonesia Industry 4.0 Readiness Index, prepared by the Ministry of Industry.^{xi} This research intends to fill the gap in the existing literature focusing on the readiness of Indonesia's university students entering the Industrial Revolution 4.0 (IR 4.0). To what extent have they acquired the digital competencies and soft skills needed to excel in the IR 4.0 era? How do they perceive their own readiness? To answer these questions, we conducted an extensive survey of 1,162 students across Indonesia.

METHODOLOGY: SURVEY

This research uses a survey to collect quantitative data of university students' characteristics and perceptions of their readiness in facing IR 4.0. The samples are chosen based on a stratified random sampling technique (using the RAND function on Microsoft Excel), where classifications of the target sample are specified.

THE RESPONDENT

Two classifications were used to ensure a better representation of university students throughout Indonesia. The first classification is based on university rank or tier. We classified Indonesia's top -100 universities in 2019 (according to by Webometrics^{xiii}) into three tiers according to university performance: first-tier, second-tier, and third-tier. From these 100 universities, we focused on 20 universities to conduct student surveys. To ensure a balanced distribution of the universities, we randomly picked seven first-tier universities, six second-tier universities, and seven third-tier universities (20 universities in total).



The second classification is based on the type of faculty or school. We classified faculties within the 20 universities into those that correspond to science, technology, engineering, and mathematics (STEM) and those that don't (i.e., non-STEM type faculties). To ensure a representative sample of students based on their faculty type, we randomly picked faculties within the university according to the actual ratio of STEM and Non-STEM faculties that exist in each university. After determining the target universities and faculty types, we aimed to collect a sample of 1,200 student respondents from a reported total of 6,924,511 Indonesian university students in 2017, according to the Ministry of Education.^{xiii} After data was collected, there were 1,162 valid survey responses that could be processed. This translates to a 2.875% margin of error, with a 95% confidence interval. The distribution of respondents by university tier and faculty type is shown in Table 2.1

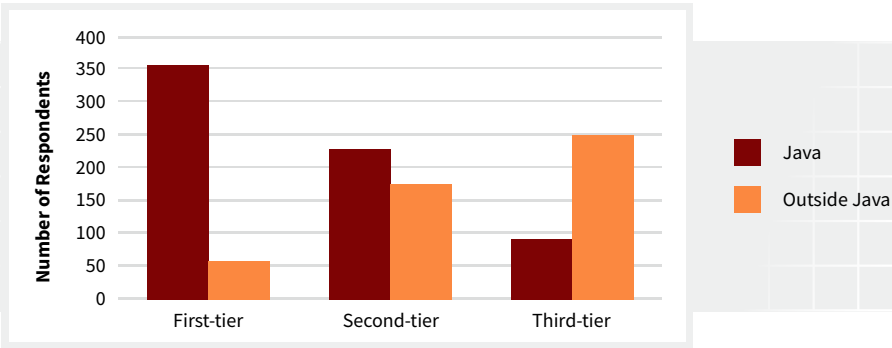


Table 2.1. Distribution of survey respondents by university name, university tier and faculty type

first-tier	University Name		STEM	Non STEM	Total
	1	Universitas Gadjah Mada (Sleman, Yogyakarta)	46	24	70
	2	Universitas Indonesia (Depok, West Java)	31	6	37
	3	Universitas Sebelas Maret (Solo, Central Java)	47	29	76
	4	Universitas Pendidikan Indonesia (Bandung, West Java)	20	38	58
	5	Universitas Jenderal Sudirman (Purwokerto, Central Java)	36	20	56
	6	Universitas Dian Nuswantoro (Semarang, Central Java)	37	19	56
	7	Universitas Udayana (Badung, Bali)	33	26	59
	Sub-total for first-tier universities		250	162	412
second-tier	University Name		STEM	Non STEM	Total
	1	Universitas Sanata Dharma (Sleman, Yogyakarta)	59	25	84
	2	Universitas Islam Indonesia (Sleman, Yogyakarta)	37	44	81
	3	Universitas Islam Negeri Sultan Syarif Kasim (Kampar, Riau)	8	20	28
	4	Universitas Negeri Semarang (Semarang, Central Java)	26	40	66
	5	Universitas Pendidikan Ganesha (Denpasar, Bali)	35	31	66
	6	Universitas Negeri Padang (Padang, West Sumatera)	33	46	79
	Sub-total for second-tier universities		198	206	404
third-tier	University Name		STEM	Non STEM	Total
	1	UIN Alauddin Makasar (Makasar, South Sulawesi)	22	40	62
	2	Politeknik Negeri Pontianak (Pontianak, West Kalimantan)	41	24	65
	3	Universitas Medan Area (Medan, North Sumatera)	20	35	55
	4	Universitas Muhammadiyah Semarang (Semarang, Central Java)	22	3	25
	5	Institut Informatika dan Bisnis Darmajaya (Lampung)	31	31	62
	6	Universitas 17 Agustus 1945 (Surabaya, East Java)	17	54	71
	7	Universitas Muhammadiyah Metro (Lampung)	0	6	6
	Sub-total for third-tier universities		153	193	346
Grand Total			601	561	1162

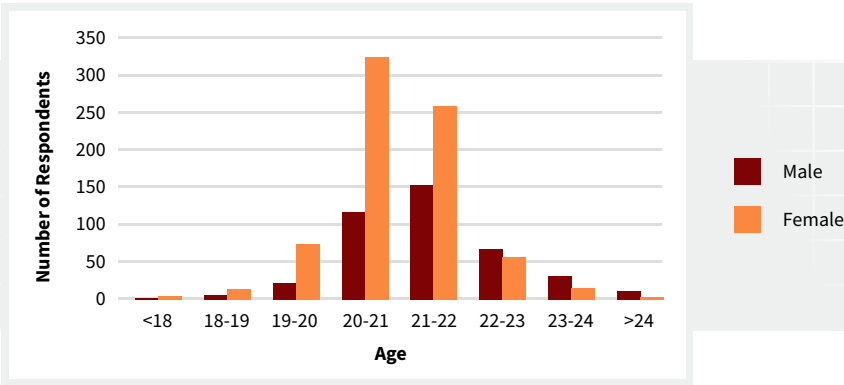
Using Excel's randomize function to select universities, we ended up with a rather balanced distribution between first-tier, second-tier, and third-tier universities (35%, 35%, and 30%, respectively), and a rather but not extremely unbalanced distribution between Java and outside Java locations (58% and 42%, respectively). However, when looking at where the different tiers of universities are located, we find that most first-tier university respondents are located in Java (85%), a substantial portion of second-tier university respondents are in Java (57%), and most of the third-tier university respondents are outside of Java (72%). See Figure 2.1 for more details.

Figure. 2.1 Distribution of survey respondents by university tier and location



We also did not specify a requirement for the distribution of survey respondents by gender and age. As seen in Figure 2.2, the distribution of respondents is unbalanced by gender (64.5% female and 35.5% male).

Figure 2.2 Distribution of survey respondents by gender and age



The age of respondents, however, is not a considerable demographic variable to consider in this research because the distribution is rather normal, with an average age of 20-21 years old. This means that most of the survey respondents are third-year and fourth-year students. The youngest respondent is 17 and the oldest is 30 years old. See Figure 2.2 for more details. Survey data collection was conducted by enumerators in each university, coordinated by a person in charge. Enumerators identified eligible respondents in STEM and non-STEM faculties within their respective universities and asked the respondents to fill the online survey. Some also collected respondents in classrooms.

SURVEY QUESTIONS AND RESULTING SCORES

The survey questionnaire's questions were developed to explore the students' ICT skill sets or “digital competencies”, as well as their cross-functional skill sets, or “soft skills.”

Table 2.2 Number of questions on digital competencies by proficiency level

Types of Digital Competency	Number of questions based on proficiency level			Total
	Basic	Intermediate	Advance	
information processing	3	3	6	12
Communications	5	5	4	14
Information processing	4	5	6	15
Safety	3	5	5	13
Technical problem solving	-	6	7	13
Total	15	24	28	67

To understand the students' level of digital competencies (or “ICT skills”), a total of 67 questions were asked based on the EU's Digital Competencies self-assessment grid.^{xiv} These questions are distributed according to five different types of digital competencies (information processing, communications, content creation, safety, and technical problem solving) and three proficiency levels (basic, intermediate, and advanced). In the survey questionnaire, we asked students to confirm if they have each of the 67 specific skills. The distribution of said skills are laid out in Table 2.2. Based on the proportion of “yes” answers to each question, the aggregate scores were created for each of the three digital competency levels: basic (proportion of “yes” over 15 basic skill questions), intermediate (proportion of “yes” over 24 intermediate skill questions), and advanced (proportion of “yes” over 28 advanced skill questions).



Towards the end of the survey, we asked the students to report their self-perceived readiness for IR 4.0, through a rating on a scale of 0-100. This self-reported perception of IR 4.0 readiness later will be compared to the readiness score described above, which is obtained by answering questions on specific digital and cross-functional skills. Aside from asking questions related to digital and cross-functional competencies, we also asked questions on basic demography (gender, age) and access to ICT (number of digital devices owned, type of network most often accessed, monthly spending for internet connectivity). Responses to questions on ICT access will help to provide an overview of the intensity and ways in which students access the internet.

RESEARCH RESULTS

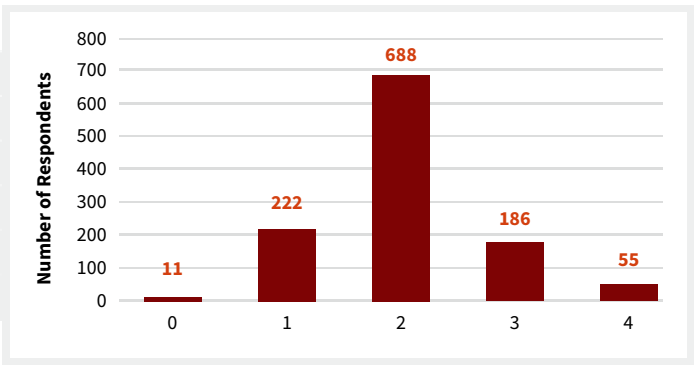
The quantitative findings presented in this section is based on a survey of 1,162 students in Indonesia, using the methodology **described previously**.

ACCESS OF ICT

OWNERSHIP OF DIGITAL DEVICES

For internet accessibility, the students rely on ownership. Most (80%) of the students surveyed admitted to owning multiple digital devices or “gadgets.”

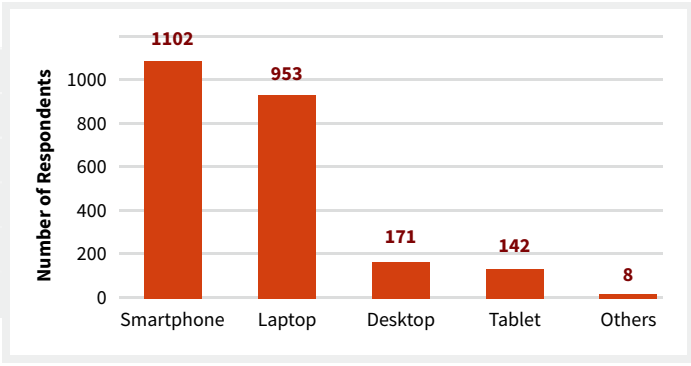
Figure 3.1 Survey respondents by number of digital devices owned



Number of
Devices Owned

As seen in Figure 3.2, most of the digital devices owned by students are smartphones and laptop computers. Close to 95% of students owned smartphones.

Figure 3.2 Types of digital devices by number of students who own them

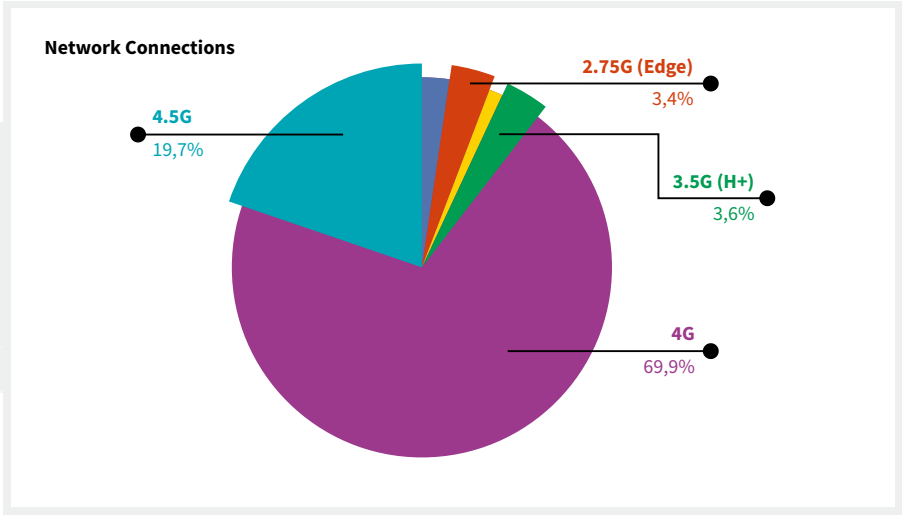


Number of Devices Owned

● NETWORK CONNECTIVITY

In terms of network connectivity, most (close to 70%) of students said that the network most often accessible to them were 4G, and close to 20% accessed 4.5G or LTE connectivity. Only about 10% of the students had 3.5G connectivity or slower. This shows that most students had pretty good access to the Internet, regardless of location or university tier.

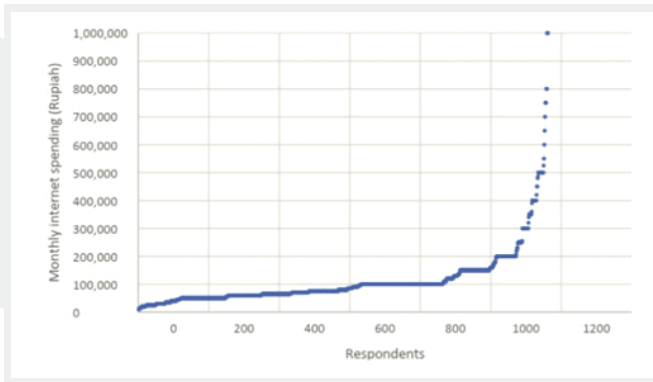
Figure 3.3 Types of network connectivity most often accessed



SPENDING ON CONNECTIVITY

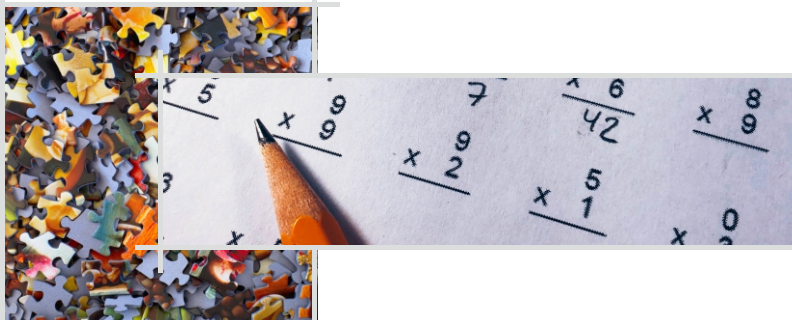
The survey finds that students' average monthly spending for connectivity was Rp 112,515, with a minimum of Rp 10,000, a maximum of 1,000,000, a median of Rp 80,000, and a mode of Rp 100,000 (230 people, or about 20% answered that they spend Rp 100,000 per month).

Figure 3.4 Distribution of monthly internet spending across respondents



DIGITAL COMPETENCY

The digital competency of Indonesia's university students is measured based on the EU's Digital Competencies self-assessment grid, categorized into five types of skill sets: 1.) Information Processing, 2.) Communication, 3.) Content Creation, 4.) Safety, and 5.) Problem Solving. They are also divided into three levels of proficiency: 1.) Basic, 2.) Intermediate, and 3.) Advanced. Ideally, each student should have all of the skills in the self-assessment grid. The aggregate score for digital competencies was 57.92 out of 100. This means that just slightly more than half (or less than 60%) of the respondents have acquired all the basic, intermediate, and advanced ICT skills required for IR 4.0. This aggregate score was derived by taking the simple average of the three scores for basic, intermediate, and advanced digital competencies (respectively: 72.89, 56.35, and 44.53).



● BASIC DIGITAL COMPETENCY

First, we explore how the students fared on the 15 skills that correspond to a basic level of digital competency (see Table 3.1). The average score among all respondents for basic digital competency was 72.89 out of 100. The distribution of the scores is shown in Figures 3.5, 3.6, and 3.7 for gender, faculty type, and university tier, respectively.

Figure 3.5 Distribution of basic digital competency scores by gender

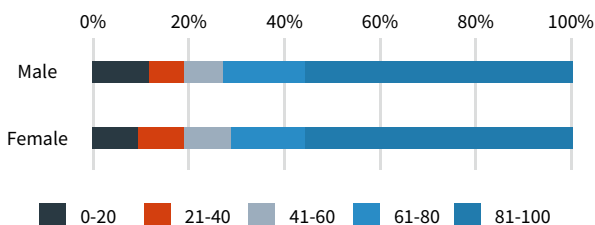


Figure 3.6 Distribution of basic digital competency scores by faculty type

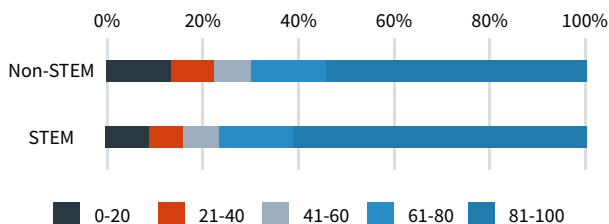
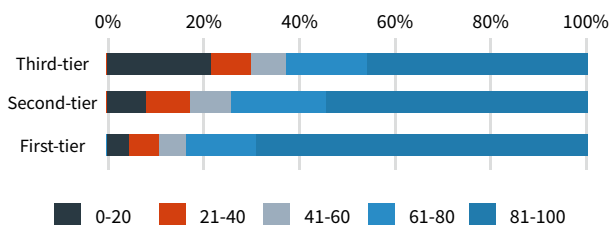


Figure 3.7 Distribution of basic digital competency scores by university tier



In Figure 3.4, we see that the distribution of scores for basic digital competency does not vary much by gender. In Figure 3.5, we see that STEM faculties tend to have a higher proportion of students who received a high score of 81-100, and fewer students who received a low score of 0-20, compared to non-STEM students. In Figure 3.6, we find that first-tier universities tend to have more students who received a high score of 81-100, and fewer students who received a low score of 0-20, compared to second-tier and third-tier universities. In more detail, the scores range from a high percentage of students who “can communicate through handphone, email, and other means” (88.64%) to a relatively low percentage who “can save power when using an electronic device” (68.67%). These scores indicate that most students have already acquired a set of basic digital skills.

Table 3.1 Average scores for basic digital basic skills

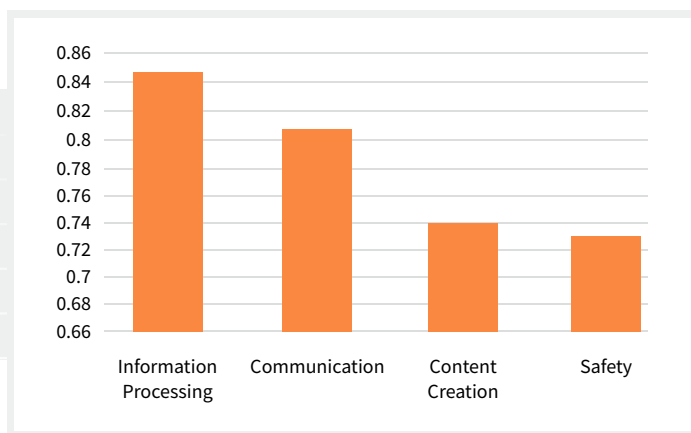
Basic Digital Skill		Avg. Score	Type of skill
1	Can communicate through handphone, email and other means	88.64	COM
2	Can seek information online using a search enginr	88.83	IP
3	Understands that not all online information can be trusted	84.77	IP
4	Can save and reopen a document	82.36	IP
5	Can use the internet to access public services	81.58	COM
6	Understands the presence of social media and online	80.81	COM
7	Can produce content using a digital tool (i.e. taking a photo)	80.38	CC
8	Can share a document	79.86	COM
9	Applies safety standards on a digital tool (i.e password, anti-virus)	76.85	SAF
10	Understands that content is protected by copyright	75.04	CC
11	Understands that private data should not be stolen or published online	74.27	SAF
12	Understands the precense of netiquette	72.81	COM
13	Can modify settings in a software/app (i.e. charge default language)	71.94	CC
14	Can edit content (photo, document) produced by other people	68.67	CC
15	Can save power when using an electronic device	68.67	SAF
Aggregate basic digital competency		72.89	

► Note
IP = Information Processing; COM = Communications Skills; CC = Content Creation; SAF = Safety



Table 3.1 above identifies the type of skill on the right-most column.¹ When we aggregated the basic skills by type (see Figure 3.8 below), skills that correspond to the “Information Processing” type scored the highest, meanwhile “Safety” and “Content Creation” types are the lowest skill sets understood by students.

Figure 3.8 Average scores for basic digital skill types



● INTERMEDIATE DIGITAL COMPETENCY

For intermediate level we explore how the students fared on the 24 skills that correspond to an intermediate level of digital competency (see Table 3.2). The average score among all respondents for intermediate digital competencies is 56.35 out of 100. This is substantially lower than the average score of 72.89 that they obtained for basic digital competency. The distribution of the scores is shown in Figures 3.9, 3.10, and 3.11 for gender, faculty type, and university tier, respectively.

¹ It is worth noting that for basic competencies, skills from the “Problem Solving” typology are not included.

Figure 3.9 Distribution of intermediate digital competency scores by gender

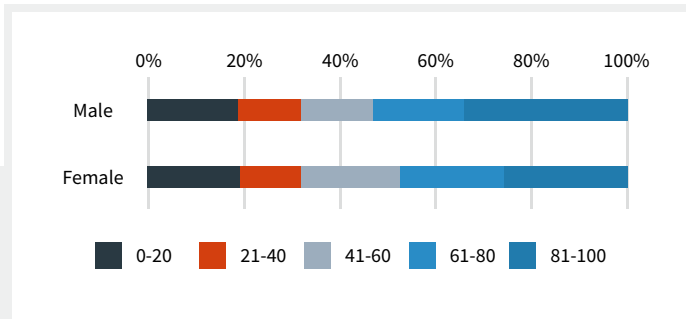


Figure 3.10 Distribution of intermediate digital competency scores by faculty type

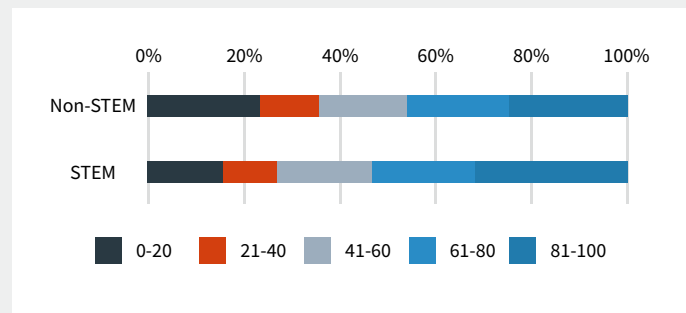
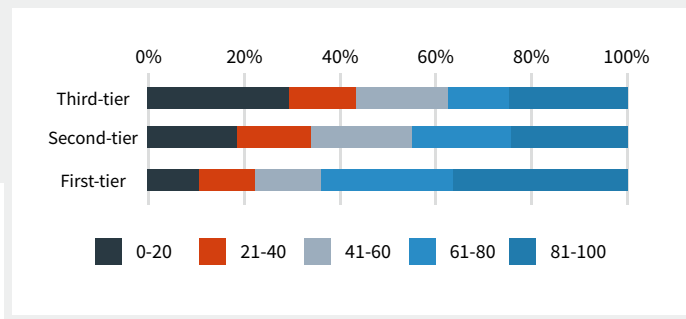


Figure 3.11 Distribution of intermediate digital competency scores by university tier



In Figure 3.9, we see that there is a higher proportion of male students who received a high score of 81-100 than the proportion of female students. In Figure 3.10, we see that STEM faculties tend to have a higher proportion of students who received a high score of 81-100, and fewer students who received a low score of 0-20, compared to non-STEM students. In Figure 3.11, we find that first-tier universities tend to have higher proportion students who received a high score of 81-100, and fewer students who received a low score of 0-20, compared to second-tier and third-tier universities.

In more detail, the percentage of students who had intermediate digital skills range from a high of 78.31% for “uses multiple online services” to a low of 34.08% for “understands digital identity and can trace one's own digital footprint.” These scores indicate that just slightly more than half of students have acquired the set of intermediate digital skills.

Table 3.2 Average scores for intermediate digital skills

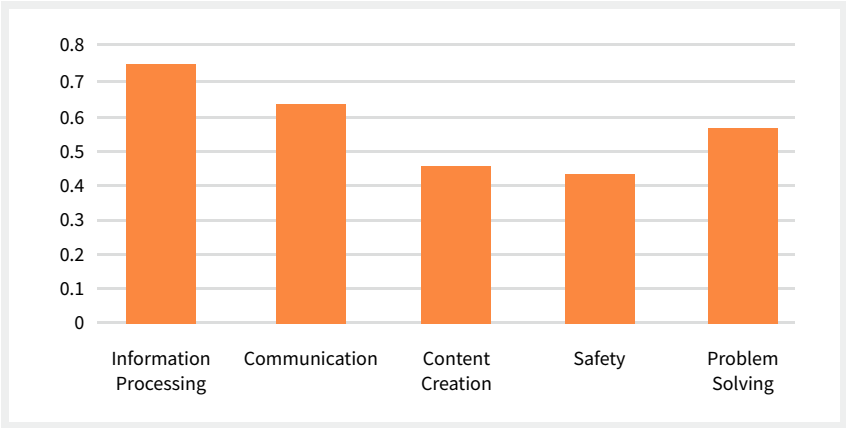
	Basic Digital Skill	Avg. Score	Type of skill
1	Uses multiple online services (i.e. public services, e-banking, e-commerce)	78.31	COM
2	Can use more than one search engine	77.62	IP
3	Shares knowledge with others online (i.e. through social)	74.18	COM
4	Understands credibility and compares information from multiple	73.49	IP
5	Understands the effects of technology on the environment	71.34	PS
6	Understands and applies netiquette	68.85	COM
7	Understands the health risk of using digital technology	67.21	PS
8	Classifies information using files and folders	65.83	IP
9	Produces digital content in various format (i.e. text, tables, images)	64.37	CC
10	Contributes in using collaborative tools (i.e. sharing a document)	59.38	COM
11	Installs safety features in tools used to access the internet	58.18	SAF
12	Understands personal limitations and upgrades digital skills	54.91	PS
13	Can troubleshoot various problems when using digital technology	54.39	PS
14	Uses digital technology to solve non-technical problems	51.38	PS
15	Uses and updates safety features in software regularly	50.09	SAF
16	Uses multiple passwords to access digital services	49.91	SAF
17	Can apply basic formatting in content produced by others	47.42	CC
18	Uses tools, features, and templates to create a website	46.73	CC
19	Solves problems by exploring settings and options in a digital tool	46.21	PS
20	Knows how to reference and reuse content protected by copyright	43.98	CC
21	Uses advanced communication features (i.e. VoIP, file sharing)	41.57	COM
22	Can identify potential threats in a website or email	38.98	SAF
23	Understands basic programming language	34.08	CC
24	Understands digital identity and can trace one's own digital footprint	34.08	SAF
Aggregate basic digital competency		56.35	

► Note

IP = Information Processing; COM = Communications Skills; CC = Content Creation; SAF = Safety; PS = Problem Solving

When we aggregated the scores of intermediate skills by type (see Figure 3.12 below), we see that skills that correspond to “Information Processing” and “Communications” types, again, scored the highest. Consistent with the basic competency scores, we find that skills that correspond to the “Safety” and “Content Creation” types are skills with the lowest scores. The same relatively low percentage of students have the ability to shape their digital identity and track their own digital footprints.

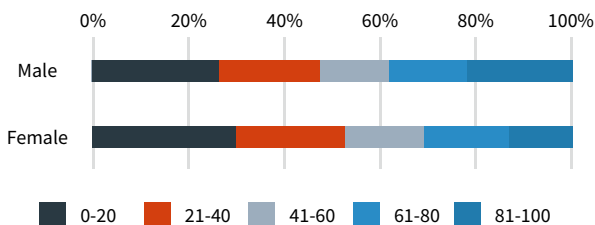
Figure 3.12 Average scores for intermediate digital skill types



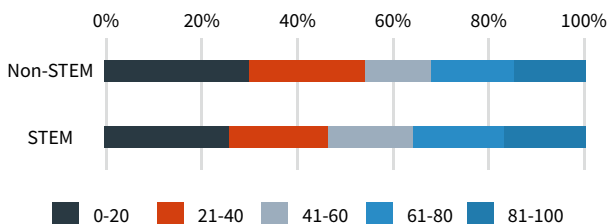
ADVANCE DIGITAL COMPETENCY

We explore respondents' scores on 28 skills that make up the advanced level of digital competency (see Table 3.2). The average score among students who are advanced in digital competency is 44.53 out of 100. The distribution of the scores is shown in Figures 3.13, 3.14, and 3.15 for gender, faculty type, and university tier, respectively.

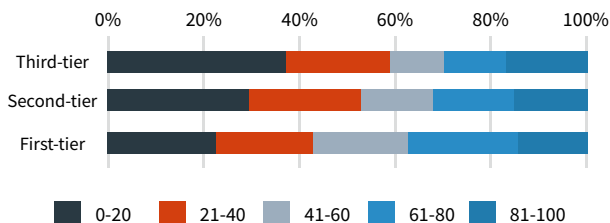
3.13 Distribution of advanced digital competency scores by gender



3.14 Distribution of advanced digital competency scores by faculty type



3.15 Distribution of advanced digital competency scores by university tier



In Figure 3.13, we see that there is a higher proportion of male students who received a high score of 81-100

Table 3.3 Average scores for advance digital skills

Basic Digital Skill		Avg. Score	Type of skill
1	Uses multiple communication tools (i.e. email, chat, sms, blog, social media)	79.43	COM
2	Saves information from the internet in various formats	72.46	IP
3	Participates in the virtual world using multiple online services (i.e. e-banking, e-commerce)	66.44	COM
4	Knows the latest development of technology	59.81	PS
5	Understands the impact of digital technology on everyday life, consumption	58.78	PS
6	Understands the latest technology for searching, storing and retrieving information	58.61	IP
7	Uses advanced strategy to find credible information	50.26	IP
8	Uses advanced features in communication tools (i.e. video conference, data sharing)	49.48	COM
9	Knows how the latest technology works	49.31	PS
10	Uses ICT to keep healthy (physically and psychologically)	48.71	PS
11	Understands what to do when a computer is attacked by a virus	47.85	SAF
12	Upgrades digital competencies regularly	45.87	PS
13	Uses cloud services to store information	44.23	IP
14	Chooses the appropriate tools, software and services to troubleshoot issues	43.89	PS
15	Creates and organizes content through collaborative tools (i.e. e-calendar)	43.03	COM
16	Understands the validity and credibility of information using certain criteria	42.17	IP
17	Knows how to apply copyrights	42.17	CC
18	Knows how to encrypt emails and documents	41.05	SAF
19	Applies email spam filter	39.67	SAF
20	Sets and modifies safety features of digital devices	35.28	SAF
21	Creates and modifies multimedia content in various formats and platform	33.82	CC
22	Solves almost all issues derived from using digital	33.48	PS

► Note
IP = Information Processing; COM = Communications Skills; CC = Content Creation; SAF = Safety; PS = Problem Solving

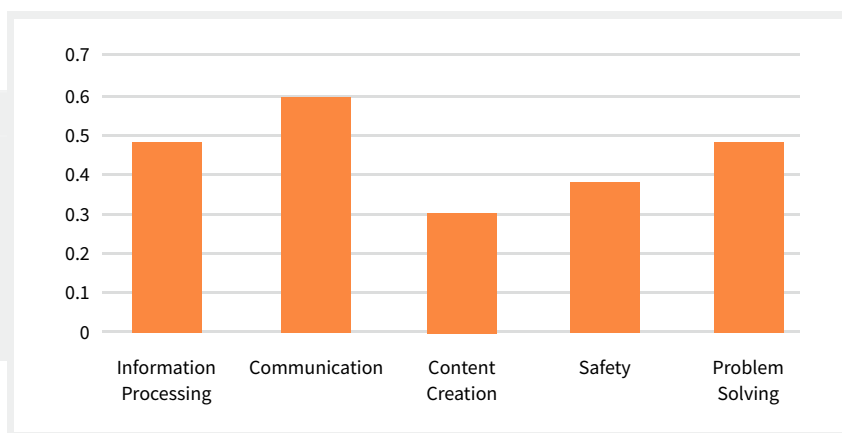
Basic Digital Skill		Avg. Score	Type of skill
23	Checks safety features and configurations of software used regularly	31.58	SAF
24	Uses advanced formatting functions in various software	30.98	CC
25	Uses web feeds (i.e. RSS) to keep up with the latest information	26.59	IP
26	Knows how to design, create and modify a database	26.59	CC
27	Uses multiple programming languages	23.84	CC
28	Can create a website using programming language	21.51	CC
Aggregate basic digital competency		44.53	

► Note

IP = Information Processing; COM = Communications Skills; CC = Content Creation; SAF = Safety; PS = Problem Solving

In Figure 3.14, we see that STEM faculties tend to have a higher proportion of students who received a high score of 81-100. In Figure 3.15, we find that first-tier universities tend to have a lower proportion of students who received a low score. When we aggregated the advanced skills by type (see Figure 3.16 below), we now see that skills corresponding to the “Communications” skill types scored the highest, and those corresponding to the “Content Creation” skill types were the least-adopted. From the section on intermediate competency above, we find that only a small portion (34.08%) of students knew the basics of programming.

Figure 3.16 Average scores for advanced digital skill types



CROSS-FUNCTIONAL COMPETENCY

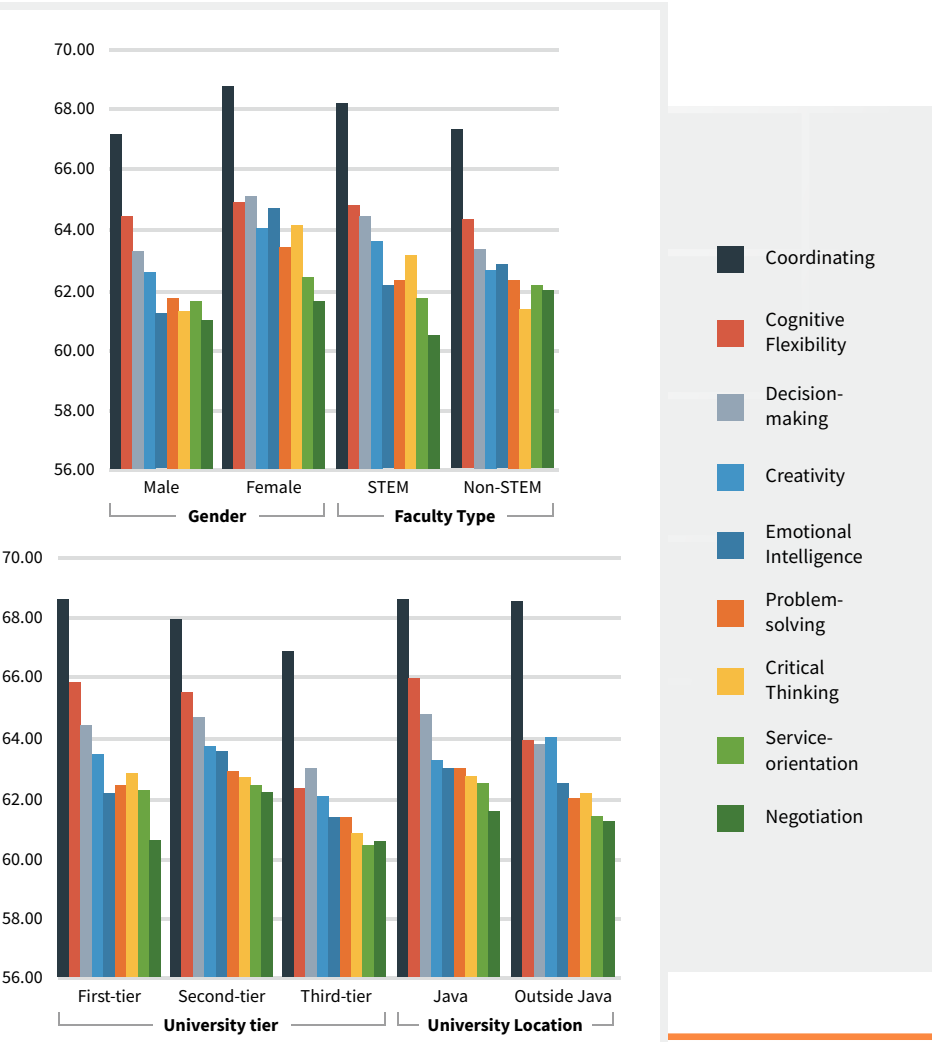
The World Economic Forum (WEF) released a report in 2016 mentioning the top-nine skills which will be highly valued in 2020. These nine skills were used to measure the extent to which Indonesian university students have reportedly acquired “soft skills” or cross-functional competencies. Our survey found, based on an aggregate of these nine skills, the overall cross-functional competency score for Indonesian students was 63.33 out of 100 (see Table 3.4). Of the nine specific skills measured, “coordinating with others” scored the highest (67.78 out of 100) and “negotiation” scored the lowest (61.29 out of 100). These numbers reflect a rather positive snapshot in which students are quite confident of their soft skills.

Table 3.4 Average scores for cross-functional skills

Basic Digital Skill		Avg. Score
23	Coordinating with Others	78.31
24	Cognitive flexibility	77.62
25	Judgement and Decision-Making	74.18
26	Creativity	73.49
27	Emotional Intelligence	71.34
28	Problem-solving	68.85
28	Critical thinking	67.21
28	Service-orientation	65.83
28	Negotiation	64.37
Aggregate cross-functional skill		63.33

The distribution of scores for the cross-functional skills varies according to the respondents' basic characteristics, as shown in Figure 3.17. It is interesting to note that across all nine types of skills, men scored higher than women, and those who studied in Java scored higher than their counterparts outside of Java. With a few exceptions, those who studied in STEM faculties and in first-tier universities tended to obtain higher scores than their counterparts. The exception was that non-STEM students actually scored higher than STEM students for Negotiation, Service Orientation, and Emotional Intelligence.

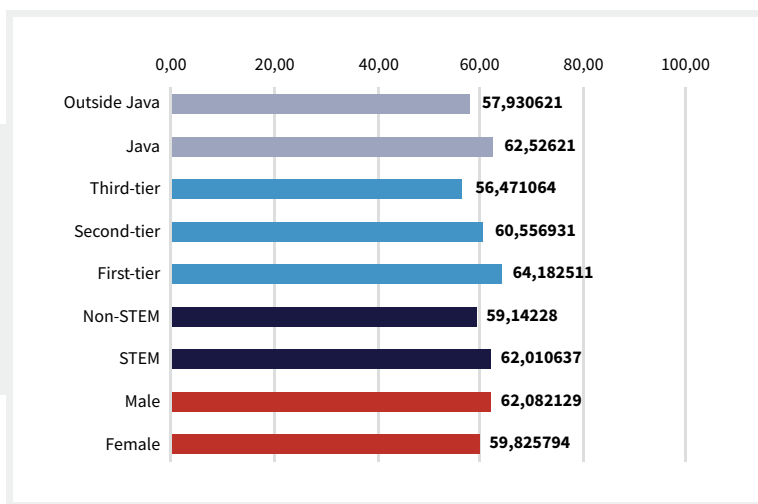
Figure 3.17 Distribution of cross-functional competency scores by gender, faculty type, university tier, and university location



● OVERALL IR 4.0 READINESS

The level of readiness shows an individual's likelihood of thriving in a working environment in IR 4.0. In this study, we measure students' readiness towards IR 4.0 by taking the average of a respondent's digital competency score and cross-functional competency score. Based on that formula, on aggregate, Indonesia's overall IR 4.0 readiness score is $(57.92 + 63.33) / 2$, which is 60.62 out of 100. The distribution of this aggregate score, however, varies according to the respondents' basic characteristics, as shown in Figure 3.18.

Figure 3.18 IR 4.0 readiness score by gender, faculty type, university tier, and university location

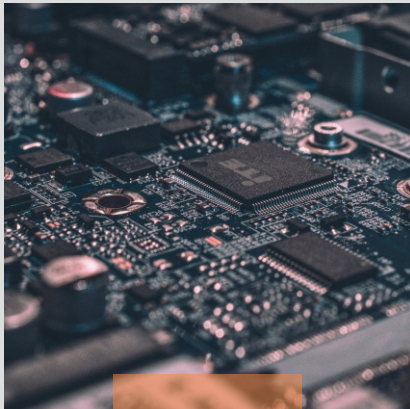
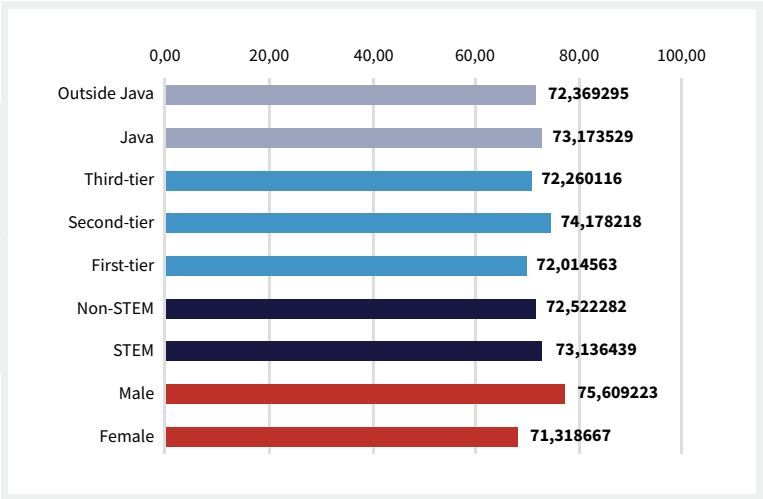


After calculating both digital competencies and cross-functional competencies into an aggregate score on measuring the higher education students' readiness, Figure 3.18 shows that those who are more ready for IR 4.0 are: (1) male students over female students, (2) students from STEM faculties over those from non-STEM ones, (3) students from first-tier universities over those from second-tier and third-tier universities, and (4) students studying in Java over those studying outside Java.

We also asked the students for a self-assessment, in which they were asked about their confidence in entering the job market, using a scale of 0-100. The aggregated readiness score based on self-assessment or perception was 72.84 out of 100. This is substantially higher than the readiness score based on digital and cross-functional competency scores, which was 60.62 of 100. Compared to the two numbers above, we find that the level of objective readiness of university students is lower than their self-perceived readiness. This seems to indicate that the students tend to possess a rather overconfident perception of their readiness for the IR 4.0 era.

The distribution of this aggregate perception also differs according to the respondents' basic characteristics, as shown in Figure 3.19. Aside from the higher scores, results in Figure 3.18 are almost similar to those in Figure 3.17, i.e. STEM students have higher confidence in facing IR 4.0, and so do male students and those studying in Java.

3.19 Self-perceived IR 4.0 readiness by gender, faculty type, university tier, and university location





■ SUMMARY OF FINDINGS

In the case of the readiness of students, University students obtained a composite score of 60.62 out of 100 for their overall readiness towards IR 4.0. This means that they admitted to having more than half of the skills required to thrive in IR 4.0, but they still have a long way to go until they acquire most of those skills. The score of 60.62 is derived by taking the average of the score for digital competency (“hard skills”), which was 57.92, and the score for cross-functional competency (“soft skills”), which was 63.33. From these scores, we see that Indonesian students seem to have a slightly higher level of soft skills than hard skills. The aggregate score of 57.92 for digital competency is derived by taking the average of the scores for basic digital competency (72.89), intermediate digital competency (56.35), and advanced digital competency (44.53). These scores seem to indicate that most students have already acquired the basic skills, while only slightly more than half have acquired intermediate skills, and slightly less than half have acquired advanced skills.

Based on gender, we found that men tend to obtain higher scores than women for intermediate and advanced digital skills, but at the basic level, both genders performed equally. Based on faculty type, we see that STEM students tend to obtain higher scores, and this disparity is seen consistently throughout the basic, intermediate, and advanced levels competencies. Based on university tier, we also see differences in digital competency, with first-tier university students consistently scoring higher than those in second-tier universities, and the latter performing better than those in third-tier universities. Based on university location, we see a digital divide between universities based in Java and those located outside of Java, with the former doing better than the latter. Looking at specific advanced skills, the three skills with the lowest scores were those related to content creation, namely: (1) creating a website using a programming language, (2) using multiple programming languages, and (3) designing, creating, and modifying a database

■ CONTRIBUTION, LIMITATION, AND FUTURE RESEARCH OPPORTUNITIES

This research has contributed to building knowledge on the readiness of Indonesia's higher education students and institutions for IR 4.0. Covering a large number of student respondents from STEM and non-STEM faculties across multiple university tiers in Indonesia. Even though the study has generated a rich dataset on the topic, it has primarily been a descriptive study, not an analytical one. Where relevant, we have presented cross-tabulations and breakdown of various dimensions of IR 4.0 readiness by gender, faculty type, university tier, and university location. However, we have not done more analytical studies using the data to find patterns, correlations, and causations. There are still plenty of opportunities to analyze the data in more detail.





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ABOUT CFDS

Center for Digital Society (CfDS) is the research center established by the Faculty of Social and Political Sciences, Universitas Gadjah Mada. The institution is created under the concern over the contemporary dynamics of socio-political condition of the world that is accentuated by the impeccable influence of information technology. The phenomenon triggers the new patterns and complexities in the society, and thus requires new approaches in managing such complexities.

CfDS pledged to delve more on the study of contemporary digital society, including related issues surrounding the topic; such as the issues of smart city and urban development. The emphasis is then put on the utilization of technology to shape the society in becoming digitalized, as well as to bring solvency to social issues.

Vision

Solving Social Problem and Accelerating Prosperity through Indonesia Digital Society

Activities

1. Research and Development
2. Dissemination and Publication
3. Education and Policy Advocacy

Research Scopes

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2. Digital Economy
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