

# Determination of 4IR Generic Skills Constructs for Engineering Graduates

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## Abstract

The current state of technological modernisation in the Industrial Revolution 4.0 (4IR) has led to changes in many fields of work; thus, the demand for existing generic skills is no longer sufficient to meet the needs and demands of the market. In this regard, a deeper understanding on generic skills needs to be obtained so that graduates especially in the engineering field are prepared for jobs that have not existed in the last 10 or five years. Align with this, the main objective of this study was to determine the constructs of 4IR generic skills for engineering graduates. A qualitative approach was used in the early stage of development of the 4IR generic skills (GS4IR) constructs from eight document analyses. Document analysis was done using frequency matrices tables. Results showed that the constructs of GS4IR were communication skills, leadership skills, critical thinking skills, problem solving skills, creativity skills, digital skills, adaptability skills, management skills and emotional intelligence. The study results can be used as a reference for recognising the new skills required to ensure that engineering students are able to get a job in the future.

**Keywords:** 4IR Generic Skills; Industrial Revolution 4.0; Engineering Graduates; Document analysis

## 1. Introduction

The emergence of a new technology wave known as the Fourth Industrial Revolution (4IR) is a major focus and agenda that is being discussed widely around the world. 4IR brings a paradigm shift to various aspects such as economics, health, education, lifestyle, employment and skills. In recent decades, the changing of the nature of employment has created considerable discussions from business, government and the workers themselves, owing to the aspect of skills. These discussions reflect on the future of jobs and skills required to sustain sustainable economic growth (Baller, et al. 2016; Foundation for Young Australians, 2017; Hajkowicz, et al. 2016; ILO, 2016; WEF, 2016;

Winthrop & McGivney, 2016; World Employment Federation, 2016). According to The Future of Jobs' report by the WEF (2016), by 2020, more than one-third of the core skills required in most jobs will cover skills that are not considered important today. In addition, according to Winterbotham, et al. (2014), 43% of job vacancies in science, research, engineering and technology are due to the lack of generic skills required by employers. This shows that the future scenario of the job world is not due to the lack of job offer, but the lack of mastery of generic skills in line with the needs and demands of industry. In addition, Fathiyah, et al. (2019) emphasize that every individual needs to upgrade or develop a set of

skills that will make them able to work in a 4IR setting.

Generic skills are referred to as the ability to master skills and attributes that meet the requirements of the field of employment according to field of study (MOHE 2006). These skills are also referred to as transferable skills as they can be used across disciplines. Different terms have been used from one country to another to describe the meaning of generic skills. For example, in the United States, the terms 'necessary skills' or 'workplace know-how' are used. In Australia, the terms 'soft skills' and 'employability skills' are used, while in the United Kingdom, the terms 'key skills' or 'core skills' are used. Generic skills are also used with the terms 'essential skills' by researchers and academics in New Zealand. It is undeniable that generic skills are the additional skills needed by graduates. The need for mastering generic skills by engineering graduates is in line with requirements in engineering where according to Yuzainee (2014), engineering is an unpredictable field of work since technology, equipment, systems and processes are constantly evolving at a rapid pace. What worry the most is, when the skills possessed by graduates are longer meet the skills required for certain job, unemployment among graduates may occur and become worse.

Generally, studies on the development of generic skills in engineering have been extensively carried out by previous researchers, but have only focused on developing several generic skills namely communication skill, problem solving and decision making skill, teamwork skills, management skills, life-long learning and professionalism (Blom & Saeki, 2011; Creasey 2013; Hanapi & Nordin, 2014; Hassan, et al. 2007; Husain, et al. 2013; Mai, 2012; Mustapha, et al. 2011; Nair, et al. 2011; Nordin, 2014; Puad, 2015; Wong & Tsang, 2009; Yuzainee 2014; Zaharim, et al. 2009; Zaharim, et al. 2010). These skills are no longer appropriate in today's field of work, which need to be improved in line with the technology

advancement in the Industrial Revolution 4.0 [6, 26, 27]. As such, there is a need for continuous development in the workforce's generic skills for the emerging jobs and skills change. Align with this, the main objective of this study was to determine the constructs of 4IR generic skills for engineering graduates.

## 2. 4IR generic skills

This section discusses the generic skills for 4IR graduates reviewed from previous studies. The definition of generic skills opted in this study was obtained from MOHE (2006) which is ability to master skills and attributes that meet the requirements of the field of employment according to field of study.

### 2.1. Framework for 21<sup>st</sup> Century Learning

Pompa (2015) in his report referred the work of Trilling & Fadel (2009) and the Partnership for 21<sup>st</sup> Century Skills (2009) to explain the skills needed for young graduates to strive in 4IR. The framework focuses both on the essential foundations, or core subjects, on which technical skills can be built, as well as the skills, knowledge and expertise necessary to succeed in the workforce of the future. The framework addressed core problems for each student in the 21st century that shape the foundation of expertise and are the required foundation for qualification and technical skills. The main topics were literacy, languages, mathematics, economics, science, geography, arts, history and civil engineering. P21 thus actively encourages the introduction of the interdisciplinary concepts such as global awareness as well as literatures on finance, economics, business and entrepreneurship, civic engagement, health and environment. It also acknowledged three core sets of skills as the keys to potential performance: (i) Learning and innovation skills; (ii) Information, media and technology skills; and (iii) Life and career skills

**Table 1** Skills for 21<sup>st</sup> Century Learning

Main skills	Skills
Learning and innovation skills	Critical thinking and problem solving
	Communication and collaboration
	Creativity and innovation

Information, media and technology skills	Information and media literacy
	Data literacy
Life and career skills	Flexibility and adaptability
	Initiative and self-direction
	Managing diversity and inclusion

Partnership for 21<sup>st</sup> Century Skills (2009)

## 2.2. The Future Manufacturing Workers- Qualifications and Skills

Manufacturing industry has been seen as an industry that will continue to grow and become a driver for economic growth of a country. Advancement of technology in 4IR such as advanced robotics, additive manufacturing and digital manufacturing urge the factories of the future to be highly innovative, networked and offer flexibility. Consequently, the qualifications and skills for future skilled workers in a factory will be differ. Gehrke, et al. (2015) in his report together with ASME American Society of Mechanical Engineers and

VDI The Association of German Engineers (VDI), for eight months (consist of 10 early career engineers from diverse sectors of industry, government, and academia), derived the qualifications and skills for skilled factory workers of the future. The derivation of the qualifications and skills were obtained by referring to three tiers of situation in a factory of the future, which are Skills & Qualifications (Tier 1), Tasks (Tier 2) and Tools and Technologies, Organisation and Structure, Working Environment, Intraorganisational and Interorganisational Cooperation (Tier 3). Table 2 displays the qualifications and skills for future skilled factory workers.

**Table 2** Qualifications and Skills for Future Skilled Factory Workers

Technical Qualifications & Skills	Personal Qualifications & Skills
IT knowledge and abilities	Self- and time management
Data and information processing and analytics	Adaptability and ability to change
Statistical knowledge	Team working abilities
Organizational and procedural understanding	Social skills
Ability to interact with modern technologies	Communication skills
Knowledge management	Trust in new technologies
Interdisciplinary/generic understanding	Mindset for improvement
Specialized knowledge	Managing diversity and inclusion
Awareness for IT security and data protection	
Computer programming about technologies	
Specialized knowledge about technologies	
Awareness for ergonomics	
Understanding of legal affairs	

Gehrke, et al. (2015)

## 2.3. Competency Model for “Industrie 4.0” Employees

Prifti et al. (2017) presented a competency model for 4IR employees concerning three clusters of Information System (IS),

Information Technology (IT) and Engineering through structured literature review and focus group session. This model was derived from SHL Universal Competency Framework [32] that acted as a foundation for the development of the model. The developed model comprised

three hierarchical levels (Big Eight) adapted from Bartham (2005) expanded with 65 competencies obtained from the results of literature review and focus groups. Additionally, the 4IR competencies were

clustered according to relevancy for IS, IT and engineering field. Table 3 displays the competency model developed by the researchers. Only generic skills that relevant for engineering field were considered in this study.

**Table 3** “Industrie 4.0” Competency Model

Big Eight	Competency dimension	Competency		
		Information Systems (IS)	Information Technology (IT)	Engineering
Leading & Deciding	Deciding and Initiating Act	Decision Making ,Taking Responsibility		
	Leading and Supervising	Leadership Skills		
Supporting and Cooperating	Working with People	Teamwork, Collaborating with Others, Communicating with People		
	Adhering to Principles and Values	Respecting Ethics, Environmental Awareness, Awareness for Ergonomics		
Interacting and Presenting	Relating and Networking	Compromising ,Creating Business Networks, Maintaining Customer Relationships		
	Persuading and Influencing	Negotiating, Emotional Intelligence, Presenting and Communicating Information		
	Presenting and Communicating Information			
Analyzing and Interpreting	Writing and Reporting	Targeted/Technical Communication, Literacy		
	Applying Expertise and Technology	Service Orientation/ Product Service Offerings, Business Process Management, Business Change, Management, Understand and Coordinate Workflows	Network Security, IT Architectures, Machine Learning	-
		-	System Development, Integrating Heterogeneous Technologies, Mobile Technologies, Sensors/Embedded Systems , Network Technology /M2M Communication, Robotics/Artificial Intelligence, Predictive Maintenance	
		Modelling and Programming, Big Data/Data Analysis and		-

		Interpretation, Cloud Computing /Architectures, In-Memory DBs, Statistics, Data Security	
	Analyzing	Problem Solving, Optimization, Analytical Skills, Cognitive Ability	
Creating and Conceptualizing	Learning and Researching	Life-long Learning, Knowledge Management	
	Creating and Innovating	Innovating, Creativity, Critical Thinking, Change Management	
	Formulating Strategies and Concepts	Business Strategy, Abstraction Ability, Managing Complexity	
Organizing and Executing	Planning and Organizing	Project Management, Planning and Organizing Work, Management Ability	
	Delivering Results and Meeting Customer Expectations	Customer Orientation, Customer Relationship Management	
	Following Instructions and Procedures	Legislation Awareness, Safety Awareness, Individual Responsibility	
Adapting and Coping	Adapting and Responding to Change	Work in Interdisciplinary Environments, Intercultural Competency, Flexibility, Adaptability and Ability to Change Mind-set	
	Persuading and Influencing	Work-Life Balance	
Enterprising and Performing	Achieving Personal Work Goals and Objectives	Self-management and -organization	
	Entrepreneurial and Commercial Thinking	Business Model Understanding, Entrepreneurship	

Prifti, et al. (2017)

#### 2.4. Skills for 4IR

Renjen and Brown (2018) identified four skills categories based from literature review and conversations from youth focus groups. Focus groups were conducted with members of the Global Business Coalition for Education Skills and Innovation Initiative Youth Advisory

Council. Nine youths attended four focus groups; the participants were aged between 19 and 29 from several countries including Jordan, Nigeria, Singapore and the United States. Focus groups lasted about 60 minutes. Table 4 displays the skills identified from the data analysis.

**Table 4** “Industrie 4.0” Competency Model

Category of skill	Description	Example
Workforce Readiness	Foundational to individuals’ entry and ongoing success in the workplace, ranging from initial job search to maintaining continuous employment	Literacy, numeracy, digital literacy, resume writing, self-presentation, time management, professionalism, etiquette, social norms
Soft Skills	Personal attributes, social skills, and	Communication, critical thinking, creative thinking,

	communication abilities that support interpersonal relationships and interactions with others	collaboration, adaptability, initiative, leadership, social emotional learning, teamwork, self-confidence, empathy, growth mindset, cultural awareness
Technical Skills	Knowledge and capabilities to perform specialized tasks	Computer programming, coding, project management, financial management, mechanical functions, scientific tasks, technology-based skills, and other job-specific skills (e.g., nursing, farming, legal)
Entrepreneurship	Knowledge and abilities that support success in creating and building a workplace opportunity or idea	Initiative, innovation, creativity, industriousness, resourcefulness, resilience, ingenuity, curiosity, optimism, risk-taking, courage, business acumen, business execution

Renjen & Brown (2018)

## 2.5. McKinsey Global Institute Workforce Skills Model

An initiative done by McKinsey Global Institute (2018) in building a comprehensive view of the changing nature of workforce skills in the United States and Western Europe countries (Austria, Belgium, Denmark,

Finland, France, Germany, Greece, Italy, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom) have identified 25 skills across five broad categories: physical and manual, basic cognitive, higher cognitive, social and emotional, as well as technological skills. For each category, specific skills were explained as in Table 5.

**Table 5** Qualifications and Skills for Future Skilled Factory Workers

Category	Skills
Physical and manual skills	General equipment operation and navigation
	General equipment repair and mechanical skills
	Craft and technician skills
	Fine motor skills
	Gross motor skills and strength
	Inspecting and monitoring skills
	Mindset for improvement
	Managing diversity and inclusion
Basic cognitive skills	Basic literacy, numeracy, and communication
	Basic data input and processing
Higher cognitive skills	Advanced literacy and writing
	Quantitative and statistical skills
	Critical thinking and decision making
	Project management

	Complex information processing and interpretation
	Creativity
Social and emotional skills	Advanced communication and negotiation skills
	Interpersonal skills and empathy
	Leadership and managing others
	Entrepreneurship and initiative-taking
	Adaptability and continuous learning
	Teaching and training others
Technological skills	Basic digital skills
	Advanced IT skills and programming
	Advanced data analysis and mathematical skills
	Technology design, engineering, and maintenance
	Scientific research and development

McKinsey Global Institute (2018)

## 2.6. Skills for the future

Skills Development Scotland (2018) has come out with a model from the perspective of the needs of the Scottish economy that present the skills to allow individuals to succeed in the future, to be recognised and used by policymakers, education and training providers as well as employers and those involved in developing skills. The developed model was focused on the significance placed by the society on those skills, promoting debates about the ways in which these competences can be incorporated in learning and facilitating the research and assessment

on the various approaches to attain and assess these skills. The model was developed by conducting literature review on the 4IR and future of work and skills. Additionally, a focus group discussion was held in February 2017 attended by representatives from the Organisation for Economic Co-operation and Development (OECD), International Labour Organisation (ILO), Gatsby Foundation, Bertelsmann Stiftung, Scottish Government, Strathclyde University and Robert Gordon University. This model consists of three main skills i) Self management: Manage the now; ii) Social intelligence: Connect with the world, and iii) Innovation: Create our own change.

**Table 6** Skills for the future

Category	Skills	Subskills	Description
Self management	Focusing	Sorting	The ability to sort information into categories and to understand the relationship between information
		Attention	The ability to focus on the present and deflect/avoid distractions
		Filtering	The ability to filter out non-essential information and focus on the essential problem at hand
	Integrity	Self awareness	The ability to understand and manage emotions, strengths, belief systems and limitations, and

			the effects of these on behaviors and the way they impact on others
		Ethics	Being aware of and acting upon personal values and principles
		Self control	The ability to exercise control over your own impulses, emotions and desires
	Adapting	Openness	Being open to new ideas and approaches – having a growth mindset
		Critical reflection	The ability to critically reflect on new knowledge and experiences in order to gain a deeper understanding, embed and extend learning
		Adaptability	Flexibility when handling the unexpected, adapting to circumstances as they arise
		Self learning	The ability to self educate without the guidance of others
		Resilience	Ability to respond positively and constructively to constantly evolving challenges and complexity
	Initiative	Courage	The ability to manage and overcome fear in order to take action
		Independent thinking	The ability to think for one's self and trust one's own judgement
		Risk taking	Doing something that involves danger or risk in order to achieve a goal
		Decision making	The act of making a considered choice after appropriately using intuition and careful thought
		Self belief	A feeling of trust in one's abilities, qualities and judgement
		Self motivation	The ability to act without influence or encouragement from others
		Responsibility	The ability to follow through on commitments, be proactive and take responsibility
		Enterprising	Willingness to take risks, show initiative and undertake new ventures
Social Intelligence	Communicate	Receiving information	Understanding and mentally processing verbal or written communication understood by those receiving the communication
		Listening	The ability to actively understand information provided by the speaker, and display interest in the topic discussed
		Giving information	Giving written or verbal communication in a way that can be best



		Storytelling	The ability to tell stories that persuade, motivate and/or inspire as well as bringing the sharing of knowledge to life through examples and illustrations
	Feeling	Empathy	The ability to take the perspective of others in order to understand their feelings and motivations
		Social conscience	A sense of responsibility and concern for wider society
	Collaborating	Relationship building	The ability to identify and initiate connections and to develop and maintain them in a way that is of mutual benefit to both one's self and others
		Teamworking and collaboration	Working with others toward shared goals. Creating group synergy in pursuing collective goals
		Social perceptiveness	Being aware of others' reactions and understanding why they react as they do
		Global and cross cultural competence	The ability to operate in different cultural settings
	Leading	Inspiring others	The ability to energize and create a sense of direction, purpose, excitement and momentum
		Influencing	Working to gain the agreement of others to a particular course of action
		Motivating others	Encouraging others to achieve goals, accomplish tasks, and complete objectives
		Developing others	The ability to coach and constructively review the work of others to improve and advance their skills, knowledge and performance level
		Change catalyst	Having the ability to ignite change
Innovation	Curiosity	Observation	The ability to notice behavior or information and register it as being significant
		Questioning	The ability to ask questions in order to increase understanding about a subject or experience
		Information sourcing	The ability to filter resources and information to find information relevant to an issue or topic
		Problem recognition	The acknowledgement and definition of a problem
	Creativity	Imagination	The ability to explore ideas of things that are not in our present environment, or perhaps not even real
		Idea generation	Proficiency at thinking and coming up with solutions and responses beyond that which is rote or rule-based

		Visualizing	Translating information and thought into accessible expressions, readable and recognizable images
		Maker mentality	The ability to explore, through tinkering and making, in order to arrive at new ideas and solutions
	Sense making	Pattern recognition	The process of classifying information into objects or classes based on key features
		Holistic thinking	The ability to see the big picture and understand subtle nuances of complex situations
		Synthesis	The process of organizing, manipulating, pruning and filtering gathered data into cohesive structures for information building
		Opportunity recognition	The ability to identify areas of opportunity for innovation
		Analysis	A systematic examination and evaluation of data or information, by breaking it into its component parts to uncover their interrelationships
	Critical thinking	Deconstruction	Breaking down a complex problem or system into smaller, more manageable parts before developing a new way of addressing the problem
		Logical thinking	The ability to identify, analyze and evaluate situations, ideas and information in order to formulate responses to problems
		Judgement	The act or process of forming an opinion after careful thought
		Computational thinking	The ability to translate vast amounts of data into abstract concepts and to understand data-based reasoning

Skills Development Scotland (2018)

## 2.7. World Economic Forum

WEF has come out with a latest report in 2018 following that published in 2016 (WEF 2016). In the present report, majority of employers expected that most of the current skills will not be relevant by the year 2022.

Mohd Kamaruzaman, et al. (2019) discussed in detail regarding the comparison of skills demand from the year 2018-2022. Table 7 shows the top 10 skills needed for graduates to pursue in the 4IR setting. The aforementioned skills will be used later in discussing the findings for this study.

**Table 7** Top ten skills in 4IR

Year 2022	
1	Analytical thinking and innovation
2	Active learning and learning strategies
3	Creativity, originality and initiative
4	Technology design and programming
5	Critical thinking and analysis

6	Complex problem solving
7	Leadership and social influence
8	Emotional Intelligence
9	Reasoning, problem solving and ideation
10	System analysis and evaluation

Mohd Kamaruzaman, et al. (2019)

## 2.8. Occupational Information Network (O\*NET) Framework

O\*NET (n.d) framework was developed by the US Department of Labour in collaboration with its Bureau of Labour Statistics' Standard Classification of Occupations (SOC) through a grant to the North Carolina Department of Commerce. O\*NET-SOC taxonomy provides comprehensive information on 974 occupations

in the US clustered into 20 wider work groups that are regularly updated and revised to meet the evolving job environment with new and emerging occupations. Details about the application of O\*NET framework can be assessed from <https://www.onetcenter.org/overview.html#project-partners>. Table 8 shows descriptions of the skills list in O'NET framework.

**Table 8** O\*NET framework

Competency bundle	Competencies
Active learning and learning strategies	Active Learning
	Learning Strategies
Reading, writing, math, active listening	Mathematics
	Reading comprehension
	Science
	Speaking
	Writing
Analytical thinking and innovation	Analytical thinking
	Innovation
Attention to detail	Attention to details
	Depentability
	Integrity
Complex problem-solving	Complex problem-solving
Coordination and time management	Time management
	Coordination
Creativity, originality and initiative	Initiative
	Creativity
	Responsibility
	Autonomy
	Originality
Critical thinking and analysis	Critical thinking
	Monitoring

Emotional intelligence	Concern to others
	Cooperation
	Social orientation
	Social perceptiveness
Instruction, mentoring and teaching	Instructing
	Training and teaching others
Leadership and social influence	Leadership
	Social influence
Management of financial, material resources	Management of financial resources
	Management of material resources
Management of personnel	Management of personnel resources
Manual dexterity, endurance and precision	Endurance
	Flexibility, balance and coordination
	Physical strength abilities
	Control movement abilities
	Fine manipulative abilities
	Reaction time and speed abilities
Memory, verbal, auditory and spatial abilities	Attentiveness
	Memory
	Perceptual abilities
	Spatial abilities
	Verbal abilities
Persuasion and negotiation	Negotiation
	Persuasion
Quality control and safety awareness	Quality control analysis
Reasoning, problem solving and ideation	Idea generation and reasoning abilities
	Quantitative abilities
Resilience, stress tolerance and flexibility	Adaptability/Flexibility
	Self control
	Stress tolerance
Service orientation	Service orientation
Systems analysis and evaluation	Judgement and decision making
	Systems analysis
	Systems evaluation
Technology design and programming	Programming

	Technology design
Technology installation and maintenance	Equipment maintenance
	Installation
	Repairing
Technology selection, monitoring and control	Equipment selection
	Operation and control
	Operation monitoring
	Operation analysis
Troubleshooting and user experience	Troubleshooting
Visual, auditory and speech abilities	Auditory and speech abilities
	Visual abilities

### 3. Methodology

A qualitative approach was used in the development of research constructs of 4IR generic skills (GS4IR) from eight document analysis as discussed above. Document analysis was analyzed by using the frequency matrices tables. The results showed that the constructs GS4IR were found to be communication skills, leadership skills, critical thinking skills, problem solving skills, creativity skills, digital skills, adaptability skills, management skills and emotional intelligence.

### 4. Findings

#### 4.1 Findings Document Analysis Creation Construct of GS4IR

In this section, frequency matrices tables based from eight model or framework of 4IR skills as discussed in Section 2 was built. The researchers made a list of the main constructs that are frequently mentioned among the aforementioned model or framework of 4IR as shown in Table 9. The constructs of GS4IR are Communication skills, Leadership skills, Critical thinking skills, Problem solving skills, Creativity skills, Digital skills, Adaptability skills, Management skills and Emotional Intelligence.

**Table 9** Comparison of document analysis construct of 4IR generic skills

4IR Generic Skills Construct	Comparative of 4IR skills								Total
	A	B	C	D	E	F	G	H	
Communication skills	√	√	√	√	-	√	√	√	7/8
Leadership skills	-	√	√	√	√	√	√	√	7/8
Critical thinking skills	√	√	√	√	√	√	√	√	8/8
Problem solving skills	√	√	√	-	√	√	-	√	6/8
Creativity	√	√	√	√	√	√	√	√	8/8
Digital skills	√	√	√	√	-	√	√	-	6/8
Adaptability skills	√	√	√	√	-	√	√	√	7/8
Management skills	√	√	√	√	-	√	√	√	7/8
Emotional intelligence	-	√	√	√	√	√	√	√	7/8

(A) P21 (2014); (B) The Future Manufacturing Workers (2015); (C) Competency model for "Industrie 4.0" Employee (2017);

(D) Deloitte (2018); (E) McKinsey Global Institute Workforce Skills Model (2018); (F) Skills Development Scotland (2018); (G) WEF (2018); (H) O\*NET Framework (n.d)

From document analysis in Table 9, nine generic skills of 4IR were frequently discussed in eight model or framework of 4IR skills and used as formation for the constructs of 4IR. From the list, it addresses generic skills in the order of those that are considered important to be mastered by graduates in facing the 4IR challenges. This list shows all eight skill model reports agreeing that the most required skills are critical thinking skills and creativity skills. Meanwhile, communication skills, leadership skills, adaptability skills, management skills and emotional intelligence were identified as important in at least seven skill models. Other skills namely problem-solving skills and digital skills were recognised as important in six skill model reports. In summary, these nine skills were considered as 4IR generic skills to be possessed by young graduates in engineering field in order to succeed in challenging work environment.

## 5. Conclusion

In this paper, the determination of 4IR generic skill constructs has been done based from the document analysis technique. It can be shown that nine 4IR generic skills constructs have been derived, which are communication skills, leadership skills, critical thinking skills, problem solving skills, creativity skills, digital skills, adaptability skills, management skills and emotional intelligence. Next, the constructs of GS4IR obtained from this study will be validated by the content expert from industry and the academic institution in the further study by the researchers. It is hoped that a framework of 4IR generic skills (GS4IR) can be obtained as a guidance by HEIs and the industry for ensuring that engineering graduates are competitive and have no problem in getting a job in the future.

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