

# Change in the Demand for Employability Skills of Engineers: An Indian Study

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**Abstract:** Employability skills are the capabilities and qualities employers look for in candidates while assessing them for employment. In case of engineers, employers demand generic and technical skills from engineers ready to join industries. This paper aims to explore the perception of Indian employers on the issue of the employability skills of engineers. Specifically, it aims to determine whether the skill requirement of engineers will change or remain the same in the post-COVID 19 era. This study used the interview method of qualitative analysis in which 16 interviews of human resource managers of different multinational companies were conducted. The findings reveal a sudden and significant paradigm shift in the required set of employability skills for engineering professionals. Digital skills have dominated over other technical and generic skills in the list of employability skills that recruiters demand. The findings can be used to spread awareness among

engineering graduates about the changing demands of the workplace. Secondly, higher education institutions can rethink and revise their curriculum to develop digital skills. Lastly, the use of in-depth interview method can help future researchers to develop questionnaires from the extensive data and replicate the research questions to understand the change in demand of employers.

**Keywords :** Digital skills; Employer's demand; Engineers, Employability skills; Post-COVID-19

## 1. Introduction

A nation's economic development and labor market policies are both greatly influenced by employability. In the 21st century, employability is a much-discussed term among its key stakeholders, both at the workplace and at university because it is regarded as one "missing link between education, training, and the world of work" (Suarta, 2012, pp. 337). It is widely considered to be one of the signs of the significant changes caused by the globalization that occurred in the last two decades. One of them is what Hillage and Pollard (1998) considered "an emphasis on skills-based solutions to economic competition and work-based solutions to social deprivation" (pp.4) which is a consequence of increasing importance of employability in labor market policy. Thus, the emphasis on knowledge acquisition led to the rapid growth of higher educational institutions (HEIs), which are expected to

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produce an employable workforce. Simultaneously, the policy intervention in the labor market led to the requirement of outcome-based performance at the workplace, which further demanded HEIs to shift to outcome-based education focusing on employability. The responsibility of being employable is shared not only by the individual (graduate or postgraduate), but also by other aspects of the labor market. This brings forth the important role of an employer and “labor demand in determining a person's employability” (Gazier, 1998 as cited in McQuaid & Lindsay, 2005, pp. 206). With Human Capital theory emphasizing the increase in productivity and efficiency of workers and the knowledge-driven economy focusing on human intellect for economic growth, the onus comes on the HEIs to produce skilled manpower. Subsequently, it is the need of the hour to focus on employability skills to generate employment as well as enhance the economy. One of the essential aspects of the employability for engineers is an ever-changing requirement of skill set which has been extensively researched. A considerable number of studies have reported the need and perception of employers regarding the desired employability skills for workplace. However, the effect of COVID pandemic on the demand of skills set for engineers remains unexplored. This study intends to collect empirical evidence from a group of Indian employers to assert whether the skill requirement will change or remain the same in post COVID era.

## 2. Literature Review

### 1) Defining Employability and Employability Skills

The term “employability” has over the years evolved from simplistic, narrower concept to more complex broader construct accommodating a variety of perspectives and interpretations which has made it a “multi-dimensional phenomenon” (Finch et al., 2013), consequently making it more complex to define. However, many scholars attempted to define the concept and reached some level of agreement. One of the most cited definitions describes employability as “a set of achievements – skills, understandings and personal attributes – that makes graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy” (Yorke, 2005, p. 3). This pragmatic definition is supported by Hinchliffe who associated employability with achieving skills, knowledge and personal attributes for successful employment (Hinchliffe & Jolly,

2011b). On the other hand, Pitan in his paper distinguished between employability and employment and added that employability is more than getting initial employment (Pitan & Muller, 2020). In the context of higher education, graduate employability is equated with a set of attributes, skills and understanding a students should develop during her/his university years (Pool & Sewell, 2007). The key terms such as skills, abilities, capabilities, a set of achievements, a group of skills and attributes, and student characteristic emerged from the above definitions, can be implicitly or explicitly put under an umbrella term “employability skills and attributes”. In this vein, employability skills are also perceived as a collection of fundamental competencies that involve strengthening one's knowledge base, degree of competence, and mindset in order to make a mark in the modern workplace (Cassidy, 2006). Keller et al. (2011) classified employability skills into two categories: attributes and skills, where attributes refer to non-technical skills related behaviors and attitudes and skills refer to the ability to perform a technical task. Emphasizing on the application of employability skills for success at all levels of employment, Overtoom (2000) considers basic employability skills as transferable core competencies which includes knowledge, skills and abilities. The term soft skills is relatively synonymous to employability skills however, it refers to a set of skills and attributes more in terms of non-technical skills. Abdullah in his article describes soft skills as “abilities, skills, traits, attitudes, behaviour personality rather than technical knowledge” (p.1) and consider them inevitable for employment in corporate world. (Abdullah et al., 2019). In the 21st century, labor market policies are driven by the knowledge-based economy, which has created a demand for highly skilled employees. Consequently, this has resulted in an increased focus to be placed on the responsibility of higher education institutions to identify the necessary skills and prepare the students to create graduates who are ready for the workforce. Identifying relevant employability skills and embedding them in the curriculum has always been a herculean task as the phrase “identifying relevant skills” is relative, context bound and changing, even within a specific discipline which tends to make the list of skills ambiguous. This paper intends to analyze the widely accepted skills required to be employable. This article, while addressing the issue of ambiguity related to skills that help engineers’ employability, also analyses the paradigm shift in skills expectation in the post-COVID-19 era.

### 3. Theoretical Framework

#### 1) Conceptualizing Employability Skills Required for Engineers

For years, the ‘skill set’ required in modern engineering profession have attracted a considerable interest and attention from various academic as well as professional organizations due to firstly, its significant role in preparing work-ready engineering graduates who are “more likely to gain employment and be successful in their chosen professions” (Knight & Yorke, 2003, p.4) and secondly, its pressing need at the workplace to yield desired output. However, these organizations have also highlighted an existing skills gap between engineering education and employment (Kolmos & Holgaard, 2018). This alleged gap can be attributed primarily to the incongruity between the supply by HEIs and demand of industry, and secondarily the nonalignment between the curriculum and pedagogy used in higher education. The victims of this alleged gap are the engineering graduates with skill deficiency.

For many decades now, since education has been the medium to develop many competencies in graduating engineers, higher education institutions are obligated to facilitate students’ knowledge acquisition and skill development to prepare them for future professional work. Therefore, academia is held responsible for not producing efficient, skillfully trained engineers. However, academia, responding to this belief, doesn’t take the accountability stating that because the university’s primary goal is to teach disciplinary knowledge, the responsibility for developing students’ generic skills does not come under their duty (Chan et al., 2018). Furthermore, a desire to get promotion through research and publication has significantly displaced teachers’ priorities in higher education institutions. Despite the fact that there is a pressing need for collaboration between industry and academia to prepare graduates with specific (technical as well as generic) skills required of a global engineer, there are multiple layers to the problem.

Many researchers and academicians who have tried to analyze and define employability skills also insist on the elusiveness of these skills, which keep mutating, evolving, and are dynamic in nature. The concept of employability has broadened over the years and from the perspective of labor market demands, it has evolved from a narrower discipline

specific to a broader generic one encompassing many soft skills (Rowe & Zegwaard, 2017). As the career paths of engineers have evolved from linear and vertical to horizontal and multi-dimensional, new skills have become imperative for multiple career reorientation and global mobility which according to Nilsson (2010) consequently made it very difficult to predict the competence required to become and remain a successful professional and to manage individual employability effectively. Emerging research and understanding of employability complicate this aspect by incorporating a wide range of areas to define skill sets. In this regard, Smith et al. (2014, p. 8) identified “six dimensions of employability termed as work-readiness which are professional practice and standards, integration of theory and practice, lifelong learning, collaboration, informed decision-making, and commencement-readiness”. Moreover, the inclusion of career self-management, professional identity, transfer of capabilities across contexts, graduates’ ability to articulate employability, networking, global citizenship, and scholarship has redefined the term employability skills (Rowe & Zegwaard, 2017). Irrespective of the dynamism and multiple interpretations, skills that encapsulate the employability skills of engineers have been loosely grouped into the three following categories:

- Core Employability Skills: entrepreneurship skills, teamwork, willingness to learn, flexibility, empathy, decision making skills, self-discipline
- Professional Skills: problem solving skills, innovation, technical skills, analytical skills
- Communication Skills: ability to write, design, read, analyze, interpret, and present data and information. (Blom & Saeki, 2011).

To further elaborate, they are “a set of skills, both generic (e.g., teamwork, organizational, communication) and discipline-specific (e.g., the skills and knowledge relevant to engineering, law, or social work) as well as personal attributes (e.g., self-confidence, resilience, discipline) that are relevant to employment and desired by industry” (Rowe & Zegwaard, 2017, p.88). A simpler description was given by STEMNET that enlisted 10 key employability skills for graduates from science and engineering. (“Top 10 Employability Skills,” n.d.). To simply state, the following core skills have been identified for engineers to be employable:

1. **Communication Skills:** The ability to confidently and effectively present ideas across different modes like oral, written or aural with co-workers and the community at large. “Communication skills that contribute to productive and harmonious relations between employees and customers are critical to career success and contribute significantly to organizational success” (Du-Babcock, 2006 as cited in Suarta et al, 2012, p. 340).
2. **Decision-making skills and problem solving:** (Huitt, W.G. (1992) as cited in Dowling, 1999) stated that finding a difference between a situation's present condition and intended state, then taking steps to find a solution, is the process of problem-solving. On the other hand, decision-making is choosing between two or more viable solutions in order to achieve the desired outcome.
3. **Teamwork:** “Teams are composed of individuals who have several different characteristics. Teamwork is a cooperative process that allows ordinary people to achieve extraordinary results” (Scarnati, 2001, p.5). The term "teamwork" refers to the collaborative nature of group work. Successful cooperation depends on the existence of synergism amongst all team members, establishing an atmosphere where they are all eager to contribute and participate, in order to develop and maintain a pleasant, productive team environment.
4. **Lifelong Learning:** The capacity to comprehend one's professional obligations in relation to society, culture, the environment, and professional and ethical obligations. Lifelong learning can be described as “Curiosity and desire to learn for life” (Rajala, 2012, p.1380). It encourages the learners to continuously upgrade himself/herself with new knowledge and skills and contribute in the development of the organization.
5. **Leadership Skills:** According to Crowne (2019), “leadership is a process of influencing others and is an important resource for any group” (p. 82). leadership is a skill of inspiring a group of people to work toward a common objective. A change in a company can be driven by leadership and employable abilities.
6. **Interpersonal skills:** The capacity to build and maintain open and honest relationships with colleagues, superiors, and external employees in order to encourage the free flow of information and create a positive work environment. Some common interpersonal skills include awareness of oneself and others, collaborating with others, clear communication, and comforting people when they need it.
7. **Creativity and entrepreneurial thinking:** Pink (2005) asserts that creativity and entrepreneurial thinking, or the capacity to think outside the box, challenge conventional wisdom, conjure up novel scenarios, and generate astounding work, are skill sets that are closely related to employment creation. Being an entrepreneur means having the capacity to put ideas into practice. It involves taking risks, being innovative, and being creative. A person with an entrepreneurial attitude can create jobs for themselves as well as for others in the workplace, and also possess the capacity to identify and seize possibilities as well as the willingness to accept risk and responsibility are always valued traits.

This list has been widely cited in the literature as a crucial set of employability skills and the same has been incorporated in the curriculum by many technical institutions as well as other academic HEIs. Although these skills appear to be ambiguous and arbitrary, they are bound to be so due to the diversified perceptual, contextual and utility value attached to them. Different studies have confirmed the involvement of multiple stakeholders like employers, students, academia and also policymakers in the selection as well as interpretation of important skills for engineering graduates and thus, accepting the element of arbitrariness and ambiguity in the process of selecting and defining employability skills. However, the issue of unemployment gives room for a debate on whether this ambiguity affects the students' employability development. Secondly, there is a need to reconsider the role of stakeholders in the changing circumstances of the twenty first century. Although reaching a consensus to define the set of employability skills of a graduating engineer is an ongoing debate, across most of the studies, the dominant skills are “communication, teamwork, problem solving, and management” (Kolmos & Holgaard, 2019, pp.502).

## 2) Employability Skills of Engineers in the Indian Context

Numerous studies have been done that emphasize the importance of both hard and soft skills, commonly referred to as employability skills for technical professionals in India. Chaita (2016) in her study provides a list of employability skills required for engineers in India. This list includes skills like problem-solving, logical and analytical thinking, the ability to access and manage knowledge and information, the capacity to use one's imagination and creativity, intellectual rigor, and values like ethical behavior, perseverance, integrity, and tolerance, as well as teamwork, communication, and leadership. In his study titled "Factors Impacting Employability Skills of Engineers," Ajit & Deshmukh, (2013) stressed the combination of knowledge, skill, and attribute, and came to the conclusion that disciplinary knowledge, empathy, communication skills, and managerial ability all significantly affect engineering graduates' employability. However, to increase the employability of engineering graduates, (Singh, 2012) specified seven soft skills, which are: communication skills, critical thinking and problem-solving skills, collaboration, life-long learning and information management skills, entrepreneurial skills, ethics, moral & professional, and leadership abilities. Nair et al. (2009) in their study lists the skills required for the engineering industry in particular, including oral communication skills, interpersonal skills with coworkers and clients, written communication skills, the capacity for cooperation and teamwork, the ability to apply knowledge in the workplace, and the capacity to handle pressure. They also list the abilities to analyze problems and solve them.

In India, the motivation to pursue engineering education is generally to study, get a qualification from one of the premier institutions, and get employment in a multinational industry. However, the rapid expansion of opportunities for engineers owing to multinational organizations' hiring of Indian institutes may have brought many "dream jobs," but it has also augmented the expectations of graduating engineers. Employers demand generic skills along with discipline-based understanding and skills, as they seek academic expertise, practical abilities, self-reflection, and personal attitudes to complement one another (Kolmos & Holgaard, 2018). These skills are interchangeably called generic skills, transferable skills, or employability skills. Employability skills

can be simply defined as "a set of skills, knowledge, and personal attributes that make a person more likely to choose and secure occupations in which they can be satisfied and successful" (Pool & Sewell, 2007, p.280). While these skills have become integral to acquisition and sustenance in the workplace, there is an ongoing debate regarding their nature and composition.

## 3). Dearth of Employability Skills in Indian Engineers

Indian engineers need to upgrade their skills as many studies have shown serious concern over the employability of Indian engineers. In 2005, the NASSCOM-McKinsey Report concluded that while India produces more than five lakh engineers annually, only a very small percentage, 25 percent, is estimated to be employable (Future of Jobs in India - 2.0, 2017). A similar study conducted for the World Bank reported that "the dissatisfaction level of employers toward engineering graduates' skills confirms that a significant share of graduating engineers does not meet employers' expected standards" (Blom & Saeki, 201, p.20). Since these studies have come to light, the deficient skills of engineers have been a consistent topic as almost all the daily newspapers have repeatedly reported the issue. According to The Economic Times, "a shocking series of revelations is the finding that 80% of Indian engineers are not fit for any job in the knowledge economy" (Economic Times, 2019, p.1). Similar articles which also reiterated the similar issue of low employability. "Why aren't engineers employable?" (Mouli, 2020); "80% of Indian engineers are unfit for jobs, according to a survey," 2019; "Over 80% of Indian engineers are unemployable and lack new-age technology skills: A Report," 2019); and "Only 1.7% of engineers in India are fit for new age jobs," 2019). Most of these articles quote the report presented by Aspiring Minds on the National Employability Report for Engineers—2019, which insisted on the lack of employability skills of Indian engineers.

## 4). COVID-19 and the Paradigm shift in Workplace Demands

The existing scholarship on employability doesn't report a consistent set of employability skills; rather, it suggests that the specific employability skills be constructed in accordance with the context and the needs of the stakeholders (Kolmos & Holgaard, 2018). In 2017, FICCI partnered with NASSCOM to roll-out the "Future of Jobs in India – A 2022

Perspective”: The report examined the fundamental reasons behind the emergence of transformative trends based on numerous interactions with pertinent parties, and as a result, three major factors were found to be driving the current disruption: globalization, Indian industry's adoption of latest technologies, and demographic changes in the region (Future of Jobs in India - 2. 0, 2017). Even though their study was conducted before the unprecedented COVID-19 outbreak, they predicted technological intervention in all spheres of engineering, thus making the clarion call for reskilling engineers for employability. Since March 2020, the world has seen a paradigm shift in the workplace and work culture. Industry 4.0 has incurred massive economic and manufacturing losses that will be difficult to overcome. The outbreak has wreaked havoc on all sectors, and the disruption caused to many sectors will be unalterable. It has become imperative for engineers to re-assess their learning goals as the skills required for employability are being redefined. In order to ensure better opportunities for professional satisfaction and success, they will need to review their skills and adjust to the demands of a changing world. With modernization and globalization, there was a demand to review the skills desired in a global engineer. Now, with the advent of work from home culture and virtual workplaces induced by the COVID-19 pandemic, the skills required need to be reviewed and re-visited.

A group of researchers namely Ramadi et al. (2016); Markes (2006); Blom & Saeki (2011); Nair et al. (2009); Sinha et al. (2020) have explored and identified the skills that employers of engineering graduates anticipate from them that are essential for recruitment. Over the last twenty years, many studies conducted in different countries have tried to document the industry's demand and understanding of engineering graduates' skill sets. Their research validates the above-mentioned skills that have been in high demand for engineers' employment.

But due to the sudden transformation brought forth by the COVID-19 pandemic, the work culture and workplaces cannot rely only on the skills that were relevant earlier, as new skills have become significant for engineers. Keeping this paradigm shift in mind, this study was conducted to decode the skills that would help young engineers get a competitive edge with reference to employment. Modern engineers are expected to assume more sophisticated responsibilities than the traditionally technical roles given to engineers (Ramadi et al., 2016, p.1). This role

entails responsibilities for effective communication and commercial environmental awareness, but it does not stop there because engineers must evolve with time and develop their skills to meet the ever-changing demands.

#### 4. Research Methodology

##### 1). Research Objective

The COVID 19 epidemic undoubtedly had a severe negative impact on the Indian economy, which is shown in the country's rapidly rising unemployment rates, which now ranges from 7.9% to 12%. In this context, the present paper aims to seek employers' perception on the required employability skills of the engineering professionals. The researchers intend to find out whether the pandemic has influenced/alterd the need and requirement of the employability skills. The objectives of this study are: a) to seek recruiters' views on important employability skills, b) to find out the effect of the pandemic on the employability skills required for engineers, and c) to enlist the employability skills that will be relevant in the post - COVID-19 era.

##### 2). Research Design

Qualitative research design was adopted to carry out this empirical research, according to which interview method was used to understand the expectations of the recruiters. Although this is a deviation from the popular method of preparing questionnaires to collect data and analyze it quantitatively, as has been done in earlier studies to understand the perception of human resource managers, the researchers decided to conduct interviews as qualitative analysis enabled them “to explore links between different contexts and categories” (Cepeda & Martin, 2005, p. 169). As the focus of qualitative research is on participants' perceptions and experiences, the researchers decided to derive meaning and interpretation by negotiating data collected (Lincoln and Guba, 1985) through the interviews of the recruiters who assess the engineers for employment. With the aim to understand change in perception of employers regarding employability skills of engineers in context of Covid 19 phenomenon, qualitative research was found more suitable as, “it explores what it assumes to be a socially constructed dynamic reality through a framework which is value-laden, flexible, descriptive, holistic, and context sensitive; i.e., an in-depth

description of the phenomenon from the perspectives of the people involved” (Yilmaz, 2013, pp.313).

### 3). Data Collection

For this study, sixteen HR managers were selected through purposive sampling from various cities in India, to bring diversity with respect to race, gender, type of industry (Information technology, Petroleum, 3D Printing, Processing, Textile, Automobile, Chemical), and years of experience in HR varied from 5 to 20 years, with the only similarity that they regularly visited various campuses in India to recruit engineers. Since these managers have been interviewing engineers for the last few years, their perceptions and expectations of engineers are integral to understanding the skill requirements of engineers at the threshold of employment. The study was aimed at understanding the skills they look forward to in engineers and the change in perception, if any, due to the pandemic. Table 1 summarizes the sample's

demographic characteristics.

**Table 1: Demographic details**

Gender	(n)	Years of experience	(n)	Types of industry	(n)	Region	(n)		
Male	11	0-5 years	2	IT	4	Delhi NCR	8		
Female	5	6-10 years	7	Petroleum	3	Maharashtra Gujarat	5		
Others	0	11-15 years	4	Textile	4	South India	3		
				6-20 years	3			Automobile	2
								3D printing Processing	1
				Chemical	2				

(n) – No of participants

## 5. Results and Discussion

The interview guide was adapted from a few notable studies like (Ramadi et al., 2016), (Blom & Saeki, 2011), (Nair et al., 2009), (Sinha et al., 2020), which used the quantitative method but sought answers to some pertinent questions to bridge the gap between industry expectations and satisfaction with the skill sets of engineering students in different regions. The researchers used the findings drawn from these studies to design the final interview questions adding a few questions relevant to the demands in the present scenario. After some introductory discussion,

the interview was divided into the following skill categories, which were codified, and random responses were chosen to address them. The analytical coding scheme is described in table 2.

- Qualities and skills recruiters look forward to in young engineers
- Recruiters' perception of employability skills of engineers
- Shift in skills post COVID-19 pandemic
- Importance of digital skills for engineers
- Decoding digital expertise desired in engineers

**Table 2: Analytical codes and sample responses**

Theme	codes	Sample response
Required Skills	<b>Soft skills</b> - problem-solving, critical analysis, adaptability, initiative, and communication; <b>Technical skills</b> - coding and digital skills	“attitude and ability to grasp knowledge during training make a successful engineer.”
Perception of Employability skills	<b>Soft skills</b> numeracy, communication skills, lifelong learning <b>Managerial skills</b> - planning, delegation, time management, <b>Technical Skills</b> - digital skills and specific skills related to their organization, like design engineering, coding, and data analytics	“the capacity to comprehend the application of scientific and engineering principles and persist in attempting them without giving up.”
Post Pandemic Shift in skills Requirement	<b>Soft skills</b> - communication, creative reasoning, design thinking, and problem solving <b>Technical Skills</b> - automation, artificial intelligence, data sciences, machine learning, and the Internet of Things	“all industries, are moving toward automation, with a focus on artificial intelligence, data sciences, machine learning, and the Internet of Things (IoT), making digital skills a requirements.”

Digital skills required	(IoT), automation, artificial intelligence, machine learning, data science, and the IoT specific to industry- AutoCAD, coral draw, engineering design	“This transformation has come as industries have come to heavily rely on the internet and technology to minimize the disruption caused by lockdowns.”
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### 1). Qualities and Skills Recruiters look forward to in Young Engineers

When asked which qualities and skills employers want in new engineers, the majority of employers agreed that technical skills are crucial, as are domain knowledge or basic concepts, as well as the ability to learn. However, they also looked for soft skills in a candidate, such as problem-solving, critical analysis, adaptability, initiative, and communication. One of the managers even stated that he favored soft skills over technical abilities, stating that “attitude and ability to grasp knowledge during training make a successful engineer.” Furthermore, another manager mentioned the need to assess how the engineer could use his expertise. The majority of them placed a high value on soft skills, which are regarded as crucial employability abilities for engineers. Their viewpoint reinforces the widely held belief that engineers must develop soft skills in order to be prepared for global settings. Learning for a career, experience, a degree, subject knowledge, and general abilities were all rated as important. Only two managers, however, added coding and digital skills to their list of qualifications.

### 2). Recruiters' Perception of Employability Skills of Engineers

Recruiters' perceptions of employability skills culminated in a list of abilities that we often perceive as generic and specific. Communication skills, with an emphasis on technical writing and presentation, were among the most commonly mentioned soft skills, and many people consider time management, flexibility, innovativeness, and creativity to be crucial employability skills. Technical expertise such as coding and qualitative data analysis were cited by two recruiters. The list of skills was mostly customized to their company's and individual's requirements by the others. In general, they defined employability skills as “self-promotional and career management abilities, as well as a readiness to learn and reflect.” Employability, according to the interviewees,

primarily refers to a set of transferable skills, and experience is more significant to them, as they defined it as “hands-on skills” and being “action-oriented.” It was even described by one manager as “the capacity to comprehend the application of scientific and engineering principles and persist in attempting them without giving up.” Hence, the recruiters presented a mixed bag of skills that included generic skills like numeracy, communication skills, lifelong learning and specific skills related to their organization, like design engineering, coding, and data analytics; and management skills like planning, delegation, time management, delegation, to name a few. Interestingly, regardless of their organization's main function and requirements, almost all of the managers added IT skills, or as some labelled them, digital skills, to their list.

### 3). Shift in Skills Post-COVID 19

Since the 1980s, several skill lists have emerged, and research and surveys will continue to provide fresh insights, but the most significant shift in the twenty-first century is the unprecedented pause brought on by the COVID-19 pandemic, which destabilized economies and disrupted regular life. Workplaces were either compelled to go virtual or shut down. The impact has been the greatest since the great depression and the World Wars. The alternate mode of working continues to be a reality for many sectors. Engineers and professionals all over the world have had to upgrade their skills in order to contribute significantly in their professions as industries look to overhaul their outlook and work experience, with many realizing that telecommuting has shown to be here to stay because of the pandemic, even though remote working was becoming more popular before the crisis (Agrawal, et al., 2020). Automation is widely considered to be the key, as it is not only cost-effective, but also does not suffer from the disadvantages of working from home. In addition to subject knowledge, effective communication, creative reasoning, design thinking, and problem solving, all the recruiters believed that engineers' skill sets should also include digital skills or digital literacy. They emphasized that all industries, including education, electronics, health care manufacturing, automobiles, and construction, are moving toward automation, with a focus on artificial intelligence, data sciences, machine learning, and the Internet of Things (IoT), making digital skills a requirement.

#### 4) Importance of Digital Skills for Engineers

Emphasizing that digitalization will be the key driver, one HR manager opined, “This transformation has come as industries have come to heavily rely on the internet and technology to minimize the disruption caused by lockdowns.” Employment of engineers is undergoing a paradigm shift in the post-COVID era. As more and more workplaces are becoming digitized, engineers' engagement with digital technologies and the application of new age knowledge gained from digital learning (and not in classrooms and workshops) will be the main force for engineers' survival. According to the McKinsey report, “Digital ability is the set of skills, knowledge, and attitudes required for a person to be proficient in digital environments and make creative, critical, and safe use of information and communication technologies” (Carretero et al., 2017). The use of automation, artificial intelligence, machine learning, data science, and the IoT in almost all sectors, including education, health care, manufacturing, and construction, has already compelled companies to explore young talent with new age digital skills.

The employers in their respective interviews stressed the importance of skills such as IT or digital skills for the engineers to prove their competence in the global workplace. Almost all the recruiters agreed that digital skills were integral to the jobs of engineers. From their opinion, we can conclude that engineers will have to upgrade and compliment their other skills with digital skills in order to provide innovative solutions for Industry 4.0 because industries increasingly face the need for digitalization. The digital competence according to the European Union Digital Competence Framework considers five areas: 1. Information and Data Literacy, which allows people to locate, retrieve, store, manage, and organize digital data, information and content. 2 . Communication and Collaboration through digital technologies. 3. Digital Content Creation that requires knowledge of how to properly use a computer system. 4. Identity and Security Management of devices, content, personal data, and privacy protection in digital environments. 5. Problem Solving, the ability to solve conceptual problems in digital environments (Carretero et al., (2017) as cited in Durate & Rodriguez, 2021, p.3).

#### 5) Decoding Digital Expertise Desired in Engineers

In his book, *Digital Competence in Practice: An*

*Analysis of Frameworks A. Ferrari explains,*

Being digitally competent today implies the ability to understand media (as most media have been/are being digitalized), to search for information and be critical about what is retrieved (given the wide uptake of the Internet), and to be able to communicate with others using a variety of digital tools and applications (mobile, internet) (2013, p.3).

His explanation and argument that all citizens need to develop digital competence was published in 2012, and since then a lot has changed. The transformation that the world has undergone due to the pandemic is unalterable. Engineers, more than ever before, need to hone their digital skills to contribute to the workforce. In their interviews, all the recruiters agreed that digital skills would be important for engineers searching for employment. Digital skills were even included as one of the top three skills engineers will require in the post-pandemic era. When probed further, they explained the various degrees of digital expertise that engineers should possess. Some suggested software development, while others suggested AutoCAD, coral draw, and engineering design; still others were more specific, such as the use of AI, IoT, automation, data analytics, and other advanced computing skills. As a result, they asserted that engineers need digital competence more than what Ferrari described because digital transformation has ushered a transition from the era of capacity building to an era of capacity augmentation as basic engineering knowledge is augmented with the key drivers of digital transformation such as artificial intelligence (AI), big data, and the Internet of Things (IoT) which have become critical for the development of any industry. In the near future, they may disrupt many sectors, particularly service and manufacturing. Therefore, engineers need to upskill fast to play a more sustainable role in the workplace. In this regard, the article "Thriving after COVID19: What Skills Do Employees Need?" addresses this issue by stating, "Basic digital skills will enable them to feel at ease and keep constant communication with the ecosystem of their firm, which includes customers, partners, suppliers, and governmental authorities. Additionally, this competency will provide workers with a fundamental understanding of key technological, data, and processing ideas and methods, such as data visualization, applied machine learning, and advanced (Feld et al., 2020).



This study has a clear implication for HEIs, particularly science and engineering colleges of India. The findings can be used to spread awareness among the engineering graduates about the changing demands of the workplace and therefore they can be helped to develop digital skills. The existing curricula can be modified incorporating courses that prepare them to use high-end technological tools to carry out the operation faster and accurately. The teachers can tailor their pedagogical approach according to the needs and expectations of the employers that can make the teaching-learning process interesting and result-oriented in terms of developing employability skills.

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