

REVIEW

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# Addressing shortage of skilled technical workers in the USA: A glimpse for training service providers

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## Abstract

Skilled technical workers are needed to make any country highly competitive and more productive globally. However, there are reports that the supply of skilled technical workers does not adequately meet the current and future demand in the US labor market, and this is expected to continue if proper efforts are not made to increase its supply. As a result, this study examines a relevant sample of the workforce (skilled technical workers) which is important to the USA but has been under-studied in management research by explaining the factors responsible for its sabotage and explaining how these factors should be considered by training service providers to educate and train their target audience to increase skilled technical workers in the country. The narrative literature review was utilized for the study. The study reveals that regulatory, demographic, environmental, educational, and occupational factors are responsible for the shortage of skilled technical workers in the USA. There is a need for training service providers to examine these factors to determine the kind of skilled technical workforce development programs to adopt, the target audience or people to benefit from them, and partner with one another to address the shortage of technical workers. Some of the ways to increase skilled technical workers are formulations of flexible policies backed by effective and efficient implementations, an increase in funding for education and training programs by the government, employers, and non-government organizations, and the motivation of existing workers to attract prospective workers.

**Keywords** The USA, Talent, Technical skills, Training service providers

## Introduction

It will be difficult for any country to compete favorably in this era of globalization, scientific, and technological change without having a talented skilled technical workforce. A skilled technical workforce is important for the growth of employment, organizational output, and productivity [31]. A skilled workforce helps to improve people's life chances and outcomes in society [36]. Skilled

technical workers are workers with a high level of professional integrity and skills who carry out difficult tasks and easily adapt to any technological advancement in knowledge with a creative mind of enjoying the job-training exercise without any bachelor's degree requirements as an entry qualification [24].

According to Chen [14], the USA had over 17 million skilled technical workers and is expected to be short of about 3.4 million workers who are qualified for the available skilled technical positions by 2022 (p. 23). And in 2023, the country is still making efforts to ensure that technically skilled workers are available to increase productivity and gain a competitive advantage in the global market. The National Academies of Sciences, Engineering, and Medicine (NASEM) [34] report shows that the

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USA is competent enough to compete with other developed countries in boosting the Gross Domestic Product of their economy and creating an enabling environment for citizens to enjoy their fundamental human rights if it can address the issues of the skilled technical workforce, whose contribution is needed to move the country forward. And this can be achieved through the combined efforts of public and private training service providers [41]. Training service providers include individuals, partnerships, corporations, institutions, organizations, federal agencies, state agencies, or local government agencies who help to identify and train talents for skilled technical jobs [34].

In 2012, the secretary of the OECD reiterates in a report that individual technical enablement has become the discussion of scholars in the digital era as a means of sustaining economies, and other developing countries are enjoined to find a means of developing their human resources technical skills through the use of science, technology, engineering, and mathematics (STEM) programs and continually invest, identify, and acquire new skills to effectively and efficiently organize and compete in this challenging period. The USA is a member of the OECD and cannot afford to lag in the global economy, and if it wants to maintain the status of overseeing economic world power, it must promote a skilled technical workforce to contend with technological progress and competition in the global market.

There are many people employed in skilled technical jobs, but more people are still needed to meet industry demand in the USA. Technical skill jobs provide good pay for people, especially for those with bachelor's degrees and those who are in occupations where there are lower unemployment rates pay than in technical skill jobs or occupations that employ people with qualifications less than a bachelor's degree and that have lower employment rates; however, technical skill jobs in occupations, such as construction and extraction, healthcare, installation, maintenance and repair, and production industries that embrace important skills and know-how in technology without necessarily requiring a bachelor's degree attract more people and pay well than those with less technological skill requirements [34].

There is an increasing demand for people with skilled technical skills in some states in the USA. Skilled technical workers are needed to keep the states highly competitive within the USA, while all the states in the USA are thriving to make the USA maintain a competitive advantage globally. Despite the important contribution of skilled technical workers to the US economy, there is limited knowledge about the factors affecting the supply of technical workers in the country, which may be of benefit to the training service providers. This paper focuses on a

relevant sample of the workforce (skilled technical workers) which is important to the US organizations but has been under-studied in management research. The paper examines the reports and options available for training service providers to utilize to address the shortage of skilled technical workers in the USA using a narrative literature review of several articles addressing the shortage of skilled technical workers through offline and online databases. The following research questions will help to achieve the aim of the study:

- 1 What are the training options and reports available for the training service providers to utilize in addressing the shortage of technical skills in the USA?
- 2 Who is the target audience for the training service providers in technical skill acquisition in the USA?

### Theoretical framework

This paper utilizes the human capital theory propounded by Becker [7] to discuss the shortage of skilled technical workforce in the USA and provide clues on what the training providers should do to identify talent and increase skilled technical workers in the USA. There are views in Becker's ideology that the skills and knowledge acquired by workers through education and training promote favorable competition, economic growth, and sustainability of an economy [4, 13]. Thompson, et al. [44] theorized human capital into 'generic' and 'unit-specific', where the latter denotes knowledge and skills entrenched in workers which directly relates to current specific organizational needs (technical skills), and the former constitutes 'skills, knowledge, and capabilities (general education) brought into the work environment' [4, p. 2]. This means that generic and unit-specific variables need to be connected for skilled technical workforce programs to be successful.

No doubt about the reality that the US government has invested heavily in education and training programs for Americans and non-Americans to acquire skills, knowledge, and abilities. While some achievements, such as the proliferation of education and training centers, increase in manpower skills and qualifications, and increasing licenses have been recorded in some aspects of the programs, there are also challenges in certain areas. One of the laudable areas, even though there is a need for more, the governments have contributed to education and training programs in the USA is funding. For example, according to NASEM [34], in one of the reports from the Department of Education, it was reported that 78% of applicants with 2 years degree/certificate program received financial support to fund their education and other necessary items needed to complete

their education [30, 34]. However, this paper focuses on a relevant sample of the workforce (skilled technical workers) which is important to the US organizations but has been under-studied in management research. There is a need to give more attention to addressing the shortage of skilled technical workforce because skilled technical workers are an integral part of economic growth and development throughout the globe. And they provide a platform for a nation's development and improve the standards of living of the people [36].

There are several policies and legal issues made by the federal, state, and local governments and implemented by agencies, such as the US Department of Labor, Department of Education, Department of Health and human services, Department of the Interior, Department of Agriculture, Department of Defense, Environmental Protection, Department of Justice, and Department of Veterans through numerous programs shaping technically skilled personnel development in the USA. The programs are supported through public and private funding, grants, and assistance. The essence of the support is to align education and training to enhance the skilled technical workforce with economic development strategies and the needs of industries for increased productivity, sustainability, or improved standard of living and competitive advantage within American states and in the global economy purposes [34].

According to a report by the NASEM [34], the various legislations that shape federal policy for skilled technical workforce development in the USA are Workforce Innovation and Opportunity Act (WIOA), the post-1/11 Veterans Educational Assistance Act; Higher Education Act (HEA); Perkins Career and Technical Education Act (PCTEA); Every Student Succeeds Act (ESSA) to mention a few. There are also state and local policies and laws on career and technical skills education and training in the USA. The federal, state, and local policies, which are polycentric in landscape, determine the US bureaucratic system of workforce education and training on technical skills acquisition [34].

The policies at various levels of government engage civic leaders, employers, industry and trade associations, labor unions, and philanthropists in private and non-profit sectors where technical skills are in high demand, such as healthcare and manufacturing for skilled technical workforce development initiatives. Nevertheless, it is suggested that the USA is heading toward a deficit supply of skilled technical workers in certain professions, such as health care and manufacturing skilled technical jobs due to demographic changes, few employment benefits, insatiable demand for labor, unsafe working conditions, inadequate training, and poor supervision [16].

There are views that workforce education and training are complex and polycentric, and it has different forms and dimensions, and students are expected to choose the one that is best for them, based on their preferences, capacities, and means right from junior school pending when they can make an informed choice on whether to pursue their education or acquire skills while learning. Students have the choice of selecting either degree or non-degree granting postsecondary education and training programs at any time before and during their work lives. Those who completed technical education may decide to go further by undergoing academic education or training, and vice versa [34]. The costs associated with education and training programs are paid for through savings, earnings, or by incurring debt (loan), except students receive scholarships or grants from the federal, state, and local governments, labor organizations, employers, or philanthropists/private individuals directly or indirectly on different arrangements [34]. However, there seems to be a dichotomy between investment in general education and investment in technical skills, which is the primary focus of Career Technical Education (CTE) [4].

Ayetimi et al. [4] argued that CTE helps to produce specific workers with certain job-relevant technical skills, which directly enrich their employability, while the proponents of general education who argued in favor of generic skills opined that general education support white-collar jobs and not necessarily technical skills [4, 38]. Therefore, investment in skilled technical programs may increase the number of skilled technical workers needed by employers and promote a skilled technical workforce in the USA. It will increase productivity, improve the standard of living of the people and promote a work-ready workforce. It will also attract investment within and from outside and provide jobs for the people in the USA.

### Literature review

According to NASEM [34], skilled technical workers work in the construction, mining, quarrying, and oil and gas extraction, utilities, manufacturing, military, medical, information, other services, except public administration, wholesale trade, professional, scientific, and management, and administrative, and waste management services, transportation and warehousing and utilities, retail trade, arts, entertainment, and recreation, and accommodation and food services, finance and insurance, and real estate, and rental and leasing, agriculture, forestry, fishing, and hunting, social assistance, educational services, and other services that may require a significant level of technological skills.

The National Science Board [35] explains that policy-makers are saddled with many responsibilities to ensure that technical education and training programs have a positive impact on the life of both the students and workers to sustain their technical skills. There are regulatory, demographic, environmental, educational, and occupational factors that need to be considered when trying to identify the challenges responsible for the shortage of skilled technical workers in the USA, and they are explained as follows:

The regulatory aspect focused on strict government regulations in areas like occupational, regional licensing, or registration of practice, which impedes skilled technical workers' mobility from one occupation or region to the other, and employment barriers for ex-offenders (incarcerated) [34]. The complex elements requirements for a license in developing and maintaining qualifications in many jobs and moving from one employer or geographical location to another are critical issues in the skilled technical workforce development in the USA [20].

The economic factors include current work arrangements, such as outsourcing and restructuring of jobs occasioned by new technology are changing the ways tasks are performed and the skills needed to execute them; the notions about manufacturing jobs being "dirty", requiring little thinking, low wages, dangerous and offers limited opportunity for personal growth/career advancement; overreliance on employers to determine the kind of skills needed in the industry; poor awareness of the importance, relevance, and benefits of technical jobs [34]. The proliferation of contingent work arrangements has reduced 30 percent of the workforce to temporary, on-call, contract, freelance, or part-time jobs Bureau of Labor Statistics [BLS], [9], p. 99), the struggles for veterans and people with disabilities to secure employment are other factors affecting skilled technical workforce development in the USA [12]), and less value in terms of low wages and incentives placed on workers [10], inadequate plans in the areas of retirement, investment, wealth creation, and support for workers [8, 10, 11, 21, 23] are other factors responsible for shortage in the skilled technical workforce.

The environmental factor has to do with the increasing demand for higher-skilled workers in certain locations or states; some regions and sectors are impeded in their ability to grow and compete favorably with the demand for skills. This is the situation when one considers the heterogeneity of the STEM workforce in relation to the skilled technical workforce diversity across certain regions and sectors; the increasing number of employers in certain occupations, such as information technology, is attracting people to the information technology sector and creating a manpower deficit in other sectors, such

as the manufacturing sector; and the negative impact of the epidemic on economic activities in the USA [34]. The negative effect of development and Information and Communication Technology on environmental sustainability in different 36 OECD economies may be responding to determining where people live [6]. This may affect the number of skilled technical workers available in an area prone to environmental degradation.

The demographic factors include inadequate information on workforce demographic characteristics; gender differences in certain occupations; ethnic differences in terms of income and supply and demand for their skills; underrepresentation of veterans and some ethnic groups, and an increase in the aging population and decreasing young population in the USA [34].

The educational factor involves low enrollment, and completion rates in schools; the higher cost of education and training requirements; increasing demand for postsecondary education certificate holders more than an associate degree or higher degree holders in the labor markets; discrimination in certificates, certification, and degree standards, limited data and information on skills requirements, and inadequate education funds and support; confusion in occupation choice [34]. In addition, there is limited guidance for the choice of career pursuit, funding, and career network [5].

The occupational factor includes the complex requirements in the health and skills deficiency in the manufacturing sectors [34]. Going by the challenges or factors among others responsible for the shortage of skilled technical workers in the USA, there is a need to investigate the various reports and options available for training service providers to utilize in addressing them.

### Data and methodology

A narrative review of the literature was conducted using information from databases, such as Science Direct, EBSCO, JSTOR, and other sources with consideration to articles published in Sage, Springer, Elsevier, Emerald, Taylor and Francis, and other sources to answer the following research questions:

- 1 What are the training options and reports available for the training service providers to utilize in addressing the shortage of technical skills in the USA?
- 2 Who is the target audience for the training service providers in technical skill acquisition in the USA?

The research questions were discussed from regulatory, demographic, environmental, educational, and occupational perspectives used in addressing the shortage of skilled technical workers using a narrative literature



review, which will be relevant and important for training service providers.

Search terms, such as talent, technical skills, skilled technical workforce, workforce development, and training service providers, were conducted between the years 1981 and 2023. The search process led to the identification of 47 important and relevant publications. In the inclusion criteria, academic articles in the English language in journals indexed in Scopus, web of Science, and other sources were considered for review. In the exclusion criteria, articles not published in the English language were ignored. The primary objective of this study is to provide the readers and training service providers with a comprehensive background for understanding current knowledge in the skilled technical workforce and highlighting the need for new research in the area.

## Results and discussion

Training options and reports available for training service providers to utilize in addressing the shortage of technical skills in the USA.

From the Educational perspective, Ra et al. [39] revealed that a society that gives priority to learning in this era of information technology will help people acquire the technical skills demanded in organizations. The educational systems need to be equipped to achieve this reality. For instance, automation is likely to change the nature of work, and people that do not possess the technical skills required for jobs may be displaced. Emerging occupations are technologically driven, and they will be interested in skills that meet their needs [39].

Ra et al. [39] demonstrated trends showing the impacts of jobs and skills development from an economic and human resources point of view, using secondary data sources from different countries, and examples were used to explore policy options. The relevance of learning different kinds of skills and new approaches to learning in workforce skills development and their implications were examined. There was an effort to encourage a practical learning culture in society to meet changing skill needs in non-routine (abstract reasoning, systems thinking, collaboration, and ability to experiment, they are useful in management information systems) and cognitive (brain-based skills which are needed in acquisition of knowledge) occupations [39].

Ra et al. [39] discovered that the scope of learning opportunities beyond schools and across different ages is not wide, the existing and new systems of learning are weak, and learning opportunities among stakeholders are not properly integrated to meet current skill needs. In view of this, widening the scope of learning opportunities beyond schools and across different age categories means that industry-based knowledge or

technical skills should be acquired through informal, formal, physical, and virtual spaces and across age categories. Widening the scope of learning will help people acquire technical skills that are currently in demand from different learning platforms and options based on choice and flexible access.

NASEM [34] report shows that the thoughts on addressing the skilled technical workforce shortage in the USA should focus on making the education and training skill acquisition process attractive to students and trainees and purpose-driven for the future workforce to advance and diversify the workforce or labor market. Emphases were made on a partnership among stakeholders to help achieve the education and training programs and policies geared toward having a competent skilled technical workforce in the USA. The need for implementation of planned programs and policies was reinvigorated, while the importance of research in identifying the impact of the programs and policies on the skilled technical workforce was stressed.

Similarly, there is a need to utilize the public and private community colleges that offer 2-year degrees to help meet the demand for skilled technical education and training needs and enhance enrollment and completion rates. The policymakers, educators, and employers should help students and adult workers understand the gap between education and training programs, and employment through improved counseling services and guidance, provision of financial aid (including tuition, fees, and book supply) to students to enroll and complete their courses, lifelong learning, wrap-around services, improved remediation, improved income for adult learners, leveraging on online learning with the support of social learning [34].

Linking secondary and postsecondary education and training were academic integration, and technical education and training should be the motive of secondary and post-secondary education to increase the return on school investment [40]. This will prepare secondary school students for employment right from school and enhance their desire for postsecondary education. There is a need to make a sequence of academic and CTE coursework to earn a living regardless of the level of education or training. Better motivations to enable students to complete their studies in community colleges through state funding, which will encourage people to acquire college degrees, should be emphasized [40]. According to Visher and Stern [45], secondary education should prepare students to be an agent of change in creating employment opportunities in the future rather than employment seekers and lay more emphasis on character building than the usual certification that is practiced globally [45].

The negative impact of COVID-19 on business organizations should be addressed to prevent the reduction in skilled technical workers in organizations. Abbas et al. [1] opined that professionals and academic needs strategies on how to revive and rebuild the business organizations' survivability in handling economic crises during the pandemic. They recommend that experts in the field of health and business organizations should reinvest and strategize their modus operandi to revive their economic losses. And one of the ways to achieve this is through skilled technical workforce programs that will develop talented people that the business organizations need to recover from economic losses and have a competitive advantage in the commodity market for profit maximization purposes.

From the occupational perspective, Darryn [15] demonstrates the benefits of flexi micro-skill ecosystems. Flexible micro-skill eco-systems for skills and training innovations are regarded as an alternative and effective approach to the Vocational, Education, and Training (VET) program, commonly known as Career and Technical Education (CTE) in the USA in addressing skill shortage and need in the manufacturing industry [15]. There is a consideration of how manufacturing firms can meet changing skill needs through innovative local training skill approaches despite limited national and or state support for vocational education. This is aimed at correcting the notions of people that blame the skills shortage in the manufacturing industry on the decline of vocational education in schools (VET providers) and the shifting focus of community colleges that are reorienting themselves to serve as pathway institutions for students going on to universities (VET system) [15].

Darryn [15] discovered that the skills shortage in the manufacturing industry is not associated with the decline of vocational education in schools and the demise of VET, but with the limited responsibility of employers in local training engagement, innovations that are taking place between manufacturers (who is able to utilize the advantage of automation and robotics), and overdependence on high schools, community colleges, universities, and regional development authorities. Innovative local training skills were recommended as a solution to the technical skill shortage in the manufacturing industry [15] p. 250).

Moreover, there is a need for companies to invest more in apprenticeships, on-the-job training, and the payment of higher wages to attract and retain already skilled workers [15]. As a result, it is expected that the prospects in micro-skills eco-systems on skills and training innovations will serve as one of the options for training providers to deploy to address the technical skills needs in the USA. The efforts of educationists,

welfare organizations, industry and employer associations, unions, and political leaders should be supported by viable skills acquisition programs at each company level to promote an adequate supply of relevant skills in the workplace. And governments should sufficiently encourage and support employers through investment in skills needed in organizations.

Besides, Dimanche and Lo [17] identify skill gaps, such as the ability to provide personalized service, emotional intelligence, that is, empathy and compassion, the ability to provide anticipatory service, creativity, professional presentation and communication, and aesthetic awareness to provide a unique experience for guests by employees at the highest level who understand the luxury culture as some challenges affecting skilled technical workers in the luxury hotels. It was suggested that there is a need to compete for the best talents to fill the skill gaps from the limited customer relations and managerial personnel in luxury hotels since they are the epitome of hospitality at the highest level [17].

More so, there is an emphasis on a positive attitude (ability to work based on the skills acquired by workers across levels and positions in the organization) to attend to customers' requests on time and based on global best practices in a service-oriented sector like hospitality. The reason is that a positive employee attitude from the skills they possess is essential to high-quality service encounters and customer interactions. This will reduce the common difficulty of discovering and training employees to be competent in handling technical and human skills that are necessary to attract valuable customers in the hospitality sector [17], p.34) and other sectors.

Dimanche and Lo [17] discovered that there is a lack of qualified employees and difficulty in training and retaining qualified collaborators in luxury hotels. They stressed the need to focus on the skill gap in the hospitality sector. According to them, the identified skill gap and ideal candidate criteria should include the ability to provide personalized service, emotional intelligence (that is, empathy and compassion), ability to provide anticipatory service, creativity, professional presentation and communication, and aesthetic awareness (p. 34). In view of this, training service providers should invest more time and money in training programs that meet current needs and demand a return on the training investment in the form of having skilled technical workers and profit maximization. This should not be limited to the hospitality sector alone, as other sectors face similar concerns about skills needed. Thus, trade schools, higher education programs, and other training providers should play a vital role in developing courses and promoting a culture that helps students understand and acquire the skills that are needed to be successful in their work environment.

From the environmental perspective, the COVID-19 pandemic, and the resulting struggles that various organizations are facing in attracting and retaining workers have created many skill gaps in several locations [26, 29]. Though it will take years for skills need to be resolved, it will require important changes in the way the government, employers, labor organizations, industry associations, and other training service providers address workforce training issues and skilled technical workforce development. Also, training and education of skilled technical workforce should be leveraged on a variety of learning options, such as proper work design, on-the-job experience, mentorship, developmental work assignments [26] p. 97), coaching, and personal interest.

The rising issues in climate and environmental change have been observed as a major challenge facing the world which led to the minimization of temperatures to 1.50C [42]. Shah et al. [42] found that urbanization contributes in large measure to environmental deterioration while technology contributes to ecological sustainability and carbon emissions in gas firms. Similarly, Hafeez, et al., [22] recommend the need to curb the rates of non-communicable diseases among people and reduce the rate of infectious diseases to a bearable minimum. This factor needs to be examined to prevent the shortage of skilled technical workers in certain geographical regions or states.

The pandemic outbreak has resulted in many global health, economic and environmental challenges which pose threats to the growth and sustainability of industries around the world. Research has shown that there was a drastic reduction in the revenue generated in tourism and leisure amounting to 2.86 trillion US dollars in losses [27]. In the work of Wang et al. [46] and Jaffar et al., [27], it was revealed that tourism experts must adopt a holistic approach to change the rules and regulations guiding the modus operandi of the organization to a better innovative environment to revive the state of the economy of the organization and the communities where they are located. They recommend that business experts, travel agencies, and government officials should be reprioritized to ensure that they put in their best to revive the economic condition of tourism firms. This is necessary to prevent skilled technical workers in this industry from losing their jobs, which may further increase the rate of unemployment.

Micah, et al. [33] recommend that despite the differences in opportunities to raise funds during the COVID-19 pandemic across the world, it is pertinent for each country to make efforts in ensuring fund-raising to maintain the health issues of their citizens. Iorember, et al. [25] revealed that the quality of the environment as a means of ecological footprints has a positive effect on

health outcomes while bio-capacity contributed negatively to health outcomes. They provide several measures to control the havoc of ecological and health issues and recognized that human capital has a positive contribution to the outcome of health. Thus, protecting workers from the negative impact of ecological and occupational health and safety issues are very vital [42], Farzadfar et al. [18, 28, 47]. This is because of the popular saying that a healthy worker is a productive worker. Therefore, a society that wants to depend on skilled technical workers to compete globally must invest in the health of its people.

In terms of government regulations, Dawson [16] is of the view that what needs to be done to address the shortage of skilled technical workers to meet current and future demand in the US labor market is as follows: there is a need to redesign workforce development strategy through policies to increase skilled technical workforce and quality jobs across occupations and sectors of the economy, change the public narrative about employer success, which gives credence to profit maximization at the expense of workers' pay; strengthen coordination with key stakeholders and redesign how skilled technical programs should be financed. Besides, taxes should be regulated to favor employees to improve their performance in the workplace. And employers who take advantage of employees' taxes should be treated as violators and necessary punishment should be melted on them [32].

More so, educational training program for skilled technical workers, and government policies should be geared toward skilled technical workforce development, supply and demand equilibrium in specific organizations, locations, and regions, and based on size, composition, and demographic changes. This will enable the USA to reduce the disparity between skilled technical supply and demand, improve or sustain employment growth, increase wages, and achieve economic development despite competition from other countries [16].

From the economic perspective, the motivation for skilled technical workers' agenda to thrive in the USA should be since there is a need to compensate (financially and non-financially) and retain the internal workers and attract the external workforce. It is assumed that the existing workers' success stories will lead to a passion for the jobs, improve productivity, and will attract external or prospective workers to take up practical skilled jobs across levels of training and education in the country [34]. A career within schools, dual-or concurrent-enrolment programs, and linking training and work through centers of excellence that are strategically positioned in technical and community colleges, specific sectors, employer-based training programs (apprenticeship programs, joint labor-management

programs, improving linkages through better data, and providing portable credentials and licenses via standardized credentials, licensing reforms, and competency model) are assumed to improve skill technical workers [34].

The reports made in research conducted on the needs for a skilled technical workforce so far indicate that the rate of completion of students' training, the number of credentials they acquire, and how they can utilize the advantages and opportunities in the training programs, which are in demand by the employers will determine the results on investments in technical skills in the labor market [34]. NASEM [34] report recommended that to develop and sustain a skilled technical workforce across occupations, industries, and sectors, there must be a formal mechanism, coordination, and cooperation among the actors (training service providers) in the technical skill spectrum and labor market, such as school teachers/trainers, employees, and students, employers, and governments at all levels, labor unions, and civic associations in the formulation and implementation of programs and policies on skilled technical workforce development in the USA [34], p. 161).

As a piece of advice, the training service providers should re-examine some key issues in the 2017 reports of NASEM as a guide for identifying talents for their skilled technical workforce programs:

- 1 Whether people are using the education and training programs available in the USA to their greatest advantage (p. 63).
- 2 The extent to which an organization contributes to the development of a skilled technical workforce (p. 63).
- 3 The decline in Career and Technical Education (CTE) and enrollment of students from low-income families in the CTE programs (p. 67).
- 4 The regulatory differences in public, private non-profit, and private for-profit education and training programs to know why students' enrolment differs and bridge the gap in tuition and other fees among these institutions and other education and training centers (p. 68).
- 5 The need to create more awareness about the value of skilled technical work and the opportunities associated with CTE preparation (p. 73).
- 6 The challenges, such as program variation, inadequate funding, polycentric and outdated rules, a lack of accountability, and how comprehensive data make it difficult to assess the value or impact of completing 2-year, 4-year, certificates or certifications, apprenticeships.
- 7 The limited responsibility of employers in local training engagement, innovations that are taking place between organizations, and complex rules.
- 8 The lack of a single and centralized system for developing a skilled technical workforce (p. 91).

Additionally, the role of parents in influencing their children to study a particular program that may not be in the interest of the children and the level of awareness of people on skilled technical jobs, requirements for and benefit of the jobs should be examined. Not only that the target audience who will be receiving specific training should be properly determined so as not to organize the right training for the wrong people.

#### **The target audience for training service providers in technical skill acquisition in the USA**

Despite various programs, policies, reports, and options in place to increase the number of skilled technical workforce in the USA, one would wonder why there is a shortage of skilled technical workers in some states and occupations despite the huge population in such states. Finch [19] is of the view that this challenge is perceived to occur because there is a skill and knowledge mismatch between individuals employed and what the employers want. This is particularly worse as there are limited numbers of individuals who are willing to upskill within the (inputs) economy. Engaging individuals' skills and knowledge they already possess or will need to earn (throughputs) and aligning these efforts well to national, regional, and occupational needs will be ideal [19], p. 119). To achieve this, efforts need to be strengthened to utilize existing workers, adults, and other categories of people instead of depending on the usual traditional high school to impact the required skills needed for the jobs [3].

Moreover, there is a need to take inventory of required skills and match them with available skills and knowledge to know the skills gap that needs to be filled. And the adults and existing workers should be well-trained and educated via on-the-job training to fill the gap. Likewise, the training and education of the adults should be aligned with employers' and sectors' needs for growth and development purposes. The following programs were suggested to meet the target: Prior Learning Assessment (PLA), Competency-Based Education (CBE), and partnership programs between employers and governments [3]. Additionally, the challenges facing veteran workers in the areas of transitioning from the military to the civilian labor market for ease in a change in career path and transferability of skills and complexity in acquiring licenses and certifications should be addressed from a quality research standpoint. Mental and physical health issues for those who experienced long periods



of deployment should also be attended to because these issues have reduced veterans' employment rates in the USA [3].

Besides, most veterans are perceived to be less educated and many of them are non-white. According to Andreason, et al. [3], younger veterans are reported to have a higher level of unemployment rate than older ones (p. 126), there are numerous government and private programs that provide educational assistance to veterans, give them good take-home pay; provide tax subsidies or tax credit; workshops and job fairs that tend to aid veterans in their job searches, such as transition goals, plans, success, and the programs are executed by the department of defense (p. 132) which the training service providers through partnership should take advantage of and effectively utilized them for the good of the veterans in the area of skilled technical development and adequate representation in the workforce. Moreso, additional research needs to be conducted to see how the lifestyles and workability of the veterans can be improved. And policymakers need to support the needs of the veterans adequately to increase the number of skilled technical workers in the USA. The reason is that veterans made up about 48% of the US labor force as of 2016 [3], p. 126), and they cannot be overlooked.

Furthermore, there is a call for African Americans to exert more effort, ability, and approaches to achieve economic equality, including wealth and mobility [3]. To achieve this means, Andreason et al. [3] explained that African Americans must fare better in the labor market in terms of making a good wage than or equivalent to their white counterpart. They said further that African Americans need to increase their high school degree completion, acquire academic and technical skills, build confidence, and get support through funding, grants, or scholarships from the governments and other organizations, such as historically black colleges and universities (HBCUs) [3].

HBCUs are important components in American workforce development in terms of efforts, recognition, and support given to people, particularly African Americans. HBCUs have helped many African Americans to build self-actualization and self-esteem to overcome discrimination. Nonetheless, there is a need for governments, private/philanthropic organizations, and individuals to invest more in HBCUs for African Americans to earn better wages, achieve equality in the labor market, and advance their careers through college and university education/degrees. And HBCUs should be used as a pipeline for diversifying intellect, creativity, and innovation [3], p. 195).

Additionally, empowering people with a disability is one of the diverse and challenging issues in US workforce

development programs. Efforts have been made to provide transportation support and increase other benefits, such as wages, and tax deductions to the disabled workforce. Also, job coaching during working hours, Philadelphia Independent Network (PIN) holistic model which supports social and vocational lives has been helpful to disabled workers [34]. However, governments, philanthropists, families, parents, private organizations, and other training service providers need to continue to provide support for people with disabilities to get the best contributions from them in the world of work. There is a need to make the hiring process more flexible and easier for them than before.

Besides, reintegrating the formerly incarcerated into the workforce and providing the right technical training and education for them will help reduce the skill shortage in the USA. For instance, while some organizations work with current inmates, others focus on those recently released [3], p. 338). These organizations focus on hard and soft skills, ensure a sense of belongingness, provide a clear understanding of job tasks and searches, conduct mentorship programs for incarcerated growth, and success, and integrate them to support the system. It is expected that the programs will help solve the problems of chronic unemployment and recidivism among the incarcerated and remove barriers, such as limited access to proper training and education programs, and connect them to jobs that will benefit them, their families, and the USA [3].

### Implications

This work has some potential implications across various areas. It can inform labor market policies and initiatives aimed at attracting, developing, and retaining skilled technical workers. This can include policies related to immigration, education and training, workforce development, and employment regulations. It can provide insights into the effectiveness of education and training programs in preparing individuals for technical occupations. It can guide improvements in curriculum, training methodologies, apprenticeship programs, and the alignment of education with industry needs. Understanding the dynamics of skilled technical workers in different industries can inform strategies to enhance the competitiveness of American industries. This can involve identifying skill gaps, promoting innovation, fostering collaboration between academia, industry, and other training service providers, and supporting research and development initiatives.

The study shed light on their contributions to economic growth and productivity. Policymakers can leverage these insights to formulate strategies that maximize the impact of skilled technical workers on the economy,

such as targeted investment in infrastructure, technology, and innovation. It can address issues of diversity and inclusion within the workforce. By identifying barriers and biases, organizations and policymakers can develop initiatives to promote equal opportunities and improve the representation of underrepresented groups in technical occupations. The study helps in anticipating future workforce needs and trends. This information can assist in developing proactive strategies to address changing skill requirements, emerging industries, and technological advancements.

### Limitations

The findings in this narrative literature review may not be universally applicable to all skilled technical workers, as the characteristics, contexts, industries, and countries in which they work may vary significantly. The results cannot be generalized because literature review studies are susceptible to publication bias, which occurs when studies with statistically significant or positive results are more likely to be published than those with non-significant or negative findings. This bias can lead to an overrepresentation of certain perspectives or outcomes in the reviewed literature. This study might have been conducted when new research may have been published after the review was conducted. This may affect the currency of the findings and may overlook recent developments in the field. The articles included in this literature review may employ different methodologies, measurement tools, and sample characteristics. These methodological variations can make it challenging to directly compare and synthesize the findings, potentially leading to inconsistencies or limitations in the conclusions drawn from the reviewed literature.

### Policy recommendations

In view of the report by the National Science Board [35], the training service providers should understand that there is a need to reform the policy and legal requirements on skilled technical workforce development, and the policy and legal issues should be geared toward skilled technical workforce investment in the USA. The following points may be incorporated into the reform:

- 1 There should be family, community, labor organizations, employers, and other stakeholders' involvement during the formulation and implementation of policies and laws that bother on skilled technical workforce development. This will help sustain the link between informal, semi-formal, and formal education in skilled technical development programs, help people acquire skills based on their innate abili-

ties and personal predispositions, and ensure that funds and grants are utilized appropriately.

- 2 Skills required for jobs in any industry should be clearly stated for people to see.
- 3 Mentoring, coaching, and counseling programs should be encouraged to help people choose the right career, grow, and retire happily.
- 4 There is a need to protect contingent workers from indecent work, exploitation, and dehumanization, especially in the manufacturing sector.
- 5 Adequate plans should be made for workers' retention, motivation, and wealth creation through investment in the workplace, and retirement.
- 6 Gender consideration should be emphasized in skilled technical workforce programs to assist women in performing the multiple roles of wife, mother, and worker. This is expected to reduce their burden on childcare. Moreover, diversity and inclusion should be encouraged.
- 7 There is a need for more flexibility in rules regulating licensing, mobility of labor from one occupation/location to another, health, insurance, and tax incentives for workers.
- 8 Implementation of skilled technical workforce development programs should be properly monitored, emphasis should be on transparency, and accountability on a regular basis, and corruption should be adequately checked.
- 9 A monitoring committee should be established in each community to monitor how public and private funds and grants for skilled technical development programs are utilized and implemented.
- 10 The federal, state, and local governments should promote and fund viable and quality research to promote skilled technical workforce development programs effectively and efficiently. Moreso, states experiencing shortage in skilled technical workers should try to develop the states through infrastructural development to attract investors and skilled technical workers to the states. Because industrial activities in an area have the tendency of attracting people to that area [2].

### Conclusion

Skilled technical workers are needed to keep the USA competitive and highly productive in the global economy. There are regulatory, economic, educational, environmental, and occupational factors responsible for the shortage of skilled technical workers in the country. The training service providers need to engage the high school, college, and university students, adult learners, veterans, disabled, vulnerable ethnic groups, and the incarcerated through apprenticeship

programs; leverage a variety of learning options, proper work design, on-the-job experience, mentorship, coaching, and developmental work assignments; practical learning culture to meet changing skill needs; flexible micro-skill eco-systems for skills and training innovations; and developing courses and promoting a culture that helps students understand and acquire the skills needed through different qualification/credential route. Also, there is a need for partnership among training service providers and they need to improve their understanding of the financial and skill needs and better procedures for teaching skilled technical courses.

#### Abbreviations

BLS	Bureau of Labor Statistics
CBE	Competency-Based Education
CTE	Career Technical Education
ESSA	Every Student Succeeds Act
HBCUs	Historically Black Colleges and Universities
HEA	Higher Education Act
NASEM	The National Academies of Sciences, Engineering, and Medicine
OECD	Organization for Economic Co-operation and Development
PCTEA	Perkins Career and Technical Education Act
PLA	Prior Learning Assessment
PIN	Philadelphia Independent Network
STEM	Science, Technology, Engineering, and Mathematics
VET	Vocational, Education, and Training
WIOA	Workforce Innovation and Opportunity Act

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##### Ethics approval and consent to participate

Not Applicable.

##### Consent for publication

Not Applicable.

##### Competing interests

The Author declares that there is no competing interest.

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#### References

1. Abbas J, Al-Sulaiti K, Balsalobre-Lorente D, Shah ARS, Shahzad U (2022) Reset the industry redux through corporate social responsibility: the COVID-19 tourism impact on hospitality firms through business model innovation, 1st edn. Routledge, London
2. Abbasi KR, Abbas J, Tufail M (2021) Revisiting electricity consumption, price, and real GDP: a modified sectoral level analysis from Pakistan. *Energy Policy* 149:112087. <https://doi.org/10.1016/j.enpol.2020.112087>
3. Andreason S, Greene T, Prince H, Van Horn CE (2018) Investing in America's workforce: improving outcomes for workers and employers. WE Upjohn Institute for Employment Research Kalamazoo, Michigan
4. Ayetimi DT, Burgess J, Dayaram K (2018) Skilled labor shortage: a qualitative study of Ghana's training and apprenticeship system. *Hum Resour Dev Int* 2(5):406–424. <https://doi.org/10.1080/13678868.2018.1447881>
5. Bailey T, Jaggars S, Jenkins D (2015) Redesigning America's community colleges: a clearer path to student success. Cambridge University, Cambridge
6. Balsalobre-Lorente D, He C, Pilař L, Shah SAR (2023) Tourism, urbanization and natural resources rents matter for environmental sustainability: the leading role of AI and ICT on sustainable development goals in the digital era. *Res Policy* 82:103445. <https://doi.org/10.1016/j.respol.2023.103445>
7. Becker GS (1981) Human capital: a theoretical and empirical analysis with special reference to education, 3rd edn. University of Chicago Press, USA
8. Berry D, Leopold J, Mahathey A (2018) Employee ownership and skill development for modest-income workers and women. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: improving outcomes for workers and employers. WE. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 147–162
9. BLS (U.S. Bureau of Labor Statistics) (2005) Contingent and alternative employment arrangements. <https://www.bls.gov/cps/lfcharacteristics.htm#contingent>
10. Boguslaw J (2018) How workforce investments leverage and create employee value. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: improving outcomes for workers and employers. WE. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 147–162
11. Boguslaw J (2018) Valuing workers through shared capital investments. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: improving outcomes for workers and employers. WE. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 147–162
12. Carter SP, Miller BJ (2015) Analysis of Army veteran unemployment benefits and transition assistance. Committee on the supply chain for middle-skill jobs, NASEM. <http://nas.edu/SkilledTechnical> Workforce
13. Chatterjia N, Kiran R (2017) Role of human and relational capital of universities as underpinnings of a knowledge economy: a structural modeling perspective from North Indian Universities. *Int J Educ Dev* 56:52–61. <https://doi.org/10.1016/j.ijedudev.2017.06.004>
14. Chen X (2021) Who participates in the skilled technical workforce after college and what are their educational pathways? *J Res Tech Careers* 5(1):23–46
15. Darryn S (2019) Vocational education and the revitalization of manufacturing in the United States. *J Vocat Educ Train* 71(2):239–259. <https://doi.org/10.1080/13636820.2018.1480520>
16. Dawson SL (2018) Now or never: heeding the call of labor market demand. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: improving outcomes for workers and employers. WE. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 92–92
17. Dimanche F, Lo K (2022) The elusive search for talent: skill gaps in the Canadian luxury hotel sector. *Tour Hosp* 3(1):31–46. [https://doi.org/10.3390/tourhosp3010003.wcm\\_428969.pdf](https://doi.org/10.3390/tourhosp3010003.wcm_428969.pdf)
18. Farzadfar F, Naghavi M, Sepanlou SG, Saeedi Moghaddam S, Dangel WJ, Davis Weaver N, Larijani B (2022) Health system performance in Iran: a systematic analysis for the global burden of disease study 2019. *Lancet* 399(10335):1625–1645. [https://doi.org/10.1016/S0140-6736\(21\)02751-3](https://doi.org/10.1016/S0140-6736(21)02751-3)
19. Finch W (2018) Adult learners: activating prior knowledge and acquiring new skills. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing

- in America's workforce: improving outcomes for workers and employers. W.E. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 107–139
20. Frogner BK, Skillman SK (2015) Pathways to middle-skill allied health care occupations. Committee on the supply chain for middle-skill jobs, NASEM. <http://nas.edu/SkilledTechnicalWorkforce>
  21. Gall C, Crandall SR (2018) The potential of profit sharing to support undervalued workers. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: Improving outcomes for workers and employers. W.E. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 129–146
  22. Hafeez A, Dangel WJ, Ostroff SM, Kiani AG, Glenn SD, Abbas J, Mokdad AH (2023) The state of health in Pakistan and its provinces and territories, 1990–2019. A systematic analysis for the Global Burden of disease study 2019. *Lancet Global Health* 11(2):e229–e243. [https://doi.org/10.1016/S2214-109X\(22\)00497-1](https://doi.org/10.1016/S2214-109X(22)00497-1)
  23. Hoover M (2018) Converting employees to owners: deeper investment for deeper impact. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: improving outcomes for workers and employers. W.E. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 115–122
  24. ILO (International Labour Organization) (2014) Skilled labor: a determining factor for sustainable growth of the nation. Policy brief. <https://www.ilo.org>
  25. Iorember PT, Iormom B, Jato TP (2022) Understanding the bearable link between ecology and health outcomes: the criticality of human capital development and energy use. *Heliyon* 8(12):e12611. <https://doi.org/10.1016/j.heliyon.2022.e12611>
  26. Jackson HGH (2018) Leadership development for a twenty-first-century workplace. In: Andreason S, Greene T, Prince H, Vantorn SE (eds) Investing in America's workforce: improving outcomes for workers and employers. W.E. Upjohn Institute for Employment Research, Kalamazoo, Michigan, pp 93–102
  27. Jaffar A, Mubeen R, Iorember PT, Raza S, Mamirkulova G (2021) Exploring the impact of COVID-19 on tourism: transformational potential and implications for a sustainable recovery of the travel and leisure industry. *Curr Res Behav Sci* 2:100033. <https://doi.org/10.1016/j.crbeha.2021.100033>
  28. Kalejaiye PO (2013) Occupational health and safety: issues, challenges, and compensation in Nigeria. *Peak J Public Health Manag* 1(2):16–23
  29. Kalejaiye PO (2022) COVID-19: presume mix-feelings on work-life balance. In: Baikady R, Sajid SM, Przeperski J, Nadesan V, Islam MR, Gao J (eds) *The Palgrave handbook of global social problems*. Palgrave Macmillan, Cham, pp 1–17
  30. Kena G, Hussar W, McFarland J, De Brey C, Musu-Gillette L, Wang X, Dunlop Velez E (2016) The condition of education 2016: NCES 2016–144. National Center for Education Statistics
  31. Lerman R, Rein V (2015) Building a robust U.S. work-based education and apprenticeship system at scale: can lessons from Europe help? Available via <http://www.aicgs.org/publication/building-a-robust-u-s-work-based-education-and-apprenticeship-system-at-scale>
  32. Li Y, Al-Sulaiti K, Dongling W, Al-Sulaiti I (2022) Tax avoidance culture and employees' behavior affect sustainable business performance: the moderating role of corporate social responsibility. *Front Environ Sci*. <https://doi.org/10.3389/fenvs.2022.964410>
  33. Micah AE, Bhangdia K, Cogswell IE, Lasher D, Lidral-Porter B, Maddison ER, Dieleman JL (2023) Global investments in pandemic preparedness and COVID-19: development assistance and domestic spending on health between 1990 and 2026. *Lancet Global Health* 11(3):e385–e413. [https://doi.org/10.1016/S2214-109X\(23\)00007-4](https://doi.org/10.1016/S2214-109X(23)00007-4)
  34. National Academies of Sciences, Engineering, and Medicine (NASEM) (2017) Building America's skilled technical workforce. National Academies Press. Doi: <https://doi.org/10.17226/23472>
  35. NSB (National Science Board) (2015) Revisiting the STEM workforce: a companion to science and engineering indicators. National Science Foundation
  36. OECD (2013) OECD skills outlook: first results from the survey of adult skills. OECD Publishing, Paris. <https://doi.org/10.1787/9789264204256-en>
  37. OECD (2013) PISA 2012 results: excellence through equity: giving every student the chance to succeed (Volume II) PISA, OECD Publishing. Available via <https://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-II.pdf>
  38. Oketch M (2014) Education policy, vocational training, and the youth in Sub-Saharan Africa. Helsinki: World Institute for Development Economics Research (WIDER). Working Paper 2014/069
  39. Ra S, Shrestha U, Khatiwada S, Yoon SW, Kwon K (2019) The rise of technology and its impact on skills. *Int J Train Res* 17(1):26–40. <https://doi.org/10.1080/14480220.2019.1629727>
  40. Ritter BA, Small EE, Mortimer JW, Doll JL (2018) Designing management curriculum for workplace readiness: developing students' soft skills. *J Manag Educ* 42(1):80–103
  41. Rothwell J (2015) Defining skilled technical work. Committee on the Supply-Chain for Middle-Skill Jobs. NASEM. <http://nas.edu/SkilledTechnicalWorkforce>
  42. Shah SAR, Zhang Q, Abbas J (2023) Waste management, quality of life and natural resources utilization matter for renewable electricity generation: the main and moderate role of environmental policy. *Util Policy* 82:100021
  43. Shah SAR, Zhang Q, Balsalobre-Lorente D, Pilař L (2023) Technology, urbanization and natural gas supply matter for carbon neutrality: a new evidence of environmental sustainability under the Prism of COP26. *Resour Policy* 82:103465. <https://doi.org/10.1016/j.resourpol.2023.103465>
  44. Thompson KR, Lemmon G, Walter TJ (2015) Employee engagement and positive psychological capital. *Organ Dyn* 44:185–195. <https://doi.org/10.1016/j.orgdyn.2015.05.004>
  45. Visher MG, Stern D (2015) New pathways to careers and college: examples, evidence, and prospects. MDRC
  46. Wang S, Abbas J, Al-Sulaiti K, Shah SAR (2023) The impact of economic corridor and tourism on local community's quality of life under one belt one road context. *Eval Rev* 47(3):445–454
  47. Yu S, Draghici A, Negulescu OH, Ain NU (2022) Social media application as a new paradigm for business communication: the role of COVID-19 knowledge, social distancing, and preventive attitudes. *Front Psychol* 13:903082. <https://doi.org/10.3389/fpsyg.2022.903082>

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