

Shaping the Future of Construction

An Action Plan to solve the Industry's Talent Gap

In collaboration with The Boston Consulting Group

February 2018



World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland
Tel.: +41 (0)22 869 1212
Fax: +41 (0)22 786 2744
Email: contact@weforum.org
www.weforum.org

World Economic Forum®

© 2018 – All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, including photocopying and recording, or by any information storage and retrieval system.

REF 120218 - case 00039754 V2

Contents

Executive summary	4
1. Introduction	5
2. Action Plan	6
2.1 Company-level measures	6
2.1.1 Plan talent supply and demand strategically	6
2.1.2 Foster employee development and continuous learning	7
2.1.3 Use new technology to increase productivity and job satisfaction	7
2.1.4 Modernize workplace culture and promote diversity	8
2.2 Industry-level measures	9
2.2.1 Run industry image campaigns	9
2.2.2 Identify and attract new talent pools	9
2.2.3 Promote common industry practices and transparent career paths	10
2.2.4 Collaborate with educators on training	10
2.3 Government-level measures	11
2.3.1 Sponsor and promote initiatives that spur innovation and improve industry attractiveness	11
2.3.2 Reduce complexity by promoting standardization and public-private collaboration	11
2.3.3 Update apprenticeships and academic programmes	11
2.3.4 Enhance support for jobs and job-matching services	12
3. Conclusion	13
Roundtable participants	14
Contributors to the Future of Construction Initiative	15

Executive summary

The Infrastructure and Urban Development (IU) industry has failed to innovate as quickly as other sectors, resulting in stagnating productivity and negative effects on the economy, society and the environment. An ongoing industry-wide shortage of qualified workers is among the key reasons for this issue. It has undermined project management and execution, adversely affecting cost, timelines and quality. It also has impeded the adoption of new digital technologies, such as building information modeling (BIM), automated equipment and cloud-based collaboration tools, which could improve productivity.

To close the talent gap and gain the skills necessary to accelerate adoption of promising new technologies, IU stakeholders should collaborate to foster talent through improving workers' skills, attracting fresh talent to the industry and promoting new technologies.

To identify actions that will close the talent gap, the World Economic Forum's Future of Construction Initiative, in collaboration with The Boston Consulting Group (BCG), hosted a roundtable "How to Solve the Talent Gap in the IU Industry?" on 17 October 2017, in BCG's Berlin office. At the roundtable, 32 representatives from leading global design, engineering and construction firms, industry associations, government and academic institutions discussed key issues and developed measures to be pursued at company-, industry- and government-level, which are detailed in the action plan outlined in this report.

IU companies must strategically plan talent supply and demand, improve in-house learning and development programmes, and adopt new technologies to improve productivity and job satisfaction. Companies must also update their work culture to appeal to younger workers and become more diverse, including increasing the percentage of women in the industry.

Industry organizations should run image campaigns to promote IU jobs, target prospective new pools of talent, such as employees with suitable skills from other industries like gaming, establish common bodies of knowledge, make career paths more transparent, and collaborate on training with academia and vocational training providers.

Government must use its role as regulator and major owner of public works projects to develop regulations and sponsor initiatives that spur innovation and thereby increase the attractiveness of the IU industry. It must also harmonize building standards to make projects less complex and less labour intensive, update public-sponsored apprenticeships and academic programmes to include training on new skills, and boost support for job services.



Introduction

The IU industry^a is a vital part of the global economy and society. The industry's core around engineering and construction alone employs approximately 100 million people worldwide and its nearly \$10 trillion annual revenue represents about 6% of global GDP.¹ Communities couldn't function without the built assets the industry provides, including transport infrastructure (airports, roads and railways etc.), social infrastructure (hospitals, schools, courthouses etc.), and housing and commercial real estate. The industry also has a significant impact on the environment. It is a major consumer of raw materials and producer of construction-related waste. Furthermore, buildings create 30% of global greenhouse gas emissions.²

Many industries have made tremendous advances during the last few decades by adopting new technologies to make themselves more efficient and increase labour productivity, but the IU industry has not fully embraced innovation. Productivity has stagnated as a result, a situation compounded by the industry's ongoing talent shortage and declining attractiveness to younger workers as an employer.

In many countries, IU companies have spent years scrambling to fill job openings with suitable personnel. In the United Kingdom, hard-to-fill vacancies have more than doubled since 2011.³ In the United States, 86% of contractors struggle to fill key roles.⁴ The industry has an entrenched gender gap, with women comprising only 13% of the workforce overall and an even smaller percentage in less physically demanding, highly-skilled management positions.⁵ A rapidly ageing workforce further complicates the sector's employment outlook. The share of employees who are aged 60 and older is increasing faster than any other age group while the proportion of employees under 30 is falling the fastest, according to a World Economic Forum survey.⁶

A widespread unfavourable perception of IU jobs exacerbates the talent gap. Although people believe the industry makes a difference and is important for society, the general perception of industry jobs is negative. For example, in the UK, just 11% of people think jobs in the construction industry are "exciting", according to a YouGov poll.⁷



Furthermore, only 42% of employers believe that graduates and new hires are adequately prepared for entry-level jobs. The IU industry's ongoing digital transformation aggravates the situation. The industry is finally embracing innovations, such as building information modeling (BIM), 3D printing and augmented reality. New technologies require companies across the industry's value chain to have staff with suitable digital skills, but given the wider situation, they face fierce competition for that talent, vying against technology companies, business to consumer (B2C) businesses and start-ups.

To improve productivity and address global challenges, such as climate change, the housing shortage, and the infrastructure gap, the IU industry must overcome talent obstacles to attract, qualify and retain a sufficient number of people with relevant skills. This report provides an action plan with steps that companies, industry organizations and government can take to reduce the talent gap.

The plan was created by the World Economic Forum's Future of Construction Initiative in collaboration with The Boston Consulting Group (BCG) based on discussions at a roundtable held on 26 July 2017, in BCG's Berlin office. At the roundtable, 32 representatives from leading global design, engineering and construction firms, industry associations, government and academic institutions discussed key issues and developed measures to be implemented at company-, industry- and government-level. These are detailed in the action plan outlined in this report.

^a Engineering and construction (E&C) represent the core of the infrastructure and urban development (IU) industry, but it also includes all other parts of the built environment value chain, from provision of building materials to asset operation and maintenance (O&M) as well as real estate and urban services.

Action plan

The action plan outlines twelve steps to solving the talent gap, which companies, industry groups and government can take individually or working together (see Illustration 1). Although the measures take different approaches to addressing the issue, they fall into three overarching categories: Upskilling the current IU workforce, attracting

new employees, and using technology to increase productivity and mitigate demand for more talent. The report describes the measures in more detail and offers examples of companies and organizations that have taken some of the steps with positive results.

Illustration 1: Solving the IU Industry's Talent Gap



2.1 Company-level measures

2.1.1 Plan talent supply and demand strategically

Historically, IU companies have done little workforce planning because of the cyclical, project-oriented nature of construction and the significant share of work performed by subcontractors. That has left companies struggling to meet massive demands for new talent at the start of projects and to retain talent with experience accumulated on the job once work on a project has phased out. In light of the ongoing talent shortage, IU companies must address their talent needs and available supply more strategically, especially for highly-skilled positions.

To determine workforce allocation and recruitment needs, talent planning should take into consideration four factors: A company's portfolio of projects; current key roles,

employee headcount and skills; skills that will be needed in the future; and anticipated availability of employees with those skills. By analysing all the data, companies can pinpoint potential gaps and the human resources (HR) department can then act based on identified gaps, including hiring, training, transfers and layoffs.

The Spanish infrastructure development and management company, ACCIONA, successfully established strategic planning of talent supply and demand by analysing historical data and running workforce simulations. The company clustered key positions, such as project director, into job families. Based on current projects, ACCIONA calculated its talent needs six months ahead. Using that information and past project win rates, the company built simulations to predict what its medium- and long-term talent demands would be for specific job families. The company also built simulations to forecast short-, mid- and long-term talent supply, taking into account historical attrition, hiring, and whether current personnel would be

available in the future. The simulations revealed gaps by position, project size, asset category and geography. Armed with the information, HR managers identified steps to address shortages and surpluses, including transferring people between positions and undertaking additional hiring.

2.1.2 Foster employee development and continuous learning

Aside from interesting work, the top factor that makes a company a desirable place to work is the opportunity for learning and development.⁸ However, only 48% of young professionals feel that employers in the construction industry meet their expectations for job-related development and training. Given the intense competition for highly-skilled employees, and reflecting the issue of a rapidly ageing workforce, IU companies must improve development opportunities to attract younger workers. To do that, they can use technology-based training, institutionalize knowledge sharing, and establish career programmes that recognize learning and development achievements.

IU companies can use technology innovations, such as simulations for employee training. In one example, Saudi Aramco created a construction site operations simulation to train safety officers in a move that significantly improved safety performance. Companies can develop digital platforms to help employees learn and share what they know across projects as well as the organization. The Consolidated Constructors Company launched a knowledge-sharing portal to help employees document and exchange ideas and success stories, including sharing key performance indicators (KPIs) of realized savings and productivity improvements. Likewise, Fluor built a knowledge transfer system, which is used by almost all employees companywide, to share information and collaborate within and across projects. As a result of the system, Fluor employees improved the quality, safety and productivity of client projects. ACCIONA deploys a collaborative learning platform with employee-specific training content. The platform is set up like a social network and allows people to share work-related content to foster engagement and connect with co-workers.

In addition, companies can institutionalize knowledge sharing through on-the-job training and mentorships. On-the-job training can create a company culture that emphasizes professional development and employees helping each other. Reverse mentorships are another way employees can gain needed digital skills. In reverse mentorships, junior employees share what they know with more senior co-workers. Older employees benefit from learning how new technologies work while younger colleagues gain insights from their more-experienced counterparts on project and business strategy. Suffolk Construction created a reverse mentoring programme, which pairs tech-savvy millennials with experienced executives. As a result of the programme, computer literacy rose from 80% to 99% companywide.

To underscore the importance of learning and development as well as to motivate employees to take advantage of learning opportunities, IU companies should tie promotions or other forms of advancement into reaching specific career-development milestones. For example, Bechtel offers a certification programme with continuing education credits. The incentive-based system, which has received multiple honours, encourages employees to participate by making certifications prerequisites for promotions.

2.1.3 Use new technology to increase productivity and job satisfaction

Reflecting the fact that the IU industry has been slow to adopt new technologies, the way work gets done has not changed in several decades, and as a result, productivity has stalled. What's more, many blue-collar workers view industry jobs as dirty and dangerous, while white-collar workers think IU jobs lack innovation and challenge. IU companies can improve productivity and job satisfaction by adopting technologies, such as automated equipment, prefabrication, sensor-equipped work gear, and mobile collaboration tools.

By adopting automated equipment, IU companies can replace dangerous, dirty, strenuous tasks and speed up processes. For example, remote-controlled demolition robots are safer and more efficient than conventional tools for demolishing concrete, particularly in confined spaces.

Shifting tasks to prefabrication factories can improve working conditions by allowing remaining on-site work to consist mainly of a project's final stages, reducing workers' exposure to job-related risks. At McAbee Construction, adopting prefabrication-based modular construction has created a safer work environment and increased productivity.

Equipment with built-in sensors that monitor working conditions also can improve worker safety. Work gear with embedded sensors is well suited to settings where personnel are exposed to extreme temperatures, potentially harmful gases or power supplies. One example of such technology is augmented reality-equipped smart safety helmets. Sensors and cameras in the helmets capture real-time information and display it to the wearer. Construction workers can use the helmets' thermal vision capabilities to avoid dangerous situations.

Aside from improving on-site worker productivity and safety, new digital technologies can also make IU industry office jobs more productive. Mobile-based platforms for collaboration could free up white-collar workers from repetitive administration tasks and provide more time for creative and strategic endeavours. For example, contractors and architects can use cloud-based collaboration platforms to work on project plans, reducing the time and resources spent updating plans and eliminating errors caused by miscommunication.

2.1.4 Modernize workplace culture and promote diversity

Workplace culture is an important factor in job seekers' decisions about where they want to work. To appeal to prospective candidates of all ages, including younger job seekers as well as compete with other industries, IU companies must transform what has historically been a more conservative workplace culture to a more contemporary one and improve its employer branding. They can transform workplace culture by establishing purpose-driven thinking, increasing flexibility and agile ways of working, and recognizing performance.

IU companies should foster a purpose-driven, forward-looking work culture that inspires younger workers and improves retention. To underscore its commitment to the environment, ACCIONA created a sustainability master plan. The strategic document outlines the company's objectives for improving sustainability throughout its business and building a culture based on sustainable development. ACCIONA regularly measures how well it meets its objectives and determines the effect on employee retention and engagement.

Companies can modernize workplace culture by offering flexible work patterns, including leaves of absence and job rotations, among other things. At Balfour Beatty, flexible working options for employees assigned to construction projects resulted in greater efficiency and improved their work-life balance.

Updating workplace cultures could mean adopting agile ways of working, where scrum teams, sprints, fast prototypes and other work methods that emphasize speed help companies respond faster to customer needs.⁹ Agile working involves shifting work to focus on performance and outcomes, and assembling cross-functional teams across silos to regularly share results and other information. Agile ways of working also empower employees to make their own decisions on challenging projects without needing prior approval, respond to ambiguity and uncertainty with flexibility and speed, and view unanticipated changes as opportunities for transformation.

To create a performance-based culture, organizations can replace annual reviews with regular check-ins, evaluations and other opportunities for informal feedback between managers and employees. At Aecon, employees receive continuous development evaluations, regular feedback and encouragement from mentors to aid their career development.

To create a more contemporary work culture, the IU industry must address a longstanding lack of diversity and inclusion. Companies' recruiting efforts should target broader talent pools, define clear goals and guidelines for improving diversity and equality, and provide support for under-represented groups.

Building a diverse workforce starts with targeting wider talent pools. Tideway works directly with schools to encourage students of all backgrounds to pursue engineering careers. To achieve a more diverse workforce, companies can establish diversity-sensitive recruiting and hiring strategies and set targets for increasing the ratio of current employees in under-represented groups and create programmes to actively pursue them. Tideway set a goal of increasing female employees so that by 2023 women represent one-half of the multibillion pound construction company's workforce.

IU companies need clear guidelines establishing equality and prohibiting workplace discrimination or harassment based on gender, ethnicity or other classification, and must cultivate work environments that follow those policies. ACCIONA created a code of conduct and a plan dictating policies for respect of human rights, equality, diversity, integrity and inclusion. Other company initiatives set targets for improving diversity in recruiting and promotions. The company created focus groups to identify new actions it could take to improve diversity, and incorporated diversity and inclusion objectives into its overall sustainability master plan.

To supplement promoting equality, companies can create networks where women and other under-represented groups can get support and share information. Aecon provides this type of support through the Aecon Women Inclusion Network (AWIN), which hosts workshops, seminars and a mentorship programme.



2.2 Industry-level measures

2.2.1 Run industry image campaigns

Compared to other industries, the IU industry has an image problem. Two-thirds of participants in a YouGov poll revealed that they would never consider a career in the construction industry.¹⁰ The industry must work to make construction careers more attractive to the younger generation.

Industry members should participate in current initiatives that are seeking to portray a more positive image of the industry, as well as launch further, ideally collaborative, campaigns in the same vein. Campaigns should share details about the IU industry's relevance to society, for example, as builders of critical transportation and utility infrastructure. Campaigns should also highlight the industry's role in solving key global challenges, such as reducing carbon emissions, and emphasize IU careers' challenges and rewards. An existing advocacy and partnership platform is the World Urban Campaign (WUC), which is coordinated by UN-Habitat and includes 180 global partners and networks, which collaborate to raise awareness of positive changes cities can make to be better planned and more green, productive, safe, healthy and inclusive.¹¹ In the construction industry, Build UK and the Construction Industry Training Board (CITB) collaborated on a joint image campaign called Inspiring Construction. It includes a website, videos and interviews with employees, and describes jobs in the IU industry in terms that are designed to attract potential jobseekers.

To highlight the industry's attractiveness, image campaigns should depict how IU employees use analytics and creativity to tackle complex challenges and make work more fulfilling. One example of this is the German Confederation of Skilled Crafts "handwerk.de" campaign and website, which promote apprenticeships in 130 skilled crafts. Young people can enter their job preferences on the site to learn about apprenticeships or internships that match their interests.

In addition to general awareness campaigns, the industry must market directly to new talent. Programmes could target schools to show students new technologies the industry is adopting, such as 3D printing, augmented reality and virtualization. The industry should complement real-world events meet-ups with a strong presence on social media, sharing information about construction careers on Facebook, YouTube, Twitter, Instagram, Snapchat and other channels frequented by younger workers. In Germany, the Build Your Thing youth recruitment campaign shares information and videos on apprenticeships in construction trades. A "Build Bus" visits schools to show construction work through hands-on, interactive activities and multimedia presentations to introduce children to the industry.

In parallel with joint industry efforts to improve the IU industry's image and market it to new talent, companies must launch their own initiatives. At Mace, employees are

encouraged to use an annual volunteer day off work to give talks about construction industry careers in schools. In its first year, employees volunteering through the company's Foundations for Your Future programme gave presentations to more than 500 secondary school students, 40% of whom admitted to having a greater interest in working in construction than they had before the talks.¹²

In another example of an individual image campaign, Arup has hosted a public exhibition on construction applications of artificial intelligence at its London headquarters, which includes interactive 3D showcases and winning models from a company-sponsored design competition.

2.2.2 Identify and attract new talent pools

The IU industry must move beyond traditional sources of talent to find new prospects, improve diversity and secure workers with sufficient digital skills.

The industry must create recruiting campaigns that target women, including sharing information about career options and showcasing women in construction jobs who could serve as role models. In one such campaign, a section of the UK's Go Construct website is dedicated to career opportunities for women. It includes videos and other multimedia content of women working in a range of IU jobs, from office settings to on-site roles. Germany's annual Girls' Day vocational orientation programme highlights job opportunities in trade-related fields, where women make up less than 40% of the workforce. In 2017, 37% of the girls who took part said they could imagine working in a profession they discovered through Girls' Day.¹³

Aside from attracting more women, the industry must look for other new sources of talent. One potential source is the gaming industry. Digital skills from the gaming industry could be transferred to construction applications, such as BIM or virtual and augmented reality. Gaming industry workers could be motivated to move to the IU industry for a chance to work on real-life projects that make a difference in society. IU companies such as WSP Global and Walsh already recruit game designers who can transfer their visualization and digital design skills from the virtual to the physical world.

University dropouts, military veterans, refugees and other underemployed groups are another potential talent pool. Depending on their background, candidates may require additional training to gain the necessary skills before they are ready to work. CITB's BuildForce initiative trains former military personnel through mentorships and work placements. The Central Association of German Crafts' Paths to Training for Refugees initiative is training 10,000 refugees in trade apprenticeships through a three-step process, which includes job orientation, job-specific language courses and internships.



2.2.3 Promote common industry practices and transparent career paths

Reflecting the project-oriented nature of the IU business, employees move between projects or leave once a large project is completed. Frequent turnover undermines productivity because companies must spend time bringing new employees up to speed, including providing training specific to an individual project, which cannot be applied to other work.

International standards that establish a common body of knowledge in specific areas could help mitigate the need for one-off training. Employers should jointly promote common industry practices similar to the Project Management Body of Knowledge (PMBOK) Guide from the Project Management Institute, a global standard that outlines fundamental project management practices.

Individual employees' uncertainty about career options and outdated HR policies at many IU companies contribute to lost productivity. Employees who switch employers may not understand their options for career advancement. To correct that, the industry should harmonize career paths, making possible career paths more visible to employees and jobseekers. The UK's Go Construct industry initiative, for example, outlines potential IU careers. A career explorer wizard on the organization's website shares job profiles, video case studies, information on required qualifications and training, and opportunities for advancement.

2.2.4 Collaborate with educators on training

As the IU industry becomes more digitalized, the workforce needs new skills. To date, neither corporate educators nor academia have kept pace with new demand. The industry must work with universities, professional colleges and vocational training providers to create relevant curricula for existing and future employees.

As a first step, industry associations and IU companies must identify skill gaps to accurately forecast what skills are needed and how many workers possess those skills. In Germany, for example, the Federal Institute for Vocational Education and Training (BIBB) and Institute for Employment Research (IAB) regularly research supply and demand for workforce skills to provide leading industry and education providers with information about the labour market and professional education trends.

The IU industry should provide feedback on how current curricula meet their needs so educators can shape future training, both in vocational educational training (VET) programmes and in higher education. In the German Dual VET system, businesses, government and society participate in the BIBB committee, which ensures real-world work requirements are incorporated into education and training.

Furthermore, the IU industry must use higher education's interest in collaboration to create new partnerships in the form of research and development (R&D) or pilot projects. Universities routinely engage with industry and typically welcome new partnerships.

2.3 Government-level measures

2.3.1 Sponsor and promote initiatives that spur innovation and improve industry attractiveness

Compared to other industries, IU companies' investments in R&D are small, amounting to a mere 1% of total industry revenue.¹⁴ Government must encourage innovation that fosters labour productivity and improves IU companies' attractiveness as employers by offering prospective employees opportunities to work with new technologies.

To that end, governments can selectively fund projects that include innovative technologies or cover risks that arise from adopting them. For example, the Government of Singapore's Construction Productivity and Capability Fund partly reimburses the costs of BIM hardware and software, consultancy and training, equipment and machines that improve productivity by at least 30%, and additional innovative processes.

Government should require new technologies be used in selected public projects to encourage innovations to spill over into the broader market. In the UK, the Government Construction Strategy stipulated a minimum of BIM Level 2 be used for all centrally-procured public construction projects by April 2016. Given the large number of public works projects, the directive provided a strong impetus for adopting BIM.¹⁵

Government should regularly update building codes and review regulations to account for, and cover, innovative technologies. For example, the Australian Building Code is performance-based and allows for the use of innovative materials, forms of constructions and designs; it is reviewed and amended annually to incorporate technical and regulatory changes.

2.3.2 Reduce complexity by promoting standardization and public-private collaboration

IU work is complex, not just on construction sites, but in the processes leading up to on-site work, such as tendering, procurement and project management. Industry regulation and highly varied building codes account for a large portion of that complexity. Regardless of the cause, complexity translates into higher workforce requirements and prevents the industry from being as productive and attractive as it could be.

Government must intervene to reduce complexity. One way is by harmonizing building standards and technical specifications, such as the EN Eurocodes (relating to building standards), which are issued by the European Commission.¹⁶ The codes consist of standards for designing buildings, as well as other civil engineering works and construction products in 10 EU-EFTA countries. They are intended to contribute to the free circulation of construction products and engineering services within the countries, mitigating talent demand in individual countries.

The public sector must streamline and standardize regulations to make approving construction projects faster and easier to free up talent currently buried in administrative tasks. Digital construction permits could be a first step in this direction. In the US, electronic building permits cut the time it takes to approve new projects by 30%, and mobile inspection technology reduces required on-site inspections by 25%.¹⁷

As public works' owners, government must collaborate with private industry to improve procurement procedures, including simplifying background requirements for project manager positions and other key project-level jobs. Many governments still require personnel in senior roles to have degrees or certifications from local institutions, which prevents foreign civil engineers from applying for those positions. Homogenizing education requirements and international certifications would remove those barriers and increase the pool of available talent, in the same way a Project Management Professional certification offered by the Project Management Institute has in that industry.

Government should consider promoting innovation-friendly delivery models for public works projects, such as public-private partnerships (PPPs), design build (DB) models or integrated project delivery (IPD) models. By ensuring that contractors get involved in projects early to provide input on innovative solutions, new delivery models increase productivity, reduce workforce requirements and create attractive workplaces that use new technologies.

2.3.3 Update apprenticeships and academic programmes

Only 45% of young workers and 42% of employers think education providers do an adequate job of preparing people for entry-level positions in the IU industry. The sentiment is one indication of the mismatch that exists between the new skills required by the industry and outdated curricula offered in current apprenticeships and academic programmes. As the industry becomes increasingly digitalized, the mismatch will only get bigger.

Government must help update training, beginning with assessing what new courses are needed by analysing the skills IU companies need and comparing the results with content covered in apprenticeships and academic training programmes. Based on what is available, classes should be added to address changing skill requirements for technology-heavy jobs as well as in areas such as project management. Apprenticeships and academic programmes should prepare students to become life-long learners so they can continue to acquire skills for jobs that have yet to be invented. A promising approach to apprenticeship programmes is combining on-the-job training with theoretical learning at vocational school, similar to the existing system in Germany.

Government should encourage universities to teach new subjects such as digital technologies. Students should also be taught soft skills as well as general skills, such as project management, foundational engineering and programming,

which they could apply to many types of jobs. Training in practical knowledge and soft skills should come through hands-on learning. For example, Olin College in the US launched a hands-on engineering programme whereby students graduate with at least 25 case studies based on projects, systems, hardware or other technologies they build during their time at the school. In the UK, the University of Chichester is building an engineering and digital technology park with a project-oriented engineering workshop that includes a fabrication laboratory, 3D printers and hands-on learning spaces. The technology park and workshop are intended to help students better address developing business challenges in engineering and technology.

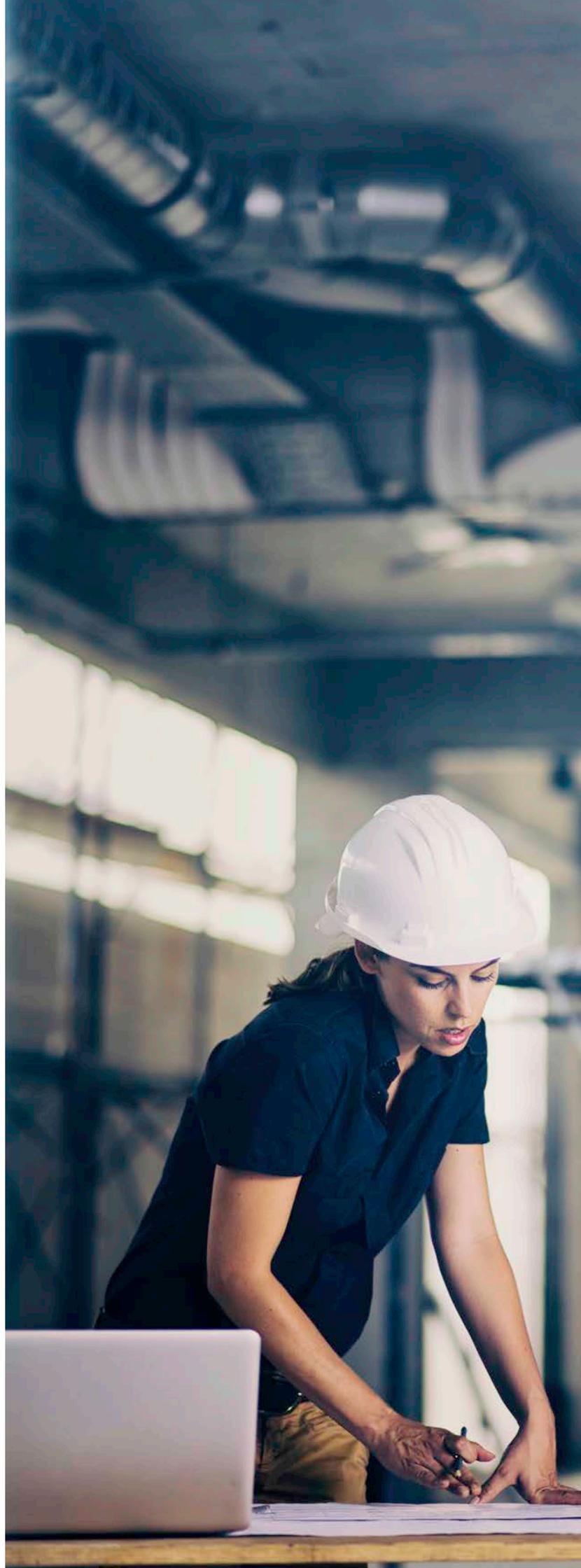
Specialized programmes support government in updating academic programmes. One such programme is UNEVOC, a UNESCO centre for technical and vocational education and training (TVET). The centre helps UNESCO member states worldwide develop and strengthen TVET systems and implement skills-development policies and programmes, which are relevant, lifelong and accessible to all.¹⁸

2.3.4 Enhance support for jobs and job-matching services

Unemployed workers from other industries represent an untapped resource that could help fill the IU industry's talent gap. By offering training and facilitating connections, government can help newcomers gain the skills they need to fill open jobs.

Government should sponsor reskilling programmes and fund programmes run by non-governmental agencies and private industry to qualify currently unemployed workers for IU jobs. The IU industry could pattern its reskilling programme efforts after the UK's Skills for Employment service, which is partially underwritten by the European Social Fund and provides personalized support to unemployed adult jobseekers in the Greater Manchester area. Participants team up with mentors who help them complete skills trainings, get relevant experience and find jobs.

Government should support both job seekers and industry efforts to recruit new hires by acting as an intermediary to create opportunities for parties to connect. Germany's Federal Employment Agency operates an online job board where job seekers can create profiles and search job openings while employers can find potential job applicants. The agency also helps employers find suitable workers.





Conclusion

The IU industry is grappling with an ongoing talent shortage caused by multiple factors, including failures to innovate in a timely manner, competition from other industries for workers with in-demand skills, ongoing image difficulties as well as conservative work cultures and a lack of standardization.

Given these challenges, closing the talent gap is unlikely to happen through isolated actions. Instead, stakeholders must work in a cohesive, coordinated way to retain existing workers and make the industry more appealing to a larger pool of potential employees.

Although companies, industry groups and government play distinct roles in the industry, they must broaden their horizons to support one another in this mission. Government, for example, must adapt existing regulations to make it easier for companies to embrace new technologies and upskill employees. For their part, companies must commit to taking advantage of opportunities created by government programmes to spur innovation and hiring. Organizing initiatives and collaborations should not be the sole burden of industry organizations. Rather, companies must increase their involvement in industry-led collaborations to encourage progress towards eliminating the gap.

Given the different maturity levels within the IU industry worldwide, implementing this action plan must take local conditions into account. For example, addressing talent challenges in emerging countries may by necessity mean emphasizing upskilling untrained labour, while organizations in developed countries may focus on attracting talent with digital skills and finding enough engineers and project managers to fill positions being vacated by an ageing workforce.

Closing the talent gap using the actions outlined in this report will guide the IU industry towards adopting new technologies and increasing productivity, which has stagnated for too long. If that happens, the industry can fulfil its role in promoting economic growth, social progress and environmental responsibility.

Roundtable participants

A total of 32 individuals from 22 organizations participated at the roundtable “How to Solve the Talent Gap in the IU Industry?” held in Berlin on 26 July 2017.

Organizers

The World Economic Forum
The Boston Consulting Group

Participants

Abertis
ACCIONA
Arcadis
Arup
Atkins
Consolidated Contractors Company
Danfoss
Dubailand
Hauptverband der Deutschen Bauindustrie
International Institute for Sustainable Development
Institut der deutschen Wirtschaft Köln
OVG Real Estate
PLP Architecture
Project Management Institute
Royal Institution of Chartered Surveyors
Saraiva & Associados
Saudi Aramco
Technical University Berlin
UN Habitat
University of Stuttgart

Contributors to the Future of Construction Initiative

Project Team

World Economic Forum

Till Zupancic, Project Manager, Future of Construction

Michael Bühler, Head, Infrastructure and Urban Development Industries

Isidora Kosta, Community Lead, Infrastructure and Urban Development Industries

Hani Dakhil, Community Lead, Infrastructure and Urban Development Industries

The Boston Consulting Group (Advisor and Knowledge Partner)

Santiago Castagnino, Partner and Managing Director; Head of Engineered Products and Infrastructure, Western Europe and South America

Christoph Rothballer, Principal, Global Infrastructure Expert

Steering Committee, Future of Construction Initiative

Abertis

Francisco Reynés, Chief Executive Officer, Abertis Infraestructuras, Spain

Marc Ribo Pedragosa, Senior Economist, Abertis Infraestructuras, Spain

Acciona

Luis Castilla, Chief Executive Officer, Acciona Infraestructuras, Spain

Pierre Patrick Buffet, Strategy Officer, Acciona, Spain

AECOM

Michael S. Burke, Chairman and Chief Executive Officer, AECOM, USA

Matt Forbes, Chief Operating Officer, Operational Excellence, AECOM, USA

Aecon

John M. Beck, President and Chief Executive Officer, Aecon Group, Canada

Mathew Kattapuram, Senior Vice President, Strategic Business Development, Aecon Group, Canada

Arcadis

Peter Oosterveer, Chief Executive Officer, Arcadis, Netherlands

Bianca Nijhof, Global Sustainability Program Manager, Arcadis, Netherlands

Arcelor Mittal

Lakshmi N. Mittal, Chairman and Chief Executive Officer, ArcelorMittal, United Kingdom

Patrick Le Pense, Manager of Flat products; Business Development Construction – Infrastructure, Arcelor Mittal, Luxembourg

Arup

Gregory Hodkinson, Chairman, Arup Group, United Kingdom

Tim Chapman, Leader - Infrastructure London Group, Arup Group, United Kingdom

BASF

Kurt Bock, Chairman of the Board of Executive Directors, BASF, Germany

Ulrich Baum, General Manager LUWOGÉ consult GmbH, Germany

Consolidated Contractors Company (CCC)

Samer S. Khoury, President, Engineering and Construction, Consolidated Contractors Company (CCC), Greece

Amr El-Sersy, Manager Learning & Innovation, Consolidated Contractors Company (CCC), Greece

Construction Products Holding Company (CPC)

Mu'taz Sawwaf, Vice-Chairman of the Board and Chair of the Executive Committee, Construction Products Holding Company (CPC), Saudi Arabia

Raja Nahas, Assistant, Construction Products Holding Company (CPC), Saudi Arabia

Danfoss

Kim Fausing, President and Chief Executive Officer, Danfoss, Denmark

Nis Jessen, Vice-President Strategy and Business Development, Danfoss, Denmark

The Durst Organization

Douglas Durst, Chairman, Durst Organization, USA

Fluor

David T. Seaton, Chairman and Chief Executive Officer, Fluor Corporation, USA

Mark Brown, Vice President - Construction & Fabrication, Fluor Corporation, USA

HCC

Ajit Gulabchand, Chairman and Managing Director, HCC, India

Arjun Dhawan, Group Chief Executive Officer, HCC, India

IC Holding

Firat Çeçen, Chairman of the Board, IC Holding, Turkey

Murat Sogancioglu, Chief Executive Officer Investment Group, IC Holding, Turkey

Kokusai Kogyo Co

Sandra Wu Wen-Hsiu, Chairperson and Chief Executive Officer, Kokusai Kogyo, Japan

Link Real Estate Investment Trust

George Kwok Lung Hongchoy, Executive Director and Chief Executive Officer, Link Real Estate Investment Trust, Hong Kong SAR

Max HK Wong, Co-Head, Co-Head of Project and Development, Link Real Estate Investment Trust, Hong Kong SAR

OVG Real Estate

Coen van Oostrom, Chief Executive Officer, OVG Real Estate, Netherlands

Cees J. van der Spek, Director, Sustainability and Marketing, OVG Real Estate, Netherlands

Perot Group

Henry Ross Perot Jr., Chairman of the Board, Perot Companies, USA

Todd Platt, Chief Executive Officer, Hillwood, USA

RMZ Corp

Manoj Menda, Corporate Chairman, RMZ Corp., India

Jayakumar K, Associate Director Projects, RMZ Corp., India

Saudi Aramco

Amin H. Nasser, President and Chief Executive Officer, Saudi Aramco, Saudi Arabia

Fahad E. Al-Helal, Vice-President Project Management, Saudi Aramco, Saudi Arabia

Abdirahman Abdi, Supervisor, Value Practices Unit, Project Optimization Division (PMOD), Saudi Arabia

Siemens

Joe Kaeser, President and Chief Executive Officer, Siemens, Germany

Roland Busch, Member of the Managing Board and Chief Technology Officer, Siemens, Germany

Alexander Stuebler, Head of Executive Office of Dr. Roland Busch, Siemens, Germany

Skanska

Johan Karlström, President and Chief Executive Officer, Skanska, Sweden

Roger Bayliss, Senior Vice-President, Operational Efficiency, Skanska, Sweden

SNC-Lavalin

Neil Alexander Bruce, President and Chief Executive Officer, SNC-Lavalin Group, Canada

Ian Leslie Edwards, President, Infrastructure, SNC-Lavalin Group, Canada

Tarkett

Glen Morrison, Chief Executive Officer, Tarkett, France

Gilles Lebret, VP Customer Operations and Group CIO, Tarkett, France

Advisory Committee, Future of Construction Initiative

Monica A. Altamirano, Specialist, Public-Private Partnerships and Climate Finance, Deltares, Netherlands

John Atkins, Director Buildings, Arcadis, Germany

Camilo Andrés Benítez Ávila, Department of Construction Management and Engineering, Twente University, Netherlands

Ron Bakker, Founding Partner, PLP Architecture, United Kingdom

Mark Bew, MBE, Chairman, PCSG Limited, United Kingdom

Johnny Clemmons, Global Industry Director and Chief Engineer, SAP, USA

André Dorée, Head, Department of Construction Management and Engineering, Twente University,

Netherlands

Mahmoud Hesham El Burai, Chief Executive Officer, Dubai Real Estate Institute, Dubailand, United Arab Emirates

Tarek A. El-Sheikh, Director, UN-Habitat, Kuwait

Thomas Ermacora, Founder, Architect and Curator, LimeWharf, United Kingdom

Danielle Grossenbacher, World President (2015-2016), FIABCI International Real Estate Federation, USA

Tiago Guerra, UK Chief Business Adviser, JFAN, Portugal

Carl T. Haas, Professor of Civil and Environmental Engineering and Interim Chair, Canada Research Chair, University of Waterloo, Canada

Lars Hesselgren, Senior Associate, PLP Architecture and Visiting Professor, Chalmers University of Technology, United Kingdom

Arjan Hijdra, Senior Advisor, Network Performance, Ministry of Infrastructure and Environment, Netherlands

Sherena Hussain, Assistant Professor, Brookfield Centre in Real Estate and Infrastructure, Schulich School of Business, Canada

Iván Jiménez, Visiting Researcher, Alexander von Humboldt German Chancellor Fellow, Germany

Richard Koss, Director of the Global Housing Watch, International Monetary Fund (IMF), Washington DC, USA

Alex Lubbock, Head of Digital Construction, Infrastructure and Projects Authority, United Kingdom

Jeffry Matsu, Senior Economist, Royal Institution of Chartered Surveyors (RICS), United Kingdom

David Mosey, Director of the Centre of Construction Law and Dispute Resolution, King's College London, United Kingdom

Milagros Mostaza, Managing Director - EMEA, Project Management Institute (PMI), USA

Ibrahim Odeh, Founding Director, Global Leaders in Construction Management - Research Group, Department of Civil Engineering and Engineering Mechanics, Columbia University, USA

Alastair Parvin, Co-Founder, Wikihouse Foundation, United Kingdom

Oshani Perera, Director, Public Procurement and Infrastructure Finance, International Institute for Sustainable Development (IISD), Switzerland

David Philp, EMIA BIM Director, AECOM, USA

Spiro Pollalis, Professor of Design, Technology and Management, Harvard Design School, USA

Bob Prieto, Chairman and Chief Executive Officer, Strategic Program Management, USA

Michael Ramage, Director, Centre for Natural Material Innovation, University of Cambridge, United Kingdom

Craig Ross, Partner, Head of Project and Building Consultancy, Cavendish Maxwell, United Arab Emirates

Claudia Schachenmann, Director, Bureaux Schachenmann, Switzerland

Sam Spata, Owner, Principal, Method Lean, USA

Marc Tkach, Director, Infrastructure, Millennium Challenge Corporation (MCC), USA

Jennifer Whyte, Laing O'Rourke / Royal Academy of Engineering Professor of Systems Integration, Imperial College London, United Kingdom

Endnotes

¹ [The Transformative Power of Building Information Modeling](#), BCG.com, March 2016

² [Shaping the Future of Construction – A Breakthrough in Mindset and Technology](#), World Economic Forum, May 2016

³ [Skills and Training in the Construction Industry 2016](#), CITB, August 2016

⁴ [Nationwide Survey](#), AGC of America, September 2015

⁵ [The Future of Jobs](#), World Economic Forum, January 2016

⁶ [Eight Ways to Win the Fight for Talent in Construction](#), World Economic Forum, May 2017

⁷ [Public Perceptions of Construction](#), UKConstructionWeek.com, April 2017

⁸ [Eight Ways to Win the Fight for Talent in Construction](#), World Economic Forum, May 2017

⁹ [The New Way of Working](#), BCG.com, December 2017

¹⁰ [Public Perceptions of Construction](#), UKConstructionWeek.com, April 2017

¹¹ [World Urban Campaign](#), UN Habitat, December 2017

¹² [‘There’s a Job For Everyone in Construction, They Just Don’t Know it’](#), Construction Manager, November 2017

¹³ [Girls’ Day](#), Kompetenzzentrum Technik-Diversity-Chancengleichheit, December 2017

¹⁴ [Shaping the Future of Construction – A Breakthrough in Mindset and Technology](#), WEF, May 2016

¹⁵ Further insights into acceleration of BIM adoption can be found in: [The Future of Construction – An Action Plan to Accelerate BIM Adoption](#), World Economic Forum, February 2018

¹⁶ [The EN Eurocodes](#), European Commission

¹⁷ [Shaping the Future of Construction – A Breakthrough in Mindset and Technology](#), World Economic Forum, May 2016

¹⁸ [International Centre for Technical and Vocational Education and Training](#), UNESCO, December 2017



COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation.

The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744

contact@weforum.org
www.weforum.org