The engineering workforce of the future will be digitally inclined

By Selvan Murugan

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The Engineering Council of South Africa (ECSA) defines engineering as "the practice of science, engineering science and technology concerned with the solution of problems of economic importance and those essential to the progress of society". ECSA states that, "Engineering work is essential to both economic activity and to national development. Effective, safe and sustainable engineering work is founded on the competence and integrity of engineering professionals."

Selvan Murugan, digital practice leader, Cape Town and Coastal, Zutari

Over time, we have seen that much of the problem-solving, analysis and synthesis and heavy mathematical lifting is now done by computers. Gone are the days where engineers are seen pouring over drawing boards to produce work, coordinating 2D drawings and sketches to ensure clash-free designs, and conducting expensive testing in the real world to confirm test results.

Digital skills, technologies

Engineers are now using new digital skill sets and associated technologies. Hand sketches and site photographs are now replaced by 3D scans and drone photogrammetry. Large teams of draftsmen in offices have been replaced by lean 3D modelling teams that produce rich, three dimensional, realistic, clash-free digital models.

Mock-ups and small-scale models have been replaced by immersive virtual and augmented reality applications; sophisticated simulation tools have replaced physical testing to a large extent, and now, during the Covid-19 pandemic, site inspections and meeting are conducted by high-resolution cameras that stream site visuals back to the office. All of this has happened in the space of 20 years and is contributing to the first wave of digitisation!

Is there more to come? You bet! Engineering project processes have stood the test of time. They consist of various work stages, for example inception, concept and viability, design development, documentation and procurement, contract administration and inspection and close-out. During this time, the digital advancements previously mentioned have shaped how work is conducted.

However, the base process remains the same. Projects have now become technically complex, and the sheer scale of work has increased dramatically. As a result of this, the amount of digital engineering data describing the works and data generated during operation has reached levels never seen before. Again, the base project process has not changed.


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Project information and data

This has resulted in the generally inefficient generation, coordination, transmission and storage of project information and data. Data generated by engineers is often stored in design systems at their offices, and only 2D construction-type information ever reaches site. Contractors struggle to understand the engineer's design intent as they grapple with 2D printed drawings, reams of specifications and bills of quantities.

Facility and asset managers also feel the pain as they receive a few boxes of operating and maintenance manuals to run their multi-million rand facilities. What this effectively means is that all the digital 'gains' achieved in an office environment are not providing value for the people who construct and run facilities.

Information-driven approach to design

The second wave of digital technology impacting the engineering industry, we predict, will see an integrated, information-driven approach to design, whereby all stakeholder needs and requirements are well understood and serviced within a common data environment. Data will be produced once, collected, analysed and managed by competent digital staff.

Site construction, health and safety, management, construction machinery and material-quality systems will be integrated into the common data environment, ensuring data is centrally managed, coordinated and providing value to the right people, at the right time. This integrated approach will ensure that asset management and facilities management teams receive up-to-date, as-built information as inputs into their systems.

Make no mistake. The base core skills for certain professions will change for the better to suit the new data-oriented environment, and the value to clients will immediately be evident in reduced cost, improved quality and on-time project delivery.

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Third wave of digital technology

The data-driven approach to engineering and construction will lead to the third wave, whereby the data produced during the engineering, construction and operations phase will be used to produce advanced insights to further enhance operational excellence and design information. Again, skills and workforce implications will lead to new roles such as AI specialists, solution developers, augmented analytics specialists and robotics specialists, etc., to be integrated into project teams.

The above analysis is based on a careful study of vendor-driven changes to software applications, the benefits of a consolidated common data environment for the lifecycle of an asset and the digital maturity of technology sets. These key drivers are pointing to a future of a digitally-inclined workforce.

Future is unpredictable

The common question that is asked at most internship presentations is: “Will computers take our engineering jobs?” The diplomatic answer, at this point in time, is “No, they won’t – they will help us do our engineering work better.” However, the best answer is: “We don’t know. The future is unpredictable, and we are seeing the emergence of generation and computational design applications where engineering rules are being built into software code.”

We are very aware of the fact that digital is impacting us as an engineering business. We strongly believe that our digital skills and toolsets enhance our projects and provide oodles of value for our clients. Our strong belief is that by combining our engineering knowledge and digital expertise, we serve the needs of our clients better.

Companies have to have people with many skills to meet these digital challenges. We certainly believe that the industry in which we operate is open for digital disruption. Our strategic digital focus is to mitigate the possible impact and take advantage of the opportunities presented to us and our clients.

ABOUT THE AUTHOR

Selvan Murugan, digital practice leader, Cape Town and Coastal, Zutari