Crimson Publishers
Wings to the Research

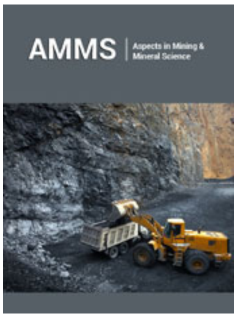
Opinion

Lack of Mid-Level Technical Talent Hampers Metallurgical Innovation

Matthew Humbert*

Department of Mechanical Engineering and Product Design Engineering, Swinburne University of Technology, Australia

ISSN: 2578-0255



***Corresponding author:** Matthew Humbert, Department of Mechanical Engineering and Product Design Engineering, Swinburne University of Technology, 1 John Street Hawthorn, Victoria, Hawthorn, Australia

Submission: October 09, 2023
Published: October 20, 2023

Volume 12 - Issue 1

How to cite this article: Matthew Humbert*. Lack of Mid-Level Technical Talent Hampers Metallurgical Innovation. Aspects Min Miner Sci. 12(1). AMMS. 000777. 2023.
DOI: 10.31031/AMMS.2023.12.000777

Opinion

Innovation requires a small team with a broad skillset. Finding the right group of people to take a novel technology from the lab to the pilot scale is difficult because there is a narrowing of experience. Both engineers and technicians have become more specialized and lack experience in the others domain. To encourage people to develop broader skills universities should revert to a model that encourages part time study, and the state should implement insurance programs that protect individuals and small firms.

The skills needed for metallurgical innovation span a range from circuit design and microprocessor programming to welding and heavy machinery operation. There is no shortage of novel ideas for extracting metal from minerals, but there is a shortage of people and capital to test these ideas at pilot scale. Process economics are difficult to quantify from laboratory experiments, so systems that can represent full scale are needed. These pilot scale systems generally require a substantial amount of engineering support for reactor design and auxiliary equipment sizing and installation. Large firms who deliver production plants are overqualified for pilot scale projects as they need to recover substantial administrative overhead. Conversely there are few small firms with the qualifications in structural steel design, refractory design and installation, and exhaust handling. The result of this gap is that firms wishing to commercialize metallurgical developments internalize the design and operation of pilot plants and struggle to assemble a small team with a broad enough skill set.

A reduction in manufacturing capacity, in the US and Australia, has led to a widening gap in experience between those with university degrees and those with vocational training. There is a penalty to those pursuing a university degree when they build tacit experience. Time spent away from study may reduce academic performance and hamper future earnings. While clubs and teams do provide some experience these generally lack appropriate mentorship and thus provide limited skills transfer to professional settings. Many universities encourage internship programs, but these are typically short and do not create the same value to either the student or the firm that longer duration part-time work could provide. In short, there are few opportunities for undergraduates to work in machine shops or engineering firms while pursuing a degree.

Those with vocational training also face challenges. The decline of manufacturing and the growth of infrastructure investment have reduced the opportunities to build the diverse skillsets needed to bring technology to market. Technicians may have vocational training and workplace experience in telecommunications or industrial automation but lack experience with sensor specification or the programming of data acquisition systems. Similarly, there are many well trained machinists and fabricators, but many lack the skills necessary to mathematically validate the performance of a new design even if they are familiar with a variety of design software. These positions are generally valued by their tangible production and have limited stake or engagement in the firm. Additionally, cost for upskilling from a vocational background generally must be paid by the individual, an added disincentive.

Though there are many challenges, there are also opportunities. It is easy to say that additional funding for more programs will increase and broaden skillsets, but this has been the paradigm for the last forty years. The result of increased formal certification has not a broadening of skill sets, it has been a narrowing. To encourage people to step out of their traditional skills there needs to be additional support for them to take the risk to try something new. Within the current context this manifest in two ways; university graduates engaging in fabrication, and people with a vocational background engaging in calculation. The goal of overlapping these skills is to improve the quality of equipment and likelihood of successful operation. This could manifest as novel metallurgical reactors, custom actuation equipment, or detailed system instrumentation.

Digital video content has shown to be particularly good at democratizing home improvement tasks and making hobbies more accessible. No longer do people need to pour over dense technical manuals to learn new things. This has been a boon for well to-do engineering types who like to get their hands dirty. Unfortunately, tutorials for engineering tasks are less engaging and applicable. Additionally, engineering tasks are generally performed in a professional context increasing the loss exposure of the firm or individual. An example task that should be accessible to a skilled fabricator would be designing a rolling gantry crane for a specific load. These cranes are generally designed from two "A" frames rolling on large castor wheels. An I-beam joins the two frames at the top from which a hoist is suspended on a skate. Calculating the maximum load rating of this type of crane is a trivial exercise, but in both the USA and Australia needs to be performed by a professional engineer if the crane is to be used in a professional setting. Indeed, even if it was used privately and a failure occurred an insurance claim may be denied because of a lack of certification.

The current ecosystem of tort law and certification results in an artificial barrier to entry for small firms, including individuals. Larger firms can internalize the administrative costs of keeping professional engineers on staff and take advantage of federal and insurance-based loss renumeration schemes. Smaller firms must internalize the risk of failure often using personal wealth, or future earnings, as collateral. This paradigm stifles innovation and unfairly benefits larger firms. Thus, it is here proposed that extending civil protections to smaller firms will promote innovation and increase skills. When individuals can be shielded from the risk of personal loss, they are more inclined to pursue opportunity. There are two further points to make regarding loss renumeration and failure penalization. When there is a failure of civil infrastructure, i.e. a bridge, those affected are renumerated by the state, as they should be. The firm who designed, or maintained, or operated the bridge may be liable and monetarily penalized, but the individuals in that firm are, unless there is extreme evidence of neglect, not personally held accountable. If this same level of personal indemnification is passed down to firms consisting of one individual, in contrast to the current system, there will be an increase in economic efficiency. More production will be realized as lower cost. Additionally, goods and services without warranty, such as a gantry crane without an engineering stamp, generally operate outside the formal economy; they are paid for in cash. By reducing restrictions, this work can become part of the formal economy increasing taxable production.

The cost of reduced personal liability is reduced quality. This intern passes risk onto consumers. More specifically loss disputes get shifted to the realm of contract law from tort law. Thus, more responsibility is put on the consumer to ensure they are appropriately protected by contract. The benefit of insulating individuals and small firms from liability is that they will be incentivized to develop a broader skillset to remain competitive. To conclude, to increase the talent pool available to startups, universities should be encouraged to reduce their academic requirements and promote part time study and states should provide risk mitigation measures for small firms to engage in engineering activities. These actions will allow engineers to benefit from additional mentorship and encourage people with vocational backgrounds to develop skills outside their formal training.