CONSTRUCTION ENGINEERING MASTERS DISSERTATION ABSTRACT

The future of the bridge designer profession. How the profession may change in the next 15 to 20 years in the era of automation and artificial intelligence

In many industries such as manufacturing, law, and medicine, automation and artificial intelligence (AI) have increasingly been seen to boost productivity and even improve quality and accuracy of products and services (Brynjolfsson and Mcafee, 2014). In contrast, productivity in the construction industry has been stagnant (Mann, 2016) and the design processes remain largely unchanged. Many advocates of automation and AI therefore consider that both of these factors could be disruptive but critically beneficial to the industry. However, the discussion around automation and AI, which has now extended to mainstream media, emphasises the threat they can represent on current human professions (Benedikt Frey *et al.*, 2013).

This research centres around the uncertainty and survival of the bridge designer profession through the era of automation and AI. The positions taken throughout the literature around the impact of technology on employment and the professions are split. On one hand, there is the ambitious expectation to see bridge design largely automated in the near future. On the other hand, there is the more sceptical stance where computers and AI will only ever act as a support to the human designer. Will there be a role for designers in the future and what would this role be?

This qualitative research proposes, evaluates and analyses several scenarios inspired by the extreme positions above, through interviews with industry and digital experts. The scenarios were further developed and tested by challenging the experts' assumptions and identifying the various barriers to automation and AI in the specific case of bridge design. This seeks to determine where on the above spectrum the profession is likely to be in 15 to 20 years in terms of the role of human bridge designers, as well as the structure of the profession itself. This research provides a methodology and level of knowledge that enables researchers in other fields to determine a viable scenario for any profession. In addition, it enables executives in design consultancy firms to stay ahead in the fast-paced digital race. It will assist them in making flexible and informed decisions around the implementation of automation and AI, the strategic investment in research and development, and the recruitment and training of staff.

The findings conclude that multiple factors will influence the pace and extent of the implementation of automation and AI to bridge design. On the one hand, they encourage design consultancies to consolidate and on the other, they challenge them to balance current work load with future ambitions. Although a large number of influencing factors render the image of the profession in 15 to 20 years somewhat blurred, this research suggests that there will a split in the profession between product bridges versus bespoke bridges. These two types of bridges will have different design and procurement approaches and will be led by different types of firms. Finally, new roles and profiles will emerge with a requirement for new skills including the understanding of first principles; robust digital literacy; and a broader than Science, Technology, Engineering and Maths

(STEM) selection of skills in line with the increased need for integrators and communicators in the future profession of bridge design.

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February 2019