ABSTRACT

The advent of the third industrial revolution—Industry 3.0—allowed manufacturers to leverage automation in producing equipment. Industry 4.0 (I4.0) brought innovation and automation to equipment manufacturing (thereby creating "smart" machines) and eventually to its associated consumer industry, such as the construction industry. With humans and smart machines in the workplace, understanding human-machine interaction (HMI), especially how humans perceive innovation and ultimately accept it, allowed manufacturers to enter the Industry 5.0 era with a focus on conceptualizing and creating human-centric equipment. The construction industry, following this industrialization trend, adopted and employed these smart machines to improvise the ongoing Construction 4.0 era (e.g. autonomous equipment, drones, BIM, etc.) while also moving towards Construction 5.0 era (e.g. human-centric equipments), thereby improving the performance of human workers in terms of safety and productivity. HMI researchers have long been considering the perception of the existing workforce to gauge acceptance of existing technology or equipment, thus focusing on the well-experienced and retiring workforce.

This study explores the perception of the emerging engineering workforce (i.e., engineering students) towards semi-/fully autonomous construction equipment to be developed from the I4.0 and I5.0 eras. This objective is achieved by creating a conceptual framework that examines new technology perception across five key factors—Safety, Accuracy and Decision & Control, Fatigue, Situational Awareness, and Learning and Adaptability. A structured survey was created based on this framework that draws inspiration from past research instruments and enables participants to respond by reflecting on their everyday experience with technology. This survey, unlike traditional surveys, utilizes a variety of question types to keep the participants engaged, a key feature of which is the

matrix that addresses two major concerns—whether the emerging workforce prefers to be involved in the decision-making process with the system or they prefer to be the user of the decisions taken by the automated system.

With a total of 56 responses, which was just enough to perform the statistical tests, the findings highlight the importance of a feedback mechanism with autonomous machines when it comes to performing small-scale operations such as excavation, but depict reliance on automation for decisions in large-scale operations. Besides decision-making preferences, the study findings also led to the conclusion that the equipment manufacturers or designers may benefit from considering user demographic factors (education level, familiarity with technology, video gaming experience, etc.), while developing equipment. Finally, this study also addresses the skill training methodology to be employed for the emerging workforce.