

Preface

The societal value of a quality-built environment is essential to life itself. Today, we can provide the bare necessities of potable water to everyone on the planet, along with food to feed everyone. Nevertheless, thousands die annually because of the lack of either or both. Why is that so? It appears that there is not the will to change how we as humans do business.

The providers of facilities and infrastructure deal with a similar scenario, albeit possibly not on the same catastrophic level. The architecture, engineering, construction, and operation (AECO) industry – and its broader ecosystem – erects buildings, industrial structures, and lays the infrastructure that is the foundation of our economies and is essential to our daily lives. It has successfully delivered ever more challenging projects – from undersea tunnels to what seem to be impossibly tall skyscrapers. However, the industry also has performed unsatisfactorily in many regards for an extended period. The AECO ecosystem represents 13% of global gross domestic product but has seen a mediocre productivity growth of 1% annually for the past 2 decades. Time and cost overruns are the norm, and overall earnings before interest and taxes are only around 5.5 percent despite the presence of significant risk in the industry. Even worse, the industry operates with as much as 50% waste, losing billions of dollars due to the lack of interoperability, meaning that we do have the capacity to accomplish much more, yet inadvertently choose to squander that opportunity. We waste building materials, time, energy, and natural resources and contribute more than one billion tons of waste to landfills.

While some action can take place sooner than later, this long-term issue will not be resolved quickly and requires systemic change. This change needs to begin with education. Education today, for the most part, rightly responds to the needs of the practitioner who responds to the requirements of the owner. The education change does not need to be in science, technology, engineering, and mathematics alone but applies to every aspect of the process.

We need to produce individuals who have elevated respect for the planet in general – not necessarily short-term-focused activists as much as better businesspeople. We must cultivate leaders who can see the big picture and understand the impact of what they do today related to the built environment on the occupants of the planet for the generations to come. While we cannot affect all aspects of the aforementioned issue, the serenity prayer may provide a guide to us to the things we can accomplish: *God grant me the serenity to accept the things I cannot change, courage to change the things I can, and wisdom to know the difference.* Hence, we plan to take on the built environment, the AECO industry, and AECO education specifically.

The need to change AECO education is the underlying goal of this book, specifically the education related to building information modeling (BIM). While this concept has many facets that will be explored in the book, it is the driving force. The past 2 decades have seen a paradigm shift from representation-based technologies known as computer-aided design (CAD) to information-rich database technologies known as BIM. This paradigm shift continues to change the way industry designs, builds, and operates buildings and infrastructure, which creates a rapidly and steadily growing market demand for BIM talent.

When looking at the workforce, the use of BIM and other digital tools bring with them new skill requirements and eventually could change AECO jobs. Traditionally, higher education has played pivotal roles in fostering the AECO industry in innovation-driven market transformation. While in some cases faculty research leads to practice change, most faculty who teach emerging technologies are challenged to keep up with all of the changing practices. Given the significant advancements achieved in BIM education during the last decade among the nation's top universities, a substantial number of institutions with limited