Chapter 5
Digital Manufacturing and the Fifth Industrial Revolution

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ABSTRACT

Industrial revolutions highly impact the workforce, skill of every occupation, and society. Many businesses have implemented appropriate competitive advantages to take lead of the market, when others yet didn't recognize the pace of the current industrial revolutions and digital transformations. This chapter emphasizes the cooperation between different sectors of digital manufacturing that requires a reinvention of the working routine to exploit big data and analytics in addition to the market network. This chapter will also put into further detail the driving forces behind the unpredictable rapid technological revolution and trends of digital manufacturing. With equal emphasis, the authors regarded ethics as the very first priority to retain a safer world for humanity. Readers will develop a strong foundation to keep adaptive control and preventive strategy against any disruption and leave an opportunity to attain an even better future.

INTRODUCTION

The driving factors for industrial revolutions include improvement of production and enhancement of economic situation. Despite the fact that at the time being we are still at the very early stages of the Fourth Industrial Revolution, our industry is growing in an exponential manner. As concluded by Intel in 2017, current advancements are hyper-scaling aggressively beyond Moor's law that concluded that the number of transistors per silicon chip is to double each year. Digital manufacturing has controverted each of Moor's, Butter's, and Kryder's laws. Moor's law (H. Moor, 2001) concluded that the number of transistors per silicon chip and thus the processing power is to double each year. Butter's law (S. Yoo, 2015) explained that the amount of data communicated over an optical fiber doubles every one year.

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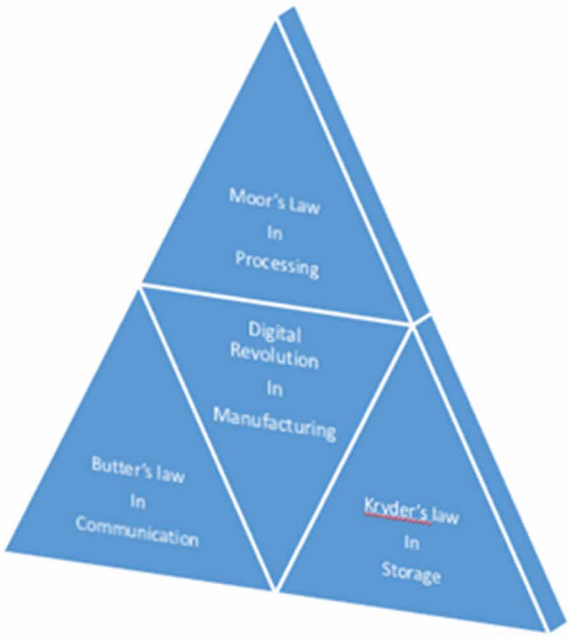
Kryder's law (Sood, M. James, J. Tellis, & Zhu, 2012) that has determined that the storage capacity of data per centimeter square of a hard drive will double each every thirteen months. This is explained by the actuality that digital manufacturing is exploiting each of the three laws, which led to a flipped exponential growth as shown in Figure 1.

Figure 1. Exponential advancement of digital industry supported by the three laws



Different engineering disciplines ranging from robotics to artificial intelligence have made it possible to develop products to meet with satisfy customer needs. An enhancement of production through the current fourth industrial revolution is made by forging different disciplines and technologies including mechatronics, cyber physics, cloud computing, biotechnology, and quantum computing. Continuous research has led to the discovery of digital manufacturing, which counts as a new vision for the upcoming future. It simply involves well-automated machines and better-qualified workers.

With an increasing demand for high quality, custom-made, and faster production, the manufacturing industry is heading towards a future quantum technology that is just around the corner. Industrial revolution 5.0, or the second quantum revolution, will be employing quantum mechanics rules that have been obtained in the first quantum revolution to create a new quantum face for our world.

Different reasons will motivate big manufacturing industries to transform to and embrace digital manufacturing. The reasons include facilitation of next level interface, flexible and inexpensive storage of data, optimization of processes that has resulted from use of augmented reality, and new abilities as a result of advanced analytics that will in return give valuable insights. Accordingly, progressing from idea into implantation will be faster than it has ever been.

In contrary to what it is thought of, the fifth industrial revolution aims on bringing back the human touch. It is only requiring evolving of technical skills. By enhancing the roles of both, humans and ma-