Chapter 15
Future of Education in Industry 4.0:
Educational Digitization – A Canadian Case Study

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ABSTRACT

With the developments in technology and innovation, the manufacturing, workforce, training, and educational systems were affected. Facing the fourth industrial revolution, academics are researching the possible changes that might arise in education and skills of the future workforce. As the workplace develops, new competencies will surface. With this context in mind, the authors initiated this research. A detailed questionnaire was prepared as a pilot study to comprehend students' views on the use of technology in classrooms and its impact on their learning experience and engagement. Knowledge of their views allowed the authors to draw inferences as to the skills and competencies of future students and whether they would match Industry 4.0. Furthermore, a gap analysis was conducted, whereby the existing situation at a Canadian higher educational institution was compared to the desired situation, and recommendations were put forward.

INTRODUCTION

Industrial revolutions were affected by the developments in technology and innovation. The 1st revolution was caused by mechanization, the 2nd was caused by the usage of electrical energy, and the 3rd industrial revolution was caused by electronics and automation (Benešová and Tupa, 2017, p.2195-2196). With these industrial revolutions not only were manufacturing systems affected, but also the workforce, training & educational systems.

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Currently, industry is transforming to a fully digitized manufacturing system, and we are facing the 4th industrial revolution, Industry 4.0. With this new industrial revolution, the workforce and the training & educational systems will be impacted. This led academics to research the possible changes that might arise in the education and skills of the future workforce. Future workforce who are today's students will encounter a more globalized, automated, virtualized and networked world (Motyl et al., 2017, p.1502). As the workplace changes rapidly, new competencies will surface, rendering them essential skills for student competitiveness and employability in the near future. With this context in mind, the authors decided to initiate this study, whereby those new competencies and skills will be researched, and recommendations given as to the required changes in the higher educational system.

INDUSTRY 4.0

Developments in both technology and innovation are the main factors affecting industrial revolutions, and these revolutions have brought about significant changes in our way of working and living. Throughout history there have been three industrial revolutions and we are currently undergoing a transformation towards the fourth industrial revolution.

Industry 1.0 exchanged the human power with the power of steam. When James Watt introduced the steam engine in the 18th century, with the mechanization, production and the transportation systems transformed. Consequently, there was an important increase in productivity.

Industry 2.0 was caused by the electrical energy and the mass production about a hundred years later. When Henry Ford introduced the assembly line, with the mass production and the usage of electrical energy, there was a significant decrease in costs and a further increase in productivity.

Industry 3.0 was in the 1960s and came with the introduction and usage of computers, which introduced the world to a faster and more capable form of processing capability. This marked the beginning of the information technology era for industry.

Industry 4.0 refers to the next developmental stage in the manufacturing industry, and was first introduced by the initiative made by academics, industrials and the German Government. Its aim is 'to strengthen the competitiveness of manufacturing industry in the country by computerization' (Baena et al., 2017, p.74).

With this high-tech strategy, which converges the industrial production and information and communication technology (ICT), industry is going through a transformation to full digitization and intelligent production. In this concept, the Internet of Things (IoT), the 'Industrial Internet', 'Cloud-based Manufacturing' and 'Smart Manufacturing' are stated as the drivers of Industry 4.0 (Erol et al., 2016, p.13).

Hermann et al. (2016) defined Industry 4.0 as: "Industry 4.0 is a collective term for technologies and concepts of value chain organization."He further explains that; within the smart factories of Industry 4.0, cyber physical systems (CPS)will monitor the processes, and make decisions while communicating and cooperating with other cyber physical systems and humans in real time. In addition, with the Internet of Services (IoS), both internal and cross organizational services will be utilized by participants of the value chain (Rossit et al., 2018, p.1).

Similarly, Gilchrist stated that "businesses will build global networks to connect their machinery, factories, and warehousing facilities as cyber-physical systems, which will connect and control each other intelligently by sharing information that triggers actions" (Gilchrist, 2016, p.195). These cyber-physical systems will then generate the enhancements in the manufacturing processes as a whole, through engi-