

4th Industrial Revolution: The Future of Machining

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The Industrial Revolution was a period of changes in agriculture, textile and metal manufacturing, transportation and socio-economy of England. The changes promote the revolution in a way of advanced techniques and practices such as in agriculture, which resulted in an increased of raw materials and food. For example, an old practice in plantation was to allow the land to rest after the cultivation activities. However, it was discovered that the fertility of the soil can be restored by the cultivation of clover and other legumes. As a result, the yearly yields is improved that leads to the increased of food for sustaining the livestock through winter. Furthermore, the adaptation of new technology agriculture organization, drastically change the production volumes, efficiency as well as profits.

Around 1760, the manufacture of textiles took place in the homes where the process is tedious from raw material to cloth. Most of the production stages were performed by women and children. The raw materials were supplied by domestic industries. However, for silk and cotton, the supply of raw materials were taken from China, West Indies, North America and Africa. The textile industry began to experience rapid changes in the middle of 1970. A device known as James Hargreaves' Jenny allowed the operator to simultaneously spin dozens of threads. As a result, nearly 20,000 of them were used in England back in 1788.

The coal mining condition and practices in the 18th and 19th centuries were found to be risky, at best and could be suicidal at worst. Even today, coal mining has been categorized hazardous at every turn. The practices of coal transportation were dominated by muscle power of animal, man and even women and children. The coal was removed slowly due to the nature of the material where a wooden basket is used from horizontal tunnel to vertical shaft up to the surface. Later in 1829, a cart on rail with ponies to pull has increased the production steadily from 2.5 million to more than 15 million tons. The coal mining has been improved through its tunnel ventilation, underground and surface transportation.

The iron industry is revolutionized in the early 18th century where the Pig Iron successfully melted with coke as introduced by Abraham Darby. Earlier, charcoal was used to melt the Pig Iron but its widespread use caused a major depletion of England's forest. Thus, Darby's technique gained the popularity within the iron industry.

The improvement of transportation encouraged the course of the industrial revolution. Canals, rivers and seas had long been used as mean of transportation. The first construction of canals

between industrial districts began in mid-1700s. Later, much more advanced transportation had been introduced in the late 1700s by using a track railroads. Tramways made by cast iron were being used by a number of mines in England. More than 200 miles of tramway were used by coal mines in 1800. For nearly a century, railroads dominated the transportation era in England from 1,000 miles in 1836 to more than 7,000 miles by 1852.

The world is changing and the 4th Industrial Revolution is now, directly or indirectly will affect us. People and machines are connected to each other with a huge number of engineering applications. Artificial intelligent and automation are the reality. Through advanced in technology, limitless processing power and speed, and massive capacity of storage, data is being collected, harnessed and stored like never before. The arrival of the 4th Industrial Revolution indicated that companies and industries must adapt with the new technology or face the struggle or failure at worst. However, with the recent technology, people can be better at their jobs rather than worrying that the human skills will be devalued. As for example, the machining process of Electrical Discharge Machining system, a skill and focus operators are still needed due to the nature of the machining parameters selection. Various advanced control systems have been reported but failed to obtain optimum machining performance. Software and technology as imposed by the 4th Industrial Revolution have the potential to empower operators to a far greater degree than in the past by unlocking the latent creativity through experience, perception and imagination for betterment of product. In addition, the industry will always need workers' brilliance, ingenuity and skills on the front line and in the field work for making smarter decision, solve tougher problems and perform their jobs successfully.