Robotics in commercial industry first appeared the early 1960s, according to the ISO definition of an industrial robot:

*a reprogrammable device with prescribed position, multifunctional manipulator having several degrees of freedom and capable of moving materials, parts, tools, or specialized devices through variable pre-programmed motions in order to perform a variety of tasks*

(Petrina 2007)

These were originally used for simple repetitive operations but required human interaction to operate. The development of sensors lessened the need for human interaction while the industrial robots completed their tasks. The problem facing developers occurs whenever there is a deviation from any of the settings programmed into the industrial robot, it had no capacity to deal with change (Petrina, 2007).

The challenge in programming an industrial robot is the need for a competent knowledge of each of the jobs required. Each job will be programmed individually which is really time consuming. One experimental approach is to program the industrial robot in a generic fashion which can be manipulated easily by an operator. The operator can use their knowledge of the production process to educate the industrial robot in the different procedures involved. The operator instructs the robot through voice commands with a headphone, hand gestures through a Wii controller, and computer applications. (Neto et al. 2010) This was experimental at the time, but the falling cost of technology drove similar methods in the following years which influenced the progression in the development of industrial robotics. The kinetic camera has been used to mimic hand and arm movement and added to haptic feedback and vision-based systems always allows the robot to determine the position of its’ arm. The robot can perform the functions of an operator without requiring large space for machinery (Ben Abdallah et al. 2017).

One industry that has taken advantage of the advance of this technology is the production of clothes. The grasping tools used to manipulate materials as they are secured on a hanger type device must be strong enough to move the material and at the same time delicate enough not to damage the material. The use of a vacuum on the end of the grippers makes this possible. This enables the robot to take cut pieces of material, place them on hangers and send them to the next procedure in the cloth making cycle. The control of the device is on a PC which oversees the operation and the timeline of each part of the process. It uses the C language to perform this, which makes it possible to control lots of similar devices connected to each other from a single computer. Each instruction has a reference number attached to prevent a mix up of procedures. This helps reduce the number of people required to mass produce items of clothing similar in design (Lutz et al. 2009).

The clothing industry has also benefitted from the use of CAD and similar software programs. A system called the Visual Motion Planner was developed which can take the dimensions and paths from a CAD program and create programs for robots. Using the software in CAD to identify any issues before going to production, saves time and money. The Visual Motion Planner is also used in other sections of industry such as milling and welding. This is used for the sewing of seams in clothes, by creating a template from one original garment, the sewing patterns in this garment are fed into the computer to create a CAD file. This is then passed to the Visual Motion Planner and this will be the instructions for the sewing path for the robot. This whole process of robotics has its’ origin in the spot-welding process of the car industry from the 1980s. The slowest part of the process is transferring the pattern of sewing to CAD, but this also takes the bulk of the processing power required to develop the patterns required. The two advantages are first the process can be done while the robotic machinery is working on another project. Secondly it means the robotic controller doesn’t need as much processing power because CAD does a lot of the work before the manufacturing of the clothes saving time and labour (Lutz et al. 2017).

Automating the manufacture of clothing through robotic machines has numerous advantages for the industry. The standard of productivity will be higher, with a consistent quality. It is very good at repetitive jobs where a high skill is required, which saves the company money in worker costs and wages. These advantages occur in almost all manufacturing industry sectors that take advantage of automating the manufacturing process. There is another side to these advances in the clothing industry. The cost of installing robotic machinery massively outweighs the money regained from manufacturing clothes making it a long-term investment. There is a significant cost in the maintenance and repair of machinery, and nothing can be produced during machine downtime. Sick workers can be replaced easily with little or no interruption to the process, plus they have no problem changing to new products or moving to different areas of the factory. These are all major obstacles for large expensive robotic machinery. The greatest disadvantage is the loss of work for the people who work these jobs. This is a problem for governments across the world but especially in countries who rely on these industries to employ large sections of their population (Lutz et al. 2017)

*A recent report published by the International Labour Organization revealed that about 88% of workers in Cambodia’s textile, clothing and footwear industry are at high risk of losing their jobs because of automation* (Nayak et al. 2017)

There are plenty of advantages and disadvantages because of the progress of robotics in the manufacturing process across many different industries. The positive and negatives from the garment industry are comparable to many labour-intensive processes around the world where robotics are beginning to take hold. It is important that governments and industry come together with favourable solutions for the workers who will eventually be displaced, robotics should be beneficial to everyone.

# Bibliography

Ben Abdallah, I., & Bouteraa, Y. (2017). A gesture-based telemanipulation control for a robotic arm with biofeedback-based grasp. *Industrial Robot, 44*(5), 575-587. doi:10.1108/IR-12-2016-0356

Lutz, T. G. (2017). Automation in Garment Manufacturing. *The Textile Institute Book Series*, 179-197. doi:10.1016/C2015-0-06156-1

Lutz, W., Kartsounis, G.-A., & Carosio, S. (2009). *Transforming Clothing Production into a Demand driven, Knowledge-based, High-tech Industry: The Leapfrog Paradigm.* London: Springer.

Nayak, R., & Padhye, R. (2017). Automation in Garment Manufacturing. *The Textile Institute Book Series*, 1-28. doi:10.1016/C2015-0-06156-1

Neto, P., Norberto Pires, J., & Paulo Moreira, A. (2010). High‐level programming and control for industrial robotics: using a hand‐held accelerometer‐based input device for gesture and posture recognition. *Industrial Robot, 37*(2), 137-147. doi:10.1108/01439911011018911

Petrina, A. M. (2007). Robotics: Present and Future. *Scientific and Technical Information Processing, 35*(2), 73-79. doi:10.3103/S0147688208020032