Sociotechnical Synthesis

(Executive Summary)

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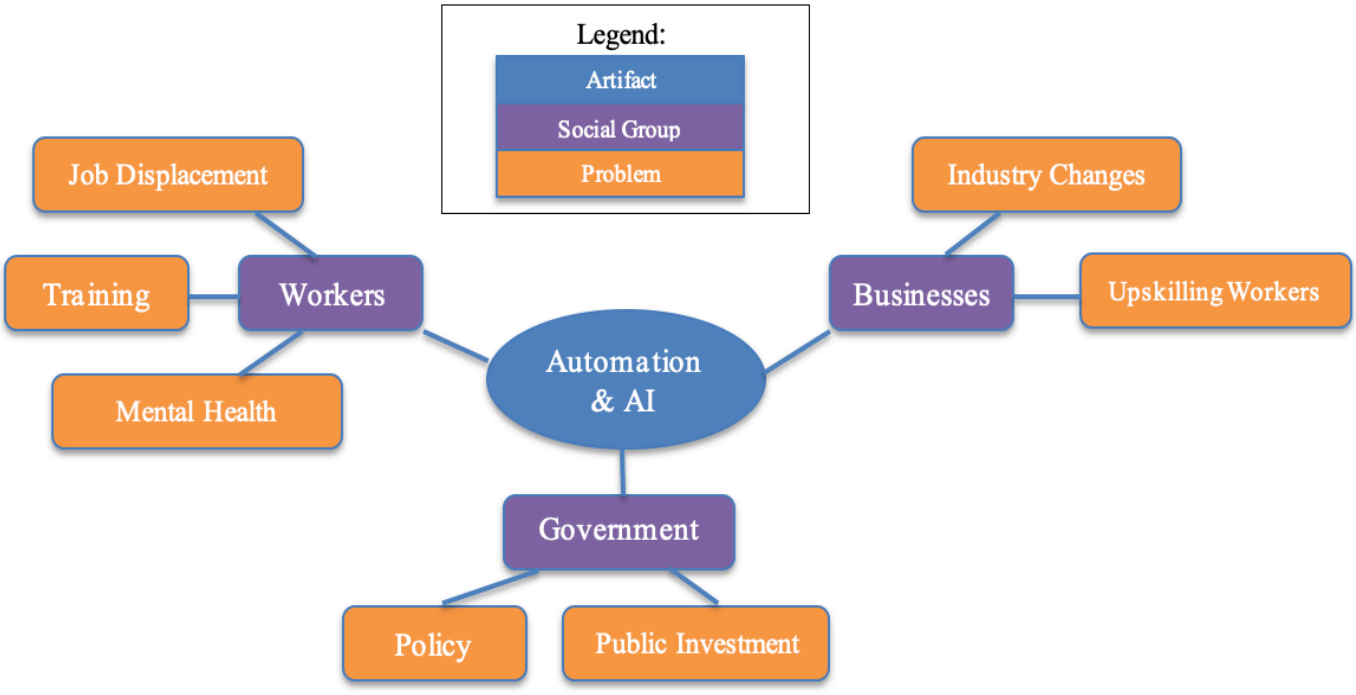
The workplace as we know it is permanently transforming across all industries at an unprecedented pace. Artificial Intelligence, automation, and robotics are becoming more prevalent in an effort to transform the efficiency of manufacturing, services, and informative decision making. Many jobs will become obsolete, many more will be created, and almost all current jobs have either already transformed in some capacity or will in the near future. My technical research in converting a manual mill press into an automated computer-numerically-controlled (CNC) machine provided the inspiration to delve deeper into the subject and analyze automation and AI's future implications on society for my STS research paper.

The technical research portion of my thesis involved my team of 5 deconstructing and replacing the components of a Precision Matthews PM-727V manual 3-Dimensional mill press in order to give it the capabilities of a functional CNC machine. By achieving this automation, the process of cutting a desired shape from a block of metal can be interpreted through a computerized set of commands sent to the machine as opposed to relying on a human to physically operate the X, Y, and Z axes of the machine. The CNC machine market is steadily growing and significantly more economical than its manual counterpart for industrial use. In working through many goals during the technical project, I gained a comprehensive understanding of the machinations of a mill press and how to apply learned manufacturing concepts in order to achieve a conversion to CNC. I also gained enough proficiency in the SOLIDWORKS CAD Program through designing and manufacturing parts for the machine in order to receive an official Dassault Systémes CSWA certification in the program following our project. Automating a mill press adds a tremendous amount of value to the machine and organizations using them because they are far easier and cheaper to use in the long term. It makes a process more efficient, requires less human labor, and delivers a far more precise,

repeatable, and therefore more valuable product for a much lower cost. However, as history has shown over time, machines that are able to perform human tasks undergo inevitable widespread adoption, resulting in many displaced workers as a symptom of this industry transformation.

My STS research studies the concerns, misconceptions, impacts on social groups, and governmental policies associated with the rapidly increasing adoption of automation and artificial intelligence (AI) in the workplace. While societies have undergone different stages of industrialization at different rates throughout history, the natural technological advancement of this next wave of automation will drastically change how businesses and organizations function at an unprecedented rate. Given the significant reach of automation and AI across society, it is critical that those involved in the research, development, implementation, and regulation of it develop a strategic transition plan that takes into account impacts to all stakeholder groups. The following figure presents a Social Construction of Technology (SCOT) model which is used as a framework for addressing the effects on different key social groups affected.



Finding a way to proactively address these rapid changes is crucial to helping society transition through this next industrial revolution smoothly due to the significant amount of people, particularly those working in lower-to-middle income jobs, that will be impacted. The World Economic Forum has estimated that 54% of employees that are a part of larger organizations will need to upskill, or undergo retraining to learn additional skills, in order to adequately adapt to their organization's transformation. Some experts predict around 15% of the global workforce, or 400 million people, could be displaced from their jobs by the end of the decade.

By following this model, my STS research breaks down these human and corporation stakeholders in a way that highlights specific industries and demographics that will be disproportionately affected. I learned about various regulatory actions to then lay out a potential framework of policy for lawmakers to consider that will help workers and businesses both adjust to and mitigate the negative effects of adoption and job displacement throughout this transitionary period.

I would like to extend my gratitude and appreciation to my teammates and to Gavin Garner, Professor at UVA Mechanical and Aerospace Engineering, for his guidance throughout our technical research project. I would also like to thank Professors Catherine Baritaud and Richard Jacques for their assistance in my STS research and thesis portfolio.