

How Automation and Human Expertise are Shaping Future Factories

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Introduction

The factory of the future is typically portrayed in black-and-white contrasts between one that is completely automated and void of humans on the other hand, and an old-fashioned factory that resists automation on the other hand. The reality is that

neither of these pictures depicts the path being taken by progressive manufacturers. Rather, the factory of the future is evolving into a judicious blend of automation and human skill, each used in those areas where each can best contribute. The understanding of how this blend is working and what it means to the enterprise, its people, and its competitiveness is critical.

Where Automation vs. Human Expertise Excels

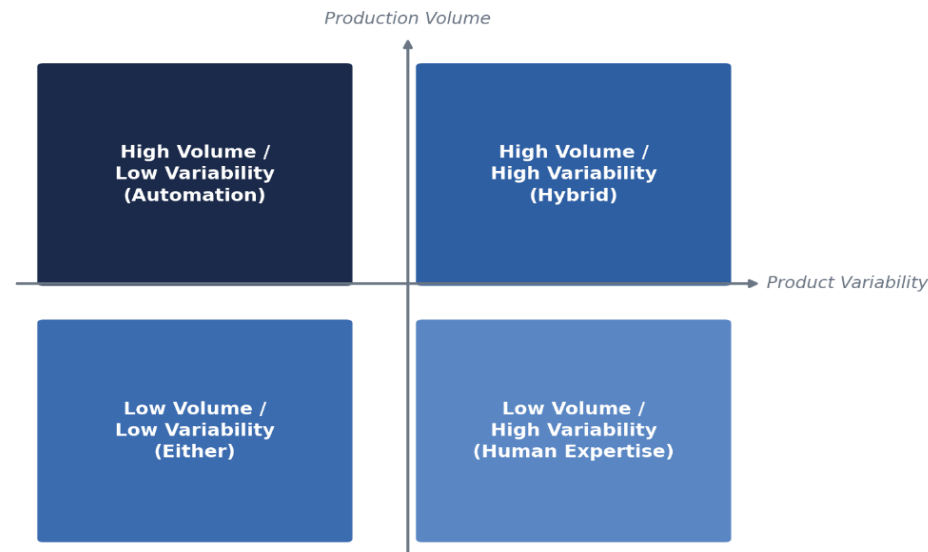


Figure 1: Process overview

In this paper, the ways in which automation and human knowledge are combining in the development of the next generation of factories will be considered, what influences the changing relationship, and the implications for manufacturers involved in that shift in figure 1.

Automation Versus Labor Story

For many years, the story about manufacturing automation could be described as an endless competition of technology versus human workers, when automation was viewed mostly as a way to lower the cost of labor and the number of employees. Of course, some categories of work in manufacturing had been substituted by automation over the years; however, the current reality in the most efficient factories is much more complicated.

While automation was developing, the sphere of its influence started to cover more of repetitive, physically hard, dangerous or extremely precise tasks, whereas the human factor became more oriented on supervising, exception processing, improving processes, and solving tasks that require judgement and flexibility.

Where Automation Does Well

Contemporary automation technologies, including industrial robots, collaborative robots, autonomous mobile robots, and more intelligent process control systems, do very well in some very specific areas.

High-volume, routine processes. There is a lot of value created when automation takes care of high-volume tasks that are very similar to each other, because consistency, speed, and endurance are superior characteristics compared to manual processes.

Precision-dependent processes. Tasks which require a level of precision that is out of reach for humans, like micro-assembly, welding with extremely precise tolerances, or making semiconductors, are increasingly being done by automated systems.

Dangerous or physically tough conditions. Automation systems are still doing very well in removing people from situations of extreme heat, dangerous chemicals, heavy lifting, and other dangers.

Monitoring large amounts of data. When it comes to constantly monitoring streams of information collected by sensors, looking for trends and anomalies, automated systems, with the help of artificial intelligence, do very well.

Where Human Expertise Still Counts

While the scope of what can be automated has expanded, there are still many areas in which human expertise is critical to manufacturing operations.

Problems solving. In the case of unexpected occurrences like equipment malfunctioning, process deviations, quality problems, and other events outside the set program, human expertise will always be necessary to identify the cause and develop an appropriate response, especially when it comes to unique situations.

Judgment. Many decisions in the manufacturing environment involve considering many things, even conflicting ones, like quality, time frame, costs, and safety factors that rely more on experience than codified automated processes.

Innovation and continuous improvement. Human expertise is the primary means by which innovative approaches and continuous improvement are achieved.

Flexible, low volume or highly customized production. Jobs that require substantial variation, involve low volume of production or have a high level of customization can be better done by skilled human employees as compared to automation systems because of the higher cost and complexities involved in programming and reconfiguration of these systems.

Interpersonal and cross-functional coordination. Production operations require effective coordination among different people and shifts. It involves communication, negotiation and problem-solving processes that cannot be achieved by machines.

The Changing Factors Impacting the Balance

There are certain factors that impact the way manufacturers are balancing automation and human knowledge in their production operations.

Maturity and cost of technology. With further advancement of automation technology and decline in its cost due to introduction of new technologies like Artificial Intelligence and advanced robotics systems, more and more applications are becoming cost effective and the balance is shifting towards automation over time.

Labor market conditions. Due to shortage of skilled labor in many manufacturing regions, manufacturers are implementing more automation systems in their operations. Not to reduce the number of jobs but in order to maintain the production rate.

Complexity and Variability of the Product. Manufacturers who produce customized products, low-volume products, and evolving products are likely to have an interest in human labor and knowledge being relatively more valuable compared to automated manufacturing processes than manufacturers who produce standardized products at high volumes.

Market Pressures. The intensification of competition, shortening of product life cycles, and increasing demands by customers for faster production, higher quality, and customization are forcing manufacturers to become more inclined towards using automation in manufacturing whenever it provides an advantage over other manufacturers.

Strategic Implications for Manufacturers

Redesigning Jobs

As the shift between automation and human knowledge is taking place, manufacturers need to redesign jobs in such a way that workers will not be assigned any tasks but rather be able to supervise, handle exceptions, improve their performance constantly, and work together with automation.

Workforce Development Investment

Preparation of the workforce for this changing ratio will require an effort to develop the skills required to collaborate with ever-smart manufacturing processes, including human-specific skills such as problem solving and analysis.

Flexible Automation Architectures

In light of the ever-changing optimal balance between automation and human labor, it makes sense for manufacturers

to focus on creating flexible and easily reconfigurable automation architectures that can adapt to changing circumstances rather than on single-purpose architectures, which would determine the balance that would never change throughout the lifetime of the architecture.

Creating Adaptive Organizational Cultures

Above all else, manufacturers should strive to create adaptive cultures that would recognize the fact that the optimal balance between automation and human labor will keep changing due to changes in the technological, market, and workforce landscape, and it will never settle down to a permanently set balance.

The Future of the Future Factory

Contrary to the expectations of the most radical proponents of automation on the one hand and its adversaries on the other, the future factory is unlikely to mean the total absence of human intervention and the total resistance to automation on the other. More likely than not, it would mean an increasingly complex dynamic distribution of labor between people and machines – one that changes along with the developments in the field in figure 2.

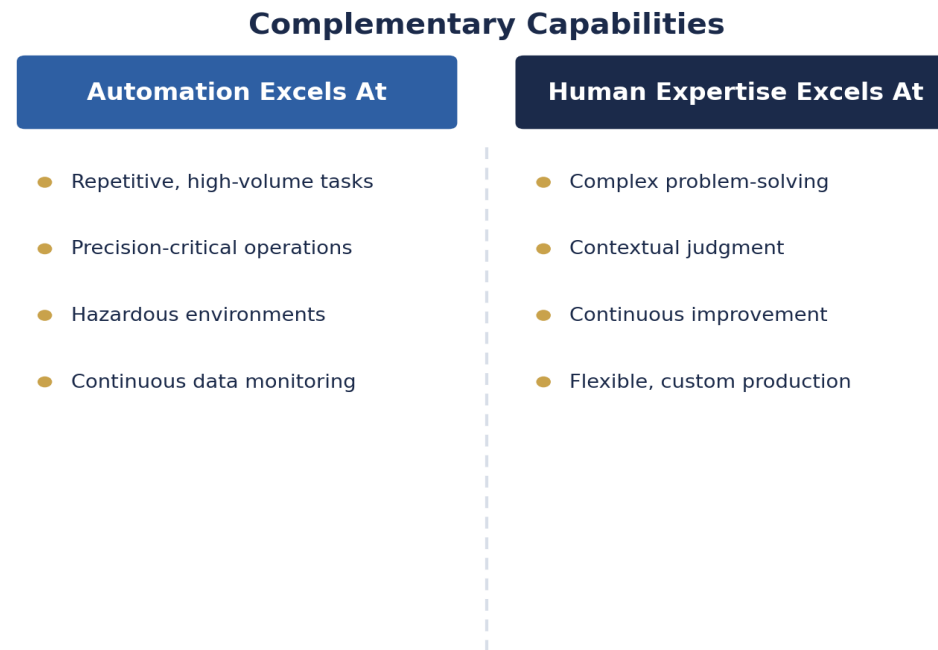


Figure 2: Key framework at a glance

Conclusion

Automation and human expertise do not exist in conflict in the future factory; rather, they are both parts of the equation for a more advanced and adaptable approach to industry. Through understanding where automation offers the most benefit, where

human expertise cannot be substituted, and the changing nature of this relationship, companies can take an educated approach to their investments in automation, while at the same time developing the skill sets necessary to complement increasing machine intelligence. Those that do will be well-placed to dominate manufacturing competition going forward.