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These Are the Jobs Least Likely to Go to Robots

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At least for now.

Fortune Insiders

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Automation is often depicted in news articles and some academic literature as a titanic struggle between man and machine, in which the machine seems destined to win and the only question is how soon to schedule the medal ceremony. As automation in the workplace moves rapidly from science fiction to business fact, we believe the changes it will bring are more nuanced than a simple choice between human and robot. We have examined 2,000-plus work activities in every industry sector across the US economy. Here are eight findings from our research, highlighting the automation potential of each sector--providing some technical indicators as to which occupations are most and least likely to go to a machine.

Just because something can be automated doesn't mean it will be
While technical feasibility is a necessary precondition for automation, other factors are required to build a compelling business case. These include the cost of developing and deploying the hardware and the software for automation, and the supply-and-demand dynamics of labor. Replacing human cooks earning $10 per hour with expensive robots may be possible technically, but might not make business sense because it may cost too much and not provide a good return on investment. Regulatory and social issues could also be factors many hospital patients will want a human nurse rather than a robot to care for them when they wake up after surgery.

Certain physical jobs have the highest potential to be automated
Almost one-fifth of the time spent in US workplaces involves performing physical activities or operating machinery in a predictable environment--that is, specific actions in familiar settings where changes are relatively easy to anticipate. More than three-quarters of such activities could be automated already with today's technology, and figure prominently in manufacturing and food service, making

these sectors the most technically susceptible to automation. Robots on factory floors already do repetitive rote tasks such as product assembly and packaging, while in food service, some restaurants are testing self-service ordering or even robotic servers.

Data collection and processing are ripe for automation, too. Across all occupations in the US economy, workers spend one-third of their time collecting and processing data. Both activities are highly like to be automated and could affect industries, from retail to financial services and insurance. Workers won't necessarily be out of the job, but their roles may very well change. For example, mortgage brokers spend as much as 90% of their time processing applications, and could instead spend more time advising clients.

Even high-paying jobs will be affected. It's not just entry-level workers or low-wage clerks who collect and process data; people whose annual incomes exceed $200,000 spend more than 30% of their time doing so, too. That makes activities in these jobs attractive for companies to automate. Overall, the correlation between wages and automatability shows a great deal of variability.

Robots aren't great at making beds -- yet

For now, activities that require physical movement or operating machinery in unpredictable settings are relatively challenging to automate. Examples include operating a crane on a construction site, collecting trash in public areas, or making beds in hotel rooms. The latter is unpredictable because guests throw pillows in different places, or may leave clothing on their beds, which makes it hard for a robot to carry out maid service. This might change soon, however, as significant research is being devoted to improving the performance of robots in physically unpredictable environments.

Time to become a teacher or dental hygienist?

The hardest activities to automate with the technologies available today are those that involve managing and developing people (9% automation potential), where expertise is applied to decision-making, planning, or creative work (18%), or interacting with customers, suppliers, and other stakeholders (20%). These activities, where experience and age are often an asset, can be as varied as coding software, creating menus, writing promotional materials -- or advising customers which color shoes best suit them.

In health care, less than 30% of a registered nurse's job could be automated, while for dental hygienists, that proportion drops to 13%. Of all the sectors we have examined, among the least susceptible to automation is education. The essence of teaching includes deep expertise and complex interactions with other people for which machines, so far and with few exceptions, receive an incomplete grade.

Machines will change jobs, but they won't fully take over from humans. The technical feasibility of automation is best analyzed by looking not at occupations as a whole, but at the amount of time spent on individual activities, and the degree to which these could be automated by using technology that currently exists and adapting it to individual work activities. Overall, we find that only about 5% of occupations could be fully automated by adapting current technology. However, today's technologies could automate 45% of the activities people are paid to perform across all occupations. What's more, about 60% of all occupations could see 30% or more of their work activities automated.

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Technology continues to develop and technical feasibility will thus evolve over time. This analysis has focused only on currently available technologies, but our on-going research considers different scenarios for technology development. As technological advances such as machines being able to acquire natural language abilities that match median human capability, the numbers and types of activities that are technically susceptible to automation will increase.

Automation will fundamentally change the nature of organizations. The challenge for managers will be to identify where automation could transform their organizations, and then figure out where to unlock value, given the cost of replacing human labor with machines and the complexity of adapting business processes to a changed workplace. Most benefits may come not from reducing labor costs but from raising productivity through fewer errors, higher output, and improved quality, safety, and speed.

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By James Manyika