House Oversight and Accountability Subcommittee on Cybersecurity, Information Technology, and Government Innovation
Hearing on Training and Developing an AI-ready Workforce
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TESTIMONY OF RICHARD C. LEVIN

Madam Chair and members of the Subcommittee:

Thank you for the opportunity to testify on preparing the government's workforce to make effective use of tools and applications using artificial intelligence.

I approach the issue of workforce training from three perspectives. I served as President of Yale University from 1993 to 2013. Subsequently, from 2014 to 2017, I was the Chief Executive Officer of Coursera, one of the world's largest platforms for online education, offering thousands of courses and learning programs focused on developing skills relevant for AI-readiness. Finally, since 2010, I have served on the Board of Directors of C3.ai, a company that offers its customers a comprehensive platform for developing AI applications as well as a large and growing number of pre-built applications such as reliability, energy management, supply-chain management, and inventory optimization.

Like the Internet or digital revolution that preceded it by three decades, the coming AI revolution will affect workers in nearly every occupation, and as in the digital revolution the training needs of the workforce will vary significantly across jobs. It may be useful to distinguish three general categories of employees who will need substantially different types of training: those who *use* AI tools in their work, those who *maintain or develop* AI systems for use across the government, and who *decide* which AI systems the government should procure and utilize. It is worth noting that this distinction among categories of employment and associated training needs applies not only to government employees, but also to the entire national workforce.

The first category includes all those who will use AI applications in their work. Large language models such as Chat-GPT, GPT-4, BARD, and Claude have already demonstrated utility in answering queries and summarizing documents across different occupations. Many more tools will follow, including, for example, those that scan and sort images, recommend where preventive maintenance is urgently needed on aircraft, identify gaps in the staffing of health care operations, and prioritize tax returns that should be audited. Some AI applications like large language models will require little training beyond general education; by analogy, think how little training is required to use a search engine. Others AI applications will require more training – think word processors, power point, and spreadsheets, in order of complexity. And some AI systems may be very challenging to use, just like some of the early enterprise platforms for processing personnel and financial data. For the most part, existing workers will be capable of developing these skills on the job, although in some instances training by software vendors and/or system integrators will be necessary. Eventually, hiring requirements are likely to change so that skills such as familiarity with the use of large language models become a prerequisite for employment, just as word processing, power point, and/or spreadsheet skills are required for many new hires today.

Over time, the need to give users extensive training will likely diminish. In the earlier digital revolution, most types of software became easier to use as vendors improved products and their user interfaces. We can already begin to see how AI is simplifying the user experience. For example, C3.ai's product – Generative AI for Enterprise – allows users to retrieve and display data in tables or graphs with simple natural language instructions, tasks that previously required the user to submit queries in programming languages such as SQL, R, or Python.

Considerably more advanced technical skills and competencies will be needed by employees who maintain AI systems, and even more will be required of staff who seek to customize a vendor's software or develop entirely new applications. Maintenance and user support staff will need to understand software operations, solve user problems, diagnose system failures, and debug as needed. This will require detailed on-the-job training provided by vendors and system integrators, but it would also help if such personnel had basic background knowledge of the fundamental concepts and models used in AI applications software. To the extent that government units want developers in-house, the training requirements escalate dramatically. Many AI developers have advanced degrees in computer science or data science, although bachelor's degree-holders with relevant experience can also be successful. It will be very challenging for the government to build in-house developer teams, and reasonably difficult to attract and retain high-quality maintenance and user support staff, because private sector demand will put pressure on available supply, and salaries, which are already very high, are likely to rise well beyond current levels.

Perhaps the greatest challenge facing the government in making productive use of AI tools will be ensuring that decision-makers have sufficient knowledge to make well-informed procurement choices. At C3.ai we have found that the Department of Defense has a considerable number of senior officers with sufficiently strong backgrounds in technology to understand how AI applications work and to set intelligent performance benchmarks for assessing their performance. Most of these are trained engineers, and many have advanced degrees. But we have also found that not every decision node in the DoD or the service branches is so well endowed. Moreover, the technical capability of many civilian agencies is very likely to lag that of the military. If these observations and conjectures are correct, they have two implications.

First, government agencies should take pains to deploy their high-capability personnel to the teams involved in making major AI procurement decisions. Second, the government should invest in training a subset of decision-makers, not to the level of expertise required of an AI developer, but at least to a sophisticated understand of how AI models work, how different types of models can be used for different purposes, and. how models should be tested and evaluated. In the future, priority in hiring should be given to candidates who already possess these skills.

The good news is that for all the training needs I have identified solutions are already emerging. AI has become such a central topic in the field of computer science that it has a significant and growing presence in the curricula of universities and colleges throughout the nation. In the future, therefore, there should a steady flow of trained graduates entering the workforce, although the competition for them is likely to be intense. Fortunately, for existing employees and for some fraction of future hires, there are very effective alternatives to a college degree. Ever since high-scale asynchronous online learning burst upon the scene a little over a decade ago, topics related to AI have been among the most popular online course offerings. Indeed, the leading online course providers – Coursera, Udemy, Udacity, and edX – have abundant offerings across the range of learning needs that I have identified.

For example, Coursera alone already offers 130 courses on subjects related to generative AI, developed by leading universities and industry experts. They range from multi-week university courses to short hands-on projects, and they span the user groups that I have identified: 31 courses are designed for non-technical users of AI, 57 courses for technical users and developers, and 42 for decision-makers. Among the providers of these courses are Stanford, Michigan, Duke, Vanderbilt, Arizona State, and the University of Colorado, as well as Amazon Web Services, Google Cloud, IBM, and

DeepLearning.ai. Nearly half these courses were introduced in the last three months of 2023, and more are on the way.

Online course platforms such as Udemy, Udacity, and edX, as well as Coursera, have already played a meaningful role in training of software developers and data scientists. Their convenience and low cost have made it possible for millions of workers around the world to acquire skills on the job, or to acquire the skills needed for new jobs. Along with the education provided by our colleges and universities, online platforms are likely to play a major role in the development of an AI-ready workforce.