A report from the Deloitte Center for Government Insights

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AI-augmented human services

Using cognitive technologies to transform program delivery

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Deloitte's "Cognitive Advantage" is a set of offerings designed to help organizations transform decision-making, business processes, and interactions through the use of insights, automation, and engagement capabilities. Cognitive Advantage is tailored to the federal government and powered by our cognitive platform. Cognitive Advantage encompasses technologies capable of mimicking, augmenting, and in some cases exceeding human capabilities. With this capability, government clients can improve operational efficiencies, enhance citizen and end-user experience, and provide workers with tools to enhance judgment, accuracy, and speed.

Introduction

Natalie is exhausted. The deputy director of a large county human services agency, she's been wrestling all week with staff turnover and media coverage about long wait times for services. Heading home on Friday evening, she worries that she might spend the rest of her career playing defense at work.

AFTER a Saturday morning of chauffeuring her kids to soccer games and music lessons, Natalie collapses on the couch. She relaxes to music from one of her favorite radio stations, wondering how Pandora always manages to serve up exactly the songs that fit her mood.

After she's had a chance to unwind, Siri® gives her the week's top headlines, reminds her that her niece's graduation is coming up, recommends a gift for the niece, and, when Natalie confirms the choice, places an order. Later, Natalie's fitness band reminds her that it's time to head to the gym for a session with her trainer. On the way to the gym, Waze alerts her to an accident ahead and automatically routes her around it.

Back at work on Monday morning, Natalie sees caseworkers straining to decipher the handwriting on application forms faxed in over the weekend, so that they can enter the data in the agency's system. She sees people queued up in the lobby waiting to check the status of their applications. Program managers huddle in the conference room, struggling to reallocate the caseloads of staff members who quit their jobs the week before.

How might life in the office look different, Natalie wonders, if she could scale up the artificial intelligence (AI) she relies on at home and bring it to the office? With help from AI-based technology, the agency could automate routine tasks, saving her staff countless hours on data entry. This technology could simplify the process of applying for benefits for individuals and families. It would also free up more time for her caseworkers to focus on the life-changing work that drew them to human services in the first place.

In this article, we examine how the same artificial intelligence-based technologies we've come to rely on in our personal lives can be put to work in human services. We also survey how government entities are using these technologies across the full life cycle of a human services case. Using the first-ever quantitative forecast of how AI will reshape government work, we outline the potential time and cost savings human services agencies can achieve from investing in AI-based technologies over the next 5–7 years.

Understanding AI and its application in human services

IN the consumer realm, AI-based technologies (also referred to as cognitive technologies)—including music-streaming services such as Pandora, intelligent personal assistants such as Siri®, and smart navigation apps such as Waze—are changing the way we manage everyday tasks (see sidebar). Cognitive technologies are also transforming business, helping companies predict market demand, understand patterns in large bodies of data—both structured and unstructured—and make better decisions on everything from resource allocation to product positioning. These same AI-based technologies can be put to use in human services to help agencies alleviate the considerable administra-

AI-BASED TECHNOLOGIES IMPACTING OUR LIVES

To better appreciate AI's potential application in human services, it is critical to understand some of the key automation and AI-based technologies impacting our lives. These technologies include robotic process automation (RPA), rules-based systems, machine learning, computer vision, speech recognition, and natural language processing (see table 1).

Table 1. Robotic process automation and key cognitive technologies

Technologies	Definition
Rules-based systems	Capture and use experts' knowledge to provide answers to tricky problems that are governed by fixed rule-sets.
Speech recognition	Transcribes human speech automatically and accurately. The technology improves as machines collect more examples of conversation.
Computer vision	The ability to identify objects, scenes, and activities in naturally occurring images.
Machine learning	Takes place without explicit programming. By trial and error, computers learn how to learn, mining information to discover patterns in data that can help predict future events.
Natural language processing	Refers to the task of organizing and understanding language in a human way. Combined with machine learning, a system can scan websites for discussions of specific topics.
Robotic process automation (RPA)	RPA robots are software programs designed to automate transactional, rules-based tasks by mimicking human interactions.

Source: Deloitte Center for Government Insights.

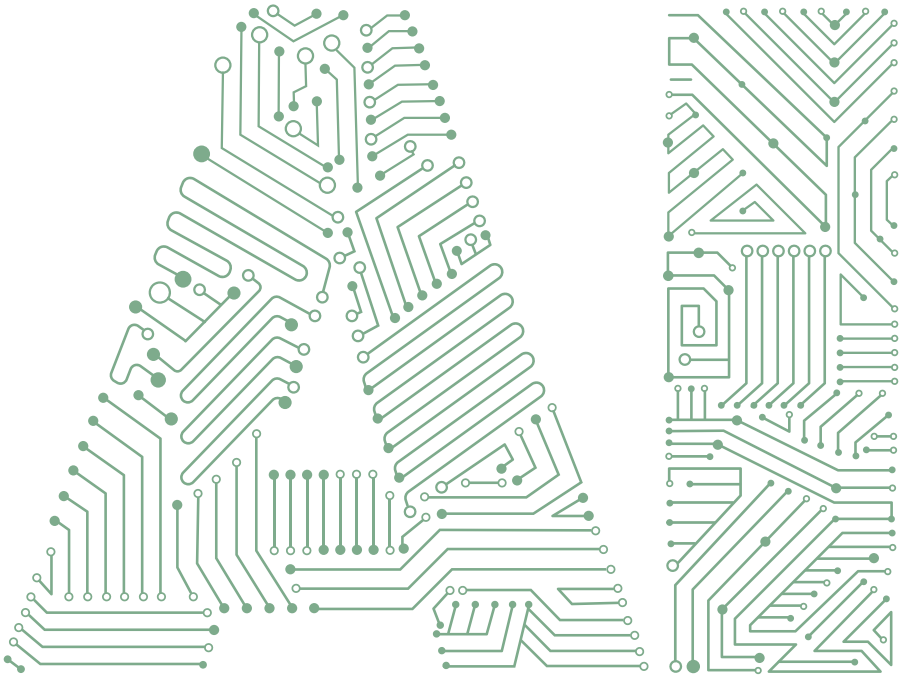
tive burden on caseworkers, free up time for more critical tasks, improve decision-making, and deliver better, faster services.

AI could go a long way toward addressing some of the long-standing challenges confronting caseworkers and the individuals and families they serve. These challenges include:

- **High turnover rates**: In Jefferson County, Kentucky, nearly a third of the county's social services workforce quit in 2016.[1] In Texas, the state auditor found that the social service occupation had a turnover rate of 25 percent in 2015, the highest among all occupations in the state.[2] Social workers say that huge caseloads and related administrative burdens, which consume anywhere from 50 to 80 percent of their time, keep them from working effectively and make them consider leaving the profession.[3] High turnover rates can increase training costs, force even larger caseloads on those who stay while positions are backfilled, and create significant instability for individuals and families who rely on caseworkers for help.
- **Large, unmanageable caseloads**: In South Carolina, 15 percent of caseworkers handle 50 or more children.[4] A single caseworker in Spartanburg County, South Carolina, manages 143 cases.[5] With such large loads, caseworkers often have trouble prioritizing their work, and it's hard for them to see the impact they make through their efforts. Caseworkers come to human services wanting to help individuals and families. When they can't do the right work, on the right case, at the right time, they may become seriously discouraged.
- **Administrative burdens that detract from spending time with individuals and families**: Caseworkers are the front line, the people best situated to improve the trajectory of clients' lives. Too often, however, they are shackled by paperwork and kept from the hands-on work that actually transforms lives. Studies have shown that caseworkers can spend upwards of 60 percent of their time completing paperwork.[6]
- **Long wait times**: Anyone who has tried reaching government call centers knows how frustrating the long waits can be. Sitting on hold is even more frustrating when the caller is trying to obtain a basic necessity such as food or housing. According to the US Government Accountability Office, unemployment insurance claimants face phone waits of anywhere from 20 minutes to two hours.[7] What's more concerning is that the majority of calls coming into call centers relate to checking the status of an application, a redetermination, or some other such matter. These status questions could easily be handled by a chatbot—a computer program that simulates human conversation through voice or text chat—freeing up call center workers to handle more complex inquiries.
- **Delays in service delivery**: Even after submitting applications and following up on their status, individuals and families often have little idea how long it might take to receive the benefits and services for which they're eligible. Such delays commonly stem from understaffed departments, budget cuts, and outdated or error-prone technology.[8]

Caseworkers come to human services wanting to help individuals and families. When they can't do the right work, on the right case, at the right time, they may become seriously discouraged.

- **Language barriers for non-English speakers**: Twenty-six million US residents—roughly 9 percent of the population—have limited English proficiency.[9] In California, the country's most linguistically diverse state, residents speak at least 220 different languages.[10] Language barriers can lead to any number of problems: forms that are filled out incorrectly, delays in benefits, and difficulties with service delivery, among other things. While states commonly translate materials and use interpreters to lower these barriers, issues remain. For instance, in one state, an Arabic-speaking individual did not receive unemployment benefits for more than three months because of delays in receiving translated application materials and finding an interpreter for his appeal hearing.[11]



Putting AI-based technologies to work across the human services case life cycle

GOVERNMENT entities are beginning to put automation technologies such as robotic process automation (RPA) and cognitive technologies to work across the full life cycle of a human services case. Their goals are to reduce the administrative burden on caseworkers, address long wait times, triage high caseloads based on risk, and free up staff time to address more complex cases (see figure 1).

Here, we examine a range of use cases for AI-based technologies in human services that jurisdictions in the United States and across the world are pursuing. The cases range from simplifying eligibility verifications and improving fraud detection to predicting the highest-risk cases.

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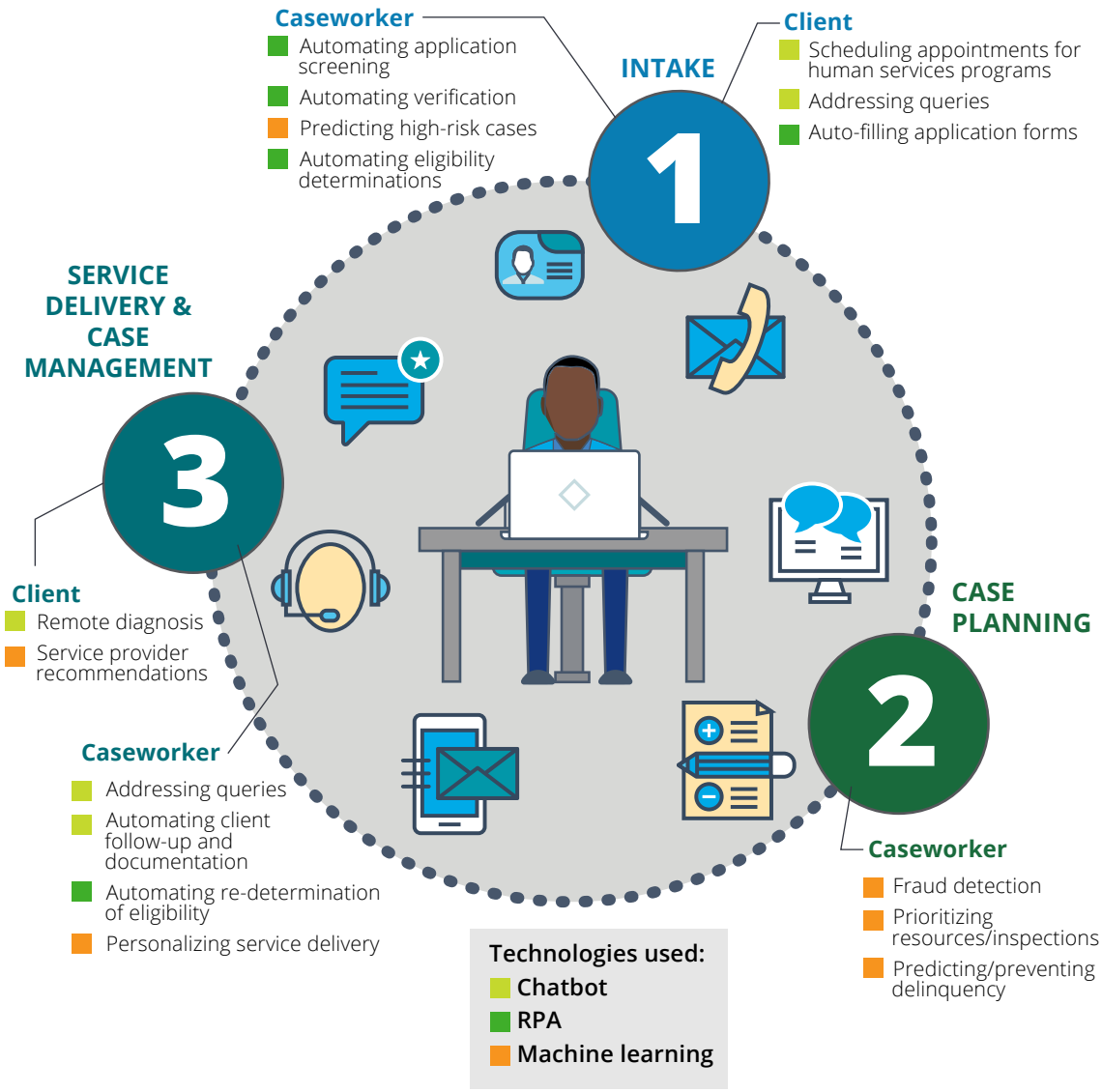
Simplifying eligibility verifications

Caseworkers today often must manually verify beneficiaries' eligibility by fetching data from multiple systems. In San Diego County, for example, caseworkers use two different systems for eligibility verifications. The first stores all the required documents to verify eligibility. The second has 500 different application forms; each form, or combination of forms, requires different documents.

Because these two systems didn't share information, caseworkers had to open forms from one system and then look for supporting documents in the other. Since there are 500 forms, these requirements created hundreds of business rules, which a caseworker had to verify *manually*. The process was complex and consumed a great deal of time.[12]

To automate the process and connect both systems, the county deployed RPA software. This looks at the open forms on a caseworker's screen, sifts through the verification fields, identifies relevant documents, and then pulls up those documents from the other system. The entire manual task was replaced with the stroke of a hot key. Thanks to RPA, the county slashed the time it takes to approve a SNAP application from 60 days to less than a week.[13]

Figure 1. Applications of RPA and cognitive technologies across the life cycle of a human services case



Client problems alleviated:

- Tedious application process
- Long wait times
- Language issues for non-English speaking people
- One-size fits all solutions

Caseworker problems alleviated:

- Following myriad program rules
- Heavy administrative burden
- Not knowing which cases to prioritize

Source: Deloitte.

Automating the application process

Caseworkers aren't the only ones who can benefit from technology that simplifies the eligibility process. A free, open application called the DoNotPay bot created in the United Kingdom helps individuals who want services from the government, automatically determining eligibility and filling out application forms for its users.

Joshua Browder, a Stanford University student born in London, originally developed the DoNotPay bot to help drivers appeal parking fines in the United Kingdom. Then he started receiving messages about evictions and repossessions from people who did not have knowledge of the law, and who were struggling to make a case for government housing. Their queries pushed Browder to add government housing to the menu of services the bot could handle. "I began to get really heartfelt emails relating to evictions, bankruptcies, and repossessions, and at the time I felt bad I couldn't help. That made me decide to expand this to help homeless people," says Browder.[14]

The bot assesses homeless persons' needs by asking a few standard questions—where they live, whether they are eligible for government housing, the circumstances surrounding their homelessness, and whether they have been diagnosed with a physical or mental health issue. Based on the answers, the bot automatically produces a completed application designed to increase an applicant's odds of being placed in a home. If an individual has a physical disability, for example, the bot will rearrange the application to focus on that condition.[15]

Improving fraud detection

AI can also be used to detect benefits fraud. An agency in the Netherlands responsible for providing social benefits was struggling with its existing fraud detection program. The system was producing a lot of "false positives," flagging many cases for possible fraud where no fraud had actually occurred. Time spent investigating those cases reduced the time available to hunt down actual fraud.

Then the agency built a new system that used machine learning. This system learns to flag benefits applications for possible fraud, using feedback from the fraud team's analysis to improve its accuracy over time. Starting with samples of actual benefits records, the agency created a model to scan the records and flag cases that appeared fraudulent.

The team ran the fraud detection model and continued to feed it more and more application records to improve its accuracy. After a number of iterations, the model was flagging fraudulent applications with 95 percent accuracy.[16]

Predicting high-risk cases

Oklahoma's Department of Human Services uses cognitive technology to help predict which child welfare cases are most likely to lead to child fatalities. The department partnered with Eckerd Kids, whose software uses machine learning to build a model that predicts which cases carry the highest risk, focusing on factors such as the presence of a child under the age of three, intergenerational abuse, young parents, mental health problems, and a history of substance abuse.[17] Once high-risk cases get flagged, they go through a detailed review and the results are shared with frontline staff, so that they can decide on remedies that will abate risk and improve outcomes.[18] This process helps field staff target investigations based on risk rather than on random sampling.

Extending self-service through chatbots

In an effort to improve self-service, reduce call center volumes, and free doctors to focus on patients who need their care, the UK National Health Service partnered with Babylon Health on a pilot in five London boroughs. There, instead of calling the 111 nonemergency helpline, patients suffering from

urgent but non-life-threatening conditions are encouraged to interact with a chatbot.[19] Patients enter their symptoms into a mobile app and the chatbot (with the help of AI) recommends whether they should go to a doctor, visit a pharmacy, or simply rest.

The whole process takes about a minute-and-a-half of back-and-forth text messaging, compared to the 10–12 minutes needed to talk with a call-center representative. The hope is that by using chatbots to perform triage, doctors can focus on treating the patients who need to see them and that will, in turn, reduce the long wait times that stem from the United Kingdom's physician shortage.[20]

Delivering more personalized services

Harrow Council, the administrative body for the Borough of Harrow in London, serves around 250,000 people. In 2013, the council launched My Community ePurse (MCeP), a program that provides an online personal budget and planning tool for recipients. Each eligible borough resident can use the personal budget to purchase services from hundreds of providers, using an electronic payment system. This program has enabled citizens to customize their social benefits plans. It has also created a marketplace for service providers, whose numbers increased from 30 to 750. Thanks to efficiencies the system created, the council was able to get providers to offer discounts on their standard rates, lowering costs by 7 percent.[21]

The next stage for Harrow Council is integrating health and social care. A case management system will pull data from various aspects of an individual's assessments and care plans, then analyze the unstructured text with the help of natural language processing to give caseworkers relevant information for each user.[22] The system searches huge amounts of data in seconds, helping to predict future health risks and recommend the best options to mitigate those risks.[23]

Freeing up worker time for more complex queries

To help reduce its staff's workload, Australia's Department of Human Services (DHS) has deployed an internal virtual assistant called Roxy to answer queries from case processing officers. Roxy uses machine learning and natural language processing to understand human language and respond to questions about the rules and regulations of the department's programs.[24] The virtual assistant currently responds to more than 78 percent of the questions put to her.[25] Prior to Roxy, DHS staff would call human experts for assistance. Now, those experts only get involved in complex queries.[26] According to DHS's Chief Technology Officer Charles McHardie, "It's been quite successful at reducing their workload."[27]

Potential savings from automation

As with most other jobs, the typical human services employee performs a number of different activities each day, chosen from the "basket" of tasks for his or her occupation. By breaking jobs into individual activities, and analyzing how suitable each is to automation, we can project the number of labor hours an agency could save by investing in AI-based technologies.

Our analysis of human services agencies in a large midwestern state found that at the high end of the investment spectrum, automation could yield up to 32.5 percent time savings within 5–7 years, with potential savings of $75.1 million (see table 2). With a mid-level investment in AI-based technologies, our analysis indicates savings of around 15.9 percent of total labor hours within 5–7 years,

Table 2. Time and cost savings from low, medium, and high levels of AI investment for human services agencies

Level of investment	Savings category	Large midwestern state
Low	Annual person hours	0.3 million
	Hours as a percentage of total	3.2%
	Salary	$7.8 million
Medium	Annual person hours	1.3 million
	Hours as a percentage of total	15.9%
	Salary	$36.8 million
High	Annual person hours	2.7 million
	Hours as a percentage of total	32.5%
	Salary	$75.1 million

Note: The savings of hours and wages is calculated based on 78 percent of human services employees. For more details, refer to the appendix.

Investment scenarios

High investment: Tasks affected by AI speed up by 200 percent on average

Medium investment: Tasks affected by AI speed up by 100 percent on average

Low investment: Tasks affected by AI speed up by 20 percent on average

Source: Deloitte Center for Government Insights.

generating potential annual savings of $36.8 million. Meanwhile, at the low end of the investment spectrum, automation could yield 3.2 percent in time savings within the same period. This amounts to 265,290 hours freed up, yielding potential annual savings of $7.8 million. Given that IT costs continue to fall and cognitive technologies are developing rapidly, even the high-end scenario may be within reach.

METHOD

The automation potential of each task was calculated based on task importance, skill requirements, work volume, and technological barriers. Then a Monte Carlo simulation was used to describe three different scenarios for the likely effects of automation on these tasks across high, medium, and low levels of government investment in automation. The detailed methodology can be found in the appendix.

Getting started

Putting AI to work in human services

THE introduction of AI can bring big changes to human services agencies, freeing caseworkers to focus on the life-changing work they wish to do when they get into human services. AI can also help them do a better job, providing the insights necessary to do the right work, for the right people, at the right time, thus achieving meaningful results for the individuals and families they serve. In the next 5–7 years, our analysis suggests AI is unlikely to cause large job losses in the human services sector.

To make the most of AI investments, agencies should consider redesigning their talent strategies so that a job is viewed not as an individual production function, but rather as a collaborative problem-solving effort, where a human defines the problems, machines help find the solutions, and the human verifies the acceptability of those solutions.

To be sure, AI can't solve every problem a human services agency might face. Agencies must evaluate the costs and benefits for each technology and use-case individually. To fully leverage AI, agencies should keep the following in mind:

Start small. Selecting a project that is not overly complex but that demonstrates the potential of cognitive technologies is a good starting point. A project that performs limited, structured tasks and that extends human capabilities is simpler to execute than one more focused on finding patterns in unstructured data. Once cognitive technologies have further matured, and an agency has developed a track record of successful deployments, it can undertake more complex projects. Also, keep in mind that not all processes are suited for the application of AI. To better assess which processes are most compatible, see our Three Vs framework in *AI-augmented government: Using cognitive technologies to redesign public sector work.*

Identify opportunities to automate administrative tasks. Technologies such as RPA automate repeatable, rules-based tasks. Unlike a typical automated system function, RPA software, also known as a "bot," operates at the user interface level and mimics the activities of a caseworker as they interact with multiple applications in the execution of a task.

Take the foster family application process, in which repetitive tasks can eat up hours. Imagine having a bot take a scanned foster family application, enter it into the appropriate system, and even validate in a separate system to determine if a mandatory lead inspection was completed in the home. This not only frees up the caseworker to spend more time determining if the home meets quality expectations, but also retrieves the lead inspection information without needing to build a data link to a separate system.

This is just one example. The challenge is to look for low-risk, high-volume, repetitive tasks that traditionally take valuable time away from the caseworker and support staff, and give those tasks to the bot.

Augment and extend. Cognitive technologies like machine learning can make caseworkers more effective by *complementing* their skills in ways not possible before. This is the true promise of AI-enabled human services: caseworkers and computers combining their strengths to achieve better results faster, often doing what humans simply couldn't do before.

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When technology is designed to *augment*, humans are still very much in the driver's seat. An example is IBM's Watson for Oncology, which recommends individual cancer treatments to physicians, citing evidence and a confidence score for each recommendation, to help them make more fully informed decisions.[28]

Keep humans at the center of the design. AI can augment the work of caseworkers by automating paperwork, while machine learning can help caseworkers know which cases need urgent attention. But ultimately, humans are the users of AI systems, and these systems should be designed with human needs in mind. Designers should start by exploring the biggest pain points for caseworkers and the individuals and families they serve. What are the most complex processes? Can they be simplified? Which activities take the most time? Can they be streamlined? This is precisely what happened in San Diego County. Designers realized that caseworkers were finding it difficult to verify applications. Rather than developing a new portal or a connected system, which can be complicated, they introduced a hot key (backed by RPA) to make the job easier.

Adopt an Agile approach. Many cognitive technologies need to be trained and re-trained in order for them to improve over time. They improve via deep learning methods as they interact with users. To make the most of their investments in AI, agencies should adopt an Agile approach, continuously testing and training their cognitive technologies. For example, after a human services agency in the Netherlands used machine learning to create a model to detect fraud in social services, it continued entering historical data to improve the model. As more data was entered, the accuracy of the model improved. Users of the model also played a key role by providing more data to the system and evaluating the performance of the model after every iteration.[29]

Establish a process for continually evaluating new technologies. Cognitive technologies keep improving, with vendors frequently adding new capabilities. Agencies need to track these developments in the market regularly to evaluate whether new technologies enable existing tasks to be automated or augmented.

Looking ahead

AI-BASED technologies are already making a profound impact on our consumer lives. Applied to human services programs, these technologies could help reduce backlogs, cut costs, overcome resource constraints, free caseworkers to spend more time with clients, inject greater intelligence into scores of processes and systems, and handle many other tasks that humans can't easily do on their own.

It's highly unusual for a business to increase speed, enhance quality, and reduce costs at the same time, but AI-based technologies offer that possibility. For human services workers, AI could free up vast amounts of time to devote to higher-value activities. It could also help these employees accomplish a great deal more on behalf of the individuals and families they serve, and achieve much better results.

Appendix

Data and methods

Data used in this research originates from two main sources. First, information on numbers of workers and their salaries collected by a large midwestern state's department of administrative services; and second, data on tasks performed by 1,110 occupations collected by the US Department of Labor as part of its O*NET OnLine database. The first source provides information on *who* is in the workforce; the second tells us *what* they do.

Analyzing the data requires linking both sources via a crosswalk. The midwestern state does not provide such a crosswalk; so we created one using state employee salary data and the state's online job classification handbook. While creating the crosswalk, we were able to connect 78 percent of human service employees to the O*NET occupation classification. For the other 22 percent of jobs in this state, we were unable to determine an exact equivalent to the Department of Labor O*NET standard.

Estimating how state human services workers spend their time

Once we can connect state employment rosters to O*NET job descriptions, we can estimate the amount of labor inputs to each activity using the following technique. O*NET contains the results of worker surveys asking respondents to estimate the time spent on each of their work activities for 19,125 detailed, occupation-specific tasks. We convert those frequency scale ratings to annual task-hours using certain equivalences (see table 3).

Table 3. Conversion of frequency scale ratings to annual task-hours

Less than yearly	0.5 hours/year
Yearly	1 hours/year
Monthly	12 hours/year
Weekly	52 hours/year
Daily	260 hours/year
More than daily	520 hours/year
Hourly	1,043 hours/year

Source: Deloitte Center for Government Insights.

We use 1,043 as the equivalent for "hourly" on the assumption that even tasks performed around the clock take up no more than half of a worker's time, with the other half used for non-occupation-specific activities. Multiplying by the proportion of respondents, choosing each value, and summing over the task, we calculate the average annual hours for the activity. This provides *annual task-hours*.

We then tally the annual task-hours performed by each occupation, multiply by the workforce-specific employment in that occupation, and apply a scale factor (0.45 for the federal workforce and 0.25 for the state workforce) to estimate total task-hours

performed by all members of the workforce. This provides the *labor inputs* to a task.

The 19,125 O*NET tasks are further linked to more than 2,000 "detailed work activities," 331 "intermediate work activities," and 37 "general work activities," allowing us to analyze annual task-hours and labor inputs for work tasks at any desired level of specificity.

Modelling how AI will affect human services tasks

Once we have estimated the labor hours consumed by each human services activity, we can then model how AI will affect those estimates in the next 5–7 years. We build a linear regression model of changes in labor inputs at different time points, using task characteristics as predictors. For more details on our models, see *How much time and money can AI save government?*

Monte Carlo simulation of AI technology adoption scenarios

We then use the coefficients from those models as inputs to Monte Carlo simulation to forecast how human services work will change in the next 5–7 years given three different levels of state government support (funding and institutional/cultural change) for AI (see table 4).

Table 4. Simulation parameters: Low, medium, and high levels of effort

Level of investment	Base mean for simulation	How value was chosen
Low	Task labor inputs decline on average by 20%	Low-end threshold of time savings for process automation
Medium	Task labor inputs decline on average by 100%	100% approximates average percent time saved on back-office functions through robotic process automation projects
High	Task labor inputs decline on average by 200%	200% approximates the savings in testing time for silicon wafer circuits at Army Research Labs reflects the higher end of time savings

Source: Deloitte Center for Government Insights

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