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1

The Current State of Problem Solving

IN 2005, THE UNITED STATES Citizenship and Immigration Services (USCIS), the successor to the Immigration and Naturalization Service (INS) and the federal agency responsible for green cards and citizenship applications, began a project to digitize the nation's immigration system.[1]

At that time anyone who wanted to stay in the country for a long period of time, or those who wanted to become American citizens, would fill out a paper form and mail it to USCIS. Those applications would then be packed into boxes, put into the back of a truck, and driven around the country for processing. All forms requiring an interview made their way through the National Processing Center in Kansas City, and then back out to regional processing centers. As they were driven around the country, at each stop the applications grew into hundred- and sometimes thousand-page files, as immigration officers and others added evidence and interview reports and other documentation. There were several computer systems that handled individual tasks such as scheduling interviews with applicants, but for the most part the process of doing anything with USCIS—replacing a lost green card, renewing an expired card, or applying to become a citizen—occurred entirely on paper. USCIS had decided it was time to move over to digital, partially to keep pace with the rest of the world but primarily to speed up the processing time, increase security, and better serve applicants. For context, that same year, Apple rolled out three new iPods, the cities of San Francisco and Philadelphia began offering free citywide WiFi, and Google launched its geographic app, Google Earth.[2]

Eleven years and $1 billion later, USCIS had managed to digitize two out of ninety-four different types of immigration forms into a system called ELIS (Electronic Immigration System), named in a nod to Ellis Island. The first design of the system—ELIS 1—had begun during the George W. Bush administration, and seven years into development was such a dysfunctional mess that USCIS was forced to scrap it and start again.

The development of gargantuan technical systems often takes much longer than anyone expects and involves multiple types of failure. In 2011, the UK was forced to kill a £4.6 billion system that had been in development for nine years, meant to streamline the National Health System's record keeping.[3] In 2019, after nine years of work and at a cost of $2.2 billion, the Canadian federal payroll system's migration to a new platform failed so spectacularly that thousands of Canadians went without pay for weeks.[4]

In government, technical failure often doesn't result in prohibiting the companies responsible from bidding on or landing future contracts. After the failed rollout of a system for public assistance built by Deloitte, the state of Rhode Island renewed the company's contract.[5] Of course, big tech failures happen in the private sector too—Boeing's disastrous development of the 737 Max is a recent, deadly example. But perhaps most crucially, unlike in the public sector, these failures typically don't put people's lives at risk (which is what drew so much attention to the Boeing failure). If Instagram goes down for a week, the rent still gets paid (unless you are an influencer who relies on Instagram for your livelihood), dinner still makes its way to the table, food and prescription drugs are still safe to consume, streets continue to be repaired, electricity still reaches your house, and so on.

The challenges ELIS faced only came to President Barack Obama's attention when the lack of a functional system threatened to interfere with the implementation of his executive actions on immigration. The new policies, which included Deferred Action for Parents of Americans (DAPA)—a policy that would have granted work permits and protection from deportation for illegal immigrants whose children were U.S. citizens or green card holders—meant that USCIS would be processing an additional four million people in a system that at capacity could likely process only seven million a year.[6] Obviously that was not going to work.

President Obama had already seen what happened when a policy his administration was intent on implementing ran afoul of technology with the launch of the Affordable Care Act (aka Obamacare). That launch had been devastating for government workers and citizens alike, as the site crashed under the user load, and failed time and again as users tried to shop for health insurance plans. Obama was not going to take the same risk this time around, so to ensure that ELIS would be able to handle the additional load, he dispatched a small technical team to take a look at what would need to happen at USCIS as they prepared to launch DAPA. (Welcome to a book full of stories about government, where there will be overabundant use of acronyms.)

Enter an Engineer

When software engineer Brian Lefler arrived at the bland USCIS office building a few blocks from Washington, D.C.'s Union Station, his expectation was that he would be writing code. He'd taken a leave of absence from his job at Google after hearing a pitch on how he could use his skills to help his country by Mikey Dickerson, who had been involved in the Healthcare.gov rescue and was in the process of recruiting people for the United States Digital Service (USDS). That sounded like an interesting opportunity, so he joined USDS, a cadre of experienced designers, engineers, researchers, and product managers embedded throughout the federal government. But after just a few days at USCIS, he discovered that a lack of quality code was not ELIS's problem.

The office was filled with software engineers who were more than capable of doing technical work. But the engineers were staffed through contracting agencies, so they were not USCIS employees and therefore didn't have anyone on the government side who could push them on the technical details. The federal career staff at USCIS were used to overseeing a paper-based process, but most were not experienced technologists. Although they were intimately familiar with the business processes and the legal and policy requirements, they lacked the skills and knowledge required to directly manage the development of a complex technical system. Without seasoned technologists on the federal team, questions about how to allocate engineers to tasks, prioritization of those tasks, and how system features should be implemented were inexpertly answered. Contracted engineers who needed these questions answered to move forward found themselves stuck.

Also missing was an incentive structure for contractors that led to speedy, solid development practices. Instead, contractors were beholden to corporate practices that had evolved over years of government bringing in contractors to build systems instead of investing in the capacity to do this in-house. As a result, the vast majority of government projects that require technical expertise are handled by private companies. And many companies, eager to lock these lucrative contracts in place for as long as possible, try to build in naturally recurring needs for their skills.[7] Because there was no one on the USCIS side who could push back on ELIS from a technical perspective in the project's early days, the contractor—IBM—had seized an undue amount of control over the design of the system. The contractor had designed ELIS so that it relied heavily on IBM products, even when those products did not benefit the processing speed or help people to use the system.[8]

"ELIS 1 was built to generate software licenses and sustain them in perpetuity, first and foremost. Then secondly to serve the agency's needs," observed Lefler. "It didn't work. ELIS 1 was unquestionably worse than paper, and it was ultimately turned down."[9] When ELIS 1 was released, USCIS discovered that it slowed down the processing of immigration forms by a multiple of five.[10] You read that correctly. The digital system took five times as long as paper to move applicants through.

When Lefler and a handful of others recruited by Dickerson's pitch sat down at USCIS, ELIS 1 had already been scrapped, and work on ELIS 2 had begun. This was in large part thanks to the arrival of Mark Schwartz, who had been hired in 2012 into the chief information officer (CIO) role at USCIS from the private sector.

"I was looking around for what might be the next thing. At some point I was reading an article about how screwed up government IT was, and being the arrogant person that I am I thought, *Well, I'll just go fix it,*" Schwartz remembers.[11]

Schwartz recognized the problem with IBM's efforts to build ELIS as "what usually happens with a monolithic waterfall project" and worked to extricate USCIS from the contract. "Waterfall" is an older methodology for building technology products, in which teams might spend years building a massive system and then release the whole thing with the flick of a switch, or what is referred to as "big bang." Schwartz was experienced with a methodology known as "agile," which has largely replaced waterfall as the go-to process for building technology. Agile allows teams to rapidly research, build, and test small portions of a system, adding on as they go, so that products can be released and improved upon quickly, rather than engineers spending years building one ginormous system. In line with modern thinking, Schwartz had begun to shift USCIS into an agile process. But moving an organization into a methodology that was largely new to them, on a project that they had been engaged in for years, was a bit like trying to turn a battleship loaded with elephants.

A lack of support from qualified staff made it especially difficult to change much of anything, says Eric Hysen, a product manager on the USDS team. "There was finally a realization that the old way wasn't working, and there were some champions, but they didn't have anyone to support them," he explains. "You had Mark [Schwartz] shouting words like *agile* and *cloud* and *dev ops,* and his staff were struggling to figure out what those meant and trying to adapt contracts accordingly."[12] It's not that USCIS staff didn't want to support the project, but they didn't know how. They were missing the context and skills needed to undertake a successful project using a methodology that was foreign to them.

Not only were the USCIS staff and contractors scrambling to adjust to a new way of doing work, but the federal government itself continued to evaluate the project's progress as though it were using a traditional approach rather than trying something new. The evaluations didn't go very well. The reports from the Office of the Inspector General (an independent oversight body housed in each federal agency that ensures that agency work is efficient, effective, and lawful) on ELIS grew increasingly alarmist and combative as time passed and no massive system was launched. The reports dismissed the switch to agile, and continued to question why the entire system wasn't being built in one mammoth effort.[13]

"It was like peeling back the layers of a hundred-layer onion, where every time there's something that cements doing things in a way that was so out of date I'd heard about it in college, learning about the old days of computing," Hysen said. "These were not even things that I did earlier in my career."[14]

The shift from waterfall to agile was as monumental and confusing as if the office had been using pneumatic tubes to send communications, and someone had walked into the building with e-mail.

Digital Is Not Always Better

Part of ELIS's problem was that the development timeline had stretched so long that the way technology was built shifted over the course of the project. In 2005, while a waterfall approach might have been considered slightly outdated, it wouldn't have been ludicrous to employ. But by 2014, when Lefler, Hysen, and others joined the team, waterfall was a pneumatic tube. Even more problematic: while ELIS 1 was in large part doomed by the fact that there was no one on staff to help move the team over to agile, ELIS 2 faced an even bigger problem in the agency's assumption that digital would unquestionably be better than paper.

This was taken as an article of faith, and it turned out to be disastrously wrong.

In some cases, based purely on the task someone was looking to complete, paper was superior to digital. Lefler sounded a bit awestruck as he recounted watching immigration officers work their way through immense case files, searching specifically for aliases that an applicant might have used. Some applicants use multiple names for cultural reasons, so this is an issue that comes up quite a bit, but immigration officers have developed a simple system for resolving it. As Lefler explains:

> They will put a little thing on their thumbs so that they can rifle through a giant pack of documents very quickly. The operator has memorized anything that is a government-looking document, that might have a name on it. As they see a document at a glance that's probably going to have a name on it, they'll check the name and then they'll continue rifling through it. They go through giant stacks of paper extremely fast. There was no way to implement that electronically, short of five years of machine learning and OCR [optical character recognition] technology. It cannot be done.[15]

A common mistake people make when trying to improve or modernize something is believing that digital will always be better. But digitizing a broken paper process doesn't make it better. Sometimes it makes it worse. In the case of ELIS, the team looked at their job as one where they took what was on a form, digitized it, and called it done. They did not factor in the colossal amount of filing, categorizing, and handwritten note making that the people processing forms did on a daily basis. They didn't think about how digitization would impact the people who used the forms and how they used them. USCIS employees worked with these forms every day. They marked them up with notes and flagged ones that needed additional work, or put sticky notes on forms that required interviews, or placed the ones that needed a supervisor to take a look on a special shelf in the office. In digitizing only the forms, ELIS accounted for a small percentage of the work required to move immigration forms from start to finish. Without the remaining pieces, the forms simply couldn't move.

"Digital was not better than paper because the system assumed a process that was different from how adjudicators actually did the work," explains Vivian Graubard, a founding member of USDS. "These files were huge but also they often had to flip back and forth between pages. So it was faster for adjudicators to print out the entire application and review that way than to review on screen."[16]

Dana Chisnell, a user experience designer and researcher who was also part of the USDS team, describes what she found when she arrived onsite. "They'd paid no attention whatsoever to the usability of the system, and there was no vocabulary to paying attention to the needs of users."[17]

In other words, in designing the system no one had thought that interviewing the front line government workers who would be using the system was important to determining how ELIS should function. The ELIS team had thoroughly documented business processes and data flows, but none of the developers really understood how immigration officers did their jobs. The team did have subject matter experts (SMEs) advising them, but in many cases these SMEs hadn't been in the field in a long time.[18] They also rotated out every few months, so people got different information based on which SME they worked with. Along with Mollie Ruskin, another USDS designer on the project, Chisnell took a trip to a service center in Nebraska to get a better handle on what people in the field did with the paper forms. The people in the service center seemed thrilled to see Chisnell and Ruskin. No one from headquarters had ever asked how they did their work.

But after the designers returned from their trip out to the service center full of new information, HQ saw the value of visiting service centers and began regularly sending teams. Chisnell also suggested to the leadership on ELIS that it would be helpful for programmers on the project to see firsthand how immigration officers worked. The first group came back excited to implement their new findings. Once they got to work, they were able to build functionality faster and more accurately, now that they had a better understanding of what people out in the field needed to do in their jobs. The team ended up creating a schedule to get everyone out for a field visit.

But even with all the improvements made by both the USCIS team and USDS, ELIS 2 dragged along in a semi-usable state for years. By 2016, after the system had been rolled out for additional forms, immigration officers were using ELIS grudgingly and with a fair amount of seething hatred. One field office made a video of themselves kicking a computer with “ELIS” taped to it on paper.[19]

In addition to the bad feelings, immigration officers had developed a series of work-arounds to make ELIS usable. Their offices were often filled with stacks of files in varying locations to make up for the lack of a filing system in ELIS. The system was slow and prone to outages. For a period of time in 2016 one of the most-used forms was taken offline while a team worked on stabilizing it. Basements staffed with contractors tasked with clicking a single button or unsticking cases that were caught up accidentally due to a faulty ELIS algorithm were filled to overflowing in Arlington, Virginia, costing USCIS uncounted stacks of dollars a day.

One employee at a processing center noted that a large portion of her day was occupied by undoing what ELIS had automated for her. “I spend three and a half hours every morning un-assigning the cases that don’t have evidence and going through the ones that do,” she told researchers in September 2016.[20]

Unclear Goals

In attempting to digitize the immigration process, USCIS had taken on a massively complex analog system. Immigration officers dealt with about a hundred different forms, each requiring its own process. Those forms were shipped across the country from storage spaces to field offices and service centers in order to serve millions of applicants every year. Adding to the complexity, Mark Schwartz says, USCIS wasn't entirely sure *why* they were going digital, beyond the vague notion that things would be better on a computer. Without hard metrics guiding their goals, the ELIS team never knew whether they'd been successful.

"They had the idea that they needed to get off paper, but they had all sorts of expectations about why—what they would accomplish by getting off of paper—and it wasn't clear what the priorities were or how they were going to actually link getting off of paper to accomplishing those particular benefits," Schwartz says.[21]

The director of USCIS, Léon Rodriguez, struggled to keep abreast of the massive technology project running off the rails that had been deposited at his feet after his confirmation hearing in 2014. Rodriguez had worked in government for decades, but he'd never before encountered a technology project that was "going off a cliff," commenting that "the level of problems that we kept having with ELIS was unprecedented in the face of all my prior experiences. Even in county government I had never seen the kinds of repeated problems, almost to the day that I walked out the door, that we had with ELIS."[22]

Rodriguez was an expert in policy and law, but technology had not been a big part of his management concerns in prior posts. ELIS was the first time he'd heard the term "agile." Reflecting on what could have been done to help get his arms around the responsibility of righting a technology project gone wrong, Rodriguez says he wishes he could have had something like a technology translator to lay out significant issues in nontechnical terms—a dedicated senior person to be his ELIS liaison, in the way government officials often have policy liaisons. But there was no one at USCIS to play that role, and because it is only relatively recently that technology has become the common medium for policy delivery, it isn't a role that normally exists.

According to Rodriguez, "You [need to] have somebody at a very senior management level who understands what's going on with the technology development and can translate it for you. In retrospect, I would have wanted to have somebody around who was consistently available, watching what was going on with those issues."[23]

The gap that Rodriguez identifies is one that many public sector organizations struggle with as technology plays an ever-increasing role in how the world conducts business—how to oversee a technology project if you have never done so before and lack technical knowledge. Rodriguez's suggestion that agencies establish a technology translator–type role would certainly solve this problem, and it is an idea we have brought before Congress.[24] In practice, this would be an executive-level role whose sole purpose is to keep tabs on any large, mission-critical technical projects within an agency. This means that any agency running a vital project that involves a technical build should ensure that there is someone on staff with a technical background—this doesn't need to be someone who can write code, but a person who has experience launching products and systems—who can think strategically about technology as it relates to policy and problem solving.

Relying on Old Processes in a Rapidly Changing World

We are not sharing the story of ELIS because it is unique. It's not that the staff heading USCIS were inept. The employees and contractors were good at what they did. And the process ELIS was trying to digitize was byzantine, but not unduly so. Many a government agency or big organization has been shaken by attempts to keep up with the times by launching a tech project, only to have the project lead them to the pit of despair. We chose to begin with the story of ELIS because it illustrates the varied reasons big government IT projects fail. Technology is viewed as a way to fix a policy or process that is broken. An agency fails to understand the underlying issues slowing down a process, or even what the agency's core goals are in building a new system. Staff and leadership often lack the technical know-how required to make decisions about modern projects. And so many more.

One of the challenges facing governments—one that ELIS ran headlong into and hit like a cement wall—is that government processes are old. Companies in the private sector evolve or die. Government and other civil society institutions, from the Red Cross to the United Way, don't have that option. They have to work—lives depend on them. The system ELIS attempted to digitize was built for a different time, when work involved paper and mail and stamps. In 2018, USCIS processed over 750,000 applications from immigrants seeking to become U.S. citizens—only one of the many processes ELIS attempted to digitize.[25] Comparatively, between 1892 and 1954, Ellis Island—the first federal immigration processing center in the nation—processed an average of 10,000 people a day, a number that included *all* foreign arrivals into New York, not only those seeking citizenship.[26]

These changes are not limited to immigration. Nearly every dimension of life has seen dramatic transformation over the past fifty years. The complexity, scale, and speed of everything from profit-making to computer processing have increased.

In the past decade, smartphones have turned millions of individuals into publishers of their own videos, audios, and texts. No longer do governments, powerful media companies, and private presses have exclusive rights to edit and control information. There used to be a printing press in every town. Today anyone with a cell phone can be a publisher. In *The Zero Marginal Cost Society*, Jeremy Rifkin estimated that today nearly a third of Earth's inhabitants are publishers.[27]

Schools and academies were once restricted to physical buildings populated by the teachers who were available in any given town or city. Today, hundreds of millions of students from across the globe learn in virtual classrooms, challenging the role and norms of educational institutions. In response to the global COVID-19 pandemic, school closings catapulted many educators and schools into online learning platforms. While these online universities and shifting remote classrooms are far from utopian, technology has changed and is likely to continue to change how education is delivered.

Not only has nearly every aspect of our lives been upended, but the world we live in today is faster, bigger, and more connected than at any other time in history. In 1965, Gordon Moore, one of the founders of Intel, wrote an article observing the complexity and speed of microprocessing development, and predicting that the number of transistors incorporated in a microchip will double every eighteen months. Remarkably, Moore's law, as this axiom has become known, has continued to bear out for over fifty years. Memory chips today store approximately two billion times as much as they did when Moore made his prediction.

There are nearly eight billion people on planet Earth today, with over twenty-eight megacities of more than ten million people.[28] The public sector now serves nearly forty-three times the population it did at the turn of the twentieth century.[29] Writing in the *New Yorker*, Evan Osnos eloquently captured the sheer number of connected humans worldwide: "If Facebook were a country, it would have the largest population on Earth. More than 2.2 billion people, about a third of humanity, log in at least once a month."[30] Put differently, Facebook has as many adherents as Christianity.[31]

Technology has enabled an unprecedented scale of connection, action, and profit for the companies driving the U.S. economy. It used to take on average twenty years for a Fortune 500 company to become a billion-dollar business. Google did it in eight years. Facebook did it in five. Tesla did it in four. Uber did it in two and a half. The speed of growth and the financial size of these companies are unlike anything the world has seen before.[32]

In 1945, when the government undertook a major improvement effort to speed the delivery of mail from the United States to theaters of war in Europe, ordinary letters could take between twelve and twenty-three days to arrive.[33] Contrasted with the speed of communication today, when our inboxes overflow with e-mails and people find themselves simultaneously talking to coworkers across the globe on Slack, gchat, and Zoom, waiting two to three weeks for a letter seems practically comatose.

Governments and large institutions of all kinds are at a strategic disadvantage in a world where speed rules. Changing a policy, moving a bill, and appropriating funds have a speed and process all their own—one that has been largely unchanged for over a hundred years. When large institutions like government and technology collide, they often don't play nicely together. ELIS and many other government technology projects are built in multiyear government contracts with details baked into the fine print up front, while the pace of technology changes on a quarterly basis.

The U.S. government as we know it today is largely the result of massive federal expansions in the 1930s and the 1960s.[34] Imagine running an institution developed nearly 100 years ago in today's hyper-connected, fast-paced, constantly changing world. That is the fundamental challenge for the federal government.

Governments are not the only organizations enmeshed in the struggle to keep up. Nonprofits, universities, and large institutions like the United Nations or the World Health Organization face similar challenges. So does the private sector. Very few companies that were driving the economy at the turn of the twentieth century are leading the economy today. Of the Fortune 500 companies that made the list in 1955, only 20 percent are on the list today.[35] Kodak, for example, launched in 1888. For over 100 years, the company was the dominant household name in cameras. In the 1970s, Kodak sold 85 percent of film cameras and 90 percent of all film in the United States. They also invented the digital camera, but company executives didn't think it would take off, arguing that "no one would ever want to look at their pictures on a television set." In 2012, Kodak filed for bankruptcy.[36]

Failure Is Not an Option, but Change Is Hard

Governments and public institutions don't have the prerogative to fail. Social Security is not going to be disrupted by an app called OldCash. People are not going to stop getting driver's licenses because the line at the DMV is too long. Governments and nonprofits must adapt to the modern world and find a way to deliver for the public. The U.S. government has been in service for hundreds of years with a similar structure. There is no competitor. There is no replacement.

Even more pressing, failure is not an option for the millions of people who rely on government for security, health, and safety. Sadly, as of this writing, in the United States we are seeing exactly what happens when government removes itself from the conversation. People who need access to food go hungry. People who need financial assistance and don't receive it get evicted. And in a public health crisis, a smattering of cases grows into a global pandemic, shuts down the economy, and leaves citizens sparring over the best way forward.

But if change is hard in the private sector, it is Sisyphean in government. In many parts of the private sector, a CEO can simply decide that a company will do something new. If the government wants to adapt its hiring practices to include higher salaries or modern benefits, it requires an act of Congress. This is true across developed democracies the world over. This feature alone makes keeping up with the speed of transformation a true challenge.

While technology is a driving factor in the transformation taking place, solving the intricately tangled problems of the modern age will require more than relying on an app or any single technology. It will require cultural shifts and new learning, skills, and tools. And though there is much to learn from the most cutting-edge practices in business, the work of meeting the world's challenges—tackling hunger, the climate crisis, inequality—is more complex than meeting those faced by the business world. Government and nonprofits cannot import techniques wholesale from the private sector without adapting them.

Up to Speed

Today, after many years of work, ELIS is functional. As of this writing, there are eight forms that can be processed through the system, which account for the majority of forms that come into USCIS.[37] In 2019 USCIS hired its first director of user experience, Michael Land, who made the switch from being a part of the USDS team to badge-carrying USCIS employee. Land is working toward incorporating research and design into the ELIS development process and bringing a consistent approach across the multiple contractor teams working on the project. IBM is no longer one of those teams. Some of the contractor teams consistently build prototypes (barebones working versions of the intended new functionality) and test them with users, then adjust their designs based on what they've learned. Some don't. Teams are still rated based on how fast they work rather than how well their product works.

"Change is very slow in government," says Land. "But we are moving in the right direction."[38]

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