Administrative Conference of the United States

Implementation and Use of Electronic Case Management Systems in Federal Agency Adjudication

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I. Abstract

Many agencies with an adjudication function face similar operational challenges including high volume caseloads, intensive paper usage, high human resource requirements, an inability to capture useful data for quality assurance, and high numbers of pending cases. Electronic case management systems (eCMS) can help agencies meet statutory requirements, reduce costs, expand public access, and improve both efficiency and accuracy.

Considering, planning, transitioning into, or improving an existing case management system requires careful and rigorous preparation. It is important to have a clear understanding of what an electronic case management system is, what it will provide, and how to prepare the organization for the cultural and institutional changes required for its successful implementation.

This case study describes the ideas and technologies that have enabled the creation of electronic management systems. It also presents some of the best practices of six federal adjudication agencies and offers recommendations based on the practices of these agencies.

II. Acknowledgements

The authors would like to thank the Office of Medicare Hearings and Appeals (OMHA), the Social Security Administration Appeals Council (SSA), the Board of Veterans Appeals (BVA), the Federal Trade Commission (FTC), the Federal Mine Safety and Health Review Commission (FMSHRC), and the Occupational Safety and Health Review Commission

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(OSHRC) for their time and considerate participation in this study. The authors would also like to thank the Administrative Conference of the United States (ACUS) for its vision to study the practices of creating an eCMS to further the goals of federal agencies.

III. Introduction

The Administrative Conference of the United States (ACUS) commissioned a study to examine the implementation and use of electronic case management systems (eCMS) in federal agency adjudication. The purposes of the study were to (1) examine the factors agencies should consider to optimize the use of electronic case management in furthering agencies' goals; and (2) share best practices to improve the process of converting to and maintaining electronic case management. This study also seeks to identify the challenges and opportunities presented by the adoption of an eCMS, gauge the state of such systems in several federal adjudicative programs, and identify factors that contributed to the success of those systems. The authors hope the lessons will be of value to the 520 hearings and appeals bodies across the federal government involved in some type of adjudication, including the 26 that employ Administrative Law Judges.[3]

Six agencies were contacted for this study:

- the Federal Trade Commission (FTC)
- the Board of Veterans Appeals (BVA)
- the Social Security Administration (SSA)
- the Federal Mine Safety and Health Review Commission (FMSHRC)
- the Occupational Safety and Health Review Commission (OSHRC)
- the Office of Medicare Hearings and Appeals (OMHA)

This report also draws information from the National Center for State Courts.[4] It shares powerful insights gained from its experiences planning, using, and continuously improving

[3] See "Types of Hearings and Appeals," a joint project of ACUS and Stanford Law School at: https://acus.law.stanford.edu/reports/types-of-hearings. As of March 2017, the Office of Personnel Management reported 1,931 ALJs employed by 27 agencies. See "Administrative Law Judges: ALJs by Agency" at https://www.opm.gov/services-for-agencies/administrative-law-judges/#url=ALJs-by-Agency.

[4] Since its founding in 1971, NCSC has worked to improve the administration of Justice through leadership and service to courts and their justice partners. NCSC is a recognized leader in helping courts improve their

eCMS systems. It also stresses the need for evaluating and improving the adjudicatory process to make the best use of an eCMS.

IV. Electronic Case Management

A. What Is Electronic Case Management?

One view of electronic case management is that it is simply an electronic version of the paper case management process. In this narrow interpretation, technology is used to replicate the paper process. However, true electronic case management is much more. It is a coherent institutional effort to align adjudication processes, technology, and subject matter expertise towards improving case management and making adjudication services more efficient and effective. A realistic view of eCMS is that it is part of a broader continuous improvement process incorporating electronic records, filings, and case management information.

Both public and private entities utilize case management systems. Hospitals, law firms, schools, human services agencies, and other organizations use case management systems to handle interactions with their clients from intake through processing and resolution. They must house, maintain, and transport these records while they are active, and are often obligated to maintain them after activities related to the records have ended.[5]

With respect to active records, every federal agency involved in adjudication must have a case management system to track movement of the records while they are being processed. In addition to maintaining an accurate record of the evidence presented in conjunction with those proceedings, agencies typically maintain specific information related to the cases processed, including when they were received, how long they remained pending, when they were finally

operations through technology and business practice changes. The NCSC has assisted numerous courts with case management systems acquisition, procurement, and implementation. Beyond that, NCSC has helped define the standard capabilities that court technology vendors are expected to provide and served as a national think tank, identifying and sharing best practices in case management technology.

[5] Agencies originally were responsible for maintaining and storing their own active and closed records, but in 1934 Congress established the National Archives as a centralized federal record keeper for closed records. The Federal Records Act of 1950 established that all federal records were to be kept indefinitely unless they either are of a temporary nature or have been approved by the renamed National Archives and Records Administration (NARA) for destruction. See https://www.archives.gov/about/history/timeline.html#event-/timeline/item/congress-passes-the-federal-records-act-of-1950. NARA and other agencies publish federal records-retention schedules in the Federal Register defining legally compliant record-keeping requirements.

adjudicated, the ultimate outcome of the adjudication, and other relevant information about agency transactions occurring while matters were pending. They also typically maintain information about which employees are involved in the processing of each case. In the past, agencies generally maintained case records and other information in paper format in filing cabinets. Maintaining paper records was costly in terms of storage space, mailing fees, and salaries for the large numbers of people required to store, track, and retrieve the records. Additionally, records, documents, and audio recordings of administrative proceedings were occasionally misfiled, misplaced, or misrouted, causing delays in processing and requiring the reconstruction of records or sometimes re-adjudication of issues. Federal agencies historically have been leaders in developing and adopting technologies to improve workload management. A well-designed eCMS can improve case-flow, information accessibility, information sharing, data capture and data analysis. It can help reduce processing time, reduce overhead costs and improve customer interactions.

An electronic case management system in the context of administrative adjudication or court actions "implicates the use of technology in three components, only the first of which is particularly evident to the outside world:

(1) electronic filing (the external component of technology in appellate courts);
(2) electronic case management and processing (the internal, often staff-based or clerk-of-court-based component); and
(3) electronic case analysis and resolution (the internal, judge-based component)."[6]

Electronic filing encompasses a range of activities related to how the agency interacts and conducts its business with people outside the agency. It can include the electronic filing of the initial claim or complaint; the electronic submission of evidence, briefs and other documents; and the electronic scheduling of hearings or other proceedings. Typically, the agency will develop a portal providing access for members of the public to submit information or view records. The portal, most often a link from the agency's Internet site, commonly would contain

[6] Performance-Focused Technology, "Prospects and Problems Associated with Technological Change in Appellate Courts: Envisioning the Appeal of the Future," Eric J. Magnuson and Samuel A. Thumma, 15 Journal of Appellate Practice and Process, Spring 2014, William H. Bowen School of Law, University of Arkansas at Little Rock.

instructions for filing or submitting claims, appeals, or other forms. It also might provide access to records and other helpful information. Electronic forms can be designed to pre-populate information already known to the agency, and the agency may provide electronic avatars programmed to answer common questions about the process and guide users through the questions contained on the forms. For security purposes, the portals generally should require authentication by the user before granting access to electronic folders.

Electronic case management generally refers to the internal agency maintenance of information pertaining to the case or claim while it is pending agency action. This concept encompasses the collection of data pertaining to the handling of the case by all employees while it is pending with the agency, as well as the electronic maintenance and security of records held by the agency. The system should be designed to provide appropriate levels of access to varying levels of employees and should capture information about each effort to access the electronic folder, each action taken with respect thereto, and each output generated and sent to another person, particularly to members of the public. A robust eCMS can provide a wealth of information useful to improve the overall management and performance of the operation.

Electronic case analysis includes electronic tools, algorithms, document generating systems and other efforts designed to facilitate the production of an analysis of the issues and evidence, including production of a final case or claim decision or other resolution up to and including the affixation of electronic signatures to the documents generated. Analysis tools can help guide adjudicators through a policy compliant analysis as they make their findings and conclusions, and the analysis tools can be linked to document generating systems highlighting where rationale in support of conclusions is needed. Natural language processing and machine learning algorithms can be developed to help check the quality of work, and eventually deep learning algorithms may be able to process some claims to final resolution.

B. Legal Impetus for the Creation of an eCMS

Well-designed electronic case management systems can help an agency comply with key federal legislation in the areas of paperwork reduction, improving agency efficiency, expanding public access to records, and technology management. There are several statutes that are particularly germane to creating an eCMS.

One such statute is the **Government Performance and Results Act** (GPRA - P.L. 103-62) which requires agencies to eliminate "waste and inefficiency," to "improve internal management," and to identify "key factors...that could significantly affect the achievement of general goals and objectives." Although GPRA does not specifically address electronic case management, one way to improve internal management of an agency is to have clear and abundant data about how the agency is performing. An eCMS can be a significant asset in furtherance of this goal because it captures a wide array of data that can be analyzed to identify opportunities to improve operational management. An eCMS also can improve the efficient handling and movement of information and claim files while reducing mailing and storage costs.

Another pertinent statute is the **Government Paperwork Elimination Act** (Pub. L. No. 105-277) which requires that, when practicable, Federal agencies use electronic forms, electronic filing, and electronic signatures to conduct official business with the public. If an agency is unable to comply with this act, it must justify to OMB why information cannot be filed electronically. The statute also requires agencies to have procedures in place to ensure the authenticity of electronic signatures such as using PIN numbers any time a document is being accepted that may impact a legal right. This act provides a direct motivation for implementing an eCMS and developing a portal into the eCMS for public access. This statute also requires federal agencies to develop appropriate authentication policies to ensure that improper access is not granted to individuals using the information housed in the eCMS. Compliance with this statute helps agencies reduce staff needed for taking claims and appeals, saves money on paper use, and helps safeguard the information in the eCMS.

The **E-Government Act of 2002** (Pub. L. 107-347) extends the requirements of the Government Paperwork Elimination Act by directing the "promotion of electronic government services and processes" through the establishment of "a framework of measures that require using Internet-based information technology to improve citizen access to government information and services." The specific mention of Internet-based information technology provides a further reason for agencies to develop external facing portals that provide members of the public the opportunity to conduct business by submitting comments, appeals, evidence, or other information electronically to federal agencies over the Internet. The E-Government Act of 2002 tasked the National Institute of Standards and Technology to develop guidelines and

standards to be used by all federal agencies that include minimum information security requirements for information and information systems. According to the Federal Information Processing Standards Publication 200, Title III of the E-Government Act, known as the Federal Information Security Management Act (FISMA), "emphasizes the need for each federal agency to develop, document, and implement an enterprise-wide program to provide information security for the information and information systems that support the operations and assets of the agency including those provided or managed by another agency, contractor, or other source."[7]

V. Designing an eCMS

A. Defining the Features of the eCMS

In every adjudication system, cases, evidence, briefs and other case-related information are received and entered into an administrative record. That record also captures and maintains general information about the case, such as the parties and representatives, as well as agency actions taken with respect to the case. Usually, some type of filing is made by a party to the proceeding, information and evidence is gathered, and a determination or decision of some type is issued. Typically, cases move from one employee to another, and each employee performs a set of tasks related to the case. When one employee completes a task, the case may move to another employee who performs additional tasks, and so on, until the final notice of disposition is issued. The case may then be moved to another component to effectuate the decision, process an appeal, or to store the records. Typically, an agency attempts to capture information about the timeliness of actions, track the movement of cases through the business process, and gather information related to staff productivity and work quality. A robust eCMS enables all of these tasks to be performed electronically.

Despite the efficiencies that may be gained from a fully functional eCMS, the decision to build one must be cautiously contemplated. It likely is not practical, cost efficient, or necessary for every agency to include every type of functionality in its eCMS, and in some cases, to create an eCMS at all. In planning the scope and capabilities of an eCMS, each agency should weigh the needs of the organization and potential benefits of the planned functions of an eCMS against

[7] See the Federal Information Processing Standards Publications 200, published by the National Institute of Standards and Technology. Retrieved from https://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.200.pdf.

the costs associated with building those functions into an eCMS. For some agencies, production, maintenance and security costs may outweigh the advantages of an eCMS. For other agencies such as SSA, which already have robust security controls at the enterprise, additional security costs are minimal as only a limited number of security controls are implemented at the application level. The calculation will vary from agency to agency but will ensure that the eCMS developed adds value to the agency.

It should be noted that the presence of an eCMS does not automatically eliminate the need for paper. For example, some court jurisdictions still require submission of paper copies of the official record, which the agency may need to produce. Thus, adjudication agencies and courts with an eCMS may operate within the constraints of a combined paper/electronic case processing environment.

Creating a flow chart of an agency's business process is a good approach for identifying the business needs for an eCMS. Carefully delineating the tasks performed by employees at each step in the process helps ensure the eCMS captures all of the activities that occur while the case is pending, from initial filing to final resolution. Agencies should also identify and delineate how members of the public or other non-agency users will access and interact with the eCMS. Caution should be taken to limit editing access to those who need such access, provide viewing access to other information in the eCMS as called for by business processes, and restrict access to individuals and external customers where required by law or as dictated by appropriate separation of duties.

Agencies may not be able to afford to incorporate automation of all of the functions they might like to include in their eCMS at the same time. SSA's Appeals Council, for example, began its pursuit of an eCMS in the late 1980s by creating macros in word-processing software for use in drafting administrative notices and actions as well as in electronic spreadsheets to develop a case tracking system.[8] In 2000, the Appeals Council began using bar coding technology to identify the location of paper cases on metal storage units and filing cabinets in a

[8] The first operational electronic spreadsheet may have been the Language for Program Arrays at Random, developed in 1969 by Renee Pardo and Remy Landau for Bell Labs. Dan Bricklin and Bob Franskston, students at Harvard and MIT at the time, developed VisiCalc for the Apple II personal computer in 1979, which was soon overtaken in popularity by Lotus 1-2-3. www.history-computer.com/ModernComputer/Software/Visicalc.html.

file storage facility called the Megasite.[9] Later still, after the agency developed electronic case folders, the Appeals Council developed the capacity to scan evidence into the electronic record, and rolled out that technology for use by claimants and their representatives. In 2008, the Appeals Council began using electronic case analysis tools,[10] and in 2017 began using an additional case analysis tool powered by natural language processing and machine learning algorithms that assists analysts and adjudicators in analyzing appealed hearing decisions. Despite these advances, however, claimants and representatives still cannot file appeals of hearing decisions to the Appeals Council electronically.

B. Software Development

Courts and administrative agencies have managed cases using paper for many years. The development and convergence of key technologies in telecommunications, the rapid advancement of computer processing power, and the improved accessibility of computer programming have made the shift to electronic case management quite compelling. But even though most administrators would agree paper is no longer a cost effective or practical way to manage cases, the paper paradigm remains difficult to break.

Planning, developing, maintaining, and continuously improving an effective eCMS is a multidisciplinary effort that generally requires involvement by subject-matter experts, computer scientists, and data-science experts. To fully benefit from a shift to an eCMS, agency leaders must focus on the information needed for case processing, not the format in which the information has traditionally been presented. Subject-matter experts, who, in adjudicative agencies likely will include judges, clerks, administrators, managers, and lawyers, can assist in identifying the most important information.

Because the cumulative information stored about the case will likely be used in other stages or in data analysis, the implications of errors and inefficiencies are magnified. Agency

[9] *See* Office of Appellate Operations, Soc. Sec. Admin., *Changing Times Bring End to Mega-Site Folder Storage*, OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, June 9, 2017, at 1, 3.

[10] *See* Office of Appellate Operations, Soc. Sec. Admin., *ARPS Took OAO into New Era*, OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Jan. 6, 2017, at page 3.

leaders also must be cognizant of some of the pitfalls of electronic media, and the challenges they will face in constructing and maintaining an eCMS.

Technology can be implemented internally with the right planning and resources, or it can be outsourced to a vendor. Either way, the institution or vendor should follow best practices for the selected technologies to avoid wasting money and squandering opportunities to improve efficiency.

Developing software requirements that best fit a particular business process is a crucial step in planning an agency's technology. Development of the software requirements originally tracked construction project development techniques, even adopting terms like architecture to describe the schema of the software construct; however, during the development of the Semi-Automatic Ground Environment (SAGE)[11] in 1956, Herbert D. Benington advanced a description of a new sequential process for software development that later became known as the Waterfall model.[12] The model calls for first capturing the product requirements - what the product is expected to do, how it is expected to operate, and in what ways users are expected to interface with the product. This is followed by an analysis of the business rules, the design of the schema for how the database powering the case management system will be constructed, and how the data residing in the database will inter-relate. The model also requires the documentation of the database structure; the development, coding and integration of the software; testing and debugging of the system; and finally, installation and migration of existing information into the system. Thereafter, maintenance and support must be available.

Other more modern approaches to software development include Rapid Application Development (RAD) and Agile Development. The RAD approach emphasizes adaptability and prototyping. Whereas Waterfall development begins with rigorously defined specifications prior to development, RAD begins only with basic requirements planning which is then adapted based on user feedback during prototype testing. System components can be reused in other processes,

[11] SAGE was the networked system for controlling and coordinating the North American Aerospace Defense Command (NORAD) response to any infringements of air sovereignty over North America.

[12] Herbert D. Benington, *Foreword: Production of Large Computer Programs* (1983), http://csse.usc.edu/TECHRPTS/1983/usccse83-501/usccse83-501.pdf.

saving time and money. Vendors that sell off-the-shelf-solutions sometimes offer component modification through RAD methodologies.

The concept of Agile Software Development was set forth in 2001 by a group of seventeen software developers including Alistair Cockburn, Jeff Sutherland, and Ken Schwaber.[13] They described guiding principles for developing software focused on direct collaboration with the customer in the planning and development of the software requirements, while flexibly embracing change as the software is developed.

Each agency should carefully consider which of these methodologies to pursue in developing software. Each of the models works best in certain specific circumstances. An assessment of the maturity of any existing eCMS can help an agency determine which methodology is best suited. For example, if an agency has no active eCMS, it also likely does not have end users of the proposed eCMS with sufficient knowledge to take full advantage of the streamlined opportunities of Agile Development. In that circumstance, the agency probably should spend the time to map its business processes and define the requirements using the Waterfall model. On the other hand, if an agency has a partially automated eCMS, it may wish to test further development using the RAD approach, and if the agency has sufficient users familiar with the functioning and requirements of an eCMS, it probably will want to use the Agile approach. SSA used the Waterfall model in developing its initial mainframe computer systems for tracking earnings information, used the RAD approach in testing the development of the electronic folder, and used Agile Development in building the eCMS at the Appeals Council.

An alternative to in-house software development is to contract for services. Many vendors have extensive experience developing inventory and case tracking systems that are used in a variety of industries and government. They also offer commercial off-the-shelf software (COTS) designed specifically to capture much of the information typically captured by an agency eCMS, including accepting filings, records and other documents electronically. Usually the COTS solutions are customizable to some degree, and agency subject matter experts can work with the vendor to customize the software to agency specifications.

[13] The developers published the *Principles behind the Agile Manifesto*, which can be found at: http://agilemanifesto.org/principles.html.

In a more sophisticated vein, several vendors offer machine learning and natural language processing solutions that could be used to review and translate documents. Specifically, they offer solutions that can classify text captured as data, identify named entities and understand the structure of language in context. To do this, they often use algorithms that compare the structured text data to large repositories of other information that can add context to the information extracted by the algorithms. However, this contextual information may not be sufficiently specific to agency adjudication to enable ready development of a decisional support systems that could, for example, read evidence and accurately apply agency policies to assist in decision making. Although rapid progress is being made in this arena, of the agencies contacted for this study, only SSA's Appeals Council has a decisional support tool of this type, and it was developed by in house experts familiar with computer programming, algorithms and techniques related to natural language processing and machine learning, and the application of agency policies in case adjudication.

C. Usability

The design and look of an eCMS is highly customizable. An important consideration in developing an eCMS is the usability of the system. Overly complex user-interface design reduces the effectiveness and efficiency of an eCMS, and can result in slow adoption by employees, while intuitive design can facilitate ease of use of these systems, spurring rapid adoption. This is true whether developing an interface with the eCMS for agency employees or members of the public. Typically, an eCMS should have a navigation bar to facilitate movement within the eCMS. For internal agency uses, a robust eCMS may link the case management system to the case analysis tools, the electronic record of the case, a variety of databases, policy sources, and document-generating systems. Other features helpful for employees and members of the public alike include radio buttons and drop-down menus that can facilitate the ease of use of these systems. Although efficient single-screen solutions can be developed, providing employees with multiple viewing screens may improve usability, particularly when the eCMS is used for document review, document generation, and database navigation.

In many agencies, multiple offices or even multiple components can be involved in the processing of cases. To facilitate sharing of information among these offices, agencies must

integrate the eCMS with existing systems and facilitate their interoperability to the extent feasible.

The Office of Medicare Hearings and Appeals (OMHA) case study, infra, provides a good example of a clearly coordinated effort to facilitate sharing of information among offices. OMHA interacts with multiple offices in the Department of Health and Human Services, and thus it was necessary for its ECAPE case management system to have the functionality to share information with other organizations' systems. OMHA identified these systems and mapped their interrelationship to ensure appropriate development of the interconnections. OMHA used Web-based service interfaces to exchange information with the Medicare Appeal System (MAS), an internal case management system for appeals. The resulting integration with MAS included an electronic docket. To lower costs, the system was also integrated with an existing HHS Access Management System to manage user access and user accounts for the ECAPE system. ECAPE also is connected to a vendor-operated scanning system to convert paper appeals to electronic records for intake into ECAPE.

One notable concern about the development of electronic case management systems in federal agencies is the lack of coordination among the agencies. An article published in the Journal of the National Association of Administrative Law Judiciary noted that:

> Recently, the U.S. Postal Service and the Federal Mine Safety Health and Review Commission conducted procurement on electronic case management and electronic filing systems. These contracts were awarded in 2014, and their implementation has begun, not surprisingly, with two different vendors and entirely different systems. While a centralized federal system that bridges the gaps between federal agencies is unlikely, individual agency approaches to these upgrades should be coordinated through a central executive branch information technology office. It is this lack of long-term planning that may lead to 26 separate systems for litigants to learn when practicing before federal administrative adjudicatory forums.[14]

Fortunately, most of the public does not need to use all of these separate systems, and many of the systems use similar graphical user interface (GUI) technologies so the look and feel of the various Web sites and access points may not be overly daunting.

[14] Administrative Adjudication in the United States, by the Honorable James G. Gilbert and the Honorable Robert S. Cohen, 37 J. Nat'l Ass'n Admin. L. Judiciary 222, Spring 2017, Copyright 2016 by the American Bar Association.

D. Preserving the Administrative Record

Courts and government agencies share many challenges with other users of case management systems, but they have unique challenges to implementing an eCMS. For example, it is vital that comprehensive and true records of the administrative proceedings and evidence are maintained. This is particularly important in cases for which the information cannot be easily reconstructed, or when additional action may be taken with respect to the records by an appellate body or an effectuating component, which might, for example, award benefit payments based on the decision issued. SSA implemented an electronic case system for keeping evidence that stored scanned images of documents in tagged image file format (TIFF) so the documents could not easily be changed. Adjudicators use a Document Management Architecture (DMA) viewer to see the information.

Efficiently organizing the information in an electronic case is a key to quick adoption of the eCMS technology and facilitates usability of the eCMS. It is helpful to standardize the indexing of information in the electronic files to facilitate ease of access to the information. SSA revised the way it organized medical, vocational, and other records about the disability cases by developing an indexed six-part "folder," which it tested with paper files before implementing the electronic version.

For appellate processes, it is possible to measure the completeness and accuracy of electronic case files if data is captured and maintained about the information associated with those files. Readily available case files that are complete and accurate are fundamental to the effectiveness and efficiency of adjudicative systems and essential to the fairness of judicial decisions. The integrity of case files affects not only the decision-making process, but also has a direct impact on organizational effectiveness.

VI. eCMS Accessibility and Security

A. Accessibility of the eCMS

Agencies are subject to statutory requirements pertinent to the maintenance, security, and disclosure of information, and these provisions must be considered carefully when developing an eCMS as part of the governance strategy for implementation.

The Privacy Act (5 U.S.C. 552a)[15] requires agencies to protect information about individuals. If the information collected is retrieved through an individual's name or other unique identifier, it is protected under this statute.

The Electronic Freedom of Information Act Amendments (5 U.S.C. 552(a)(2)(D))[16] require federal agencies to electronically provide information requested pursuant to the Freedom of Information Act (FOIA), if it is practical to do so. When records that have been released to any person are likely to become the subject of subsequent requests, an agency must make such records available by electronic means if the records were created on or after November 1, 1996.

While an eCMS makes access for individuals to their personal information easier, it makes unauthorized access and improper disclosure easier because many individual records are aggregated in one place. However, well-designed and implemented access controls provide a high level of assurance against unauthorized disclosure. Thus, agencies must establish well-considered privacy and access policies prior to implementing an eCMS or when significantly changing the online capabilities for the public.

The Federal Trade Commission (FTC) case study, infra, demonstrates how issues of privacy and confidentiality were considered early in the agency's eCMS design and implementation. The FTC began by analyzing and revising its Rules of Practice governing access to agency records. The FTC has very clear rules in its processes that all actors of the process know in order to keep information confidential and redact files when necessary before publishing. This includes protocols for providing restricted access to confidential information so that only the intended recipient has access to the required information. At the time of this study, the FTC had a redaction team that reads and redacts unstructured private or confidential information before making it public. The FTC is currently evaluating Natural Language Processing as a tool to help automate this process.

An eCMS can significantly help agencies track, manage, and timely comply with any requests for information based on FOIA. However, filings associated with administrative legal

[15] As amended by the FOIA Improvement Act of 2016 (Public Law No. 114-185).

[16] Enacted in 1996, as amended by the FOIA Improvement Act of 2016 (Public Law No. 114-185) amends the Freedom of Information Act, "FOIA", 5 U.S.C. § 552.

actions often contain confidential information. Agencies must have policies in place to identify this information and redact it from the original documents prior to dissemination.

B. The Threat of Malware

Agencies are mandated to protect their critical infrastructures, including their computer systems. The Critical Infrastructure Assurance Presidential Decision Directive 63 (PDD-63)[17] calls for a national-level effort to improve cyber security because the public and private sectors are increasingly reliant on internet-based infrastructure. PDD-63 requires every federal agency to be responsible for protecting its own critical infrastructures, including both cyber-based and physical assets. To fulfill this responsibility, PDD-63 called for agencies' chief information officer to be responsible for information assurance, and it requires every agency to appoint a chief infrastructure assurance officer to be responsible for the protection of all other aspects of an agency's critical infrastructure. Although an agency CIO should take the lead on general cybersecurity, agency leadership should emphasize the need for appropriate security reviews and design strategies for electronic case management systems.

Every eCMS is vulnerable to the risks of the infiltration of malware, and the hacking of sensitive information. One type of malware, the computer virus, was first postulated by Professor John von Neumann at Princeton University's Institute for Advanced Study, who surmised that computer programs could reproduce.[18] Although the first reported virus was produced by Frederick G. Stahl of Chesterfield, Missouri in 1959,[19] computer viruses rarely were unleashed on the general public, businesses, and governmental agencies prior to the proliferation of the personal computer, at which point viruses were mostly spread through removable media like floppy disks. The expansion of wide area networks and the widespread adoption of the internet in the mid-1990s led to macro viruses most commonly written in scripting languages and embedded in software applications that allow macro programs to run automatically when documents are

[17] See https://fas.org/irp/offdocs/pdd/pdd-63.htm.

[18] "Theory and Organization of Complicated Automata." https://www.scientificamerican.com/article/when-did-the-term-compute/.

[19] Dave Carlson, *Computer Virus History*, DynoTech (January 5, 1990), http://www.dynotech.com/articles/virushistory.shtml; also see *Colossus - The First Large Scale Electronic Computer*, by Jack Copeland, et alia. Retrieved from http://www.colossus-computer.com/colossus1.html.

opened. Anti-virus is one of many security software solutions employed to address potential issues with viruses and other malware.

As a defense to malware, most computer networks employ firewalls, first successfully developed commercially at Digital Equipment Corporation in 1988[20] and enhanced at AT&T Bell Laboratories[21] the following year, to filter traffic and block unwanted packets of information. Nonetheless, sophisticated malware known as "worms,"[22] which exploit vulnerabilities in operating systems and infect and damage networks rather than merely the computer that may access it, and denial-of-service attacks, which can suspend the functioning of networks, have been launched against a number of companies and websites. The denial-of-service attacks are specifically designed to overwhelm the memory used to store incoming packets of information while the system attempts to filter the packets by making an algorithmic judgment about whether to receive the packet.

C. Other Security Measures

It is also important measures such as encryption are used so that information held in an eCMS cannot be easily accessed or changed by wrong doers, sometimes known as black hat hackers.[23] Significant encryption advances have been met with more sophisticated efforts to defeat the encryption, all enabled by improved computational speeds.

A variety of network protocols have been developed that implement cryptography and encryption techniques to secure the information housed on the network, including Secure File Transfer Protocol (SFTP), Secure Hypertext Transfer Protocol (HTTPS) and Secure Socket Layer (SSL). Generally, these protocols ensure that the information can only be decrypted with a logic key, algorithm, or mathematical formula. Encryptions standards like the Data Encryption

[20] See *Xerox PARC Turns 40: Marking Four Decades of Tech Innovations* by T.R. Weiss at https://www.computerworld.com/article/2515846/computer-hardware/xerox-parc-turns-40-marking-four-decades-of-tech-innovations.html.

[21] Kenneth Ingham and Stephanie Forrest, *A History and Survey of Network Firewalls* (2012), http://www.cs.unm.edu/~treport/tr/02-12/firewall.pdf.

[22] Initial research on worms was conducted by John Shock at Xerox PARC during development of the Xerox Alto computer. See John Shoch, Jon Hupp, "The Worm" Programs – Early Experience with a Distributed Computation", *Communications of the ACM*, Volume 25, Number 3, March 1982, pp.172-180.

[23] The term hacker originally was applied to software experts. Over the years, some of these experts began using their skills to break into or tamper with the systems of unsuspecting people. These hackers became known as black hat hackers.

Standard (DES)[24] have been updated to Rijndahl, otherwise known as the Advanced Encryption Standard (AES),[25] but the arms race in encryption and de-encryption continues. Quantum cryptology is now seen as a potentially unbreakable type of encryption that may be adopted in the future.[26]

Much of the information obtained in the course of administrative adjudication and judicial proceedings must remain confidential, which raises additional problems that must be considered carefully as eCMS are developed and expanded. An important feature for many electronic case management systems is access for external customers to file claims or appeals, submit evidence, comments, or other information, and to view records. Additionally, it is common for many employees to be involved in processing administrative proceedings. To help ensure the security of the information contained in the eCMS, multiple access levels can be created based on the Personal Identity Number (PIN) or other unique identifier of the user to limit access for some users to only view records while permitting other users to input or edit information in the eCMS.

Providing direct access permissions to parties operating both within the agency and externally would create a risk that sensitive information may be improperly disclosed. Aside from the damage improper disclosure may do to the reputation of an agency, the improper release of sensitive information also may do long-term damage to the reputation or credit standing of the individuals whose information is disclosed. Thus, agencies typically do not allow outside users direct access to agency systems, but instead provide an access portal through a separate e-services infrastructure. In designing an eCMS, it is imperative that access be limited only to those who need to consider or review the information. Agencies must ensure that sensitive information is not inadvertently provided to unintended third-parties through unsecured wireless transmission, use of private email services, or non-encrypted use of wide area network connections.

[24] https://www.britannica.com/topic/Data-Encryption-Standard.
[25] http://nvlpubs.nist.gov/nistpubs/FIPS/NIST.FIPS.197.pdf.
[26] https://www.sciencedaily.com/releases/2017/11/171124142847.htm.

Another important safeguard is the use of multi-factor authentication, which grants access only to users who successfully provide two or more independent credentials (such as a security token, a PIN, a complex password, or biometric information[27]).[28] To the extent that individuals external to the agency have access to cases in which they are involved, it is important to ensure that information from other cases is electronically walled off from their view to reduce significantly, if not eliminate entirely, the potential public disclosure of protected information or other loss of data and information. Multi-factor authentication can greatly reduce the risk of unauthorized entry into the eCMS, but no access system is entirely foolproof.

Another promising technology is the block chain, popularly known as the technology behind crypto-currencies like Bitcoin. Many block chain applications use substitution or transposition ciphers with one or more cryptographic hash functions[29] that convert a group of characters to another set of characters of a specified length. Block chain acts as a secure distributed ledger technology with wide applicability because it maintains traceable records of every transaction.[30] This feature makes it potentially attractive as a security feature for maintaining the integrity of both business and agency transactional records.

VII. Constructing an eCMS in a Tight Budget Environment

A government-specific challenge to an eCMS project is the risk of an unexpected funding limitation. At times and with little warning, some government entities experience unexpected funding reductions. This risk specifically affects long-term projects. Agencies have an obligation to manage resources effectively and that includes resources invested in information technology (IT). The term "governance" describes the management structure to plan, manage, and oversee implementation of both budget and IT strategy. In setting out to build an eCMS, the governance strategy must recognize the possibility of future tight budgetary restrictions that may slow or

[27] Biometric technology addressing this issue includes retinal scans, as well as facial and fingerprint recognition algorithms.

[28] https://www.ffiec.gov/pdf/authentication_guidance.pdf.

[29] Bitcoin uses a cryptographic, or one-way, six hash hexadecimal algorithm originally developed by the National Institute of Standards known as Secure Hash Algorithm 2 (SHA-2). See https://www.entrust.com/sha-2-ssl/.

[30] "BlockChain Technology, Beyond Bitcoin" by Michael Crosy, Nachiappan, Pradhan Pattanayak, Sanjeev Verma and Vignesh Kalyanaraman, October 16, 2015 published by the Sutardja Center for Entreprenership and Technology, University of California at Berkeley, 2150 Shattuck Ave., 11th Floor, Berkeley, CA 94704; *available at* http://scet.berkeley.edu/wp-content/uploads/BlockchainPaper.pdf.

hamper future phases of construction of a long-term IT project like the development of an eCMS. Thus the strategy for eCMS development should be envisioned and implemented as a series of fully-functioning and independently sustainable phases. The completion of each of the phases should yield functionality that enhances business processes in meaningful ways, while enabling supplementary and complimentary future build-outs to the eCMS.

Agencies and courts often face budget reductions when there are economic downturns or political shifts that influence budget priorities. Large agency expenditures, such as may be required during development of a robust eCMS, must be optimally executed and successfully accounted for to ensure continued funding. Both state courts and adjudicative federal agencies face budgeting challenges and need to demonstrate optimal service delivery.

Budget issues can affect decisions taken in designing and building an eCMS. Servers, work stations, computer storage, and telecommunication lines and links must be acquired and maintained. Internet and telephone services also must be obtained. One option for reducing infrastructure and maintenance costs of an eCMS is to employ cloud computing services.[31] Cloud computing services, which started as time-sharing of large computer systems run by International Business Machines, Digital Equipment Corporation and others,[32] can reduce equipment, maintenance and staffing costs by providing shared centralized internet-accessible software, servers, storage devices, or other hardware and maintenance necessary to maintain an eCMS. This technology is relatively easy to implement and provides an excellent opportunity for agencies facing tight budgets or lacking the human resources necessary to maintain the reliable and secure complex technology infrastructure needed for an eCMS. For smaller adjudicative bodies, buying the hardware and contracting cloud computing services is often the best viable option. For larger agencies, administrators often choose a blended approach of internal design and maintenance, with contractor assistance in building and coding the eCMS.

The case study of the Occupational Safety and Health Review Commission (OSHRC), infra, is illustrative of how an agency was able to overcome budget challenges and still develop

[31] A cloud symbol was used to represent networks of computing equipment in the original ARPANET in 1977 and is often used in network diagrams. See https://www.quora.com/What-is-the-story-behind-what-is-the-origin-of-the-term-cloud-as-it-pertains-to-cloud-computing-services.

[32] Remote job entry workstations were used as a component of the IBM System/360 Operating System, colloquially known as the OS/360, a system used by SSA beginning in the mid-1960s.

an effective eCMS. OSHRC faced the challenges of updating and upgrading its existing technology infrastructure while expanding bandwidth and increasing the number of available work stations. OSHRC met its budgeting challenge through careful planning that ensured that each phase of the eCMS implementation provided good end user value while the agency awaited a budget for the next phase.

VIII. Supporting an eCMS

An eCMS should be conceived as an institutional effort and not merely a collection of information technology systems. The starting point for any eCMS is the business need. Identifying that need and the agency goals and strategies for filling it are the province of the agency leadership who must ensure that the agency's technology choices fully support the agency's goals and strategies. Broadly, the steering of the development of technological solutions for business needs is known as technology governance. In loosely coupled organizations, decision-making authority often is delegated to those who are closest to the relevant customer or decision. However, most agency administration tends to be characterized by centralized decision-making, and good technology governance requires individuals with sufficient authority and status to establish project legitimacy. Technology governance requires a thoughtful balance of autonomy and authority particularly for projects affecting multiple organizations or agencies.

In most agencies, a technology strategic plan sets out how technological support can aid in achieving goals and performance indicators set out in the broader agency strategic plan. The technology strategic plan should be built around three key concepts: service delivery management, capacity management, and continuity management.[33]

Service delivery management is the long-term planning and upgrading of IT services. Service delivery management helps establish the necessary processes and technology necessary for service availability and helps identify the technology capacity necessary over time for the delivery, growth, and maintenance of the system. This aspect of IT management should include

[33] *IT Service Management Version 2.1.b*, by Ivor Macfarlane, Colin Rudd, and Derek Cambray, 2005, available on the IT Service Management Forum.

estimates of the costs associated with implementing and maintaining the technologies employed, and should include a plan for business continuity, disaster recovery, and fraud prevention.

Capacity management is the long-term plan to "ensure that all current and future capacity and performance aspects of the business requirements are provided cost-effectively."[34] Capacity management provides financial management with a technological focus. It concentrates on the reduction of overall long term costs, identifying actual costs of IT services and their provision, providing accurate financial information to assist in decision making, and providing measurements of value obtained for money invested in aligning IT services to business needs.[35]

Service continuity management is the provision of business continuity or recovery during emergency situations. It encompasses not only the technological aspects but also the human resources, facilities, and communications plans to coordinate continuity and recuperation of service in the face of an emergency.

The service desk, or Help Desk, is the central point of contact between those who use the system and the IT staff. It handles incidents (interruptions of service) and requests from users. The service desk can be staffed internally, through shared resources with another agency, or through third-party contracts. Because system access is essential to efficient agency operations, a robust and accessible service desk is critical for the successful implementation of an eCMS. The FTC, for example, has a help desk for its e-filing system with separate call numbers for procedural questions and technical support. In addition to actively responding to requests for technical support, the Help Desk reaches out to customers through phone calls to assess client satisfaction. Communication with customers has led to changes in extending filing times to 11:59 PM in a given day. Both SSA[36] and OMHA[37] offer national toll-free service lines to assist beneficiaries and other appellants with technical questions regarding their appeals.

[34] *Ibid.*
[35] *Ibid.*
[36] https://www.ssa.gov/agency/contact/phone.html.
[37] Medicare Program: Changes to the Medicare Claims and Entitlement, Medicare Advantage Organization Determinations, and Medicare Prescription Drug Coverage Determination Appeals Procedures, January 17, 2017 OMHA response to comment – 82 Fed. Reg. 4974-01.

The service desk also provides technical support capable of addressing integration of hardware and software, and changes to the IT infrastructure or software. Technical support delivers service in five key areas vital to the successful use of technology in an institution:

Incident Management is the process of restoring normal operation after a system goes down. The eCMS must be highly reliable, and the goal of Incident Management is to restore access as quickly as possible with minimum disruption to the agency.

Problem Management focuses on reducing negative results triggered by problems in the technological infrastructure. It also refers to the processes used to prevent the occurrence of incidents, problems, and errors.[38]

Configuration Management is at the heart of well-integrated software solutions. It provides the logical model of the IT infrastructure by identifying, controlling, and maintaining the versions of all the configuration Items (components of the technology infrastructure) used in the eCMS.

Release Management is the oversight of changes to an IT service (eCMS, new infrastructure capacity, etc.) and ensures that both technical and non-technical aspects of the change are considered together. For example, to issue a major release of the eCMS where many technical or functionality changes are included, the project management team must consult with end users after having the clearance of the technical staff to determine the best timing for the release. Prior to release, the entire system must be tested to ensure robust and reliable performance.

Change Management, within technology, describes standardized methods and procedures used to handle all changes to minimize service interruptions. Change management is the organized approach to overcoming resistance and fostering acceptance of change in an organization. Changes occur when infrastructure, performance, or security are upgraded. An eCMS will undergo many modifications, improvements and repairs during its lifecycle, and the goal is to ensure these changes occur without incidents or problems. Coordinating such changes

[38] *IT Service Management Version 2.1.b,* by Ivor Macfarlane, Colin Rudd, and Derek Cambray, 2005, available on the IT Service Management Forum.

while maintaining system access and reliability is a common challenge. Effective Change Management makes these processes seamless to the end user. Often, changes are released in batches during hours when few users are accessing the system.

Change management responsibility extends beyond the help desk, and includes strategies that can be employed to address changes in processes, resources, roles, projects or operations. Educators, industrial psychologists, statisticians, subject matter experts and project managers, or others with specialized expertise can help guide individuals, teams, and the organization to adopt new practices or technology to achieve new goals. Communication is key to helping create effective and long-lasting changes in behaviors. Solid change management efforts not only help smooth the eCMS implementation but also help improve overall performance in the organization. When successfully applied to eCMS implementation, change management helps individuals overcome resistance to eCMS adoption and provides them with a clear understanding of the value of the eCMS for themselves and the agency.

Change management is particularly important when migrating from a paper-based, or a partially electronic, case management system to a fully electronic system. The Federal Mine Safety and Health Review Commission (FMSHRC) case study, infra, involved an eCMS project that required a migration of 14,000 open cases and data from an old system, which it accomplished in approximately six months. To ensure that data was not lost in the transition to the new electronic case management system during the migration and early implementation phases, case managers and data entry personnel used a double system (paper and electronic). During the implementation, temporary employees were hired to assist with every role in the case process, and direct technological support was provided as needed. Directing this support at the judges, law clerks, docket management employees and policy group employees, helped make the FMSHRC eCMS adoption a success.

IX. Optimizing the Value of an eCMS Through the Use of Data Analytics, Performance Metrics, Training and Feedback

Agencies often have attempted to capture performance metrics related to their business processes even when using traditional record-keeping in the days before electronic case

management systems were developed. Performance metrics gauge the efficiency and effectiveness of a process; they are the backbone for continuous improvement. The cycle starts with capturing data accurately and analyzing it to detect and define problem areas that present opportunities for improvement. Analytics can detect root causes for delays or poor quality, facilitating corrective action. Following corrective action, performance goals are refined and performance under the newly improved process is measured again. This process continues as performance is continually measured, corrective actions are taken and goals are continually refined. Performance measurement can fundamentally change the way courts and agencies do business.

Data analysis is a set of mathematical processes that are best understood by those initiated in these sciences, but it is important for managers and executives to acquire a general sense of data analysis and how unstructured information can be transformed and made accessible to judges, managers, and other support personnel. Taking complex and intricate information produced in challenging and complex environments, but reflecting operational reality, and making it accessible to decision makers can greatly improve an operation and the delivery of services.

Often it is necessary to convert raw data into a more useable format so it can be analyzed. It also is important that agencies assess the quality of the data and clean it before drawing conclusions. Data fields are sometimes incomplete, reflect errors made when keying the data, or use fields that have been overwritten so that their values are different than they were originally. Data cleaning identifies and accounts for these errors and omissions. Failure to properly clean data can result in misleading or erroneous conclusions. Based on the state of the data, techniques are available to account for problems with data integrity or quality. For example, extreme outliers might be excluded from calculations of summary statistics or certain observations might be given more weight than others. This process ensures that analyses reflect the reality of what the data is intended to measure rather than the state of the data itself. Data cleaning can also have other positive impacts. For example, the cleaning might reveal process or systems improvements that could reduce the amount of future data cleaning or even open new possibilities for analysis. To some extent, automated data quality mechanisms can be built into

an eCMS. Such mechanisms include required fields, predefined data entry "drop-lists," and spellcheck. Periodic system audits can also lead to improved data quality.

Once the data has been cleaned, agencies can begin analyzing the data to identify opportunities to improve operational efficiency. One of the many benefits of a robust eCMS is the opportunity to obtain and evaluate data about how well the administrative processes within the adjudication system are functioning. This opportunity can be greatly enhanced if, during the construction of the eCMS, agencies consider the types of data that would be useful for evaluating the effectiveness of the business processes, the soundness of the operational policies, the effectiveness of training, the productivity of the staff, and the timeliness and quality of service the agency provides. Agencies can also benefit from developing a comprehensive data dictionary as the eCMS is developed, so computer programmers who later may need to modify the data fields and data scientists who may need to analyze those data fields understand what the data fields are intended to represent and capture. Similarly, agencies should develop and write an electronic business process using active voice to clearly delineate the actions and activities expected by the people who are to use the eCMS. To facilitate later data analysis, agencies should develop data fields to capture data about activities of the users of the system, including a history of what actions were taken, what information was altered or updated, and what documents were added to or generated by the system.

The National Center for State Courts (NCSC) has formulated a process for facilitating direction, conceptual clarity, and systematic methodology in the development of a performance measurement system. CourTools, a performance measurement tool for state trial and appellate courts, may also be useful to federal agencies.[39] CourTools recommends 10 measurements for Trial Courts and six for Appellate Courts.[40] Many of the performance measures used in courts should be applicable to federal agencies that adjudicate, including three that are particularly important: clearance rates, age of active pending caseload, and time to disposition.

The clearance rate measures how an agency is keeping up with the incoming caseload by calculating the number of outgoing cases as a percentage of the number of incoming cases.

[39] For more information about performance measurement, go to CourTools.org.
[40] National Center for State Courts, 2017.

Incoming cases include new, reopened, and reactivated cases as input workload. Outgoing cases include entry of judgment, reopened dispositions, and cases placed on inactive status for non-workload activities.

If the number of incoming cases exceeds the number outgoing, the backlog of cases pending disposition will increase. This single number is useful for comparing monthly and yearly activity by case type. The agency's clearance rate can reveal issues and help identify where in the process a solution may be found.

The age of active cases pending before the court, measured as the number of days from filing until the time of measurement, is called the age of active pending caseload. This measurement is important to ensure timely adjudication of cases. Only active cases are included for this measurement.

The percentage of cases disposed or otherwise resolved within established time frames is the time to disposition. Used in combination with clearance rates and age of active pending caseload, the time to disposition assesses the length of time it takes an agency to process cases. Time to disposition should be reviewed on a regular basis to detect trends that later can be aggregated into an annual report.

In the NCSC model, cases to be included in measuring the time to disposition fall into one of two categories: cases that move through the system without interruption, and cases whose progress is interrupted by inactivity but are reactivated. Even when cases have different filing dates, they are counted as "without interruption" if their disposition is within the reporting date. If reactivated cases are disposed during the reporting period, they should be included in the number of "interrupted" cases, and the time considered is the time since the case was reopened, not the original filing date.

Agencies should evaluate case disposition times against historical data and carefully consider current pending workload levels, projected receipts, current staffing, attrition and hiring rates, and productivity of the staff in order to set reasonable goals for reducing the average time to disposition. Data from an eCMS also can be used to build workload forecasting models, determine appropriate staffing levels, and support budget formulation.

For performance measurement to deliver its full benefit, it must be integrated with key business processes and day-to-day management. SSA's Appeals Council provides an example of how this can be done effectively. The Appeals Council provides the final agency review of disability and other social security claims. Its primary workload is the review of appealed and unappealed hearing decisions issued by administrative law judges. The Appeals Council built an eCMS that integrated information flowing from the hearing level case control system, information from electronic claims folders, as well as information captured during review by the Appeals Council. The Council was able to analyze the information captured in this eCMS to adjust the amount of staff devoted to various tasks, alter the order in which work is assigned to improve the speed of case processing, and develop numeric based performance standards to ensure consistent productivity of its own staff as well as staff of hearing offices. It also was able to identify why and how often cases were remanded back to the hearing level, and used this information to redesign training and identify proposals for revising policies and procedural guidance. The Appeals Council saw significant improvements in employee productivity and decisional quality as well as declines in the average case processing time and numbers of aged cases pending despite experiencing a significant decline in staffing.

To obtain even greater benefit from the Appeals Council's eCMS, Administrative Appeals Judges identified each of the factors that must be considered in correctly evaluating disability issues and they flow-charted and mapped these factors to identify the policy compliant pathing to each of approximately 2000 types of decisions that could be made in disability claims. This information was then incorporated into a case analysis tool that was included in the eCMS. The case analysis tool included questions designed to help guide analysts and adjudicators through the structured analysis of the hearing decision intended by the regulations, rulings and other policies, and was designed to assist them in determining whether a basis exists under the law and regulations for the Council to grant a claimant's request for review of the hearing decision. This portion of the eCMS, the Appeals Council Analysis Tool (ACAT), captures structured data related to the policy compliance of hearing decisions. The data was analyzed and visualized to identify why cases were remanded. In turn, this led to improvements in training, policy formulation, and decisional quality.

Additionally, knowledge of the policy compliant pathing for decision-making, the sequential nature of the evaluation process, and the way in which decisions are formatted in the document generating systems, led to the development of a new analytical tool powered by natural language processing that uses machine learning algorithms. This tool, known as INSIGHT, extracts text from hearing decisions and independently analyzes the language for policy compliance and consistency with other parts of the decision. INSIGHT uses mathematical algorithms to enable understanding and manipulation of natural language texts using pattern recognition and computer heuristics. It also probabilistically finds commonalities in existing data and makes predictions about new data.

INSIGHT is estimated to be able to identify as many as one third of the issues that generate Appeals Council remands. INSIGHT generates a report of its findings, highlighting potential problems in the decisions being reviewed, and it contains hyperlinks to the problematic decisional language and to related policy guidance. Opportunities also exist to develop even more powerful deep learning algorithms to interpret the medical evidence and other information in claim files to further assist adjudicators.

X. Agency Case Studies

A. Occupational Safety and Health Review Commission (OSHRC)

OSHRC is an independent federal agency providing trial and appellate review of contested citations or penalties resulting from inspections by the Occupational Safety and Health Administration (OSHA).

OSHA conducted 32,396 inspections in 2017, from which OSHRC administrative law judges received 2,168 new cases. Appeals of ALJ decisions are made to the Commission, which directed twelve cases for review in FY 2017. OSHRC faced three main challenges early in its eCMS implementation.[41]

[41] Data obtained from the OSHA website at: https://www.osha.gov/oshstats/commonstats.html.

At the time of this study, OSHRC was two months into the process of transitioning from a hybrid (paper and electronic) case management system that allows electronic filing through its Web page or via e-mail, to a full eCMS system that includes fully automated e-filing. OSHRC elected to implement a two-level service process, first to deliver business support in the filing process to external users, and second, to analyze and resolve internal technological issues by upgrading technologies already in place.

OSHRC attempted to implement commercial off-the-shelf solutions to the OSHRC adjudication work processes, but software configuration adjustments were necessary. OSHRC recognized that when using commercial off-the-shelf software, it was important to carefully analyze with the vendor the adjudication and review processes from end to end, from the beginning of the filing to the final adjudication or appeals review process. By doing so, OSHRC hopes to build a robust system requiring fewer modifications once it is implemented, potentially saving money and time. OSHRC's efforts also may facilitate easier technology adoption by eCMS end-users.

Operating in a tight budgetary environment, OSHRC also faced the challenge of updating and upgrading its existing technology infrastructure. Although much of the implementation was through contracted services, OSHRC had internal technology needs such as the purchase of additional work stations and the need to increase the available internet access bandwidth. OSHRC's experience shows that budgeting challenges often require careful planning to ensure that each implemented version of the eCMS software is sustainable and that each phase of the eCMS implementation provides good end-user value, particularly given OSHRC's concern that later phases in the project providing new functionality may be delayed due to budget limitations.

B. Federal Trade Commission (FTC)

The FTC has a dual mission to protect consumers and promote competition. It protects consumers by stopping unfair, deceptive or fraudulent practices in the marketplace. It conducts investigations and collects varied complaints, including Do Not Call violations. It makes these complaints available to different law enforcement agencies. The Office of Administrative Law Judges in the FTC generally performs the initial adjudicative fact-finding in administrative

complaint proceedings for the Commission, although the Commission also has this authority. FTC cases and proceedings are published online.

Like other agencies, improving efficiency was a key tenet to the FTC strategy, and it has a strategic mandate to advance organizational performance and to comply with the Electronic Freedom of Information Act Amendments of 1996 (E-FOIA) and the E-Government Act of 2002.[42]

The FTC's eCMS has been a continuous change management effort which was prompted by two events: first, a mandate to move the record from paper to electronic form and second, the logistical challenges customers faced in filing large-volume paper records by a deadline, with copies for all parties. The transition has been gradual. Methods of filing documents with the FTC include document transfers and the submittal of filings by e-mail, which are scanned or uploaded into the eCMS. The E-Filing System (E-Filing) was instituted to allow the electronic filing of documents under 16 C.F.R. Part 3, which govern the procedure for formal adjudicative proceedings.[43].

Today, most filings related to adjudication under 16 C.F.R. Part 3 are submitted electronically through a secure portal requiring multifactor authentication. Participants in Part 3 cases receive notification and immediate access to the information. E-Filing documents can be viewed by Commission staff and external parties participating in Part 3 litigation procedures. A paper filing option is still available for non-tech savvy and pro-se litigants who at times present handwritten complaints. The FTC has also extended filing times beyond normal working hours to 11:59 p.m. when filing via E-Filing. E-Filing is hosted offsite by a contractor. The FTC also established a Help Desk for electronic filers, with separate numbers for procedural and technical problems. The Help Desk also reaches out to customers through phone calls to help them assess client satisfaction.

The repository for the FTC's electronically stored documents is known as DocSmart, built from the Documentum platform and hosted onsite in FTC's data center.[44] A wide variety of

[42] 5 U.S.C. 552 and Public Law 107-347, 116 Stat. 2899, 44 U.S.C. 101.
[43] 20 C.F.R. 3.1, 74 Fed. Reg. 20208, May 1, 2009.
[44] Documentum is an enterprise content management system now owned by OpenText. See "*OpenText Buys Documentum"* at https://documentum.opentext.com/.

documents can be uploaded to DocSmart, including compliance documents, Commission Orders, decisions, transcripts, and consent agreements, where they are available for viewing by FTC staff. The DocSmart records management function was disabled and licenses were not renewed in 2015, but the system still maintains its functionality.

The FTC's Records and Filings Staff as well as other bureaus and offices in the Commission index documents in a platform named Matter Management System 2 (MMS2), which is used to create, track and maintain records related to the development and investigation of matters before the Commission. This system can only be accessed by FTC personnel. The staff produce their work products using Microsoft Office products that are stored on a shared drive available only to FTC employees. All final Commission documents are eventually uploaded to DocSmart. General members of the public do not have access to DocSmart or the Matter Management System 2, although some decisions are published on the FTC website.

In some matters that come before the FTC, the agency has a mandate to make public information available on the web. The FTC uses the Comment Works System for this purpose. Issues of privacy and confidentiality were considered early in the agency's design and implementation of the Comment Works System. The FTC began by analyzing and revising its Rules of Practice governing access to agency records. The FTC has very clear rules that all involved employees know to keep information confidential and redact files when necessary before publishing. The FTC has protocols for providing restricted access to confidential information so that only the intended recipient has access to the required information. At the time of this study, the FTC had a redaction team that reads and redacts unstructured private or confidential information before making it public. The FTC is currently evaluating Natural Language Processing as a tool to help automate this process. The FTC has also recognized the importance of having a complete data dictionary specifically defining which data elements are private or confidential.

The FTC also is able to use its eCMS along with MMS2 to measure times to disposition, case aging and other performance indicators. The FTC annually publishes its overall agency

performance report and makes it available to the public.[45] To comply with the E-Government Act of 2002, the FTC also is working to post every public document on its website. While the process will take an estimated 15 years, it already has published many documents dating back many years.

C. Federal Mine Safety and Health Review Commission (FMSHRC)

The FMSHRC experience illustrates how a relatively small adjudicative body can use strict project management governance and carefully orchestrated change management to successfully implement an eCMS under tight timelines and budget constraints.

The FMSHRC is an independent adjudicative agency that provides administrative trial and appellate review of legal disputes arising under the Mine Act of 1977. This Act enforces compliance with mandatory safety and health standards to eliminate fatal accidents and reduce other types of accidents in our nation's mines.

The FMSHRC is a relatively small agency with approximately 79 employees, including 48 Administrative Law Judges (ALJ) who travel to conduct trials at the hearing sites located at or near the mine involved, a Chief Administrative Law Judge, and a five-member Review Commission.

Trial cases are usually initiated by the Secretary of Labor. In 2016, the 48 ALJs received 4,051 new cases for a total case workload of 8,733 cases. Review of the ALJ's decision by the Commission requires the approval of at least two Commissioners. In 2016, the Commission accepted 202 new cases for a total workload of 364 cases for the year. Most appeals come from the Mine Safety and Health Administration (MSHA).

The FMSHRC started planning for a new eCMS in 2010 as part of a joint operating plan to reduce case backlogs with the U.S. Department of Labor. At the time, it also initiated a formal Request for Information to study available options in the market. FMSHRC had an internal

[45] The FTC measures time to disposition, case aging, and performance information. Its overall agency performance is provided through a yearly performance report known as One Page Performance Snapshot, available to the public at www.ftc.gov https://www.ftc.gov/about-ftc/performance.

infrastructure that needed upgrading but did not have the resources to run and maintain an internal server structure to deliver an eCMS. This motivated FMSHRC to pursue a cloud-based solution, which could eliminate time and geographical work restrictions for the judges, enabling the traveling judges to access their work from anywhere at any time.

FMSHRC created a Project Management Office which was tasked with ensuring that every business group was represented in the development of the eCMS, that subject matter experts were available for the contractors to contact directly, and that an Implementation Committee with representation from all affected business areas was available to make quick development decisions. This strong project management structure helped ensure timely creation of the eCMS despite the fact that no one on the staff worked on the project full-time. Availability of funding necessitated that the project's eCMS delivery obligation was no more than one year. FMSHRC relied on strict project management discipline to achieve this result. Their efforts included creating a small subcommittee to make quick developmental decisions, unfiltered access by developers to end users, representation of every business group in the eCMS development, and twice daily check-ins during the launch of the eCMS. They also set clear deadlines and a fixed budget to enable completion within the time and budget constraints.

Through a request-for-proposal process, the FMSHRC acquired the services of a contractor that provided the design, creation, implementation, and maintenance of the software and infrastructure necessary to deliver the cloud-based eCMS. An Administrative Judge with previous experience in the Utah Courts became the head of the eCMS Steering Committee. Despite tight timelines, FMSHRC was able to shift the focus of the eCMS development from e-filing only to e-filing with case management. A comprehensive outlook was adopted requiring the contractor to examine the processes end to end, from receipt of filing through final adjudication. The eCMS was designed for both adjudication and review. Implementation of such significant changes to the work process required a pronounced effort in change management and cultural transformation.

The eCMS project required a migration of data from an old system. FMSHRC migrated about 14,000 open cases in approximately six months. To ensure that data was not lost in the transition to the new electronic case management system during the migration and early

implementation phases, case managers and data entry personnel had to use a double system (paper and electronic). During the implementation, temporary employees were hired to assist with every role in the case process, and direct technological support was provided as needed. Directing this support at the judges, law clerks, docket management employees, and policy group employees helped make the eCMS adoption a success. Another key factor to this success was the daily publication of implementation priority lists which were shared among users, allowing for daily feedback and adjustments during the implementation phase.

Electronic filing began in 2014. Once the system was stable, faxes were eliminated and only e-filing was allowed. This improved the availability of crucial case information, enabling faster case assignment and more time available for reviewing a case. Before implementation, about 80 percent of case management processing time was spent gathering case information and assigning cases, and only 20 percent of the time was dedicated to case adjudication. Since implementation, those figures have reversed.

D. Office of Medicare Hearings and Appeals (OMHA)

OMHA is part of the U.S. Department of Health & Human Services Agency (HHS).[46] It administers the nationwide ALJ hearing program for appeals arising from individual claims for Medicare coverage and payment for items and services furnished to beneficiaries under Medicare Parts A, B, C and D. OMHA also hears appeals arising from claims for entitlement to Medicare benefits and disputes of Part B and Part D premium surcharges. OMHA generally conducts the third level of a five-level appeals process, and operates separately from the other agencies involved in the Medicare claims appeal process. Its 2017 dispositions excluding remands numbered 84,729, and its software systems currently have approximately 700 users. OMHA is in the process of developing its new electronic case management solution, the Electronic Case Adjudication and Processing Environment (ECAPE), due to be completed at the end of 2018.

OMHA's goals in implementing ECAPE are to provide a solution that supports a unified electronic business process and delivers efficiencies through automation. OMHA used a product

[46] Medicare hearings and appeals were processed by the Social Security Administration until 2005, when OMHA was created pursuant to the Medicare Modernization Act of 2003, as an independent staff division under the Office of the Secretary within HHS.

from a vendor that offered a configurable case management solution to automate these processes.[47] The first phase of the project was the implementation of an Appellant Public Portal and the functionality for OMHA staff to receive appeals through ECAPE. The Appellant Public Portal is currently in its preliminary release and allows a limited number of appellants to electronically file a request for hearing, submit electronic evidence, and check appeal status. In addition to the portal and intake release, two interim ECAPE releases have been deployed to production that allow OMHA staff to process withdrawal dismissals and appeals eligible for certain types of Centers for Medicare & Medicaid Services (CMS) special initiatives. At the end of 2018, OMHA will be able to use ECAPE to process all aspects of the appeals process including exhibiting, scheduling a hearing, decision generation, and use of improved management information. A planned future software release will include an enhanced Appellant Public Portal, where authenticated appellants can view files and communicate with OMHA through ECAPE.

ECAPE interacts with multiple systems to share data and documents for efficiency. The CMS owned Medicare Appeals System (MAS) remains the system of record for Medicare appeals. ECAPE interfaces with MAS to pull data and documents into ECAPE at receipt and sends all data and documents back at appeal closure. ECAPE also interfaces with a vendor that converts paper documents received at OMHA to electronic records and transmits them to the associated ECAPE appeal. In addition, ECAPE has been integrated with an existing HHS Access Management System to manage user access and user accounts.

OMHA is looking forward to the final release of ECAPE and its positive impact on appellants, OMHA staff, and the overall appeals process.

E. Board of Veterans Appeals (BVA)

The BVA provides a good example of how a data-driven strategy that focuses on technological modernization through change management can help implementation an eCMS. At the time of this study, the BVA was developing an eCMS called Caseflow. The BVA sees

[47] Medicare Program: Changes to the Medicare Claims and Entitlement, Medicare Advantage Organization Determinations, and Medicare Prescription Drug Coverage Determination Appeals Procedures, January 17, 2017 OMHA response to comment – 82 Fed. Reg. 4974-01.

this as an opportunity to create a better and more efficient way to process appeals instead of replicating the old system with current technology. Its goals are to improve each veteran's experience with the appeals process, increase appeals processing accuracy and decrease processing times.

The BVA is part of the Department of Veterans Affairs (VA). The Board members, or Veterans Law Judges (VLJ), conduct hearings and decide appeals. The appeals process in the VA is a complex, multistep adjudication process.[48] Appeals are initiated by the agencies of original jurisdiction, which includes the Veterans Benefits Administration Regional Offices, Veterans Health Administration medical facilities, the National Cemetery Administration, and the Office of General Counsel.[49] In fiscal year 2016, the agencies of original jurisdiction certified 86,836 cases to the BVA.[50]

The major driver for creating a new system originated from the need to replace an outdated system. The Veterans Appeals Control and Location System (VACOLS) was built in the 1980s and is currently operating in an outdated infrastructure. VACOLS was built mainly for paper tracking which renders it outmoded for furthering current institutional goals focused on operational improvements through data analytics.

Since VACOLS was developed, cases have increased in complexity, resulting in an increase in the inventory of documents and information, which, in turn, has increased workload. Simply updating VACOLS was not a good option because it was built primarily to track activities related to paper files, it lacks a data dictionary explaining what is intended to be captured in each data field, its data fields have been used inconsistently over time, and some of the data fields were reused over time and overwritten with other data.

One of the key requirements of the BVA's eCMS is the development of a system capable of supporting data analytics efforts. The new Caseflow system is a paperless, web-based system with clearly documented fields that capture structured data, allowing for robust data analysis.

Beginning in 2015, VA partnered with the United States Digital Services (USDS) to phase out VACOLS, and to develop a data-driven approach to managing and streamlining the

[48] https://www.bva.va.gov/
[49] https://www.bva.va.gov/.
[50] Ibid.

VA appeals process. USDS is a startup at the White House, using design technology to deliver better services to the American people. To accomplish its work, USDS recruits top technologists for term-limited tours of duty with the Federal government; these technologists partner with Federal employees to improve the usability and reliability of the government's digital services. Through the partnership with VA, the USDS is iteratively developing the Caseflow system for VA to more effectively manage benefits appeals. USDS also provides documentation and knowledge transfer related to their work.

The USDS delivers a quarterly Product Impact Statement on the eCMS progress and impact. The statement includes a description of the business priorities that are addressed through software and provides a high-level summary of improvements and research performed before, during, and after each iteration or software release, and documents key performance indicators.

For each proposed technological improvement that will produce a module or component for the BVA's Caseflow technology toolbox, a Product Impact Statement is presented that follows a specific format:

1. Problem Statement - defines the problem with a quantified baseline measurement to be address by the technological solution.
2. Product Scope - shows the proposed reach of the implementation within the process and states weather the component to be worked on is currently launched in production or in active development.
3. Hypothesis – describes ways in which the component aims to mitigate or resolve the defined problem. These hypotheses are based on a launched component or one in active development. Potential improvements based on interactions with other components or in other iterations are identified separately in a section called "Future Opportunities".
4. Key Performance Indicators (KPIs) – These are process outcomes. The hypotheses are translated to KPIs which must be SMART: Specific, Measurable, Attainable, Relevant and Time bound.
5. Other metrics – Additional measurements that could monitor product success that are not directly related to process outcome.

6. Future opportunities – Future product improvement decisions prioritized strategically considering immediate impact and future synergies with other planned components.

Caseflow has streamlined the process for the Veterans Benefits Administration to transmit documentation to the BVA when an appeal is certified. The old process created errors in the data transferred as information had to be uploaded to a common shared file repository at different dates and then certified using a form that dates to 1933, when all quality control checks had to be carried out manually. This process sometimes created duplicate information because some of the information was already loaded in VACOLS or elsewhere. The baseline key performance indicator measured in December 2015 showed that 40.6 percent of the cases uploaded to the shared file repository had missing or inaccurately dated documents. The target for this key performance indicator was 20 percent by April 2018; Caseflow achieved this target in July 2017, when the percentage of cases with mismatched documents was reduced to 19.1 percent. By January 2018, this figure had been further reduced to 11.5 percent.

Other Caseflow applications released into production to date include Caseflow eFolder Express, Caseflow Dispatch, Caseflow Intake, and Caseflow Reader. Two additional products, Caseflow Hearing Prep and Caseflow Queue, are in pilot testing with users, and a final tool in the suite of applications, Caseflow Hearing Scheduling, is in a discovery phase.

USDS uses Agile software development, which requires a close interaction between software developers and agency subject matter experts. USDS conducts weekly meetings with Board and VBA stakeholders to discuss the priorities and other topics to clarify points in the software development cycle. More importantly, Digital Service uses direct access to its user base – VA administrative, attorney, and judge staff – to design products with users, rather than merely for them. This practice ensures that Caseflow tools meet the needs of users and improve processes along the way. USDS follows industry best practices, making it easy for the BVA to continue with its operation. Best practices in technology makes for a sustainable transition between projects to ongoing programs.

The BVA is focused on change management as a methodology to further its modernization efforts in creating an eCMS. Because continuous improvement is part of the

BVA's agency culture, regular feedback through the product impact statement, the weekly software development sessions, and open channels of communication ease technology adoption.

The BVA's commitment to change management in creating its eCMS is paying off. It allows users and stakeholders to see clear and measurable progress in the eCMS development. Also, all progress is reported in "before and after" measured scenarios where the true impact of eCMS can be shared.

F. Social Security Administration's Appeals Council

Electronic case management systems offer opportunities to improve business processes that go far beyond filings and evidence submissions, maintaining records, and managing the business process. In particular, the mining and analysis of data captured by these systems creates opportunities to improve adjudication in ways not possible before. SSA's Appeals Council offers an example of an agency is doing just that.

SSA administers retirement and disability benefits in all 50 states, the District of Columbia the Territories of the U.S., and for U.S. citizens residing elsewhere in the world. It is one of the largest administrative adjudication systems in the world. Approximately 2.5 million disability claims are filed each year. State agencies process these claims, and dissatisfied claimants may file a request for hearing where approximately 1,600 Administrative Law Judges in the Office of Hearings Operations (OHO) issue more than 600,000 decision and dismissals each year. Appeals of those decisions are filed with the Appeals Council, in the Office of Analytics, Review and Oversight (OARO) where approximately 70 Administrative Appeals Judges (AAJs) and 55 Appeals Officers review[51] more than 150,000 appeals of hearing decisions

[51] 20 C.F.R. 404.970 and 416.1470 provide that:
(a) The Appeals Council will review a case if—
(1) There appears to be an abuse of discretion by the administrative law judge;
(2) There is an error of law;
(3) The action, findings or conclusions of the administrative law judge are not supported by substantial evidence; or
(4) There is a broad policy or procedural issue that may affect the general public interest. (b) If new and material evidence is submitted, the Appeals Council shall consider the additional evidence only where it relates to the period on or before the date of the administrative law judge hearing decision. The Appeals Council shall evaluate the entire record including the new and material evidence submitted if it relates to the period on or before the date of the administrative law judge hearing decision. It will then review the case if it finds that the administrative law judge's action, findings, or conclusion is contrary to the weight of the evidence currently of record.

and dismissals each year. The Appeals Council also has the authority to review cases *sua sponte*, and it serves as the final level of administrative review for the agency.[52] Claimants dissatisfied with the agency's action have a right to file a civil action in federal district court, and about 17,000 claimants do so each year. The Appeals Council is charged with providing a certified administrative record to the court. The Appeals Council also processes cases remanded from the federal courts.

In early 2000, SSA implemented an electronic case system for keeping electronic evidence. Documents are stored as scanned images in tagged image file format (TIFF) so they cannot be changed by people accessing the electronic record. The system later evolved to include electronic filing of claims and requests for hearing. Bar codes are used to ensure scanned materials are sent electronically to the correct folders, and the agency developed a document indexing system to facilitate correct tagging of the materials received. Information was captured in a six-part folder, which mirrored the paper folder that captured medical, vocational and other information. To see the information, adjudicators use a Document Management Architecture (DMA) viewer. In 2005, an updated docket management system was developed for the hearing level.

SSA's Appeals Council improved its processes and the quality of its decisions through the sophisticated analysis of data captured in their eCMS. SSA used the data to carefully craft feedback to adjudicators and develop personalized training to foster quality improvement.

In 2005, the Appeals Council undertook Agile software development (as described in Section V. above) with subject matter experts working closely with developers to design and build an eCMS that integrated information flowing from a case control system built previously for the hearing level, information captured or stored in electronic claims folders, and information captured during the review by the Appeals Council. The effort also required migration of data about pending cases from two earlier case control systems, one housing information about appeals pending with the Appeals Council, and the other housing information about civil actions filed following Appeals Council action.

[52] (Social Security Administration, 2017).

During this time, the Appeals Council also sought to improve the productivity of the staff to improve the overall speed of case processing. Using data from the prior case control system, the Council was able to isolate twelve types of case dispositions issued by the Council, and determine the average time needed to process each of these types of cases. With this information, the Appeals Council was able to establish numeric-based performance expectations in 2006 that resulted in higher staff productivity. The improved performance persuaded the Appeals Council leadership and then-Social Security Commissioner Michael Astrue that it could reposition some of its staff to conduct more *sua sponte* reviews of unappealed claims. In October 2010, the Appeals Council established the Division of Quality to perform this function.

The Appeals Council also wanted to improve service delivery by improving the quality of agency decisions. To do that, the Appeals Council first adopted a clear, understandable, and measurable definition of quality,[53] defining a quality decision as ...

- factually accurate,
- procedurally adequate,
- policy compliant,
- timely issued, and
- supported by the evidence[54]

The Social Security disability program uses a defined sequential evaluation process for deciding whether a claimant is disabled. Agency decisions are required to include supporting rationale for the conclusions reached, and the regulations and rulings specify to a significant degree the criteria under which the evidence should be evaluated. AAJs at the Appeals Council realized that the regulatory scheme for evaluating disability was largely Boolean[55] in nature, and concluded that it could be flow-charted. By using this flow chart to develop an electronic analysis tool, the Appeals Council Analysis Tool (ACAT), the Appeals Council could capture structured data about the quality of their adjudicative work. ACAT works within the case control or docket management portion of the broader eCMS, the concurrently developed Appeals

[53] *See* Office of Appellate Operations, Soc. Sec. Admin., *The Four Pillars of Disability Adjudication and Review,* OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Feb. 18, 2011, at page 1.

[54] Substantial evidence is the appellate standard of review under SSA regulations, but a preponderance of the evidence is necessary at the hearing level. *See* 20 C.F.R. 404.953(a), 416.1453(a) and 404.970, 416.1470 (2016*).*

[55] For a description of the logic of Boolean Algebra, see *"Boolean Algebra,"* by David Belton at http://www.ee.surrey.ac.uk/Projects/Labview/boolalgebra/#booleantheorems.

Review Processing System (ARPS). The ACAT enabled propagation of information from other parts of the eCMS, including the electronic folder and the hearing level docket management systems. The AAJs categorized and mapped the policy compliant pathing to each of approximately 2,000 types of decisions that could be made in disability claims,[56] and used this information to develop the questions contained in ACAT. The questions were designed to help guide analysts and adjudicators through the structured analysis of the hearing decision intended by the regulations, rulings and other policies, and assist them in determining whether a basis exists under the law and regulations for the Appeals Council to grant a claimant's request for review of the decision. ACAT became operational in March 2008.[57]

Soon thereafter, the Appeals Council began analyzing data captured by the staff when using the case analysis tool in reviewing appeals of decisions and dismissals during the last quarter of 2009.[58] The tool was updated in 2009 to capture structured data about cases remanded from the federal courts, and updated again in 2010 to capture information about unappealed decisions reviewed *sua sponte* by the Appeals Council.[59] The information generated through mapping policy compliant decisions and generating questions to guide structured analysis also was used in developing training for analysts who assist the AAJs in the case reviews.

The Appeals Council acquired the services of several SSA data scientists to assist in analyzing the data captured by analysts and adjudicators using ACAT. The Appeals Council also hired attorneys with data science backgrounds or degrees. The specific reasons why cases were being remanded by both the Appeals Council and the federal district courts was of particular interest.

[56]Ray, G. K., & Lubbers, J. S. (2015, September). A Government Success Story: How Data Analysis by the Social Security Appeals Council (with a Push from the Administrative Conference of the United States) Is Transforming Social Security Disability Adjudication. (W. D. Hermandorfer, Ed.) *The George Washington Law Review*, *83*(4/5), 1575-1608.

[57] *See, e.g.*, OFFICE OF THE INSPECTOR GEN., SOC. SEC. ADMIN., A-12-13-13039, REQUEST FOR REVIEW WORKLOADS AT THE APPEALS COUNCIL 7-10, 15 (2014) at http://oig.ssa.gov/sites/default/files/audt/full/pdf/A-12-13-13039.pdf.

[58] *See* Office of Appellate Operations, Soc. Sec. Admin., *ARPS Took OAO into New Era,* OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Jan. 6, 2017, at page 3.

[59]The Council established a dedicated staff to conduct this work. *See* Office of Appellate Operations, Soc. Sec. Admin., *OAO Makes History with Launch of Quality Review Branches,* OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Sep. 17, 2010 at page 3.

The data analysis identified which cases were being remanded and reworked, why this was occurring, and whose adjudicative work was the subject of the remands and rework. The Appeals Council paired this analysis with an analysis of other data identifying outlying behaviors. To fully investigate the emerging patterns, the Appeals Council tasked the Division of Quality to conduct focused reviews[60] of cases involving certain issues or work produced by or involving certain individuals and report its findings to an Executive Oversight Board.[61] While the data analysis is particularly helpful in identifying anomalies, the focused reviews help the agency understand what, if any, corrective action should be taken. The focused reviews provide information about how evidence is obtained and considered, and how agency policies are being applied in case adjudication.[62] The focused reviews frequently identify training opportunities and provide detailed information that can be relayed to adjudicators.

Based on the careful analysis of the focused reviews, and drawing on the work of Princeton Professor Daniel Kahneman,[63] the Appeals Council concluded that most divergence from agency policy by adjudicators is inadvertent, and likely caused by the use of incomplete heuristic models.[64] Thus, the Appeals Council sought ways to improve feedback to adjudicators to ensure that any heuristics developed and used in case adjudication comply with agency policies.[65]

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[60] The Council may review cases originating from one ALJ or hearing office on behalf of the SSA Commissioner (e.g., to collect information about the cases), and can use the information collected to provide feedback to individuals or offices. See *Oversight of Rising Social Security Disability Claims and the Role of Administrative Law Judges: Hearing Before the Subcomm. on Energy Policy, Health Care & Entitlements of the H. Comm. on Oversight & Gov't Reform*, 113th Cong. 66 (2013) [hereinafter *Oversight Hearing*] (prepared statement of Glenn Sklar, Deputy Comm'r for Disability Adjudication and Review, Social Security Administration).

[61] The Board currently is comprised of executives in OHO and OARO, including the Chief and Deputy Chief Administrative Law Judges, and the Chair and Deputy Chair of the Appeals Council, and the Deputy and Assistant Deputy Commissioners of OHO. It is convened regularly to select and prioritize cases and issues for focused reviews.

[62] *See Oversight Hearing*, *supra* note 136, at 66. 139 *See* STAFF OF H. COMM. ON OVERSIGHT & GOV'T REFORM, 113TH CONG., MISPLACED PRIORITIES: HOW THE SOCIAL SECURITY ADMINISTRATION SACRIFICED QUALITY FOR QUANTITY

[63] In 2002, Dr. Kahneman was awarded the Nobel Memorial Economic Prize in Economic Sciences. See https://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2002/.

[64] Heuristics are mental shortcuts or rules of thumb people use to processing complex information quickly. See "What Is a Heuristic and How Does It Work?" by Kendra Cherry at https://www.verywell.com/what-is-a-heuristic-2795235, updated October 20, 2017

[65] Dr. Kahneman has suggested that heuristics can be improved if people are immersed in a business process, the business rules do not change frequently, and the individuals are provided with feedback about their performance. *See* DANIEL KAHNEMAN, THINKING, FAST AND SLOW, page 98

This effort required the Appeals Council to rethink its training techniques. The training staff studied adult learning techniques and revised the training to make it more contextual and interactive, focusing on problematic casework issues identified through data analysis.[66] The new approach made it possible to reduce the time newly hired employees spend in the classroom from eight weeks to six. By tracking post-training performance, the Council also discovered that the new training process dramatically reduced the new-hire learning curve from 18 months to 5 months.[67]

Quality control measures were incorporated into the training to determine both acceptance and effectiveness. The Appeals Council developed scaled response surveys to measure student satisfaction and combined this information with post-training performance metrics. Following initial training, performance is continually analyzed. When opportunities are identified for improving decision quality and performance through training, additional training is provided. Training may be delivered to a group, but the training is primarily focused on improving individual performance.

The Appeals Council also developed unique, customized multi-tiered training modules for specific groups and individuals to address specific training needs. These modules provide interactive exercises within a case to teach adjudicators how to improve their work in specific areas. Support paralegals and attorneys are available to help with researching and navigating legal and regulatory guidance. The modules are delivered through an electronic medium over the agency's intranet known as "How MI Doing?" that also pushes case management data directly to individual adjudicators. This tool empowers employees to improve their individual understanding of case adjudication, and provides customized, continuous, interactive feedback.[68] The highly successful change management and training methodology resulted in a consistent

[66] *See, e.g.*, *Oversight Hearing*, *supra* note 136, at 66–67 (describing transition from "anecdotal" to "data-driven identification of training . . . gaps").

[67] Ray, G. K., & Lubbers, J. S. (2015, September). A Government Success Story: How Data Analysis by the Social Security Appeals Council (with a Push from the Administrative Conference of the United States) Is Transforming Social Security Disability Adjudication. (W. D. Hermandorfer, Ed.) *The George Washington Law Review, 83*(4/5), 1575-1608.

[68] *See* Office of Appellate Operations, Soc. Sec. Admin., *OAO Launches Remand-Reason Training Modules for Hearing Level,* OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Aug. 8, 2014, at pages 1, 3.

demonstration of improved performance, twice earning the Appeals Council the prestigious W. Edwards Deming Outstanding Training Award from the Graduate School, USA.[69]

The Appeals Council discovered that in some circumstances training alone would not improve consistency in adjudication and reduce remands. The Appeals Council saw this as an opportunity to mobilize data to determine how policy changes could foster greater consistency in adjudication. Data visualizations such as heat maps helped the Appeals Council identify areas of policy that led to the greatest numbers of remands, suggesting they were susceptible to multiple and varied interpretations. Relying on the Division of Quality to analyze the cases and research the history and intent of laws, regulations, and other policy issuances and changes, the Appeals Council proposed numerous changes designed to foster consistent applications of the law, regulations and other policies governing adjudication.

The Appeals Council saw other opportunities to analyze the data and information obtained in the eCMS to improve their business processes, and understood the importance of having staff with the necessary skill sets for conducting high quality analysis on the data gathered, and sought multidisciplinary expertise, including mathematicians, computer scientists, economists, and operational research specialists. The Appeals Council sought these data scientists to clean, summarize and classify the data, and use econometric techniques and statistical methods to identify patterns in the data that might aid in the efficiency of case processing.

One example of the innovative ways in which the Appeals Council incorporated data analytics into its case processing was an effort undertaken to speed processing without reducing the quality of the work performed. The complexity of case adjudication often requires adjudicators to review the regulations and policies before making their decisions. The Appeals Council thought if cases involving similar issues could be assigned in batches, adjudicators

[69]The Appeals Council won the award in 2011 and 2014, while part of the Office of Disability Adjudication and Review. *See* Office of Appellate Operations, Soc. Sec. Admin., *Deming Award Double Eagles,* OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Jun. 26, 2015, at page 3. For a description of the award, see http://www.graduateschool.edu/content/deming. The Council's innovative training techniques have since been adapted elsewhere within the Social Security Administration, and the agency has won two more Deming Awards, in 2016 and 2017.

would spend less time researching regulations and policies related to those issues.[70] Thus, the Appeals Council believed it could improve efficiency by reordering the adjudication of appeals. To accomplish this reordering without first reviewing the cases, AAJs and staff at the Appeals Council worked closely with data scientists[71] to develop a multivariate probit analysis of its pending workload to identify cases with similar characteristics without first reviewing the records. This effort proved to be successful. Algorithms sorted the cases into small batches of cases with similar characteristics. The cases were worked in the usual manner by the same employees who otherwise would have worked them. This re-ordering of case assignment resulted in nearly a 12 percent reduction in the time needed to process cases, and a 7.5 percent reduction in the reworking of cases because the intellectual thought process involved in adjudicating similar cases could be repeated more quickly than when cases were assigned randomly.

The Appeals Council also worked with contracted data scientists to develop a naive Bayes analysis of pending workloads that determined the probability of an award of benefits based solely on certain characteristics of the claims. This analysis was not used to adjudicate the cases, and the probabilities of allowance were not shared with adjudicators, but cases with higher probabilities of allowance were moved ahead of cases in the queue with lower probabilities of allowance under the notion that disabled claimants should receive their decisions as soon as possible.

In early 2015, the Appeals Council began to take even greater advantage of the benefits of its eCMS. By that time, the Appeals Council had acquired the capability to convert the electronically stored decision documents to a text mine-able format. Given knowledge of the policy compliant pathing to each of the decisions that can be issued in a disability claim, the

[70] The Appeals Council was taking a page from queueing theory. Agnar Krarup Erlang published the first paper on queueing theory in 1904. Queueing theory generally is described as a means of allocating resources to respond to demands for those resources in a timely and cost efficient manner. *See* Queueing Theory and Modeling by Linda Green, Graduate School of Business, Columbia University, New York, New York 10027 at https://www0.gsb.columbia.edu/mygsb/faculty/research/pubfiles/5474/queueing%20theory%20and%20modeling.pdf.

[71] A term popularized by D. J. Patil, former Chief Data Scientist of the United States Office of Science and Technology Policy during the Obama Administration, and described in "Data Scientist: The Sexiest Job of the 21st Century," by Thomas H. Davenport and D.J. Patil, Harvard Business Review, October 2012 Issue. Available at https://hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century (last visited September 21, 2017).

sequential nature of the evaluation process, and knowledge of the way in which decisions are formatted in the document generating systems, the opportunity arose to develop a supplemental analytical tool powered by natural language processing using machine learning algorithms.[72] The tool became known as INSIGHT.

INSIGHT is a powerful natural language processing and machine learning[73] tool. Natural language processing, also known as computational linguistics, uses mathematical algorithms to enable understanding and manipulation of natural language texts using pattern recognition and computer heuristics. Machine learning refers to algorithms that probabilistically find commonalities in existing data and make predictions about new data.

INSIGHT extracts text from hearing decisions and independently analyzes the language for policy compliance and consistency with other parts of the decision. Hundreds of different paralegals and attorneys write decisions for hundreds of ALJs in the Social Security disability process. The language used by so many different people varies significantly even when the issues are quite similar. Despite the differences, however, decisional language uses many terms of art with specific meanings in the context of agency regulations. INSIGHT relies, in part, on supervised text-classifier algorithm training sets generated by analyst review of many thousands of the several million decisions stored in SSA's database. In this case, the training sets consisted of phrases and language constructs that exhibited a lack of policy compliance, internal inconsistencies, and other types of known issues affecting decisional quality that often lead to remand. The training sets also included examples of policy compliant phrasing for comparative purposes. Training sets can consist of collections of language constructs which exhibit quality issues that can result in remand and those which do not.[74] INSIGHT also implements concepts

[72] One of the attorney advisors at the Appeals Council, Kurt Glaze, originated the idea and developed a mock-up of this tool that he called Second Sight. He presented this mock-up to executives, who endorsed and supported continued development of the project. Glaze has continued to serve as the primary developer and programmer of the INSIGHT tool.

[73] A term coined by Arthur Samuel in 1959 while working at International Business Machines. Samuel, a pioneer in artificial intelligence (AI), developed the first self-learning program, the Samuel Checkers-playing Program. See http://researcher.watson.ibm.com/researcher/files/us-beygel/samuel-checkers.pdf.

[74] Note that other technologies can be used to approach the issue of extracting meaning from the text identified. In some machine learning powered applications, lexical semantic algorithms, for example, are used to computationally extract the meaning of words in context.

known as regular expression[75] to find relevant terminology and decisional language,[76] fuzzy string matching to help identify spelling variants and typographical errors, and co-reference resolution to find other words, phrasing and notations that have the essentially the same meanings.

INSIGHT also uses named entity recognition classification to identify items in the text that are proper names and to deduce the type of each name, i.e., whether the name is that of a person, organization or place.

INSIGHT runs in a matter of seconds, and is estimated to be able to identify as many as one third of the issues that generate Appeals Council remands. INSIGHT generates a report of its findings, highlighting potential problems in the decisions being reviewed, and it contains hyperlinks to the problematic decisional language and to related policy guidance. The INSIGHT outputs are reviewed as a starting point for an analyst, who then reviews the record and decision and recommends to an AAJ what, if any action the Appeals Council should take. The tool includes a feedback mechanism if analysts identify problems in the INSIGHT tool or outputs supplied by the tool.

The Appeals Council continues to innovate new solutions to improve its adjudicative processes and pursue new opportunities to creatively use the data available from its eCMS. Most recently, the Appeals Council and the ACE have begun investigating the construction of a Bayesian belief network[77] to help structure and categorize information necessary for deep learning[78] and artificial intelligence[79] algorithms. Such algorithms hold the promise of being able not only to read and extract information from the medical records associated with disability

[75] A concept first formulated in 1956 by Stephan Cole Kleene while serving as a Professor of Mathematics at the University of Wisconsin.

[76] A regular expression is one or more characters defining a specific pattern in a text that can be located with string search algorithms. See "Logical Foundations of Artificial Intelligence" by Michael R. Genesereth and Nils J. Nilsson

[77] A Bayesian belief network is essentially the information that NLP technology uses as a comparison point for data extracted by the NLP program.

[78] For a description of artificial intelligence, deep learning and other terms related to machine learning, see https://www.slideshare.net/NVIDIA/the-deep-learning-glossary. For data sets, demonstrations and deep learning research groups and labs, see http://deeplearning.net/.

[79] *Ibid.*

claims but also to understand the records within the context of the Social Security Act, its implementing regulations, and agency policies.

Recognizing the value of these data analytics efforts, Acting Commissioner Carolyn Colvin established an Academy in 2014 to provide training on data analysis to executives and staff across SSA, and in 2015 created the Analytics Center for Excellence (ACE), a team of data science professionals who are helping to infuse data-driven decision making across SSA.[80] In furtherance of that effort, current Acting Commissioner Nancy Berryhill recently moved the ACE into a new Deputy Commissioner-led component, the Office of Analytics, Review and Oversight (OARO), that also includes the Appeals Council.[81]

Perhaps one of the most important takeaways from this case study is that these efforts are being executed with the understanding that the process of evolution of an eCMS never ends. As an eCMS is integrated into the day-to-day processes and work behaviors of the subject matter experts who provide services to an agency's customers, the quality of the services delivered improves continuously.

XI. Conclusion and Recommendations

The emergence, improvement, and convergence of a number of technologies make the case for electronic case management systems for agency adjudication programs quite compelling. The technologies offer easier and faster interaction with customers and improves the transparency of agency actions. Electronic case management systems hold the promise of improved productivity, streamlined case flow, enhanced productivity, shortened processing times, improved consistency, and better quality. Data streams flowing from the eCMS can be used to enhance training, assist in the formulation of clearer policies, and guide adjudicators through policy compliant pathing, while setting the stage for future improvements using natural language processing, machine learning, and deep learning to assist in case adjudication. The

[80] *See* Office of Appellate Operations, Soc. Sec. Admin., *ACE Launched to Grow SSA Data Analytics Expertise*, OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, May 20, 2016, at 1,2.

[81] *See* Office of Appellate Operations, Soc. Sec. Admin., *OAO Moves to OARO,* OFF. AP. OPERATIONS EXECUTIVE DIRECTOR'S BROADCAST, Aug. 25, 2017, at page 1.

recommendations which follow may help agency adjudication programs develop robust ecosystems.

A. Develop a good governance structure that maintains an operational focus

Before doing anything else, agencies should set up a governance structure to identify the critical needs and decide how to allocate resources toward development of an eCMS. They should take into account the costs associated with building, maintaining, and improving the eCMS, and they should put in place a management structure capable of dealing with incidence, problem, release, change, and configuration management. They should map the business process, identify critical needs, and look for opportunities to get things done in the short term. They should plan to engage the staff and expect to deal with training and change management issues as the staff converts to more electronic work.

Whether the agency decides to adopt a waterfall software development approach with defined releases in stages as OMHA did, a Rapid Application Development (RAD) as the BVA did, or the Agile approach used by the Social Security Appeals Council, it is important to understand that configuring and maintaining software is an on-going process. Agencies must plan and provide the required resources for continuous improvement delivery. The vendor or IT office practices at times may determine the development method, but the agency's strategy should determine the long-term vision and resource assignment, including the continuous improvement focus.

Additionally, if the agency does not have a service desk, it is important to establish one. Implementing a service desk is crucial to the success of the eCMS implementation. As implementation expands, the needs for supporting the eCMS will increase. The service desk is a central hub for reporting and receiving all needed support. It is available to gather statistics of the eCMS issues which can help guide the improvement process of the eCMS. It also provides feedback on the resolution of problems to the end-users. A service desk also can be set up for eCMS users to offer suggestions for improving the eCMS in addition to providing service support.

B. Automate where possible within budget

Agencies should carefully consider the types of functions they perform in determining what to automate. They should establish a strategy with clear goals to identify, prioritize, and address issues in the short, mid, and long term. Electronic Case Management Systems should be designed to improve service in a demonstrable and cost-effective way. Development of an eCMS can be a considerable investment and the investment needs to be justified. Savings can be quite significant. Electronic folders reduce storage and mailing costs, and facilitate work from offsite locations. Electronic public access can save staff time in helping customers with routine inquiries or in filing documents. Document generation systems can speed analyses and document preparation. Case analysis tools can improve work quality and may reduce the expenditures for quality assurance. They also can speed the processing of cases, freeing up staff for other purposes.

Incremental improvements can produce easily measured and demonstrable progress, and they can be expanded to other areas. The BVA's implementation of eCMS services in areas where problems were clearly defined and baseline metrics established is an example. Even in times of tight budgets, agencies should still have opportunities to build useable tools for their staff such as document generating systems. For agencies with smaller workloads and budgets, contracting for cloud services may offer a relatively inexpensive way to build parts of an electronic case management system. For agencies with high volumes of work, once they convert their records to electronic format, they should consider building case analysis tools and consider developing the capability to enable the filing of claims and appeals electronically.

C. Take care to ensure the security of the system

It is critical for agencies to maintain secure systems. The internet is the main tool used for public access to eCMS. The way to keep data safe and seen by the intended audience is to consider data confidentiality and privacy early in the eCMS process. Inadequate security can lead to the importation and installation of viruses and worms, denial of service attacks that affect the performance of the systems, and potential loss of non-disclosable data and information. Despite these threats, electronic case management systems often provide access to non-agency personnel, run on networked computer systems with multiple users, and send information to agency users

working offsite. Encryption, multi factor identification, malware and anti-virus detection software and firewalls can be employed to maintain secure systems. Discouraging the use of removable media like flash drives also helps maintain the security of the systems.

D. Consider how to analyze and leverage the data that is captured and develop an organizational structure to do so

Regardless of whether an agency is just beginning to build an eCMS, or whether it already has developed a robust eCMS, it should consider how its organization structure and employee hiring facilitate its ability to take full advantage of the eCMS. The abundance of data generated by an eCMS affords opportunities for data analysis that typically far surpass the data analysis opportunities of the past. Hiring staff specifically trained in data science can greatly facilitate data analysis, particularly when the data scientists have ready access to subject matter experts. SSA recently merged its quality assurance, data analytics, fraud unit, and appellate level offices to seize these unique opportunities, for several reasons. First, quality assurance data is captured from appeals and with unappealed review. Data analytics helps identify issues that may need the attention of the quality assurance unit, and the investigation of those issues sometimes uncovers potential fraud-related issues. Additionally, data analytics can uncover problems in case adjudication, so the information obtained can also inform training and policy formulation. Data analytics can be used to monitor and improve performance, including staff productivity and timeliness. Data analytics also can be used to identify areas of concern in the quality arena, suggesting issues that might warrant greater scrutiny, or issues that might warrant retraining for some or all of the staff. Further, data analytics can help identify policy guidance that is open to multiple interpretations, and can be used to help identify potentially fraudulent conduct.

XII. Appendix

A. Technology Advancements Leading to the eCMS

Agencies have sought to automate casework processes since the invention of electro-magnetic business machines. Some early technological advancements were undertaken by government employees at the Census Office. In 1872, Census clerk Charles Seaton built a machine that sped the counting of census data, as well as a matrix printing machine to display the results.[82] Despite this effort, the 1880 census took seven years to tabulate. Herman Hollerith, another Census Office employee, saw an opportunity to further automate this process and left the agency to build several machines. One machine punched cards, with each punch representing data gathered by the census-takers. The cards were fed into a sorter and then into a tabulating machine that operated much like a Jacquard loom,[83] but in this case completing an electric circuit through each hole punched in each card, which tabulated the census result. The machine was successfully used to reduce the tabulation time to about one year in the 1890 census. The company he founded later merged with other companies to become International Business Machines.[84] Other Census Office workers, led by James Legrand Powers, developed an even more advanced tabulating machine used in the 1910 Census, and the company they founded later became part of the Unisys Corporation.[85]

Progress in the development of fully electronic digital computing machines occurred rapidly during World War II. One of the earliest fully electric programmable machines was the Electronic Numerical Integrator and Computer. ENIAC, as it was known, and the British computer Colossus,[86] were developed through government funding as part of the war effort.[87]

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[82] https://www.census.gov/history/www/innovations/technology/tabulation_and_processing.html.

[83] https://www.census.gov/history/www/census_then_now/notable_alumni/herman_hollerith.html.

[84] See generally "Chronological History of IBM" at http://www-03.ibm.com/ibm/history/history/history_intro.html.

[85] https://www.census.gov/history/www/innovations/technology/tabulation_and_processing.html.

[86] Efforts to decipher German war transmissions via the Lorentz SZ-40 led to the development of the first programmable digital electronic computer, Colossus, designed by British electrical engineer Tommy. See http://www.cryptomuseum.com/crypto/colossus/index.htm and http://www.cryptomuseum.com/people/tommy_flowers.htm.

[87] Swaine, M. and Freiberger, P. "ENIAC," Encyclopedia Britannica at https://www.britannica.com/technology/ENIAC.

Following the war, the Census Bureau commissioned the development of the Universal Automatic Computer, or UNIVAC, a fully electronic computer designed specifically for business use. Developed by engineers J. Presper Eckert and John W. Mauchly, both of whom had worked on ENIAC during World War II,[88] UNIVAC more than doubled the tabulating speed of previous electro-mechanical machines.[89]

The development and confluence of several other technologies also contributed to the development of electronic case management systems. The creation, miniaturization, and improvement of transistors, first developed at Bell Telephone Laboratories by John Bardeen, Walter Brattain, and William Shockley,[90] and the later development of the integrated circuit in 1958 by Jack Kilby of Texas Instruments,[91] afforded new opportunities to process and store information cheaply, effectively, and securely in electronic format,[92] setting the stage for the personal computer. Early on, the programs to operate these machines were written in assembly language, and programming required a high degree of technical skill.[93] Binary Code, first posited by Claude Shannon in his 1937 Massachusetts Institute of Technology (MIT) master's thesis, "A Symbolic Analysis of Relay and Switching Circuits," [94] became the foundation for modern computer programming. Numerous efforts to obviate the need for unwieldy assembly language programs were undertaken in the 1940s and 1950s, particularly by government funded research laboratories and universities. These efforts ultimately made computer programming more accessible to people who did not possess highly technical math and computer science backgrounds. [95]

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[88] https://www.britannica.com/technology/UNIVAC.

[89] https://www.census.gov/history/www/innovations/technology/tabulation_and_processing.html.

[90] Gertner, J. *The Idea Factory: the Bell Labs and the Great Age of American Innovation.*

[91] Isaacson, W. *The Innovators: How a Group of Hackers, Geniuses, and Geeks Created the Digital Revolution*, 173, 175 (2014).

[92] *Ibid*, at page 175. Robert Noyce of Fairchild Semiconductor independently developed an integrated circuit a few months after Kilby.

[93] Ada, Countess of Lovelace, the daughter of the poet Lord Byron, wrote what some historians recognize as the first computer program in 1843. https://www.britannica.com/biography/Ada-Lovelace.

[94] http://dspace.mit.edu/bitstream/handle/1721.1/11173/34541425-MIT.pdf?sequence=2

[95] In 1964 Dartmouth Mathematics Professors John Kemeny and Thomas Kurtz developed Beginners All Purpose Symbolic Instruction Code (BASIC) to simplify coding for those without a strong technical or mathematical background. By 1972 it was common for high school students to take courses in computer programming. See http://time.com/69316/basic/. Since that time, many other computer programming languages have been developed, including the open source Python, developed by Guido Van Rossum and first released in February 1991. See "25

Progress in telecommunications also was important to the development of the eCMS. Telecommunications developed rapidly in the second half of the 20th Century, leading to the development of the internet.[96] Initial efforts were led by the Department of Defense. Concern about nuclear attacks persuaded the U.S. Air Force to develop a wide area network for their Semi-Automatic Ground Environment (SAGE) radar defense system.[97] In 1961, Paul Baran of the RAND Corporation gave a presentation to the U.S. Air Force on the concept of distributed adaptive message block switching.[98] This was later referred to as packet switching by an independent inventor of the same basic technology, Donald Davies of the National Physical Laboratory in the United Kingdom.[99] Baran's publications[100] described the general architecture for a large-scale distributed communications network that used a "store-and-forward" approach similar to the full-message switching then used by telegraph operators.[101] The network divided messages into equally sized blocks with header addresses that directed their travel across a decentralized network through multiple paths.[102] This technology was developed by the Defense Advanced Research Projects Agency and became a key component of the progenitor of the

Years of Python at CWI," Bennie Mols, March 4, 2015, at https://www.cwi.nl/news/2015/25-years-of-python-at-cwi.

[96] Power to run the expanding electronic systems and the ability to operate them across the country was made possible, in part, by the electrification of rural America, which began in earnest in 1933 with the creation of the Tennessee Valley Authority and the creation of the Rural Electrification Administration (REA) in 1936. Later, the REA also made low interest loans available for the expansion and improvement of telephone services. See https://eh.net/encyclopedia/rural-electrification-administration/, and Laurence J. Malone, *Commonalities: The R.E.A. and High-Speed Rural Internet Access* 3 (2001), https://pdfs.semanticscholar.org/f46e/a18fa1b03e57af4598b5ba3859c279eaeb98.pdf

[97] "In Your Defense," produced by the Western Electric Company for the United States Air Force, 1963, available at www.youtube.com/watch?v=06drBN8nlWg, by the Computer History Museum.

[98] The Innovators, by Walter Isaacson, Simon and Shuster, UK Ltd., 1st Floor, 222 Gray's Inn Road, London, 2014, pages 238 - 240

[99] Id, 242.

[100] "On Distributed Communications Networks," report P-2626, published by RAND Corporation, Santa Monica, CA, 1962 and superseded by "On Distributed Communications: 1. Introduction to Distributed Communications Networks" Memorandum RM-3420-PR, August 1964. *See also* http://www.realtechsupport.org/UB/MRIII/papers/CollectiveIntelligence/Baran_DistributedCommunications.pdf.

[101] The Innovators, *supra*, at page 238.

[102] Leonard Kleinrock developed the mathematical theory of packet networks, while he was a graduate student at the MIT Research Laboratory of Electronics in Cambridge, Massachusetts. See https://www.lk.cs.ucla.edu/index.html.

Internet, the ARPANET,[103] which became operational in 1969.[104] In 1974, Vinton Cerf and Robert E Kahn published the specifications for Transmission Control Protocol (TCP) and packet network interconnection protocols (IP) for sharing resources using packet-switching among the nodes of a network in 1974.[105] ARPANET became the first network to run TCP/IP that same year. In 1990, Tim Berners-Lee, then a contractor for the European Organization for Nuclear Research,[106] developed HyperText Markup Language, Uniform Resource Identifiers, and the Hypertext Transfer Protocol. He also created the first web page editor and browser, effectively creating the foundation of the World Wide Web, which was opened to people outside of CERN in 1991.[107] Bandwidth for sending data between parties also improved rapidly after development of the first modem in 1959.[108]

Prior to 1980, most computers used a command-line interface, requiring users to type text commands in a specific format on a computer keyboard. In the 1960s, Douglas Engelbart and others at the Stanford Research Institute and at Engelbart's Augmentation Research Center first developed a different type of user interface using mouse clicks and featuring icons, widgets, and other visual indicators.[109] These features became generally known as graphical user interface (GUI), and were later refined and extended by researchers at the Xerox PARC facility, which

[103] Built for the Defense Department, ARPANET became the shortened name of the Advanced Research Projects Agency Network

[104] Charles Kline sent the first message over ARPANET from Leonard Kleinrock's computer at the Stanford Research Institute on October 29, 1969. See https://www.livescience.com/20727-internet-history.html and https://gizmodo.com/this-is-the-room-where-the-internet-was-born-1527205592.

[105] The Innovators, by Walter Isaacson, Simon and Shuster, UK Ltd., 1st Floor, 222 Gray's Inn Road, London, 2014; also, *see* http://history-computer.com/Internet/Maturing/TCPIP.html

[106] CERN is an acronym of the French name of the organization

[107] "History of the Web," World Wide Web Foundation at https://webfoundation.org/about/vision/history-of-the-web/.

[108] The first narrowband technology, the telegraph was developed in the1830s. Morse code, first used in 1844, and had a transmission rate of about four characters per second by a skilled operator. When Bell Labs released the first commercial modem, the Bell 103 Modem in 1962, transmission speeds increased to about three hundred characters, or 0.30 kilobytes per second. See http://www.techradar.com/news/internet/getting-connected-a-history-of-modems-657479. Modems gradually improved to a speed of about 56 kilobytes per second. See http://www.dslreports.com/faq/1643. The Data over Cable Service Interface Specifications (DOCSIS) v1.0 cable modem developed in 1997 had downstream capacity of about 40 Mbit/s and upstream capacity of about 10 Mbit/s. See https://volpefirm.com/wp-content/uploads/2009/10/Screen-Shot-2012-11-10-at-8.16.28-AM.png. Fiber optic services are now capable of download speeds of more than one Gigabit per second. See http://bgr.com/2015/11/20/google-fiber-speed-how-fast-1-gbps/. Speeds continue to increase as these technologies advance.

[109] See https://www.britannica.com/biography/Douglas-Engelbart.

opened on July 1, 1970.[110] GUI was incorporated into the Xerox Alto computer in 1973,[111] and into the commercially sold PERQ workstation and the Xerox Star in 1981. The introduction of personal computer workstations and the widespread adoption of graphical user interface (GUI) brought computers into the mainstream.

B. An Example of the Evolution of Case Management

The Social Security Administration (SSA) provides a clear example of the early adoption of business machines and technology and how they were used to improve efficiency. SSA, established when President Franklin Roosevelt signed into law the Social Security Act (Pub. L. 74-271) on August 14, 1935, began using mechanical tabulating machines before the close of 1936 to record information about employee earnings on what were called "master record" cards that were then stored in file cabinets.[112] Some of the machines, like the Alphabet Direct Subtraction Accounting Machine, were electro-mechanical devices, using plugboards with wires to program the machines to carry out various specific functions.[113] Later, records were printed onto flexoline strips by a listing machine.[114] By July 1951, SSA's Division of Accounting was using 806 punching machines, accounting machines, sorters, collators, and other mechanical and electro-mechanical machines to assist in maintaining the claim records for more than 100,000,000 accounts and 127,113,000 names in the National Employee Index.[115]

In June 1958, Reinhard A. Hohaus,[116] an executive with the Metropolitan Life Insurance Company, chaired a specially convened group consisting of members mostly drawn from major

[110] https://www.forbes.com/sites/tendayiviki/2017/07/01/as-xerox-parc-turns-forty-seven-the-lesson-learned-is-that-business-models-matter/#7a54df9b7548.

[111] "The Art of Unix Usability by Eric Steven Raymond and Rob W. Landley, copywrite 2004 Eric S. Raymond, available at www.catb.org/esr/writings/taouu/html/index.html; see also *CED in the History of Media Technology*, 1973 at http://www.cedmagic.com/history/xerox-alto.html.

[112] The Baltimore Sun reported on Wednesday, December 2, 1936 that: "The Social Security Boards' intricate tabulating machinery in the Candler Building swung into action yesterday on the first down-the-line production of employes' (sic) records. Approximately 50,000 application forms were started on a journey through a long line of business machines and checking clerks. And some 2,000 reached the end of the line in the form of "master record" cards ready for deposit in the board's half acre of steel filing cabinets."

[113] Machine Methods of Accounting, No. AM-17, 1936, IBM Corporation, Printed in USA.

[114] https://www.ssa.gov/history/candlerops3.html.

[115] Your Social Security Record, Appendix III, Federal Security Agency, Bureau of Old-Age and Survivor's Insurance, Baltimore, Maryland, Revised September 1951.

[116] Hohaus also is the originator of the three-legged stool metaphor to describe private pensions, savings and investments, and Social Security benefits as the foundations for retirement. See https://www.ssa.gov/history/stool.html

United States corporations to analyze data processing opportunities for SSA.[117] The Hohaus group recommended that "the Bureau review its work process and organizational assignments from the point of view of integrated data processing."[118]

To implement the concept of integrated data processing, the agency acquired fully electronic computers.[119] The agency's Central Planning Staff also piloted the use of Teletypewriter Exchange Services,[120] a switched network of teleprinters that sent text messages over wire services to pilot offices through relay stations, via leased privately owned wires, to other teleprinters. The relay stations were connected to the Baltimore electronic data processing system and became operational on July 11, 1960.[121] The transmission of earnings request traffic over this system was found to reduce the time for transmission of this information by 5.9 days compared with the United States Postal Service.[122] The rollout of this system continued over several years as six larger communications centers were established, each serving eight relay centers, which in turn served 548 district offices.[123] In the late 1960s, additional beneficiary information was transmitted via this system, resulting in an estimated savings of "500 man years."[124]

As personal computers powered by integrated circuits became more affordable and mainstream, agencies such as SSA began integrating them into the work processes. In the mid-1980s, SSA purchased 3,279 personal computers for use in field and regional offices that included database software to help managers maintain, sort, analyze, and retrieve information. The computers also enabled spreadsheet software for analysis of office operations, word

[117] Memorandum dated December 14, 1959 from Social Security Commissioner W.L. Mitchell to Arthur Fleming, Secretary of Health, Education and Welfare.

[118] Memorandum dated October 25, 1960 from Roy Touchet, Assistant Director, Central Planning Staff to Victor Christgau, Director, Bureau of Old Age and Survivor's Insurance (BOASI) titled "Recommendation to Proceed Toward a National Wire System for Integrated Data Processing."

[119] Specifically, the IBM 360/OS, one of the most advanced computers of the era.

[120] Commonly referred to as TWX.

[121] Memorandum dated October 25, 1960 from Roy Touchet, Assistant Director, Central Planning Staff to Victor Christgau, Director, Bureau of Old Age and Survivor's Insurance (BOASI) titled "Recommendation to Proceed Toward a National Wire System for Integrated Data Processing.

[122] *Id.*

[123] Memorandum dated May 19, 1961, from Roy Touchet, Assistant Director, Central Planning Staff, to Arthur Hess titled "Bureau IDP Work Plan for Fiscal Years 1962-1963."

[124] Memorandum dated August 16, 1968 from Jack Futterman to Robert Ball titled "BDOO Proposal to Establish a System for District Office Access to MBR Data."

processing software to permit the preparation of correspondence and reports, and a desk organizer with calendar, calculator, and telephone-directory functions.[125]

Despite these efforts, most of SSA's operations continued to rely on paper files throughout the 1980s. For example, hearing examiners used Edison Dictaphones to dictate their decisions, which clerical support staff transcribed into typewritten documents. Records were stored in paper folders housed in file cabinets or on open storage shelves within the local office, and mailed to other offices when needed. Handwritten entries on case control cards reflected folder movement and activities, and a set of handwritten reports showing progress made on pending cases were produced each month by each organization unit (branch, division or office). The reports typically reflected the numbers of receipts, dispositions, average processing time, and pending workload level. Individual employee performance also was captured manually on reports showing time usage and cases processed. As pending workloads grew, centralized storage sites were opened to house cases awaiting action.

By 1991, however, SSA was conducting paperless office demonstration projects, including one at the Appeals Council, an appellate adjudicative body within SSA, using graphical user interface technologies[126] incorporated into small portable computers known as individual work stations.[127] These projects demonstrated many of the efficiencies that could be gained through implementation of an eCMS, including the potential for reduced mailing and storage costs, the ability to automate reporting and expand reporting capabilities, and the improved ability to locate and access records across the agency. These steps were the first within SSA to introducing digitalization to a culture that had always worked with paper, and led directly to the development of an eCMS at SSA.

[125] Q&A with Janice Warden, Acting Director for Field Liaison and Support Staff, in the SSA Management Newsletter for Supervisors and Management Personnel, Special Edition, July 29, 1986, published by the SSA Office of Management, Budget and Personnel, SSA Pub. No. 23-053.

[126] The computer mouse and other usability innovations were originally developed by Douglas Engelbart and others at the Stanford Research Institute and at Engelbart's Augmentation Research Center. See https://www.britannica.com/biography/Douglas-Engelbart.

[127] Office of Technology Assessment, U.S. Congress, *The Social Security Administration's Decentralized Computer Strategy: Issues and Options, pages 53 – 68 (April 1994). See* https://www.princeton.edu/~ota/disk1/1994/9439/943907.PDF.

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