ICC INTERNATIONAL CODE COUNCIL®

STRATEGIES FOR FILLING DIGITALIZATION GAPS

CODES
Code Official Digitization and Efficiency Support

+ lab architect llc.

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Contents

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Acronyms

AEC	Architecture, Engineering and Construction
AI	Artificial Intelligence
BIM	Building Information Modeling
CODES	Code Official Digitization and Efficiency Support
GIS	Geographic Information System
ICC	International Code Council
RVI	Remote Virtual Inspections

Executive Summary

Digitalization offers significant advantages beyond operational efficiency. The shift to digital permitting streamlines workflows, improves compliance, and reduces administrative burdens, while also enhancing interdepartmental collaboration. Remote virtual inspections can further enable inclusivity, allowing senior and disabled professionals to remain engaged in the workforce, where they can pass down institutional knowledge to new hires. Access to real-time inspection data has strengthened decision-making, reduced errors, and improved enforcement outcomes. Additionally, emerging technologies such as AI (artificial intelligence) show potential in automating routine pre-permitting tasks, freeingup staff to focus on more complex applications. While enthusiasm for AI is growing, jurisdictions are proceeding with caution, recognizing the need for careful implementation strategies.

Despite these significant advantages, transitioning to digital permitting is not without obstacles. Jurisdictions face different challenges depending on their level of digitalization, ranging from basic digitalization efforts to fully integrated digital workflows. This *Strategies for Filling Digitalization Gaps* provides a structured approach to navigating these hurdles, offering insights into common roadblocks and corresponding recommendations. This analysis has been structured in alignment with the four levels of increasing digitalization outcomes, as outlined in the companion *Roadmap for Code Department Digitalization* and described briefly below. It serves as a guide to help jurisdictions assess their current state of digitalization while planning strategically for future advancements.

At the initial Digitization stage, jurisdictions must conduct a self-assessment addressing fundamental tasks, including selecting appropriate storage solutions, digitizing historic records, restructuring outdated workflows, and addressing budget constraints. Recommendations emphasize adopting cloud storage, seeking external support for data migration, and ensuring that budgeting is aligned with long-term digitalization objectives.

As jurisdictions move forward to Essential Digitalization, they typically establish core digital workflows, including project tracking and permit application processes. While digitalization levels vary by size and resources, common barriers include cultural resistance, insufficient training, delayed vendor timelines, integration complexities, lack of internal technical support, and lack of funding for implementation plans. Key recommendations include aligning digital tools with existing processes through internal evaluations, supporting cultural shifts with responsive tools and adequate training, and building realistic timelines with contingencies for vendor delays. Jurisdictions are encouraged to prioritize software with robust API capabilities, enhance internal IT capacity, and include contractual provisions for long-term vendor support and updates.

Advanced Digitalization involves automated workflows and digital plan reviews. These initiatives enhance efficiency but require careful integration, robust training, and sustained vendor support. Long-term planning becomes crucial to ensuring scalability and adaptability as technology evolves. In the most forward-thinking phase—Aspirational Digitalization—jurisdictions may explore emerging technologies such as AI and remote virtual inspections. While these tools offer transformative possibilities, they also present integration and standardization concerns, necessitating a cautious, phased approach supported by pilot projects and foundational training programs.

Systemic gaps and unique challenges limit jurisdictions' ability to transition to digitalization. Many jurisdictions face workforce concerns, particularly in hiring and retaining qualified staff. An aging workforce poses a risk of losing institutional knowledge, compounded by pay disparities between the public and private sector. Smaller jurisdictions struggle to maintain adequate training resources and attract skilled personnel. Additionally, a jurisdiction's size plays a crucial role in determining the level of digitalization required, as smaller jurisdictions often lack scalable enterprise tools tailored to their needs.

Jurisdictional differences in code adoption and enforcement hinder the creation of standardized digital permitting platforms. Municipal independence can result in varied workflows and compliance rules, limiting tool interoperability and complicating multi-jurisdictional applications. Additionally, the absence of standardized performance metrics—often focused solely on application turnaround time—overlooks factors like efficiency, training, and user satisfaction.

The enforcement of energy codes can add another layer of difficulty, both in regard to compliance and verification by building departments. Code officials, already burdened by the permitting process, may lack the time and resources to receive specialized training on energy code metrics and documentation requirements.

Furthermore, the absence of hazard vulnerability data can be a major obstacle to implementing effective pre-disaster resiliency strategies. Many local codes lack proactive hazard adaptation measures, leaving buildings exposed to future risk. Additionally, incompatible platforms among building departments, emergency responders, and permitting authorities hinder coordinated post-disaster recovery. To address these gaps, jurisdictions have reported enhancing preparedness by updating local ordinances with resiliency requirements, providing staff with laptops for remote access during disasters, and adopting cloud-based systems for operational continuity. They are also using digital damage assessment tools that allow residents to report disaster impacts in real time, improving response and recovery efforts.

Ultimately, this Strategy reveals that successful digitalization of permitting processes is dependent on several key factors, which are consistent across all levels of digitalization. These include comprehensive budget planning, adequate training programs, and allocating contingency time to accommodate setbacks, each contributing to a smoother transition. Similarly, conducting robust internal assessments of existing processes can aid appropriate tool selection and maximize efficiency gains from digital solutions. Jurisdictions must remain aware of emerging technological shifts which can aid with the existing processes, approaching them with caution and ensuring that new tools integrate seamlessly with existing platforms and devices. A strong internal IT support system and long-term vendor assistance agreements are critical to reducing staff burden during the rollout and beyond, ensuring ongoing support for troubleshooting and maintenance. Moreover, proactive planning for system maintenance, accompanied by clear communication to all stakeholders, is vital to minimizing disruptions and maintaining trust in new digital tools.

By planning for the gaps with foresight, jurisdictions can fully realize the benefits of digitalization—enhancing code compliance, and workflow efficiency while fostering resilience, and sustainability.

Looking Forward: The Future is Now – Reimagining Permitting for the AEC Industry

While digital tools can bring efficiency to building departments and the design and construction process, the digitalization process inherently requires an examination of the underlying workflows and processes and whether they meet current and future needs. Building departments are part of a broader construction ecosystem and the tools and processes they adopt must be contextual to that bigger system. Building department processes and tools must adapt to assure they do not perpetuate inefficiencies.

As jurisdictions, both large and small, engage in enhanced levels of digitalization (advanced and aspirational) they should undertake a broader effort to identify opportunities to improve underlying processes. This is particularly critical to match the level of digitalization undertaken by AEC professionals—their customers.

Today's design and engineering teams operate in integrated, data-rich environments. From building information models (BIM) to parametric modeling, the industry has shifted to dynamic 3D workflows—yet permitting remains largely static, reliant on 2D submissions and manual review processes. This misalignment leads to delays, redundancies, and inefficiencies that ripple across project timelines.

A transformed permitting process should consider the full capabilities of emerging technologies:

- Artificial Intelligence for rule-based compliance checks
- Digital Twins for iterative performance modeling and lifecycle validation
- GIS integration for spatial coordination and zoning alignment
- Digital ledgers for secure, transparent record keeping and audit trails

By moving toward digital permitting environments that accept and interpret intelligent 3D models, jurisdictions can enable real-time compliance verification, reduce approval times, and increase consistency across projects.

Moreover, this approach would allow for automated code validation, performance benchmarking, and the creation of feedback loops between design, construction, and operations—ultimately elevating the role of permitting from a bureaucratic hurdle to a mechanism for quality assurance and project and industry optimization.

Detailed Gap Findings and Recommendations

As mentioned above, the gaps have been categorized in alignment with the four levels representing increasing digitalization outcomes as identified in the *Roadmap to Code Department Digitalization*. Recommendations and considerations are then provided for the identified gaps, based on considerations for best practices from stakeholders' engagement and literature. The goal of this gap analysis is to meet jurisdictions where they are in the digitalization process and help them move to the next stage by aiding anticipation for potential challenges and plan accordingly.

The gap findings take the following format:

- Gap Title
  - Gap: Explained
  - Recommendation: Considerations/Best Practices

Digitization: Gaps, & Recommendations

The gaps and considerations in this section are focused on the first step in the *Roadmap to Code Department Digitalization*.

This step can either be a steppingstone to further digitalization or a standalone improvement, depending on the jurisdiction's goals. Jurisdictions can begin by moving from paper-based workflows to digital document and file submissions, online storage, and digital reviews. If this step is part of a larger digitalization effort, it serves as the foundation—preparing forms and documents for integration into a connected digital system. The key gaps to consider at this stage include choosing the appropriate digital storage solution, adjusting budget to cover new costs, and ensuring that inefficient processes aren't simply replicated in digital forms. The recommendations are framed as considerations to help mitigate the identified gaps and are supported by best practices.

- Scoping for the Appropriate Data Storage System Type & Size
  - Gap: Scoping for the right data storage system—selecting server versus cloud—should consider features like changes in size, and ability to upgrade. Furthermore, as jurisdictions adopt new tools like remote virtual inspections (RVI), storage systems should also have the potential to accommodate video files or other large file types.
  - Recommendation: Consider cloud-based storage systems, as server-based systems may be prone to more crashes than cloud storage systems. Cloud-based storage systems offer more flexibility in terms of expanding storage and the ability to store a variety of file types. They not only offer more reliability but allow staff to access data remotely—an essential feature for keeping operations running and supporting recovery post disaster via remote working capacity. Scoping for storage systems will vary for each jurisdiction depending on available funding and consideration of policies on data security.

- Digitizing Historic Data
  - Gap: Digitizing data internally could add to the workload of existing staff who are already managing daily permitting tasks. This could be particularly challenging for smaller jurisdictions which may be understaffed or have staff in part-time roles.
  - Recommendation: Consider new workflows, scheduling, and budget planning in this scoping stage of the transition. Smaller jurisdictions should consider external digitization services to assist with data digitization. Ensure that the anticipated cost of this service is accounted for in the budget planning stage.

- Budget Management
  - Gap: Jurisdictions transitioning their storage capacity from analog to digital systems may find it challenging to allocate the same fee to pay for both warehouse storage and new costs related to digitization (includes digital storage and third-party services).
  - Recommendation: Budget planning should consider reallocation of funds and explore new funding sources to support the transition. One option of a new funding source could be to add a technology fee to the filing fee, with a clear and transparent budget plan to ensure those funds are used to support both current and future digital needs.

- Application and Form Conversion
  - Gap: During the initial phase of digitizing paper permit forms to digital formats, most jurisdictions look at mirroring all the information without evaluation of existing content and processes. This may lead to transfer of irrelevant information which may contribute to transferring process inefficiencies into digitization or may end up foregoing the opportunity to capture additional information which may support future data analysis.
  - Recommendation: Digitization is an opportunity to simplify existing processes, making it less cumbersome and streamlining the process and submittals. Similarly, consideration of plug-in requirements for pre-disaster planning and energy efficiency into the permit process may be of value. The process helps gather key data points from past applications that serve to aggregate data for jurisdictional use in the future. While looking at adopting advanced technologies like AI into workflow, this data could help build applications to support jurisdictional needs.

- Legal Barriers
  - Gap: Legal obligations in some jurisdictions may require the retention of physical records, limiting their ability to fully transition to digital tools, introducing inefficiencies and increasing staff workload.

- Recommendation: Jurisdictions may consider evaluating which processes can be digitized to maximize efficiency within existing legal constraints. Selecting digital tools that offer flexibility to scale or adapt as legal requirements evolve can support long-term digitalization efforts.

- Digital Infrastructure
  - Gap: Jurisdiction may lack the digital infrastructure to implement digitalization.
  - Recommendation: Conducting digital readiness assessments could help jurisdictions understand their current state, identify barriers, and tailor a roadmap based on where they are at.

Essential Digitalization: Gaps, & Recommendations

This section focuses on Essential Digitalization, which involves establishing basic digital workflows for jurisdictions including project tracking, management, and application processing. The level of digitalization can differ for each jurisdiction depending on size and available resources. This section highlights common challenges in implementing digital tools, including internal resistance to change, delays from software vendors, limited training programs, and issues with digital tool features. The recommendations provided to address these challenges offer both strategic guidance and some examples from best practices to help jurisdictions develop their own roadmap.

Scoping for the Proper Tool

- Configuring Digital Tools versus Permitting Processes
  - Gap: Often jurisdictions skip a thorough evaluation of their existing permitting processes when transitioning to digital systems, aiming for quick buy-in from staff and other departments. Unfortunately, this can result in simply transferring existing inefficiencies into the new workflows and tools.
  - Recommendation: Best practices encourage viewing this transition as an opportunity to assess and evaluate current processes and adapt to changes in workflow, increasing overall efficiency. This internal assessment and evaluation can help with setting clear goals and outcomes for the transition. Consideration of pre-defined software configurations versus a more tailored approach at this stage is critical.

- Cultural Shift
  - Gap: Updated processes typically requires a cultural shift in addition to user buy-in, involving not just technical changes but also interdepartmental operational adjustments. Despite the efficiency gains digital tools offer, many staff can be reluctant to change established workflows and habits. Inadequate training and allocation of resources (i.e. funding) present further challenges.
  - Recommendation: A key consideration to overcoming this gap is to select a tool that staff can easily update on their own for small changes. This keeps the permit platform flexible and responsive as they use it and helps build confidence by showing that the tool can adapt to their needs—not the other way around. Specific and appropriate approaches to training existing staff members can help address fear and trepidation regarding the overall long-term transition.

- Timing of Software Implementation
  - Gap: Software providers may lack accuracy on actual time for implementation of digital tools. Most often they tend to overpromise and underdeliver, leading to frustration for jurisdictions. Project delays due to this can lead to loss of momentum and participation both from staff and applicants. It can also result in jurisdictions feeling like they are not getting the expected value from their investment.

- Recommendations: Jurisdictions need to consider extra contingency time allotment for setbacks and delays with implementation during the planning stage. Additionally, onboarding new staff or external temporary consultants that have experience in digitalization and software can assist in scoping digital tools, further informing decisions and critical guidance during this phase.

- Integration and Coordination Issues
  - Gap: Software platforms and tool integration can present significant hurdles for many jurisdictions. Data connectivity and entry workflows are difficult to streamline amongst varying software providers and types requiring additional staff input and time resources. Integration of existing long-standing enterprise software may not be compatible with newer tools and plug-ins utilizing newly available technology.
    - Key consideration while scoping is to understand the pros and cons of creating a single platform to integrate all departments involved in the permitting process. One of the issues with single platform configuration is the constant modification and updating to accommodate evolving departmental workflows and code enhancements. Additionally, during annual maintenance cycles, a unified structure of the platform could create possible disruption for all departmental services, delaying approvals.
  - Recommendation: When scoping digital tools, jurisdictions should closely examine the application programming interface (API) capabilities to ensure they support integration with both new and existing systems. This is especially important for tools used across multiple departments where seamless coordination and data sharing are critical. Choosing digital solutions with robust API functionality can help prevent information silos and ensure that all departments involved in the permitting process stay aligned and informed.

- Internal Technical Support
  - Gap: Lack of internal IT support presents key challenges for a smooth transition to digital tools. Departments that lack this support during the tool selection process may end up relying entirely on vendor-based assistance, leading to tool selection which does not meet departmental goals causing implementation delays and poor user experience. Additionally, having limited vendor-based assistance can be challenging, particularly for new users that may need support while using new digital tools.
  - Recommendation: Jurisdictions should establish or strengthen internal IT support to manage the integration, updates, and ongoing maintenance of new digital tools. Providing skills-based IT training for departmental staff can further expand internal capacity during transition including troubleshooting and issue resolution.

- Post-implementation Vendor Support
  - Gap: Once software systems are established and online, support from the vendor generally transitions to a helpdesk. At this point it can be difficult for more significant changes to be made in the program if certain capabilities are desired later. This situation can also create the impression of vendors overpromising and underdelivering in their level of support.
  - Recommendations: Software and tool vendor contracts should consider the need for scheduled updates or upgrades to provide for continued growth of the system. Jurisdictional budgets should be considered for any additional related costs.

- Code Resource Alignment

  - Gap: Access to building codes and local amendments can present difficulties when not conveniently stored or grouped comprehensively. Cross-referencing amongst varying platforms and resources increases permit application and approval times.
  - Recommendations: When digitizing codes jurisdictions should consider having all codes and amendments on the same platform for ease of access to the applicant.

- Staffing Considerations
  - Gap: Digitizing internal records and archives can be time consuming. Small jurisdictions may already be understaffed or experience high turnover prior to the digitalization transition. Loss of knowledge during the transition may also occur if senior staff members retire or transition out of the jurisdiction due to resistance to the transition.
  - Recommendation: Scoping phase consideration must accurately assess and plan for adequate staff resources and time when undergoing the transition. Onboarding new entry level and experienced staff members may be considered at this time. Integrating both senior and entry level staff can assist in generational knowledge transfer.
    - The software and tool selection process can explore case management specific platforms, typically used by finance or legal firms.
    - Incremental or phased adoption of digital tools may also be an approach to assist in the substantial time requirements of a more comprehensive adoption strategy. A practical starting point could be adopting basic document management tools, like Dropbox, and accepting plans in digital formats.
    - Consider outsourcing to a third-party consultant specifically to digitize archives if understaffing is an issue.

Resistance to change and learning curves

- Long Serving, Veteran Staff Members
  - Gap: Senior staff may resist adoption of new digital tools due to fears of job loss or difficulties adapting.
  - Recommendation: Digital tools can help senior staff stay in their roles longer by reducing travel requirements for site inspections. This is a real benefit worth highlighting when talking to them about making the shift—it shows how the tools can support their needs, not just change how things are done.

- Staff Resistance to Change
  - Gap: Resistance from staff, specifically those accustomed to traditional methods, could be due to limited digital literacy, leading to potential attrition risks. Additionally, the learning curve also needs to be considered which could initially reduce productivity while users are adapting.
  - Recommendations: Adoption of new technology and workflows require planning for adequate uptake of the new systems by staff. It is helpful to have dedicated technical support to resolve queries to ensure a smooth transition. Jurisdictions should also plan for contingencies to time-related benchmarks while staff learn new systems, and schedule periodic check-ins to monitor and discuss how the process is going.

- User Engagement Gaps
  - Gap: Excluding end users from procurement can lead to tools that don't meet operational needs, requiring burdensome post-implementation fixes and reduced productivity.

  - Recommendation: Involve staff in scoping and tool selection to ensure alignment with current needs and adaptability. User input helps minimize workarounds and enhances efficiency and experience.

- Interdepartmental Alignment and Coordination
  - Gap: Ensuring alignment, coordination and communication with all departments involved in the permitting process could be a challenge. Some departments may be more advanced than others, which could slow down the overall process.
  - Recommendation: Seek to secure long-term buy-in from different departments in advance through agreements that commit resources to digitalization. Departments can be onboarded gradually and evaluations can be conducted simultaneously on where they are at; with the goal to bring all stakeholders to the same level of digitalization. Plan for unified training across departments to develop overall better working relationships as a benefit.

- Leadership Support
  - Gap: Leadership support may be constrained by concerns about the potential exclusion of certain stakeholder groups.
  - Recommendations: To build leadership support engage diverse stakeholders—such as design professionals, contractors, and community members—to surface user needs and build consensus. A hybrid permitting model that includes in-person options can also address inclusivity concerns.

- Public Buy-in
  - Gap: Public buy-in is critical when transitioning to new processes. Since jurisdictions are investing taxpayer dollars in these changes, it's essential to ensure the community understands the benefits and feels included in the transition.
  - Recommendations: Informal outreach efforts such as handouts and lunch-and-learn sessions can serve as co-learning spaces for the community to interact with code officials and provide feedback on new processes.
    - Considering applicant-friendly add-ons to make the process less cumbersome such as pre-permit decision tools can help applicants understand which permits they need. These tools can be critical for post-disaster recovery, to identify permits for recovery and rebuilding.
  - Gap: Digitalization may not be uniform—while some jurisdictions have moved online, some applicants still prefer or rely on printed plan submissions, creating friction in the process.
  - Recommendation: Create user-friendly digital platforms in familiar formats—like a TurboTax-style interface—that works for both tech-savvy applicants and those less familiar with technology. Recognize the different backgrounds of applicants (design professionals, contractors, and homeowners), making tools more effective.

Lack of Funding

- Budget Planning
  - Gap: Jurisdictions may face challenges in covering digital tool acquisition and operational costs, limiting infrastructure investment and hindering platform performance. This can lead to outdated systems, compliance difficulties, and inefficient permitting. Smaller jurisdictions may find it hard to justify these costs through permit fees, and slow budget approvals can further delay implementation.

- Recommendation: Jurisdictions should consider budgeting for contingency spending and increasing annual maintenance allocations. This could involve having a strong action plan in place and being persistent in the approval process to avoid implementation due to approval delays.
  - Consider partnering with adjacent jurisdictions to adopt shared permitting and code enforcement digital tools. Additional funding opportunities for software and equipment-based costs, like tablets for field use could be covered through grants, while each municipality covers ongoing licensing fees based on the number of users. A centralized IT team (i.e. county level) could help evaluate and manage the implementation.
  - Educational grant opportunities, state-level or public-private partnerships, can help support staff training and enhance departmental capacity regarding new tools and technologies.
  - Small jurisdictions that do not require full digitalization of all processes but that want to accept plans and applications digitally may consider using financier or law firm software, which offers document submission, robust version tracking, and notification features, instead of investing in more costly enterprise tools.

- Planning for Incremental Cost
  - Gap: There is a concern that jurisdiction leadership may become reliant on technology providers' enterprise digital tools. Providers may increase costs over time, due to prioritization of profits over public service and goals of the jurisdiction. This type of dependency can lead to challenges in budget management as tools become more expensive over time.
    - Software providers may conceal incremental costs for add-ons and improvements to get initial buy-ins, leaving jurisdictions without sufficient budget to cover these costs.
  - Recommendation: Jurisdictions should consider dedicated funding source(s) in the form of a technology fund financed by additional fee(s) on the permit. Other alternative fee structures for consideration are drawn-out fees, convenience fees, and fees "baked-in" to the overall permit costs. Funding received through these fees can offset new technology costs, both hardware and software.
    - Consult with jurisdictions of similar size and need to gain insight into potential cost considerations.

Inadequate Training and Support

- Underutilizing Digital Tools
  - Gap: Insufficient training and support for staff using digital tools can lead to underutilization, hindering their effective use.
  - Recommendation: Agreements with software providers should include training and support services for extended periods of time. A balanced approach including both in-house and software provider training can be helpful in maintaining tools and updates.

- Enhanced Training Support
  - Gap: Improved training and support are needed to help users understand how their roles contribute to the overall workflow.
  - Recommendation: In addition to integral training programs, jurisdictions may enhance support for diverse users by incorporating innovative methods like simulated scenarios, role-playing and recorded walkthroughs of successful inspection models to be presented as best practices.

- Continuing Education

  - Gap: Lack of dedicated time to learn and train on new features and updates of digital tools can limit adoption of productivity-enhancing features.
  - Recommendation: Self-learning through innovative formats including video resources and audio-based models should be considered to support different learning curves and educate users about new features. The recommended video length is 30 minutes or less.

- Training New Hires
  - Gap: Even though onboarding new staff is generally observed to be easier than transitioning existing staff at times, there is a concern that digital tools may diminish users' understanding of the underlying processes by providing quick answers. New staff, particularly not well-versed in fundamental, foundational knowledge, could have difficulty in understanding the 'why' behind those decisions.
    - Additionally, new hires may be expected to learn the building code, navigate new digital tools, and troubleshoot issues simultaneously, which can be challenging.
  - Recommendations: Jurisdictions that have gone through the digitalization process have generally experienced a training period between 4 to 6 months for existing staff and 3 months to 1 year to achieve full proficiency for new hires. However, there is no one-size-fits-all approach; jurisdictions should access and tailor their training timeframes to specific needs including learning curves, staff experience and level of digitalization.
    - New staff training considerations should include foundational knowledge building through a "shadowing" program where they can learn directly from experienced team members.

Workflow Design and Interdepartmental Communication

- Configuring Plan Review Workflows
  - Gap: When multiple reviewers are involved in the permit process, it is essential to support both simultaneous and sequential review options. Flexibility in the workflow allows tasks to progress without unnecessary waiting periods. In contrast, overly rigid workflows can create bottlenecks—where one delayed review stalls the entire process—ultimately leading to inefficiencies and prolonged approval timelines.
  - Recommendation: Explore and plan accordingly during the scoping phase. Software and tool providers should be part of the process for configuration of plan review software to meet the jurisdiction's needs.

- Communication Barriers
  - Gap: Poor communication and coordination among inter-department reviewers can lead to data or process loss.
  - Recommendation: To improve coordination, it's important for departments to communicate effectively. This means combining feedback and replies into a single, organized message or response rather than sending fragmented updates. It also involves ensuring all parties are kept informed.

Tool Specific Feature Challenges

- Tool Limitations
  - Gap: Some tools cannot handle conditional or phased approvals, flagging permits which may be required at later stages too early in the process leading to unnecessary delays.
  - Recommendation: Ensure provisions for manual override in the digital tools so staff can use adjustable tags to prevent unnecessary workflow hurdles and avoid work delays.

        - Jurisdictions can ask vendors how their software product handles conditional or phased approvals. If the vendor's product does not adequately account for this, then caution should be applied, as the lack of this capability will drastically impact organization and clarity of project tracking.
    - Gap: Digital tools may make incorrect workflow assumptions—such as marking reviews complete upon document upload—due to limited support for exception handling. This can lead to inaccurate outcomes, process disruptions, and reliance on manual workarounds.
    - Recommendation: Jurisdictions should proactively assess workflow limitations with software vendors to understand exception handling and required staff interventions. If mitigation demands significant manual effort, the tool's suitability should be reevaluated.

- Payment Processing
    - Gap: Digital tools may lack cashier features, which cause application fees to be routed to other departments, instead of permitting offices. Solving this issue may require purchasing or implementing extra software, which could result in increased expenses.
    - Recommendation: Engage with software providers to understand fundamental options within the digital tool. Scoping should include additional tool considerations to manage this gap and ensure that the process is mapped successfully and updated incrementally.

- Digital Downtime
    - Gap: Jurisdictions need to account for system downtime during maintenance and even unexpected outages which may delay the permit process.
    - Recommendation: Regularly scheduled maintenance for system updates and upgrades should be well-driven and planned for. Community and user notifications can reduce impacts and possible delays.
        - Unexpected outages should be planned for with an alternate temporary back-up "system" in the interim.
        - Consider these systems and data for "critical plug load" when looking at agency continuity of operations planning (COOP).

- Compatibility Issues
    - Gap: Compatibility across various devices and platforms can be an issue, affecting the ease of use and accessibility of digital tools.
    - Recommendation: Ensure that digital tools are compatible across various devices, accessible on different screen sizes and operating systems, like iOS and Android, for a user-friendly experience. This would help users, such as inspectors, who may need to access information on the go.

Applicant Challenges

- Code Updates and Communication
    - Gap: Applicants often struggle with limited access to clear, timely updates about code changes within digital platforms, increasing compliance risks, and complicating enforcement efforts.
    - Recommendation: Develop tools to facilitate better communication between code officials and the public which can improve the overall process and reduce frustration. Develop features like discussion boards or real-time communication options within digital platforms to bridge the gap left by reduced in-person interactions.

- Tool Interface and Resources

- Gap: Limited guidance on digitalized permit process and documentation during the initial permit submission may result in frequent back-and-forth between applicants and code officials, leading to delays.
- Recommendation: Jurisdictions can enhance user orientation to digital platforms by incorporating guidance in the form of decision charts and FAQs. Ensuring the platform supports status notifications and requests for additional information can enhance communication. Additionally, ensuring the platform is user friendly and has an intuitive user interface may further support applicants to address objections efficiently and track applications independently.

Advanced Digitalization: Gaps & Recommendations

Depending on the level of digitalization a jurisdiction needs, advanced software tools can enhance efficiency through features like sophisticated workflows automation and tracking through digital plan reviews. These tools may be integrated into a main digital platform or exist as stand-alone solutions. This section highlights gaps associated with these digital tools and cautions against pitfalls when adopting new tools—particularly regarding their compatibility with existing permitting platforms and additional training considerations. The recommendations focus on key planning considerations while also emphasizing the benefits of digitalizing these processes.

Integration with Existing Digital Systems

- Gap: Integration among existing permitting platforms and tools while rolling out advanced tools could be a challenge.
- Recommendation: Develop a comprehensive jurisdictional or departmental digital roadmap (e.g., CODES Digitization Roadmap) that outlines the scope and potential of various technologies and tools. Leverage the *Roadmap for Code Department Digitalization*. This may help clarify which advanced solutions could be implemented in the future and communicate those needs to software providers, particularly to determine whether platforms can support such integrations.

Navigating Evolving Technology

- Gap: Technology evolves rapidly, and today's roadmap may quickly become outdated.
- Recommendation: Best practice should include review of current software APIs to confirm integration and compatibility with other tools. Plan to review and update the roadmap periodically to assure continued alignment, identify any updated software capabilities, or changed jurisdiction needs.

Training and Support

- Gap: Implementation of new tools may stress an already strained workforce, now required to devote additional time and resources to training and learning new software and workflow processes.
- Recommendation: Training programs should be built into the agreement(s) with new software providers. Provisions for continued support addressing user queries and facilitating seamless transitions to new systems.

Aspirational Digitalization: Gaps & Recommendations

This section highlights key gaps with transformational strategies that may support remote virtual inspections and artificial intelligence workflows. It emphasizes the need for cautious implementation of emerging technologies

which can lead to overreliance and may require specialized expertise. If not properly integrated, these strategies can produce inaccurate results and reduce overall efficiency of the process. Many of these tools are still evolving and lack standardized guidelines, often causing rework and delays. The recommendation thus is to treat these emerging technologies as a supplement to existing processes—starting with the automation of routine tasks to ease workload and save time for already overextended staff. Building trust and experience through pilot projects focused on small improvements or upgrades can also help ease inefficiencies and support smoother adoption.

Remote Virtual Inspections

- Adoption Challenges
    - Gap: One of the key challenges with remote virtual inspections (RVI) is the lack of clear standards and best practices. There's a real need for consistent communication protocols and universal guidelines to ensure inspections are thorough and trusted. Currently, inspectors and applicants face uncertainty around how data should be shared and documented. Without standardized video angles, site assessment checklists, or clear categories for types of work, it's hard to ensure consistency and completeness. There's also concern that those important details—like the conditions of surrounding areas or compliance with site cleanliness under OSHA norms—may be missed, potentially leading to safety risks.
    - Recommendation: Explore starting with trade permits and small improvements of limited scope to be inspected via RVI and slowly build trust and awareness in how to conduct more comprehensive and robust RVI. Inspections for in-kind domestic hot water heater replacements could be a low-stakes project type to trial RVI. Leverage the guidance that does exist including *Recommended Practices for Remote Virtual Inspections*, ANSI/RESNET/ICC 1450-2025 Standard for Remote Virtual Inspections for Energy and Water Performance in Buildings, and checklists for using RVI with the 2018 and 2021 International Energy Conservation Code (IECC).

- Emerging Tool Challenges
    - Gap: RVI tools, such as drones, also lack clear standards and guidelines on best practices leading to inconsistent implementation, frequent rework, and confusion among inspectors, limiting their potential benefits.
    - Recommendation: Jurisdictions can explore rolling out test projects, starting with basic site-readiness assessments using these technologies. Improving compatibility with mobile devices (e.g. tablets) can give real-time data access to inspectors, expanding its benefit to rural or underserved areas, even when connectivity is limited.
        - Additionally, drone technology can play a critical role for post-disaster assessments, helping expedite inspections for rebuilding and recovery.

- Connectivity Issues
    - Gap: Technology access limitations, including inadequate internet connectivity, can pose a challenge particularly in remote areas of the jurisdiction.
    - Recommendation: For now, areas in the jurisdiction with limited digital access can continue to have in-person inspections. In the future, the jurisdiction could push these areas to be integrated into a broader digital access strategy, with the ability to conduct RVI highlighted as a key benefit. Jurisdictions should explore software that has an offline function so that applications can be used on sites with poor connectivity and then recorded data can be synced to the larger database (cloud/server) once connectivity is reestablished.

- Budgetary Considerations

  - Gap: Funding for digital storage, specifically large formats such as video files, remains a challenge. This is particularly true for remote inspections when storing and organizing video files increases the need to invest in storage capacity.
  - Recommendation: Cloud-based storage solutions may provide more efficient and less costly options.

- Implementation Hurdles
  - Gap: Existing policies, opposition from decision makers and overall lack of interest from stakeholders are some other challenges to implement RVI.
  - Recommendations: Seek buy-in from decision makers and staff in advance by highlighting its numerous benefits (RVI). RVI can reduce the number of in-person site visits, thus saving valuable time, aiding veteran staff retention, including those with disabilities.
    - Post Disaster assessments also benefit greatly by utilizing RVI to streamline the process. When integrated into the permit system, RVI allows inspectors to log and manage these assessments as specific jobs tied to the disaster event, increasing efficiency and the next phase of recovery, re-building.
    - RVI is well suited for locations and geographies with challenging conditions, both climatic and long driving distances.

Artificial Intelligence Supported Tools

- Technology Overreliance
  - Gap: Overreliance on digital tools, particularly artificial intelligence (AI) supported tools by newer staff could lead to poor decision making, missed errors due to faulty assumptions, and lack of foundational knowledge about the process.
  - Recommendation: Develop a robust training program assisting new hires to build foundational knowledge. Best practices include strategies such as in-house training, continued internal support, and shadow programs with senior team members.

- Cautious Adoption
  - Gap: While there is interest in emerging technologies, such as AI and remote inspections, caution should be applied in their adoption, with a focus on being supplementary rather than primary tools.
  - Recommendation: Building codes are often open to interpretation, presenting challenges for AI systems. However, AI can still play a valuable role in pre-permitting tasks—such as automating routine processes, sorting applications, and prioritizing workflows to improve overall efficiency.

- New Technology Limitations
  - Gap: Specialized AI systems are needed for plan reviews, which require detailed configuration, training, and continuous refinement with real-world data.
  - Recommendation: AI can assist with plan review processes, specifically with the review of prescriptive code requirements and non-discretionary applications. AI could also assist with verification of permitting checklist item requirements. This allows staff to focus on more complex, performance-based applications that require greater review times.
  - Gap: Although a digitalized permit process offers applicants greater flexibility to submit applications 24/7, the high volume of applications and expected turnaround time may strain staff capacity particularly in understaffed small jurisdictions.
  - Recommendation: Jurisdictions can explore the use of AI tools to help sort and categorize applications based on timelines and priority, supporting more efficient workflow management.

Unique Gaps and Best Practices

This section outlines unique challenges facing some jurisdictions exploring digitalization. Some of the challenges—particularly those related to systemic gaps such as dictional variability of permit processes and performance metrics—require broader policy interventions to be addressed. Currently, there are integration challenges between building permitting and allied processes, including energy code compliance and resiliency raising concerns about safety and long-term sustainability. Additionally, operational hurdles are also evident in the use of third-party review services that support permitting functions. A critical concern highlighted is the additional burden placed on Tribal Nations, whose distinct land rights can create complex permitting considerations. Despite these challenges, many jurisdictions are actively working to enhance resiliency and community safety through pre- and post-disaster planning.

The following are some of the **Systemic Challenges**:

- Jurisdictional Variability of Procedure
    - The absence of uniform code adoption and enforcement practices across jurisdictions, even within the same state, directly hinders the development of standardized digital permitting systems. Independent authority at the municipal level can result in divergent workflows and compliance requirements, complicating the implementation of interoperable solutions and limiting scalability across regions. This may complicate the permit process for applicants working across jurisdictions who must navigate multiple digital platforms.

- Absence of Performance Metrics
    - There is currently a lack of standardized guidelines for evaluating the efficiency gains of digital permitting processes. Most jurisdictions focus primarily on application turnaround time and volume after rollout, while mechanisms to capture feedback on other key factors—such as user-friendliness, workflow efficiency, training effectiveness, and applicant feedback—are missing.

The following are the **Gaps & Challenges** specifically related to energy codes, resiliency, Tribal Nations, and third-party reviewers:

- Energy Codes
    - While federal energy compliance tools such as REScheck and COMcheck are well-established and widely used, critical gaps remain in federally supported energy modeling resources. Notably, tools like ResStock, developed by the National Renewable Energy Laboratory, currently exclude Hawaii, Alaska, and U.S. Territories—effectively limiting these regions' access to essential analytical capabilities needed for informed energy planning.
    - Additionally, the Pacific Northwest National Laboratory, a key resource in supporting building energy policy analysis, does not yet fully incorporate localized climatic conditions into its modeling frameworks. This creates significant challenges for states and territories with distinct environmental contexts, making it difficult to implement new or update existing building energy policy.
- Energy Code Software
    - Gap: There is a diverse range of tools related to energy code compliance; however, most are not used directly by jurisdiction staff or code officials. These programs often do different things and are used in different situations. Code officials need to understand the metrics and outputs of various software types and forms that show compliance. Code officials need a foundational understanding

of energy code compliance paths, and what documentation is required for proving compliance. Software such as ResCheck and ComCheck can assess building envelope compliance, but do not provide verification of other energy code provisions. Meanwhile, reports generated from paid software REM/Rate, Ekotrope Rater, or EnergyGauge provide performance reports that are all organized differently.
    - Recommendation: Training that highlights key metrics, details, and building science concepts can help code officials better review supporting energy code compliance documentation.

- Third Party Reviewers
    - Stakeholder interviews highlighted challenges related to energy code compliance reviews. Energy code compliance is complex and may require expert review. Jurisdictions with limited internal capacity may hire third party reviewers to conduct the evaluation. However, existing policies may limit access to full project information resulting in reliance on piecemeal information with little understanding of how their assessment is conveyed to the applicant.

- Tribal Nations
    - Stakeholder interviews revealed unique challenges Tribal Nations face in the permitting process, pointing to a lack of inclusivity in the current system. Due to distinct land rights these communities may need software tools adapted to their specific requirements (which may not be on the market or require considerable customization). Addressing these barriers is key to creating a more equitable and supportive permitting process.

- Resiliency and Emergency Response
    - Limitations of Paper-based Permitting: Jurisdictions that still rely on paper based permitting processes may have limited capacity to support effective disaster preparedness due to lack of integration with hazard vulnerability data. Absence of real-time data may also delay disaster recovery efforts like rapid permitting and damage assessments.
    - Platform Incompatibility: Digital systems used by building departments, emergency responders, and permitting authorities may lack interoperability, restricting information exchange and delaying coordinated response efforts.
    - Lack of Data: Jurisdictions face challenges when maintaining reliable, up-to-date databases to support disaster planning with both current and future risk projections, particularly for under-resourced small jurisdictions. Sole reliance on federal resources whose focus on historic data (example FEMA Flood Maps) may not be helpful to develop comprehensive disaster planning strategies.
    - Integration into Local Codes: Local codes often fall short integrating proactive hazard adaptation and mitigation measures resulting in structures that may be inadequately designed to withstand future climate risks and increase their susceptibility to damage during disasters. This in part can be attributed to the lack of current and predictive databases that jurisdictions may have limited capacity to create as mentioned in the earlier point.

Integration of Pre- and Post Disaster Preparedness within the permit process: Digital tools can be utilized to pre-plan and build a more robust permitting process, increasing resiliency standards on the front end. Initiatives and best practices for **pre- and post-disaster recovery** include:

- Enhance Operational Resilience: Select jurisdictions have transitioned all staff to using laptops instead of desktops, allowing for greater flexibility. This setup enables staff to work from home and access necessary

systems remotely, critical to disaster situations, when access to the office might be restricted. Cloud-based data systems can also ensure accessibility during event scenarios.

- Damage Assessment Tools: Applications enabling citizens to self-report on disaster status on their property or in their neighborhood should be considered. This parcel level information can be integrated into GIS mapping, crucial to assisting post-disaster assessment.

- Access to Data: Pre- or post-disaster, easy access to information on buildings within the jurisdiction including their characteristics (e.g., code built to, foundation characteristics) may assist in assessing shelter needs or prioritizing damage assessments.

- Rapid Permitting Post-Disaster:
    - Many jurisdictions are streamlining permitting to speed up disaster recovery. This helps quickly process a large number of applications, which is crucial in areas with widespread damage and limited code enforcement capacity. Faster permitting reduces delays, but rebuilding to the latest codes remains essential to ensure long-term resilience.
    - In some jurisdictions, programs exist that allow residents to quickly obtain permits for disaster response. For example, citizens can submit photos of issues like downed trees impacting structures, which inspectors use to issue rapid permits or activate volunteer safety teams to assess damage and begin recovery efforts.
    - Jurisdictions can also explore integrating emerging technologies such as drones, blockchain-based compliance tracking, and virtual reality applications to maintain operational continuity for inspections and post-disaster assessments while ensuring safety of code officials and the community.

- Mutual Aid and Resource Sharing: During post-disaster recovery local jurisdictions may be overwhelmed with the high volume of permits. A recommended strategy is to create mutual aid agreements with adjacent jurisdictions to share resources and personnel during times of need. This can include both inspection and permit processing capacities. Digital tools can help track resources, but procedures for training users and determining user access should be pre-determined to allow for efficiency.

- Continuity of Operations Plan (COOP): Include temporary relocation plans if a Building Department facility becomes non-operational during disaster scenarios. This includes how department personnel will access needed digital tools.

- Developing Collaborative Database: Jurisdictions can explore partnerships with county and state agencies to develop databases on both current and future disaster risks, ensuring effective integration into disaster pre-planning into local codes and recovery response.

Potential Vendors/Partners

- **Excessive Options and Choice of Vendors**
    - Gap: There are many vendors that jurisdictions can engage with for municipal administration. However, there is no standard set of functions and capabilities.
    - Recommendation: Jurisdictions should work with staff across buildings, code enforcement, finance, fire department, etc. to better understand critical roles and where expertise is needed. Clear understanding of the roles of stakeholders and how/when they need access to documents and data held within municipal administration software is needed. Jurisdictions should

comprehensively consider the internal and external parties who will use the software, and what features are required. Each potential software and vendor should be assessed for their software capabilities/features to verify alignment with the jurisdiction's needs.
    - Develop standards to outline minimum capabilities of municipal administration software necessary for municipal departmental and interdepartmental functionality.
- Collaborate with other jurisdictions to identify potential vendors and understand how neighboring jurisdictions like/dislike the software(s) and vendor(s) they may currently use.
- Approach vendors with specific needs and goals.
    - Jurisdictions should lead the vendor and not rely on the vendor telling the jurisdictions what they need.
    - Discuss training and on-going support to ensure that operations will continue to function as needed.
- If no vendor meets the jurisdiction's needs, call for new solutions through trade groups.
- Once systems are set up, investigate how AI or blockchain technology could help fill additional gaps in efficiency.