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AI-Driven Transformation of Building Administration: Achievements of the AI Building Code System and Future Policy Directions

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Korea's highly complex building administration system imposes significant social and economic costs, and AI-based systems are rapidly emerging as a core alternative to address these challenges. Many countries are already leveraging BIM and AI to shorten permitting timelines and maximize administrative efficiency. In Korea, the "Archilaw" AI legal interpretation support system developed by the Architecture & Urban Research Institute has demonstrated strong technological potential with high accuracy and user satisfaction. A next-generation system, ALRIS, is now under development. The new system aims to implement a self-evolving platform that integrates AI agents with expert collective intelligence. To ensure a successful AI transition in building administration, several policy programs are required. These include linking the national building administration system Seumteo with AI platforms, adopting multimodal AI capable of automatically interpreting design documents, and establishing a regulatory sandbox to provide the necessary legal foundation. The AI-based transformation of building administration is expected to significantly improve productivity in the national construction industry and enhance public convenience.

- **Social Costs of Building Administration and the Need for AI Adoption**

Korea's building administration system generates substantial social costs due to its complex regulatory framework and heavy administrative burden. More than 200 laws must be directly referenced for building permits, and over 800 subordinate regulations and related cases must be reviewed during actual administrative processing (Cho et al., 2024). This multilayered legal structure leads to conflicts between regulations, ambiguity in interpretation, and increased administrative inefficiency. Across 243 permitting authorities nationwide, each processes more than 1,000 permits annually. The Ministry of Land, Infrastructure and Transport (MOLIT) alone receives approximately 10,000 building-related inquiries each year (Cho et al., 2024).

Such administrative overload directly results in permit delays, placing heavy financial burdens on private development projects. According to the Ministry of Land, Infrastructure and Transport, shortening the permitting period by just one month could save more than KRW 300 billion in financing costs (Ministry of Land, Infrastructure and Transport, 2024a). A survey of real estate developers found that 66% identified permitting delays as a "major difficulty," and 40.4% reported experiencing direct damages within the past three years (Ministry of Land, Infrastructure and Transport, 2024b).

Administrative delays caused by complex building codes increase financing and construction costs, which are ultimately passed on to consumers through higher sales prices, further intensifying the housing cost burden (Ministry of Land, Infrastructure and Transport, 2024a). Advanced technologies, especially AI, have therefore emerged as an urgent policy priority to address long-standing inefficiencies in building administration.

- **Global Efforts to Introduce AI and Regulatory Technology**

Leading countries are adopting AI and RegTech to automate complex building permitting procedures and enhance administrative efficiency. Their initiatives focus on digitalizing regulations, utilizing BIM data, and establishing integrated multi-agency platforms for faster and more accurate administrative processing.

- Singapore: CORENET X

Singapore is the world's first country to implement BIM-based electronic permitting (BCA, 2024). The CORENET X system integrates the permitting processes of multiple regulatory agencies into a single platform and mandates BIM model submission. Its most notable feature is the Auto Code Compliance Checking function, which automatically examines whether submitted BIM data meet statutory requirements such as building height or exit stair width (BCA, 2024). This allows designers to correct errors before submission and has reduced actual permitting timelines by more than 50% (BCA, 2024).

- United States (California): AI-Based Permit Review System

In April 2024, the State of California introduced an AI-based permit review tool to accelerate reconstruction and recovery in regions affected by large-scale wildfires (Office of the Governor of California, 2024). The system rapidly scans and analyzes vast volumes of architectural plans and documents, significantly accelerating the approval process. It is expected to resolve bottlenecks in disaster recovery and support rapid return to daily life for affected residents.

- United States (Private Sector): UpCodes

In the United States, the private startup UpCodes is leading the development of AI-based building code interpretation services (UpCodes, 2024). The platform integrates building codes from across the country into a unified database and provides GPT-4-based "Copilot" AI assistance that cites relevant code sections in response to natural language queries (UpCodes, 2024). The system can automatically detect code violations within drawings, functioning like a spellcheck tool for regulatory compliance, enabling real-time code validation during design stages.

- European Union: The ACCORD Project

The ACCORD project, funded through the EU's Horizon 2020 research and innovation program, aims to advance automated compliance checking and accelerate the shift toward digital building permitting across Europe. Several EU countries are participating in pilot projects, with Finland and Estonia leading the

way in digital governance. In Finland, approximately 83% of municipalities operate online permitting systems and conduct semi-automated BIM compliance checks (ACCORD Partners, 2024). Estonia links its BIM-based electronic permitting system with the national digital twin and is experimenting with using blockchain technology to verify the integrity of permitting records (ACCORD Partners, 2024).

Cases of Permit Process Improvements Using AI/RegTech in Various Countries

Country / Case	Key Features	Key Outcomes
Singapore CORENET X (Source: BCA (2024))	<ul style="list-style-type: none"> - BIM-based integrated e-permitting platform - Auto Code Compliance Checking - Multi-agency collaborative review 	<ul style="list-style-type: none"> - More than 50% reduction in permitting time - Improved review accuracy and regulatory consistency
United States (California) AI Permit Review Tool (Source: Office of the Governor of California (2024))	<ul style="list-style-type: none"> - AI-based analysis of building plans and documents - Rapid permit support for disaster-affected areas - Reduced review burden for officials 	<ul style="list-style-type: none"> - Accelerated permit approval process - Mitigation of bottlenecks during disaster recovery
United States (Private Sector) UpCodes (Source: UpCodes (2024))	<ul style="list-style-type: none"> - GPT-4-powered AI assistant "Copilot" - Automatic detection of code violations on drawings - Nationwide unified database of building codes 	<ul style="list-style-type: none"> - Real-time regulatory compliance checks during design - A leading private-sector RegTech innovation
EU Accord Project (Source: ACCORD Partners (2024))	<ul style="list-style-type: none"> - BIM (IFC)-based plan submission and semi-automated checking - Integration with national digital twins (e.g., Estonia) - Advancement toward machine-readable regulations (Rules as Code) 	<ul style="list-style-type: none"> - Greater administrative efficiency and review accuracy - Enhanced data-driven urban planning and policy support

● Achievements of Archilaw Developed by the Architecture & Urban Research Institute

To address challenges inherent in Korea’s building administration system, the Architecture & Urban Research Institute (AURI) developed Archilaw, a building code interpretation support system powered by large language models (LLMs). Archilaw V2, released in 2024, incorporates the latest GPT-4o model and an advanced retrieval-augmented generation (RAG) framework (Cho et al., 2024). The major achievements are as follows.

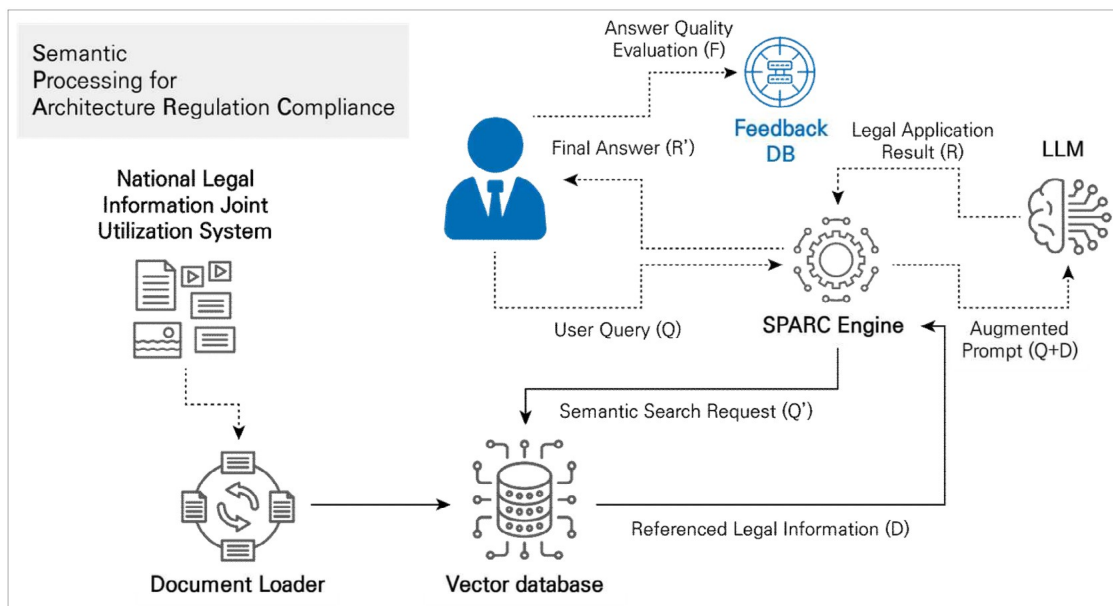
- High-Accuracy Response Generation

Archilaw significantly improves answer accuracy by learning from extensive datasets that include previous inquiry-response cases and authoritative interpretations issued by the Ministry of Government Legislation, and by integrating functions that track regulatory updates. For inquiries where public officials had previously provided a definitive answer, the system achieved a 78% match rate, representing an improvement of more than 20%p compared with the earlier version (Cho et al., 2024).

- Positive User Evaluation

In a user perception survey of experts and public officials, 60.4% reported satisfaction with system-generated answers, and 84.6% agreed that the system is necessary. Respondents identified “reduced time spent searching and interpreting legal provisions” and “lower administrative workload” as the primary expected benefits of using the system (Cho et al., 2024).

System Architecture of the AI-Based Architectural Legal System (Archilaw V2) Developed by AURI



* System access URL: <https://archilaw.streamlit.app>

- **Limitations of Archilaw and Development Direction of the Next-Generation System (ALRIS)**

Although Archilaw V2 has demonstrated meaningful empirical achievements, several limitations remain. The system processes each question independently and cannot manage conversation-level context. It also lacks a robust mechanism to verify the quality of generated answers, and its static knowledge base makes it difficult to incorporate legal amendments in real time (Cho & Nam, 2025). To address these limitations, the Architecture & Urban Research Institute is developing ALRIS (AI Legal and Regulatory Intelligence System), a next-generation platform that integrates advanced agentic AI technologies and community intelligence to create a self-evolving system (Cho & Nam, 2025).

- **Adoption of an Agent-Based Architecture**

The next-generation system replaces the existing single-process structure with a multi-agent architecture in which independent AI agents collaborate according to their assigned functions. New agents under development include Triage Agent, which evaluates the appropriateness and intent of user questions and formulates a task plan; Query Processor, which analyzes conversational context and optimizes search queries; Retriever, which gathers the information required for answer generation; and Answer Writer, which produces responses in an appropriate format and links relevant reference materials. This agent-based architecture is expected to enable multi-turn dialogues, seamless handling of complex user requests, and future enhancements such as drawing interpretation and integration with web-based search tools, which were difficult to implement in the previous system.

- **Integration of Community Intelligence and Expert Verification**

ALRIS introduces an experimental “hybrid intelligence” strategy that combines automated AI-generated answers with human collective intelligence to improve system reliability and service quality. The new functions and pipelines include the following.

- ① User Feedback: Users can evaluate AI-generated answers, leave comments, and propose alternatives, thereby contributing to the refinement of the system’s knowledge.
- ② Expert-in-the-Loop Verification: Important issues arising from AI answers or user discussions are forwarded to a panel of experts. Experts review and finalize the most accurate interpretation in the form of a “knowledge template.”
- ③ Continuous Learning: Verified knowledge templates are incorporated into the system’s official knowledge base and serve to enhance answer quality for similar questions in the future.

Comparison of Archilaw V2 and ALRIS V1

Category	Archilaw V2	ALRIS v.1.0.0–preview	Expected Outcomes
System Architecture	Simple RAG structure <ul style="list-style-type: none"> – Question → search → answer generation – Linear processing 	Agent-based collaborative system <ul style="list-style-type: none"> – Triage, Query Processor, Retriever, Answer Writer, Knowledge Manager Agent – Asynchronous collaborative processing 	Improved processing accuracy, Enhanced system flexibility and scalability
Dialogue Management	Independent query processing <ul style="list-style-type: none"> – Each question processed separately – No use of contextual information 	Session-based history management <ul style="list-style-type: none"> – Tracking and analysis of dialogue flow – Persistent personalized context 	Ability to understand follow-up questions
Answer Quality Control	Basic verification <ul style="list-style-type: none"> – No post-generation quality review – No structured feedback mechanism 	Multi-layered quality assurance <ul style="list-style-type: none"> – Real-time evaluation of answer quality – Combined Triage and expert review system 	Higher accuracy and reliability of answers
Access to Up-to-Date Information	Static knowledge base <ul style="list-style-type: none"> – Dependent on initial data collection – Manual updates 	Dynamic knowledge management <ul style="list-style-type: none"> – Asynchronous knowledge-cycle loop – Automated extraction and updating of knowledge 	Up-to-date reference information, Improved reliability and timeliness
Safety	Basic filtering <ul style="list-style-type: none"> – Relevance-based blocking – Reactive safety approach 	Intelligent proactive filtering <ul style="list-style-type: none"> – LLM-based harm assessment – Multi-stage safeguards 	Prevention of inappropriate responses, More efficient system operation
Search Accuracy	Basic vector similarity search <ul style="list-style-type: none"> – Simple semantic matching – No contextual integration 	Query rewriting with context consideration <ul style="list-style-type: none"> – Accurate intent recognition – Automatic normalization of technical terms 	Higher search precision Reduced irrelevant results
Expert Participation	Limited to initial system development <ul style="list-style-type: none"> – Review of initial data only – No involvement during operation 	Continuous expert participation <ul style="list-style-type: none"> – Real-time review of knowledge templates – Approval and rejection workflow 	Stronger service credibility and visibility, Improved consistency in legal interpretation

- **Policy Directions for an AI-Driven Transformation of Building Administration**

A successful AI transition in building administration requires not only technological development but also institutional and policy support. To maximize the potential of ALRIS and establish a sustainable operational foundation, the following core policy tasks must be prioritized (Cho & Nam, 2025).

- **Establishing a Nationwide Public Service and Integrated Platform**

To ensure consistent legal interpretation and improve administrative transparency, the national building administration system Seumteo, operated by the Ministry of Land, Infrastructure and Transport, should be integrated with ALRIS. This would enable civil servants, applicants, and AI systems to interact within a unified platform and support the full-scale operation of a national-level service.

- **Developing Permit-Support Systems Including Automated Interpretation of Design Documents**

Beyond text-based interpretation, next-generation systems must incorporate multimodal AI technologies (VLLMs) capable of directly interpreting architectural drawings and automatically detecting code violations. Although such technology remains in its early stages globally, early research leadership will allow Korea to secure international competitiveness and advance toward a fully AI-enabled administrative ecosystem.

- **Introducing an AI Building Administration Sandbox**

A regulatory sandbox is needed to test the application of AI-generated review results within actual permitting processes. During this pilot phase, a legal immunity mechanism should be established to reduce the burden on civil servants and applicants, thereby encouraging broader adoption of AI in administrative workflows.

- **Expanding Application to Various Certification Systems**

Technologies developed and validated through ALRIS should be extended to

labor-intensive certification systems such as Green Building Certification and Barrier-Free Certification. This will reduce social costs associated with certification procedures and accelerate digital transformation across the building and construction sector.

If successfully implemented, these policies could alleviate bottlenecks in the annual construction investment cycle of approximately KRW 185 trillion and improve administrative efficiency by 10 to 30%. AI-based building administration is not merely a technological upgrade but a strategic initiative that can enhance productivity in the national construction industry and significantly improve public convenience.

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