Digitalization of Intellectual Property Accounting and Audit

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Abstract

Intellectual property has become a central component of enterprise value, while conventional accounting and assurance processes remain constrained by fragmented records, periodic controls, and limited traceability. This integrative review examines how digital innovation technologies can strengthen the identification, measurement, control, and audit of intellectual property. A structured thematic synthesis was conducted across accounting, auditing, information systems, and innovation-management literature. The evidence was organized around six functional domains: asset identification, rights verification, valuation support, transaction processing, continuous monitoring, and reporting. Findings indicate that data analytics and artificial intelligence improve classification, valuation inputs, and anomaly detection; robotic process automation enhances repetitive control execution and evidence assembly; cloud platforms and standardized data architectures support system integration; and blockchain-based mechanisms improve provenance and multi-party traceability when legal and governance conditions are established. Across technologies, recurring limitations concern data quality, model explainability, cybersecurity, interoperability, legal enforceability, and overreliance on automated outputs. A layered governance framework is therefore proposed that links each technology to accounting assertions, audit objectives, control ownership, validation procedures, and human oversight. Effective digitalization depends less on isolated technology adoption than on coordinated data governance and assurance design. The synthesis identifies priorities for empirical research on implementation quality, evidential reliability, and professional judgment.

Keywords: Intellectual property; Digital innovation; Accounting; Audit; Data analytics; Automation; Blockchain; assurance

1 Introduction

Innovation increasingly depends on resources that are difficult to observe through conventional accounting records. Software, databases, patents, designs, trade secrets, digital platforms, and algorithmic capabilities may determine an enterprise's competitive position even when only a limited part of their economic value qualifies for recognition as an intangible asset. The distinction between economic importance and accounting recognition is especially significant for internally generated intellectual property. Under IAS 38, expenditure in the research phase is expensed, while development expenditure can be capitalized only when specified conditions are satisfied [2]. Consequently, reliable systems must distinguish research from development, connect expenditure to identifiable projects, document technical and commercial feasibility, and preserve evidence of control over the resulting rights.

The innovation literature also emphasizes that innovation is broader than a single technological invention. It includes new or improved products, processes, organizational arrangements, and business methods [1]. This broader perspective creates two related accounting challenges. First, enterprises need detailed information about the resources consumed in innovation activities and the rights produced by those activities.

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Second, auditors need sufficient and appropriate evidence to evaluate recognition, measurement, ownership, impairment, amortization, licensing, and disclosure. These challenges become more complex when intellectual property is produced through distributed teams, cloud services, external developers, research alliances, or platform ecosystems.

Digital technologies provide a possible response to these problems because they can connect operational evidence with accounting records more directly than periodic manual procedures. Continuous auditing research had already demonstrated that data extraction, automated tests, exception reporting, and near-real-time assurance can change the timing and scope of audit work [4]. The expansion of big data and analytics added the possibility of using structured and unstructured information beyond the general ledger [5][6]. Artificial intelligence introduced tools for classification, prediction, text analysis, and anomaly detection [13][18]. Robotic process automation offered a practical mechanism for executing repetitive rules across existing systems [21][24]. Blockchain and smart contracts then raised the prospect of shared records, automated contractual execution, and persistent evidence of transactions and rights [16][22].

However, technology does not remove the conceptual requirements of accounting or the professional responsibilities of auditors. A blockchain entry does not itself establish that an asset meets the recognition criteria. A machine-learning estimate does not become reliable merely because it is statistically sophisticated. An automated procedure may execute an incorrect rule consistently, and a cloud repository may increase both accessibility and exposure to cyber risk. The central issue is therefore not whether a technology is innovative, but how its capabilities can be mapped to specific accounting assertions, audit objectives, and governance controls.

This paper develops an integrated view of innovation technologies for intellectual property accounting and audit through a structured synthesis of the relevant literature. It differs from studies that examine one technology in isolation by comparing complementary roles across the full information cycle. The paper addresses four questions:

1. Which innovation technologies are most relevant to intellectual property accounting and audit?
2. Which accounting and assurance functions can each technology support?
3. What risks and institutional constraints limit implementation?
4. What staged research and implementation agenda can connect technological capability with accounting substance and audit evidence?

The remainder of the paper is organized as follows. Section 2 explains the integrative review design. Section 3 develops a taxonomy of technologies and accounting functions. Sections 4 and 5 synthesize evidence on analytical, automation, infrastructure, and distributed-ledger technologies. Section 6 compares benefits and limitations. Section 7 presents governance requirements and a staged research agenda, followed by conclusions.

2 Review Design

2.1 Scope and approach

An integrative review was selected because the relevant knowledge was distributed across accounting, auditing, information systems, innovation management, and professional standards. The purpose was not to estimate a single effect size, but to connect conceptual, empirical, design-oriented, and professional contributions. Publications were considered when they addressed at least one of the following: digital accounting infrastructure, automated audit procedures, analytical evidence, artificial intelligence, robotic process automation, continuous auditing, blockchain-based accounting, smart contracts, or governance of technology-enabled assurance.

The evidence base was closed on 31 December 2021. Intellectual property statistics and standards were included only when publicly issued by that date [2][3]. Later publications were excluded to preserve a consistent temporal boundary for the synthesis.

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2.2 Search, screening, and coding

Searches combined terms such as *intellectual property accounting*, *intangible assets*, *digital audit*, *audit analytics*, *artificial intelligence in auditing*, *robotic process automation*, *blockchain accounting*, *smart contract audit*, *cloud accounting*, *continuous auditing*, and *XBRL*. The review emphasized peer-reviewed journal articles and authoritative standards or reports. Studies were screened for direct relevance to accounting information, audit evidence, control, or reporting. Purely technical papers without an accounting or assurance connection were excluded.

Each retained source was coded across four dimensions: (1) technology, (2) accounting or audit function, (3) claimed benefit, and (4) implementation risk. The synthesis used repeated comparison to identify common themes rather than treating the technologies as mutually exclusive. For example, RPA often depends on cloud or enterprise-system access, while blockchain-based assurance may incorporate analytics and smart-contract logic. Figure 1 summarizes the review process.

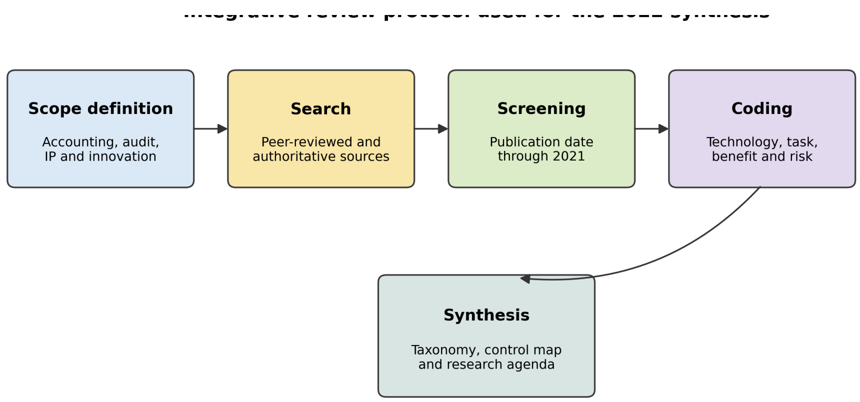

Figure 1: Integrative review protocol and thematic synthesis workflow.

2.3 Profile of the reviewed literature

The literature developed in overlapping waves. Continuous auditing established the architecture for automated evidence and exception reporting. Big data research then focused on expanding the sources and scale of audit evidence. Artificial intelligence and RPA shifted attention toward task automation and judgment support. Blockchain studies considered shared records and smart contracts, while cloud research emphasized system integration, access, and control. Table 1 summarizes representative contributions that shaped these streams.

The review reveals that no single technology solves the full problem. Instead, value arises from a layered system in which standardized data and cloud integration support automation; automation generates timely records; analytics interprets those records; and governance preserves accountability.

3 A Functional Taxonomy of Innovation Technologies

A useful taxonomy should begin with accounting and audit functions rather than technological labels. Intellectual property information passes through six linked functions: identification and classification, valuation and impairment, verification of rights and control, transaction processing, continuous monitoring, and external or internal reporting. Technologies differ in how strongly they contribute to each function.

3.1 Identification and classification

The first requirement is a complete inventory of intellectual property and related rights. Enterprises often maintain fragmented records across legal departments, research units, finance systems, contract repositories, and operational platforms. Natural-language processing can extract names, dates, rights, territories, obligations, and renewal terms from patents, licenses, development agreements, and legal correspondence.

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Table 1: Representative literature and its contribution to technology-enabled accounting and audit

Stream	Representative studies	Primary contribution	Relevance to intellectual property accounting and audit
Continuous assurance	Chan and Vasarhelyi [4]	Automated data access, testing, and exception reporting	Supports timely monitoring of project expenditure, rights status, renewals, impairment indicators, and licensing transactions.
Big data and analytics	Alles [5]; Vasarhelyi et al. [6]; Cao et al. [8]; Gepp et al. [20]	Expanded evidence, full-population testing, anomaly detection	Links operational, legal, market, and financial data to recognition, valuation, and audit procedures.
Artificial intelligence	Issa et al. [13]; Sutton et al. [14]; Kokina and Davenport [18]	Classification, prediction, knowledge support, text processing	Assists document classification, contract analysis, valuation scenarios, and detection of inconsistent asset records.
RPA	Moffitt et al. [21]; Huang and Vasarhelyi [24]; Kokina and Blanchette [25]	Rule-based automation across existing systems	Automates reconciliations, evidence collection, renewal alerts, amortization checks, and report preparation.
Blockchain and smart contracts	Dai and Vasarhelyi [16]; Rozario and Vasarhelyi [22]; Schmitz and Leoni [28]	Shared ledgers, provenance, programmable execution	Provides persistent records of rights transfers, licenses, royalties, and approvals, subject to legal and governance controls.
Digital transformation	Moll and Yigitbasioglu [26]; Manita et al. [31]; De Santis and D'Onza [34]	Organizational change, legitimacy, skills, governance	Shows that implementation depends on professional roles, standards, data access, and institutional acceptance.

Classification models can group expenditures by project phase or detect records that appear to relate to research rather than development. RPA can then transfer validated fields into the asset register and schedule follow-up procedures.

The accounting benefit is not automatic capitalization. Rather, technology can improve completeness, consistency, and traceability, thereby enabling accountants to apply recognition criteria more reliably. The audit benefit is a clearer population from which ownership, existence, accuracy, and completeness tests can be designed.

3.2 Valuation, useful life, and impairment

Valuation is one of the most judgment-intensive areas. Market data may be sparse, income forecasts uncertain, and the useful life of technology-dependent assets vulnerable to rapid obsolescence. Analytics can combine internal performance indicators with external market, product, legal, and technological information. Machine-learning models may identify variables associated with licensing revenue, patent renewal, software usage, or project abandonment. Scenario models can support impairment testing and sensitivity analysis.

Nevertheless, predictive accuracy is not equivalent to accounting reliability. Models require transparent assumptions, stable data definitions, validation, and controls over changes. Brown-Liburd et al. [10] warn that large data sets can create information overload and pattern-recognition problems. Earley [12] similarly emphasizes that analytics create opportunities only when auditors can assess the relevance and reliability of outputs. For intellectual property, explainability is particularly important because valuation often depends on management assumptions that must be challenged rather than hidden inside an algorithm.

3.3 Rights, ownership, and provenance

Rights verification requires evidence that the enterprise controls the resource and can obtain future benefits. Blockchain has been proposed as a mechanism for timestamping creation, recording transfers, and maintaining a shared history of approvals and licenses [16][23]. Smart contracts can encode payment rules, territorial restrictions, or royalty calculations. However, the ledger must be connected to valid legal identity, authoritative registries, and enforceable contracts. A technically immutable record may still contain an incorrect or unauthorized initial entry.

3.4 Processing, monitoring, and reporting

RPA and standardized data are well suited to repetitive tasks such as posting amortization, reconciling legal and accounting registers, checking renewal dates, calculating royalties, and preparing disclosures. Continuous monitoring can test complete populations rather than periodic samples. Cloud platforms and application

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programming interfaces enable data exchange across accounting, legal, project-management, and registry systems. Standardized reporting formats improve comparability and machine readability. Figure 2 maps the relative contribution of the principal technology groups across the six functions.

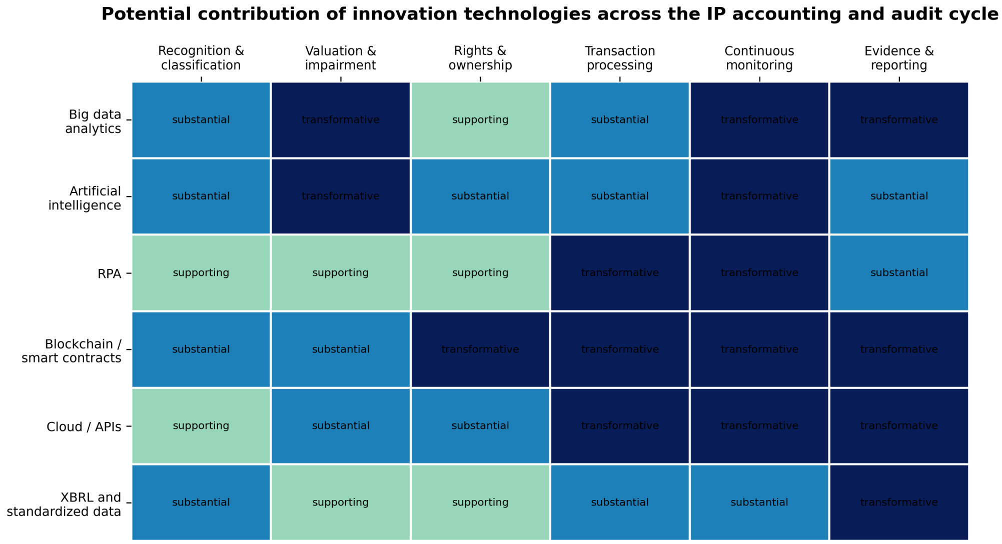

Figure 2: Potential contribution of innovation technologies across the intellectual property accounting and audit cycle.

4 Analytics and Intelligent Automation

4.1 Big data analytics as expanded evidence

The big data literature argues that accounting and auditing can use information that is more voluminous, varied, timely, and externally sourced than traditional transaction records [6][7]. In intellectual property settings, relevant evidence may include patent citations, renewal events, product usage, development milestones, source-code activity, customer adoption, licensing patterns, competitor announcements, legal disputes, and technology-market indicators. These data can complement, but not replace, conventional evidence [9].

Three applications are especially important. First, analytics can improve population completeness by comparing the accounting register with legal records, project systems, procurement data, and contract repositories. Second, anomaly detection can identify assets with unusual capitalization patterns, unsupported useful lives, missing renewals, inactive software, or royalty terms inconsistent with recorded revenue. Third, forecasting can support valuation and impairment by relating operational indicators to future cash-flow assumptions.

The literature also identifies barriers. Data may be inaccessible, unstructured, or controlled by the client. Auditors may lack the authority or technical capacity to extract it. Standards are principles-based and generally do not prohibit analytical evidence, yet practitioners may hesitate when reliability and documentation requirements are unclear [5][15]. Salijeni et al. [27] show that audit technology changes the production and interpretation of evidence, not merely the speed of existing tests. De Santis and D'Onza [34] further indicate that organizational legitimacy and professional acceptance influence adoption.

4.2 Artificial intelligence and judgment support

Artificial intelligence covers several capabilities relevant to intellectual property. Natural-language processing can read contracts, patent descriptions, technical reports, and board approvals. Supervised learning can classify expenditure or predict project outcomes. Unsupervised learning can detect unusual combinations of cost, timing, ownership, or performance. Knowledge-based systems can formalize decision rules, while intelligent interfaces can guide users through recognition and audit procedures.

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The accounting literature presents AI as a supplement to professional work rather than a simple replacement. Issa et al. [13] distinguish formalizable audit tasks from activities that require contextual judgment. Sutton et al. [14] demonstrate that accounting AI research remains relevant when it combines technical design with organizational and behavioral understanding. Kokina and Davenport [18] describe automation as a shift in the allocation of audit work, with machines handling selected tasks and professionals focusing on interpretation and exceptions.

For intellectual property, a practical AI system should produce more than a final classification. It should retain the source documents, variables, decision rules, confidence levels, and reasons that support the output. An auditor must be able to reproduce the result, evaluate bias, and determine whether contradictory evidence exists. Model governance therefore includes training-data quality, version control, validation, override procedures, and monitoring for performance deterioration.

4.3 Human and organizational consequences

Analytics can widen audit scope but also create dependence on specialists and proprietary tools. Professional skepticism may weaken when outputs appear precise or are difficult to challenge. Information overload can shift from raw data to excessive alerts. Organizations therefore need thresholds, prioritization, and escalation rules. The strongest design is a human-in-the-loop model: technology identifies patterns and executes defined tests, while accountable professionals evaluate relevance, uncertainty, and economic substance.

5 Process Automation and Digital Infrastructure

5.1 Robotic process automation

RPA uses software robots to execute rule-based tasks through existing user interfaces or system connections. It is particularly suitable where inputs are structured, rules are stable, volumes are high, and exceptions are limited. Moffitt et al. [21] identify audit procedures that can be decomposed into repeatable steps. Huang and Vasarhelyi [24] propose a staged RPA framework and demonstrate its application to an audit confirmation process. Kokina and Blanchette [25] provide early evidence that accounting organizations were using digital labor to redesign routine work.

In intellectual property accounting, RPA can perform the following activities:

- retrieve new patent, trademark, copyright, or license records from approved repositories;
- compare legal and accounting registers and report unmatched items;
- collect project expenditure and route it for research-development classification;
- calculate scheduled amortization and identify assets with missing useful-life reviews;
- monitor renewal dates, license expirations, milestone payments, and royalty clauses;
- assemble evidence packages for audit testing and disclosure preparation.

RPA improves consistency and creates execution logs, but it does not independently assess the economic substance of a transaction. Bots are vulnerable to changes in screen layouts, data formats, access rights, and business rules. Poorly governed automation can reproduce errors at scale. Controls should therefore include authorized process design, test environments, change approval, bot credentials, exception queues, log review, and segregation between development and operation.

5.2 Cloud platforms and application programming interfaces

Cloud platforms can centralize documents, calculations, models, and workflow while providing scalable computing resources. Their importance lies less in novelty than in integration. Intellectual property evidence is often dispersed across legal, research, finance, tax, and commercial functions. A controlled cloud environment can provide a common repository and use application programming interfaces to connect source systems. This infrastructure enables analytics and RPA to operate on timely information.

Cloud adoption changes the audit boundary. The enterprise may depend on service organizations for storage, identity management, processing, or model execution. Auditors must understand shared responsibilities, access controls, encryption, backup, data location, service continuity, and third-party assurance.

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Appelbaum and Nehmer [30] show that cloud-based blockchain accounting systems create combined risks involving distributed records and outsourced infrastructure. Moll and Yigitbasioglu [26] similarly argue that internet-related technologies reshape accountants' work and require new research on control and professional practice.

5.3 Standardized data and reporting

Standardized data structures are a prerequisite for reliable automation. Common identifiers for projects, rights, contracts, territories, owners, and accounting entries allow systems to reconcile information without repeated manual interpretation. XBRL and related machine-readable reporting approaches can improve consistency in disclosure and facilitate automated comparison. Within the enterprise, a standardized intellectual property data model should include source document links, recognition status, legal owner, economic user, project phase, valuation method, useful life, impairment indicators, restrictions, and audit history.

Standardization also improves portability. An organization should not become dependent on a single vendor's proprietary representation of its intellectual property. Data dictionaries, interface specifications, and retention policies are therefore governance assets in their own right.

6 Blockchain and Smart-Contract Applications

Blockchain research attracted attention because shared ledgers can reduce reconciliation between parties and preserve a chronological record. Dai and Vasarhelyi [16] describe a blockchain-based accounting and assurance environment in which transaction information is validated and made available for continuous verification. Kokina et al. [19] document early industry adoption and discuss implications for accounting. Bonsón and Bednárová [23], Schmitz and Leoni [28], and Pimentel and Boulianne [32] synthesize benefits, limitations, and research opportunities.

6.1 Applications to intellectual property

A permissioned blockchain could record the creation, registration, transfer, license, pledge, renewal, and termination of rights. Each event could be linked to authenticated parties and supporting documents. Smart contracts could calculate royalties, enforce payment schedules, or trigger notifications when contractual conditions are met. The ledger could also support a shared view among creators, owners, licensees, collecting organizations, auditors, and regulators.

The most credible benefit is provenance rather than valuation. A ledger can strengthen evidence about when an event was recorded, by whom, and under which digital identity. It can reduce duplicate records and reconciliation effort where several parties maintain separate databases. It may also support automated audit procedures if the consensus process, access controls, and smart-contract code are reliable.

6.2 Limits of ledger-based assurance

The literature consistently warns that blockchain does not eliminate the need for audit. The system must still address the validity of inputs, authorization of participants, linkage between digital tokens and legal rights, privacy, cybersecurity, governance, and correction of errors. Smart contracts can execute the encoded rule, but the rule may be incomplete, unlawful, or inconsistent with the parties' economic intent. Rozario and Vasarhelyi [22] show the potential of smart contracts for automated audit procedures, while also implying the need to audit the contract logic and the data sources on which it depends.

For intellectual property, legal enforceability is decisive. Patent and trademark rights depend on jurisdictions and official registries. Copyright ownership may depend on employment, assignment, or licensing agreements. Trade secrets require continuing confidentiality. A blockchain record cannot replace these legal conditions. It may provide supporting evidence only when integrated with authoritative institutions and valid identity management.

6.3 Public, private, and permissioned designs

Public blockchains maximize openness but may conflict with confidentiality, cost predictability, and data-protection requirements. Private ledgers offer control but may provide little advantage over a well-governed

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centralized database. Permissioned consortia represent a middle approach in which identified participants share rules and validation responsibilities. The appropriate design depends on the problem. Internal cost accounting may not require a blockchain, whereas multi-party licensing or rights-management ecosystems may benefit from a shared ledger.

Table 2 compares the principal technology groups. The comparison emphasizes that technological maturity and institutional readiness are separate. RPA is relatively mature for stable processes but has limited judgment capability. AI is powerful but requires data and model governance. Blockchain can support shared trust, yet its benefits depend on legal and interorganizational coordination.

Table 2: Comparative assessment of innovation technologies for intellectual property accounting and audit

Technology	Best-suited tasks	Principal benefit	Main risk	Implementation condition
Big data analytics	Population comparison, anomaly detection, valuation support	Broader and more timely evidence	Irrelevant correlations, inconsistent data, overload	Governed data access, clear audit objectives, reproducible procedures
Artificial intelligence	Document classification, prediction, text analysis	Scalable judgment support	Opacity, bias, model drift, overreliance	Explainability, validation, human review, version control
RPA	Reconciliations, calculations, evidence collection, alerts	Consistent execution and lower manual effort	Scaled errors, brittle interfaces, unauthorized changes	Stable rules, bot governance, exception management
Cloud and APIs	Integration, shared repositories, scalable processing	Accessibility and interoperability	Cyber risk, provider dependence, unclear responsibility	Security architecture, service controls, data standards
Blockchain and smart contracts	Provenance, shared records, rights transfers, royalties	Reduced reconciliation and persistent event history	Invalid inputs, legal uncertainty, privacy, code defects	Trusted identities, authoritative linkage, consortium governance
Standardized reporting data	Disclosure, exchange, automated comparison	Consistency and machine readability	Incomplete taxonomies and mapping errors	Common definitions, validation rules, controlled extensions

7 Governance, Control, and Professional Judgment

Technology-enabled intellectual property systems require a governance model that assigns responsibility for data, models, automated processes, and legal interpretations. The literature on digital transformation shows that benefits depend on organizational redesign and the legitimacy granted to new forms of evidence [27][31][34]. Governance should therefore be embedded before advanced automation is deployed.

7.1 Data governance

A complete intellectual property record requires consistent definitions across legal and accounting functions. Each record should have an accountable owner, source, update frequency, access classification, and retention rule. Data lineage should show how information moved from source documents to accounting entries and audit outputs. External data used in valuation or impairment models should be assessed for reliability, licensing, and reproducibility.

7.2 Model and automation governance

Models should be inventoried and classified by their financial-reporting impact. High-impact models require independent validation, performance thresholds, sensitivity analysis, and controlled changes. Automated procedures require documented business rules, approved credentials, logging, exception handling, and periodic re-performance. Where AI recommends a conclusion, the system should record the evidence considered, confidence level, reviewer decision, and reason for any override.

7.3 Cybersecurity and access

Intellectual property is both an accounting subject and a valuable target. Centralized digital repositories, cloud integration, and shared ledgers may increase the consequences of unauthorized access. Security controls should cover identity, least-privilege access, encryption, key management, incident response, backup, and secure deletion. Trade-secret information needs particularly strict controls because loss of secrecy may destroy the legal protection and economic value of the asset.

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7.4 Professional judgment and accountability

The auditor remains responsible for evaluating evidence and forming an opinion. Technology can increase coverage and speed, but it cannot resolve ambiguous accounting standards or management intent without judgment. The literature on AI and analytics repeatedly highlights the need to combine formalizable procedures with human expertise [10][13][18]. Accordingly, organizations should define which decisions may be automated, which require review, and which must remain exclusively professional.

8 Research Agenda and Staged Implementation Framework

The literature suggests a sequence rather than a single transformation project. Figure 3 proposes four stages supported by a common governance foundation.

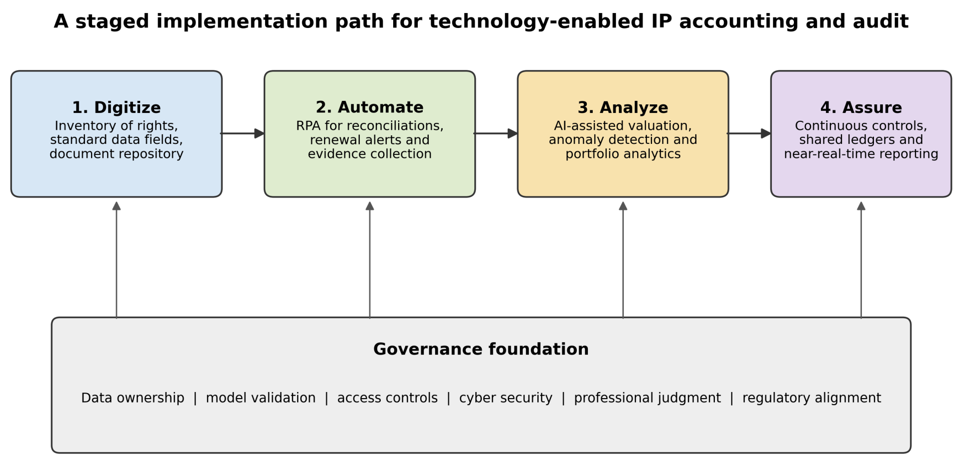

Figure 3: Staged implementation path for technology-enabled intellectual property accounting and audit.

Stage 1 - Digitize. Organizations should first create a complete, standardized, and controlled intellectual property inventory. Research should examine data models that connect legal rights, innovation projects, accounting recognition, and audit assertions.

Stage 2 - Automate. Stable, repetitive controls should be automated with RPA and workflow tools. Research should measure error reduction, control reliability, maintenance cost, and the effect of automation on segregation of duties.

Stage 3 - Analyze. Analytics and AI should support valuation, impairment, contract review, and anomaly detection. Research should compare explainable models with more complex techniques and evaluate how model outputs influence accountant and auditor judgment.

Stage 4 - Assure. Mature environments may introduce continuous monitoring, shared ledgers, and smart-contract assurance. Research should test legal enforceability, consortium governance, interoperability with official registries, privacy-preserving techniques, and the auditability of code.

Additional research questions emerge from the comparison:

- How can internally generated intellectual property be tracked without encouraging premature capitalization?
- Which operational indicators provide reliable evidence for useful-life and impairment assessments?
- What level of explainability is necessary for an AI model used in financial reporting or audit?
- How should auditors assess evidence generated by client-controlled algorithms or external cloud providers?
- Under what conditions does a shared ledger provide more assurance than a centralized database?
- How can smart-contract code be reconciled with legal contracts and accounting substance?

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- Which digital competencies should be required of accountants, auditors, and valuation specialists?

Longitudinal field studies are especially needed. Much of the literature available through 2021 was conceptual, exploratory, or based on early implementations. Future work should observe systems over several reporting cycles, measure control failures and maintenance costs, and distinguish demonstration projects from sustainable organizational use. Comparative studies across jurisdictions would also be valuable because intellectual property rights, data rules, and audit regulation differ substantially.

9 Conclusion

This integrative review examined how innovation technologies can support intellectual property accounting and audit. The analysis shows that the technologies are complementary. Standardized data, cloud platforms, and application programming interfaces provide the infrastructure. RPA automates repetitive processes. Big data analytics and artificial intelligence expand evidence and support classification, valuation, and anomaly detection. Blockchain and smart contracts offer potential for provenance, multi-party coordination, and continuous assurance.

The most important conclusion is that technological capability must remain subordinate to accounting substance and audit objectives. A digital record does not prove control unless legal rights and economic benefits are established. A model does not justify valuation unless its data, assumptions, and uncertainty are transparent. An automated control is not reliable unless its rule, access, changes, and exceptions are governed. A blockchain does not create trust when identities, inputs, or legal relationships are invalid.

For practice, the recommended path is staged. Enterprises should begin with a complete and governed intellectual property inventory, automate stable procedures, introduce analytical models with human review, and consider continuous or shared assurance only when the underlying data and controls are mature. For research, the priority is to evaluate real implementations, explain how technologies alter evidence and judgment, and design governance mechanisms that preserve accountability. Such an approach can improve the reliability, timeliness, and usefulness of intellectual property information while avoiding the assumption that innovation technology is itself a substitute for accounting standards, legal rights, or professional skepticism.

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