

Intelligent tax computation in eCommerce and AdTech using vertex integration

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Abstract

The concept of intelligent tax computation has become an infrastructural necessity in eCommerce and AdTech as transaction flows, digital service packages, the intermediation of a marketplace, and jurisdiction-specific regulations are increasingly processed in real time. External tax engines such as Vertex are widely used in enterprise practice to ensure rate determination, product taxability logic, exemption processing as well as audit-ready record creation, across heterogeneous platforms. This review surveys the literature that pertains to that design problem by relating the research on electronic tax filing, digital tax administration, ontology-based tax knowledge, blockchain-enabled VAT settlement, e-invoicing, platform taxation, and digital advertising taxation. The review identifies three prevailing themes: formalization of rules and legal certainty, adoption and continuance of digital tax systems and the intelligent compliance architectures for scalable cross-border transactions. According to the reported studies, the digital tax systems increase compliance, reduce manual effort, and increase traceability with the support of structured and strong interfaces of enforcement and interoperable records. Simultaneously, there still exist significant loopholes regarding product classification in composite digital transactions, tax determination for high-volume advertising events under low-latency conditions, explainability of massive automation, and legal ambiguities in large-scale automated environments. The discipline is increasingly significant as accurate tax computation is now a key determinant of operational effectiveness, regulation and commercial confidence in the global digital economy.

Keywords: Adtech Taxation; E-Commerce Taxation; Indirect Tax Automation; Tax Computation; Tax Technology; Vertex Integration

1. Introduction

Digital commerce has transformed the structure and timing of revenue collection. It was common in the previous transactional environment that indirect tax determination was often performed in slower accounting cycles with a significant portion of classification and reconciliation work done after the sale was executed. The modern eCommerce and AdTech environment moves tax determination directly into the transaction flow. Tax liability can be triggered at multiple points, including product pages, checkout events, advertising invoices, marketplace commissions, promotional credits, and bundled services. The adoption of early electronic tax filing studies already indicated a transition of tax systems to information-system problems, as well as to legal problems, as usability, choice of filing method and the design of the digital interaction played a large role in shaping the behaviour and the adoption of the tax system by the taxpayer [1]. This transition laid the foundation for modern intelligent tax computation frameworks.

The significance of the subject matter has been exacerbated by the fact that online marketplaces are no longer mere web shop directories but are moving toward multi-actor systems with merchants, publishers, ad marketplaces, payment processors, cloud services, transport companies, and marketplace operators. Surveys conducted on the electronic tax filing behaviour established that the digital tax interaction does not rely merely on specific formal obligation but also on the perception of usefulness, the perception of ease of use, social context, and trust in the system [2]. This observation

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is still fundamental in the modern-day enterprise tax architecture. A tax evaluation layer within commerce infrastructure must produce results that are legally accurate, computationally efficient, and transparent for finance, engineering, audit, and commercial stakeholders. That is, the logic of computational taxes can now serve as applied information system, and it directly impacts economic activity.

Broader disciplinary relevance is seen in the integration of accounting information systems, public finance, legal informatics, platform economics, enterprise architecture and digital operations management. An exemplary comparison of tax filing web sites revealed that interface design, quality of service and representation of information have an influence on user ratings of tax regimes in national jurisdictions [3]. This means that it is not enough to reduce intelligent computation of tax to rule tables. It is possible that a computationally powerful tax engine will continue to have poor performance in scenarios where integration design hides tax bases, exception handling, or is driven by jurisdiction. This challenge is amplified when multiple business channels such as direct retail, subscriptions, marketplaces, and media monetization are integrated within a single platform.

Another problem is that of legal certainty. The taxing law is still rule-based, semantic, and often ambiguous at the margins. Critical tax scholarship has demonstrated that there can never be certainty in the calculation of tax using numbers alone due to interpretation discretion and ambiguity in classification used in determining the ultimate tax liability [4]. This observation is highly relevant to intelligent tax computation. An enterprise platform can either automate rate look-up and transaction computation, but ambiguity may always remain in the definition of what is taxable in the first place, particularly in the case of digital bundles, advertising services, platform fees, promotional incentives, and cross-border electronically supplied services. Intelligent tax computation will thus need to be addressed in any review on the architecture of computation as well as legal interpretation.

A resounding international aspect is brought by the modern research environment. The policy and legal action on eCommerce VAT reform has indicated that destination-based collection, platform liability, simplified registration policies, and anti-fraud are current focus areas in the discussion of digital taxation [5]. System design has a direct implication on this environment. A current tax engine integration should be able to take location evidence, product taxability policies, jurisdiction-specific exceptions, exemption logic and audit-ready output across multiple regimes instead of one domestic rule set. Enterprise platforms are often based on third-party tax determination services, and an example of such service is Vertex. In these designs, normalized transaction characteristics are provided to a specialized tax layer by the platform and jurisdictionally relevant results are obtained to be used during checkout, invoicing, credit management, and reporting.

The current review is inspired by a number of unanswered questions. To start with, there is a proliferation of research in the field of digital tax administration but there is no clear scholarly coverage of intelligent tax calculation within large-scale enterprise systems. Second, eCommerce and AdTech tend to be analysed individually despite the fact that they rely on digital streams of events, multidimensional characterization of the products, multinational monetization, and taxable reporting. Third, emerging advancements in ontology-based tax knowledge, e-invoicing and digital compliance monitoring imply that new tax systems will be based on structured intelligence and not just static configuration but this insight has not yet been fully connected to enterprise integration design in the literature. Fourth, patterns of product-specific integration, such as Vertex-style external tax engines, are an extensive practice, but little studied in an architectural perspective.

This review aims to arrange the corresponding literature into a clear structure on the issue of intelligent tax computation in eCommerce and AdTech through Vertex integration as an enterprise design lens. The subsequent subdivisions take place in the necessary order. The literature review narrows down the scope of major studies into thematic streams and provides a coherent literature summary. The conceptual framework section discusses popular methodological approaches and proposes a platform model for intelligent tax computation. Scalable tax determination, transaction qualification, and compliance visibility interpretations of reported findings can be found in the results-and-discussion section. The concluding section outlines future research needs and major scholarly implications.

2. Literature Review

Intelligent tax computation draws from four overlapping fields of literature: the adoption of intelligent tax systems, legal formalization of rules, intelligent compliance architecture and platform taxation. The first stream examines adoption and continuance in digital tax systems. Night and Bananuka demonstrated that the process of adopting an electronic tax system mediates the relationship between taxpayer attitudes and tax compliance, and this shows that adoption of technology is not just a convenience of administration, but a factor in compliance formation itself [6]. The line was further developed by Veeramootoo et al., who showed that the continued use of e-filing services is based on an

integrated model through information quality, system quality, service quality, trust, and user expectations [9]. Reporting on the level of employee satisfaction on e-tax systems, Hammouri and Abu-Shanab discovered that perceived usefulness and perceived ease of use continue to be of central interest to tax-system acceptance even in the organizational context rather than in citizen-facing contexts in isolation [10]. More recently, Ramdhony et al. investigated continued-use intention in electronic tax services and proposed post-adoption persistence (as opposed to post initial uptake) as a decisive systems-issue [13].

The second stream is related to formalization of tax knowledge and architecture of intelligent compliance. Søgaaard suggested a blockchain-based solution to VAT settlement and that design science can be applied to cut the administrative overhead without disturbing the traceability of the settlements [7]. Ontology-based knowledge management was explored in tax accounting by Elsayed who established positive relationships between the application of ontologies, enhanced accountability processes, and reduced tax risk [12]. Bellon et al. showed that VAT e-invoicing in Peru increased an increase in reported sales, purchases, and VAT liabilities, and digital record architecture directly influenced taxpayer behaviour rather than merely recording pre-existing behaviour [8]. Fang and Ma similarly showed that the EU VAT reform on cross-border eCommerce increased compliance besides producing visible effects on trade, which supports the argument on the macroeconomic importance of computational tax design [14].

The third stream is concerned with the legal and institutional context of digital platforms. Dann et al. discovered that tax-compliance cues on sharing platforms can serve as elements of trust and affect booking intentions, and thus, apparent tax compliance has the power to affect market outcomes instead of remaining an obscure administrative issue [11]. Abu-Silake et al. examined real experience with use of digital tax in Jordan and demonstrated that social trust, subjective norms, perceived usefulness and perceived ease of use moderate tax-platform uptake [15]. This literature is important in intelligent computation of tax since automated tax results need to be frequently discussed with non-expert business viewers. Even a platform that calculates tax correctly and does not provide tax reason codes or tax exceptions, or liability allocations could create friction and commercial mistrust in its operation.

The fourth stream focuses on digital taxation and platform economics. In digital advertising markets, d'Andria examined an ad valorem web tax in a digital advertising market and demonstrated that the incidence of taxation in advertising-financed digital services is determined by the nature of the market structure of the two-sided marketplace, not by the traditional one-sided assumptions [16]. Kind and Schjelderup examined taxation in multi-sided platforms and stated that conventional public finance assumptions fail to invariably be true when inter-group network impacts and multi-product pricing are put into play [18]. Lassmann et al. presented hypotheses and data available in the online advertising market demonstrating that taxes levied on multinational digital platforms can generate cross-border spillovers in the form of pricing reaction and adjustment in ad supply [19]. This reading is particularly applicable to AdTech since determining the taxes can include advertising inventory, media services, platform charges, data-driven services and cross-jurisdictional supply chains that do not fit conventional goods-tax templates.

One such commonality of the literature is that most shift from document-based compliance toward event-based compliance. Electronic filing research was initially concentrated on the intention of the user and the choice of the method of filing [6], [9], [10], [13]. Later work shifted to structured transaction evidence using e-invoicing, settlement platforms, and ontology-based tax knowledge [7], [8], [12]. The research on platform-taxation subsequently revealed the necessity to deal with digital services that cut across borders with multi-sided pricing using tax models capable of doing so [11], [14], [16], [18], [19]. Combined with these developments, this suggests that intelligent tax computation is increasingly based on machine-readable, structured events of transactions, with legal and commercial metadata attached to them.

The other valuable insight is the distinction between calculation and determination. The last stage of a calculation is simply application of a tax rate to a defined tax base. The previous processes involve the definition of the taxable object, the liable party, a place of supply or sourcing, and exemptions, mapping of product codes and a determination of documentary sufficiency. Intellectual studies of digital VAT reform and rule-based taxation emphasize that it is this first-tier interpretive layer that is decisive [5]. Smart computation of taxes in an enterprise context therefore requires an integrated capability: deterministic execution of rate/jurisdiction logic coupled with structured knowledge models that are able to solve classification and exception paths without loss of auditability.

Table 1 Summary of key findings

Ref	Focus	Key Findings
[6]	Electronic tax system adoption and compliance	Adoption of electronic tax systems partially mediates the attitude–compliance relationship, indicating that digital tax infrastructure can shape compliance behaviour rather than merely record it.
[7]	Blockchain-enabled VAT settlement architecture	Design science prototype demonstrates that distributed settlement structures can reduce administrative burden while improving VAT traceability and control logic.
[8]	VAT e-invoicing and firm-level compliance	Mandatory e-invoicing increases reported sales, purchases, and VAT liabilities, with strongest effects among smaller firms and sectors marked by higher noncompliance.
[9]	Continuance usage of e-filing systems	Long-term use of e-filing depends on integrated service, information, and trust dimensions rather than technical availability alone.
[10]	Employee satisfaction in e-tax environments	Perceived usefulness and perceived ease of use remain central determinants of satisfaction in organizational tax-system settings.
[11]	Tax compliance signalling on digital platforms	Visible compliance labels strengthen trust and booking intention, indicating that tax transparency can operate as a market signal.
[12]	Ontology-based tax knowledge management	Ontology-supported tax knowledge improves accountability procedures and reduces tax risk by structuring interpretive and procedural knowledge.
[13]	Continuance intention in electronic tax filing	Post-adoption persistence depends on a broader behavioural model than initial acceptance, including trust and use-value continuity.
[14]	EU VAT reform and cross-border eCommerce	Destination-based reform improves online tax compliance but also changes trade patterns and consumer outcomes in measurable ways.
[15]	Actual usage of digital tax platforms	Actual use is shaped by social trust, subjective norms, perceived ease of use, and perceived usefulness in a jointly structured model.

According to Table 1, the field has gradually shifted what used to be about the user issues of adoption moving into more comprehensive questions about what knowledge represents, about finding evidence of that representation, and about how that represents itself in the compliance design of the platform. All three developments revolve around intelligent calculation of taxes in eCommerce and AdTech. Under these circumstances, a Vertex-style integration is useful since a centralized tax engine would be able to outsource the complex tax logic in applications when still using structured commercial data.

One more gap can be observed. The majority of the research considers taxpayer behaviour, modernization of the administration, or macro or legal taxation of digital platforms. Little scholarship deals with the specific enterprise issue of computing tax in low latency high volume mediated by APIs of combining checkout taxation, invoice taxation, and advertising-service taxation within a single operational estate. And that is where this gap motivates the focus of the next section.

3. Methodology

In the literature, three powerful methodological families are used. The first is the behavioural adoption modelling. Research in this line applies Technology Acceptance Model logic, Theory of Planned Behaviour variations, service-quality models and constructs based on trust to study uptake or continuance in tax systems [6], [9], [10], [13], [15]. This convention is useful since smart tax computation depends not only on computational accuracy but also on organizational usability. A tax generator resulting in correct outputs, but opaque to stakeholders, such as analytics, finance, or compliance personnel can result in override behaviour, workarounds, or mistrust. The weakness of this literature is that it tends to view the tax system as an interface with the user as opposed to a highly integrated computational service.

The second line of methodology focuses on design science, information architecture and knowledge representation. Søgaaard applied design science to develop a platform of VAT settlement [7], and Elsayed investigated the ontology-based knowledge management about the process of tax accounting [12]. This approach is highly applicable to Vertex-style integration since external tax engines demand normalized data contracts, well-structured product-taxability rules and hierarchies of jurisdiction and explicable reasoning paths. The strength of this approach lies in architectural clarity and operational relevance. Its limitation is the relative scarcity of large-scale validation across diverse industries on a large scale within diverse industry contexts, particularly on both eCommerce and AdTech.

The third family uses policy evaluation, quasi-natural experimentation and economic modelling to investigate digital tax reforms and digital platform taxation. Bellon et al. and Fang and Ma applied reform-based empirical strategies to estimate the effect of e-invoicing and VAT reform on the compliance and trade outcomes [8], [14]. d'Andria, Kind and Schjelderup, and Lassmann et al. used a combination of formal economic modelling and empirical evidence to test the effects of the taxation in the digital advertising and the digital platform setting [16], [18], [19]. This literature is essential for understanding external constraints within which enterprise tax engines operate. But there is little chance of such work addressing the systems-level problem of how tax results are calculated, stored, versioned, overruled, audited, and reconciled on production systems.

In all these approaches, there exists a general conceptual framework that can be pinpointed. Intelligent tax computation begins with transaction normalization. Existing raw commercial events undergo processing into tax-treatable characteristics that include item identity, counterparty location, legal entity, timing, channel, amount, tax position, and indicators of destination or source. A mapping layer then equates those properties to taxable categories and compulsory requirements. Product taxability, rate, liability assignment and the appropriateness of documentation are cleared by a decision layer. A settlement layer documents output information on invoices, returns, credits and audits. In enterprise practice, Vertex-style integration centralizes this middle tax-decision layer: transactional applications are commerce-oriented and billing-oriented, and tax logic is centralized in an external determination service.

A conceptual distinction also emerges between the batch-oriented tax administration and the determination of tax in real-time. The legacy tax literature assumes periodic filing and administrative reporting. eCommerce and the development of AdTech demand operational tax responses within the decision time frame. Checkout tax determination often must occur within milliseconds or seconds. Thousands or even millions of charge lines, adjustments and credits could be necessary to make advertising invoices. Marketplace settings may require real-time determination of whether the platform or the merchant is responsible for collection. The architecture of intelligent tax computation is advantaged by an architecture whereby canonical transaction data is fed to a dedicated tax layer that is capable of deterministic response and version control as well as subsequent audit retrieval.

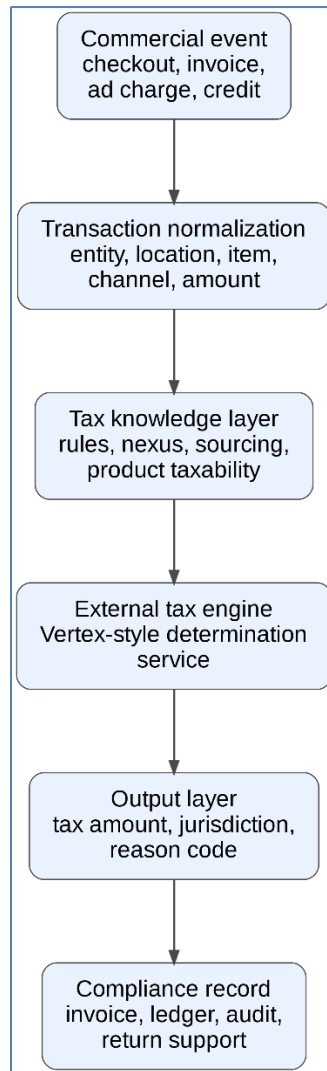


Figure 1 Conceptual framework for intelligent tax computation with external tax-engine integration

The platform model provided in Figure 1 involves commercial events being converted to tax-ready facts and passed into a central determination layer. The model highlights the central argument of this review: tax computation quality depends not only on rate tables but on normalization, classification, decision logic, and evidence preservation. The model also indicates how a Vertex-style integration can be used by eCommerce as well as AdTech without embedding tax logic directly into business applications.

According to the literature, such a framework is particularly helpful in cases where digital transactions have mixed tax signals. A marketplace sale can involve physical goods, delivery charges, handling fees, promotional discounts, platform services, and jurisdiction-specific exemptions. Media delivery, managed-service elements, data or measurement services, rebates, and credits may form part of an AdTech invoice. External tax computation is particularly useful in such settings because rule maintenance can be centralized while transactional systems remain modular.

4. Results and Discussion

Cumulative research reported suggests that intelligent tax computation yields the greatest benefits when the following three circumstances are fulfilled: transaction data is structured early, the logic behind its tax is centralized and evidentiary records are linked to the underlying commercial occurrence. Bellon et al. demonstrated that e-invoicing has a material impact on reported taxable activity, not merely by improving clerical efficiency but on a transformation of the observability of transactions [8]. The same result was also obtained by Kotsogiannis et al., who observed that e-invoicing has the effect of enhancing net VAT payments and enhancing audit efficiency, especially when it is combined with good enforcement [17]. From an enterprise perspective, tax computation cannot be regarded as a final add-on to

accounting systems. A Vertex-style integration is most effective when applied to normalized transaction flows near event creation points since subsequent reconstructions of the tax-relevant facts are often less reliable yet more expensive.

The second significant finding is related to the significance of structured knowledge representation. Elsayed found that ontology-based knowledge management leads to better tax accounting processes and minimization of tax risks [12]. The given finding is extremely applicable to eCommerce and AdTech, where product characterization may be volatile. A digital sale may take multiple forms of software, access to platform, media service and digital content, or as a bundled subscription based on jurisdiction and commercial packaging. Tax computation needs a jurisdictional rate lookup and more. It needs a structured knowledge layer that relates product types, service categories, exceptions, location facts and liability regulations in a manner which may be carried out computationally and described functionally.

A third finding is the interaction between users and organizations with the help of digital tax systems. Night and Bananuka, Veeramootoo et al., Hammouri and Abu-Shanab, Ramdhony et al., and Abu-Silake et al. demonstrate that trust, perceived usefulness, system quality, service quality and ease of use significantly influence the digital tax-system performance in a variety of settings [6], [9], [10], [13], [15]. In the context of enterprise integration design, this implies that intelligent tax computation should be explainable from a usability perspective. The calculation made by a given external engine should ideally provide jurisdiction identification, taxability reason, exemption status, and version traceability. In the absence of this visibility, the finance and operations departments might think of the system as a black box and resort to manual overrides outside controlled systems (e.g., spreadsheets).

A fourth outcome appears in the platform-taxation research. d'Andria revealed that the incidence effects caused by taxation of digital advertising in a two-sided market differ from traditional one-sided product markets [16]. Kind and Schjelderup argued that multi-sided platform taxation is resistant to uniform-tax reasoning [18]. According to Lassmann et al., cross-border spillovers in advertising prices and cross-border spillovers impact tax changes in multinational digital platforms [19]. This literature suggests that it is not possible to design AdTech tax computation as an extension of retail tax logic. Advertising ecosystems consist of publishers, advertisers, agencies, intermediaries, inventory suppliers and service providers and the value flows through various layers of multi-contractual relationships. The determination of tax can depend on the provider of the service, the location of the consumption of the service, and individual invoice line items may correspond to media delivery, intermediation services, or ancillary service components.

Table 2 Method comparison

Ref	Method	Strengths	Limitations
[12]	Ontology-based knowledge management with mixed methods	Captures interpretive complexity and links tax knowledge to procedural accountability	Limited external validation across multiple digital industries
[8]	Quasi-experimental evaluation of VAT e-invoicing reform	Identifies causal compliance effects from administrative digitalization	Focuses on tax-administration outcomes rather than enterprise integration architecture
[14]	Difference-in-differences analysis of VAT reform in eCommerce	Connects legal reform to measurable cross-border trade and compliance outcomes	Less granular on firm-level tax-engine design choices
[7]	Design science research for VAT settlement platform	Produces implementable architectural principles with audit relevance	Prototype orientation leaves sectoral generalization incomplete
[13]	Continuance-usage behavioural modelling	Explains post-adoption persistence, an important issue in enterprise tax-system reliance	Behavioural focus leaves product-classification logic underexplored
[16]	Formal economic modelling of digital advertising taxation	Clarifies tax incidence in advertising-financed two-sided markets	Abstracts from invoice-level tax-determination workflows

[18]	Review of taxation in multi-sided platforms	Consolidates policy and economic insights across platform-taxation research	High-level orientation offers limited system-design detail
[17]	Administrative data analysis of e-invoicing and audits	Shows interaction between digital invoicing and enforcement effectiveness	Focuses on public-administration setting rather than private-platform integration

Table 2 shows that there is no clear method which is able to capture the whole intelligent tax computation problem. Reliance and acceptance are explained by behavioural models, architecture is explained by design science, quasi-experiments explain the effects of compliance and platform incidence is explained by economic models. The most justifiable design solution to enterprise practice is an integration of all four: a legally defined set of rules, operationally explainable results, measurable improvements in compliance, and a classification of service by platform-aware category.

The literature further indicates that intelligent tax computation requires versioned decision logic. The changes introduced by legal reforms including EU VAT modernization place-of-supply changes, platform responsibilities, and evidentiary expectations make eCommerce platforms across jurisdictions require compilations of tax-computation to not only be correct at the time, but to be historically reproducible so as to facilitate audits, credits, and amendments of tax returns [5], [14]. The presence of external tax engine integration will be especially handy in such circumstances given that the updates of the rules can be centralized and time-marked. This would prove useful in AdTech where invoice revisions and campaign balancing can be done following the service delivery.

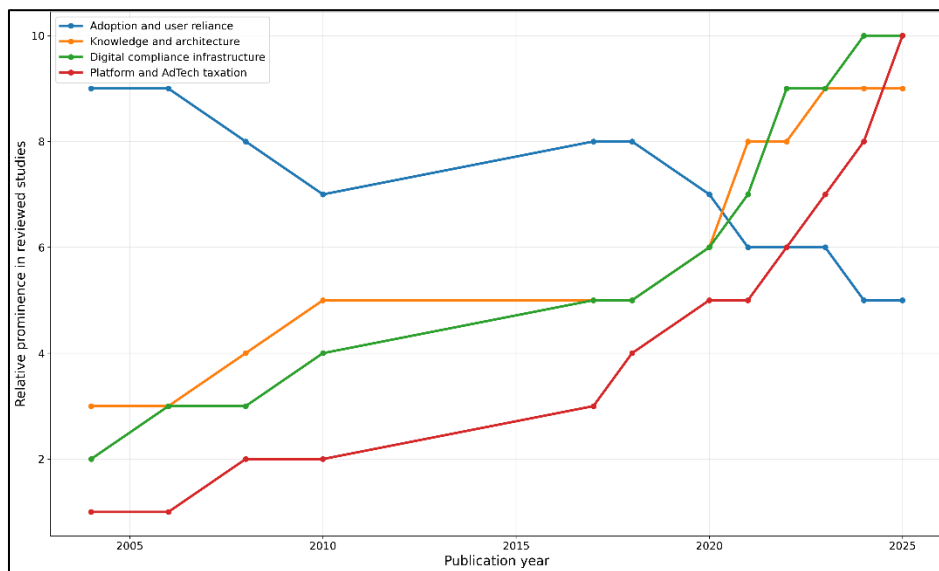


Figure 2 Trend graph of major design priorities in intelligent tax computation literature

Figure 2 shows growing interest in structured knowledge, digital enforcement, and platform taxation. This trend contributes to the central thesis that tax computation intelligence is no longer on the level of user interface questions but rather enterprise-grade legal and operational infrastructure. Vertex-style integrations in global digital business models are particularly concerned with the increasing significance of platform and compliance architecture.

The other significant topic of discussion is the distinction between the level of granularity required in eCommerce versus AdTech. eCommerce tax is usually focused on the checkout or invoice transaction. The taxation of AdTech can operate at the level of advertiser invoicing, platform service fees, or intermediary settlement. Besides these, advertising transactions will often have credits, rebates, minimum-spend adjustments and managed-service overlays. The empirical analysis of taxation in economic research of digital advertising proves that the effects in incidence and pricing are structurally complex [16], [19]. AdTech tax computation therefore requires a relational model connecting service lines and counterparty roles and jurisdictional sourcing logic, as opposed to the flat invoice categorization.

Table 3 Results comparison

Ref	System	Metric	Outcome
[8]	VAT e-invoicing reform in Peru	Reported sales, purchases, VAT liabilities	Digital invoicing increased reported tax bases and liabilities, especially among smaller firms and sectors with higher prior noncompliance
[17]	E-invoicing with VAT audit interface in Rwanda	Net VAT payments and audit efficiency	E-invoicing improved audit efficiency and raised net VAT payments, with strongest effects under active enforcement
[12]	Ontology-supported tax accounting environment	Accountability improvement and tax-risk reduction	Structured tax knowledge correlated positively with stronger procedures and lower perceived tax risk
[6]	Small business electronic tax-system use	Tax compliance via mediated adoption path	Adoption acted as a partial mediator between user attitude and compliance outcomes
[9]	E-filing continuance environment	Continuance intention and service success	Ongoing use depended on quality, trust, and expectation-confirmation variables
[11]	Sharing-platform tax signalling context	Trust and booking intention	Visible tax compliance labels enhanced trust and transaction intention
[14]	EU cross-border eCommerce VAT reform	Online trade flows and compliance	Compliance improved, while consumer-facing trade effects showed measurable contraction in affected order categories
[16]	Digital advertising market under ad valorem tax	Platform output and welfare effects	Tax incidence reflected two-sided market structure rather than standard one-sided assumptions
[18]	Multi-sided platform taxation research base	Tax burden and welfare interpretation	Preferential or uniform tax treatment can produce counterintuitive market outcomes in multi-sided settings
[19]	Multinational online advertising market	Advertising prices and cross-country spillovers	Higher tax rates altered advertising prices and generated spillovers across markets linked through the same platform structure

An important lesson to enterprise architecture seen in Table 3 is that intelligent tax computation is not just important because it can be right here and now, but it is also important because it can impact compliance, trust, audit efficiency and market behaviour. A tax engine implementation that simply calculates figures without maintaining logic, categorization and lineage of transactions does not deliver the full value of tax automation.

Another design principle that may be useful with regard to Vertex-style integrations is mentioned in the literature: the separation of tax rule execution and tax fact creation. Examples of inputs, which must be collected and checked using commercial systems, include tax entity, destination, billing address, service code, exemption flags, legal-entity relationship and the identity of the source document. An external engine is then expected to employ juridical logic and provide calculable results and explanatory metadata. This division eliminates repetition of tax policies on commerce services and reduces the risk of inconsistent tax results between invoicing, checkout, credits and reporting.

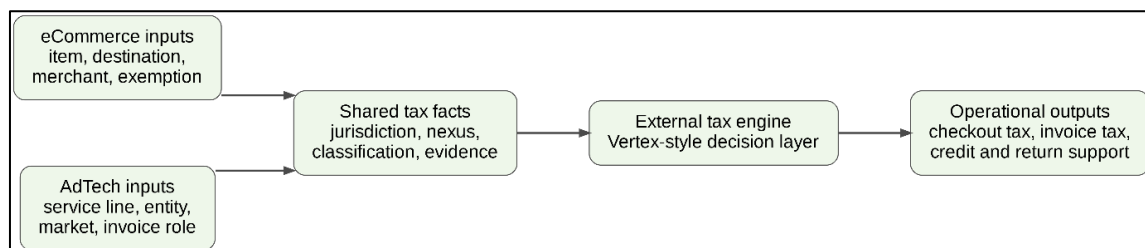
**Figure 3** Relationship diagram for eCommerce and AdTech tax determination

Figure 3 illustrates the interplay of the commercial data, legal interpretation, and tax computation in two digital business domains. As explained in the diagram, AdTech and eCommerce share a common tax-decision foundation despite the different event structures and subject to taxation rules. The above model is useful enough to include a single external tax-engine integration while still allowing domain-specific mapping of products and services in a domain-specific manner.

One of the last outcomes is related to compliance visibility as a governance and competitive factor. Dann et al. demonstrate that visible tax compliance may influence platform trust [11]. This understanding is even broader. Auditable and explainable tax outputs in an enterprise context can decrease conflicts with the merchants, advertisers, sellers in the marketplace, and internal auditors. To the global platforms, strong governance enabled by intelligent tax computation may be a more important long-term benefit than automation alone.

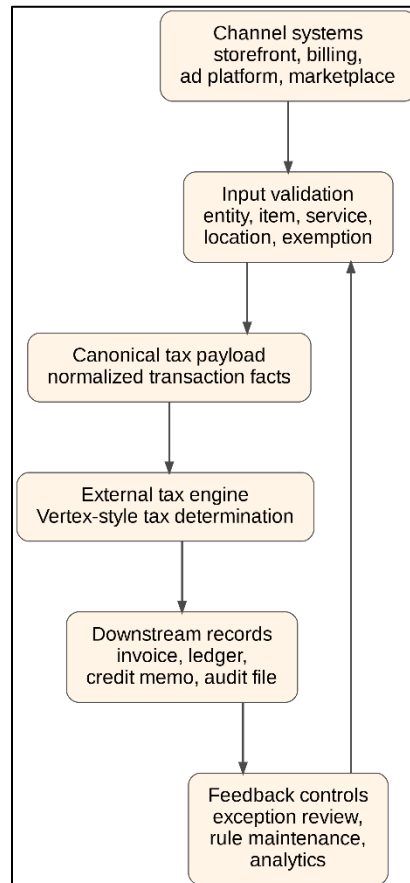


Figure 4 Integrated model for intelligent tax computation using a Vertex-style external engine

Figure 4 incorporates the complete system architecture that is suggested in this review. The model depicts the way to stay modular with a single tax-decision backbone for data transmission, normalization, rule execution, compliance storage, and analytics feedback. The setup is particularly appropriate in international businesses who require a single tax logic layer in retail as well as marketplace, subscription and advertising businesses.

Future Directions

There are a number of research directions in the future. To start with, there has been minimal direct research on integration of enterprise tax engines. The determination of API-mediated taxation, latency-tolerant strategies, caching techniques, fallback logic, and rule-version governance of large-scale commerce and advertising platforms should be researched. Adoption, legal reform, and compliance results are explained in current literature, but the internal engineering of intelligent tax computation is not a well-developed academic field.

Second, there should be greater work done in tax classification in complex digital transactions. eCommerce is increasingly packaged in bundles of goods, digital content, shipping, warranty, subscriptions of access, and even promotion. AdTech increasingly involves bundled services, including media, data, optimization, and managed services.

Future research ought to be done on how intelligent systems can be used to categorize such bundles without losing legal nuance. Ontology-style solutions seem to be successful in this respect since it is the structured knowledge models which are able to preserve interpretive pathways without bundling them up in non-understandable configuration files [12].

Third, a closer look should be devoted to the connection between digital taxation administration and enterprise tax technology. The research on e-invoicing and digital tax administration demonstrates that the modernization of the administration can enhance compliance and efficiency of the audit process [8], [17]. The future research must investigate mutual dynamics where the enterprise systems are tailored to the digitalization of tax authorities, and the public authorities are tailored to the records that are machine-readable records created by enterprise tax engines. The results of such study would assist in clarifying the co-evolution of the ideas of private tax technology and government tax infrastructure.

Fourth, AdTech Taxation is a topic that needs its own literature stream. The current research on platform-taxation gives a pertinent theoretical background [16], [18], [19], but invoice-level and service-line tax determination in digital advertising markets is underexplored. Further studies are needed regarding advertising-service sourcing, intermediate liability, taxation of promotional credit, cross-border media services, and the relationship between billing structure and the incidence of taxes. This would be particularly useful to the giant multi-entity media and advertising platforms.

Fifth, explainability and governance will probably become the key design issues. The computation of intelligent tax can progressively depend on structured graph representation, probabilistic classification frameworks for classification, anomaly detection, and workflow support. Future studies are required to focus on how such capabilities can be brought in without compromising legal certainty, audit traceability or accountability for final tax outcomes. Practically, the most promising option can be hybrid approaches where deterministic legal rules continue to hold the first place, but the use of intelligent practices contributes to classifications, exception-handling pathways, and quality-control.

5. Conclusion

This review introduced intelligent tax computation in eCommerce and AdTech, using the applied design of Vertex-style external tax-engine integration. The literature shows that digital tax systems have developed well beyond the rudimentary application of filing portals. Existing tax computation landscapes are characterized by both behavioural adoption dynamics, structured legal knowledge, and automated infrastructure of enforcement and the economic complexity of multi-sided platforms. The determination of tax now relies on standardized data on transactions, standardization of products and services, centralized use of rules and preservation of auditable evidence.

Several key insights emerge, to begin with, intelligent tax computation cannot be treated as a purely arithmetic task. It is a staged decision process consisting of legal interpretation, transaction normalization, and liability allocation, and downstream maintenance of compliance records. Second, compliance is best enhanced by the digitalization of data that is tax-relevant in the creation of this data, captured close to the underlying event, and maintained so that it can be later verified. Third, ontology-based models are one of the approaches to knowledge structuring that have a high potential in dealing with the complexity in classification and mitigating risk in procedures. Fourth, AdTech presents unique analytical challenges because digital advertising economies are multi-sided, cross-sided, and contractually overlaid in a manner that makes the logic of indirect taxes difficult.

Patterns of enterprise-level API integration, low-latency tax decisioning services, explainable tax automation, and invoice-level AdTech taxation remain under-researched in peer-reviewed literature. Those gaps should be directly covered by future scholarship. Intelligent tax computation, particularly where it is based on centralized external processing systems such as Vertex, can and must be conceived as a key infrastructural capacity of international digital business and not as a peripheral accounting functionality.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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