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VAT and E-Commerce: Digital Reporting, E-Invoicing, and Fraud Prevention in Online Marketplaces (Benchmarking the EU ViDA Reforms)

Abstract

E-commerce increases VAT compliance risks through high-volume, low-value transactions, fragmented cross-border reporting, and platform-enabled business models that complicate identification of the taxable person and the place of supply. The European Union's VAT in the Digital Age (ViDA) package, adopted on 11 March 2025, introduces a harmonised architecture for e-invoicing-based digital reporting requirements for intra-EU B2B supplies by 2030, expands "single VAT registration" through One-Stop Shop mechanisms, and strengthens platform-related VAT rules supported by enhanced administrative cooperation. This study develops an applied policy-and-operations framework for tax administrations and online marketplaces to reduce VAT fraud and unintentional error. Using legal-institutional analysis of ViDA and standards-based assessment of EN 16931, the paper proposes (i) (i) transaction-level reporting aligned with interoperable invoice semantics, (ii) platform governance and liability controls informed by OECD guidance, and (iii) analytics-enabled risk scoring integrated into enforcement workflows. Outputs include an end-to-end control architecture (Figure 1) and a fraud-risk control matrix with practical KPIs (Table 1), benchmarked against ViDA timelines and the VAT gap evidence base. The findings support a design principle: shortening reporting latency and standardising invoice data improves detectability and reduces opportunities for evasion when paired with data-quality controls and operational enforcement capacity.

Keywords: VAT, e-commerce, e-invoicing, digital reporting, marketplace fraud, ViDA, OSS/IOSS, administrative cooperation

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1. Introduction

Value-added tax (VAT) is a broad-based consumption tax whose effectiveness depends on credible transaction visibility, enforceable invoicing rules, and cooperation across jurisdictions. The growth of e-commerce and platform-mediated trade has increased the proportion of remote sales, fragmented supply chains, and facilitated cross-border participation by non-resident sellers. These features intensify information asymmetry between taxpayers, marketplaces, and administrations, and they expand the space for misreporting, including undervaluation of consignments, misclassification of goods, and misuse of registration and place-of-supply rules.From a compliance perspective, three structural issues are recurrent. First, the speed of digital commerce often exceeds the cadence of periodic reporting, creating exploitation windows in which non-compliant actors can churn accounts and routes before detection. Second, cross-border supply chains distribute evidence across multiple entities (seller, platform, payment service provider, and logistics operator), complicating audit trails unless identifiers and records are linked. Third, marketplaces concentrate transaction data and control seller onboarding and delisting, making them a plausible enforcement locus for preventive and detective controls—provided governance and legal design are proportionate and transparent.The European Union has responded through successive reforms relevant for international benchmarking. The 2021 e-commerce VAT package introduced the One-Stop Shop (OSS) and Import One-Stop Shop (IOSS), revised distance-selling rules, and expanded deemed-supplier obligations for marketplaces in defined cases, aiming to simplify compliance and improve fairness in B2C cross-border trade. VAT e-Commerce - One Stop Shop+1 However, this framework did not fully resolve delayed and uneven data flows across Member States.The VAT in the Digital Age (ViDA) package—adopted on 11 March 2025—addresses this gap by moving toward a harmonised system of digital reporting requirements (DRR) anchored in structured e-invoicing for intra-EU B2B transactions by 2030, strengthening administrative cooperation for the digital era, and further reducing the need for multiple VAT registrations. Consilium+1 The legal core comprises Council Directive (EU) 2025/516, Council Regulation (EU) 2025/517 (amending Regulation 904/2010 on administrative cooperation), and Council Implementing Regulation (EU) 2025/518 (amending Implementing Regulation 282/2011 on certain scheme information requirements). EUR-Lex+2EUR-Lex+2.The policy urgency is reinforced by VAT gap evidence. The European Commission's VAT gap resources and the "VAT gap in Europe – Report 2025" extend benchmarking and, notably, include coverage of EU candidate countries, supporting broader comparative assessment of VAT performance and the effectiveness of anti-fraud strategies. Taxation and Customs Union+1.OECD guidance provides an operational foundation for involving digital platforms in VAT/GST collection and reporting, emphasizing that platforms can reduce compliance burdens and improve enforcement efficiency when rules reflect platform capabilities and the nature of facilitation. OECD.Against this background, the paper adopts a dual perspective. First, it interprets ViDA as a benchmark architecture for VAT digitalisation (structured e-invoices, DRR, and strengthened administrative cooperation). Second, it translates this benchmark into an implementable marketplace-operational model: how marketplaces and administrations can jointly prevent fraud through identity assurance, transaction integrity controls, data standardisation, and analytics integrated into enforceable workflows.

Research objectives

This paper aims to:

1. Specify an end-to-end VAT control architecture for marketplaces under a ViDA-like DRR regime (Figure 1).
2. Identify dominant e-commerce VAT fraud vectors and map them to preventive and detective controls with measurable KPIs (Table 1).
3. Benchmark e-invoicing and real-time reporting evidence from early adopters (Italy and Hungary) and align lessons with ViDA timelines and EN 16931 interoperability.
4. Provide implementable recommendations for administrations and marketplaces on data governance, compliance automation, and risk analytics.

2. Materials and Methods

2.1. Research design

A structured "policy-to-controls" research design was applied, combining:

- legal-institutional analysis of the EU ViDA framework;
- standards-based assessment of e-invoicing interoperability requirements;
- comparative review of early digital VAT systems;
- control design for marketplace fraud prevention and operational governance.

2.2. Materials (sources and standards)

Regulatory benchmark (EU)

Council of the European Union press release confirming adoption of the ViDA package (11 March 2025). Consilium

European Commission (DG TAXUD) adoption notice (11 March 2025). Taxation and Customs Union

Legal acts: Directive (EU) 2025/516; Regulation (EU) 2025/517; Implementing Regulation (EU) 2025/518. EUR-Lex+2EUR-Lex+2

Baseline instruments: Directive 2006/112/EC and Regulation 904/2010. EUR-Lex

EU OSS/IOSS portal describing the 1 July 2021 reform scope. VAT e-Commerce - One Stop Shop

Standards benchmark

European e-invoicing standard EN 16931 resources and Commission guidance on access and implementation ecosystem. European Commission+1

Evidence benchmark

"VAT gap in Europe – Report 2025" and European Commission VAT gap resources. Publications Office of the EU+1

Empirical evidence from Italy on e-invoicing and cross-border VAT fraud proxies (trade data gaps). Springer Link+1

Hungary real-time invoice reporting (RTIR) model as operational benchmark (country factsheet and implementation notes). European Commission+1

OECD platform VAT/GST collection guidance. OECD

Research on ML-based fraud detection and organisational integration constraints. arXiv

2.3. Methods

Step 1: Legal requirements decomposition (ViDA)

ViDA was decomposed into:
(a) reporting and e-invoicing obligations,
(b) administrative cooperation requirements, and
(c) simplification mechanisms (single registration / expanded OSS logic). Consilium+2Taxation and Customs Union+2

Step 2: Marketplace VAT risk taxonomy

A risk taxonomy was defined across:

- seller identity risk,
- transaction misreporting (undervaluation, misclassification, split shipments),
- place-of-supply and registration risk (OSS/IOSS misuse),
- invoice integrity risk (missing/duplicate/fake invoices; invoice–payment mismatch),
- refund and return abuse,
- reporting timeliness and completeness risk,
- data quality risk (schema failures, missing fields, inconsistent identifiers).

Step 3: Control mapping to reporting architecture

Controls were mapped to an "invoice → reporting → audit" chain using EN 16931 semantics as interoperability baseline. European Commission+1 Preventive, detective, and corrective controls were designed for the marketplace layer, seller layer, and administration layer.

Step 4: Comparative benchmarking

The control chain was benchmarked against learning from Italy and Hungary, where digitalisation increases transaction visibility and changes detection probability and audit latency. Springer Link+1

Step 5: Synthesis outputs

Two artefacts were produced:

- Figure 1: ViDA-aligned marketplace VAT control architecture.
- Table 1: risk-control matrix with KPIs aligned to VAT gap reduction and enforceability.

3. Results

3.0. Summary of findings

VAT fraud prevention in online marketplaces is most effective when reforms converge on:

1. Structured transaction truth (invoice semantics and integrity);
2. Reduced reporting latency (near-real-time or event-driven visibility);

Concentrated enforcement points (platforms and payment/logistics intermediaries), supported by cross-jurisdiction administrative cooperation. Consilium+1

First citation of Figure 1 and Table 1

The proposed end-to-end control architecture is presented in **Figure 1**, and the corresponding risk-control matrix with KPIs is presented in **Table 1**.

3.2. Figures, Tables and Schemes

Figure 1. ViDA-benchmarked VAT control architecture for e-commerce marketplaces (data → reporting → analytics → enforcement)

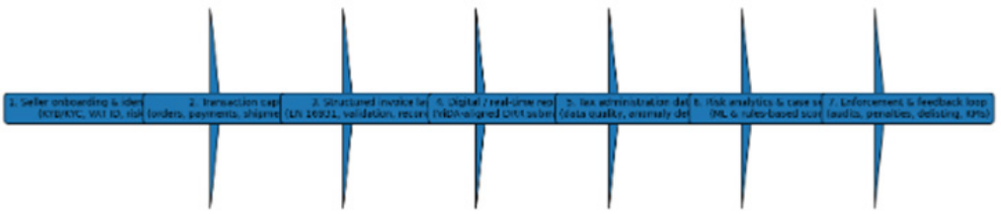

Figure 1 specifies a sequence of operational layers linking marketplace controls and administration visibility:

1. **Seller onboarding & identity assurance (Marketplace)**

- KYB/KYC, VAT ID validation, beneficial ownership checks
- Risk tiering (new seller, high-risk categories, abnormal refund rates)

2. **Transaction capture (Marketplace + seller)**

- Order, payment, shipment, and returns event stream
- Invoice dataset mapped to EN 16931 semantic fields

3. **Structured invoice layer**

- Structured invoice creation, validation, integrity controls, and archiving
- Invoice-to-payment reconciliation and anti-duplication checks

4. **Digital reporting / real-time reporting**

- DRR dataset generation and submission aligned to ViDA logic
- Optional domestic extension for wider risk coverage

5. **Tax administration data hub**

- Data-quality checks, anomaly detection, and validation feedback
- Cross-border sharing enabled by upgraded administrative cooperation

6. **Risk analytics & case selection**

- ML-assisted and rules-based scoring (seller/product/route/invoice patterns)
- Targeted audits, interventions, and refund controls

7. **Enforcement & feedback loop**

- Assessments, penalties, VAT registration actions, platform delisting
- Continuous improvement KPIs linked to VAT gap indicators

This architecture aligns with ViDA's transition toward harmonised digital reporting and structured e-invoicing. Taxation and Customs Union+2European Commission+2

Table 1. Marketplace VAT fraud risks and controls (benchmark: ViDA DRR + OECD platform guidance)

Risk domain	Typical fraud/error pattern	Preventive controls (marketplace)	Detective controls (admin/ marketplace)	Evidence artefacts	KPIs
Seller identity	Shell sellers; rapid churn; non-resident concealment	Enhanced KYB/ KYC; VAT ID validation; risk-tiered onboarding OECD	Network analytics linking sellers, bank accounts, and devices	Onboarding logs; VAT ID checks	% high-risk sellers blocked; seller churn rate
Value undervaluation	Under-declared customs value; split shipments	Catalogue price sanity checks; HS-code guidance; shipment consistency rules	Outlier detection vs catalogue price bands and route patterns	Order, invoice, shipment records	Undervaluation flags per 1,000 shipments
Place-of-supply errors	Wrong VAT jurisdiction; OSS/IOSS not used	Automated tax determination; OSS/IOSS routing logic VAT e-Commerce - One Stop Shop	Cross-check declared VAT vs destination and logistics	OSS filings; destination data	Destination–VAT mismatch rate

Risk domain	Typical fraud/error pattern	Preventive controls (marketplace)	Detective controls (admin/ marketplace)	Evidence artefacts	KPIs
Invoice integrity	Missing/fake/ duplicate invoices; invoice–payment mismatch	EN 16931 field validation; reconciliation; immutable archiving European Commission+1	Duplicate detection; sequence gaps; return mismatch checks	Invoice archive; payment ledger	% invoices failing validation; duplicates per 1M
Missing/late reporting	Delayed reporting enables fraud windows	Event-driven reporting readiness aligned to DRR logic Consilium	Timeliness analytics; completeness scoring	DRR submissions; error logs	% reported within SLA; completeness index
Refund abuse	Inflated returns; false chargebacks	Return rules; proof-of-delivery and return tracking	Cluster detection; seller–buyer collusion signals	Return logs; delivery proof	Refund fraud rate; chargeback ratio
Cross-border carousel risk	Manipulated intra-EU flows; missing-trader patterns	Enhanced B2B checks; chain monitoring; discrepancy signals	Cross-admin cooperation and matching EUR-Lex	Audit trails; cross-border exchange	High-risk chain detections; case closure time
Data quality	Missing fields; inconsistent IDs; duplicates	Schema validation; master-data governance	Rejection reason dashboards; correction cycle analysis	Schema reports; QA logs	Rejection rate; correction cycle time

3.1. Digital reporting and e-invoicing under ViDA

ViDA positions structured e-invoicing as the primary data source for modern VAT control, with the policy objective of making cross-border B2B reporting fully digital by 2030 and reducing fragmentation from divergent national reporting approaches. Consilium+1 Directive (EU) 2025/516 links structured invoice data to automated transmission of information needed for control purposes and supports the transition away from legacy mechanisms where redundant under harmonised DRR. EUR-Lex.Interoperability is anchored in EN 16931, which defines a semantic data model for core invoice elements required for compliance and cross-border usability. European Commission+1 For marketplaces, semantic uniformity enables automated validation, payment/shipping reconciliation, and near-real-time anomaly detection. It also lowers compliance friction by replacing heterogeneous invoice formats with machine-readable schemas that can feed DRR pipelines.Evidence from early adopters supports the design logic that increased transaction visibility reduces opportunities for fraud by raising detection probability and reducing audit latency. Italy's comprehensive 2019 e-invoicing introduction has been studied for its impact on cross-border VAT fraud proxies using discrepancies in mirrored trade data. Springer Link+1 Hungary's RTIR model, introduced in 2018, illustrates how centralised invoice reporting can enable faster risk responses when integrated with quality controls and enforcement workflows. European Commission+1

3.1.1. Fraud prevention in marketplaces: platform role and OECD benchmark

Marketplaces concentrate three enforcement levers: seller access (onboarding and delisting), transaction orchestration (checkout, pricing, promotions), and data consolidation (orders, payments, logistics). OECD guidance on platform involvement in VAT/GST collection provides practical design approaches for platform liability and platform-assisted compliance, recognising that platforms can often collect and report more efficiently than dispersed sellers in online sales contexts. OECD

In a ViDA-like environment, marketplaces can act as compliance accelerators by implementing:

- **Identity assurance:** KYB/KYC, VAT ID validation, beneficial ownership checks, continuous monitoring.
- **Invoice integrity:** EN 16931 validation, reconciliation, immutable archiving. European Commission+1
- **Transaction integrity:** classification governance, undervaluation detection using catalogue benchmarks, logistics-data consistency checks.
- **Reporting automation:** DRR dataset generation, seller dashboards, structured error feedback loops.
- **Risk analytics:** scoring and anomaly detection for under-declaration, refund abuse, and collusive networks.

Machine learning can improve detection at scale, but operational constraints (false positives, adversarial adaptation, and workflow integration) must be managed for enforceability and proportionality. arXiv Accordingly, robust design pairs ML scoring with explainability and audit logging, supported by human-in-the-loop governance.

Numbered list (recommendations)

1. Adopt a unified transaction data spine linking order ID, invoice ID, payment ID, shipment ID, and return ID.
2. Standardise invoice semantics using EN 16931-aligned fields and validation rules. European Commission+1
3. Build DRR readiness before mandates via event-driven reporting pipelines and data-quality scoring aligned to ViDA direction. Taxation and Customs Union+1
4. Implement platform-assisted compliance: automate OSS/IOSS decisioning and blocking rules when critical VAT fields are missing. VAT e-Commerce - One Stop Shop
5. Deploy layered controls: preventive (onboarding gates), detective (anomaly detection), corrective (delisting/withholding payouts/reporting). OECD
6. Use risk-based enforcement prioritised by expected revenue impact and confidence scores, with documented audit trails. arXiv
7. Track VAT-gap-linked KPIs: timeliness, completeness, validation failure rates, and recovery metrics, contextualised by VAT gap evidence. Taxation and Customs Union+1

4. Discussion

Although ViDA is EU legislation, its architecture is relevant for global VAT systems facing the same underlying constraint: timely, standardised, and enforceable transaction information for cross-border digital trade. The reform's core premise is that invoice-anchored DRR and stronger administrative cooperation reduce fraud opportunities, but only if supported by data quality controls and the organisational capacity to convert signals into interventions. Consilium+2EUR-Lex+2.Two transferable design principles emerge. First, standardising reporting content through semantic interoperability is necessary for analytics and cooperation; without standardisation, higher reporting frequency may only produce unusable data. Second, cross-jurisdiction cooperation must be engineered into operational practice rather than treated as a legal formality. Regulation (EU) 2025/517 updates administrative cooperation arrangements under Regulation 904/2010 to support the digital age, providing an institutional basis for systematic data exchange. EUR-Lex.Comparative evidence supports cautious optimism. Italy's experience suggests that comprehensive e-invoicing can reduce cross-border VAT fraud proxies, but causal impact depends on enforcement capacity and behavioural adaptation. Springer Link+1 Hungary demonstrates that real-time reporting can support faster risk responses when quality controls and workflows are mature. European Commission+1 For marketplaces, the practical locus of control remains onboarding governance, reconciliation across payments and logistics, and structured reporting pipelines that reduce the opportunity for "evidence fragmentation."Finally, the VAT gap provides an outcome lens. The "VAT gap in Europe – Report 2025" improves benchmarking breadth and includes candidate countries, enabling more comparable evaluation of reforms and compliance strategies. Publications Office of the EU+1 However, attributing macro-level VAT gap changes to a single policy requires careful evaluation design; a practical approach is to monitor leading indicators (timeliness, completeness, validation errors) alongside lagging indicators (audit yield, assessments, collections) and to apply counterfactual methods where feasible.

5. Conclusions

E-commerce VAT compliance is fundamentally an information and governance problem intensified by platform intermediation and cross-border fragmentation. The EU's ViDA package provides a coherent benchmark: structured e-invoicing as the default information source, harmonised digital reporting for cross-border B2B by 2030, improved administrative cooperation, and expanded simplification through one-stop shops. Consilium+2Taxation and Customs Union+2 The associated legal instruments—Directive (EU) 2025/516, Regulation (EU) 2025/517, and Implementing Regulation (EU) 2025/518—illustrate that VAT policy, reporting technology, and cross-border enforcement are most effective when designed jointly. EUR-Lex+2EUR-Lex+2.This paper translates the benchmark into implementable outputs: a marketplace-and-administration control architecture (Figure 1) and a risk-control matrix (Table 1). The central conclusion is operational: fraud prevention improves when controls attach to the platform's comparative advantages—seller onboarding governance, consolidated transaction data, and observability across payment and logistics—while maintaining proportionality, auditability, and transparent governance. OECD guidance supports platform-assisted models that align with practical realities of online sales and enforcement feasibility. OECD.Empirical and operational learning from Italy and Hungary reinforces the direction of travel: transaction visibility and shorter reporting latency can reduce exploitation windows, but outcomes depend on data quality, enforcement capacity, and integration of analytics into case workflows. Springer Link+1 The VAT gap evidence base supports monitoring reforms through a layered KPI approach that connects operational measures (timeliness, completeness, validation failures) to fiscal outcomes over time. Publications Office of the EU+1

6. Patents

No patentable inventions are claimed. Potential patentable developments could arise from privacy-preserving anomaly detection integrating EN 16931 semantics with payment and logistics signals; cryptographic invoice integrity mechanisms optimised for marketplace scale; verifiable OSS/IOSS routing engines with auditable decision logs; and cross-jurisdiction matching algorithms for detecting carousel-like chains while minimising sensitive data transfer.

Supplementary Materials

Supplementary materials may include: (i) an EN 16931 field-mapping template; (ii) a DRR dataset schema and validation rule set aligned to ViDA concepts; (iii) seller onboarding risk-tiering questionnaires; (iv) an OSS/IOSS decisioning flowchart; (v) a library of anomaly detection features; and (vi) KPI dashboards aligned to Table 1 with governance guidance for model review and audit traceability.

Author Contributions

Conceptualization: M.A. Methodology: M.A. Formal analysis: M.A. Investigation: M.A. Writing—original draft: M.A. Writing—review and editing: M.A. Visualization: M.A.

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Institutional Review Board Statement

Not applicable. The study uses publicly available legal texts, standards documentation, and published research outputs. No human participant data were collected.

Informed Consent Statement

Not applicable.

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Conflicts of Interest

The author declares no conflicts of interest.

Appendix A. Minimum viable marketplace VAT compliance checklist (ViDA-ready controls)

A1. Seller KYB/KYC + VAT ID validation + continuous monitoring (risk tiers). OECD
A2. Unified transaction identifiers across order–invoice–payment–shipment–return.
A3. EN 16931-aligned invoice validation, reconciliation, and archiving. European Commission+1
A4. Event-driven reporting readiness and data-quality scoring aligned to DRR principles. Taxation and Customs Union+1
A5. Automated OSS/IOSS decisioning workflows (where applicable) and seller prompts. VAT e-Commerce - One Stop Shop
A6. Fraud analytics governance: explainability, monitoring, and human-in-the-loop workflows. arXiv

Appendix B. Evaluation plan for digital VAT measures in marketplaces

B1. Baseline: measure completeness/timeliness and mismatch rates pre-implementation.
B2. Leading indicators: invoice validation error rate; undervaluation flags; refund anomaly rate; late reporting rate.
B3. Enforcement outcomes: audit yield per case; assessment cycle time; collections rate.
B4. System outcomes: VAT compliance gap trends where available. Publications Office of the EU+1
B5. Counterfactual methods: difference-in-differences with phased rollouts; matched controls by category/route.
B6. Governance: quarterly model review; documentation for audit defensibility.

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