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RITHMS – Research, Intelligence and Technology for Heritage and Market Security

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Deliverable 6.2
Impact Analysis v.2

Work Package 6 – Communication, dissemination, exploitation, and sustainability

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Executive Summary

This deliverable assesses the **anticipated economic, societal, and technological impacts** of the RITHMS project and especially of its main output: RITHMS SNA-based Platform, a modular, user-centred system designed to help authorities detect, investigate, and prevent the illicit trafficking of cultural goods (TCG). The assessment draws on the project's exploitation strategy, market overview, economic assessments, and asset definitions compiled in D6.5. As already underlined in D6.5 and other previous deliverables, RITHMS aims to complement, not replace, trusted ecosystems (e.g., INTERPOL, EUROPOL, WCO) by providing an analytics layer that fuses multi-source data, Artificial Intelligence (AI) and Social Network Analysis (SNA) analytics, operational protocols, and training.

In terms of *economic impact*, RITHMS targets a conservative, evidence-based opportunity among 138 potential EU buyers across LEAs, customs, ministries, national museum consortia, prosecution services, and selected EU-level bodies, with transparent Total Addressable Market (TAM) / Served Available Market (SAM) / Serviceable and Obtainable Market (SOM) range bands anchored in public investigative-tool pricing and realistic seat assumptions. This supports a credible path from pilots to initial licences and service revenues, validated by a further "bottom-up" sanity cross-check aligned with the SOM band.

Regarding the *societal impact*, the Platform is expected to contribute to reduced criminal harm, heritage protection, and cross-border cooperation, while strengthening digital skills, standardised practices, and innovative tools through the involvement of a potentially vast array of international cultural heritage user communities (e.g., involving not only LEAs and customs but potentially also other type of stakeholders such as museum consortia, ministries, or academia). In addition, this aspect aligns perfectly with other general EU goals (e.g., EU AI Act obligations) and trends in the cultural heritage sector inviting for more shared cultural-data infrastructures, helping move the sector toward trusted, interoperable, and auditable analytics.

In terms of *technological impact*, RITHMS advances in particular operational readiness across six Exploitable Assets (reported in Annex 1) clustering KERs into licensable capabilities, ranging from multi-source ingestion and ontology/knowledge-graph management to analytics intelligence, and an AI evidence verification/validation toolkit (TRL 6–8 across assets). Furthermore, it is worth noticing that the developed approach in RITHMS allows for a potential use also in other adjacent poly-criminal domains (e.g., environmental crime, firearms), interoperating also with the outcomes of other complementary Horizon projects (e.g., Ceasefire, Perivallon, Emeritus).

List of Abbreviations

AI	Artificial intelligence
DG HOME	Directorate-General for Migration and Home Affairs
EU	European Union
FCT	Fight against Crime & Terrorism
FTE	Full Time Equivalent
GA	Grant Agreement
GEOINT	Geospatial Intelligence
ICT	Information and communication technology
IIT	Italian Institute of Technology
IT	Information technology
KG	Knowledge graph
LEA	Law enforcement agency
LSA	Law & Society
NGO	Non-governmental organisation
NLP	Natural language processing
REA	European Research Executive Agency
ROI	Return on Investment
SAM	Served Available Market
SNA	Social network analysis
SOM	Serviceable and Obtainable Market
SRE	Security Research Event
TAM	Total Addressable Market
TPC	Command for the Protection of Cultural Heritage
WCO	World Customs Organization

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1 Introduction[1]

The Horizon Europe project RITHMS (*Research, Intelligence and Technology for Heritage and Market Security*) tackles illicit trafficking of cultural goods as a security challenge intertwined with organised crime and terrorism financing. The main output of the project consists in a modular, user-centred Platform that integrates AI, Social Network Analysis (SNA), Geospatial Intelligence (GEOINT), Natural Language Processing (NLP) and legally compliant data handling to support detection, investigation, and prevention. The Platform aims to be positioned as an interoperable analytics layer on top of trusted repositories and secure exchange systems already used by LEAs and customs.

Deliverable D6.2 features the RITHMS anticipated economic, societal, and technological impact assessments, specially building on insights on market assessment, exploitation strategy, and the exploitable assets presented in D6.5.

1.1 Relation to other deliverables

Aiming at presenting the diverse prospected impact of the RITHMS project, Deliverable D6.2 is tightly connected to the following deliverables:

- D2.2 -Methodology protocol to address illicit trade in cultural goods
- D2.5 – Report on overcoming obstacles to CH crimes prosecution
- D2.6 – Report on validation requirements for AI-based evidence
- D6.1 - RITHMS Impact Analysis v.1
- D6.5 - Exploitation and sustainability strategy
- D6.7 - Final report on Communication and Dissemination
- D6.12 - Policy recommendations and standardisation roadmap
- D7.3 - Report on RITHMS social benefits and risks
- D7.4 - Report on RITHMS application to border management
- D8.4 – IPR Management Plan

[1] It must be noted that Evenflow (EVF), the partner responsible for this deliverable, joined the RITHMS project only in its very last phase, a few months before its end, due to StAG SASU's termination at M29. This Deliverable was originally assigned to Coordinator-IIT with the foreseen strong and continuous support of StAG as the Exploitation expert and leader of the whole WP6. The early termination of the expert partner and the managing work overload fallen upon the Coordinator-IIT made it advisable to reassign D6.2 to the incoming partner EVF, which finally joined the Consortium with the AMD signed on 29/07/2025. The concept of D6.2, therefore, slightly changed with respect to the original structure planned in D6.1, in accordance with EVF's expertise and approach to the topic.

2 Economic Impact[2]

2.1 Addressable Opportunity and Early Uptake

2.1.1 Buyer ecosystem & pricing anchor

As executed and reported in D6.5, the market-sizing assessment for RITHMS was designed to be clear and defensible in how it derives TAM, SAM, and SOM. To prevent double-counting, we first mapped the potential buyer landscape at the EU-27 national level and assumed a single potential buyer per Member State across five categories: the art-crime/heritage unit within law enforcement, the national customs administration, the culture/heritage ministry or agency, the national museum organisations or consortia, and the national prosecution service. We then added a small number of EU-level institutions (e.g., Europol, Eurojust and Frontex) bringing the total to **138 potential organisations** (27×5 + 3). This is intentionally conservative: although Europol indicates there are more than 90 law-enforcement agencies across the EU, we counted one art-crime/heritage buyer per country rather than multiple LEAs.

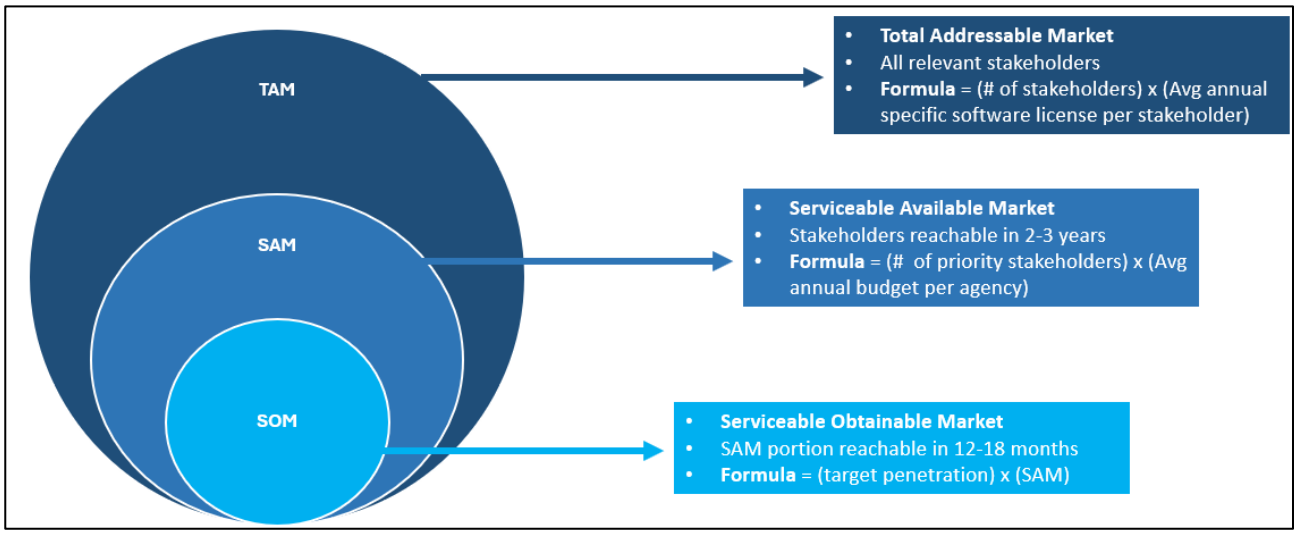
To anchor pricing to public information, we used the Maltego Professional licence[3] at EUR 6,000 per seat per year as a proxy for an investigative/intelligence tool, since it is a software tool already used in different law-enforcement settings. Recognising that national units may differ in size, we defined **three seat bands** aligned with typical team sizes: Low (5 seats, roughly 1–5 FTE), Medium (15 seats, about 5–15 FTE) and High (30 seats, 15+ FTE). These bands correspond to baseline annual licence values of EUR 30,000, EUR 90,000 and EUR 180,000 per organisation. To reflect real delivery costs, such as systems integration, maintenance, support and training, we added a 40% uplift, resulting in all-in annual spends of EUR 42,000 (Low), EUR 126,000 (Medium) and EUR 252,000 (High) per organisation.

[2] The comprehensive Market analysis and RITHMS Economic strategy are featured in full in D6.5.

[3] https://store.maltego.com/

2.1.2 TAM/SAM/SOM realism

Figure 1: TAM, SAM, and SOM approach for RITHMS



TAM was calculated with a straightforward "price × buyer count" method. For each of the three seat scenarios, we multiplied the all-in annual spend per organisation by the 138 potential EU buyers. This yields a transparent range—low (small teams), central (mid-sized teams) and high (larger deployments)—rather than a single point estimate.

For **SAM**, we focused on what is realistically accessible over the next two to three years and applied a uniform 60% reachability factor to the TAM in each scenario. This assumption can be tightened on a country-by-country basis as commercial access improves, for example through framework agreements or reference customers.

For **SOM**, we assumed a 30% penetration of the SAM in the first 12–18 months, reflecting early adopters of the platform to roughly 25 organisations. Even though EU police agencies are expected to benefit from the RITHMS platforms free of charge (see D6.5 for more details), the team considered a first-wave adoption at around 25 organisations (rather than all 27). Firstly, this considers that early uptake might be constrained by other considerations (e.g., data-sharing MOUs, system integrations), which may vary by Member States and LEAs. Secondly, the number takes into account a *mixed stakeholder group*, not only police. Indeed, early adoption could benefit from diversity of use-cases and integration patterns (e.g., customs for border seizure and risk targeting; prosecution services for case preparation and evidence chains; museum/heritage consortia for provenance checks and restitution), especially considering the flexibility that the RITHMS platform can have in addressing potential additional needs and type of stakeholders (e.g., security agencies).

Overall, the team adopted a conservative method in both the buyer counts (e.g., one national buyer per category per Member State despite Europol[4] counting 90+ LEAs in total) and pricing (a public, verifiable seat price plus a relatively modest uplift). In addition, presenting low/medium/high bands makes the assumptions explicit and the outputs easy to interpret. As more granular data becomes available—confirmed seat counts by country, segment-specific pricing, and signed customers—the framework can be refreshed quickly by updating the buyer list, seat assumptions and reach/penetration percentages.

Table 1: TAM, SAM, and SOM for RITHMS

	TAM	SAM	SOM
Unit size_low	EUR 5.796.000	EUR 3.477.600	EUR 1.043.280
Unit size_medium	EUR 17.388.000	EUR 10.432.800	EUR 3.129.840
Unit size_high	EUR 34.776.000	EUR 20.865.600	EUR 6.259.680

As an additional cross-check to the top-down price × buyer count model, the team ran **a bottom-up validation** using LEAs Art Crime units FTE that participated in Operation Pandora IX (including EU and non-EU countries). For each country, we identified the relevant agency (e.g., police art-crime unit, border police, customs). Where information on unit-level headcount dedicated to cultural-heritage protection was public, we used it directly; when no public information was available, we applied a conservative staffing proxy derived from Italy's Carabinieri TPC (300 specialists out of total 116,000 FTE personnel corresponding to around 0.26%) but scaled down to **0.03%** for other countries **to avoid overestimation**, since Italy is likely the EU country with the highest dedicated count of FTE specifically focused in this area.

Using the same public price anchor as the main model, we multiplied the per-seat figure (Maltego EUR 6,000 per seat plus 40% uplift = EUR 8,400) by each unit's FTE and summed across Pandora IX participants, producing an annual total of around *EUR 5 million for the full sample* and around *EUR 4 million for the EU-only subset*. It is worth to be noticed that these results sit within the principal model's SOM band (between the medium and high scenarios), reinforcing its realism. The check remains deliberately **conservative**: it includes only agencies known to have joined Pandora IX, assumes a simple 1:1 FTE-to-seat mapping, uses the low **0.03%** proxy where data is missing, and most importantly still aligns with the SOM range from the main model.

[4] https://www.europol.europa.eu/faq

Table 2: Bottom-up LEAs sanity cross-check_SOM [5]

Country	EU / Non-EU	LEA/art crime unit (where applicable)
Albania	Non-EU	State Police
Austria	EU	Police / The Austrian Federal Criminal Intelligence Service (BK)
Belgium	EU	Federal Police
Bosnia & Herzegovina	Non-EU	Border police
Bulgaria	EU	Border police
Czechia	EU	Police
France	EU	Police / OCBC
Germany	EU	Federal Criminal Police Office (BKA)
Greece	EU	Police / Cultural Heritage and Antiquities Protection Department
Ireland	EU	Garda police
Italy	EU	Carabinieri / Command for the Protection of Cultural Heritage (Carabinieri TPC)
Malta	EU	Police
Moldova	Non-EU	Border Police
Netherlands	EU	Police / Team Kunst & Antiek
North Macedonia	Non-EU	Police
Norway	Non-EU	Police
Poland	EU	Police
Portugal	EU	Police / Polícia Judiciária (PJ)
Romania	EU	Police
Serbia	Non-EU	Police
Spain	EU	Police / Policía Nacional (Patrimonio Histórico)
Ukraine	Non-EU	Police
United States	Non-EU	FBI / art crime team
TOTAL	**EU & Non-EU**	**EUR 4,954,066**
TOTAL	**EU only**	**EUR 4.199.682**

[5] The full calculation with FTEs and numbers is reported in D6.5, for security reasons this data is not publicly released.

Near-term revenue tracks

As detailed in D6.5, four exploitation tracks are considered:

- (A) services from pilots (onboarding, integration, case support);
- (B) licensing/SaaS;
- (C) policy uptake;
- (D) scientific/R&D capitalisation.

Track A/B drive near- to mid-term revenue, while C/D expand policy influence and R&D capital.

Table 3: Potential RITHMS Exploitation tracks

Exploitation track		Primary outcome	Target stakeholder	Time to revenue (indicative)	Main risks/dependencies
A	**Contracts from engaged users**	Near-term services/ops revenues	Pilot LEAs and Customs units	Short: M6-M9	Demonstrated operational value; tailored onboarding
B	**Commercialisation (Licensing/SaaS)**	Recurring revenues	LEAs and Customs	Medium: M9-M18	IP management; integration with legacy systems
C	**Policy Uptake**	Influence and funding for scale-up	EU bodies, NGOs, policymakers	Long: M18-M36	Alignment with strategies; evidence base from pilots
D	**Scientific or R&D Capitalisation**	Reputation and influence	Research community, conferences	Long (indirect)	Publications; IP management; long-wait for R&D calls

2.2 Efficiency Gains and Cost Avoidance

2.2.1 Analyst productivity

By merging OSINT/social signals, GEOINT, Call Data Records (CDRs), and institutional data into an analysis-ready Platform, as well as by exposing graph- and SNA-based hypothesis generation, RITHMS targets reduced time-to-insight and higher lead numbers per analyst hour. Expected effects include fewer manual lookups, improved entity/link disambiguation, and prioritisation of high-risk patterns.

2.2.2 Avoided losses via incremented recovery operations

As discussed in D6.5, based on seizure-based value bands (using data 854,742 seized items in 2020; EUR 100/EUR 500/EUR 1,500 average-value bands; 2%/5%/10% detection-rate scenarios) and implying a global illicit value interval of around EUR 0.85 billion – EUR 64 billion with a central EUR 8.5 billion case (EUR 500/item and 5% detection rate), the market resulting from illicit trafficking of cultural goods

can be assessed as in **Table 4**. While recoveries cannot be all attributed to a single tool, improved intelligence and case support with network analysis can incrementally increase recoveries, providing societal Return on Investment (ROI) and measurable case-level benefits.

Table 4: Illicit trafficking of cultural goods market size - sensitivity table

	EUR 100	EUR 500	EUR 1,500
Detection-rate: 10%	EUR 854.742.000	EUR 1.709.484.000	EUR 4.273.710.000
Detection-rate: 5%	EUR 4.273.710.000	EUR 8.547.420.000	EUR 21.368.550.000
Detection-rate: 2%	EUR 12.821.130.000	EUR 25.642.260.000	EUR 64.105.650.000

2.3 Market Development Effects

RITHMS' modularity and interoperability may support and encourage adjacent-use expansion (e.g., environmental crime, firearms), also in synergy with sister projects' outcomes (e.g., Ceasefire, Perivallon, Emeritus), and stimulate analytics competencies in cultural-heritage security, ultimately supporting a potential secondary market of integration, training, and certification services.

3 Societal Impact

3.1 Reduced harm to Cultural Heritage and communities

RITHMS contributes to earlier detection and more consistent disruption of trafficking chains by (i) unifying multi-source signals into analysis-ready knowledge, (ii) surfacing high-risk actors/artefacts through link analytics, and (iii) shortening the handoff from screening to case support. In practical terms, agencies can convert fragmented leads into coherent case threads faster, which increases the probability of seizure/recovery and reduces community harm from looting. Immediate **efficiency-gain outcomes** would involve time-to-first-lead, number of platform-identified items/actions that escalate to investigation, and the proportion of cross-border cases where RITHMS supported coordination.

3.2 Cross-Border Cooperation and Trust

The RITHMS Platform is designed to interoperate with trusted ecosystems (INTERPOL, EUROPOL, WCO) rather than replace them. Therefore, by aligning ontologies and exposing repeatable workflows, it can support LEAs, customs, ministries, and museum networks cooperate without replacing trusted systems (e.g., INTERPOL/EUROPOL/WCO channels). The main societal impact here refers to **improved procedural trust**: shared concepts, comparable risk indicators, and shorter coordination cycles. In addition, this can translate also into additional practical benefits, such as clearer division of labour between jurisdictions and faster transition from alert to joint action.

3.3 Governance, Ethics, and Legal Compliance

The EU Artificial Intelligence Act (Regulation (EU) 2024/1689) establishes a risk-based framework and obligations (particularly for “high-risk” systems) shaping procurement criteria around explainability, human oversight, data minimisation and technical documentation. In this context, the **alignment with the EU AI Act requirements** is then key for RITHMS to shorten legal reviews and accelerate procurement and operational trust. Embedding a **verification/validation method for AI-generated potential digital evidence**, along with model/dataset documentation, supports responsible use and judicial acceptability, reducing legal review friction during deployments.

3.4 Capacity-Building and Professionalisation

The multi-source feeding approach for the Platform allows for turning scattered research and practice into actionable guidance, standard operating procedures, and curricula for investigators, customs

officers, and curators. This promotes skills uplift, knowledge sharing, and consistent capability transfer beyond the project.

3.5 Social Impact as Public Awareness

A key dimension of the RITHMS project lies in its commitment to **raising public awareness and fostering a deeper societal understanding of crimes against cultural heritage**. Beyond its scientific and policy-oriented objectives, RITHMS recognises that long-term impact depends on engaging citizens, cultural professionals, and policymakers alike. To this end, IIT as the project's coordinator produced the **documentary** *Threads of Heritage. Down the Rabbit Hole of Art Crime*[6], a powerful communication tool directed by Brian Parodi and designed to bring the complex realities of the illicit trafficking of cultural goods to a broad audience. Featuring the collaboration of project partners TPC, SP, and SatCen, besides the participation of several renown experts, the documentary offers an unprecedented insight into the mechanisms and human stories behind the illegal art market. Through evocative storytelling and exclusive footage, it sheds light on the devastating consequences of clandestine excavations and the intricate networks linking traffickers, auction houses, and even prestigious museums.

Filmed across Rome, Cerveteri, and Madrid, *Threads of Heritage* takes viewers on a journey from looted archaeological sites to museum storage rooms that are normally closed to the public, where hundreds of recovered artefacts await restitution. These objects, often seen only as commodities in illicit trade, become the true protagonists of the narrative—symbols of memory, identity, and cultural continuity. The documentary has been presented at major events such as the International Archeofilm Festival in Florence (Italy) and the Archaeological Film Festival in Rovereto (Italy), as well as at public screenings hosted by the National Etruscan Museum of Villa Giulia in Rome, the Municipality of Genoa, and the Security Research Event in Warsaw. In November, further screenings will take place in Brussels for representatives of the European Commission's Directorates-General, reinforcing the film's role as a bridge between scientific research, public engagement, and policy dialogue.

By combining emotional narrative with rigorous research, *Threads of Heritage* fulfils a dual purpose: it raises awareness among the general public about the magnitude and implications of cultural heritage crime, while simultaneously engaging institutional stakeholders and policymakers in meaningful reflection on how to strengthen protection mechanisms. Complementing this effort, the affiliated partner *Art Crime Project-APS* (ACP) has produced two emotionally impactful **short films** released

[6] https://rithms.eu/communication/events/threads-of-heritage-down-the-rabbit-hole-of-art-crime.

on social media (*The Crater* and *The Concert*, directed by Alessandro Garilli[7]), which have successfully reached diverse audiences and promoted the values of cultural heritage protection—particularly in relation to illicit excavations and art theft. Together, these audiovisual initiatives amplify the social dimension of RITHMS, ensuring that its outcomes resonate beyond the academic and professional spheres, and contribute to building a culture of respect and shared responsibility for Europe's cultural heritage.

[7] https://rithms.eu/communication/events/the-krater - https://rithms.eu/communication/events/threads-of-heritage-down-the-rabbit-hole-of-art-crime-2.

4 Technological Impact

4.1 Exploitable Assets and TRL Progress

The technological impact is channelled through **six Exploitable Assets (EAs)** that span TRL 6-8: EA1 Multi-Source Data Ingestion & Fusion; EA2 Knowledge Graph Base Management System & Ontology Manager; EA3 Analytics Intelligence; EA4 Operational Protocol & Training; EA5 Cultural-Property Crime Intelligence Pack; EA6 AI Evidence Verification/Validation Toolkit & Reference Pack. The value of this packaging is practical: each EA has significant potential for exploitation/monetisation, yet together they form an end-to-end capability from data capture to evidence-ready analytics and training. Additional information on the EAs can be found in **Annex 1**.

Overall, the **innovation of the RITHMS Platform** can be assessed by the fact that it is **purpose-built for the cultural-heritage market**: it tracks *events* and *actors* tied to *provenance* with timestamps, locations and relationships, enabling the discovery of networks and indirect links (e.g., common interests in specific artworks, attended fairs/auctions/conferences, shared experts). Unlike general-purpose OSINT tools, the RITHMS platform was specifically designed for artwork market analysis.

4.2 Interoperability & Standards

By aligning taxonomies/ontologies and enabling fast graph operations, the platform strengthens **semantic interoperability** across fragmented sources (LEA/case data, customs alerts, cultural-goods databases, marketplace/web signals). This improves data quality and queryability for investigative and analytical workflows.

Practically, investigators can select and ingest relevant data from many source types and extend/adapt the domain ontology with granular cultural-heritage concepts (e.g., artists, collectors, experts, galleries, auction houses, archaeological sites, excavations, techniques). This domain-aligned modelling improves cross-source entity resolution and the comparability of indicators across jurisdictions.

4.3 Responsible and Forensic-Grade AI

The AI validation/verification toolkit and reference pack help systematise **evidence-readiness of AI outputs**, making analytics more auditable and acceptable in judicial and forensic contexts.

RITHMS integrates Natural Language Processing-driven entity extraction aligned to the cultural-heritage ontology, producing structured, provenance-aware records from unstructured text and supporting confidence levels, temporal analysis, centrality metrics and multilayer links within a

dedicated knowledge graph. On the contrary, other OSINT general tools allow generic entity extraction without domain expertise and require manual setup for each data source.

In addition, the platform runs in a safe, isolated environment with one-way communication, without running on the public internet, and maintains audit trails and documentation to support admissibility and review.

4.4 Replicability to Adjacent Crime Areas

Due to the modular architecture of the Platform, its analytical methods can be applied to **adjacent poly-criminal domains** (e.g., environmental crime, firearms trafficking, waste-related crimes). The technological impact of this approach involves the transferability of core components (e.g., ontology patterns, graph queries, analytics models, etc) and the ability to interoperate with the outcomes from sister projects that bring complementary data and larger practitioner communities, supporting potential joint pilots and interoperable workflows.

Indeed, while RITHMS is domain-specialised, its components (e.g., ingestion connectors, ontology manager, graph/SNA analytics, visualisation layers) are reusable via ontology adaptation. Compared with generic OSINT tools that only connect nodes from fixed scrapers/crawlers, RITHMS automatically organises targeted sources (and can enrich them with proprietary data) and enables complex network analysis (e.g., SNA, link prediction) on its own purpose-designed data store, reducing manual set-up and enabling deeper provenance-chain insights.

The interest expressed by EUROPOL Innovation Lab representatives well align with the idea of exploring RITHMS Platform's potential to adapt to other types of illicit trafficking and crime, providing effective transferable methodology and technology. A dedicated presentation of the RITHMS Platform is scheduled at EUROPOL's Headquarters on November 11th, 2025.

5 KPIs framework

Table 5: KPIs framework

#	Domain	KPI	Key Activities
1	**Economic**	Licensing/Service Uptake	• # agencies onboarded • # licences • Annual Recurring Revenues • % renewal
2	**Economic**	Time-to-Insight Reduction	• Median hours from data collection to first actionable lead (baseline vs. with RITHMS)
3	**Economic**	Lead Yield/Analyst hour	• Unique credible leads per analyst hour vs. baseline.
4	**Societal**	Enforcement Support	• # cases supported • # cross-border cases • average time from alert to cross-border coordination
5	**Societal**	Recoveries	• # items flagged leading to further action • % of platform-linked cases resulting in seizures/returns
6	**Societal**	Training & Protocol Uptake	• # trained personnel • training completion rate • # agencies adopting the protocol
7	**Technological**	Interoperability Milestones	• # external systems connected • % data sources with harmonised entities
8	**Technological**	Analytics Performance	• Typical query latency on graph ops • hypothesis generation throughput • precision/recall on selected match tasks
9	**Technological**	Evidence-Readiness	• # of validation evidence operations completed

6 Risks & mitigation

Table 6: Risks & mitigation

Risk	Mitigation
Operational value not demonstrated early.	Co-design new pilots with LEAs/customs with explicit KPIs (e.g., time-to-insight, leads, case support), short iteration loops, embedded training.
Integration issues with legacy systems.	Provide templates, connectors, deployment patterns, and documentation; prioritise low-friction integrations proven in pilots.
IP/ownership ambiguity slowing licensing/R&D.	Manage a clear IP register for KERs/EAs; contributor agreements; transparent mapping of background assets and project results.
Policy-uptake uncertainty.	Align outputs with EU strategies; publish externally validated Pilot Evidence Pack; engage early with policy fora.

7 Conclusions

RITHMS provides a credible pathway from research to operational impact by filling the analytics and orchestration gap between trusted repositories and front-line investigative workflows. Its modular EAs (TRL 6–8), interoperability focus, and training/protocol components are designed to produce measurable economic, societal, and technological benefits:

- **Economic**: realistic early-adopter capture (validated SOM band) and efficiency gains (time-to-insight; lead yield) via multi-source data and graph/SNA analytics.
- **Societal**: reduced harm to heritage, stronger cross-border collaboration, governance-aligned AI use, durable capacity-building, and awareness raising.
- **Technological**: interoperable knowledge-graph/ontology foundations, analytics intelligence, and verifiable AI components supporting forensic contexts, with replicability to adjacent crime domains.

In particular, RITHMS' innovation lies in its purpose-driven design for the artwork market: tracking events and actors with temporal/spatial relations; a cultural-heritage ontology that users can extend; NLP-aligned entity extraction; domain-specific SNA and link-prediction to identify unobvious intermediaries; and a dedicated, secure knowledge-graph workspace with customisable visualisations and metrics. Unlike general-purpose OSINT tools, RITHMS can automatically (i) organise targeted sources and allow for further enrichment with proprietary data, (ii) operates in an isolated, one-way environment, and (iii) supports provenance-aware multilayer analysis and visualisation to identify suspicious events across the provenance chain.

With evidence-driven KPIs, risk controls, and a compact exploitation path (e.g., services licensing, with policy/R&D capitalisation), RITHMS can deliver tangible, defensible value to stakeholders and society, consistent with EU goals in crime prevention, cultural-heritage protection, and digital transformation.

Annex 1 - KERs and Exploitable Assets

The following tables detail the primary Exploitable Assets elaborated based on the KERs produced throughout the project (**KERs and EAs are presented in detail in D6.5**). Indeed, the KERs were considered more as "building blocks" and not automatically as market-ready offers. Therefore, in order to define **real exploitable assets**, the team clustered into **6 focused and coherent EAs** only those KERs that, when combined, form a **separable and licensable capability** with clear differentiators (e.g., unique method, data, know-how), defensibility (IP or know-how expertise), and that can address specific needs and willingness-to-pay from target users in support of their workflows.

In addition to the assets presented below, it must be noted that **additional "tailored" solutions** can potentially be provided by the RITHMS platform depending on specific needs and other types of stakeholders along LEAs (e.g., security agencies) for which some parts of the RITHMS platform could be adapted as needed.

TECHNO-ECONOMIC/SCIENTIFIC KERs	**Asset 1**	**Multi-Source Data Ingestion & Fusion**
	KER 1	*OSINT ingestion modules and Data Source Controller*
	KER 2	*GEOINT and CDRs ingestion modules*
	KER 3	*Data Cleaner modules*
	KER 4	*Correlator and Validator modules*
	KER 8	*Confidence Calculation and Data Enrichment*
	Asset 2	**Knowledge Graph Base Management System & Ontology manager support**
	KER 5	*Knowledge Graph Base Management System (KGBMS)*
	KER 9	*Ontology Manager*
	Asset 3	**Analytics Intelligence**
	KER 6	*Graph Visualisation and Analysis Tools*
	KER 7	*Hypothesis Generation and Management Component*
	other	
	KER 10	*User Interface*
SOCIAL KERs	**Asset 4**	**RITHMS Operational Protocol & Training component**
	KER 11	*Methodology Protocol for a Replicable Strategy in Countering Illicit Trafficking in Cultural Goods*
	KER 12	*Training Modules & Manual*
	other	
	KER 13	*LEAs Cooperation Plan & Statement* (not achieved yet)
SSH & STEM RESEARCH KERs	**Asset 5**	**Cultural Property Crime Intelligence Pack**
	KER 15	*Incremented Knowledge of the Criminology of Cultural Property Crime*
	KER 16	*Incremented Knowledge of Current Trends & Possible Future Development of Crimes Related to Illicit Trafficking in the Case-Study Countries*
	KER 17	*Improved Overview of the Involvement of Cultural Heritage in the Context of Different Kinds of Organised Crime*
	KER 18	*Updated Map of Current Hurdles in Countering Illicit Trafficking*
	KER 20	*Improved Overview of Social Network Analysis Application to Criminal Investigations*
	Asset 6	**AI Evidence Verification/Validation Toolkit & Reference Pack**
	KER 19	*Advanced Analysis of Verification & Validation Requirements for the Potential Use of AI-based Digital Evidence in Court*
	KER 21	*Training Datasets produced during the Development of Data Collection Modules*

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