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D.1.2.2. JOINT ANALYSIS OF IMPROVEMENT AREAS

Author: Regional Civil Protection Agency of Abruzzo Region

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Executive summary

This deliverable (D.1.2.2) presents a joint analysis of improvement areas for Early Warning Systems (EWS) across the Interreg Italy–Croatia Programme Area, with a specific focus on strengthening cross-border coherence and operational effectiveness for coastal flooding and compound coastal events. It builds directly on the evidence base produced in WP1, including the mapping of existing EWS and the governance and decision-making structures activated during an alert, and translates the diagnostic findings of Deliverable D.1.2.1 (gaps and missing elements) into a structured set of joint improvement domains. The core premise of the report is that EWS effectiveness at Programme Area scale is often determined less by the presence of individual technical components and more by the strength of interfaces across the end-to-end warning workflow—particularly along the alert lifecycle (issue–update–cancel/stand-down), at governance handover points, and in the transition from institutional notification to last-mile public warning. The joint improvement areas are therefore formulated at the level of shared baselines, conventions, and routines, ensuring compatibility with heterogeneous institutional settings while maximising cross-border added value.

Eight joint improvement areas were identified:

1. Minimum cross-border interoperability package – definition of a minimum dataset, metadata conventions, and exchange routines enabling consistent cross-border sharing of warning-relevant information.
2. Common warning semantics and operational crosswalk – a pragmatic mapping between warning levels, their functional meaning, and expected operational posture/actions to reduce misinterpretation in cross-border contexts.
3. Alert lifecycle governance alignment (Issue–Update–Cancel/Stand-down) – alignment of lifecycle states, decision rights, delegation principles, versioning and traceability practices to ensure coherent updates, cancellation, and stand-down management.
4. Shared situational awareness routines and common reporting templates **–** common minimum templates and operational routines to align shared understanding during evolving events.
5. Cross-border preparedness and joint exercising programme – structured testing of the full warning lifecycle and cross-border coordination routines under realistic time pressure.
6. Last-mile public warning baseline (minimum practices) – minimum expectations for channel redundancy, accessibility and inclusiveness, feedback mechanisms, and coherence of public warning messaging over time.
7. Coastal flood operational baseline (meteo-marine integration) – comparable coastal-flood warning outputs and baseline descriptions of meteo-marine integration to strengthen shared understanding of coastal impacts.

8. Benchmarking and performance-visibility layer (where feasible) – a pragmatic approach to track progress and learning through feasible indicators for timeliness, coverage visibility, and lifecycle traceability.

The report proposes a dependency-aware prioritisation and sequencing logic. The highest priority improvement areas are those that act as foundational enablers and address interface-driven weaknesses:

- High priority: IA1 (interoperability package), IA2 (warning semantics crosswalk), IA3 (lifecycle governance alignment), and IA4 (shared situational awareness routines).
- Medium–High priority: IA5 (joint exercises), IA6 (last-mile baseline), and IA7 (coastal flood operational baseline).
- Medium priority: IA8 (benchmarking/performance visibility), recognising variability in data availability and institutional constraints.

Sequencing is designed to establish shared baselines first (interoperability, semantics, lifecycle governance), then operationalise them through routines, last-mile minimum practices and joint testing, and finally consolidate coastal-flood-specific comparability and learning visibility.

Cross-border synergy emerges primarily from aligning shared conventions and routines rather than from harmonising institutional structures. The report identifies three synergy clusters: (i) interoperability and shared situational awareness; (ii) lifecycle coherence and public warning consistency; and (iii) coastal flood comparability. Together, these clusters target the main pathways through which gaps generate operational risks, including asynchronous activation, fragmented shared situational awareness, inconsistent warning interpretation, and contradictory public messaging during evolving coastal events.

Overall, D.1.2.2 provides a structured and traceable foundation for implementation-oriented project activities by clarifying the joint improvement domains most likely to strengthen EWS coherence and coastal flood preparedness at Programme Area scale, while remaining grounded in the evidence-based WP1 analytical work and in the gap landscape established in D.1.2.1.

1. Introduction

1.1 Background and rationale

Early Warning Systems (EWS) in the Interreg Italy–Croatia Programme Area operate within diverse institutional and technical contexts, while being exposed to shared meteorological and marine drivers that can generate transboundary impacts, particularly in relation to coastal flooding and compound coastal events. In such settings, effective early warning depends not only on monitoring and forecasting capabilities, but also on the coherence of decision-making chains, the consistency of warning semantics, and the ability to exchange information and align actions across borders. The WP1 analytical work has shown that core EWS functions are present across territories, yet the overall effectiveness and cross-border coherence of early warning may be influenced by differences and interface discontinuities—especially along the alert lifecycle (issue–update–cancel/stand-down), at the boundary between technical assessment and governance authorisation, and in the transition from institutional notifications to last-mile public warning.

1.2 Objectives and scope of this deliverable

This deliverable (D.1.2.2) provides a joint analysis of improvement areas aimed at strengthening EWS effectiveness, comparability, and cross-border interoperability across the Programme Area. It translates the diagnostic findings of Deliverable D.1.2.1 – Report on gaps and missing elements into a set of structured improvement domains where coordinated approaches can generate added value at Programme scale. The report does not propose a single uniform EWS model and does not replace national or regional mandates. Instead, it identifies improvement areas that are compatible with existing governance frameworks while enabling greater alignment at key operational interfaces—such as shared situational awareness routines, common warning semantics, alert lifecycle management practices, and minimum baselines for coastal flood warning outputs.

The analysis builds upon the evidence base and methodological foundations developed in previous WP1 deliverables. The D1.1.1 Mapping report on existing EWS established a structured baseline of operational EWS features, tools and platforms, and institutional communication fluxes across the Programme Area, applying an evidence-based approach and explicit interpretation rules.

In parallel, the D1.1.2 Mapping of the governance and decision-making structures activated during an EWS alert provided a functional governance baseline for comparability, structured around a “chain of command” and the alert lifecycle (detection, validation, classification, authorisation, dissemination, activation/escalation, update, and stand-down). This governance framework supports the identification of improvement areas focused on interfaces and decision points rather than on institutional labels alone.

Finally, D.1.2.1 consolidated partner questionnaire inputs into a structured gap landscape, identifying cross-cutting gaps and missing elements across technical interoperability, semantics/procedures, governance, last-mile communication, monitoring/forecasting, cross-border preparedness, and coastal-specific integration. D.1.2.2 builds directly on this diagnostic baseline to define joint improvement areas that respond to shared constraints.

1.4 Understanding "joint improvement areas" and cross-border added value

In this report, "improvement areas" are defined as joint domains where coordinated action can strengthen EWS performance and cross-border coherence. Jointness is interpreted as added value achieved through harmonised baselines, shared operational conventions, common templates and routines, and structured cooperation mechanisms—benefits that would be difficult to achieve through isolated territorial action. This focus is particularly relevant in the Adriatic context, where the same hazard drivers may affect neighbouring territories, and where cross-border coordination depends on timely information exchange, comparable interpretation of warning levels, coherent lifecycle management of updates and cancellations, and consistent public-facing communication. The improvement areas identified in this deliverable therefore target high-leverage interfaces and dependencies that shape end-to-end warning effectiveness at Programme Area scale. D.1.2.2 is designed to provide a practical analytical bridge between the diagnostic stage (gap identification) and subsequent implementation-oriented activities. By structuring joint improvement areas in a traceable way—explicitly linked to the gaps identified in D.1.2.1—and by clarifying cross-dependencies and sequencing logic, the deliverable supports collective prioritisation and a coherent roadmap approach for later work packages, pilot activities, and cross-border cooperation actions, while remaining aligned with the heterogeneity of institutional settings across the partnership.

2. Methodology

The purpose of this chapter is to provide a brief description of the methodological approach used to identify and analyse joint improvement areas. The rationale is parallel to the methodology used in the other WP1, Action 1 reports.

2.1 Purpose and continuity with WP1 analytical work

This deliverable (D.1.2.2) builds on the evidence base and analytical logic developed in WP1. While Deliverable D.1.2.1 provided a diagnostic assessment of gaps and missing elements across partner territories, the present report translates that gap landscape into a structured set of joint improvement areas**.** The aim is to identify domains where coordinated approaches can generate added value at Programme Area scale, strengthening cross-border coherence and operational effectiveness without replacing national or regional mandates.

Methodological continuity is ensured through: i) the same thematic dimensions used in D.1.2.1 (interoperability, semantics/procedures, governance, communication/last-mile, monitoring/forecasting, cross-border preparedness, coastal specificity); and ii) the functional governance reference model ("chain of command" and alert lifecycle) applied in the governance mapping baseline.

2.2 From gaps to improvement areas: translation logic

The joint improvement areas were defined through a structured translation process designed to preserve traceability from evidence to proposed domains of improvement. The translation follows three principles:

- Traceability**:** each improvement area is explicitly linked to one or more gap clusters identified in D.1.2.1, ensuring that improvement domains remain grounded in observed limitations rather than generic "best practice" statements.
- Jointness (cross-border added value): improvement areas are formulated only where the benefit is expected to increase through coordination across territories (e.g., shared conventions, harmonised baselines, common templates, or structured cross-border routines).
- Compatibility with heterogeneous governance models**:** improvement areas are defined at the level of *interfaces and shared baselines* (what needs to be aligned), rather than prescribing identical institutional structures (who must own it), consistent with the functional comparability approach of WP1.

Operationally, the translation was performed as follows:

1. Consolidation of fine-grained gaps: the fine-grained gaps identified in D.1.2.1 were grouped into a limited number of *gap clusters* (e.g., data exchange conventions; warning semantics; alert lifecycle governance; last-mile communication; coastal baselines; cross-border preparedness).
2. Formulation of improvement domains: for each cluster, one improvement area was formulated to cover the set of gaps at Programme Area level (e.g., "minimum interoperability package" rather than multiple fragmented initiatives).
3. Definition of scope and components: each improvement area was described through a standard template including scope/objectives, key components, stakeholders, expected benefits, and constraints/readiness assumptions. This ensures completeness and comparability across improvement areas.

2.3 Handling cross-dependencies

A key lesson from the gap analysis is that major weaknesses are often interface-driven**,** spanning multiple dimensions (e.g., alert update/versioning affects semantics, governance, communication, cross-border coherence, and coastal-event handling). In D.1.2.1, cross-dependencies were therefore treated as a core analytical element rather than as secondary observations. Cross-dependencies were captured by mapping each fine-grained gap to the analytical dimensions and identifying clusters with multi-dimensional impact (e.g., lifecycle management, metadata/versioning, shared situational awareness, coastal operational outputs). This dependency logic is used in two ways:

- to avoid improvement areas that focus on one dimension while ignoring enabling conditions in others (e.g., technical interoperability improvements without governance clarity for updates and versioning);
- to support sequencing logic (short/medium/long term), recognising that certain improvement areas act as prerequisites for others.

2.4 Criteria for prioritisation (qualitative multi-criteria approach)

Improvement areas were qualitatively prioritised using a multi-criteria approach suitable for heterogeneous institutional contexts, where fully standardised quantitative scoring is not always feasible. The criteria applied are:

1. Expected impact on operational coherence and effectiveness: extent to which the improvement area is expected to reduce asynchronous activation, improve shared situational awareness, and strengthen the end-to-end warning workflow (including update/stand-down coherence).

2. Cross-border added value: extent to which benefits depend on coordinated action and shared conventions across borders (vs. improvements achievable independently by a single territory).
3. Feasibility and implementability within the project context: consideration of practical constraints (data availability, governance alignment needs, stakeholder involvement, and resource requirements) and whether the improvement area can realistically be advanced through project activities.
4. Scalability and transferability: potential to be adopted across multiple partner territories without requiring identical institutional structures, favouring modular baselines and shared minimum standards.
5. Urgency for coastal flooding and compound event scenarios**: r**elevance for time-sensitive hazards where short lead times and frequent updates make lifecycle coherence and communication effectiveness particularly critical.

The prioritisation outcomes are presented in Chapter 5 (Prioritisation and sequencing) and are complemented by a dependency-aware sequencing logic to ensure coherence across improvement areas.

2.5 Scope and limitations

The joint analysis reflects the evidence base generated by partner questionnaires and WP1 mapping deliverables and is designed to support collective prioritisation at Programme Area level. Limitations include:

- variation in partner mandates and visibility across the EWS chain;
- differences in reporting granularity, particularly regarding lifecycle details and last-mile communication;
- the qualitative nature of prioritisation, which is appropriate for a programme-level strategic deliverable but does not replace territory-specific implementation planning.

Despite these limitations, the method provides a traceable and structured transition from diagnostic findings to jointly defined improvement domains, enabling a coherent cross-border narrative and a solid basis for subsequent implementation-oriented activities.

3. Synthesis of the gap-to-improvement logic

This chapter provides the analytical bridge between the diagnostic findings presented in Deliverable D.1.2.1 and the joint improvement areas developed in Chapter 4 of the present report. Its purpose is to make the translation logic explicit and traceable: it summarises how the fine-grained gaps identified across the Programme Area were consolidated into a limited set of gap clusters and subsequently reformulated into joint improvement domains with cross-border added value.

3.1 Consolidation of fine-grained gaps into thematic clusters

The gap analysis (D.1.2.1) highlighted that limitations are rarely confined to a single domain. Instead, gaps often emerge at interfaces between technical interoperability, warning semantics, governance decision points, and last-mile communication—especially along the alert lifecycle (issue–update–cancel/stand-down). In order to avoid fragmented or overly granular improvement proposals, the fine-grained gaps were consolidated into a limited number of thematic clusters reflecting the project's analytical dimensions and cross-dependencies.

The consolidation resulted in seven core clusters:

1. Interoperability baselines and exchange conventions (data/metadata, interfaces, minimum comparable datasets)
2. Warning semantics and procedural comparability (meaning of levels, crosswalks, interpretation)
3. Alert lifecycle governance and traceability (decision rights, updates, cancellation/stand-down, versioning/logging)
4. Shared situational awareness routines (templates, reporting routines, cross-border alignment mechanisms)
5. Last-mile public warning minimum practices (responsibilities, channel redundancy, accessibility, feedback loops)
6. Cross-border preparedness and operational testing (joint exercises and full-lifecycle testing)
7. Coastal flood comparability and meteo-marine integration (minimum coastal outputs, thresholds/areas, update needs)

This clustering supports a Programme Area perspective focused on systemic constraints and cross-border coherence rather than on partner-by-partner descriptions. The first step of the analysis is to convert gaps in opportunities according to a reverse-logic approach (fig. 3.1.1)

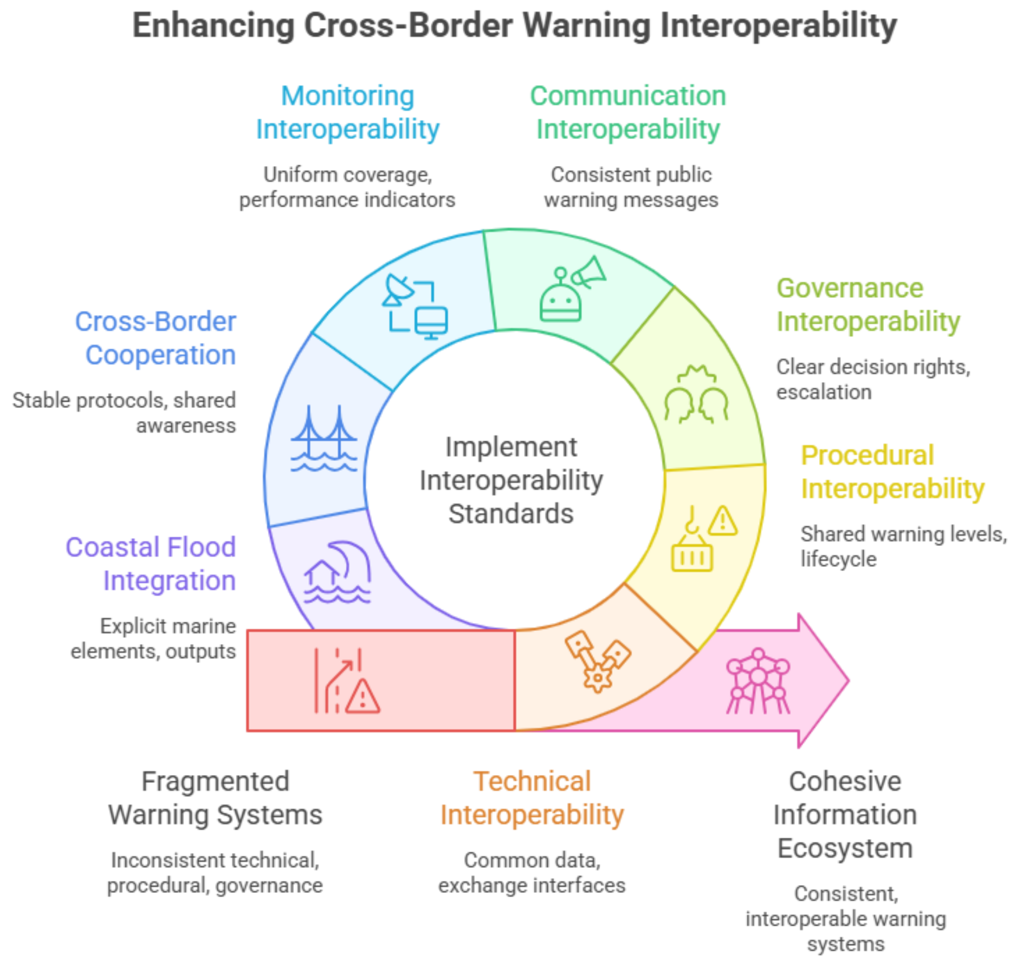

Figure 3.1.1: opportunities from gaps schematic representation.

3.2 Cross-dependencies as a driver of "jointness"

A key observation from D.1.2.1 is that several gaps act as amplifiers: for example, incomplete specification of update/versioning rules affects semantics (what the warning means), governance (who authorises changes), communication (message coherence), and cross-border coordination (shared situational awareness and synchronisation).

For this reason, cross-dependencies were treated as a primary design criterion when defining improvement areas. The improvement domains in Chapter 4 were formulated to address not only single-gap symptoms but also the enabling conditions required to reduce cross-dimensional risks. In practice, this means that:

- technical interoperability improvements (IA1) are linked to semantic and lifecycle coherence (IA2–IA3), because cross-border exchange is only operationally meaningful when information is interpreted consistently and updated coherently;
- shared situational awareness routines (IA4) depend on minimum datasets and lifecycle governance conventions (IA1 and IA3);
- last-mile baselines (IA6) are inseparable from lifecycle governance, particularly for updates and cancellations (IA3);
- coastal flood baselines (IA7) require prior alignment of exchange conventions, semantics, and lifecycle rules (IA1–IA3), given the time-sensitive nature of coastal hazard evolution.

3.3 Traceability: mapping gap clusters to improvement areas

To ensure transparency, each improvement area was defined as a direct response to one or more gap clusters. Table 3-1 summarises the gap-to-improvement mapping at cluster level.

Gap cluster	Main improvement areas
Interoperability baselines and exchange conventions	IA1 Minimum cross-border interoperability package
Warning semantics and procedural comparability	IA2 Common warning semantics and operational crosswalk
Alert lifecycle governance and traceability	IA3 Alert lifecycle governance alignment
Shared situational awareness routines	IA4 Shared situational awareness routines and templates
Cross-border preparedness and operational testing	IA5 Cross-border preparedness and joint exercising programme
Last-mile public warning minimum practices	IA6 Last-mile public warning baseline
Coastal flood comparability and meteo-marine integration	IA7 Coastal flood operational baseline
Limited performance visibility and benchmarking comparability (cross-cutting)	IA8 Benchmarking and performance-visibility layer

Table 3.3.1: Gap clusters (from D.1.2.1 synthesis) and corresponding joint improvement areas.

This mapping demonstrates that the improvement areas are not “generic best practices”, but a structured response to an evidence-based gap landscape.

Finally, the gap-to-improvement translation provides the foundation for the prioritisation and sequencing presented in Chapter 5. Prioritisation reflects not only expected impact but also enabling relationships across improvement areas. In particular, areas addressing lifecycle coherence, semantic comparability, and minimum interoperability baselines were treated as prerequisites for operationalisation through shared routines, joint exercising, and coastal-flood-specific consolidation.

4. Joint improvement areas

This chapter presents the jointly identified improvement areas derived from the gap landscape established in D.1.2.1 and grounded in the WP1 mapping baselines on existing EWS and governance/decision-making structures. The improvement areas are formulated at the level of shared baselines and operational interfaces, in order to remain compatible with heterogeneous institutional settings while strengthening cross-border coherence and end-to-end warning effectiveness.

Each improvement area is described using a standard structure: scope and objective, rationale linked to gaps, cross-border added value, key components, dependencies, stakeholders, expected benefits, and readiness assumptions/constraints.

4.1 Improvement Area 1 — Minimum cross-border interoperability package

Scope and objective

Define and operationalise a minimum, shared interoperability package enabling consistent cross-border exchange of warning-relevant information and datasets. The objective is to reduce fragmentation caused by heterogeneous platforms and to enable more reliable shared situational awareness through common exchange conventions, without requiring uniform IT architectures.

Rationale linked to gaps

The gap analysis identified limited evidence of stable system-to-system interfaces, heterogeneous IT landscapes, and missing common conventions for minimum interoperability datasets and metadata (e.g., timing, zones, versions).

These gaps constrain routine cross-border exchange and complicate comparability when the same hazard affects multiple territories.

Cross-border added value

A minimum interoperability package is inherently cross-border: its value emerges only if multiple territories adopt compatible conventions. It creates a shared “language” for data exchange regardless of national/regional platforms, supporting coordinated decision-making under time pressure.

Key components

- Definition of a minimum interoperability dataset for warnings and situation reporting (e.g., hazard descriptor, area/zone identifiers, severity level reference, timestamps, validity, confidence/uncertainty markers where available).
- Agreement on metadata conventions and basic versioning identifiers (especially for updates/cancellations).

- Identification of feasible exchange routines (e.g., automated feed where possible; otherwise structured templates and machine-readable exports).
- Baseline mapping of who exchanges what with whom across borders (operational "exchange points").

Dependencies

Strong dependencies on warning semantics alignment (IA2) and alert lifecycle coherence (IA3), since shared data exchange is most valuable when meaning and lifecycle are aligned. It also enables shared situational awareness routines (IA4).

Stakeholders involved

Regional/national IT and operational platform owners; meteorological/hydrological services; civil protection operational rooms/112 centres; cross-border coordination nodes.

Expected benefits

Improved comparability of warning information, reduced manual conversion workload, and enhanced timeliness and reliability of cross-border information exchange, particularly for fast-evolving coastal events.

Readiness assumptions / constraints

Requires agreement on minimum fields and identifiers and clarity on data governance (what can be shared, under which conditions). Implementation can be modular to accommodate heterogeneous platform maturity.

4.2 Improvement Area 2 — Common warning semantics and operational crosswalk

Scope and objective

Strengthen semantic interoperability by establishing a shared crosswalk between warning levels (including colour codes where used), their operational meaning, and the expected activation posture/actions across territories.

Rationale linked to gaps

D.1.2.1 highlighted variability in warning levels and operational interpretation and the missing element of explicit "level → actions" crosswalks. This creates a risk that similar labels imply different operational consequences across borders.

Cross-border added value

Semantic alignment is one of the highest-value cross-border improvements: it reduces misinterpretation, supports coordinated escalation timing, and improves mutual understanding during shared hazard scenarios.

Key components

- A semantic crosswalk mapping each territory's warning levels to a common functional meaning (not a forced reclassification);

- A shared reference linking warning meaning to expected operational posture (e.g., monitoring intensification, coordination activation, public warning amplification).
- Clarification of terminology bridges to support translation across institutional vocabularies, consistent with the WP1 governance approach;
- Documentation of scope conditions (e.g., coastal vs inland, compound events) where semantics differ.

Dependencies

Depends on alert lifecycle governance alignment (IA3) for updates/stand-down meaning and is enabled by minimum interoperability conventions (IA1) for consistent exchange of level/meaning references.

Stakeholders involved

Technical warning issuers (meteo/hydro/marine services), civil protection decision-makers, 112/operational centres, and communication officers responsible for translating warnings into public guidance.

Expected benefits

Reduced ambiguity in cross-border interpretation; increased coherence of escalation timing and preparedness posture; improved clarity for joint situational awareness products.

Readiness assumptions / constraints

Requires agreement on a common functional frame while respecting national mandates; should avoid “one-size-fits-all” and instead produce a pragmatic, comparable mapping.

4.3 Improvement Area 3 — Alert lifecycle governance alignment (Issue–Update–Cancel/Stand-down)

Scope and objective

Improve coherence and traceability of the full warning lifecycle by aligning governance touchpoints for issuance, updates, downgrades/escalation, cancellation, and stand-down (“all clear”), with explicit attention to decision rights and versioning.

Rationale linked to gaps

The gap analysis identified insufficiently specified update/termination logic, incomplete decision logging/versioning, and unclear approval chains for public-facing messages—especially for updates and cancellations. These elements are critical for coastal events where warnings evolve quickly.

Cross-border added value

Cross-border coherence depends heavily on lifecycle alignment: neighbouring territories may exchange and relay warning updates, and differences in update/stand-down governance can create contradictory messaging and asynchronous activation.

Key components

- A shared baseline for lifecycle states (Alert / Update / Downgrade/Escalation / Cancel / Stand-down) and minimum content per state.
- Clarification of decision rights and delegation/substitution principles (who approves what, including after-hours continuity).
- Minimum versioning and traceability practices to avoid "version drift" across actors.
- Explicit governance touchpoints linking institutional notifications and public warning messages.

Dependencies
Strong dependency with last-mile baseline (IA6) and situational awareness routines (IA4), since lifecycle coherence is necessary for coherent public messaging and shared operational pictures. Enabled by minimum interoperability package (IA1).

Stakeholders involved
Decision-making authorities, operational rooms/112 centres, communication units, and IT/platform owners for versioning and message routing.

Expected benefits
More coherent warning updates, reduced risk of contradictory messages, improved auditability and learning, and more reliable cross-border alignment during evolving events.

Readiness assumptions / constraints
Requires agreement on minimum lifecycle definitions while allowing institutional diversity; must respect legal mandates for issuing public alerts.

4.4 Improvement Area 4 — Shared situational awareness routines and common reporting templates

Scope and objective
Strengthen shared situational awareness by establishing cross-border routines for exchanging and aligning "what is happening now" and "what is expected next," using common templates and minimum reporting practices compatible with different platforms.

Rationale linked to gaps
D.1.2.1 identified limited systematic evidence of shared situational awareness mechanisms and routines (dashboards/templates), contributing to fragmented shared pictures during transboundary events.

Cross-border added value
Shared situational awareness is a direct driver of cross-border coordination quality and

timing. Templates and routines are low-regret enablers that work even when IT interoperability is partial.

Key components

- Common situation report templates (SITREP) including minimum fields aligned with IA1;
- Routine alignment of warning updates and status changes (tie-in with IA3).
- Identification of operational "exchange moments" (e.g., pre-event watch, escalation, peak, de-escalation);
- Optional principles for shared dashboards where feasible, without forcing a single platform.

Dependencies
Enabled by IA1 (minimum dataset) and IA3 (lifecycle coherence). Benefits from IA2 (semantic crosswalk) to ensure shared interpretation.

Stakeholders involved
Operational coordination centres, 112 nodes, technical services contributing to situational products, and cross-border liaison roles.

Expected benefits
Faster alignment of operational understanding, reduced coordination mismatch, improved mutual visibility on escalation posture and key impacts—particularly in coastal events that move quickly.

Readiness assumptions / constraints
Requires agreement on minimum fields and routines; should be designed to minimise workload and avoid duplicating national reporting.

4.5 Improvement Area 5 — Cross-border preparedness and joint exercising programme

Scope and objective
Establish a structured programme for joint preparedness activities and exercises focusing on cross-border coastal flood scenarios and testing the full warning lifecycle (including updates and stand-down).

Rationale linked to gaps
The evidence base does not consistently document systematic joint exercises and operational testing. Governance mapping emphasises the importance of lifecycle coherence and decision touchpoints that are typically validated through exercises.

Cross-border added value
Exercises are one of the most effective mechanisms to convert formal baselines into operational capability across borders and to test interoperability under realistic time pressure.

Key components

- A minimal annual cycle of joint table-top exercises and, where feasible, field/communication drills;
- Scenario set including storm surge/coastal flooding and compound events.
- Testing of Alert/Update/Cancel/Stand-down pathways and cross-border information exchange routines (IA1–IA4);
- After-action review structure to capture lessons and feed back into shared baselines (link to IA6 feedback principles).

Dependencies
Depends on the definition of lifecycle and semantic baselines (IA2–IA3) and benefits from SA routines (IA4). Not strictly dependent on full IT integration.

Stakeholders involved
Civil protection authorities, 112 centres, local authorities, responder organisations, technical services, and communication units.

Expected benefits
Improved cross-border operational readiness, clearer shared understanding of warning meaning and lifecycle, increased coherence of public communication across territories.

Readiness assumptions / constraints
Requires stakeholder commitment and scheduling; exercises should be scaled to feasibility and focus on high-leverage interfaces rather than exhaustive testing.

4.6 Improvement Area 6 — Last-mile public warning baseline (minimum practices)

Scope and objective
Define a Programme Area baseline for last-mile public warning practices that strengthens reach, redundancy, accessibility, and feedback, while respecting decentralised responsibilities and local autonomy.

Rationale linked to gaps
D.1.2.1 identified fragmented last-mile arrangements, uneven redundancy visibility, accessibility not consistently specified, and weak feedback mechanisms.
These issues directly affect population outcomes in coastal flooding.

Cross-border added value
During shared events, inconsistent public messaging and uneven channel redundancy can undermine trust and create uneven preparedness across neighbouring territories. A minimum baseline supports coherence without enforcing uniform tools.

Key components

- Definition of minimum channel redundancy expectations by warning severity (without prescribing exact tools);
- Baseline principles for accessibility and inclusiveness (e.g., vulnerable groups, multilingual considerations where relevant);
- Clarification of public message lifecycle governance (tie-in with IA3);
- Simple, structured feedback loop mechanisms (what to capture post-event: reach, clarity, behaviour, misinformation signals).

Dependencies
Strong dependency on IA3 (approval chains, updates, cancellations) and benefit from IA2 (semantic consistency). Can be supported by IA5 (exercises) for validation.

Stakeholders involved
Communication units, local authorities/municipalities, civil protection coordination bodies, 112 centres, and media/social channels where relevant.

Expected benefits
More consistent public warning reach, reduced risk of contradictory updates, improved inclusiveness, and improved learning visibility across territories.

Readiness assumptions / constraints
Must be adaptable to local communication ecosystems and legal responsibilities; should define minimum outcomes and principles, not force identical channels.

4.7 Improvement Area 7 — Coastal flood operational baseline (meteo-marine integration)

Scope and objective
Establish a shared baseline for coastal flood early warning by improving comparability of meteo-marine integration, operational outputs, and thresholds/areas descriptions across the Programme Area.

Rationale linked to gaps
The gap analysis identified uneven documentation and embedding of marine/coastal components within EWS cycles and missing common minimum operational outputs for coastal flooding.

Cross-border added value
Coastal hazards propagate across the Adriatic and may affect multiple territories within short time windows. Comparable coastal warning outputs improve cross-border understanding and coordination.

Key components

- Shared description of coastal flood variables used operationally (sea state, surge drivers, coastal impacts indicators);
- Minimum baseline for coastal warning products (what is issued, update frequency principles, and how areas are delineated);
- Alignment of coastal outputs with semantic crosswalk (IA2) and lifecycle governance (IA3);
- Links to monitoring/forecasting constraints and real-time data needs (interface with IA8).

Dependencies
Depends on IA1 (minimum dataset), IA2 (semantic comparability), and IA3 (update/stand-down coherence). Benefits from IA4 (shared SA routines).

Stakeholders involved
Meteo-marine services, coastal authorities, civil protection structures, and operational responders dealing with coastal impacts.

Expected benefits
Improved comparability of coastal warnings, better shared situational awareness for coastal events, and reduced ambiguity in cross-border interpretation of coastal impacts.

Readiness assumptions / constraints
Must account for different coastal morphologies and institutional mandates; focus on minimum comparable outputs rather than identical models.

4.8 Improvement Area 8 — Benchmarking and performance-visibility layer (where feasible)

Scope and objective
Improve Programme Area capability to monitor and compare EWS functioning by defining a pragmatic set of indicators and visibility practices for timeliness, coverage, and coherence—within the limits of available data and mandates.

Rationale linked to gaps
D.1.2.1 identified limited comparability of accuracy/timeliness indicators in available sources and uneven visibility on monitoring density and real-time data availability.
A performance-visibility layer supports evidence-based learning and prioritisation.

Cross-border added value
Common visibility allows partners to jointly understand where constraints are systemic vs local and to monitor whether cross-border baselines (interoperability, lifecycle coherence, communication) are improving over time.

Key components

- Definition of a minimal set of **process indicators** (e.g., update frequency visibility, time-to-dissemination markers where feasible, lifecycle event logging completeness);
- Where feasible, high-level **coverage visibility** (monitoring network density proxies, known blind spots) without forcing sensitive data disclosure;
- Linkage to feedback mechanisms (IA6) and exercise after-action reviews (IA5) to build a learning loop.

Dependencies
Enabled by lifecycle traceability improvements (IA3) and supports prioritisation/sequencing across all areas. Benefits from minimum interoperability conventions (IA1).

Stakeholders involved
Operational centres, technical services, data owners, and programme-level coordination for harmonised indicator definitions.

Expected benefits
More transparent understanding of system performance constraints, improved ability to track progress of joint baselines, stronger evidence for future planning and investments.

Readiness assumptions / constraints
Indicator selection must remain pragmatic and feasible; some performance data may be institutionally sensitive or not uniformly available.

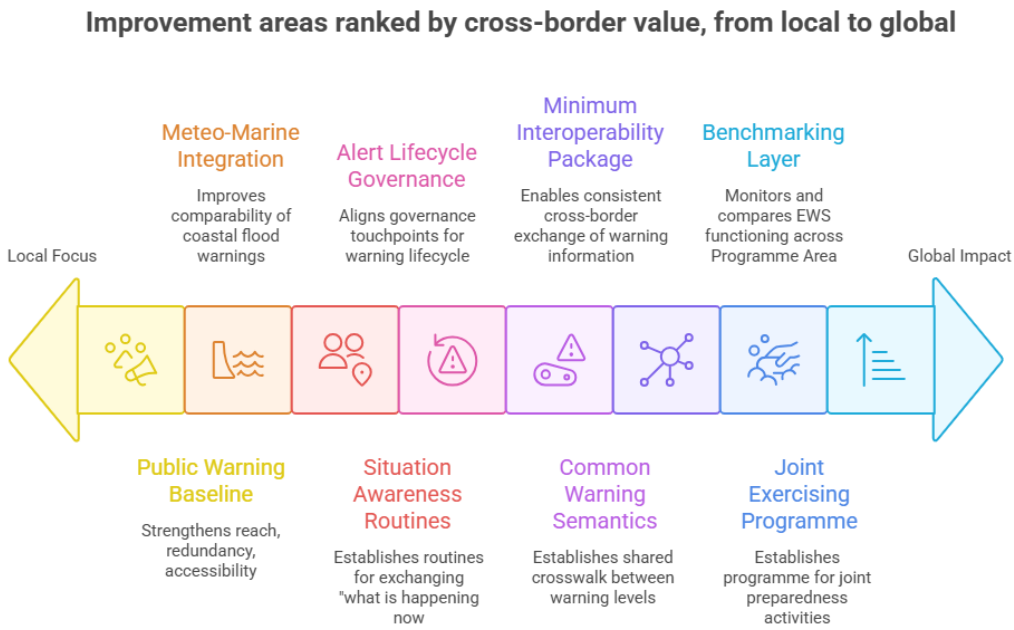

Figure 4.1 Upscaling improvement areas

5. Prioritisation and sequencing

This chapter presents a structured prioritisation and sequencing of the joint improvement areas identified in Chapter 4. Prioritisation is qualitative and evidence-informed, consistent with the heterogeneous institutional contexts of the Programme Area and the diagnostic baseline developed in WP1. The goal is to support a coherent roadmap logic by (i) identifying "high-leverage" improvement areas, (ii) making cross-dependencies explicit, and (iii) proposing a realistic sequencing (short/medium/long term) that reflects enabling relationships between areas.

5.1 Prioritisation criteria

Improvement areas were prioritised according to the criteria defined in Chapter 2, with Prioritisation of the joint improvement areas was conducted using a qualitative, evidence-informed multi-criteria approach, suitable for heterogeneous institutional contexts and consistent with the diagnostic baseline developed in D.1.2.1. The criteria were applied to identify which improvement areas are likely to generate the highest added value at Programme Area scale, while ensuring feasibility and compatibility with national and regional mandates.

1) *Expected impact on operational coherence and end-to-end effectiveness*
   This criterion captures the extent to which an improvement area is expected to reduce fragmentation and strengthen the continuity of the warning workflow from technical assessment through governance authorisation, dissemination, activation, and public warning. Particular attention is given to improvement domains that address interface-driven weaknesses (e.g., alert lifecycle management, update/version coherence, and handover clarity), as these tend to amplify operational risks if not addressed. The assessment considers whether an improvement area is likely to improve timeliness, reduce contradictory information flows, and support more consistent activation postures under time pressure.
2) *Cross-border added value*
   This criterion assesses whether the benefits of an improvement area arise primarily from coordinated cross-border adoption, rather than being achievable through isolated territorial action. Priority is assigned to domains that require shared conventions (e.g., minimum exchange datasets and metadata, semantic crosswalks), shared routines (e.g., common situation reporting), or joint validation mechanisms (e.g., exercises testing the full warning lifecycle). In practice, the criterion evaluates how strongly the improvement area contributes to shared situational awareness, synchronisation of warning updates,

and coherent interpretation of warning meaning during transboundary hazard scenarios.

3) *Feasibility and implementability within the project context*
This criterion captures the practicality of advancing the improvement area within the project’s scope, timeframe, and stakeholder landscape. Feasibility is assessed in relation to the level of institutional alignment required, the availability of data and operational information, the complexity of governance changes implied, and the degree to which improvements can be implemented through modular steps (e.g., adopting common templates before full system automation). This includes consideration of legal and mandate constraints for warning issuance and public communication, and the extent to which the improvement area can be piloted without extensive structural reforms.

4) *Scalability and transferability across heterogeneous contexts*
This criterion assesses whether an improvement area can be adopted by multiple territories with different institutional architectures, technical maturity levels, and operational practices, without requiring uniform organisational models. Improvement areas score higher when they can be expressed as minimum baselines, shared definitions, and interface standards that remain valid regardless of local structures (e.g., common lifecycle states, minimum information fields, template-driven routines). This criterion supports Programme Area-wide applicability and ensures that joint outputs can remain usable beyond individual partner contexts.

5) *Urgency for coastal flooding and compound event scenarios, and enabling role (dependencies)*
This criterion captures two closely related aspects. First, it considers urgency in relation to hazards where rapid evolution and multiple updates are common, particularly coastal flooding and compound events; in such scenarios, lifecycle coherence, update/versioning practices, and consistent public warning become especially critical. Second, it explicitly accounts for dependencies between improvement areas, prioritising domains that function as enablers for other improvements (e.g., interoperability conventions enabling shared situational awareness routines, lifecycle governance enabling coherent last-mile messaging and performance visibility). This dependency-aware lens supports a sequencing logic that reduces the risk of implementing downstream improvements on unstable foundations

Criterion	Key question	Typical evidence / signals considered
i) Expected impact on operational coherence and end-to-end effectiveness	Will this area strengthen continuity across the warning workflow (technical → governance → dissemination → activation → public warning)?	Addresses lifecycle interfaces (updates/stand-down), reduces handover ambiguity, improves consistency/timeliness of operational posture and messaging.
ii) Cross-border added value	Does the benefit require coordinated adoption across borders (vs. achievable by one territory alone)?	Shared conventions (datasets/metadata), semantic crosswalks, common routines/templates, joint validation/testing relevance.
iii) Feasibility and implementability within the project context	Can this be realistically advanced within project scope, constraints and stakeholder readiness?	Modular implementation potential, manageable governance alignment needs, data availability, legal/mandate constraints not prohibitive.
iv) Scalability and transferability across heterogeneous contexts	Can multiple territories adopt it without requiring uniform systems or structures?	Expressed as minimum baselines/standards; compatibility with different architectures; low dependency on specific tools; adaptable to local mandates.
v) Urgency for coastal/compound events and enabling role (dependencies)	Is it urgent for fast-evolving coastal events and does it unlock other improvements?	Direct relevance to coastal flood dynamics (frequent updates); prerequisite role (e.g., interoperability and lifecycle coherence enabling SA routines, last-mile coherence, and monitoring visibility).

Table 5.1.1: prioritisation criteria

Table 5.1.2 summarises the proposed prioritisation level for each improvement area, summerised in table 5.1.1.

Improvement area	Priority	Rationale (high level)
IA1 Minimum cross-border interoperability package	**High**	Foundational for consistent exchange and for shared situational awareness; enables multiple downstream areas
IA2 Common warning semantics and operational crosswalk	**High**	High cross-border added value; reduces misinterpretation and supports aligned activation timing
IA3 Alert lifecycle governance alignment (Issue–Update–Cancel/Stand-down)	**High**	Major cross-cutting leverage; directly affects operational coherence and public message consistency
IA4 Shared situational awareness routines and common reporting templates	**High**	Converts baselines into operational coordination capability; works even with partial IT integration
IA5 Cross-border preparedness and joint exercising programme	**Medium–High**	Essential to validate and operationalise improvements; effectiveness increases once IA2–IA4 are defined
IA6 Last-mile public warning baseline (minimum practices)	**Medium–High**	High impact on communities; depends on lifecycle governance clarity for updates/cancellations
IA7 Coastal flood operational baseline (meteo-marine integration)	**Medium–High**	Critical for coastal focus; benefits strongly from interoperability and semantics baselines
IA8 Benchmarking and performance-visibility layer (where feasible)	**Medium**	Valuable for learning and monitoring progress; depends on traceability/logging practices and data availability

Table 5.1.2: Prioritisation of joint improvement areas

5.3 Dependency-aware sequencing logic

The improvement areas are not independent: some act as prerequisites or “enablers” for others. Sequencing therefore follows an enabling logic that prioritises interface coherence before advanced benchmarking or specialised coastal baselines.

5.3.1 Key dependency relationships

The following dependency relationships emerged as particularly relevant:

- IA1 → IA4 (and supports IA7, IA8): a minimum interoperability package supports the exchange of comparable information needed for shared situational awareness routines and for coastal operational baselines.
- IA2 → IA4, IA6, IA7: semantic alignment is needed to interpret shared information consistently, translate warnings into coherent public guidance, and ensure coastal outputs are comparable.
- IA3 → IA6, IA4, IA8: lifecycle governance alignment (especially updates/stand-down and versioning) is an enabling condition for coherent public messaging, stable situational awareness updates, and meaningful performance visibility.
- IA4 → IA5: shared situational awareness routines define what exercises should test and provide the operational backbone for joint preparedness activities.
- IA5 ↔ IA6/IA3: exercises help validate public warning practices and lifecycle governance under realistic time pressure, revealing interface frictions that may not be visible in documentation.
- IA7 depends on IA1–IA3 and benefits from IA4: coastal flood operational baselines become effective when exchange, semantics, and lifecycle coherence are sufficiently established.
- IA8 benefits from IA3 (traceability) and IA6 (feedback): performance visibility is more meaningful when lifecycle events and public warning processes are traceable and measurable.

These dependencies reflect the cross-cutting nature of the gap landscape, where interface-driven gaps (updates/versioning, governance handovers, semantics) affect multiple dimensions simultaneously.

5.4 Proposed roadmap: short-, medium-, and long-term sequencing

The roadmap below provides an indicative sequencing aligned with the enabling logic above. Time horizons are expressed qualitatively (short/medium/long) and should be understood as a sequencing device rather than fixed calendar commitments (fig. 5.4.1).

Short term (foundational baselines and interface clarity)

Primary focus: establish shared minimum baselines and clarify lifecycle touchpoints that enable coherent exchange and interpretation.

- *IA3 Alert lifecycle governance alignment (Issue–Update–Cancel/Stand-down)*
  Rationale: lifecycle coherence is a high-leverage prerequisite for consistent updates and public messaging, especially during rapidly evolving coastal events.
- *IA2 Common warning semantics and operational crosswalk*
  Rationale: reduces misinterpretation and supports aligned operational posture across borders.
- *IA1 Minimum cross-border interoperability package*
  Rationale: establishes minimum data/metadata conventions and exchange routines supporting downstream improvements.

Short-term output logic: creation of shared conventions and comparable baselines, rather than new infrastructure.

Medium term (operationalisation through routines, communication baselines, and testing)

Primary focus: convert baselines into operational capability through routines, minimum practices, and structured testing.

- *IA4 Shared situational awareness routines and common reporting templates*
  Rationale: operationalises interoperability and semantic baselines into shared coordination practice.
- *IA6 Last-mile public warning baseline*
  Rationale: strengthens public warning coherence and minimum redundancy/accessibility, enabled by lifecycle clarity.

- *IA5 Cross-border preparedness and joint exercising programme*
  Rationale: validates and stress-tests lifecycle, semantics, and situational awareness routines; builds joint operational readiness.

Medium-term output logic: stable cross-border coordination practices that function under time pressure, including message update/cancellation coherence.

Long term (specialised coastal baselines and mature performance visibility)

Primary focus: consolidate specialised coastal flood comparability and establish sustained learning visibility.

- *IA7 Coastal flood operational baseline (meteo-marine integration)*
  Rationale: requires the earlier establishment of shared data/semantics/lifecycle foundations to ensure coastal outputs are comparable and actionable across borders.

- *IA8 Benchmarking and performance-visibility layer (where feasible)* Rationale: supports sustained improvement monitoring and joint learning; depends on traceability/logging and feasible indicator definitions.

Long-term output logic: stronger Programme Area capability to monitor progress and consolidate a coastal-flood-specific cross-border operational baseline.

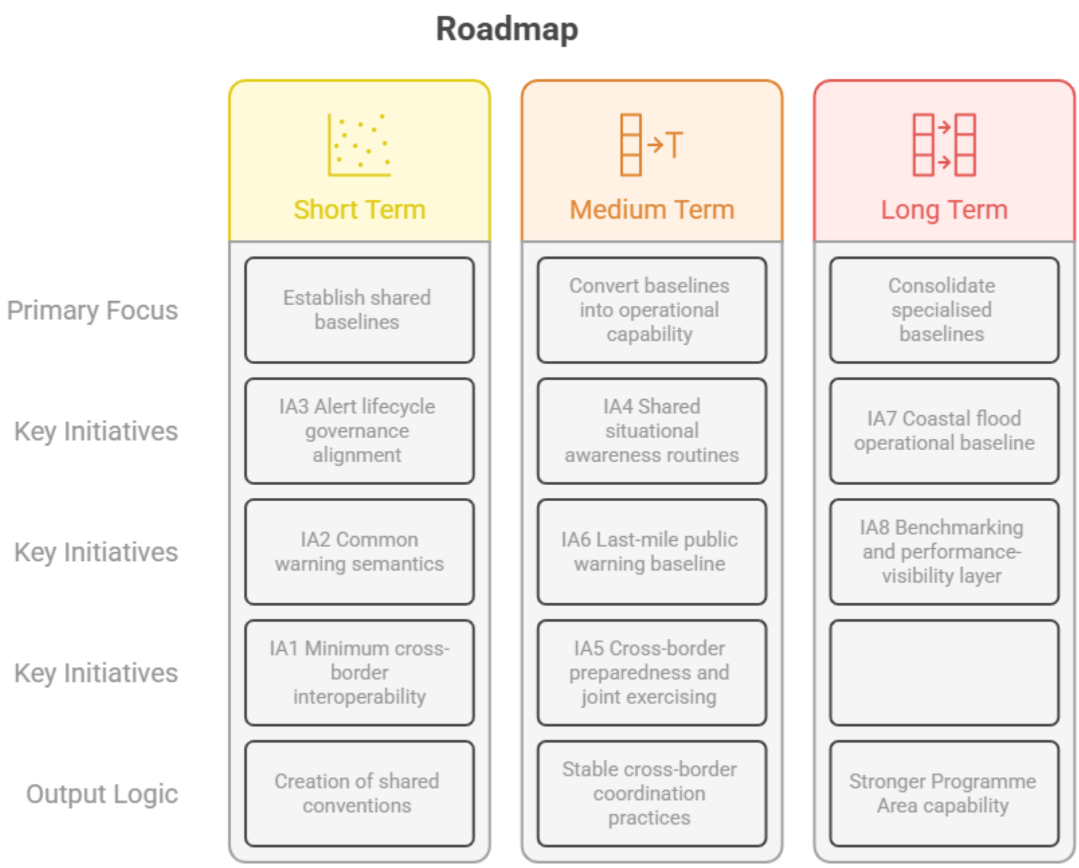

Figure 5.4.1: roadmap temporal sequence of implementation

5.5 "No-regret" improvement areas

Based on the gap landscape and cross-dependencies, the following areas can be considered "no-regret" because they provide value even under heterogeneous institutional contexts and partial implementation:

- IA3 Alert lifecycle governance alignment (improves coherence regardless of IT platform choices)
- IA2 Common warning semantics and operational crosswalk (improves shared understanding across borders)
- IA4 Shared situational awareness routines (templates and routines work even with limited automation)

These areas address interface-driven gaps that amplify multiple operational risks when left unresolved.

The prioritisation and sequencing presented here provide a roadmap logic to support subsequent implementation-oriented work packages and pilot activities. By clarifying enabling relationships and sequencing, the report supports pragmatic planning: early effort is concentrated on shared baselines and lifecycle coherence, followed by operationalisation through routines and testing, and finally by specialised coastal consolidation and performance visibility enhancements.

6. Cross-border synergy map

*This chapter summarises the cross-border synergy logic emerging from the joint improvement areas and the prioritisation framework. The aim is to clarify where the greatest Interreg added value is generated, how different improvement areas reinforce each other, and how joint progress can be achieved without requiring uniform institutional structures. The synergy map is therefore organised around **interfaces and shared baselines**, consistent with the WP1 functional governance approach and the evidence-based mapping foundations.*

6.1 Sinergy clusters and their enabling relationships

Within D.1.2.2, cross-border synergy refers to the benefits generated when partner territories adopt compatible baselines, conventions, and routines that enable:

- faster and more reliable information exchange during shared hazard scenarios;
- consistent interpretation of warning meaning and operational implications across borders;
- coherent lifecycle management of alerts (issue–update–cancel/stand-down) and reduced risk of contradictory messages;
- shared situational awareness and coordination continuity during rapidly evolving events, with specific relevance for coastal flooding.

Synergy therefore emerges primarily from alignment at *interfaces* (technical, governance, and communication), rather than from harmonising institutional structures.

The joint improvement areas form three main synergy clusters, each characterised by strong cross-dependencies and progressive enabling relationships.

Cluster A — Interoperability and shared situational awareness (IA1 + IA4, enabled by IA2 and IA3)

This cluster strengthens the ability of neighbouring territories to build a shared operational picture. The minimum interoperability package (IA1) provides the baseline conventions needed to exchange comparable information, while shared situational awareness routines and common reporting templates (IA4) convert those conventions into operational practice. The effectiveness of this cluster increases when warning semantics (IA2) and lifecycle coherence (IA3) are aligned, ensuring that exchanged information has consistent meaning and versioning.

Synergy outcome**:** improved cross-border coordination readiness through shared understanding of "what is happening now" and "what is changing," including warning updates and de-escalation/stand-down.

Cluster B — Lifecycle coherence and public warning consistency (IA3 + IA6, supported by IA2 and tested through IA5)

This cluster targets the end-to-end coherence of warnings over time, including updates, escalations/downgrades, and cancellations/stand-down messages. Governance alignment of the alert lifecycle (IA3) clarifies decision rights, versioning and traceability, and the touchpoints between institutional notifications and public warning. A minimum last-mile baseline (IA6) strengthens reach, redundancy, and inclusiveness while reducing variability in minimum practices across territories. Joint exercises (IA5) provide a mechanism to validate these interfaces under time pressure, including the communication challenges associated with update/cancellation phases.

Synergy outcome: reduced risk of contradictory public messaging and improved trust and actionability for exposed communities during rapidly evolving events.

Cluster C — Coastal flood comparability and compound event handling (IA7, enabled by IA1–IA3 and supported by IA4)

This cluster addresses the project's coastal focus, strengthening comparability of meteo-marine integration and coastal flood operational outputs across the Programme Area. The coastal operational baseline (IA7) benefits strongly from the prior establishment of minimum data/metadata conventions (IA1), common warning semantics (IA2), and lifecycle governance coherence (IA3). Shared situational awareness routines (IA4) support operational integration by enabling consistent reporting and alignment of coastal flood impacts across borders.

Synergy outcome: improved cross-border understanding and operational coherence in coastal flooding and compound events where timing, update frequency, and impact interpretation are critical.

6.2 Joint versus territorial improvement logic

The synergy map supports a practical distinction between:

- Joint elements (Programme Area baselines and routines) that should be compatible across borders because they enable cross-border coherence; and

- Territorial implementation elements (specific platforms, institutional arrangements, and local tools) that can remain diverse as long as they interface consistently with the joint baselines.

Examples of joint elements include: minimum interoperability fields and metadata; a shared semantic crosswalk for warning meaning; common lifecycle state definitions (Alert/Update/Cancel/Stand-down); minimum situation reporting templates; and minimum principles for channel redundancy and accessibility. These are "joint" because their value depends on mutual adoption and comparability.

Examples of territorial elements include: specific IT platforms, internal organisational structures, and locally adapted communication channels. These can remain heterogeneous as long as they implement the shared baselines and routines at the interface level.

6.3 Cross-border synergy pathways (summary)

The cross-border synergy logic emerging from the joint improvement areas can be described through three complementary pathways. Each pathway represents a progressive mechanism through which the Programme Area can move from heterogeneous, territorially specific EWS configurations towards greater **operational coherence and interoperability**, without requiring uniform institutional structures. The pathways are not strictly linear; they can partially overlap, but together they provide a practical narrative for how joint improvements generate added value.

Pathway 1 — From shared conventions to shared practice (baseline alignment → operational interoperability)

The first pathway describes the transition from comparability "on paper" to comparability "in use". It starts with the definition of minimum shared conventions—particularly the minimum interoperability package (IA1), common warning semantics (IA2), and alert lifecycle governance alignment (IA3)—which provide a common language for exchanging and interpreting warning information. These conventions become operationally meaningful when they are embedded in routine coordination practices through shared situational awareness routines and templates (IA4). In practical terms, this pathway strengthens the ability of neighbouring territories to exchange comparable information with clear meaning and consistent versioning, and to align understanding at key moments of the event evolution (pre-alert monitoring, escalation, peak impacts, de-escalation and stand-down). The synergy generated is therefore primarily a reduction of "translation effort" and coordination friction, which improves the speed and reliability of cross-border alignment under time pressure.

Pathway 2 — From shared practice to validated capability (routines → stress-testing → learning loop)

The second pathway focuses on converting shared baselines and routines into robust capability through structured testing and learning. Once common conventions and situational awareness routines exist, joint preparedness and exercising (IA5) provides the mechanism to validate whether these elements hold under realistic operational conditions—particularly during rapidly evolving coastal flood scenarios where frequent updates, escalation/downgrade decisions, and stand-down messaging are critical. Exercises and drills also provide a controlled environment to test cross-border communication touchpoints, the coherence of update/cancellation practices, and the coordination interfaces between technical services, decision-makers, operational centres, and public communication units. This pathway is essential to reveal residual interface ambiguities that documentation alone may not capture. It also establishes a learning cycle: after-action insights can be used to refine minimum baselines, clarify lifecycle governance touchpoints, and strengthen shared routines over time.

Pathway 3 — From general coherence to coastal specialisation (foundation → coastal comparability → sustained visibility)

The third pathway describes how general cross-border coherence enables more specialised, hazard-specific consolidation. Coastal flooding and compound events require high-frequency updates, clear interpretation of meteo-marine drivers, and comparable operational outputs. For this reason, the coastal flood operational baseline (IA7) becomes most effective when built on the foundations of interoperability, semantics, and lifecycle coherence (IA1–IA3), supported by shared situational awareness routines (IA4). In parallel, a pragmatic performance-visibility layer (IA8), where feasible, helps track progress and sustain improvement by making process coherence more observable (e.g., lifecycle traceability, use of common templates, exercise coverage). This pathway therefore strengthens the Programme Area's capacity to handle coastal events with shared understanding and coordination continuity, while creating the conditions for monitoring whether joint baselines are being adopted and are improving operational coherence over time.

Together, these three pathways describe a coherent cross-border synergy logic: minimum shared baselines reduce friction; routines and templates translate baselines into practice; structured testing validates and improves capability; and specialised coastal consolidation builds on the established foundations to strengthen preparedness for the most time-sensitive scenarios (Tab. 6.3.1).

Synergy pathway	Main improvement areas involved	Typical minimum common baselines and routines (examples)
Pathway 1 — From shared conventions to shared practice	IA1 Minimum interoperability package; IA2 Common semantics crosswalk; IA3 Lifecycle governance alignment; operationalised through IA4 Shared situational awareness routines	Minimum cross-border exchange dataset and metadata conventions; shared semantic crosswalk for warning meaning; minimum alert lifecycle state definitions and versioning/traceability logic; common SITREP minimum fields and routine alignment “exchange moments”
Pathway 2 — From shared practice to validated capability	IA4 Shared situational awareness routines; IA5 Joint exercising; supported by IA3 Lifecycle governance and IA6 Last-mile baseline	Joint exercise packages (table-top/drills) aligned to minimum baselines; validated lifecycle coherence for update/cancel/stand-down across borders; structured after-action review routines feeding baseline refinement; agreed operational touchpoints between technical, governance and communication actors
Pathway 3 — From general coherence to coastal specialisation	IA7 Coastal flood operational baseline; enabled by IA1–IA3 and supported by IA4; monitored where feasible via IA8 Performance visibility layer	Minimum comparable baseline for coastal-flood operational outputs (variables, products, area delineation logic, update principles); minimum common description of meteo-marine integration in EWS cycles; cross-border routines for coastal situational awareness alignment; pragmatic visibility of adoption and lifecycle traceability (where feasible)

Table 6.3.1: Cross-border synergy pathways – link to improvement areas and typical minimum common baselines

Conclusions

This deliverable (D.1.2.2) provides a joint analysis of improvement areas for Early Warning Systems (EWS) across the Interreg Italy–Croatia Programme Area, translating the diagnostic gap landscape identified in D.1.2.1 into structured, cross-border-relevant improvement domains. The analysis is grounded in the WP1 evidence base and maintains methodological continuity with the mapping of existing EWS (D1.1.1) and the governance and decision-making assessment (D1.1.2), which established functional comparability across heterogeneous institutional contexts.

The report identifies eight joint improvement areas that target high-leverage interfaces shaping end-to-end warning effectiveness: minimum interoperability conventions, shared warning semantics, lifecycle governance coherence, shared situational awareness routines, joint exercising, last-mile minimum practices, coastal flood operational baselines, and feasible performance-visibility mechanisms. Collectively, these improvement areas reflect the project's central finding that EWS maturity and cross-border coherence are often determined less by the presence of core functions and more by the strength of interfaces across technical, governance, and communication domains—particularly along the alert lifecycle (issue–update–cancel/stand-down).

The prioritisation and sequencing logic highlights that the highest cross-border added value is generated by establishing shared baselines and interface clarity first (interoperability conventions, semantic crosswalks, and lifecycle governance), then operationalising these through shared situational awareness routines, last-mile baselines, and systematic joint testing, and finally consolidating coastal flood comparability and sustained learning visibility. This dependency-aware approach supports a realistic roadmap that is compatible with diverse institutional settings while enabling coherent progress at Programme Area scale.

Overall, D.1.2.2 provides a structured foundation for implementation-oriented project activities by clarifying what should be strengthened jointly and why these domains matter for cross-border coherence and coastal flood preparedness. The improvement areas and sequencing presented here can support subsequent work packages, pilot actions, and cooperation mechanisms, while remaining grounded in the evidence-based analytical work conducted in WP1.

The improvement areas and sequencing logic presented in this deliverable are directly traceable to the diagnostic gap landscape established in D.1.2.1 and provide a coherent basis for subsequent implementation-oriented project activities, including piloting, operational cooperation actions, and stakeholder engagement. By focusing on minimum shared baselines and cross-border interfaces, the report supports Programme Area added value while remaining compatible with heterogeneous institutional mandates.