Contents

Supplementary Material S4: Questionnaire, Task Instructions, and Case Vignettes

S4.1 Controlled Experimental Evaluation: Participant-Facing Materials

Opening text and consent confirmation

Thank you for participating in this study. The study investigates how patent professionals structure complex intellectual-property governance situations involving multiple actors, de-

cision rights, approval steps, and temporal dependencies. You will complete two case-based tasks under time constraints. The purpose is not to test your legal knowledge of a particular jurisdiction, but to observe how you represent and analyse governance structure.

Please work only with the information provided in the case materials. Do not use external databases, internet searches, or colleagues during the task. Your responses will be anonymised and analysed only in aggregate. You may withdraw at any time without giving a reason.

By continuing, I confirm that I am at least 18 years old, that I participate voluntarily, that I understand the anonymised use of my responses for research purposes, and that I may stop participating at any time.

Eligibility screening

1. Do you have at least three years of professional experience in patent prosecution, licensing, supplementary protection certificates, technology transfer, freedom-to-operate work, or a closely related IP-governance function? Response options: ☐ Yes ☐ No
2. Are you currently involved, at least occasionally, in decisions in which several actors or institutions influence the status, transfer, licensing, or enforcement of intellectual property? Response options: ☐ Yes ☐ No
3. How often do you create, review, or use a visual representation of an IP-related process, ownership structure, licensing arrangement, approval pathway, or freedom-to-operate situation? Response options: ☐ Weekly or more often ☐ Monthly ☐ Quarterly ☐ Less than quarterly ☐ Never
4. Have you previously seen or used the Actor-Gate Dependency Notation (AGDN)? Response options: ☐ Yes ☐ No ☐ Not sure
5. Is your current role primarily administrative or paralegal, without responsibility for substantive IP-governance analysis? Response options: ☐ Yes ☐ No

Participants were eligible if they answered Yes to Items 1 and 2, Monthly or more often to Item 3, No or Not sure to Item 4, and No to Item 5.

Pre-task questionnaire

1. Participant code: [entered by study administrator].
2. Session number: [entered by study administrator].
3. Professional context: ☐ Patent attorney firm ☐ Industry IP department ☐ University technology-transfer office ☐ Other, please specify
4. Age band: ☐ under 30 ☐ 30-39 ☐ 40-49 ☐ 50-59 ☐ 60 or above ☐ prefer not to say
5. Years of professional experience in IP-related work: [numeric entry].
6. Gender: ☐ female ☐ male ☐ diverse or non-binary ☐ prefer not to say
7. Are you a qualified European Patent Attorney? Response options: ☐ Yes ☐ No
8. Are you a qualified German patent attorney? Response options: ☐ Yes ☐ No
9. Which of the following areas are part of your current or recent professional work? Multiple responses permitted: ☐ patent prosecution ☐ licensing or transaction support ☐ supplementary protection certificates ☐ university technology transfer ☐ freedom-

to-operate analysis ☐ opposition or litigation ☐ regulatory or certification interfaces ☐ other, please specify

10. Have you previously used BPMN, UML, ArchiMate, decision trees, influence diagrams, or a similar formal notation in professional work? Response options: ☐ No ☐ Yes, introductory exposure only ☐ Yes, occasional use ☐ Yes, regular use Free-text field: Which notation(s)?
11. How familiar are you with visual notations for modelling decision structures? Scale from 1 to 5, where 1 = not familiar and 5 = very familiar. ☐1 ☐2 ☐3 ☐4 ☐5
12. How confident are you in analysing multi-actor IP governance structures under time pressure? Scale from 1 to 5, where 1 = not confident and 5 = very confident. ☐1 ☐2 ☐3 ☐4 ☐5

Common task rules for both conditions

You will work on two independent case scenarios. For each task, you have 35 minutes. A visible countdown will be used. You may use the provided drawing application and blank workspace. You may add short written notes where necessary. Please focus on the actors, decision rights, dependencies, preconditions, information flows, approval steps, and temporal or status distinctions that are relevant to the case.

No additional facts should be invented. Where you make an assumption, mark it explicitly. The quality of the response will be assessed by how clearly and accurately the governance structure is represented and analysed, not by artistic appearance.

Treatment-condition briefing: AGDN

For this task, please use the Actor-Gate Dependency Notation (AGDN). You may consult the one-page AGDN quick reference throughout the task. You may ask syntax questions, for example which symbol denotes a gate or how status is encoded. The study team will not answer questions about case content, legal strategy, or the correct solution.

Use AGDN elements to represent actors, gates, assets, approvals, value relations, time markers, and relevant dependencies. Distinguish institutional and algorithmic decision modes where the case calls for that distinction. Mark active, pending, and blocked states where they are relevant.

Control-condition briefing: free sketching

For this task, please use any representation method of your choice. You may use boxes, arrows, labels, tables, timelines, flow diagrams, mind maps, or any combination of text and sketching. There is no required notation. The study team will not answer questions about case content, legal strategy, or the correct solution.

Please make your representation clear enough that another patent professional could understand the structure without an oral explanation.

S4.2 Task 1 Vignette: BioShield SPC

Note on the cases. Both task vignettes (BioShield SPC and NeuroFlex Licensing) are constructed scenarios. They were built to be technically realistic and to exercise specific governance structures; company names, product designations, and parties are fictitious. Where a scenario draws on the structure of an actual matter, all identifying detail has been removed, and any resemblance to a specific organisation or product is unintended.

Case description shown to participants

BioShield Therapeutics GmbH is a university spin-off developing BS-17, an inhaled antiviral formulation originally discovered in a university pharmacology laboratory. The university owns the underlying patent family. BioShield holds an exclusive option to obtain a field-limited therapeutic licence once the patent family reaches grant or allowance in the relevant territory. The option is currently active, but the definitive licence has not yet been signed.

The commercial plan depends on obtaining market exclusivity beyond the normal patent term by filing for a supplementary protection certificate (SPC) after marketing authorisation. The basic patent must be in force, and the first marketing authorisation for BS-17 must be granted, before an SPC application can be filed. The German Patent and Trade Mark Office will examine the SPC application once it is filed. At the time of the task, the patent prosecution record indicates that the core claims are allowable, but formal grant and register update are still pending.

BioShield cannot itself manufacture BS-17 at clinical or commercial scale. An originator manufacturer, HelixPharm AG, controls the manufacturing dossier and the release of GMP process information needed for the marketing-authorisation file. HelixPharm has agreed in principle to cooperate, but its internal approval gate for releasing the manufacturing package is still pending. HelixPharm will not release the complete package until BioShield confirms that the university licence will cover commercial manufacture and sublicensing.

A contract research organisation, CertiLab CRO, is completing the final stability and bioequivalence report. The marketing-authorisation submission is blocked until this report is delivered. CertiLab expects to complete the report within approximately eight weeks, unless additional batch testing is requested. Without the report, BioShield can continue preparing the file but cannot submit it.

Two prospective licensees are considering commercial participation. NorthMed GmbH is interested in an exclusive Germany-Austria distribution licence, but only if the SPC path is credible and the SPC application can be filed promptly after marketing authorisation. PanEU Pharma prefers a broader non-exclusive European commercialisation arrangement, but requires freedom-to-operate warranties and evidence that the university licence permits sublicensing. Both prospective licensees have active discussions with BioShield, but neither will sign until the status of the patent, manufacturing package, and marketing-authorisation pathway is clear.

The university technology-transfer office wants the fastest route to a licence that preserves university ownership and ensures milestone payments. BioShield wants to keep the option

alive and secure a licence broad enough to satisfy at least one commercial partner. HelixPharm wants to avoid releasing manufacturing information before the commercial rights are clear. The prospective licensees want to avoid committing to a product for which the SPC route, manufacturing authority, or freedom-to-operate position remains uncertain.

Participant task instruction

Produce a visual model of the BioShield SPC governance structure. Your model should capture:

- the relevant actors and their formal decision rights or control positions;
- the status of the core processes or gates, distinguishing active, pending, and blocked states where relevant;
- information, approval, licence, and manufacturing-package flows;
- dependencies and preconditions, especially the dependencies between patent status, marketing authorisation, SPC filing, university licensing, manufacturing release, CRO reporting, and prospective licence agreements;
- any timing markers or sequencing constraints that are relevant to the decision structure.

You do not need to calculate legal deadlines, commercial value, or success probabilities. Focus on the governance structure. You have 35 minutes.

Expected task output

A visual model with any short explanatory notes needed to make the structure interpretable to another patent professional.

S4.3 Task 2 Vignette: NeuroFlex Licensing

Case description shown to participants

A university research group has developed NeuroFlex, a brain-computer-interface technology for neurorehabilitation after stroke. The technology combines two patent families. Patent Family A covers adaptive neural-signal decoding software. It is pending in Europe and the United States, with broad claims still under examination. Patent Family B covers a flexible dry-electrode array and has been granted in Germany, but a third party has filed an opposition against the European patent. The university technology-transfer office manages both families.

NeuroFlex GmbH, a spin-off founded by two of the inventors, holds an exclusive option to negotiate a licence in the neurorehabilitation field. The option expires in four months. It gives the spin-off priority over third-party licensees, but it does not automatically authorise sublicensing. Any sublicence or transfer to a major industry partner requires university approval. The spin-off has limited funding and needs either a seed round or an industry collaboration to continue development.

MedTechCo plc, a large medical-technology company, is interested in financing clinical translation and taking a worldwide exclusive licence in the medical-device field. MedTechCo

wants direct contractual access to the university-controlled patent families or, at minimum, a clearly authorised sublicence from NeuroFlex GmbH. MedTechCo will not commit development funding until it receives a credible freedom-to-operate assessment and clarity on whether the spin-off option blocks or delays a direct licence.

A competing start-up, SynapTrack GmbH, owns an earlier patent family relating to real-time filtering of neural input signals. SynapTrack has sent a letter to MedTechCo alleging that the planned NeuroFlex product would infringe its rights. External counsel has not completed the claim chart. A preliminary view is that a design-around may be possible, but the technical team says that the design-around could reduce performance and delay the prototype by several months.

The clinical team wants to begin a first-in-human feasibility study as soon as a prototype and regulatory pathway are stable. The study cannot start until the development partner, patent-licence structure, and freedom-to-operate position are sufficiently clear for the university ethics and contracting offices to approve the collaboration. The university wants to maximise translational impact while preserving publication rights and avoiding an exclusive licence that becomes stranded if either the spin-off or MedTechCo fails to perform.

The parties are considering two broad approaches. One approach is accelerated: a tri-party arrangement among the university, NeuroFlex GmbH, and MedTechCo, with conditional sublicensing or direct licensing, milestone-based conversion, and rapid FTO work in parallel. The other approach is risk-mitigated: extend or renegotiate the spin-off option, complete the FTO analysis first, amend or narrow claim strategy where necessary, and only then sign a definitive industry licence.

Participant task instruction

Analyse the NeuroFlex Licensing scenario. You have 35 minutes. Your response should include:

1. the three most critical bottlenecks that could delay or block a licence agreement, ranked from most to least critical;
2. a short explanation of why each bottleneck is binding and which actor or actors control it;
3. two alternative governance configurations: one accelerated configuration and one risk-mitigated configuration;
4. a blocking-risk rating for each principal actor under each configuration, using 0 = no meaningful blocking risk, 1 = low risk, 2 = moderate risk, 3 = high risk, and 4 = critical blocking risk;
5. a short written justification of your preferred configuration.

You may use a diagram, a table, written notes, or a combination of these. Focus on decision structure, dependencies, and actor-specific risks rather than on drafting contractual clauses. You have 35 minutes.

Expected task output

A structured analysis identifying bottlenecks, alternative configurations, actor-specific risks, and the preferred governance configuration with reasons.

S4.4 Post-task Questionnaire

The post-task questionnaire was completed after both tasks.

NASA-TLX short-form workload ratings

For each task separately, please rate the following dimensions on a scale from 0 to 100. Use increments of 5 if helpful. A higher value indicates a higher workload or a more negative workload-related experience, except where the scale labels specify the direction.

Task 1: BioShield SPC

1. Mental demand: How mentally demanding was the task? 0 = very low, 100 = very high.
2. Physical demand: How physically demanding was the task? 0 = very low, 100 = very high.
3. Temporal demand: How hurried or pressured did you feel due to the pace of the task? 0 = very low, 100 = very high.
4. Performance: How successful do you think you were in accomplishing what you were asked to do? 0 = perfect, 100 = failure or very poor performance.
5. Effort: How hard did you have to work to accomplish your level of performance? 0 = very low, 100 = very high.
6. Frustration: How insecure, discouraged, irritated, stressed, or annoyed did you feel during the task? 0 = very low, 100 = very high.

Task 2: NeuroFlex Licensing

The same six items and anchors were repeated for Task 2.

Perceived usefulness

1. Overall, the representation method I used in Task 1 helped me structure the BioShield SPC case. Scale from 1 to 5: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. ☐1 ☐2 ☐3 ☐4 ☐5
2. Overall, the representation method I used in Task 2 helped me analyse the NeuroFlex Licensing case. Scale from 1 to 5: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. ☐1 ☐2 ☐3 ☐4 ☐5

Suspicion check

1. Did you suspect during the session that another participant group received different modelling instructions or different representational materials? Response options: ☐ No ☐ Yes ☐ Not sure

2. If Yes or Not sure, what did you suspect?
3. What do you think was the main purpose of the study?

Open feedback

1. What made the first task easier or harder for you?
2. What made the second task easier or harder for you?
3. Which parts of your representation or analysis were most difficult to produce?
4. Which aspects of the method you used were most helpful, if any?
5. Would you use a similar representation in professional practice? If yes, in what type of case? If no, why not?
6. Please add any further comments on the case materials, timing, or task format.

Completion and technical issues

1. Did you complete both tasks? Response options: ☐ Yes ☐ No
2. Did any technical issue materially affect your response? Response options: ☐ No ☐ Yes, please describe
3. Should your response be excluded from analysis for any reason known to you? Response options: ☐ No ☐ Yes, please describe

S4.5 Formative Expert Walkthrough: Instrument Wording

Opening text

This walkthrough evaluates whether AGDN can be understood and applied by domain experts after a short self-paced introduction. The exercise is not a test of individual performance. Please work from the materials provided and record points of confusion as they arise.

Phase 1: Self-paced tutorial

Participants received a one-page AGDN notation summary covering core elements, sphere variants, connector types, status encoding, and a short (Supplementary Figure S1, reproduced below). No oral instruction was provided. Written clarification questions were answered only from a standardised FAQ.

Phase 2: Comprehension walkthrough using the MDR certification diagram

Participants were shown the AGDN diagram of a simplified medical-device-certification pathway under the Medical Device Regulation reproduced as Supplementary Figure S4. They were asked to answer the following short-answer questions.

Sphere-type and actor identification:

1. Which actor is represented as the manufacturer or applicant?
2. Which actor is represented as the notified body or certification authority?
3. Which actor, if any, is represented as an academic, transfer, or research actor?

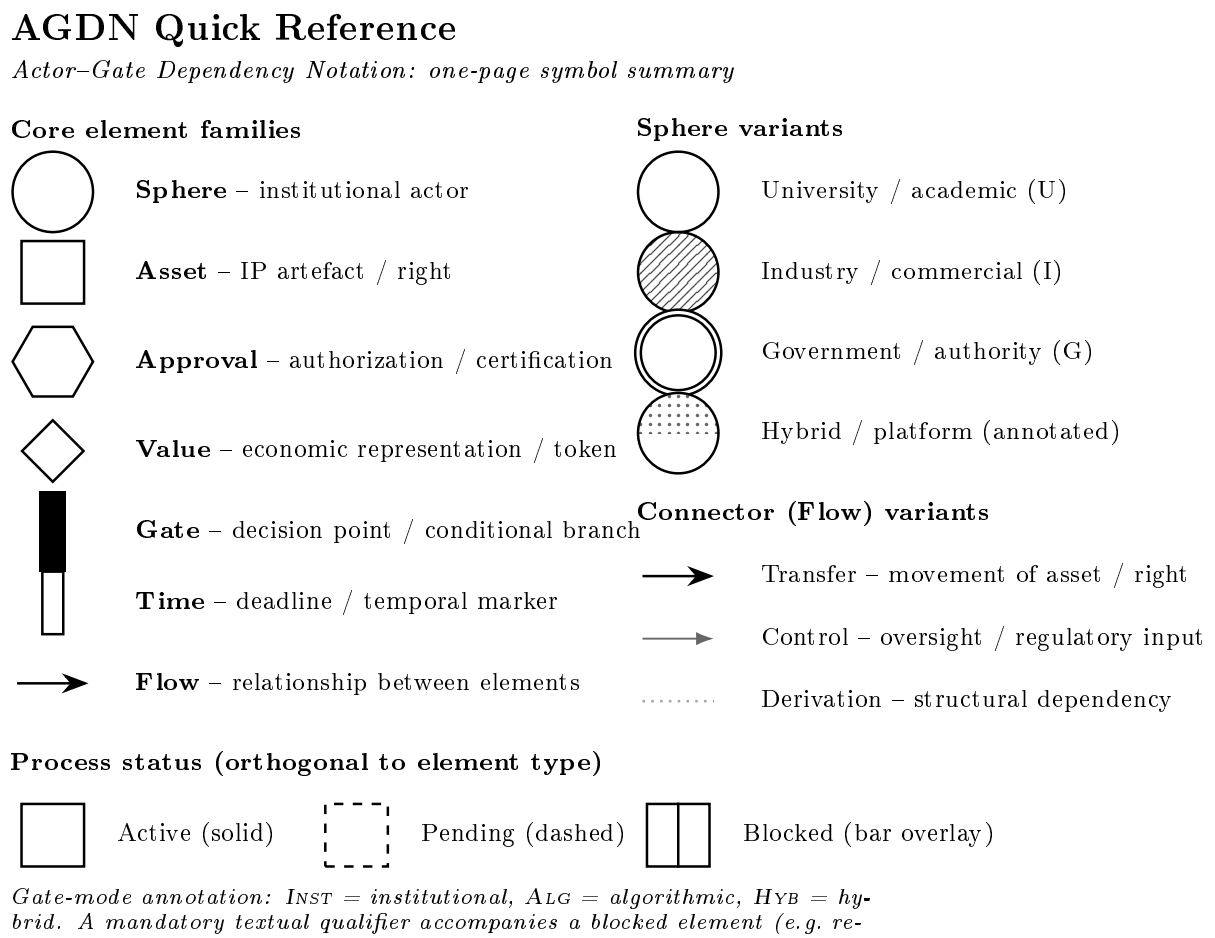
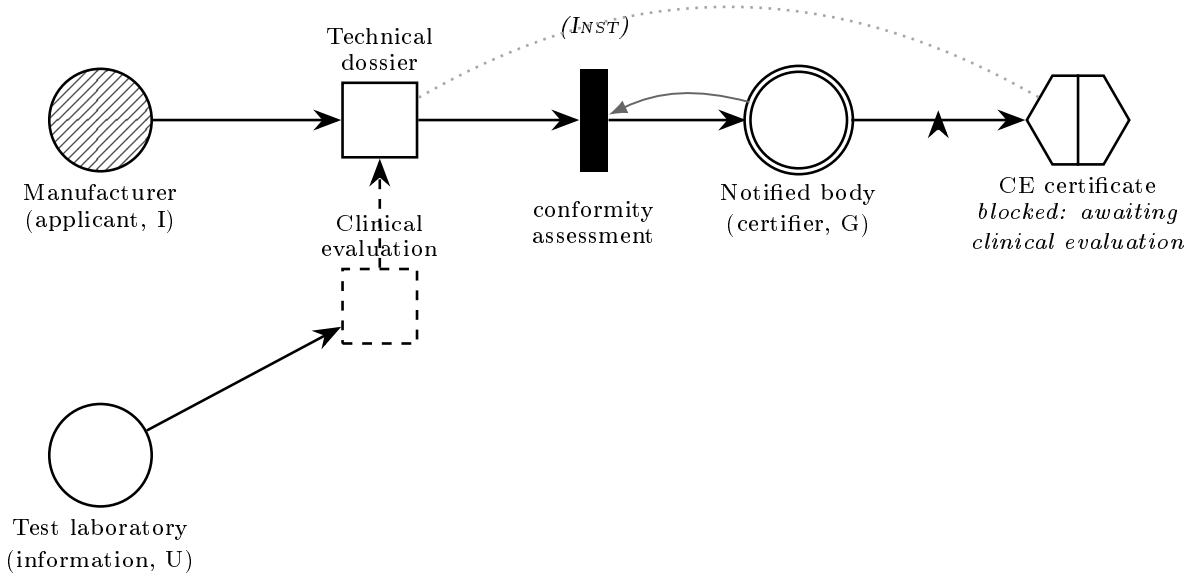


Figure 1: AGDN quick reference provided to participants (reproducing Supplementary Figure S1).



Reading: the manufacturer (I) submits the technical dossier through the institutional conformity-assessment gate (Inst) controlled by the notified body (G); the test laboratory (U) supplies the clinical evaluation but does not control the certification decision. The CE certificate is blocked (bar overlay) and is unblocked once the pending clinical evaluation completes. Solid = active, dashed = pending, bar = blocked; gray arrow = control, dotted = derivation.

Figure 2: AGDN diagram of a simplified MDR certification pathway, used as the comprehension stimulus (reproducing Supplementary Figure S4).

4. Which actor, if any, is represented as a hybrid or platform-like actor?
5. Which relationships cross institutional boundaries rather than remaining within one actor sphere?

Gate-mode identification:

6. Which gate or gates are institutional decisions made by an organisation or authority?
7. Which gate or gates, if any, are algorithmic or rule-executed decisions?
8. What does the institutional gate marker indicate in this diagram?
9. Which actor controls the certification decision, and which actor depends on that decision?

Status-encoding interpretation:

10. Which element or process is active?
11. Which element or process is pending?
12. Which element or process is blocked?
13. What event or prerequisite would unblock the blocked process?
14. Does the diagram distinguish relationship type from process status? If yes, identify one example.

Dependency tracing:

15. Trace the dependency path from the technical dossier to certification.
16. Which preconditions must be satisfied before the certificate can be issued?
17. Which actor supplies information without controlling the final approval?
18. Where does a delay at one actor create a downstream delay for another actor?
19. Identify one dependency that would be easy to miss in a purely narrative description.

Phase 3: Construction-task vignette for the formative study

A university technology-transfer office owns a patent application for a sensor technology developed in a publicly funded research project. The application is pending, but the search opinion is positive. A start-up founded by two inventors has an active exclusive option to negotiate a licence in the industrial-monitoring field. The option will expire in three months unless the start-up reaches a financing milestone.

An established engineering company wants an exclusive field-limited licence for use in safety-critical industrial plants. The company is willing to fund further development, but it requires evidence that the start-up's option does not block the company's licence, that the university can approve sublicensing if the start-up remains involved, and that publication rights for the remaining academic work will be preserved.

A public funding agency has a reporting and approval role because the original project was grant-funded. The agency does not negotiate the commercial licence, but it can delay approval if the exploitation plan conflicts with grant obligations. A certification laboratory must also complete a technical validation report before the engineering company will sign. The certification report is pending. The definitive licence is blocked until the option position, funding-agency approval, and certification report are clear.

Please translate this scenario into an AGDN diagram. Represent the main actors, their decision rights, the option and licence pathway, the pending and blocked states, and the key dependencies among patent status, option expiry, funding-agency approval, certification, and the contemplated industry licence. You have 15 minutes.

Phase 4: Semi-structured feedback questions

1. Which elements were most intuitive, and which were least intuitive?
2. What distinctions were difficult to represent?
3. What symbols or conventions would you add?

S4.6 Data-Field Mapping

The wording above maps to the submitted data fields as follows:

- Professional context maps to `ProfessionalBackground`.
- Age band maps to `AgeBand`.
- Years of professional experience maps to `ExperienceYears`; grouped values map to `ExperienceBand`.
- Gender maps to `Gender`.
- European Patent Attorney qualification maps to `QualifiedEPA`.
- German patent attorney qualification maps to `QualifiedGermanPA`.
- Prior BPMN/UML or comparable notation exposure maps to `PriorNotationExperience`.
- Task condition is assigned by session and group and maps to `Task1Condition` and `Task2Condition`.
- BioShield SPC performance maps to `Task1TotalScore` and Task 1 rubric criteria.
- NeuroFlex Licensing performance maps to `Task2TotalScore` and Task 2 rubric criteria.
- NASA-TLX ratings map to `NASATLXTask1`, `NASATLXTask2`, and the subscale entries in Supplementary Material S2.
- Perceived usefulness items map to `UsefulnessTask1` and `UsefulnessTask2`.
- Suspicion-check response maps to `SuspicionCheck`.
- Completion and technical-issue items map to `BothTasksCompleted`, `ExclusionFlag`, and `ExclusionReason`.