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Paper

Quality-Assuring Doctoral Impact: The Potential of Readiness Level Frameworks

Abstract

European research policy increasingly expects research, and doctoral education with it, to demonstrate impact. The impact of the doctorate is hard to determine: it is diffuse and often delayed, carried by people as much as by products, and rarely attributable to one project. Readiness level frameworks, first developed at NASA to judge the maturity of technologies, have since become funding criteria in European programmes and spread to markets, adoption, human use and society. This paper asks what these frameworks assume about how research takes effect, and what doctoral quality assurance (QA) could learn from them without subordinating doctoral research to short-term exploitation.

We analysed nine frameworks in documented real-world use, covering scientific, technological and manufacturing maturity, market, commercial and adoption readiness, and human, societal and innovation readiness. A three-dimensional codebook recorded what the frameworks say about themselves, their implicit theories of impact and guiding metaphors, and how far they align with criteria drawn from research on doctoral impact.

Across the nine frameworks the object of readiness moves outward from the artefact to organisations, markets, users and society, and the imagery shifts from maturity to fit, traction and integration. Eight frameworks address the receiving context, all can be used reflectively, and profile-based frameworks keep uneven progress visible. Only one treats the person as a carrier of impact, two look at impact after a project has ended, and most presuppose technological knowledge and single scores. Safeguards against metric misuse exist, but no framework combines them.

We propose a heuristic for discussion: assess the environment, develop the person, don't grade the pathway. Readiness elements can support supervision and programme review if thesis assessment stays separate and candidates in readiness-governed projects are credited for what they contribute to a project's readiness.

1. Introduction: impact, the doctorate and readiness

Impact has become a standing expectation of research policy. A CoARA working group defines societal impact as *"the evidenced contributions of research to improvements beyond academia"* (Bleischwitz et al. 2025). The Letta (2024) and Draghi (2024) reports bind research more tightly to competitiveness. The impact of a doctorate is harder to pin down. It comprises "*outcomes, benefits and returns that include, but are not limited to, economic returns*" (Halse & Mowbray 2011, p. 514), often surfaces after graduation (Boud et al. 2021) and may go unrecognised (*"the research is being implemented but not acknowledged*", Creaton 2021, p. 280). Evidence is largely narrative and self-reported (Kumar 2014; McSherry et al. 2019). Funding programmes supply the categories, as in the Marie Skłodowska-Curie Actions' "*academic, societal, and economic/technological impacts*" (Szybisty, Shawrav & Greco 2025, p. 10).

Funding programmes also rely increasingly on readiness levels, which frame doctoral impact directly. Technology Readiness Levels (TRL) propagated from NASA into Horizon 2020 and on into the Horizon Europe General Annexes (Héder 2017; European Commission 2025a). Cluster 5 "*pilots the integration of a Societal Readiness approach through eight pilot topics*" (European Commission 2025c, p. 12), and Clean Energy Transition Partnership applicants state the *"initial and target societal, market, and commercial readiness*" of their results (CETP 2024b, p. 6). Being the most institutionalised test of whether knowledge is ready for use, readiness frameworks spell out what funders assume about implementation. We study nine of them in documented use (Table 1). The question of fit is most pressing where candidates work in readiness-reporting projects, in Horizon Europe consortia or industrial doctorates (Hämäläinen, Marti & Peneoasu 2026), whose level targets need not match what the doctoral project means by impact.

Our aim is to understand readiness frameworks, their objects, evidence regimes and implicit theories of impact, and to inform the discussion of impact in doctoral supervision, assessment and quality assurance (QA). Readiness frameworks and doctoral QA answer different questions. The frictions between the two, and what each might take from the other, inform the analysis.

The paper asks:

- To what extent do the selected readiness frameworks align with literature-derived criteria on doctoral impact?
- Which elements of the frameworks could inform doctoral QA?
- Under which conditions and safeguards could readiness elements be used in doctoral QA, including for candidates working in readiness-governed projects?

2. Readiness frameworks and doctoral impact: a brief review

The literature on readiness frameworks is largely critical: TRL has become "*a de facto standard used for technology assessment and oversight in many industries*", though its implementation raises recurrent problems of system complexity and validity of assessment (Olechowski, Eppinger & Joglekar 2015). Héder (2017, p. 2) traces how *"the concreteness and sophistication of the TRL scale gradually diminished as its usage spread outside its original context*" and warns that, without domain-specific guidance, TRLs "*will predictably become a source of confusion and a subject of abuse in efforts to obtain EU funding*" (p. 3). The Commission concedes that the scale "g*enerally assumes a linear progression from idea to market*", which "*rarely reflects the actual innovation process*" (European Commission 2025b, p. 6). Later extensions to integration, human use, markets and society still "*implicitly presuppose linear development trajectories towards higher levels of 'readiness'*" (Bernstein et al. 2022, p. 3). Their Societal Readiness Thinking Tool dispenses with levels and "*encourages double-loop learning"* (p. 6).

Research on doctoral impact draws mostly on professional doctorates (Boud et al. 2018; Keegan, Brown & O'Hara 2026). For industrial doctorates, a review of 54 studies found "*no quantitative longitudinal studies"* (Compagnucci & Spigarelli 2025, p. 1086). Impact is carried by people at least as much as by results (Boud et al. 2021). Graduates are a main channel of benefit from publicly funded research (Salter & Martin 2001), and knowledge circulates with the scientists (Zellner 2003). Pathways are seldom linear (Mowbray & Halse 2010; Boud et al. 2018). Workplace impact depends on students´ motivations, employers and programmes (Creaton 2021, p. 274). Measuring impact has its own hazards, as pathway-to-impact statements invite exaggeration (Chubb & Watermeyer 2017) and indicators tend to displace the goals they stand for (Wilsdon et al. 2015).

Doctoral QA follows a different logic. The Salzburg principles place original research at the core of the doctorate and treat candidates as early-stage professionals (EUA 2005), a premise that holds less firmly

for professional and industrial doctorates and not at all for vocational qualifications at EQF level 8 (Council for the European Union 2017). The ESG ask institutions to assure the environment and processes of programmes through periodic review (ESG 2015). The ARDE project found institutional doctoral QA concentrated on admission, supervision and progression rather than on outcomes (Byrne, Jørgensen & Loukkola 2013). Peers assess the thesis, and impact enters this system, if at all, as a feature of the environment and of the candidate's development, without being graded itself. At the level of competences, ResearchComp lists '*making an impact'* among its seven areas (European Commission 2023).

3. Corpus and method

Framework selection

As readiness frameworks are issued mainly by funders, agencies and standards bodies, we used grey-literature methods that combine targeted searches of issuing organisations with expert knowledge (Godin et al. 2015). We searched documents of funders and agencies in Europe, the United States and Australia, drew candidates from overview literature on readiness scales (Héder 2017; Olechowski, Eppinger & Joglekar 2015; Bernstein et al. 2022) and followed references backwards (citation chasing). In heterogeneous fields, such routes locate sources that database searches miss (Greenhalgh & Peacock 2005).

Figure A1 in the Annex reports the flow after PRISMA 2020 (Page et al. 2021). The 28 candidates were screened for ordered levels or rated dimensions of readiness and for a public primary text from the issuing body, following documentary criteria of authenticity (Scott 1990; Bowen 2009). The fourteen that remained were assessed for documented real-world application and for a distinct readiness logic, sampled for maximum variation (Patton 2015) across three families of three. The System Readiness Level (Sauser et al. 2008) was coded and then removed, since its documented application is limited to one programme. Seven supporting texts informed interpretation without being coded.

Framework	Issuer and version (source)	Readiness of what	Documented application (source)
A Scientific, technological and manufacturing maturity			
Scientific Readiness Levels (SciRL)	ESA; handbook, issue 2.0, 2023 (ESA 2023a)	Science behind an Earth observation mission	Earth Explorer 12 call: evidence of current level; SRL 4 after Phase 0, SRL 5 by end of Phase A (ESA 2023b)
Technology Readiness Levels (TRL)	NASA; white paper 1995, edited 2004 (Mankins 1995)	A technology	Horizon Europe topics; EIC Accelerator requires at least TRL 5, targets TRL 6 to 8 (European Commission 2025d)
Manufacturing Readiness Levels (MRL)	US DoD, OSD ManTech; deskbook, version 2025 (OSD ManTech 2025)	Manufacturing capability and risk of an organisation	Manufacturing readiness assessments required throughout DoD acquisition (IDA 2022)
B Market, commercial and adoption readiness			
Market & Commercial Readiness Level (MCRL)	Clean Energy Transition Partnership; assessment canvas (CETP 2024a)	Key exploitable result and its business	CETP calls: initial and target MCRL per KER, updated annually (CETP 2024b)
Commercial Readiness Index (CRI)	Australian Renewable Energy Agency; 2014 (ARENA 2014)	A technology class in its market	ARENA funding guidance (RD&C Program Guidelines 2025, Appendix A) (ARENA 2025)
Adoption Readiness Levels (ARL)	US DOE, Office of Technology Commercialization; 2025 (US DOE 2025)	Adoption risks of a solution	DOE programme design, investment and risk decisions; OCED portfolio; PNNL pilot (US DOE n.d.)
C Human, societal and innovation readiness			
Human Readiness Levels (HRL)	ANSI/HFES; standard 400-2021 (ANSI/HFES 2021)	A system's fitness for human use	US Army and FAA work; DoD adoption in preparation (2022) (JHU APL 2022)
Societal Readiness Levels (SRL)	Innovation Fund Denmark; level definitions, undated (Innovation Fund Denmark n.d.)	Societal adaptation of a solution	Grand Solutions applications state start and end TRL and SRL (Innovation Fund Denmark 2018)

KTH Innovation Readiness Level (KTH IRL)	KTH Innovation; version F, 2025 (KTH Innovation 2025)	A research-based idea and venture, in six dimensions	DTU, under licence, assesses and ranks invention cases (DTU n.d.)

Table 1. The nine frameworks by family: issuer and version, object of readiness and documented application (retrieved 2026/10/23). ESA abbreviates its Scientific Readiness Levels as SRL. SciRL is used here to keep them apart from the Societal Readiness Levels.

Codebook

Following structured qualitative content analysis (Kuckartz & Rädiker 2023), the codebook combined deductive codes from research on readiness and doctoral impact with refinements from a pilot. The descriptive dimension records what each framework says about itself: the object and meaning of readiness, progression logic, evidence, assessment mode, stakeholder entry and the place of people. The interpretive dimension reconstructs the implicit theory of impact (mechanism, carrier, agents, context, timing, attribution) and the guiding metaphors, identified with the Metaphor Identification Procedure (Pragglejaz Group 2007). The evaluative dimension applies twelve criteria derived from research on doctoral impact and its quality assurance (Table 2). For each criterion a framework was judged explicit, adaptable, silent or in tension, and marked tentative where readings diverged. 'Explicit' requires that the framework address the content of the criterion, whether or not it refers to doctoral settings. A synthesis code collected elements transferable to doctoral QA.

Coding procedure

A pilot coding of two readiness frameworks by a co-author refined codes and rules. The coding followed an approach of human-led, AI-assisted interpretation (Lieder & Schäffer 2026; Schäffer, Lieder & Krämer 2026), in which machine-generated classifications (Claude Opus 5.5, 2026/09/22) serve as an initial analytical input and remain subject to human review and curation. The AI was not treated as an independent interpretative agent. Every code received a value, an anchor and a rationale. Each entry in the coding table was checked against the source document. A second author re-examined all evaluative judgements. Divergences concentrated on timing (EV-D1) and pathway shape (EV-B2) and were resolved by tightening the rule for EV-D1, under which 'explicit' now requires that impact be assessed after the end of a project, and by marking the remaining split readings as tentative (Figure A2). The analysis treats the frameworks as texts, in English-language versions from 1995 to 2025, and leaves their use in practice beyond the documented application aside. Quotations from the frameworks cite their primary texts in Table 1.

Evaluative Criterion	Anchor in literature on doctoral impact
Breadth of impact (EV-A1)	Doctoral impact comprises "outcomes, benefits and returns that include, but are not limited to, economic returns" (Halse & Mowbray 2011, p. 514; in the same vein: Kumar 2014). It takes instrumental, conceptual and capacity-building forms and, in graduates' own accounts, carries career, skills, social and personal value (Bryan & Guccione 2018).
Levels and actors (EV-A2)	Impact concerns "individuals, organizations and institutions participating in various phases of the doctorate" (Halse & Mowbray 2011, p. 514, in the same vein Kumar & Dawson 2013): candidates, supervisors, programmes and the awarding institution, partner and employing organisations, professions and fields, the labour market, society.
Person as carrier (EV-B1)	Impact arises less from the products of the doctorate than from the "processes and habits of mind engendered in the doctoral process" (Boud et al. 2021), and capacity is built "whatever the outcome of the research project" (Davis & Frame 2016, p. 34). For PhDs generally, skilled graduates are a main channel of benefit (Salter & Martin 2001) and knowledge transfer is embodied in people who move (Zellner 2003).
Pathway shape (EV-B2)	Doctoral influence has a "multi-level and at times indirect nature" and resists "simple cause-and-effect or input-output models" (Boud et al. 2018). Mowbray & Halse (2010, p. 654) reject the assumption of "a seamless, linear transference from instruction to mastery and workplace application".
Receiving context (EV-C1)	Workplace impact is "shaped by three interrelated factors: the motivations of students, the role of their employer and the nature of the programme" (Creaton 2021, p. 274). Continued sponsorship after completion mattered more than "notional engagement through funding the project or facilitating access to participants" (p. 286). For HE-based candidates the receiving context is the university and future employers.

Doctoral environment (EV-C2)	The programme shapes impact through design, supervision and community: projects identified at entry, learning agreements, supervision as facilitation. The cohort is possibly "the biggest impact" in the eyes of programme leaders (McSherry et al. 2019). Supervisors' own learning and, in industrial doctorates, the rules of selection, supervision and evaluation also matter.
Timing (EV-D1)	Some effects appear early, so impact should be explored "during a professional doctoral program, before as well as after students begin their dissertation research, and after students graduate" (Kumar 2014, p. 3). Others emerge later: reporting at graduation "*would have identified far less impact*" (Boud et al. 2021).
Evidence compatibility (EV-D2)	Evidence of doctoral impact is mostly narrative and self-reported. Candidates are "not necessarily the best placed to be objective about the impact they are having" (McSherry et al. 2019), yet self-reports "encompass tacit impact of which researchers might not be aware" (Kumar 2014, p. 17). Triangulation is possible through CVs, employer accounts and register data.
Attribution (EV-D3)	Whether doctoral work drove change or accompanied it is often "impossible to determine" (Boud et al. 2021, p. 13); in one graduate's words, "the research is being implemented but not acknowledged" (Creaton 2021, p. 280).
Knowledge and disciplines (EV-E1)	Doctoral knowledge includes practice-based, professional and artistic knowledge; disciplines "are necessary but are not always sufficient to support real world developments" (Armsby, Costley & Weller 2021). Opportunities for visible non-academic research careers differ by discipline and institution (Hancock 2023).
Reflective use (EV-F1)	Reflection is central to professional doctorates, and making impact explicit in supervision is recommended (Davis & Frame 2016); reflection that is assessed risks becoming performative (Cranfield, Boud & Costley 2025).
Metric risk and safeguards (EV-F2)	Indicators invite opportunism and goal displacement (Wilsdon et al. 2015), and pathway-to-impact statements encourage exaggerated claims (Chubb & Watermeyer 2017).

Table 2. Evaluative criteria (dimension 3) and their grounding in research on doctoral impact and its quality assurance.

4. Results

Framework alignment with doctoral impact literature (RQ1)

No framework meets all twelve criteria (Figure A2, Annex). Correspondence is strongest where impact depends on conditions outside the research. Every framework except TRL addresses the receiving context explicitly (EV-C1), most contain elements adaptable to the doctoral environment (EV-C2) and recognise several levels and actors of impact (EV-A2), and all nine lend themselves to reflective use (EV-F1). Evidence regimes are largely compatible (EV-D2), with TRL and CRI in tension.

Correspondence is weakest where doctoral impact differs most from that of an artefact. Only the KTH IRL treats persons as carriers of impact (EV-B1). Six frameworks leave attribution unaddressed (EV-D3), seven are in tension with the range of knowledge a doctorate may produce (EV-E1), and six with a broad notion of impact (EV-A1). Seven are in tension with the risks of metric use (EV-F2). ARL alone confronts them, warning against "*the lack of nuance that comes with false precision*" (p. 13). Pathway shape divides the frameworks: only the three profile-based frameworks and MRL accommodate uneven progress (EV-B2).

On timing (EV-D1), most frameworks allow repeated assessment, but only two look at impact after a project has ended. CRI observes a sector over years and can trace "*the historical policy journey of technologies"* (IEA-RETD 2017, p. 28); HRL requires that "*upon fielding, human systems experts systematically monitor the system*" (ANSI/HFES 2021, p. 17). The KTH IRL could be adapted, since its top level describes an organisation that "*is maintained, develops, and performs over time"* (KTH Innovation 2025, p. 11). The others end with flight proof, full-rate production, a launch plan or the close of the project. SciRL, coded as adaptable, is a boundary case: its top level, "Science Impact Quantified" (p. 23), falls during or after the mission's final phases yet stays within the mission's own life cycle.

Elements that can inform doctoral QA (RQ2)

The most obvious element is the inventory of contextual factors the frameworks assemble. They name customer needs, funding, workforce, facilities, supply chains, company maturity, employers' capacity to

absorb new knowledge, regulation, competitors, adoption risks and partnerships. MRL requires "*an assessment of the required skills, availability, and number of personnel*" (p. 12), CRI rates stakeholder acceptance as "*the maturity of the process for evidence-based stakeholder consultation*" (p. 6), and ARL counts as a risk a value chain whose "*benefits do not accrue to critical decision makers / gate keepers*" (p. 6). For a doctoral programme, such lists show what partners and environments must contribute before impact can occur.

Many instruments also take a reflective form. Some consist of questions, such as SciRL's "*Has user feedback been collected and analysed?*" (p. 21). In others the level descriptors can be turned into questions without loss of meaning, and the MCRL canvas asks users to list "*the actions required to advance to the next MCRL*" (p. 1). Asked in a candidate's self-assessment or in a supervision meeting, such questions can open a conversation about impact (without scoring it).

Seven frameworks distinguish the actors involved in creating impact: the individual innovator, the team, the organisation, partners and investors. They appear mostly as sites of risk or as preconditions, as when the KTH IRL requires that "*at least one champion (driver and committed to take the idea forward) is present*" (p. 12), and seldom as places where impact occurs.

Profile-based frameworks keep dimensions apart. CRI, ARL and the KTH IRL rate their dimensions side by side, and MRL assesses its threads separately without a single aggregate: in CRI, the overall status "*does not require each of the individual Indicators to be at the same level*" (p. 4). Uneven progress thus remains visible.

Less aligned elements

In every framework except the KTH IRL, the vehicle of impact is knowledge, usually in the form of technology. TRL assesses "*the maturity of a particular technology*" (p. 1). The KTH IRL also locates readiness in people, with a team scale that runs from "*Defined needed competencies (and plan for finding them)*" (p. 11) to "*continuous learning and staff development*" (p. 12). HRL, by contrast, places "*the current physical or mental readiness of human operators*" outside its scope (p. 1). Attribution is equally thin. SciRL attributes impact to the mission through "*a data denial experiment*" (p. 29), and CRI alone offers a contribution logic, in which "*an individual project will not raise the overall Status Summary but rather will increase an Indicator/s*" (p. 4).

Seven frameworks presuppose technological knowledge (EV-E1). HRL and SRL are more open: HRL accepts that "*basic human research may be conducted at HRL 1 with no immediate goals to invent practical applications or technological solutions*" (p. 8), and SRL extends readiness to "*a particular social project […] an intervention, or an innovation (whether social or technical)*" (p. 1). Many frameworks also picture impact as a line from an idea to a commercialised product, ending in a system "*flight proven*" (TRL, p. 1), a "*Final Go-to-Market Strategy*" (MCRL, p. 2) or a "*Business model proven to meet expectations on profit, growth and sustainability*" (KTH IRL, p. 7).

The imagery shifts with the object of readiness: from maturity and ascent in family A to terrain and movement in family B, where "*valleys of death*" lie on the way and unresolved challenges can "*derail a technology solution*" (ARL), and to fit in family C, where solutions are "*to be integrated into society*" (SRL, p. 1).

5. Discussion: readiness-informed quality assurance of doctoral impact

Read against the results, readiness-informed doctoral QA (RQ3) would need a person-centred dimension, for which the KTH IRL's team scale and ResearchComp's "*making an impact*" (Section 2) offer starting points. It would need a contribution logic in place of attribution (Reed et al. 2021), as in CRI, which credits a project with the indicators it moves. Its time horizon would have to extend beyond

graduation, as HRL's monitoring after fielding does for systems. Graduate tracer studies would be the doctoral counterpart. And it would need a wider register of knowledge and of settings than any of the nine provides: practice-based, professional and artistic knowledge, and effects on candidates, supervisors, organisations and professions.

Behind these conditions lie structural differences between the two logics (Table 3). Readiness frameworks judge an object at a decision point for a funder or investor. Doctoral QA judges a person and a process, formatively in supervision and summatively once, by peers (EUA 2005; ESG 2015). What doctoral QA can borrow is the explicit inventory of contextual preconditions and the habit of naming who must contribute before impact can occur. The frameworks, in turn, would gain from treating people as carriers of impact, crediting contribution, looking beyond the end of the project and keeping formative and summative judgement apart.

	Readiness frameworks	Doctoral QA
Unit of readiness	An object: technology, organisation, market or venture	A person and a process
Moment of judgement	Gates at decision points; levels reported annually	A trajectory of supervision and progress review; one final examination
Evidence	Self-declared levels backed by tests and documents	Peer judgement of originality and rigour
Credit	Results attributed to the project	The candidate's own contribution as condition of the degree
Purpose	Allocation of funding, investment or acquisition	Development and certification of a researcher

Table 3. Two logics: structural frictions between readiness frameworks and doctoral QA.

The frameworks also hold four safeguards against metric misuse, though none combines them: non-applicability (ARL), purpose limitation (SciRL levels "*cannot be used to compare the importance or relevance of one particular scientific discipline or its value to another*", p. 4), profiles instead of single scores (CRI, ARL, KTH IRL) and proportionality (MRL, ARL, HRL). Readiness-informed doctoral QA could adopt all four.

Candidates in readiness-governed projects meet these frictions most directly. CETP asks partners to "*Determine the initial and target Technological, Societal, and Market & Commercial Readiness levels of each KER"* (CETP 2024b, p. 8), and Horizon Europe topics name expected TRLs (European Commission 2025c), so a doctoral project in such a consortium inherits targets set for the project. Tensions follow: project levels are reported annually, whereas doctoral impact often shows after graduation. Credit for readiness gains is open to dispute, which is why the KTH IRL requires that "*Inventors/creators are clarified"* (p. 10). In industrial doctorates the candidate's need to publish collides with the partner's interest in secrecy and in intellectual property.

The frameworks themselves suggest how the two logics can coexist. Contribution logic (CRI), parallel tracks (HRL, where human systems work *"may safely precede technology development efforts"*, p. 8), non-applicability (ARL) and profiles (KTH IRL) allow a candidate's contribution to a project's readiness to be documented without becoming a criterion for the thesis. Supervision agreements could state the project's readiness expectations, the candidate's expected contribution and the separation of thesis assessment.

Uses should also match the level of QA. For the individual candidate, readiness questions belong in supervision and progress review, as dialogue. At programme level, the readiness of the environment, with its partners, funding and support, can enter internal review, and external QA can ask for descriptive reporting without ranking, as part of the periodic review the ESG already foresee (ESG 2015, Standard 1.9; Standard 1.2 in the draft ESG 2027).

6. Conclusion

Readiness frameworks give doctoral QA a vocabulary for the conditions and pathways of impact: contextual factors, actors, questions for reflection and profiles that keep dimensions apart. For the person, who carries much of a doctorate's impact, they offer little, and their horizon mostly ends with the project. Their forward-looking logic is still instructive: doctoral QA could attend to readiness for impact, building it in candidates and reviewing it in environments, and leave realised impact to later study. Their value lies in structured dialogue between candidates, supervisors and partners, provided the safeguards are retained and thesis assessment stays separate. Mapped onto the levels of QA, this suggests a heuristic for discussion: assess the environment, develop the person, never grade the pathway.

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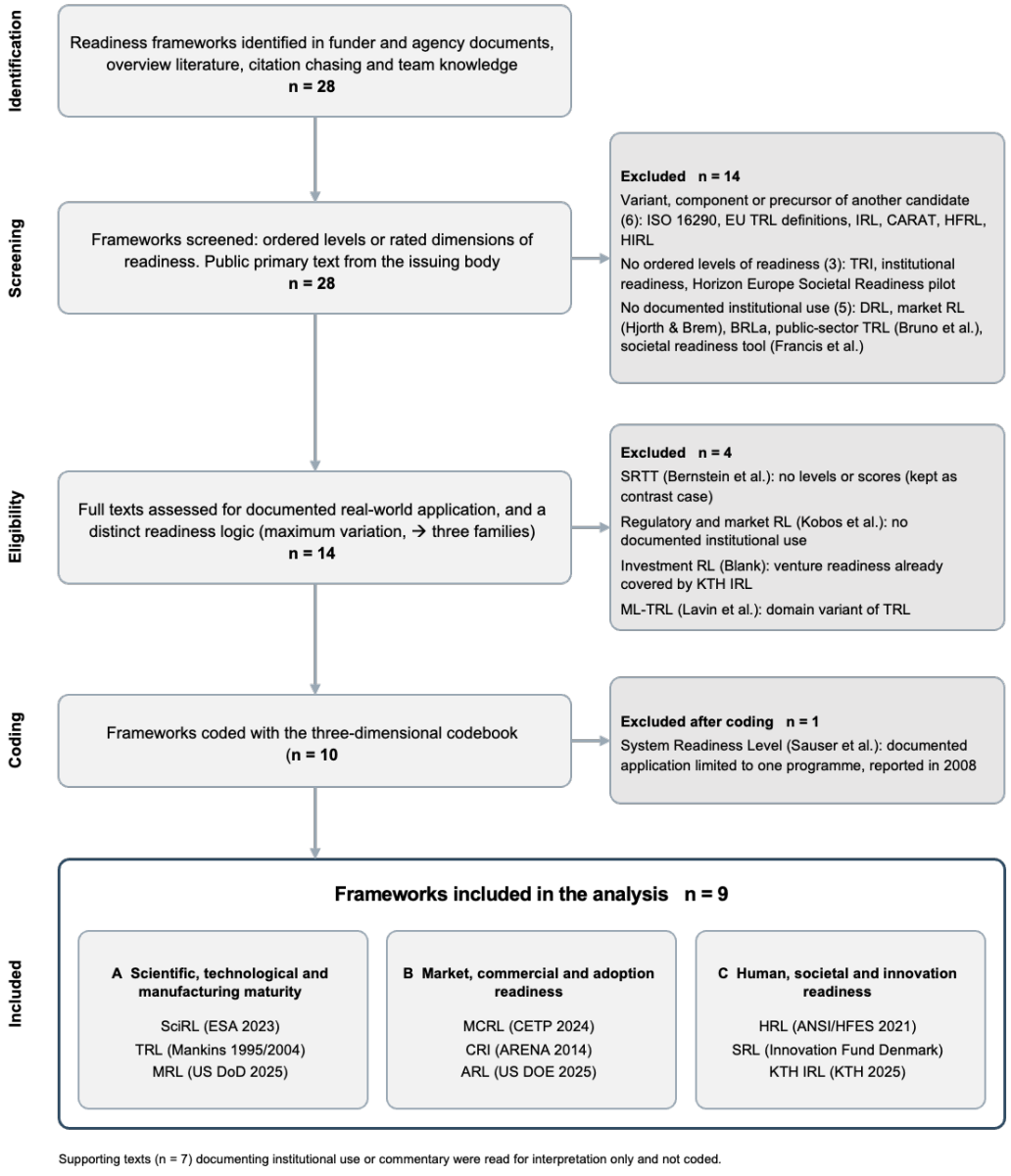
Annex

Figure A1. Selection of readiness frameworks (PRISMA-flowchart, after Page et al. 2021). Sources of the included frameworks as in Table 1. Excluded candidates are listed with their sources.



Supporting texts (n = 7) documenting institutional use or commentary were read for interpretation only and not coded.

Figure A2. Judgements for the nine frameworks on the twelve evaluative criteria (E = explicit, A = adaptable, S = silent, T = in tension; * = split or tentative reading).

E Explicit A Adaptable S Silent T In tension * split or tentative

	Family A			Family B			Family C		
Criterion	**SciRL**	**TRL**	**MRL**	**MCRL**	**CRI**	**ARL**	**HRL**	**SRL**	**KTH IRL**
EV-A1 Breadth of impact	E*	T	T	T	T	T	A	A	T*
EV-A2 Levels and actors	A	S	A	A	A	A	A	S	A
EV-B1 Person as carrier	A	S	A	A	A	A	T*	S	E
EV-B2 Pathway shape	T*	T	A*	T*	A	A	T*	T*	A
EV-C1 Receiving context	E	S	E	E	E	E	E	E*	E
EV-C2 Doctoral environment	A*	S	A	A	A	A	A	S	A*
EV-D1 Timing	A*	T	S*	S*	E*	S*	E	S*	A
EV-D2 Evidence compatibility	A	T	A	E	T*	E	A	A	A
EV-D3 Attribution	T	S	S	S	E	S	S	T	S
EV-E1 Knowledge and disciplines	T*	T	T*	T*	T*	T*	A*	A	T*
EV-F1 Reflective use	E	A	E	E	A	E	E	A	A
EV-F2 Metric risk and safeguards	T	T	T	T	T	E	T	T	A

Codes and criteria as in Table 2. EV-D1 follows the revised rule: explicit only where impact is assessed after the end of a project.