Salvador-Carulla, Luis, Lukersmith, Sue, Woods, Cindy, Alonso-Trujillo, Federico and Chen, Tom (2026) *A taxonomy of the process in implementation science: the Global Impact Analytics Framework (GIAF).* Implementation Science Communications 7 .

A taxonomy of the process in implementation science: the Global Impact Analytics Framework (GIAF)

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Abstract

Background Despite growing global efforts to evaluate the impact of research, there remains a lack of practical, standardised tools to assess implementation in the real-world.

Aim This study introduces a comprehensive implementation taxonomy for use in impact evaluations based on onto-terminology principles.

Methods This work is part of the Global Impact Analytics Framework (GIAF) program. An international expert panel of 32 members developed the taxonomy using nominal group techniques and an iterative refinement process. The design was informed by the Technology Readiness Levels for Implementation Sciences (TRL-IS) to ensure its relevance and application across the life cycle of implementation. Case studies have been conducted in ten countries and the knowledge gained from practical experiences has been incorporated into the taxonomy.

Results The GIAF taxonomy outlines 82 subdomains organised across 15 domains and three sequential implementation phases. The Initiation phase captures early preparatory steps before real-world use, including planning, engagement, and pre-readiness. The Maturity phase focuses on early implementation and real-world demonstration studies, covering the initiative's readiness (from demonstration to release), dissemination, usability, adoption, and uptake. The Evolution phase refers to later-stage activities once the intervention or tool is fully implemented, with domains encompassing sustainability, diffusion, prolongation, expansion, diversification, exporting, and de-implementation. The taxonomy is supported by tools including a glossary and practical checklists to guide consistent application.

Conclusions The GIAF taxonomy offers a structured, detailed, and flexible toolkit for evaluating implementation processes using mixed methods and across diverse projects and settings. It supports both quantitative scoring and qualitative insight to inform cross-context comparison and learning. By clearly defining and measuring these processes, it enhances the rigour, replicability, and comparability of implementation research and practice. The taxonomy also supports comparative effectiveness analyses of implementation strategies. This comprehensive approach addresses a critical gap in the implementation science field, contributing to stronger evidence-based practices, health and social care programs, and research globally. The GIAF toolkit provides researchers, evaluators, and other decision-makers with a practical resource for assessing implementation impact. It can also support planning processes and, through learnings from assessment results, help improve future implementation efforts.

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Contributions to the literature

- Although many frameworks describe implementation outcomes, few provide a common structure for evaluating how implementation processes unfold across phases and settings.
- The GIAF taxonomy responds to this gap by offering a practical, ontology-informed classification of implementation domains, supported by a glossary and tools for consistent application.
- The framework enables researchers, funders, and practitioners to compare implementation processes across diverse projects, contexts, and sectors.
- By distinguishing process impact from intervention outcomes, GIAF improves transparency and supports cumulative learning in implementation research.

Background

There is growing demand for evaluations that can demonstrate the real world impact of research, particularly in health and social care contexts [1, 2]. In the theory of change, evaluation theories, models and frameworks typically focus on the resources and the results concerning outcomes for individuals, and less on the implementation processes [3]. Despite this demand, there has been limited progress in developing tools that support consistent, comparative assessments of impact across diverse and complex projects and implementation settings. Most current approaches rely on project-specific narratives or subjective scoring systems – often referred to as "narratives with numbers" – which combine qualitative accounts of success with basic impact ratings [4, 5]. While this approach has been endorsed by major national and international funders [6–9], it often lacks the structure needed for rigorous comparison and replication. These limitations constrain evaluators, especially when comparative effectiveness analysis is required to assess not only whether a program works, but *how well it was implemented*, and whether differences in implementation influenced the outcomes observed [10–13].

To support clarity and consistency, we use the following definitions throughout this paper.

As a field, implementation science is the study of the application of policy, programs, services, interventions for real world use in practice or community settings. Implementation research seeks to understand the planning, process and actioning of the implementation, and thereby improve the processes that shape successful uptake. The process includes the strategies, activities, and contextual factors that influence whether, how, and to what extent an intervention is delivered as intended. In this context, impact refers to the effects of the implementation process—for example, whether implementation led to sustained adoption, appropriate adaptation, or meaningful change within a system. Clarifying the distinction between the impact of an intervention on the individual (e.g. improvements in a measure of depression) and the impact of its implementation is essential. Yet, current approaches often lack the framework and toolkit to evaluate how implementation processes themselves contribute to observed outcomes for the individual.

Two major challenges lie behind this impasse. First, the focus on results has overshadowed a detailed analysis of the process of implementation—whether during a research project or in real-world program delivery [8]. Outcomes are central indicators of implementation [11], but they should be measured together with the process involved in achieving them. A detailed description of implementation is necessary to trace the chain of events that lead to outcomes, and to uncover the underlying mechanisms that enable causal inference [14]. Moreover, high-quality implementation – characterised by fidelity, acceptability, reach, and local adaptation – is often a precondition for achieving meaningful and sustained impact. In this sense, implementation is not only instrumental to impact but also a core component of it. While there is a wide range of outcome measures across projects, the methods used to achieve those outcomes should be more consistently described and then measured to allow for meaningful evaluation and comparison across projects.

Second, there is a persistent lack of terminological clarity and standardisation in implementation science [15]. Researchers use diverse and overlapping terms to describe strategies (e.g., methods, interventions, models) and processes (e.g., diffusion, dissemination, reach, translation), leading to a "Tower of Babel" effect [16]. Over a decade ago, Powell et al. identified 68 discrete implementation strategies and grouped them into six process categories [17]. Yet confusion persists, exacerbated by the expansion of the field and inconsistent use of terms across studies. This review identified over 100 definitions of the term 'research impact' [17] indicating the wide heterogeneity of implementation frameworks. Nilsen classified frameworks into three major aims—process guidance, explanatory models, and evaluation

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frameworks—but noted that few span all levels or support comprehensive measurement [18]. A scoping review conducted by our team identified 71 papers describing different theories, frameworks and models relevant to impact evaluation [3], yet most lacked a focus on process or did not offer operationalised measures for implementation.. The review identified ten frameworks deemed comprehensive, covering at least two phases (e.g., initiation and maturity) and five components. However, it did not identify a framework that encompasses major phases of implementation nor included a sufficient number of key components in each phase to complete a full evaluation of the process of implementation from an operational perspective [3]. While frameworks like RE-AIM [19] and Consolidated Framework for Implementation Research (CFIR) [20] identify key domains, none provide a unified structure for evaluating implementation across phases nor service sectors.

This underscores the need for a common taxonomy to support clear consistent communication and cumulative learning in implementation research. Taxonomies help organise knowledge through clearly defined concepts and standardised definitions, and their role in improving shared understanding is well recognised [21]. A standardised taxonomy would help harmonise language, enable cross-study comparisons, and ultimately strengthen the credibility, reproducibility, and scalability of implementation evaluations.

The aim of this paper is to introduce the Global Impact Analytics Framework (GIAF), a taxonomy of impact analysis in implementation research that emphasises the implementation and delivery processes of health and social care interventions across three key phases of implementation science: initiation, maturity and evolution. Developed, tested, and validated through a multistage process and applied in multiple studies and settings, the GIAF provides a sequential structure for categorising implementation domains, a glossary of agreed terms, and a standardised method for data collection and impact analysis. It is intended to be used not only by researchers and evaluators seeking to design, analyse, and report implementation studies with greater rigour, but also by policymakers, funders, program managers, and practitioners who require a practical tool to plan, assess, and strengthen implementation in real-world contexts. The GIAF is part of a broader international initiative led by the Mental Health Policy Unit at the University of Canberra (Australia), and the Psicost Scientific Association (Europe), with the aim of enhancing the rigour, transparency, and comparability of impact evaluation in real-world implementation.

This paper provides an overview of the full 10-year development process of the GIAF. Within this paper, we report in detail on the development of the taxonomy and international glossary of terms. Other components of the program, such as the domain-specific checklists, are being published separately [22].

Methods

The method for the taxonomy development using an onto-terminology approach, co-design and external validation by experts, testing, and validation followed the Technology Readiness Levels (TRL) adapted to implementation sciences (TRL-IS) [22]. TRL is a globally accepted approach for assessing the maturity of research development. It defines nine levels of development grouped in four major functions. These include:

a) Prototyping: foundational knowledge and frameworking (Level 1), formalisation of the knowledge base (e.g., scoping reviews, identification of concepts, analysis of barriers and facilitators) (Level 2), proof of concept (Level 3), and prototype (Level 4);
b) Evaluation and piloting: validation (Level 5), piloting in a relevant environment (Level 6);
c) Demonstration in real world environments (Level 7);
d) Deployment: pre-release and release or commercialisation (Levels 8 and 9).

The steps followed in the development of the GIAF taxonomy are shown in Table 1. The development process has taken place over 10 years (2015–2025) (Fig. 1). Apart from the taxonomy and the international glossary of terms, this process included the development of checklists to evaluate every domain and subdomains. The glossary and these additional tools are being published in separate papers [22].

Technology readiness levels 1–4 prototyping [3]

A sequential taxonomy is an ordered classification framework in which categories are arranged to signify a logical or developmental sequence. Each level typically represents a stage that follows from and extends the one before it, forming a cumulative or stepwise structure that supports interpretation of progress [22]. In developing such a taxonomy, logic rules are applied to structure categories, define relationships, and establish sequencing. For example, the rule < is a > indicates the type of category and it is formalised in the glossary of terms. The rule < part of > defines parent, sibling or child relationships, and underlies the hierarchical tree structure of the taxonomy. For example, Initiation is a parent category of planning, engagement and pre-readiness, and proof of concept is a children category of pre-readiness. Likewise,

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Table 1 Steps followed in the GIAF Taxonomy development based on the Technology Readiness Levels in Implementation Science (TRL-IS)

Steps in the development of the GIAF Taxonomy based on the Technology Readiness Levels in Implementation Science (TRL-IS)		
TRL-IS Level 1 Basic principles	Prior knowledge base established. Gaps and unmet needs identified from existing frameworks. Two scoping reviews conducted	2015–2024
TRL-IS Level 2 Concept formulated	Synthesis and formulation of foundational knowledge critiqued and reviewed. Scoping reviews published	2020–2025
TRL-IS Level 3 Proof of concept	Proof of Concept of Taxonomy developed incorporating three phases of implementation; Initiation, Maturity, and Evolution with their own domains and subdomains. Workability appraised	2020–2021
TRL-IS Level 4 Prototype development	Alpha version of GIAF taxonomy produced and tested internally to resolve issues, identify gaps, redundancies, and inconsistencies	2020–2021
TRL-IS Level 5 Validation of prototype	Refinement of domains and sub-domains within the sequential arrangement of the GIAF taxonomy. Feasibility of the Beta version tested and validated	2021–2022
TRL-IS Level 6 Tested in a relevant environment	Piloted with expert panel. Consensus reached on domains and sub-domains within the sequential arrangement and usability validated	2022
TRL-IS Level 7 Demonstrated in the real world	GIAF impact analysis demonstrated with 13 real-world case studies. Two protocols and 12 results papers (including a thesis) published (Table 5)	2017–2025
TRL-IS Levels 8 & 9 Pre-release and release	IP agreement completed and GIAF made available for non-commercial use. Training materials developed and training course conducted	2024
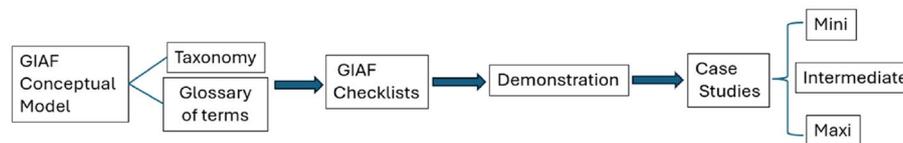
Fig. 1 Steps in the development and demonstration of the GIAF (2015–2025)

proof-of-concept (PoC) and prototyping are sibling categories of pre-readiness, but PoC < precedes > prototyping, that < follows > PoC. When formalised as an ontology, this structure includes clearly defined relationships and decision rules that enable consistent application, comparison across settings, and potential use in digital tools or automated evaluation systems [37, 38]. This also requires a glossary of terms that is unambiguous, clear and lists mutually exclusive terms [21]. This taxonomy does not include the rule of causality < if then >, that indicates conditional relationships.

The onto-terminology approach combines a taxonomy with a glossary of terms to enhance clarity and consistency in the representation of concepts within a specific domain. It emphasises the integration of precise definitions and formally defined relationships among terms to support shared understanding and improve communication in health and social research and practice [47, 48]. In this case, the glossary of terms was developed and refined through a nominal group process to achieve expert consensus [49], ensuring that all stakeholders operate from a shared understanding of key concepts.

These logic rules guided the design and development of the GIAF taxonomy, structuring domains and subdomains, defining hierarchical relationships, and sequencing across the three implementation phases. While not represented as standalone features in Fig. 2, they underpin the organisation of the phases and domains, ensure internal consistency, and lay the groundwork for future ontological formalisation and potential digital applications.

Development of the prior knowledge base included a summary review of the previous studies using components of the taxonomy and the scoping of existing frameworks and related tools [3]. This process provided a rationale for why a new taxonomy and its related tools are needed in the field.

Overall, 6,677 articles were identified through database searching, and 31 through hand searching and prior knowledge. After duplicates were removed and title/abstract and full text screening, 71 articles were included in the review. Our final categorisation of the seminal theories, models, and frameworks were theory ($n = 6$), models (14), and frameworks ($n = 51$). The frameworks were mostly typologies ($n = 50$) and one limited taxonomy comprising of eight implementation outcomes and glossary of terms [11]. For clarity, theories explain causal relationships, frameworks organise

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concepts without implying causality, and models visually represent either theories (explanatory) or frameworks (descriptive). Although several conceptual frameworks were identified that guide the assessment of research impact, these primarily focus on resources and/or outcomes, emphasising cause-and-effect relationships or the overall value of programs and policies [6]. The scoping review identified a major gap in implementation research: the lack of effective methods for measuring both the implementation process and its impact. These findings are presented here as part of the methodological foundation for developing the GIAF, rather than as standalone results.

Meta-framework

The absence of a suitable taxonomy for analysing the impact of implementation research prompted the core research team to create a new meta-framework for classifying the domains and components involved in impact analysis. A meta-framework is an overarching structure that integrates multiple frameworks to guide research design, analysis and interpretation in multidisciplinary system-level design, and considers the implications for policy and practice. This iterative process commenced with the extraction of key concepts, elements, and components pertinent to impact analysis from the selected review articles, as outlined in Table 2.

Themes were generated and critically synthesised to develop a prototype taxonomy for impact assessment (IA) in implementation research. The taxonomy prototype was stratified by three identified phases of implementation research: initiation (preparation or pre-implementation); maturity (early implementation); evolution (later implementation) [50–52].

Expert panel

To ensure the taxonomy accurately reflected key aspects of implementation research and was interpretable by stakeholders, the prototype was subsequently reviewed and refined through a structured expert panel process. Nominal groups are a structured technique to reach consensus following a step-by-step process where participants receive a synthesis of the background information, key documents to be discussed, and a set of questions to facilitate the generation of individual thoughts and ideas that are shared and clarified collectively. The facilitated discussion ensures the experts talk through their ideas and concerns, which is then followed by a voting process.

Expert panel members were identified through the core team's professional networks and selected for their diverse disciplinary backgrounds, organisational roles, and their experience relevant to health and social implementation research. Individuals with recognised expertise in implementation science – such as health service planners, health economists, epidemiologists, policy analysts, psychologists, and psychiatrists – were invited via email to participate. Those who accepted the invitation were included in the panel. The expert panel comprising 32 subject matter experts (female = 56%, $n = 18$) on implementation research and planning from Australia ($n = 14$) and Europe ($n = 18$ from 7 countries – Austria, France, Italy, Netherlands, Spain, Switzerland, United Kingdom) -participated in the development, review, refinement, and consensus on the domains and subdomains of the maturity phase of the taxonomy. Digital conferencing was used to run the panels in two separate series, one in 2020–2021, and a second series of nominal groups in 2022.

The first series focused on the completion of the domains and subdomains of early implementation or maturity, along with an initial analysis of the initiation

Table 2 Key elements relevant for the development of a taxonomy of the process of Impact Analysis

Elements of Impact Analysis				
Implementation	Development (Incorporates stages and phases) • Preparation • Application • Analysis	Stages [2, 39] • Screening • Scoping • Appraisal • Evaluation	Phases [40] • Initiation (preparation) • Maturity (early implementation) • Evolution (late implementation) CDC [40, 41]: Planning Implementation Maintenance	
Framework	Conceptual frames [42] Process of care • Health care ecosystem (including the process of care) • Complexity • Strategies, barriers & facilitators.	Content [43] New (emerging) Scientific Knowledge • Applications: Plans/Services/ Interventions/Methods/Products	Components [44–46] • Resources • Process • Results	Domains - Initiation (Planning, Engagement, Pre-readiness) - Maturity (Readiness, Dissemination, Usability, Adoption, Uptake) - Evolution (Sustainability, Diffusion, Spread, De-implementation)

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and evolution phases. This work built on a Minimum Viable Product, an early version of the taxonomy developed by the core team in advance of the expert panel meeting to provide a foundation for structured feedback and refinement. The expert panel was divided into two groups based on geographic location (Australia and Europe). Two sessions were organised with each group (four sessions in total – 2 h duration each), alternating sessions between the two groups as a means of obtaining validation [53, 54]. The aims of the two sessions with each group were to reach consensus on domains and subdomains to be included and how they are arranged in a sequential taxonomy to allow standardised classification and to confirm the taxonomy was complete, reasonable, and feasible. The sessions were recorded to ensure all discussions were captured and the essence of discussions, comments, and amendments could be taken to the alternate nominal group for background context and further discussion. A fifth combined nominal group session (2 h duration) was undertaken to conduct a final review, prepare the final version of the Maturity phase of the taxonomy, and to confirm that all feedback from both nominal groups had been considered.

The second series occurred between June and July 2022. The purpose was to finalise phase 2, to review, refine, and reach consensus on the *process* domains and sub-domains of the initiation and evolution phases of the taxonomy; and to revise the evaluation tools related to the taxonomy. This phase involved 11 experts, a subset of the original group that participated in the first series, and maintained a relatively balanced gender representation, with six male and five female participants. This series followed the same process as the first series.

The outputs of the expert panels informed the iterative refinement of the GIAF. These details are included here as part of the methodological foundation for developing the framework, rather than being presented as standalone results.

Development of an evaluation toolkit

The GIAF evaluation toolkit was developed to enable structured, quantitative assessment of each domain and subdomain. For each major domain, a 7-item checklist was created. The toolkit supports multiple scoring approaches: ordinal scales for gradual, sequential progression; ladders for qualitative levels that may not be strictly sequential; and profiles for representing patterns across domains within an implementation phase rather than a single aggregate score.

Checklist items and scoring levels were derived from the Capability Maturity Model (CMM), a validated framework widely used to assess organisational and process maturity [55]. The CMM defines five maturity levels

based on key characteristics within a domain. For the GIAF, a preliminary "zero" level was added to indicate minimal or absent domain characteristics, and a sixth level was added. Items were generated by mapping each domain and subdomain to observable indicators corresponding to CMM levels, ensuring alignment with the theoretical framework.

The toolkit underwent iterative review by the research team to confirm clarity, relevance, and consistency. While formal pre-testing was limited, the tool was applied to exemplar cases during development to verify usability, interpretability, and appropriateness of the checklist items and scoring structure.

These preparatory activities established the knowledge base and consensus processes that underpinned the framework's development. The Results section that follows presents the outputs of this process—the GIAF taxonomy and its refinement.

Ethical considerations
Ethical approval for the work with the expert panel to develop the GIAF was granted by the Human Research Ethics Committee at the Australian National University in 2020 (#2020/768). When the team relocated to the University of Canberra the transfer of the ethical approval was granted on 29/4/2022.

All expert panel member participants gave written informed consent and completed a disclosure of interests declaration prior to taking part in the nominal groups. No potential conflicts of interest were raised.

Results
Taxonomy
Following the described iterative nominal group process, a revised and final sequential taxonomy of the domains and sub-domains was developed. Figure 2 illustrates the GIAF domains/sub-domains of the three phases of implementation (initiation, maturity, evolution).

The initiation phase marks the beginning of an implementation project (pre-implementation), and encompasses the initial idea, planning, prototype development and testing, engagement with stakeholders and pilot testing (Table 1). This phase includes planning, engagement, and pre-readiness activities. The maturity phase (early implementation) occurs when the application is implemented in a real-world setting or adapted and implemented in a new context. This phase includes the assessment of readiness, dissemination, usability, adoption, and uptake. The evolution phase involves the ongoing sustainability and diffusion of the application once the seminal study in the real world is completed, including spread: prolongation (extending), expansion

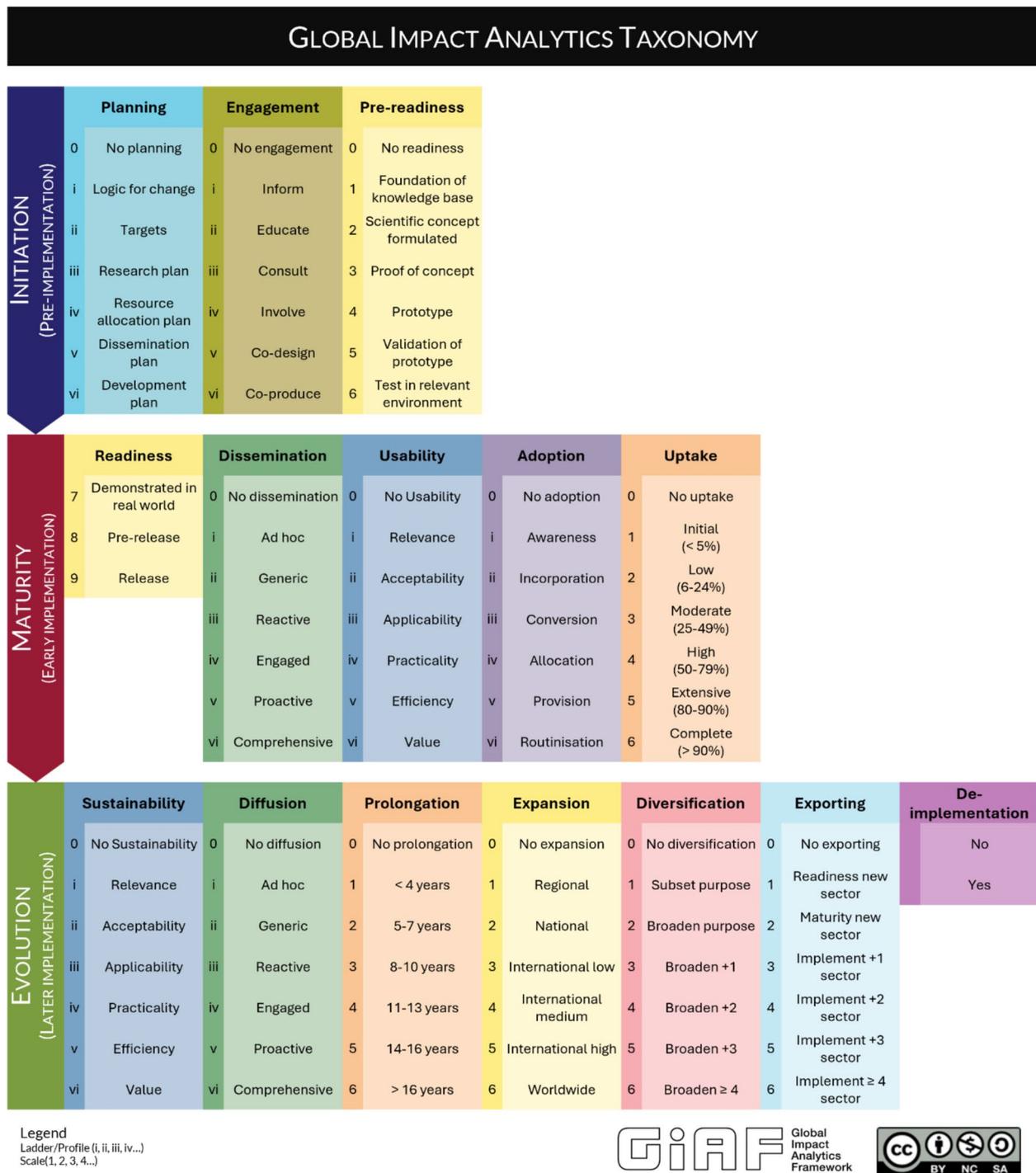Salvador-Carulla *et al. Implementation Science Communications* (2026) 7:26

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Fig. 2 GIAF phases, domains and sub-domains

(geographic), diversification (additional aims, new purpose), and exporting (to new sectors, target audiences, markets).

Definitions of domains

Using the agreed upon glossary definitions, the following table defines the GIAF phases and domains in each phase of implementation (Table 3).

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Table 3 Implementation phases, domains and GIAF glossary definitions

GIAF Phases and Domains	Glossary Definitions
Initiation phase domains	Initiation: The phase of starting an implementation project (pre-implementation) that includes the study of its planning, engagement and the pre-readiness of the prototype
Planning	Planning: Is the process of thinking and formalising in a written document, the steps and activities required to achieve an explicit goal. It includes deciding on the tasks in advance to achieve the implementation of a project; what, when, where, why and how and who will do the activities
Engagement	Engagement: Is a two-directional interaction and relationship between the sender (e.g. developers) and recipient (users) of the policy/program/service/intervention/product and its application (e.g. health program). It should increase the understanding of the new knowledge by the recipient and advance its implementation in the real world. It mainly describes the involvement of recipients throughout the whole development process
Pre-readiness	Pre-readiness: The level of preparedness of a policy/program/service/intervention/product, where the knowledge base is established, a scientific concept is formulated, there is proof of the concept, a prototype is developed, validated, and tested in a relevant environment
Maturity phase domains	Maturity: The phase in which the policy/program/service/intervention/product is tested in the real world for the first time or in a new context (early implementation), and includes the study of its readiness, usability, dissemination, adoption, and uptake
Readiness	Readiness: Is the level of preparedness of a policy/program/service/intervention/product to be used in the real world and for its' release, marketing, commercialisation or open access
Dissemination	Dissemination: The act of making the policy/program/service/intervention/product or its application 'known and making it used" to the target audience so that it reaches, is made known to or available to facilitate the uptake and use
Usability	Usability: A measure of the usefulness of the policy/program/service/intervention/product during the maturity phase. The sub-domains of usability are relevance, acceptability, applicability, practicality, efficiency, value
Adoption	Adoption: The level to which a target user or organisation takes the policy/program/service/intervention/product as its own. The sub-domains of adoption are awareness, incorporation, conversion, allocation, provision, routinisation
Uptake	Uptake: The level of adoption of the policy/program/service/intervention/product in a target audience at the end of the maturity phase
Evolution phase domains	Evolution: The phase beyond early implementation when the policy/program/service/intervention/product is fully operational in the real world, and includes the study of its sustainability, diffusion, spread or de-implementation
Sustainability	Sustainability: Is the capacity to continue the policy/program/service/intervention/product once the initial funding and external support has ended. The application is considered established and mature. It refers to the measurement of the usefulness during the implementation phase of Evolution
Diffusion	Diffusion: Is the dissemination of the policy/program/service/intervention/product beyond the scope of an early implementation study and into the evolution phase (later implementation). Diffusion targets general audiences which are out of the scope of the early implementation research
Spread	The breadth of the policy/program/service/intervention/product in the evolution phase. The sub-domains of spread are prolongation, expansion, diversification and exporting of the application beyond the maturity phase of implementation
De-implementation	De-Implementation: Refers to reducing or stopping the use or delivery of the application of the policy/program/service/intervention/product that are ineffective, unproven, harmful, overused, or inappropriate

Application: Any output of the emerging scientific knowledge that can be implemented in the real-world (e.g., policy, program, service, intervention, product or technology). See Supplementary File for sub-domain definitions

Purpose and design

The GIAF taxonomy has three main purposes of evaluation:

(1) Comparison

Given the high heterogeneity of the units of analysis in impact research and in implementation projects, the main aim is to ensure comparability and not correlation or regression. Considering the complexities of measuring impact, we cannot expect raw, uncalibrated, self-report estimates to reflect project-level estimates of impact [56]. Comparison here refers to the process of determining the relationships between the responses given across different sets of evaluation (different individuals, timeframes, different environments or contexts, and different projects). Comparability indicates the degree to which two or more projects or datasets can be meaningfully compared in relation to scope, context or methodology. A key component of comparability is relative calibration. It refers to the process of adjusting and aligning different indicators or measures to ensure that comparisons across different studies are meaningful and valid even when absolute values differ. In the GIAF context, calibration involves standardisation (the different measures related to a common domain and

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framework), adjustment (corrections for structural and contextual differences), and validation (empirical confirmation that indicators behave similarly across studies and contexts). Calibration is relative and not absolute because it provides a comparison among the available cases. Calibration is a useful tool for estimating uncertain parameters, as well as more accurately defining model uncertainty (particularly with respect to the representation of the relationships between parameters) [57]. Calibration involves the comparison of model process (e.g. level of adoption or readiness) with empirical data, leading to the identification of model parameter values that achieve a good fit. Checklists should be able to show project rankings according to the process of impact.

(2) Organisational change

A main purpose of impact analysis of implementation is to facilitate organisational change by making visible the outcomes, processes, and contextual influences of implementation efforts [58]. Organisational change requires not only the adoption of new practices but also systemic approaches to planning, monitoring, and adapting them across different levels of a health system. Powell et al. developed a set of "Expert Recommendations for Implementing Change" (ERIC), which provides a comprehensive menu of implementation strategies that organisations can draw upon to guide change processes [59]. While ERIC offers "what to do" in terms of strategies, it does not provide a framework for assessing the impact of those strategies. The GIAF complements ERIC by offering a structured approach to analyse and measure the intended and unintended outcomes of implementation, thereby linking strategies to organisational impact.

Similarly, the Centers for Disease Control and Prevention (CDC) has emphasised the importance of both formative and summative evaluation for organisational change, highlighting the need to assess not only whether change occurs but also how and why it happened [41]. The GIAF aligns with this guidance by providing domains and tools that can be applied throughout the implementation process: in formative stages (e.g., assessing planning, readiness, and usability) and in summative assessments (e.g., examining adoption, sustainability, scalability, and broader system impact). In this way the GIAF serves as a practical framework that brings together ERIC's strategic guidance and the CDC's evaluation recommendations to facilitate evidence-informed organisational change.

(3) System improvement

Key to impact analysis is systems thinking and a system perspective, as it emphasises the interconnectedness of components and considers how changes in one part can have ripple effects on the whole system. Domains are not isolated, and they interact with each other in complex patterns.

The GIAF toolkit has been designed as a flexible instrument that allows the use of the full taxonomy or parts of the system. It can be used to undertake varying levels of impact assessment. Three suggested levels of evaluation can be undertaken, depending on the scope, purpose, and available resources of the project [34]:

- Mini impact assessment—Suitable for early-stage or small-scale projects, or when time, data, or evaluation resources are limited. It provides a focused snapshot of key implementation outcomes, often used for rapid feedback or formative assessment (1–3 ladders – recommended: adoption, uptake, prolongation).
- Standard impact assessment—Designed for mid-scale or mature projects where a more comprehensive understanding of implementation is needed across several domains. This level balances depth and feasibility and can be useful when reporting to funders or informing program improvements (4 ladders – recommended: either engagement or readiness, usability, adoption, and uptake).
- Maxi impact assessment—Best suited to large-scale, multi-site, or policy-relevant initiatives where full-spectrum evaluation is required. This level supports system-level learning, cross-domain comparisons, and strategic decision-making across sectors or jurisdictions (5 or more ladders – recommended: engagement, readiness, usability, dissemination, adoption, uptake).

These levels are not prescriptive but are offered as a practical guide. Users of GIAF are encouraged to determine which domains are most relevant to their context and to report which were applied in their evaluation.

The taxonomy can be used prospectively as a planning tool in the design of studies, also concurrently and retrospectively. The pre-readiness and readiness ladders and assessment checklist have been validated [22], and demonstrated strong inter-rater reliability, with an ICC of 0.90 (95% CI: 0.74–0.98, $p < 0.001$), supporting its consistency as a measurement tool. They can be used to assess the readiness level of an intervention or innovation for funding agencies such as European Commission – Horizon Grants, or National Health and Medical Research Council (NHMRC) that now request this information in grant applications. The scoring system (checklists) within the GIAF toolkit has been applied in

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multiple demonstration studies, providing proof of concept for its feasibility and utility across settings. However, all ladders and checklists have not been fully evaluated in the way that the readiness ladders have. As an important next step, the validation of other checklists within GIAF is under development.

Usability

The results from the expert panel survey conducted in 2022 on the usability of the GIAF taxonomy are shown in Table 4. A total of 18 of the 32 members of the expert panels completed the survey, 50% male and female. The frequency and mean scores of the question responses are shown in the second and third columns respectively. Each cell represents the score or answer of a different expert, and the last column shows the mean of their quantitative scores.

The highest rated items were:

- Components and their relationships in the GIAF glossary are reasonably understandable (practicality) 4.94.
- The GIAF taxonomy provides information useful for communication across researchers, research groups and target organisations or across organisations (relevance) 4.72.
- There is a need for an agreed taxonomy (relevance) 4.55.
- The GIAF taxonomy provides important information (relevance) 4.55.

These findings suggest that subject matter experts viewed the GIAF taxonomy and glossary as highly relevant and practical. Expert panel members endorsed the appropriateness and cross-project utility of the GIAF taxonomy's components and sequential structure ($M=4.33$), providing evidence of content validity.

However, several items received comparatively lower ratings, highlighting areas where refinement may be needed. For example, the efficiency domain received mixed feedback with relatively lower mean scores for appropriateness of time and effort ($M=3.88$), cost-effort balance ($M=3.94$), and practicality relative to cost ($M=3.88$). Similarly, some experts somewhat disagreed or disagreed that the taxonomy could be applied without or with low intensity training ($M=3.90$), suggesting that further user support, training resources or streamlined guidance may improve usability. Finally, while overall value ratings were favourable, a small number of experts expressed reservations about the general benefit of the GIAF for the broader field ($M=3.88$). Together, these results indicate that while the taxonomy was seen as relevant, practical and useful, further refinement may

be required to improve its efficiency and accessibility, particularly in relation to training requirements and perceived cost–benefit balance.

Demonstration of the GIAF

The GIAF taxonomy and toolkit has been used to assess impact in various implementation studies in ten countries around the world. Table 5 illustrates the number of demonstrations and countries. The current version of GIAF is therefore usable across projects, with refinements to date reflecting normal adaptation processes rather than fundamental changes to the framework. Broader organisational learnings and examples of how projects have tailored the framework will be reported separately to provide more detailed guidance for future users. The demonstrations include a mental health policy initiative implemented in the education sector [23], a classification system for producing service directories in social and health care [25], case management [24], classification of mental health care services in relation to the delivery of psychotherapy [48], assessment of the implementation of policy strategies for disability, drug and alcohol, and early intervention in childhood by the regional government of Andalusia (Spain) [27].

The full GIAF toolkit (taxonomy, ladders, checklists) has been used in two maxi-evaluations of large international studies. One is the EMPOWER project, funded by the European Union's Horizon program, which aimed to develop and implement a digital platform to promote workplace mental health and wellbeing across Spain, Finland, and Poland [34]. The project underwent a maxi impact evaluation using the GIAF framework, which involved mixed methods, multiple data sources, and independent ratings of implementation processes across the framework's phases and domains.

To support cross-national implementation in one international project [34], key elements of the GIAF toolkit—including checklists and templates—were translated into three languages (Spanish, Finnish, Polish) and linguistically adapted to reflect local terminology, workplace practices, and health system contexts. This experience highlights the framework's adaptability to different cultural and linguistic settings, and its potential to support international comparisons in implementation research and evaluation.

The GIAF analysis provided structured assessment across Initiation and Maturity domains, including planning, engagement, readiness, dissemination, usability, and uptake. Strong planning and early engagement with stakeholders were identified, although revisions to the tool were needed before full release. Dissemination strategies were effective and the platform was rated as useful

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Table 4 Expert panel members' responses to the usability questionnaire

ITEM	SCORE (frequency)	MEAN
Relevance		**4.56**
There is potential for the GIAF taxonomy to be used as an information source for impact analysis of implementation research.	AGREE · STRONGLY AGREE	4.44
There is a need for an agreed taxonomy.	AGREE · STRONGLY AGREE	4.55
The GIAF taxonomy provides information that is important.	AGREE · STRONGLY AGREE	4.55
The GIAF taxonomy provides information that is useful for communication across researchers, between research groups and target organisations or across organisations.	AGREE · STRONGLY AGREE	4.72
Adequacy and Content Validity		**4.11**
The components and sequential structure in the GIAF taxonomy are appropriate and can be useful for different projects.	AGREE · STRONGLY AGREE	4.33
Implementation researchers will agree with the components and sequential structure of the GIAF taxonomy (parent and child categories).	SOMEWHAT DISAGREE · AGREE	3.88
Acceptability		**4.11**
Implementation researchers will approve of its use.		4.11
Applicability		**4.38**
The GIAF taxonomy can be used in specific research studies that are familiar to me.	AGREE · STRONGLY AGREE	4.44
The GIAF taxonomy can be used in the specific environment that I am familiar with e.g. the country, sector or discipline.	AGREE · STRONGLY AGREE	4.33
Practicality		**4.28**
The GIAF taxonomy is a user-friendly resource.	SOMEWHAT DISAGREE · AGREE	4.00
The GIAF taxonomy could generally be applied without/low intensity training.	AGREE · STRONGLY AGREE	3.90
The components and their relationships in the GIAF glossary are reasonably understandable.	AGREE	4.94
Efficiency		**3.91**
The time and effort required to use the GIAF taxonomy is generally appropriate.	SOMEWHAT DISAGREE	3.88
The relationship between time and effort, and its cost is appropriate.	SOMEWHAT DISAGREE · AGREE	3.94
The GIAF taxonomy is practical in relation to the cost involved in using it.	SOMEWHAT DISAGREE	3.88
The costs of applying the GIAF taxonomy is offset by its usefulness and relevance.	SOMEWHAT DISAGREE · AGREE	3.94
Value		**4.07**
The GIAF taxonomy (components and sequential structure) could be used for wider purposes in implementation research.	SOMEWHAT DISAGREE · AGREE	3.88
There is potential for the GIAF taxonomy to be of general benefit to the field of impact analysis of implementation research.	AGREE · STRONGLY AGREE	4.27

1 = strongly disagree, 5 = strongly agree ▮▮ = Disagree

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Table 5 Demonstration of GIAF

Project	Aim	Type study	Timing of impact analysis	Level	Site/location	Refs
Ed-LinQ	Policy to Practice	Mini	Retrospective	State/Regional	Queensland, Australia	[23]
BICM-T	Research to Practice & Policy	Mini	Retrospective	State/Regional	NSW, Australia	[24]
DESDE-AND	Research to Policy	Mini	Prospective	State/Regional	Andalucia, Spain	[25]
SOMNeT	Research to Policy	Mini	Retrospective	State/Regional	Bizkay, Basque Country, Spain	[26]
Disability Planning	Policy to Planning	Mini	Prospective	State/Regional	Andalucia, Spain	[27]
Disability Act	Research to Policy	Mini	Retrospective	State/Regional	Andalucia, Spain	[28]
Early Intervention	Planning	Standard	Retrospective	State/Regional	Andalucia, Spain	[29]
AOD Planning	Policy to Practice	Mini	Concurrent	State/Regional	Andalucia, Spain	[30]
Atlas MH	Research to Policy	Mini	Retrospective	National	Spain	[31]
Atlases MH	Research to Planning	Mini	Retrospective	International	Australia and Europe (Spain and Norway)	[32]
Atlas SEWB	Research to Planning	Standard	Prospective	Local	Yarrabah, Queensland, Australia	[33]
EMPOWER	Research to Research	Maxi	Concurrent	International	Poland, Spain, Finland	[34]
MOVEMBER VFR	Research to Practice & Policy	Maxi	Concurrent	International	Australia, Canada, Germany, Ireland, Aotearoa (NZ), UK, USA	[35, 36]

AOD alcohol and other drugs, *BICM-T* brain injury case management taxonomy, *DESDE* Description and Evaluation of Services and DirectoriEs, *MH* mental health, *NZ* New Zealand, *SEWB* social and emotional wellbeing, *VFR* Veterans and First Responders

overall, but usability results were tempered by challenges with effectiveness and adoption. A number of external barriers, including workplace constraints and the COVID-19 pandemic, further limited implementation progress.

In addition to the GIAF domains, the evaluation considered inherent complexity factors, such as diverse target audiences, multi-component design, and dependencies across developmental stages. These factors shaped implementation feasibility and highlighted the challenges of scaling digital interventions across multiple countries and workplace contexts.

By systematically capturing these strengths, challenges, and contextual influences, the GIAF clarified the impact pathways shaping EMPOWER's implementation trajectory. The framework provided valuable organisational learnings and benchmarks for future workplace mental health initiatives, while enabling international comparisons across sites.

The second international project, the Movember and the Distinguished Gentleman's Ride Veterans and First Responders Mental Health Grant was an international initiative involving 15 organisations and 23 projects across seven countries: Australia, Canada, Germany, Ireland, New Zealand, UK, USA [35, 36]. The evaluation applied the GIAF framework to assess implementation processes, cross-cutting impacts, and sustainability. Published results of the evaluation can be found here [40] and are summarised below.

The GIAF toolkit was used to evaluate projects across all three phases of implementation where relevant (Initiation, Maturity, Evolution) and 15 domains, providing structured ratings of planning, engagement, readiness, dissemination, usability, adoption, uptake, sustainability, and spread. All projects were rated as usable, adoptable, and having potential for sustainability, although uptake varied depending on factors such as recruitment challenges, duration of interventions, and the presence of marketing/social media expertise. The use of GIAF also highlighted critical facilitators (e.g., strong partnerships, lived experience in project teams, continuous collaboration with evaluators) and barriers (e.g., recruitment delays, limited resources, organisational constraints).

Through this evaluation, the GIAF demonstrated its capacity to standardise assessments across highly heterogeneous interventions while accounting for contextual complexity. It not only clarified impact pathways by linking engagement, planning, and dissemination practices to outcomes such as adoption and uptake, but also provided benchmarks and lessons to inform continuous improvement of future programs. Based on the success of this evaluation, Movember invited the evaluation team to apply GIAF in a forthcoming international initiative in 2025.

The on-going application of the taxonomy across diverse international settings drives its continuous refinement and adaption. Together, these cases illustrate the GIAF's versatility across cultures, languages,

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and sectors, and highlight its emerging role in guiding evidence-based evaluation of complex global programs.

Discussion

This study addresses a critical gap by introducing a taxonomy that promotes consistency in how process domains of implementation are classified and understood from the conceptual and the operational perspectives. Drawing on an onto-terminology approach, we developed a sequential taxonomy, associated glossary of terms, and measurement tools to support systematic impact analysis. The aim is to enhance clarity in how implementation processes are defined and measured, ultimately enabling more reliable comparisons across studies, settings, and implementation strategies—including comparisons of how the same program is implemented across different sites, or how different designs and measures are applied to similar goals. This has particular relevance for efforts to scale effective interventions, where variation in implementation is often a key barrier to broader impact.

Our findings contribute to implementation science by providing a structured framework that distinguishes broader system- and policy-level impacts from those occurring within individual studies. This distinction supports more accurate assessments of implementation strategies and aligns with calls for conceptual clarity in the field [40]. In doing so, the taxonomy extends the work of Proctor et al. [11], who emphasised the need for clearly defined implementation outcomes to enhance the field's methodological and theoretical foundations.

A key motivation for the development of the taxonomy was to address persistent inconsistencies in terminology, a challenge noted by Aarons et al. [60]. Terminological variation can hinder communication and cross-study learning [61]. By offering a standardised glossary in tandem with the taxonomy, our approach seeks to support shared understanding among researchers, practitioners, and policymakers – users who frequently operate across disciplines and sectors and require accessible, interpretable frameworks.

In comparing our taxonomy to existing frameworks, we note that GIAF builds on established models such as RE-AIM [19], Implementation Outcomes Framework [11], and the Consolidated Framework for Implementation Research (CFIR) models [20]. While each of these frameworks has made significant contributions to the field, they also exhibit limitations that can affect their operational utility. For instance, in RE-AIM, the domain of "Adoption" is defined by the type of individual or setting (e.g., staff, clinics) rather than the process of knowledge incorporation, resulting in potential overlap with the "Reach" domain. GIAF seeks to resolve such ambiguities

through an ontology-based structure that ensures greater conceptual separation between domains.

The added value of the GIAF taxonomy lies in its combination of ontological clarity and structured measurement, which can assist with evaluation planning, impact assessment, and strategic learning. However, we acknowledge that GIAF is not intended to replace existing frameworks, but to complement and extend them, particularly in contexts where impact needs to be tracked across multiple levels or sectors. This perspective aligns with Nilsen's argument that implementation frameworks often serve different purposes and may be used in complementary ways to suit the complexity of multi-level implementation contexts [18].

GIAF has been applied in a range of cases through mini, standard, and maxi impact analyses across multiple implementation research projects. These include efforts that span transitions from research to policy, policy to practice, and practice to scale. Together, these demonstrations highlight the practical utility of the framework, and set the stage for evaluating its usability — both in terms of relevance to end users and efficiency in application.

While overall usability ratings for the GIAF taxonomy were high in 2022, expert feedback also pointed to areas requiring refinement, some of which has occurred in the intervening period. The lowest ratings were observed in the efficiency domain, with concerns about the time, effort, and costs associated with applying the taxonomy. This suggests that although the framework provides comprehensive coverage, its practical application may benefit from simplification or closer integration with existing research workflows. Some experts also questioned whether the taxonomy could be applied without training or with minimal training, underscoring the importance of developing guidance materials, worked examples, and training modules to support adoption. Ratings for value and general benefit were favourable overall, but the presence of some disagreement highlights the need to further demonstrate GIAF's added benefit across diverse settings. Addressing these issues through ongoing refinement and external validation will strengthen the accessibility, efficiency, and scalability of GIAF, increasing its utility in advancing impact analysis.

Limitations

While the nominal group meetings provided valuable insights from experts, it is important to acknowledge that the perspectives gathered may not be fully representative of the broader community of health and social science professionals. The participants in these groups were individuals with extensive experience in different health

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and social service sectors, and implementation science, which may have influenced the focus and nature of the discussions. As a result, their contributions might reflect a particular set of experiences and expertise that could differ from those of researchers or clinicians with different backgrounds, disciplines, or specialties.

Additionally, the workshops were conducted with participants primarily from high-income country contexts, which may limit the applicability of findings to low- and middle-income settings where healthcare systems, resources, and organisational structures can differ significantly. This concentration of perspectives could contribute to potential inequities in how the framework is understood or applied globally. Further research is needed to examine the relevance and usability of GIAF in lower-resource environments to ensure it can support impact analysis equitably across diverse settings.

Finally, all GIAF usability testing to date has involved at least one member of the GIAF development team. While this ensured fidelity to the intended constructs and facilitated iterative refinement, it also introduces the possibility of bias in testing and interpretation. Future studies led by independent researchers will therefore be important to establish the objectivity, generalisability, and practical utility of the framework.

Conclusion

This study contributes to the field of implementation research through the development of the Global Impact Analytics Framework (GIAF) – a structured taxonomy designed to distinguish between core components of the implementation process and to differentiate implementation factors from study-specific outcomes. By building on existing frameworks such as RE-AIM and CFIR, GIAF introduces an ontology-informed structure that aims to address known challenges related to conceptual clarity and cross-study comparability.

Findings from Australia's Productivity Commission (2020) underscore the need for more effective implementation strategies, particularly within mental health reform, where systemic barriers have slowed progress. The Commission highlighted the importance of not only designing better programs but also supporting their implementation at the scale needed to achieve meaningful impact. The GIAF framework is intended to support this kind of work by offering tools for planning, evaluating, and analysing implementation efforts in real-world settings.

The inclusion of a scoring system within the GIAF toolkit enables comparative analysis across implementation sites and projects, helping stakeholders understand how implementation processes influence observed outcomes. While researchers and evaluators are key users—particularly in designing, analysing, and reporting implementation studies—the toolkit is also intended for policymakers, program managers, funders, and practitioners. These users benefit from its structured and transparent approach to tracking implementation progress, identifying barriers and enablers, and informing strategic decisions. Its adaptability makes it useful across sectors, supporting diverse implementation goals from policy roll-out to service innovation and systems change.

While initial testing suggests that GIAF has utility across various sectors and contexts, further research is required to validate the framework independently and explore its adaptability to diverse implementation challenges. To ensure that GIAF reaches its intended audience and achieves impact, dissemination efforts need to be coupled with practical supports for uptake—such as training resources, worked examples, and integration into existing policy and service planning processes. Partnerships with government agencies, service organisations, and funders will be critical to embedding the framework into routine evaluation and decision-making, helping ensure that GIAF contributes directly to policy reform, program improvement, and systems change. Future research should focus on further validating the GIAF taxonomy and exploring its real world applicability, ensuring that it meets the needs of a broad range of stakeholders involved in implementation efforts. By doing so, we can ensure that the GIAF continues to contribute meaningfully to advancing the conceptual and practical tools for implementation research, and the effectiveness of implementation science.

Supplementary Information

Supplementary Material 1.

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A taxonomy of the process in implementation science: the Global Impact Analytics Framework (GIAF)

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Authors' contributions

L. S-C. made a substantial contribution to the concept of the article, creation of the model/framework, acquisition of data, validation and revising the article critically for important intellectual content. S.L. made a substantial contribution to the concept of the article, creation of the model/framework, project administration, acquisition of data, formal analysis, validation, writing the original draft and revising it critically for important intellectual content. C.W. made a substantial contribution to formal analysis, writing the original draft and revising it critically for important intellectual content. F.A.T. made a substantial contribution to the acquisition, analysis, and interpretation of data for the article, and revising it critically for important intellectual content. T.C. made a contribution to the creation of the model/framework and revised the article critically for important intellectual content. The GIAF Taxonomy Expert Panel substantially contributed to the research process and data/evidence collection and revised the article critically for important intellectual content. Panel members who participated in at least two meetings were invited to be group authors. All authors approved the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Data availability

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

Ethics approval was initially granted by the Human Research Ethics Committee at the Australian National University in 2020 (#2020/768). Ethics approval was then transferred and approved by the Human Research Ethics Committee at the University of Canberra in 2022.
All expert panel members completed a written consent form and a conflict of interest declaration prior to participation.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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