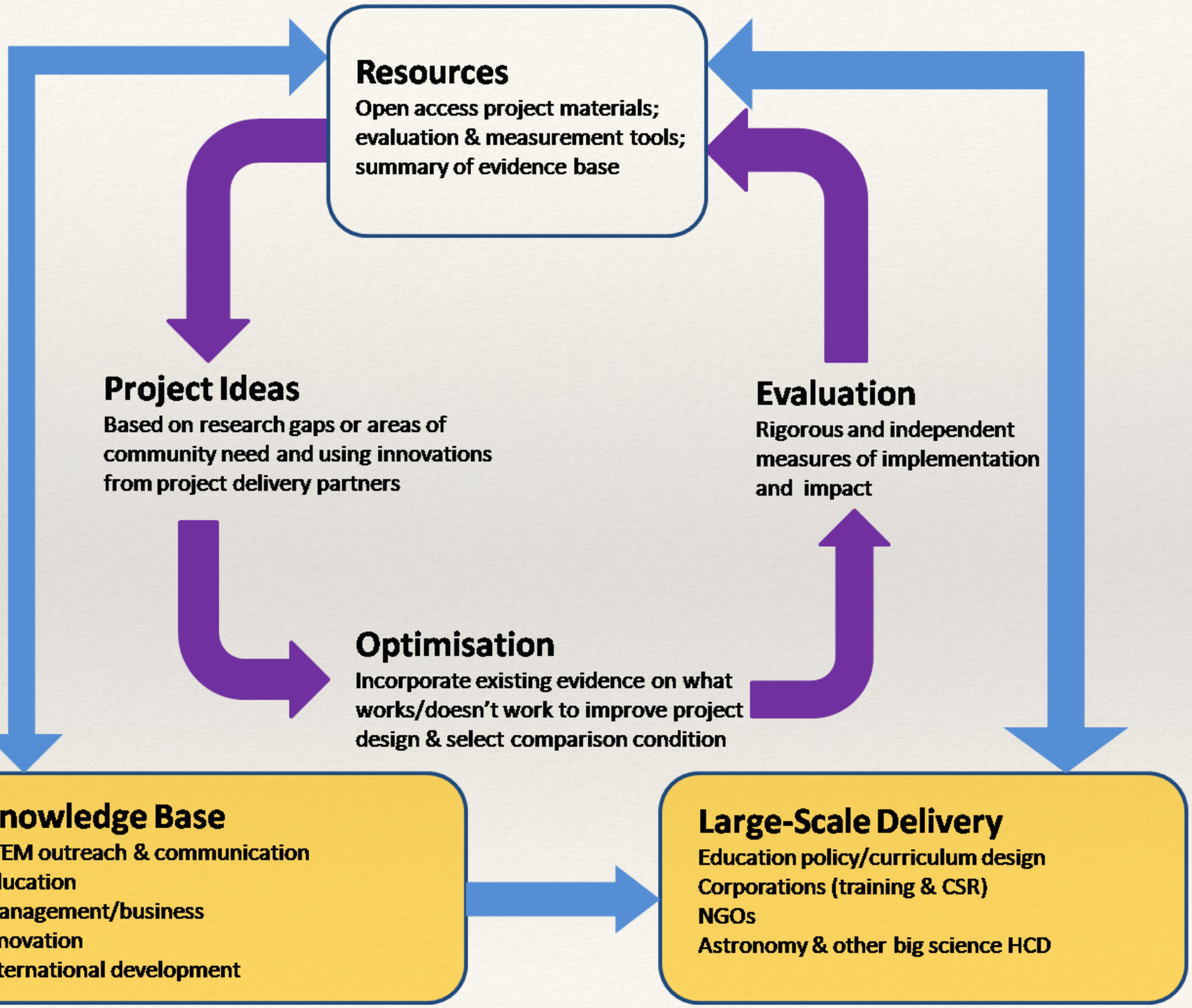
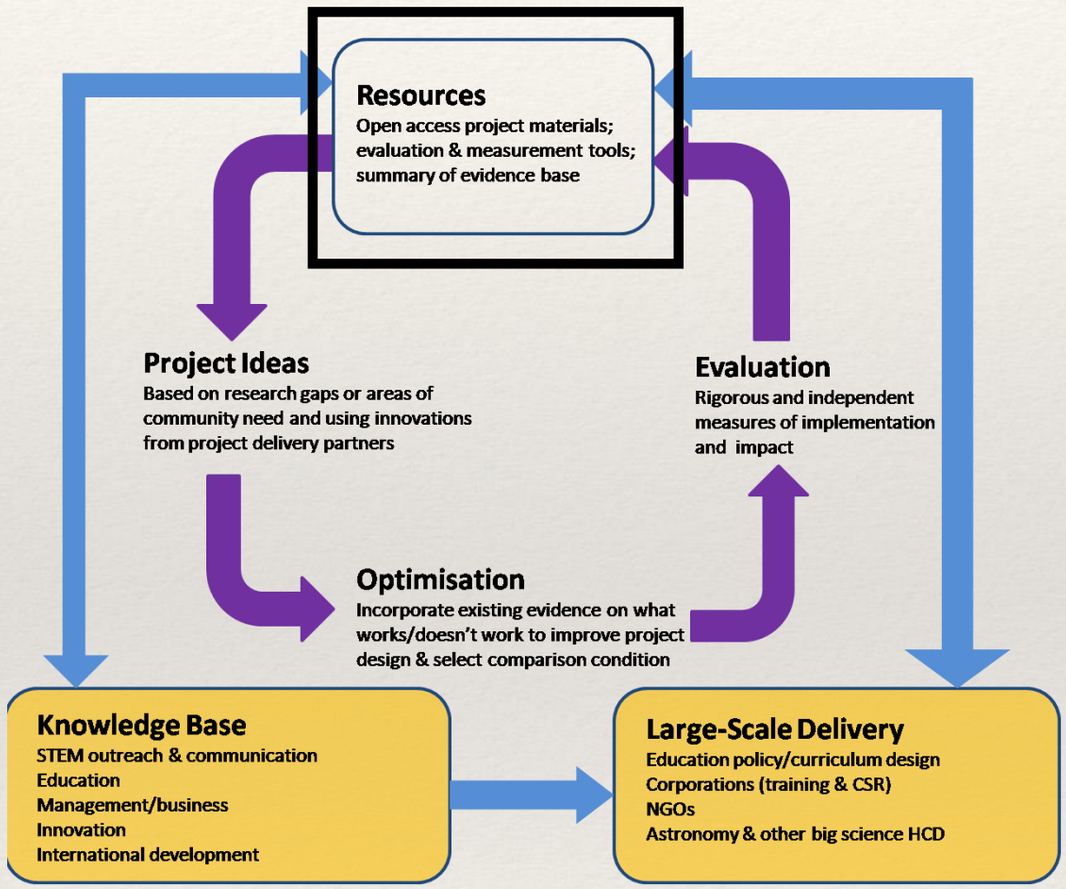
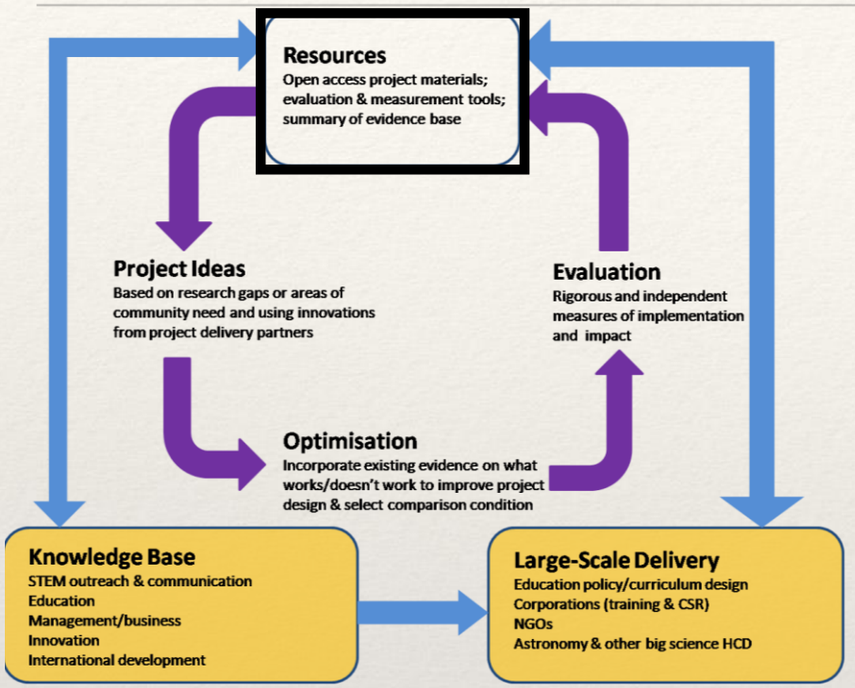
OAD Impact Cycle



1. Resources


Resources
Open access project materials; evaluation & measurement tools; summary of evidence base
Project Ideas
Based on research gaps or areas of community need and using innovations from project delivery partners
Evaluation
Rigorous and independent measures of implementation and impact
Optimisation
Incorporate existing evidence on what works/doesn't work to improve project design & select comparison condition
Knowledge Base
STEM outreach & communication
Education
Management/business
Innovation
International development
Large-Scale Delivery
Education policy/curriculum design
Corporations (training & CSR)
NGOs
Astronomy & other big science HCD

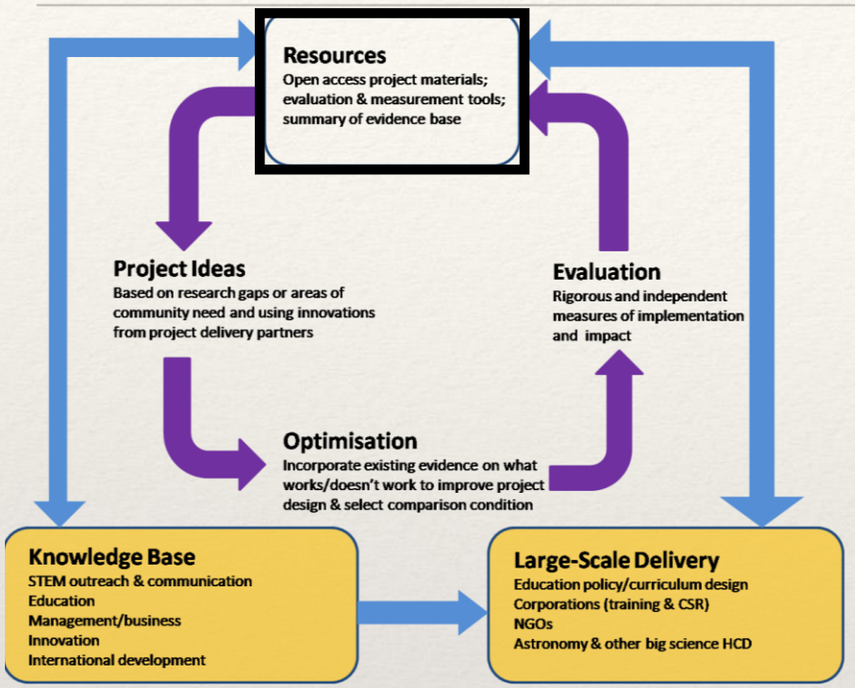
Resources: Evidence



- **Evidence**
- Interventions
- Project Tool Box
- Data
- Partners

- Guidance on finding and interpreting relevant evidence (e.g. thinking about research design, validity etc.)
- Collection of relevant Systematic Reviews and Brief Evidence Appraisals; generated by community, partners OAD and externals (if open access)
- Short best practice principle info-sheets or intervention catalogue, esp. relating to mechanisms such as self-fulfilling prophecies, bias, incentives
- Links to relevant websites, review collections and research articles (e.g. Campbell Collaboration, 3iE, Better Evaluation, OECD); list of book and article references/reviews on education, outreach, development
- Policy Reports and Journal: Research articles, commentary, editorials on evidence-based outreach, education & development

Resources: Interventions



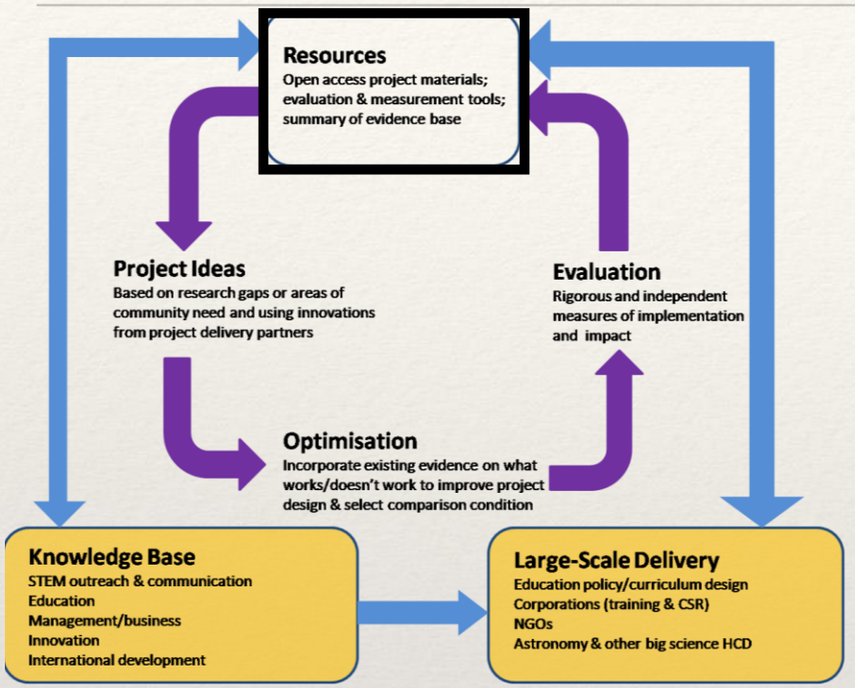
- Evidence
- **Interventions**
- Project Tool Box
- Data
- Partners

- Catalogue of all OAD projects, connected to target populations, outcomes and problems and with evidence appraisals

- Repository of project manuals, with sufficient detail to enable replicability:
  - Theory and evidence base review
  - Component description (who delivers, where, duration, dose, activities/schedule etc.)
  - Worksheets, exercises, slides, assessments
  - Participant and staff selection/training criteria
  - All other materials (link to data section)

- Links to (replicable) materials from other sources (e.g. NASA), linked to evidence appraisals

Resources: Tool Box & Training



- Evidence
- Interventions
- **Project Tool Box**
- Data
- Partners

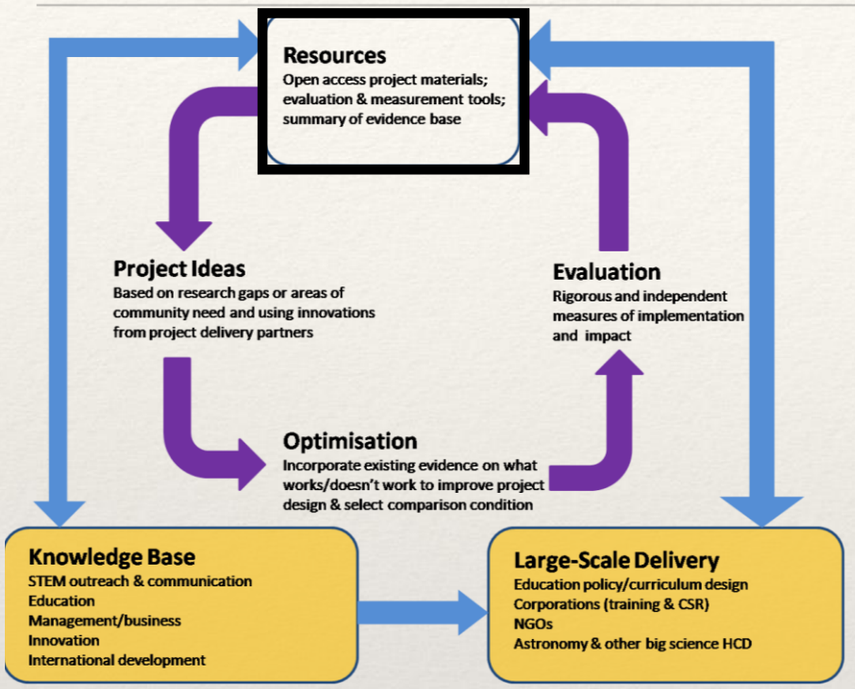
1. Project Design
   - PICO framework guidance (building on evidence)
   - Theory of Change
   - Estimating cost-to-impact estimates
   - Project management
   - Budgeting and equity mainstreaming

2. Assessments
   - Collection of validated assessments for common learning outcomes
   - Guidance on developing new assessments
   - Guidance on measuring/data collection for other behavioural outcomes (e.g. school completion)

3. Evaluation (linked from "evaluation" section of cycle)
   - Guidance
   - Framework, design and templates; advice
   - Template consent, information forms
   - Ethical approval procedures
   - Registration & monitoring data collection tools
   - Random assignment software

4. Scale-Up, Publication and Dissemination (linked from "Large-Scale Delivery)
   - Manualisation & publication
   - Fund-raising and publicity

Resources: Data



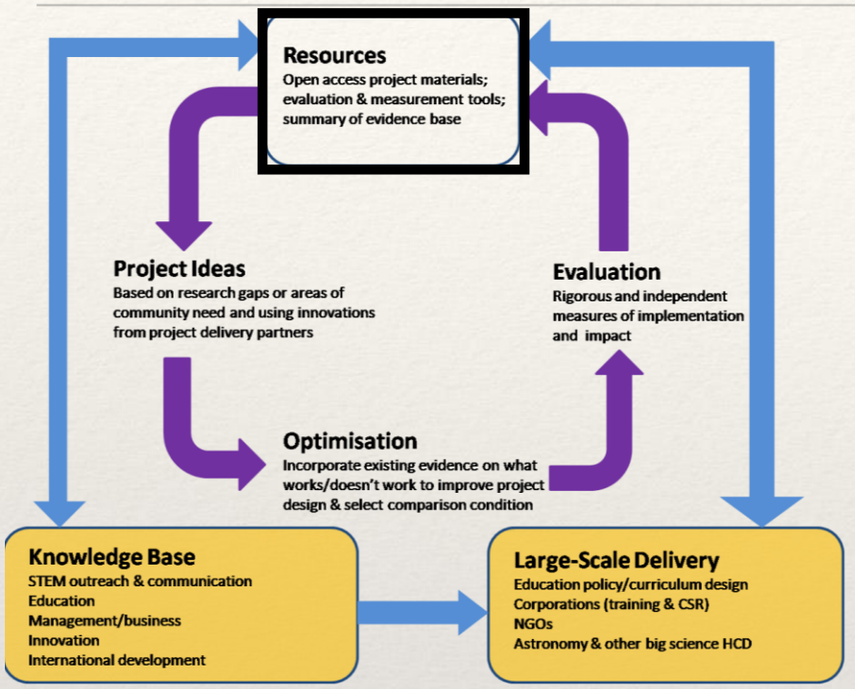
- Evidence
- Interventions
- Project Tool Box
- **Data**
- Partners

- Needs Analyses (linked from "Project Ideas")
  - Survey results (e.g. astronomy capacity in West Africa)
  - On-the-ground reports (e.g. through ROADs)

- Evaluation Data (linked from "Evaluation")
  - Primary project impact evaluation reports
  - Individual-level data from project evaluations
  - Follow-up contact details from projects

- Implementation Data
  - Number recruited/reached (intended, actual)
  - Cost per person
  - Qualitative/process data
  - Evaluations of component mechanisms
  - Delivery challenges

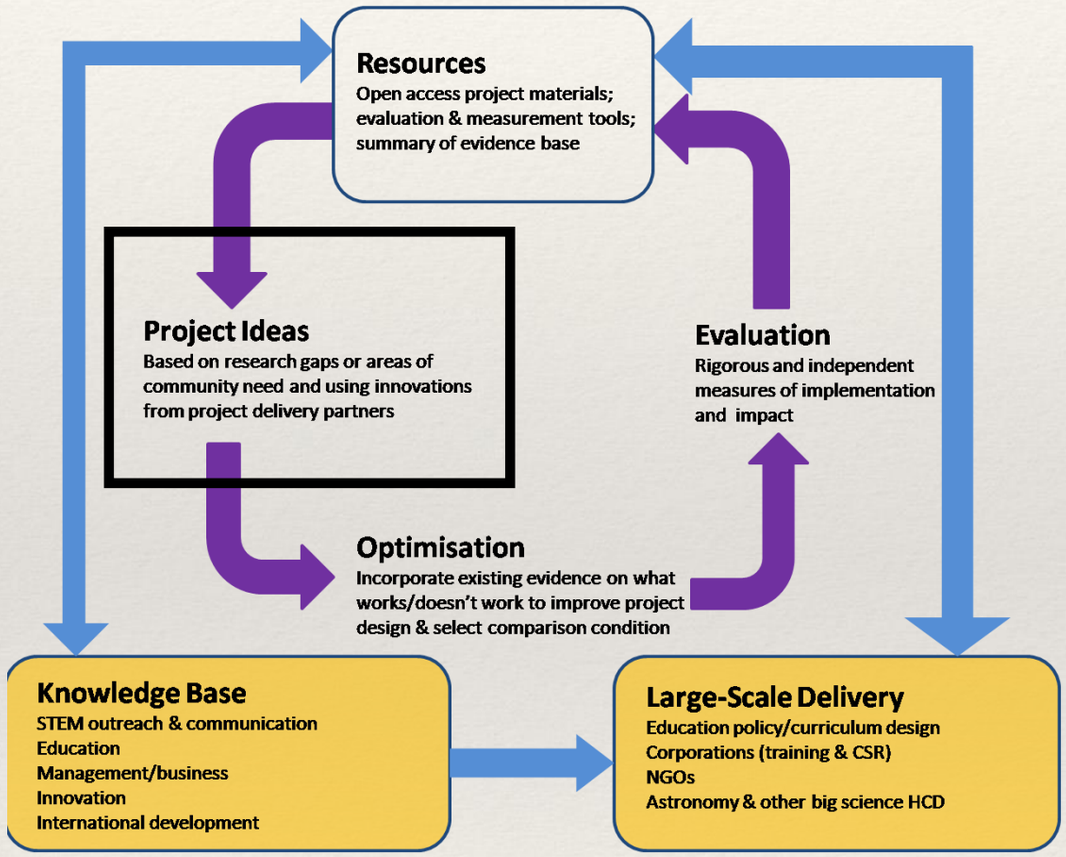
Resources: Data



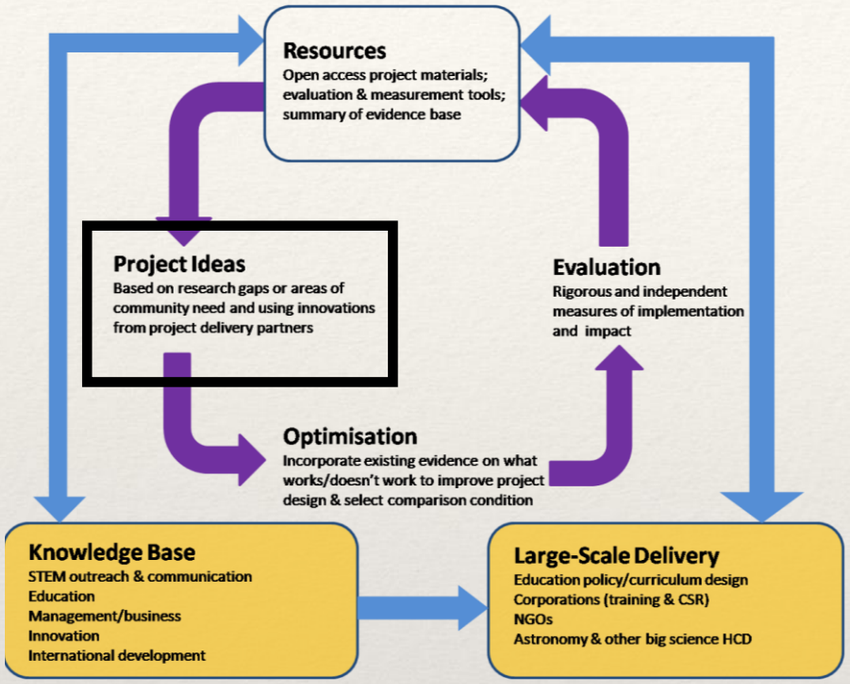
- Evidence
- Interventions
- Project Tool Box
- Data
- **Partners**

- Development partners: list of potential collaborators from the development field who could assist with project
- Development projects: list of projects that one could get involved with or help to disseminate e.g. tested positive parenting activities can be used to enhance an outreach event.
- Astronomy partners: list of astronomy-related projects/programmes that can be used as collaborators e.g. UNAWE, GTTP, etc.

2. Project Ideas



Project Ideas: Call Structure



- **Expand dissemination** outside of Astronomy

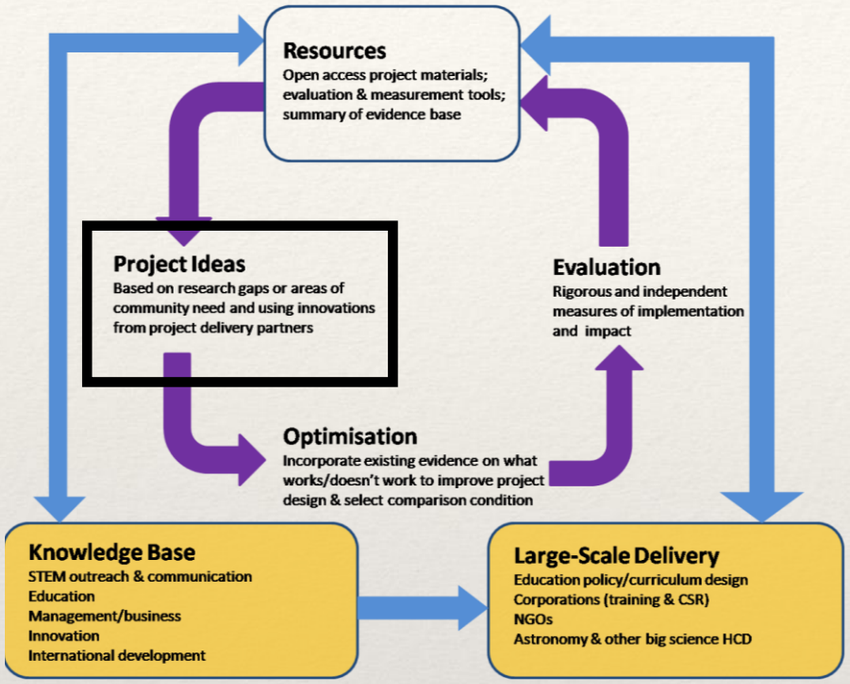
- **Providing information** about the areas that require intervention.
  - Gaps in evidence, e.g. tested interventions that need replication in new contexts; interventions/mechanisms that are promising or widely used but need testing
  - Areas of need, e.g. specific priority development issues (e.g. SES/gender inclusion, literacy) or effective interventions that need support (link to "Resources")

- **Call Structure**
- Selections

- **Application form** requires greater levels of specificity and thought about nature of problem, intervention features, comparison condition and outcomes.

- **Two-stage process** where stage 1 is idea, stage 2 is optimisation

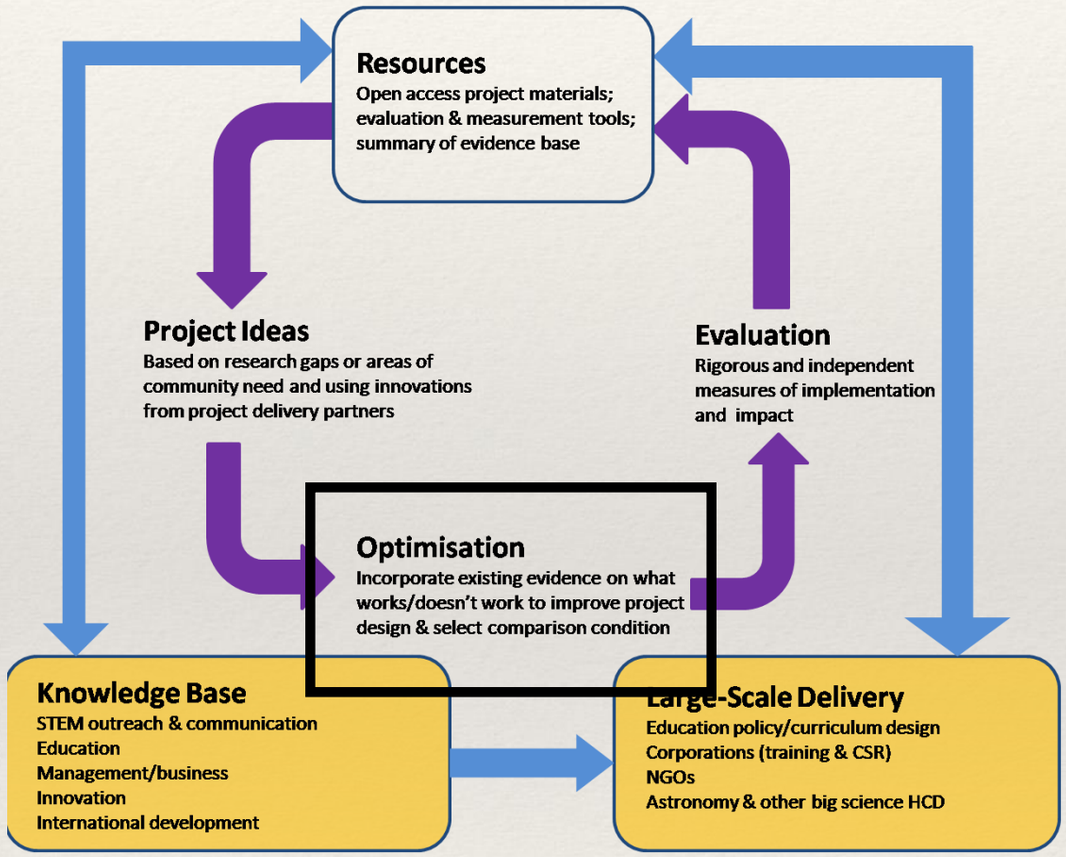
Project Ideas: Selections



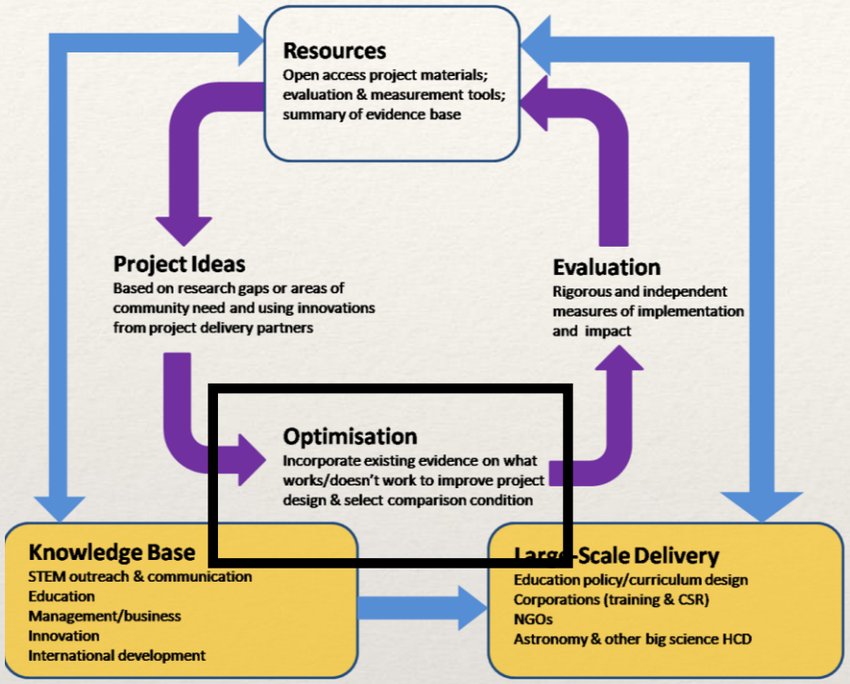
- Call Structure
- **Selections**

- Anonymous submission
- Explicit selection criteria, e.g.:
  - PICO specified (see “Optimisation”)
  - Compatible with existing evidence
  - Low risk of harm
  - Feasible
  - Positive cost-impact estimates
  - Scalable
  - Can be evaluated OR does not need to be
  - Addresses priority outcomes

3. Optimisation



Optimisation: PICO



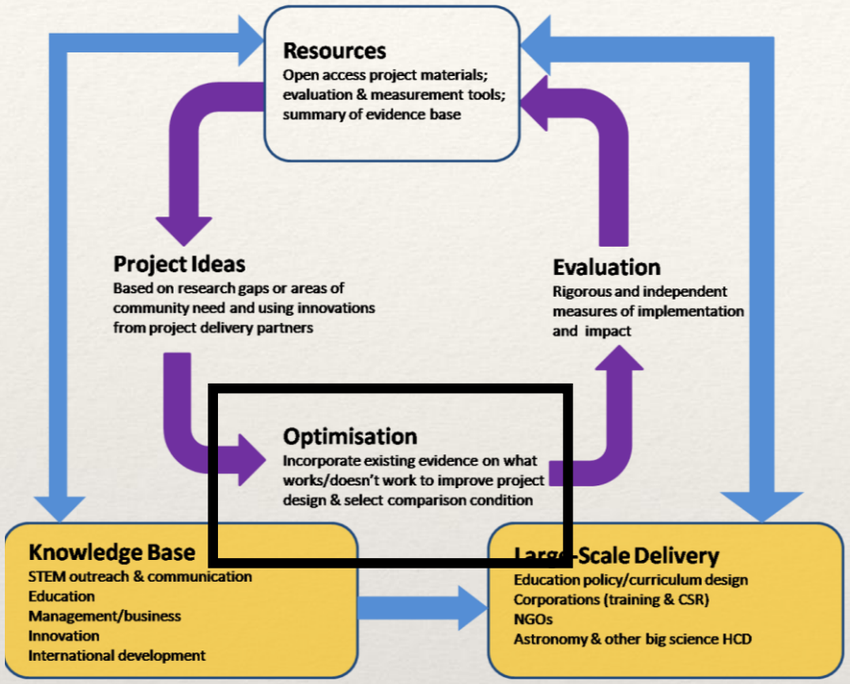
- **PICO**
- Theory
- Outcomes
- M&E

- Work with projects to explicitly specify and refine:
  - **P**roblem(s)
  - **I**ntervention
  - **C**omparison
  - **O**utcome(s)

(Use PICO tools from Resources Toolbox)

- Connect projects that are addressing the same problem and seeking to achieve the same outcomes
  - Where possible, use prior OAD interventions or "usual conditions" as comparisons (link to past project consolidation in "Resources")

Optimisation: Theory & Outcomes

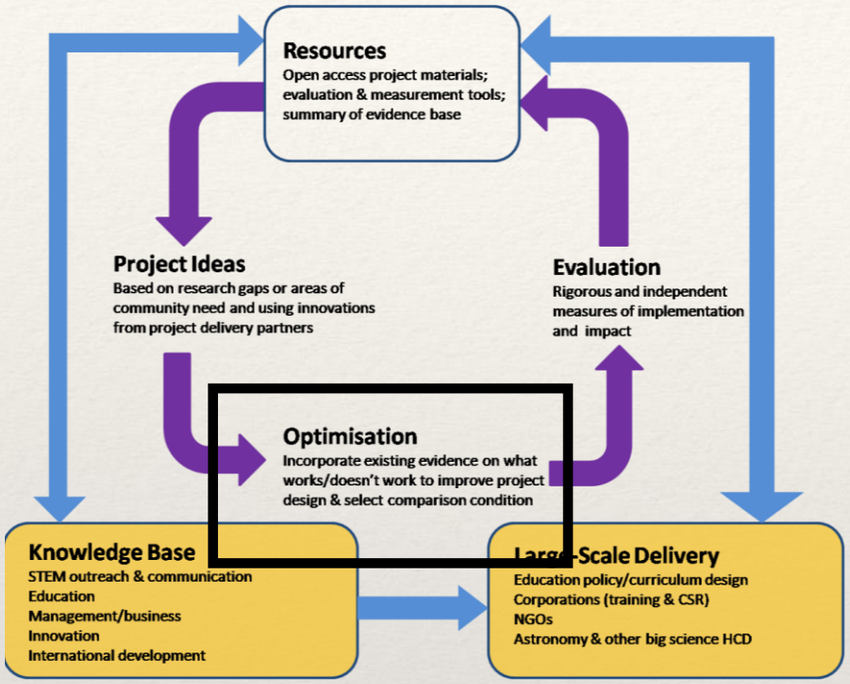


- PICO
- **Theory**
- **Outcomes**
- M&E

- Active support from OAD and Task Forces to:
  - Use guidance on theory of change from Resources Toolbox
  - Support projects in building evidence-informed theory
  - Identify which aspects of theory need to be evaluated
  - Specify measurable and theoretically relevant outcomes

- Equity Mainstreaming and Budgeting
  - Incorporate gender, race, socio-economic status and (dis)ability perspectives
  - Use these to optimise design and budgeting

Optimisation: Monitoring & Evaluation

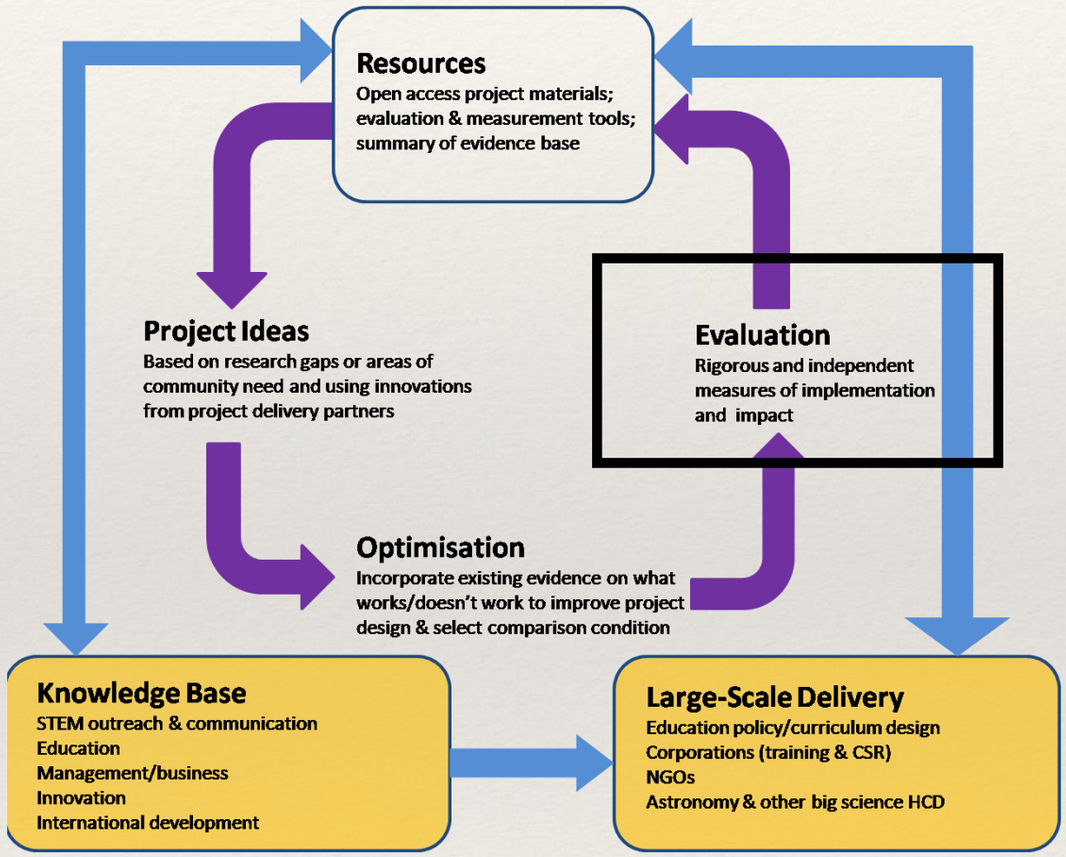


- PICO
- Theory
- Outcomes
- **M&E**

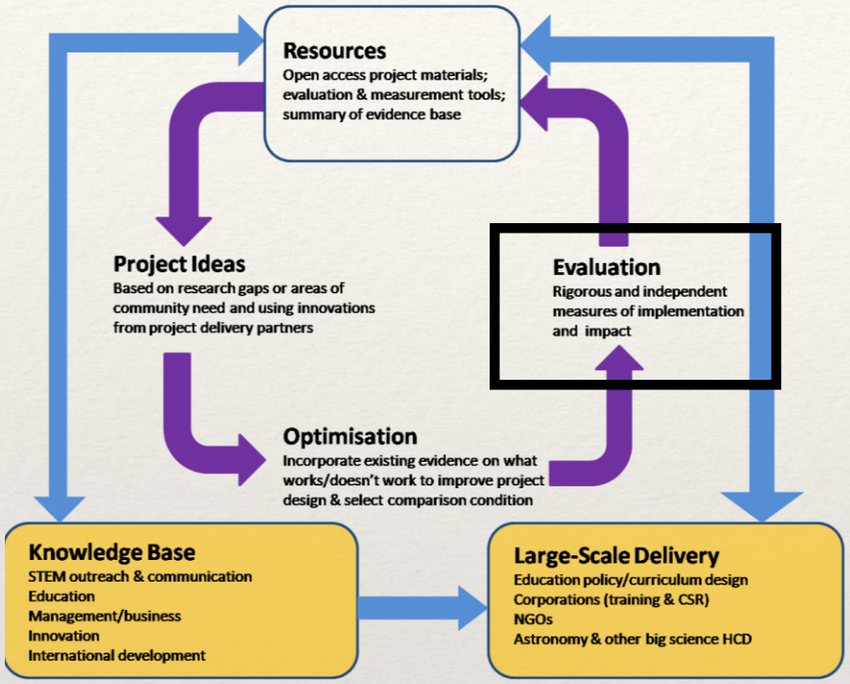
- Build monitoring into project proposal, design and implementation processes. For example:
  - Online project registration forms to collect data on project participants (teachers, students, schools)
  - Standardised online financial and implementation reporting
  - Automated system for flagging planned milestones from proposal data

- Build evaluation plans and timelines into project design:
  - Use Evaluation Framework and Resources toolbox to design and plan evaluation at the project design stage
  - Incorporate evaluation, data collection and reporting into budget and time planning

4. Evaluation



Evaluation: Framework



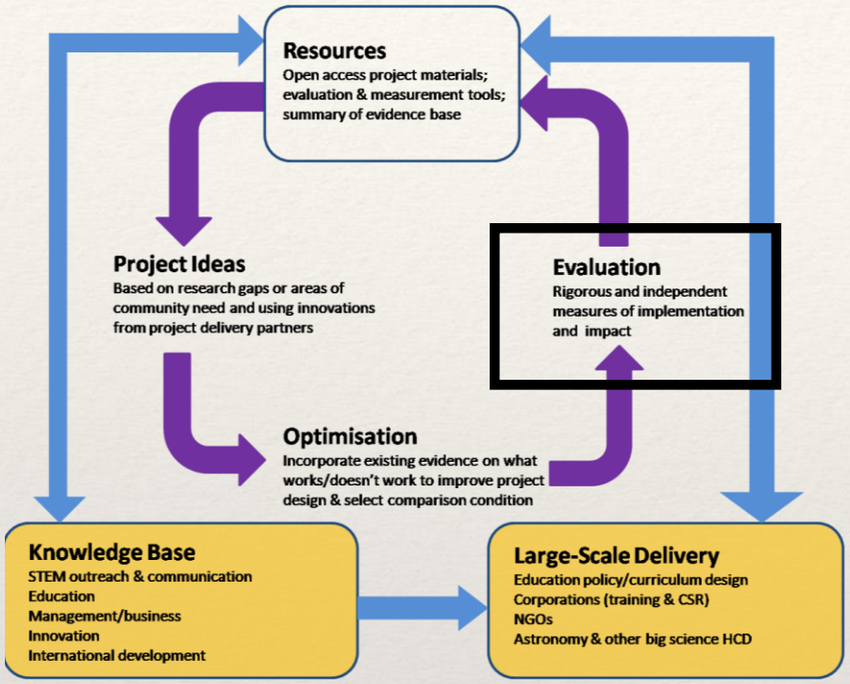
- **Framework**
- Types
- Examples
- Support

- Theory-informed
  - Address unanswered questions about project mechanisms and/or impact
  - Uses theory to select outcome or impact measures

- Feasible (low cost, short timeline)
  - Use existing data where possible
  - Small sample size if necessary
  - Enable follow-up, but plan on short-term
  - Minimise burden on project leader (automate registration, random assignment, etc.)

- Rigorous
  - Select design best suited to answer question of interest: random assignment to measure causal impacts
  - Pre-trial registration; post-trial reporting that adheres to CONSORT guidelines
  - Seek partners with relevant experience (link to “Resources”)

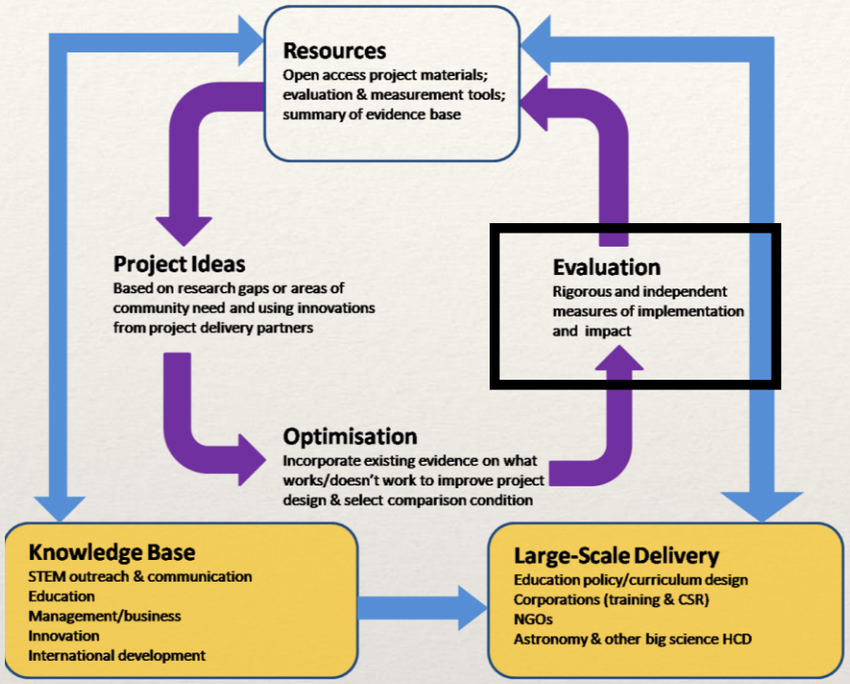
Evaluation: Types



- Framework
- **Types**
- Examples
- Support

- Needs Analysis (link to "Resources")
  - Random sample or respondent-driven sampling survey research (e.g. measure a University's gender disparities)
  - Analysis of open access data
- Feasibility Evaluation
  - Test feasibility and cost of delivering an innovative intervention (e.g. remote telescopes) or a planned data collection strategy (e.g. response rate for e-mail follow up)
- Process Evaluation
  - Causal mechanisms (experimental)
  - Participant experiences (qualitative)
  - Project delivery experiences (qualitative)
- Impact Evaluation
  - Whole-project impact measures (experimental)
  - Hierarchy of evidence
  - Random assignment at appropriate level of analysis (e.g. school/classroom/individual)
  - Long-term follow up requires extra funding

Evaluation: Needs Analysis

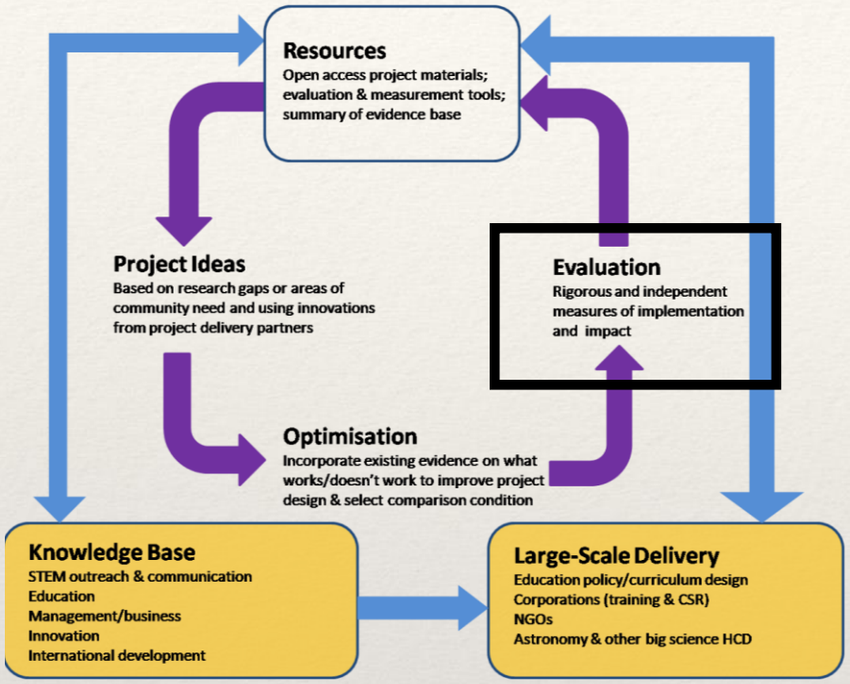


- Framework
- Types
- **Examples**
- Support

- Example questions:
  - Is Astronomy needed in the curriculum or is it already there? What would it replace?
  - What have students already been taught? What do they already know?
  - Do outcomes differ by gender, racial, SES or (dis)ability?
  - Which skills are most in demand in local labour markets?
  - What are the barriers causing students (or a sub-set of students) to under-perform or drop out of science degrees/careers?

- Evaluation design (some combination of):
  - Analysis of public data (e.g. TIMSS, PERL, World Bank indicators, local education data)
  - Key informant interviews (with students, teachers, administrators) and documentary review (curriculum materials, assessment instruments)
  - Surveys, using random sampling or respondent-driven sampling strategies to obtain representative estimates

Evaluation: Feasibility Evaluation

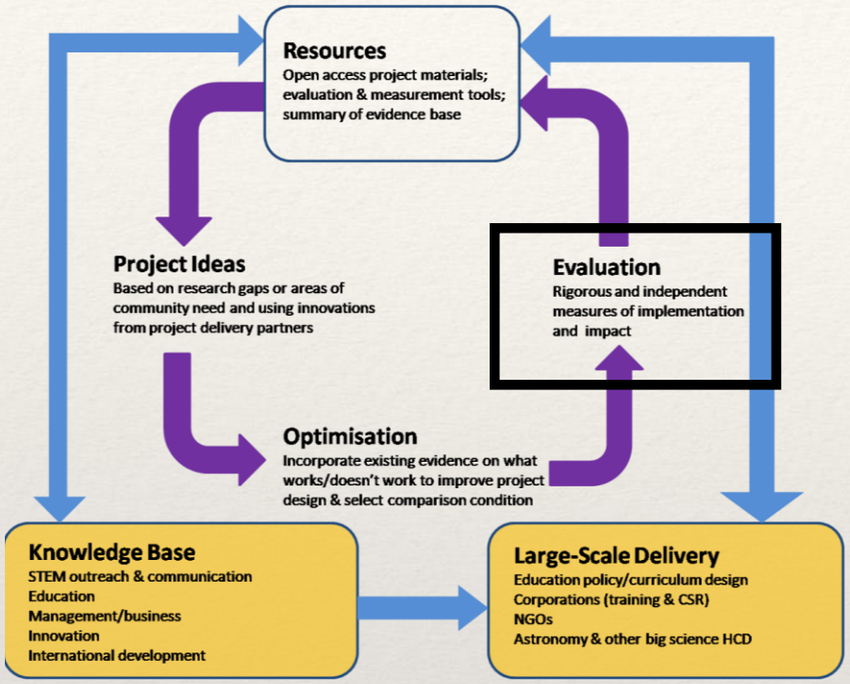


- Framework
- Types
- **Examples**
- Support

- Example questions:
  - Are internet connections stable and fast enough for teachers in Francophone West Africa to participate in an online teacher training course?
  - Will students in Central America be willing to take a bus for 15 hours to attend a two-week Astronomy workshop?
  - Can an Ultrascope be feasibly built and remain under budget in South Africa?

- Evaluation design:
  - Collect monitoring data on project design (e.g. how were projects advertised? where? for how long?)
  - Collect monitoring data on project uptake (e.g. how many students applied? how many qualified volunteers offered their skills?)
  - Collect budget data (e.g. how much did the Ultrascope components cost? how much time did it take?)
  - Collect implementation data (e.g. how was the project implemented in practice? what unplanned adaptations needed to be on the ground? which components could not be delivered?)

Evaluation: Process Evaluation

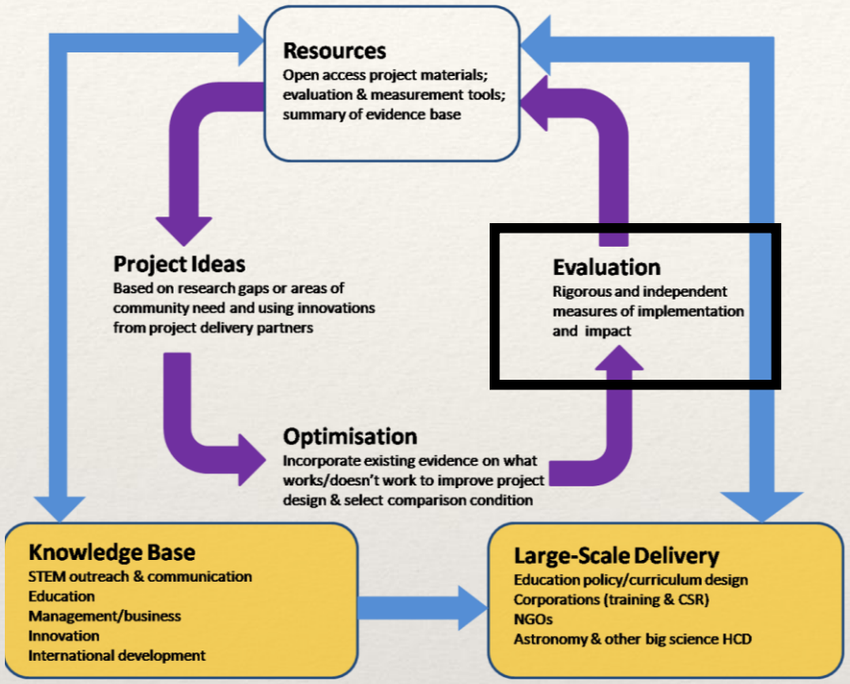


- Framework
- Types
- **Examples**
- Support

- Example questions:
  - Did science test results improve because students were more interested in the course?
  - Where there any unanticipated positive or negative consequences for participants?
  - How did participants feel about the project?
  - How could the project be improved?
  - Did the gender balance of role models in career brochure affect learning outcomes?

- Evaluation designs:
  - If a causal mechanism is specified, experimental evaluation to measure the causal effect on short-term outcomes of variations in a specific project component (e.g. random assignment to materials with different proportions of male or female role models)
  - For other questions, qualitative methods (open interviews or focus groups) and post-project surveys to elicit perspective of participants

Evaluation: Impact Evaluation



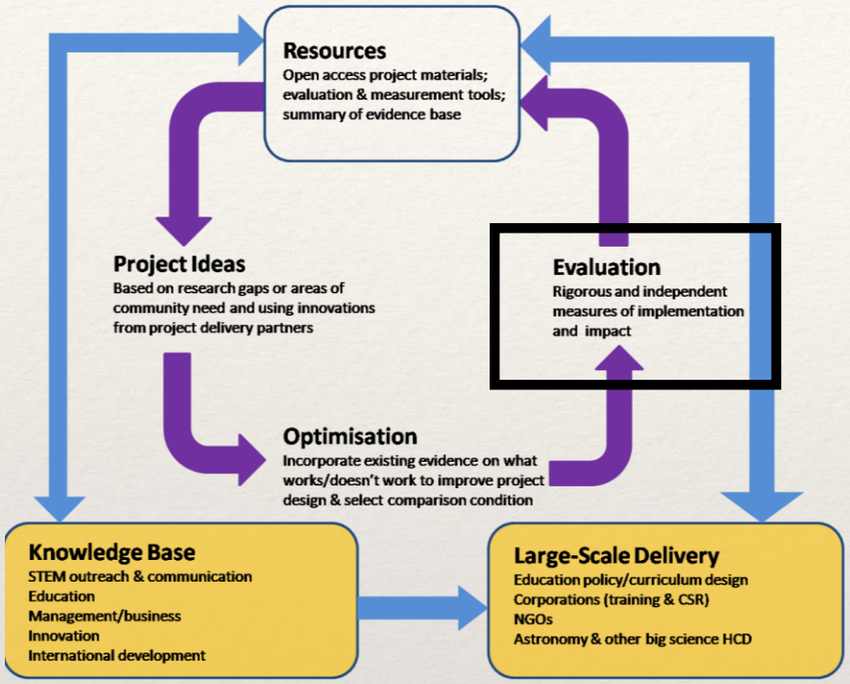
- Framework
- Types
- **Examples**
- Support

- Example questions:
  - Did the project "work"? i.e. did the project cause changes the target outcome that would not have occurred in its absence?

- Evaluation designs:
  - Use evidence hierarchy
  - Measure of causal impact is always relative (i.e. A vs B)
  - Exposure to the project needs to be (statistically) independent of the outcome (random assignment)
  - Evaluation of overall impact will not always be possible

Example: Over-subscribed workshop
- Select all eligible applicants (population of interest)
- Randomly assign eligible applicants to attend workshop (A) or to access online course (B)
- Measure pre- and post-workshop knowledge of material
- Statistical comparison of A vs B = size of A's impact relative to B; cost-effectiveness can then also be computed

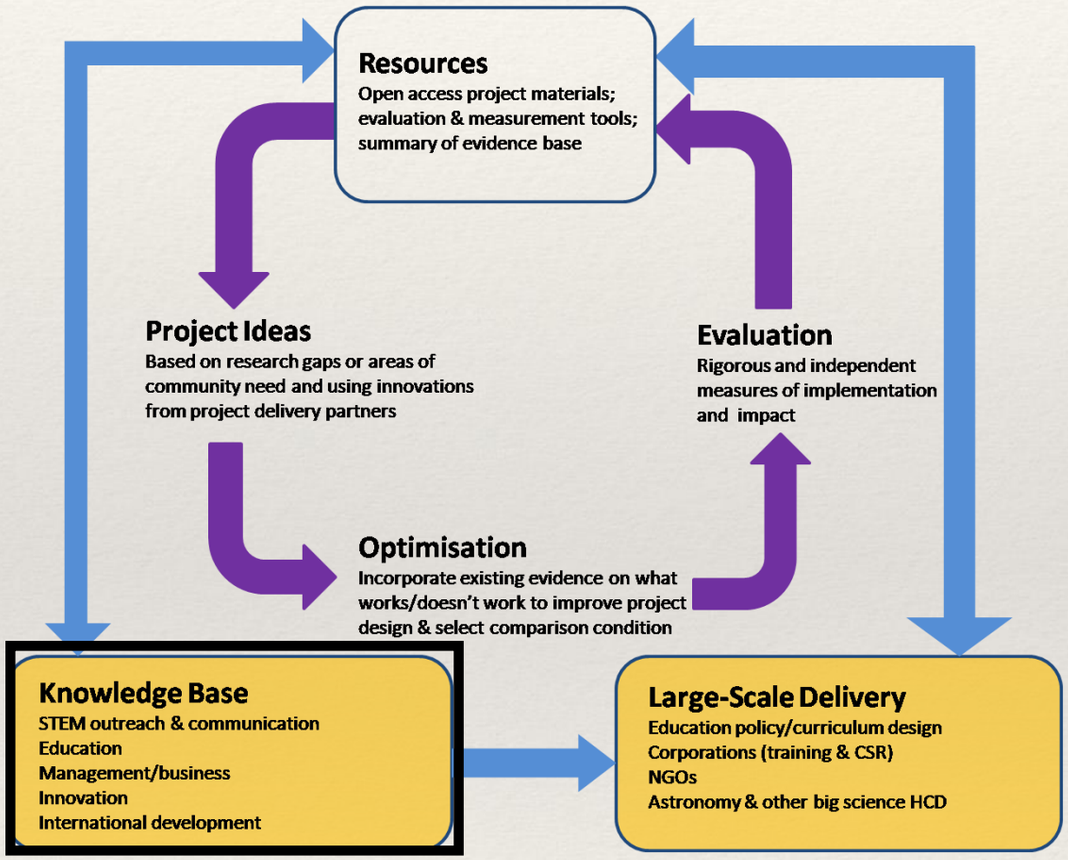
Evaluation: Support



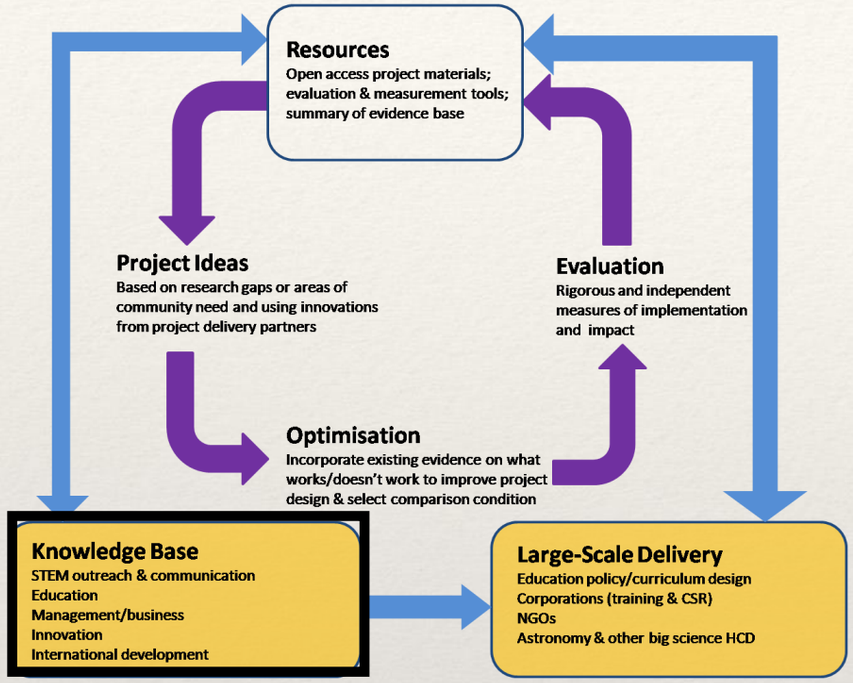
- Framework
- Types
- Examples
- **Support**

- OAD should support the project leaders, from internal resources and via relevant partners, in planning evaluation approaches (link to “Resources”)

5. Knowledge Base



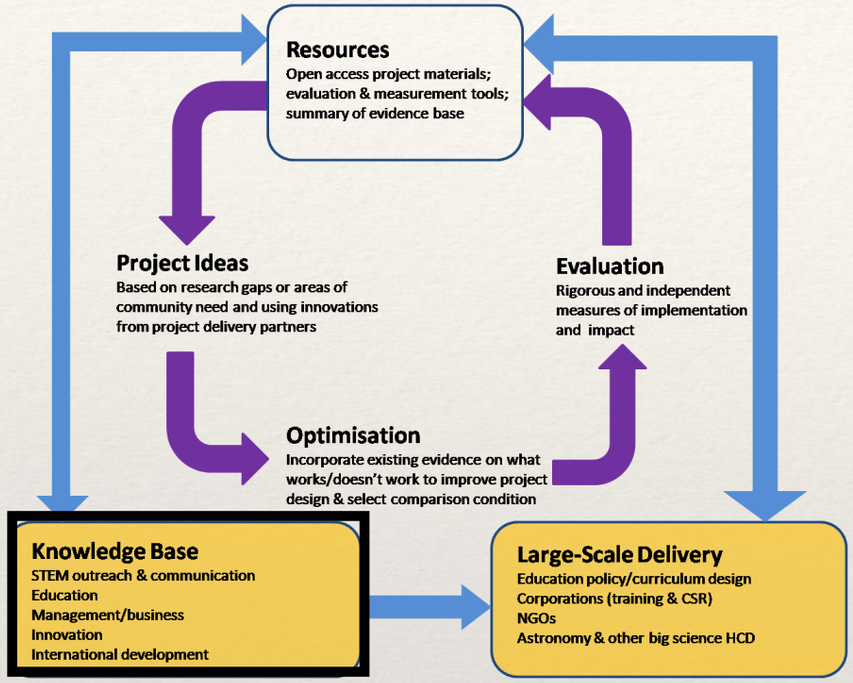
Knowledge Base: Target Communities



- **Target communities**
- Publications
- Policy briefs

- **STEM outreach and communication:** academic research, practitioners and supporting institutions
- **Education**: academic research, teachers (primary, secondary and tertiary), teacher training institutions, governmental departments, NGOs can benefit from findings on effective educational interventions (e.g. Does incorporating Astronomy in mathematics lessons lead to higher engagement or better learning outcomes?)
- **Management/Business:** academic research, human resources in industry, academia and research, corporate social responsibility initiatives
- **Monitoring & Evaluation**: professional and academic evaluation specialists, government departments, multilateral organisations
- **Development Economics:** academic researchers, development banks and NGOs

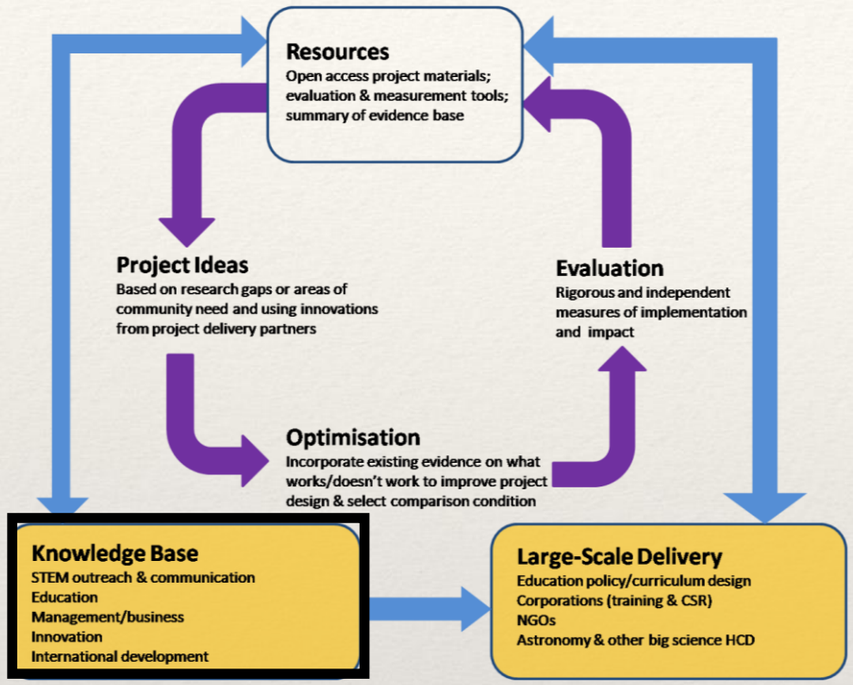
Knowledge Base: Publications



- Target communities
- **Publications**
- Policy briefs

- Open-access publications through OAD website and in peer-reviewed journals.
- Publications allow OAD-generated evidence to be incorporated in systematic reviews and policy reviews, thereby feeding into the global evidence base on science for development.
- Publications may be prepared by:
  - Project leaders (needs analysis, process evaluations, theory and project manuals)
  - OAD (process evaluations, impact evaluations, systematic reviews and evidence appraisals, meta-analyses combining impact evaluations)
  - External researchers and partners (analyses of primary and evaluation data)
- OAD and its partners can support project leaders to publish; impact and some process evaluations need to be published by OAD (independent of project implementer) or other independent evaluators

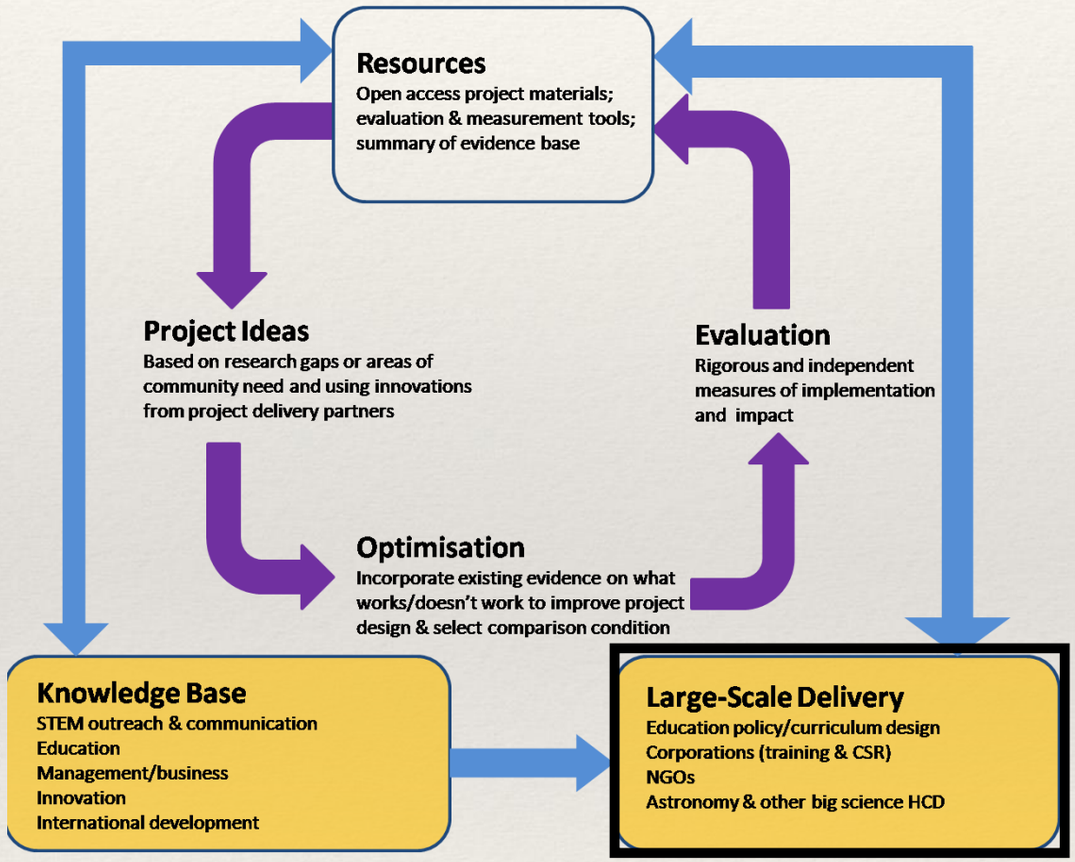
Knowledge Base: Policy Briefs



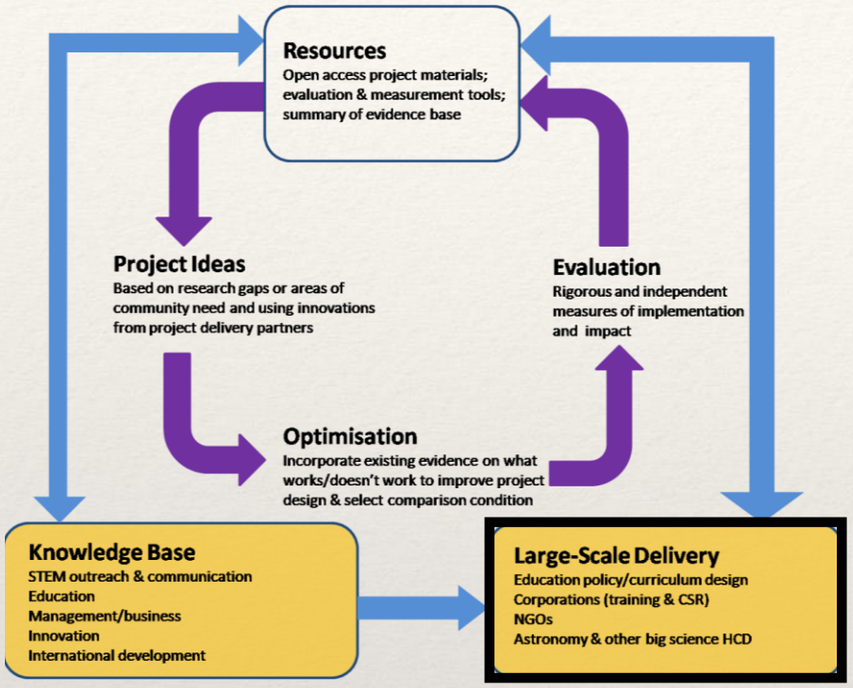
- Target communities
- Publications
- **Policy briefs**

- Accumulated knowledge from needs analyses and evaluations provides a platform for offering policy briefs to science and human capital development policy makers.
- Policy briefs are tools for translating “lessons learned” into practice by offering brief summaries of evidence pertaining to alternative policies.
- Resources offered by the OAD through the impact cycle (specifically project materials, data and publications) will be available for use in policy briefs prepared by others (e.g. think tanks, governments, science bodies, lobbyists, unions and NGOs)

6. Large-Scale Delivery



Large-Scale Delivery: Policymakers

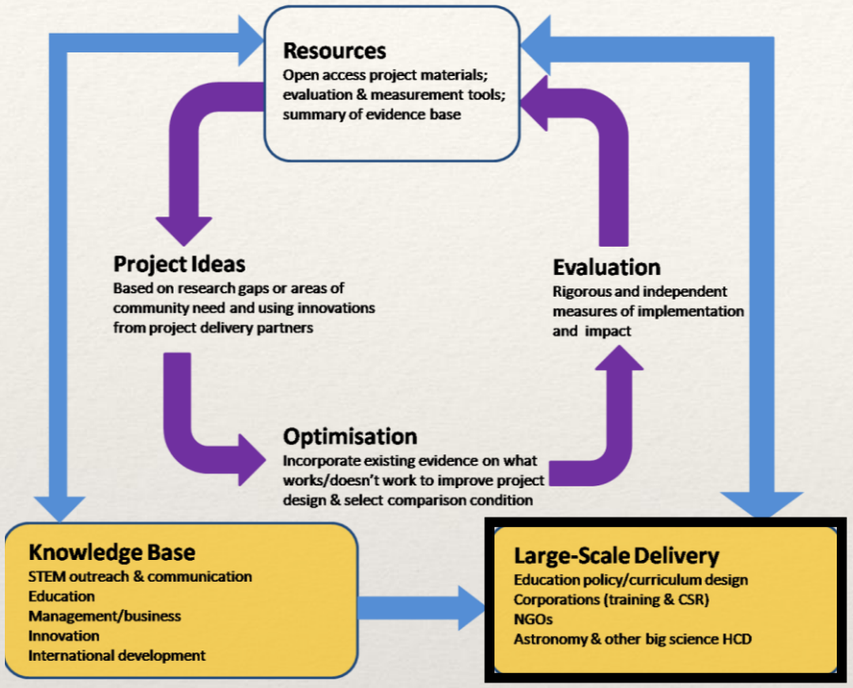


- **Policy makers**
- Industry
- NGOs
- Volunteers

- Large-scale policy changes (e.g. to national curriculums, science policy or educational funding streams) use available evidence to inform choices between alternative priorities and programmes

- Impact Cycle outputs (via Resources) would allow relevant evidence to be produced and provided to policymakers:
  - Evidence of impact and of cost-effectiveness demonstrated through evaluations
  - Dissemination via policy briefs and evidence reviews

Large-Scale Delivery: Industry

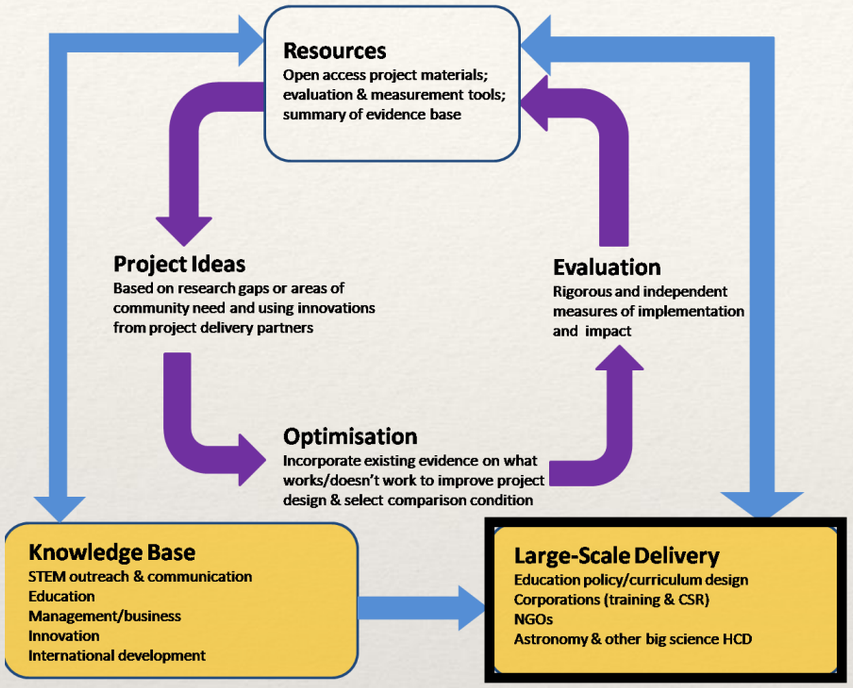


- Policy makers
- **Industry**
- NGOs
- Volunteers

- Evidence would allow the OAD to demonstrate that Astronomy can be an effective tool for addressing labour-market skills shortages (e.g. in data science, programming, engineering and software development)

- Industry support via investment in skills training workshops, changes to higher education curricula, and scholarship programmes could enable large-scale and sustainable expansion of related projects

Large-Scale Delivery: NGOs



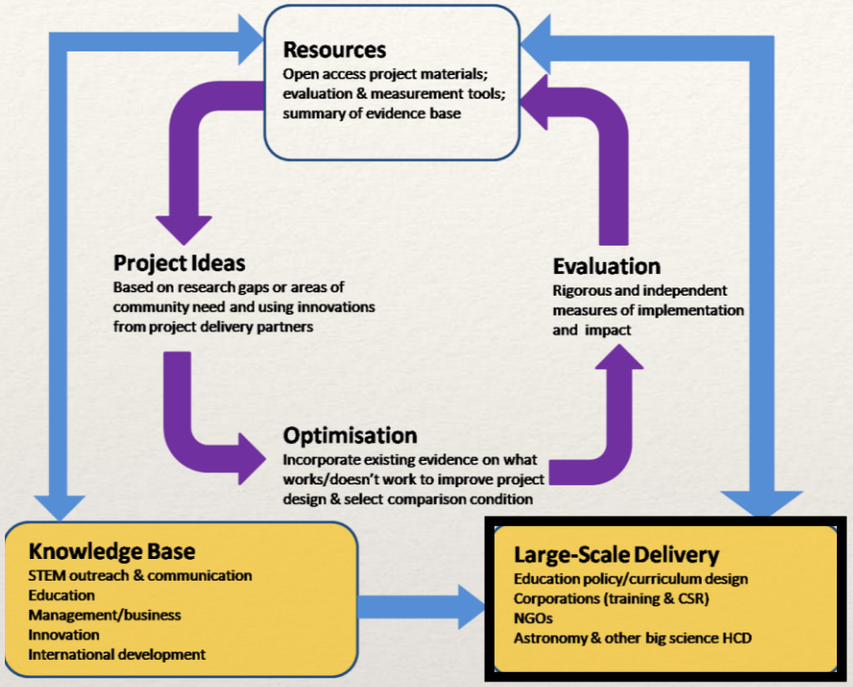
- Policy makers
- Industry
- **NGOs**
- Volunteers

- Large international non-governmental organisations (NGOs) (e.g. Save the Children, Oxfam); governmental departments (e.g. DFID, USAID); and multilateral organisations (e.g. UNICEF, UNDP, World Bank) support educational and human capital programmes on a much larger scale than the OAD can do alone.

- These organisations typically develop their own programmes; however, if an approach has been shown to be effective (i.e. have impact and be cost-effective), they are likely to adopt it.

- Impact Cycle outputs (evidence and replicable project materials) would provide such agencies with the information and materials they need to (1) be convinced that an OAD projects approach is worth using and (2) to scale-up the project

Large-Scale Delivery: Volunteers



- Policy makers
- Industry
- NGOs
- **Volunteers**

- Many science outreach and development projects are designed and delivered by volunteers
- There are many Astronomy outreach and educational resources currently available online but no strategic co-ordination to support volunteers (and teachers) in selecting those best-suited to their needs and most likely to be effective
- The Impact Cycle would allow volunteers to easily identify which relevant interventions have been *shown* to be effective and to replicate these approaches