How to access, evaluate and apply academic research: A practitioner's guide with examples from water, sanitation and solid waste

Version 1

This brief aims to inform practitioners on how to access, evaluate, and apply published academic research in their day-to-day tasks to make decisions and strengthen performance. This can include, but is not limited to:

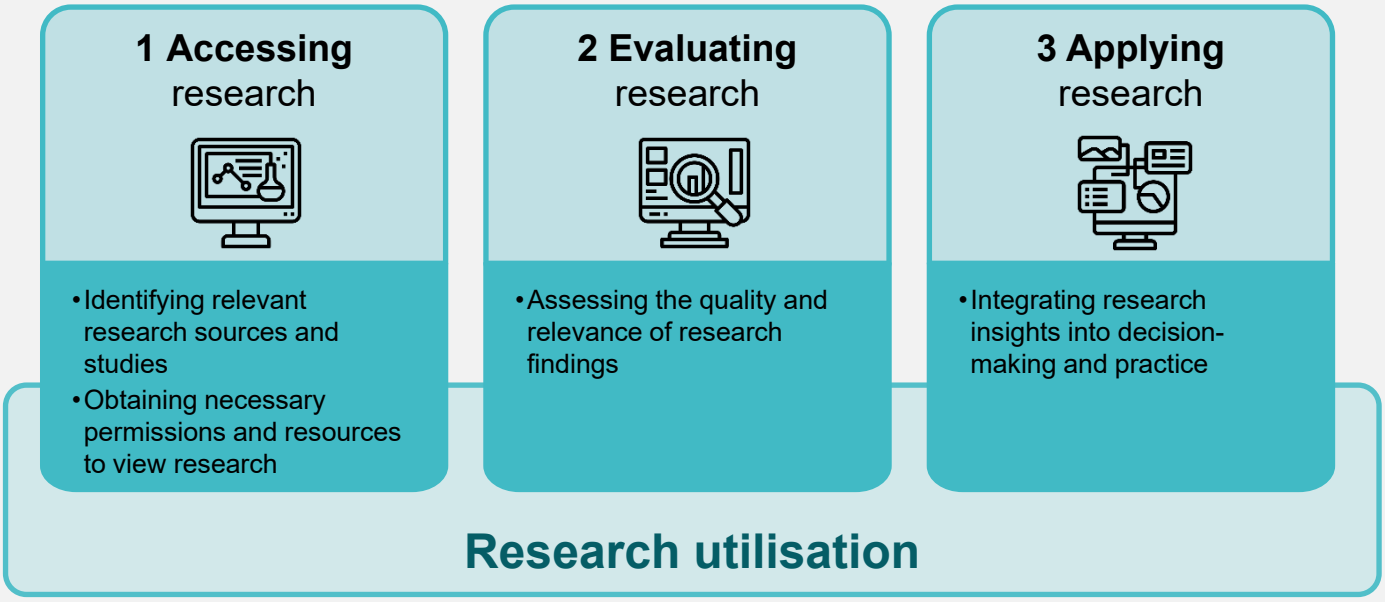
- **Funders:** Inform investment decisions and prioritise funding
- **Implementers**: Design effective activities and improve practices
- **Early Career Scholars**: Conduct research with practical applications and policy impact.

Why is research important?

Research continues to shape development and humanitarian aid activities. Without research, it is difficult for practitioners, including policy makers, funders, programme designers, and technical staff, to make informed decisions and evaluate progress.

- Research can provide insights to overcome the shortcomings of previous programmes and strengthen the success of shared outcomes.
- Research can provide validated methods, best practices, and innovative solutions, helping practitioners address challenges more effectively.
- Research fosters a culture of critical thinking, enabling practitioners to evaluate and adapt to evolving circumstances.

However, not all research is of the same quality. Research conducted in academic institutions is guided by more rigorous procedures and backed by peer-review processes that ensures the integrity of results and helps to build a robust evidence base.



This brief's objective is to guide practitioners on how to access and use current research findings found in published articles of scientific journals to improve their daily activities. Throughout the brief, we provide examples from the water, sanitation, and solid waste sectors to clarify some of the points. This brief first explains the structure of research articles, the publication process, and the main types of articles. Next the brief outlines: 1) where to find research articles, 2) how to assess them, and 3) how to utilise them. The brief focuses on published research articles, but this does not suggest that translated versions of research findings, such as policy and research briefs and other grey literature, are irrelevant. Rather, we highlight how published academic research can be effectively applied.

Typical structure of published papers

Typically, papers follow a standardised structure as illustrated in Figure 1. A research paper typically starts with an **Abstract**, which is a concise summary of the study. It provides a snapshot for quick comprehension of the main takeaway points. The **Introduction** comprises the background, research question, objectives of the paper, and a brief overview of the paper's structure. Some journals encourage authors to separate the background as a separate section or include a theoretical framework or scaffolding on which to situate results. The introduction and background set the context of the research both in literature and practice. The **Methods** offer the detailed context, procedures and materials used to ensure transparency and reproducibility of similar research. Some journals call this section the methodology and others the approach. Important information about ethics is often found in this section. The **Results** present the data and findings, reporting on the observed evidence and highlighting new discoveries. The **Discussion** comprises the interpretation, implications, limitations of the research, and opportunities for future research. Some journals encourage mixing results and discussion, while others require a separation. The **Conclusion** provides a summary and future directions in line with the findings. Finally, **References** are citations to support the work. Each part is critical. An example outline is provided in Box 1 on the next page.

Typical publication process

The publication process of scientific research typically begins with researchers preparing and submitting a draft manuscript. An editor screens it for relevance and quality before sending it for peer review, where experts evaluate its methodology, originality, and significance to the field. Based on reviewers' feedback, the manuscript may be revised, accepted, or rejected with potential recommendation for resubmission. Once accepted, the manuscript undergoes editing and formatting before publication. This publication process ensures that the research is accurate and valuable; however, such challenges as delays, bias, and accessibility could remain. The publication process alone can take a substantial amount of time. Post-publication, the work's quantitative impact is measured through citations and further use by the scientific and practice communities. An example process is provided in Box 1 on the next page.

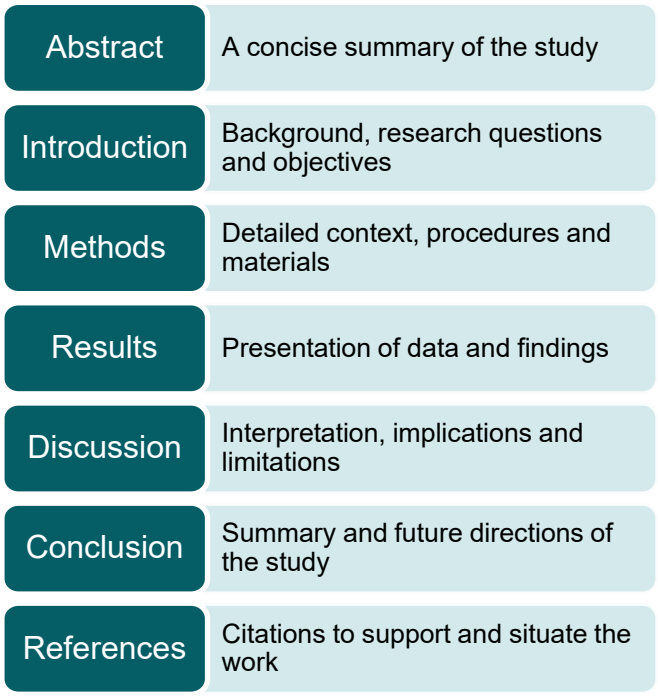


Figure 1: A typical structure of research articles

Box 1

Let's look at an example paper analysing rural water supply programmes by Sara Marks, Emily Kumpel, Jean Guo, Jamie Bartram and Jennifer Davis published in the *Journal of Cleaner Production* [1]. This paper was submitted in February, resubmitted in May, and accepted and made available online in September 2018; a total of seven months. The paper broadly follows the typical research paper outline; yet, it combines results and discussions and pulls out study limitations as a sperate section. At the time of publishing this brief, the paper had been cited 54 times, with 272 readers in the reference management platform Mendeley, and promoted through one blog and one news article.

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Pathways to sustainability: A fuzzy-set qualitative comparative analysis of rural water supply programs

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ABSTRACT

Despite recent progress extending access to drinking water supplies globally, ensuring long-term functionality of rural water infrastructure remains challenging. Past research on rural water project outcomes has used two principal approaches: large-N statistical studies estimating average effect sizes, or case studies providing causal description. Notably lacking is a rigorous comparative analysis of conditions determining sustained service delivery. We use fuzzy-set qualitative comparative analysis (fsQCA) to identify causal conditions ("pathways") leading to sustained functionality of rural water supplies across diverse geographies. Twenty cases were selected through a review of the literature. We identified and coded five conditions to examine their influence on project outcomes for each case. Results reveal three distinct pathways sufficient for achieving sustained functionality: Pathway 1 features piped networks with professionalized, service-oriented management and post-construction support. Pathway 2 features a self-supply approach (e.g., private wells and small piped schemes) delivering water services on premises. Pathway 3 describes community-managed water points (e.g., deep boreholes with handpumps) in the context of freshwater scarcity. Two conditions were common across all pathways: good financial management and user participation in project decisions. Strong management, combined with sufficient financial and technical resources, moderates the influence of physical water availability on service sustainability.

1. Introduction

Domestic water supply projects in rural communities have constituted one of the main forms of global development in recent decades. Much progress has been made in recent years extending rural water services to unserved communities worldwide (WHO/UNICEF Joint Monitoring Programme, 2015). Yet as the sector enters the Sustainable Development Goal (SDG)[2] era, with SDG 6 aiming to extend access to safe drinking water and adequate sanitation to all by 2030, water professionals would benefit from taking stock of the successes and failures of past decades.

Currently 884 million people worldwide still lack access to basic drinking water services (World Health Organization, 2017). The vast majority of the unserved live in rural areas of the least developed nations, where most fetch water at some distance from their homes. Even among water points qualifying as "improved" per global metrics, a substantial share do not deliver water that is safe for drinking (Onda et al., 2012). Accordingly, SDG Target 6.1 specifically prioritizes universal and equitable access to safe and affordable drinking water for all (United Nations, 2016).

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[1] Present address: Harvard School of Business, Harvard University, Boston, MA 02163, USA.
[2] Abbreviations: SDGs, Sustainable Development Goals; fsQCA, fuzzy-set qualitative comparative analysis; JMP, Joint Monitoring Programme; PCS, post-construction support.

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Outline

Academic papers can be downloaded as Portable Document Format (PDF) or viewed online in a web-browser.

Types of research articles

There are various categories of academic papers. These include original research, reviews, methodologies, theoretical models, positions, evaluations and opinions. Each serves a different purpose for practitioners and researchers.

- **Original research** present new findings from experiments or observations. These are important for operational staff since they feed the latest information into programmes, projects, or policies. From the Sandec department, we have an example where the performance of seven types of chlorination devices were tested in Uganda [2] and an example where system-level, passive chlorination in gravity-fed piped water systems in rural Nepal were evaluated [3].

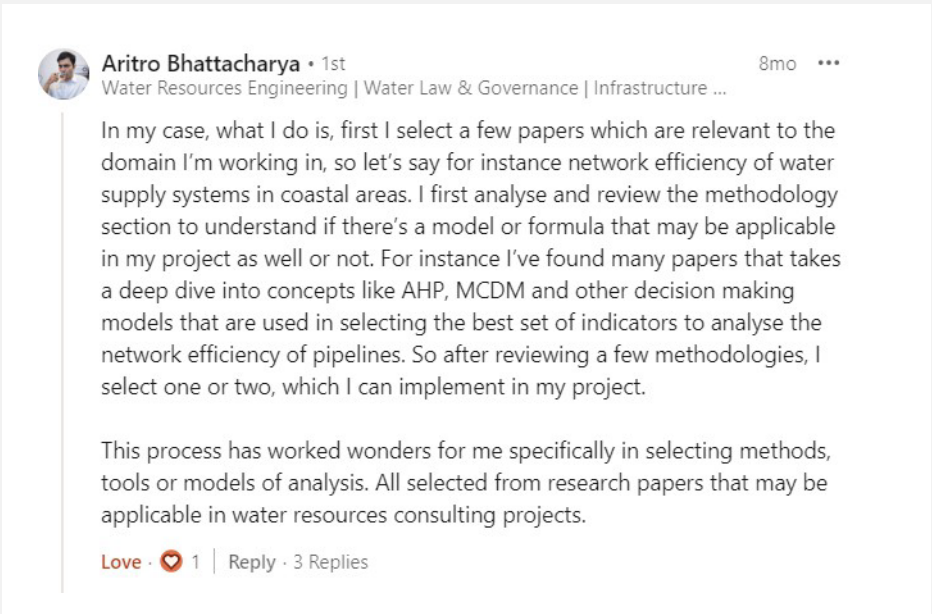
- **Reviews** assess scientific articles on a particular topic to identify trends and gaps. They are useful to get a broad insight into the state of knowledge on a particular theme and can potentially assist in re-orienting interventions accordingly. This example reviewed scientific advancements in non-sewered sanitation [4]. This review explored another review of treatment technologies for urban solid biowaste to create value products, focusing on low-and middle-income settings [5].

- **Methodology articles** focus on novel techniques or tools. However, all papers include a methods section, which can be particularly useful for consultants, as they offer validated ways of investigating challenges in practice (see **Box 2**). Often, methodological papers also include a specific case study to highlight the methodology in practice. In this example, the authors share a methodology to explore participation dynamics and the link to project outcomes [6]. This example from Vietnam explored plastic leakage into the aquatic environment from solid waste - by applying a waste flow diagram [7].

- **Theoretical papers** propose new models or frameworks of perceiving challenges for practitioners. They are particularly useful for managers and senior executives who drive the missions and visions of their organisations.

- **Position papers** advocate for a particular viewpoint with supporting evidence and are useful in shedding light on overlooked issues. Short communications report significant findings briefly, perspective papers share expert opinions on trends, and technical papers detail specific technologies or processes.

Box 2



This LinkedIn comment by Aritro Bhattacharya [8], a water resources consultant, illustrates the value of the methodology section for practitioners.

Step 1. Finding and accessing research: Identifying and searching for open access articles

Research articles can either be **open access** or **closed access**. Open access papers are accessible to anyone without payment or special licenses. They are typically published in journals for which access has been paid for by tax funding through public research institutions or other means. Only the abstract of closed access papers is publicly accessible without payment. Many universities and organisations have licenses to access closed papers.

Open access articles can be found and accessed through many platforms, including peer-reviewed databases, e.g. PubMed, JUSTOR, Scopus, Plos and Web of Science, institutional repositories, such as Eawag's Digital Object Repository (DORA) [9], and online search engines, such as Google Scholar, which help locate academic articles and rank scholars. ResearchGate and other platforms allow users to access papers directly from authors, while personal and institutional websites also host research outputs.

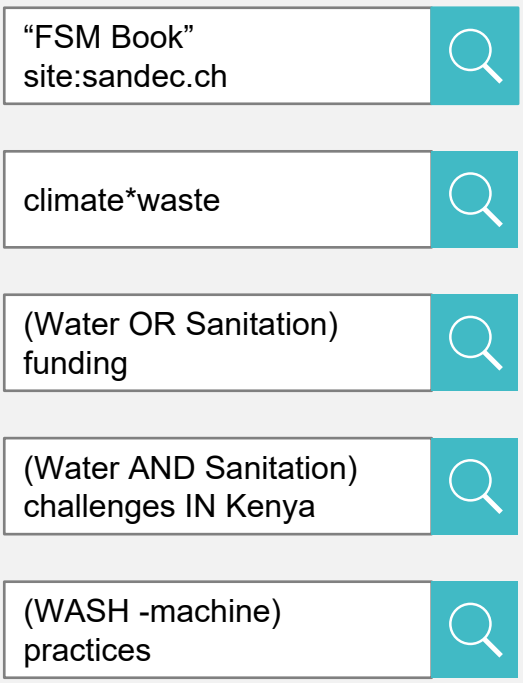
In addition to search engines, one can follow researchers and curated subject lists on social media platforms, such as LinkedIn to learn about new and emerging research.

To enhance search efficiency, we recommend familiarising oneself with basic search techniques to find more relevant papers quickly (see **Box 3**). This includes utilising relevant keywords and Boolean operators. Boolean operators (e.g., AND, OR and NOT) connect your search words together in a search engine to either narrow or broaden your set of results.

Many of these same search techniques can also be used on search engines to find grey literature, such as reports from like UN agencies, the World Bank, cooperation agencies, or even Sandec News [10].

Looking ahead, artificial intelligence (AI) based research support tools, such as WASH AI, Research Rabbit, Elicit, Consensus and Litmap, can assist practitioners in accessing, mapping, synthesising, and contextualising research. Additionally, AI can aid in optimising search queries, while DeepL can translate articles from and to different languages. These tools are useful; however, more advancement is needed for them to be able to simplify information accurately for practitioners to contextualise in their work, as well as understand contextual nuances.

Box 3



To refine search results effectively, specifically on Google Scholar, practitioners can use specific techniques.

- Use quotes to search for exact phrases - "FSM Book"
- Search for specific sites using site:url - site:sandec.ch
- Apply OR or AND for flexible or combined queries - water OR sanitation | water AND sanitation.
- Use an asterisk (*) to replace unknown words in phrases - "climate*waste"
- Group searches with brackets for complex queries - (water OR sanitation) AND (hygiene OR handwashing)
- Add IN and a country name to localise results - challenges IN Kenya.
- Exclude unwanted terms with a minus sign. This removes all results where the term WASH occurs with machine. - WASH -machine.

Step 2. Evaluating Research: Reading, interpreting and assessing the quality of research articles

The next step is to critically read and understand the identified articles. Articles can be stored in reference management platforms, such as EndNote, Mendeley or Zotero. These allow for further searching, highlighting and notetaking, as well as the creation of properly formatted references for future outputs.

Begin reading an article by reviewing the overall structure of the paper and read the abstract to have a big picture of the research and the findings. The conclusion can also give some well summarised insights into the findings.

As you do not always have time to read a full article, identify which other part of the paper are the most valuable for you. The introduction usually sets the background and identifies the research gap, justifying why the research is needed. It is informative to read especially for practitioners starting out or venturing into a new sector. If you are interested in how the study was done so you can do something similar, review the methodology. If you want to understand the detailed findings, read the results. If you want to know what these results mean to practitioners, read the discussion.

All journal publications have a corresponding author listed with contact details. If you have questions about the paper, or want further information, it is possible to contact the corresponding author for clarification.

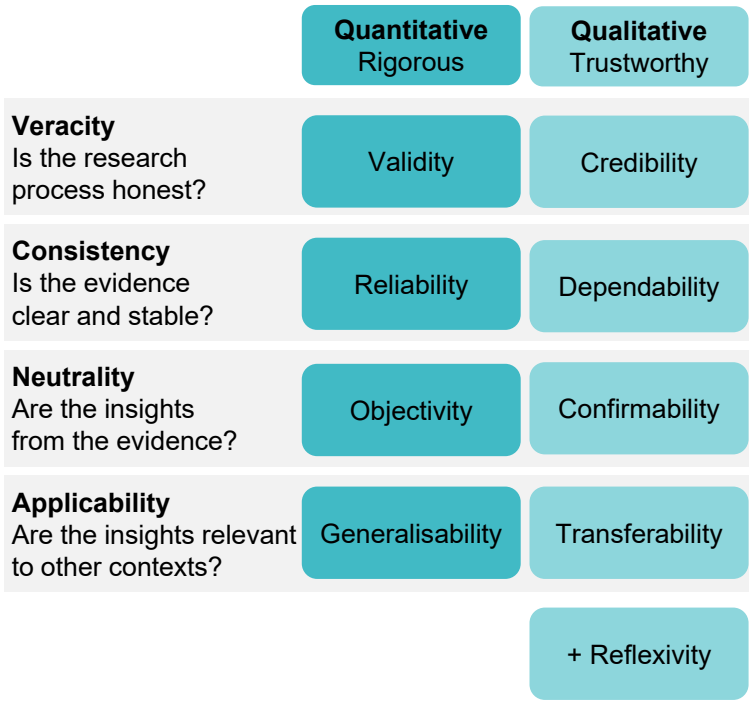


Figure 2: Principles of quality research (adapted from [11], [12] and [13])

Although most articles are peer-reviewed, there can still be a wide range of quality in published research. As such, it is also useful to assess the quality of research articles, which might be different if the research is quantitative (broadly, numbers based) or qualitative (broadly, words based). See **Figure 2**.

Good articles have veracity (truth value), consistency, neutrality and applicability [13]. They effectively outline the problem, the current research status, research gaps, and methods, while contextualising results within existing literature. They outline sufficient methodological detail to allow for replication of the study. This includes realistic sample sizes in relation to the study's conclusions, as well as analysis procedures that match the problem at hand. Good articles also address a tangible issue of practical concern to be relevant for the practitioners' sector. Good research also avoids exaggerated claims, explicitly states limitations and may be well-cited, suggesting influence in the field. All research is a process and most studies have limitations. Limitations themselves are not the problem; it is when limitations are not reported or understood that there tends to be a problem with incorrect interpretation of the evidence. If the author has previously published work, this can indicate reliability, and publication in a peer-reviewed journal often correlates with quality. **Box 4** provides an example of how clear objectives and study limitations look in practice.

Box 4

Our example article from **Box 1** illustrates both a clear objective and the integration of study limitations.

- The paper asks: how do conditions combine to ensure the sustainability of rural water supply systems? It provides three responses: 1) piped networks with professionalised, service-oriented management and post-construction support; 2) a self-supply approach (e.g. private wells and small piped schemes) delivering water services on premises; and 3) community-managed water points in the context of freshwater scarcity.
- The paper is also open about its limitations. In particular, the authors highlight the limitations in their case study approach, their data and the way that the data is interpreted.

Step 3. Applying Research: Contextualising research findings to practice

To contextualise research to practice, it is essential to start by understanding the context where the study was done. This involves identifying the location of the study and comparing its conditions with those in the place where you plan to use the research results; a similar concept to applicability from **Figure 2**. The key question is: what would make these papers' findings irrelevant for my context? Pay attention to geospatial scopes and key factors influencing the results, as well as the study's methodology, to understand the circumstances under which the research was conducted and to compare them with your own context.

A study's applicability can be internal or external. This is also sometimes referred to as internal and external validity. Internal applicability is when findings are true to the local context and the focus is on identifying causal relationships. An example of this is a consultant's report about a specific subject, e.g. water quality, in a small section of a town done to inform a water utility of the town. This cannot be generalised or transferred to other towns. Nevertheless, it is still useful. On the contrary, high external applicability is when findings can be generalised or transferred to other contexts and focus is on comparison. For example, a framework of water security, that can be applied across contexts. High applicability both internally and externally is great to have in studies, but significantly difficult to achieve for researchers.

It is also necessary to be mindful how the study's limitations affect the use of the findings in your context, including those not explicitly stated, such as funding constraints, the availability of trained professionals, or pre-existing trust between researchers and the community. These factors can significantly affect the outcomes and may not always be replicated in other settings. In addition, practitioners should engage directly with researchers by reaching out to them for clarification.

Lastly, practitioners should document any challenges they face when contextualising research and provide feedback to researchers. This creates a collaborative feedback loop, improving both future research and its practical application.

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