CERN IdeaSquare Journal of Experimental Innovation, 2024; 8(1): 5-8
DOI: https://doi.org/10.23726/cij.2024.1509

METHODOLOGICAL NOTE

Action research: Combining research and problem solving for socio-technical engineering and innovation management research

Matthias Guertler[1*], Nathalie Sick[1]

[1] University of Technology Sydney, Sydney, Australia
*Corresponding author: Matthias.Guertler@uts.edu.au

WHAT IS ACTION RESEARCH?

Action Research (AR) is an applied research approach, which aims at combining scientific rigour with practical relevance. It can help to overcome so-called "so what" research findings that do not show relevance or a clear implication to practice (Flyvbjerg and Sampson, 2011, p. 132f).

AR traces back to Kurt Lewin, one of the founders of organisational change management (Lewin, 1946). The idea is that purposeful research interventions in a real-world setting create practical change while at the same time evaluating and enhancing academic knowledge. Despite common misconceptions, AR is neither about unplanned activities without a clear research methodology nor about pure problem-solving (Levin, 2012). Instead, AR builds on existing academic theory to design an iterative series of interventions to solve a specific practical problem (Susman and Evered, 1978) (**Fig. 1**). A systematic observation and analysis of the intervention and its outcomes allow for evaluating the underlying theory in this context as well as enlarging theory through identifying tacit, often hitherto unknown aspects. Through the close interaction of researchers and practitioners, both sides benefit from mutual learning and competence building (Brydon-Miller *et al.*, 2003).

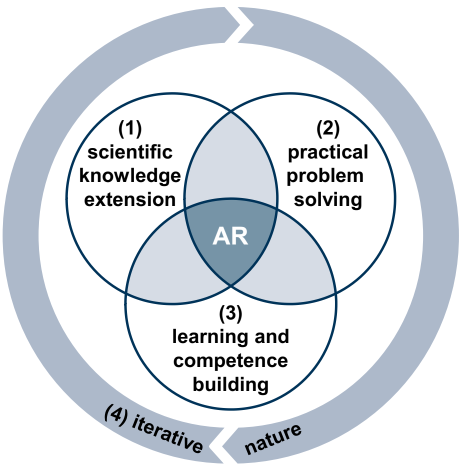

Fig. 1. The three core elements of action research (Susman and Evered, 1978; Levin, 2012)

Although often seen as a qualitative research approach, AR is sometimes considered as a third column besides qualitative and quantitative research (Lindhult and Axelsson, 2021). AR focuses on "research with" rather than "research on" practitioners enabling close and often trusting relationships (Eikeland, 2006, p. 196).

WHAT IS ACTION RESEARCH GOOD FOR?

AR is an applied research approach and especially useful for researchers who aim at exploring complex issues, providing support to practice, and creating change. AR is particularly helpful to explore complex issues inherent in socio-technical systems. In line with the perception that even the best technical system fails, once it gets in touch with a human, the multitude, variety and dynamics of elements within socio-technical systems make it challenging to build a holistic understanding of these systems.

AR interventions work similar to experiments to test specific hypotheses and research questions. A systematic reflection between AR iterations allows for continuous learning, refinement of research questions, and pivoting of the research direction (Guertler *et al.*, 2020). Doing research in the field also allows for investigating so-called anomalies, i.e. outliers and/or unexpected and inexplicable findings, from other studies.

AR is also suitable when researchers aim at using their research to provide specific support to practitioners, such as solving a specific problem or developing methods enabling practitioners to do this themselves.

This links to AR's ability to create change or impact. Depending on the specific research topics, this could range from solving a focal problem to building lasting learning and competences. Through its applied and learning nature, AR also supports the collaboration of interdisciplinary research teams (Levin, 2012).

Different disciplines have developed often loosely linked AR traditions to support specific research topics and contexts (Guertler *et al.*, 2019).

This means that there is not the one and only AR approach. On the downside, this variety can be overwhelming and cause confusion about what AR approach is particularly suitable. On the upside, this variety of AR approaches offers a range of choices for different research goals and settings.

Despite having similar core concepts, each AR approach has specific sub-processes, activities and methods. Although their names often indicate their disciplinary origin, most AR approaches can be used across disciplines. Differentiating AR approaches based on their focal (1) level of change, and (2) level of engagement between researchers and practitioners provides decision support for which AR approach to choose for a particular research setting (Fig. 2).

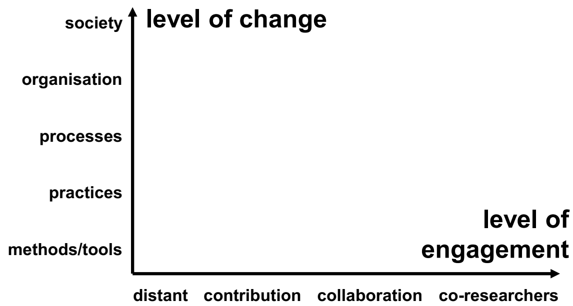

Fig. 2. Dimensions of Action Research approaches

Level of change describes where an intended change should take place, ranging from methods and tools to processes and organisations or (parts of) society.

Level of engagement describes the degree of interaction between researchers and practitioners and can range from rather distant relationships to co-researcher settings (Susman and Evered, 1978). Closer approaches like participatory AR can provide specific support in working with and empowering vulnerable groups.

For example, participatory AR shows a strong social action and theory basis to create change from a procedure to a society level. Centred on the idea of empowering practitioners, it is highly collaborative and can include co-researcher settings (Ozanne and Saatcioglu, 2008). Canonical or organisational AR shows a preference for changing procedures, from an individual level to entire organisations (Susman and Evered, 1978). The engagement level ranges from collaboration to occasionally co-researcher settings. In comparison, educational AR is most often practitioner-led, i.e. a strong co-researcher setting, focussing on changing (teaching) practices and processes, sometimes including schools as organisations (Mertler, 2016). Innovation AR aims at publishing and transferring academic knowledge into practice. Its focus is on methods like the Balanced Scorecard, single practices and processes, based on contribution and collaboration (Kaplan, 1998).

HOW TO USE ACTION RESEARCH

Action Innovation Management-Research (AIM-R) is an AR approach that is especially useful for socio-technical research topics, which makes it suitable for a large variety of research areas, such as innovation management, engineering (systems) design, robotics human-centred design and beyond (Guertler *et al.*, 2020). Its iterative form is based on other AR approaches like Susman and Evered (1978). AIM-R specifically stresses the duality of academic research and problem-solving, which need to be situationally balanced. AIM-R focuses on changes on a method/tool, practice and process level, while focussing on engagement levels, ranging from rather distant, via contribution, to a collaborative interaction.

AIM-R has five iterative phases, where the outcomes and reflections of an AIM-R cycle inform the planning of the next one. Within each phase, researchers can use different activities and methods to achieve their specific research and practice goals, such as interviews, surveys, design-led focus groups, etc.

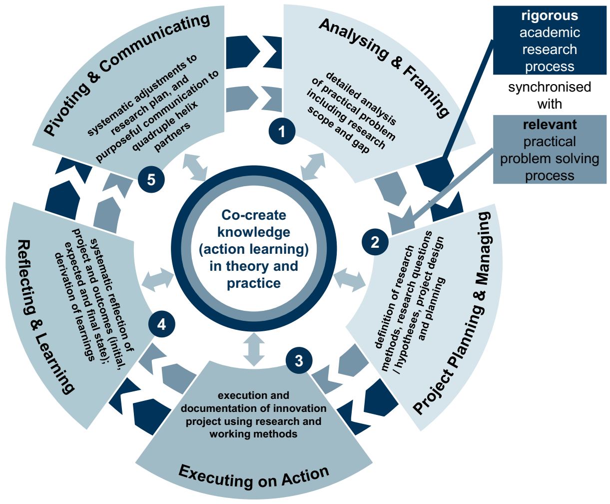

Fig. 3. Action Innovation Management-Research (AIM-R) (Guertler *et al.*, 2020)

1) Analysing & Framing: An AIM-R project can be triggered both by an identified research gap and/or a practical problem. This phase analyses, frames and scopes the research and the problem-solving part of the project, including an analysis of key stakeholders and contextual factors and constraints.

2) Project Planning and Managing: Based on phase 1, this phase specifies the objectives, research methods, project activities, quality metrics, required resources, and timeline. This also includes refining research questions and/or hypotheses, which are usually drafted in phase 1. The outcome is a research project plan for the following phase.

3) Execution on Action: This is the actual action phase, where the research project plan is executed. However, researchers need to closely observe, document and analyse each project activity. This is critical from a research perspective as well as from a project management perspective to timely identify unforeseen events and deviations between plan and reality, in order to adapt accordingly if necessary.

4) Reflecting & Learning: A systematic reflection of project activities, outcomes and incidents is essential to derive new insights for academia and learnings for practitioners and researchers. Along with the two preparation phases, this phase is critical to ensure the scientific nature of AIM-R and AR.

5) Pivoting & Communicating: Based on the derived insights and learnings, the following AIM-R cycle is planned. This could range from a rather similar next cycle to obtain further empirical evidence on an issue to a major course adjustment if new issues were identified and rated more critical than original ones. This phase also addresses a holistic communication of findings beyond pure academic outlets. Practitioner magazines, news articles, workshops, etc. can help to communicate learnings back to practitioners, create benefits, and motivate them to participate in future research projects.

HOW WAS AIM-R APPLIED IN AN EXAMPLE PROJECT

From an overarching research design perspective, each AIM-R cycle could be treated as a separate case study. AIM-R can also be used recursively, i.e., it can be used within each of its phases: for instance, while the main AIM-R process aims at the systematic planning of open innovation and development of a guideline, its Execution on Action phase can comprise a series of embedded AIM-R cycles to evaluate and advance the guideline in different settings. The example of this open innovation research project helps to illustrate the iterative and recursive use of AIM-R (**Fig. 4**). Guertler *et al.* (2020) provide additional project details.

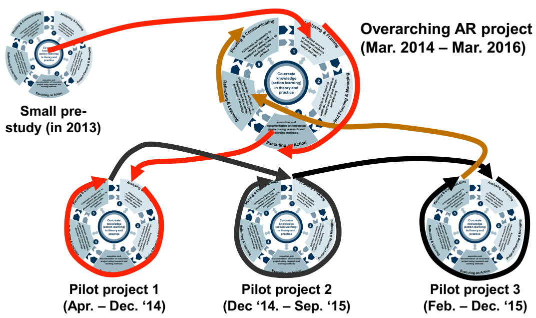

Fig. 4. Example procedure of an AIM-R project (Guertler et al., 2020)

1) Analysis and Framing: The overarching AIM-R project was triggered by a small qualitative pre-study, which validated the practical relevance of methodically planning open innovation projects. Along with a literature analysis to confirm the research relevance, this allowed to derive nine potential research questions. In collaboration with an industry cluster funding agency, three research questions were selected for the overarching project, including the recruitment of three company partners. The role of the companies was to sense-check initial research findings as well as provide specific R&D tasks to help develop and evaluate a new open innovation project planning guideline. Thus, the goal was to engage the companies on the level of collaboration, where each company's project team was actively involved in developing and evaluating the guideline. The intended level of change focussed on changing procedures within an overarching R&D management process.

2) Project Planning and Managing: As part of project planning, each company provided a list of potential R&D tasks, from which the university research team selected the most suitable ones with respect to research relevance. These built the basis of three pilot projects, i.e. one per company. The pilot projects allowed to apply and evaluate a new open innovation guideline for different R&D tasks and company settings. The guideline itself was developed based on existing literature and enhanced by new elements to address the selected research gaps. To allow for learnings and pivots between pilot projects, they were planned sequentially with some overlaps.

3) Execution on Action: This phase comprised three recursive AIM-R iterations. Based on the overarching project plan from phase 2, the specific R&D task was clarified, project success metrics defined, and a detailed project plan for each pilot project created – please note that this could also be done in phase 2. In each pilot project, the practitioners from the companies applied the draft open innovation guideline. Based on their feedback and questions, observations of them using the guideline and the analysis of generated artefacts, the university research team evaluated the effectiveness and efficiency of the guideline as a whole as well as specific guideline elements. This also allowed to evaluate the application of theory in new settings and combinations, such as combining stakeholder theory and open innovation.

4) Reflecting & Learning: The captured data from phase 3 identified strengths and weaknesses of the draft guideline, underlying reasons and potential areas for improvement as well as resulting academic insights. Given the high level of practitioner engagement, this also included a careful analysis whether identified effects were due to the guideline, project settings, individual practitioners, or interaction with researchers. For instance, aside from two successfully completed pilot projects, the last pilot project was not successful. The retrospective analysis revealed that this was due to a change of the company project manager and the research team having focussed too much on ensuring project manager commitment but neglecting the rest of the company project team. In the successful pilot projects, the project team members had been intrinsically motivated and used the research project to build their competences and to support their career progression.

5) Pivoting & Communicating: Aside from academic publications, the open innovation guideline and project findings were presented at a series of regional industry workshops of the funding agency to share learnings among their member companies. As phase 4 had revealed company size as a key success factor, another pilot study with a start-up company was added to explore this further.

CONCLUSION OF STRENGTH AND WEAKNESSES OF AR

In sum, AIM-R and AR in general support a deep exploration of complex socio-technical systems and issues (Kaplan, 1998; Guertler *et al.*, 2019). Through applying academic theory in practice, AR solves specific problems and thus this allows for evaluating as well as enhancing existing theory (Levin, 2012; Mumford, 2001). Its interdisciplinary character is particularly helpful to overcome disciplinary silos (Levin, 2012) and to build a deeper understanding of effects and their causes (Flyvbjerg and Sampson, 2011). The often close interaction with practitioners supports competence building and the diffusion of academic knowledge, i.e. research impact (Kaplan, 1998). The iterative research process with its pivots can help to explore new and unknown research fields and to continuously balance research and practice needs (Guertler *et al.*, 2019).

However, AR also has its own challenges that need to be considered. The close interaction with practitioners within a socio-technical system increases efforts and time for research planning and execution (Sørensen et al., 2010), especially to ensure research validity and rigour (Eikeland, 2006). The close interaction with practitioners also means researchers need to pay close attention to stakeholder interests and politics (Mumford, 2001), as e.g. highlighted by the failed pilot project in the example AIM-R project. This includes aspects like bias resulting from a close researcher-practitioner collaboration and how to present research findings in a suitable way to different stakeholders. Although approaches like AIM-R focus on providing methodological structure for researchers, the iterative nature of AR projects can be challenging. Aside from the planning and execution of AR projects, this includes issues such as presenting a lengthy iterative project in a concise format within a linearly structured research paper.

We hope that this overview inspired fellow researchers to use AR to tackle socio-technical engineering and innovation management challenges. By applying AR in structured and rigorous way, we can help to increase trust in action research quality and increase its acceptance in the academic community.

REFERENCES

Brydon-Miller, M., Greenwood, D. and Maguire, P. (2003), Why Action Research?, Action Research, Vol. 1 No. 1, pp. 9–28.

Eikeland, O. (2006), Validity in Action Research - Validity of Action Research, in Nielsen, K.A. and Svensson, L. (Eds.), Action and interactive research - Beyond practice and theory, Shaker, Maastricht, pp. 193–240.

Flyvbjerg, B. and Sampson, S. (2011), Making social science matter: Why social inquiry fails and how it can succeed again, 13. printing, Cambridge Univ. Press, Cambridge.

Guertler, M.R., Kriz, A. and Sick, N. (2020), Encouraging and enabling action research in innovation management, R&D Management, Vol. 50 No. 3, pp. 380–395.

Guertler, M.R., Sick, N. and Kriz, A. (2019), A Discipline-Spanning Overview of Action Research and Its Implications for Technology and Innovation Management, Technology Innovation Management Review, Vol. 9 No. 4, pp. 48–65.

Kaplan, R.S. (1998), Innovation Action Research: Creating New Management Theory and Practice, Journal of Management Accounting Research, Vol. 10, pp. 89–118.

Levin, M. (2012), Academic integrity in action research, Action Research, Vol. 10 No. 2, pp. 133–149.

Lewin, K. (1946), Action Research and Minority Problems, Journal of Social Issues, Vol. 2 No. 4, pp. 34–46.

Lindhult, E. and Axelsson, K. (2021), The logic and integration of coproductive research approaches, Int J Managing Projects in Bus, Vol. 14 No. 1, pp. 13–35.

Mertler, C.A. (2016), Action research: Improving schools and empowering educators, Fifth edition, SAGE, Los Angeles.

Mumford, E. (2001), Advice for an action researcher, Information Technology & People, Vol. 14 No. 1, pp. 12–27.

Ozanne, J.L. and Saatcioglu, B. (2008), Participatory Action Research, Journal of Consumer Research, Vol. 35 No. 3, pp. 423–439.

Sørensen, F., Mattsson, J. and Sundbo, J. (2010), Experimental methods in innovation research, Research Policy, Vol. 39 No. 3, pp. 313–322.

Susman, G.I. and Evered, R.D. (1978), An Assessment of the Scientific Merits of Action Research, Administrative Science Quarterly, Vol. 23 No. 4, p. 582.