Systematic Reviews in Software Engineering

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Application

Systematic reviews [1] synthesizing evidence about **socio-technical factors in technical debt**, including:

- **Human factors** (communication, expertise, team structure) influence debt accumulation.
- **Organizational policies** on debt identification and remediation.
- **Knowledge sharing** impact on technical debt awareness and management.
- **Cultural factors** (time pressure, quality values) and their relationship with debt types.
- **Research biases** in technical debt measurement and assessment methods.

Characteristics

Philosophy: Positivism that is pragmatism-oriented, focus on evidence buildup and practical implications.

Approach: Primarily deductive, hypothesis-testing by meta and thematic analysis of empirical evidence.

Choice: Multi-method design that includes qualitative and quantitative synthesis.

Time horizon: Cross-sectional synthesis with longitudinal analysis where possible

Techniques and procedures: Systematic search, quality assessment and data extraction of both technical and social aspects, bias assessment, and open PRISMA reporting processes.

Researcher Bias: The Use of Machine Learning in Software Defect Prediction [2]

Context: Despite decades of research on software defect prediction, no consensus exists on the optimal methods. This systematic review of 42 base studies (600 experimental outcomes) aimed to understand why prediction performance varies so erratically across studies. Varied outcomes reflect strong socio-technical influences - just as technical debt management struggles with a multitude of disparate assessment approaches among teams and companies.

Objective: In order to find and quantify socio-technical factors (primarily researcher bias) behind experimental outcomes in defect prediction research, and present recommendations for reducing them. This meta-analysis demonstrates the potential of systematic reviews to reveal social factors behind technical processes and make them visible - a strategy directly applicable to revealing socio-technical factors behind technical debt accumulation.

Empirical evaluation

RQ$_1$ What is the relative contribution of technical factors (classifier, data set, input metrics) to experimental outcomes relative to socio-technical factors (researcher group)?

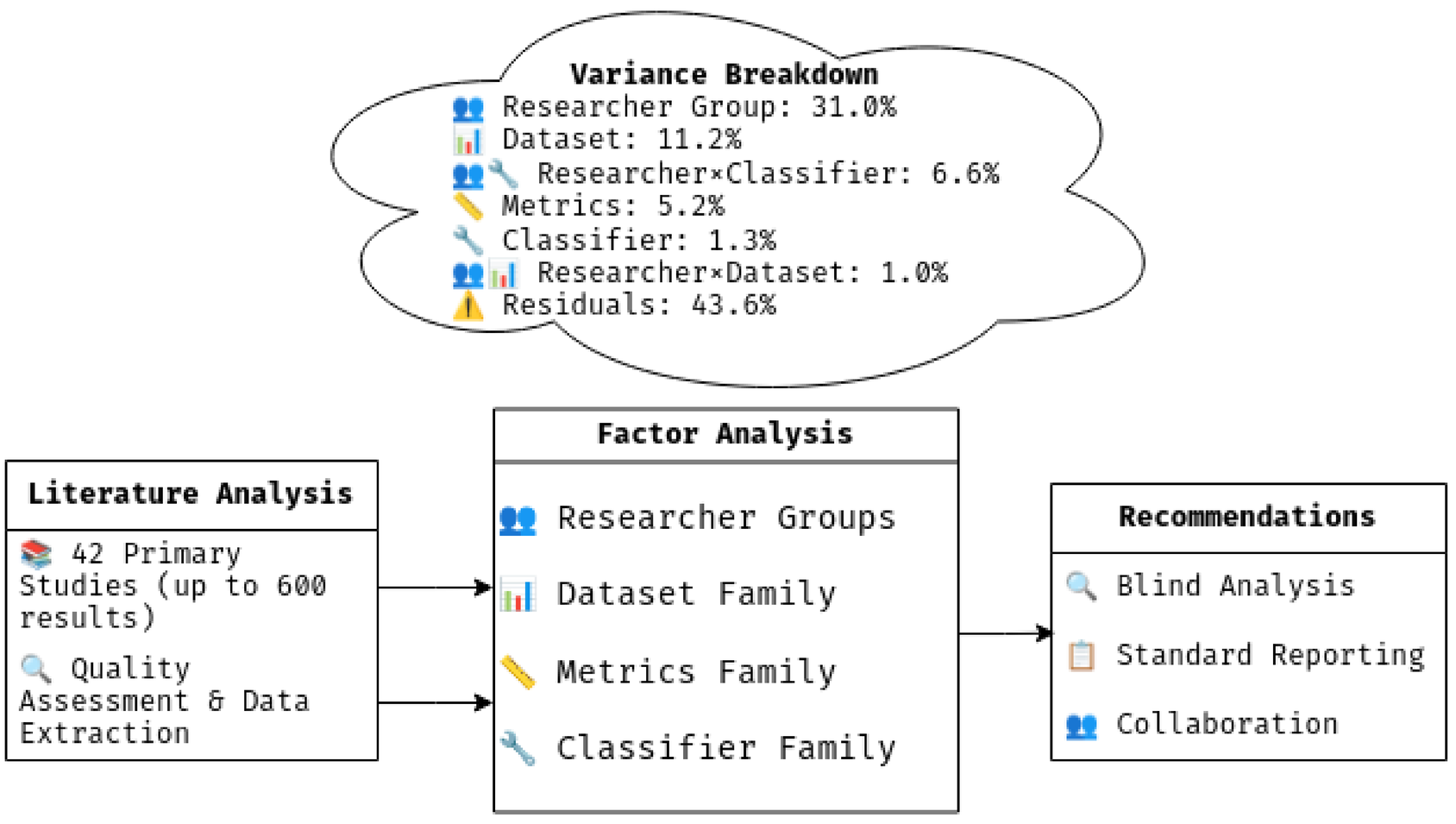
RQ$_2$ To what extent is researcher group affiliation a factor in reported performance compared to the actual classifier technique?

RQ$_3$ How do different research teams approach the same technical problem, and why do their results vary?

RQ$_4$ What reporting conventions and methodological practices can reduce researcher bias?

RQ$_5$ How does the software engineering community distinguish between authentic technical advancements and artifacts of research/team knowledge?

RQ$_6$ What team research practices would minimize expertise-driven biases in empirical studies?



[1] https://github.com/acmsigsoft/EmpiricalStandards/blob/master/docs/standards/SystematicReviews.md (last visited: 06/04/2025)

[2] Martin Shepperd, David Bowes, and Tracy Hall. "Researcher Bias: The Use of Machine Learning in Software Defect Prediction." IEEE Transactions on Software Engineering, vol. 40, no. 6, pp. 603-616, June 2014. DOI: https://doi.org/10.1109/TSE.2014.2322358