## Software Sustainability An Annotated Bibliography

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Due to the diversity of research teams, experimental setups, methodological frameworks, tools, and the emerging nature of the field, navigating the Software Sustainability domain can be a daunting task. Here, we provide a conceptual compass to help readers navigate the landscape of Software Sustainability.

## References

- IASA Business Technology Architecture Body of Knowledge (BTABoK) on Sustainability Architecture, https://iasa-global.github.io/btabok/sustainability.html,
  This website is collecting, among other, architecture principles from industrial
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- 3. Fatima, I., Lago, P.: Towards a sustainability-aware software architecture evaluation for cloud-based software services, pp. 200–216. Lecture notes in computer science, Springer Nature Switzerland (2024)
  - This article presents a blueprint to provide guidance for sustainability-aware software architecture evaluations.
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- 5. Font Vivanco, D., Freire-González, J., Galvin, R., Santarius, T., Walnum, H.J., Makov, T., Sala, S.: Rebound effect and sustainability science: A review. Journal of industrial ecology 26, 1543–1563 (2022), http://dx.doi.org/10.1111/jiec.13295
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  - In 2024, over 10 research groups in four countries came together to reconcile their visions of Software Sustainability, measurement models, technical setups, and research about how to assess the environmental impact of software. The result of this collaborative effort is the Green Software Measurement Model (GSMM), a framework (with guidelines) containing the essential elements for measuring software and to categorize existing measurement methods in the context of Software Sustainability.
- Heldal, R., Nguyen, N.T., Moreira, A., Lago, P., Duboc, L., Betz, S., Coroamă, V.C., Penzenstadler, B., Porras, J., Capilla, R., Brooks, I., Oyedeji, S., Venters, C.C.: Sustainability competencies and skills in software engineering: An industry perspective. The Journal of systems and software 211, 111978 (2024), https://www.sciencedirect.com/science/article/pii/S0164121224000219
  - To understand the knowledge needs of practitioners, Heldal *et al.* present a comprehensive survey of IT/sustainability practitioners from 28 distinct organizations in different industrial domains and 9 countries.
- Hilty, L.: Computing Efficiency, Sufficiency, and Self-sufficiency: A Model for Sustainability? In: Computing with Limits. s.n. (2015), https://computingwithinlimits.org
  - This article provides a general introduction in a relatively recent research line resembling de-growth (as opposed to unsustainable continuous growth) and called *digital sufficiency*, *i.e.*, investing in *less* technology as opposed to more technology that is optimized.
- 9. Huang, D., Qing, Y., Shang, W., Cui, H., Jie, M.Z.: EffiBench: Benchmarking the Efficiency of Automatically Generated Code (2024)
  - This article presents a benchmark on the efficiency of (automatically-generated) software.
- ISO/IEC: ISO/IEC 21031:2024 Information technology Software Carbon Intensity (SCI) specification, https://www.iso.org/standard/86612.html, This standard presents a methodology for calculating the rate of CO<sub>2</sub> emissions for software systems.
- 11. Lago, P., Condori-Fernandez, N.: The sustainability assessment framework (SAF) toolkit: Instruments to help sustainability-driven software architecture design decision making. https://github.com/S2-group/SAF-Toolkit (Apr 2022), The Sustainability Assessment Framework (SAF) Toolkit is a set of concrete instruments developed to support software architects and design decision makers in modeling sustainability as a software quality property.
- Lago, P., Condori Fernandez, N., Fatima, I., Funke, M., Malavolta, I.: The sustainability assessment framework toolkit: A decade of modeling experience. Springer Software & Systems Modeling 12, 1–23 (2024)
  - The SAF Toolkit is the result of more than a decade of case studies in collaboration with industrial partners.

- 13. Lago, P., Koçak, S.A., Crnkovic, I., Penzenstadler, B.: Framing sustainability as a property of software quality. Communications of the ACM 58(10), 70–78 (2015) This article introduced the four dimensions of sustainability as software quality concern. This is definitely the first and foremost reading for understanding how technical, social, economic, and environmental sustainability dimensions fit together.
- 14. Malavolta, I., Stoico, V., Lago, P.: Handbook on Teaching Empirical Software Engineering, chap. Ten Years of Teaching Empirical Software Engineering in the context of Energy-efficient Software, pp. 209–253. Springer (2024) onsidering the increasing interest in the energy footprint of software systems and how to measure it, we point the interested reader to the reflections of Malavolta et al. on their 10 years of experience in teaching how to design and execute empirical experiments that measure software energy consumption among other quality concerns.
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