Augmented Agile: Human Centered AI-Assisted Software Management

Rashina Hoda, Monash University, Australia
Hoa Dam, University of Wollongong, Australia
Chakkrit Tantithamthavorn, Monash University, Australia
Patanamon Thongtanunam, University of Melbourne, Australia
Margaret-Anne Storey, University of Victoria, Canada

Cite as: Hoda, R., Dam, H., Tantithamthavorn, C., Thongtanunam, P., & Storey, M. A. (2023). Augmented Agile: Human-Centered AI-Assisted Software Management. *IEEE Software*, *40*(4), 106-109. https://doi.org/10.1109/MS.2023.3268725

From the Editor

In this issue, our column tries to break down the false dichotomy between "traditional SE" and "SE+AI." Our authors argue that a combination of both can improve standard SE methods, specifically agile software development and project management. But for future issues, what do you want to see in this "SE for AI" column? Do you have a surprising result or industrial experience? Something that challenges decades of conventional thinking in software engineering? If so, e-mail a one-paragraph synopsis to tim@menzies.us (subject line: "SE for AI: Idea: [Your Idea]"). If that looks interesting, I'll ask you to submit a 1,000–3,000 word article (where each graph, table, or figure is worth 250 words) for review for IEEE Software. Note: Heresies are more than welcome (if supported by well-reasoned industrial experiences, case studies, or other empirical results). —Tim Menzies

Is Being Agile Enough?

Agile methods have served software engineering well for over two decades, improving responsiveness to change, empowering teams, and facilitating better communication among various project stakeholders. But is it enough to lead us through the next era where balancing business value with human values has become more relevant than ever, especially in an increasingly artificial intelligence (AI)-assisted, hybrid world? We do not think so, and, in this article, we present our vision of "augmented agile" where agile practices are augmented with new capabilities made possible by AI while incorporating human-centered values.

We argue that the term "agile" is fast becoming redundant. A majority of software engineering projects use agile methods as standard and a growing number of software engineers are *agile natives*, having never experienced traditional software methods. Since their emergence in the late 1990s, agile methods have dominated about half of software engineering history and have ushered in a paradigm shift from a sequential documentation-led approach to one led by regular communication and responsiveness to change.[1]

The success of software projects relies heavily on project manage ment.[2] Agile project management frameworks such as Scrum have served us well to "enhance ability to manage changing priorities," "accelerate software delivery," and "increase team productivity."[3] But they are not without limitations:

- *Business value over human values*: While agile methods focus on "people and interactions," when it comes to the core agile project management (APM) activities, they are mainly designed to maximize *business value*. On the other hand, *human values* (e.g., fairness, equity, diversity) and *human factors* (e.g., emotions, wellness, motivations) are seen to be largely missing from popular frameworks such as Scrum[4] and SAFe.[5] As such, while APM is generally considered more human-focused than traditional project management, it still does not address human values and human factors explicitly.

- *Dependence on Human Gut Feel*: Despite advances in AI-assisted programming support for developers, such as GitHub Copilot[6] and tools for debugging and maintenance[7] and theoretical visions of AI-powered APM,[1,8] APM is still performed with little to no intelligent support. Popular APM tools (e.g., JIRA and Trello), provide basic project tracking and visualizations. And while expert and ongoing project management guidance in the form of permanent agile coaches are not affordable for a majority of software teams around the world, software teams and managers still rely on human "gut feel" and trial and error to make their most critical APM decisions, costing trillions of dollars in loss from software project delays and failures, with ~$2 trillion in the United States alone.[9] While some work has been done on improving APM activities such as effort estimation[10] and task allocation[11] in agile con texts, there is vast room for improvement in the effectiveness of these techniques. Critically, these techniques have focused on factors to do with software team performance but have not sufficiently taken more human aspects into consideration.

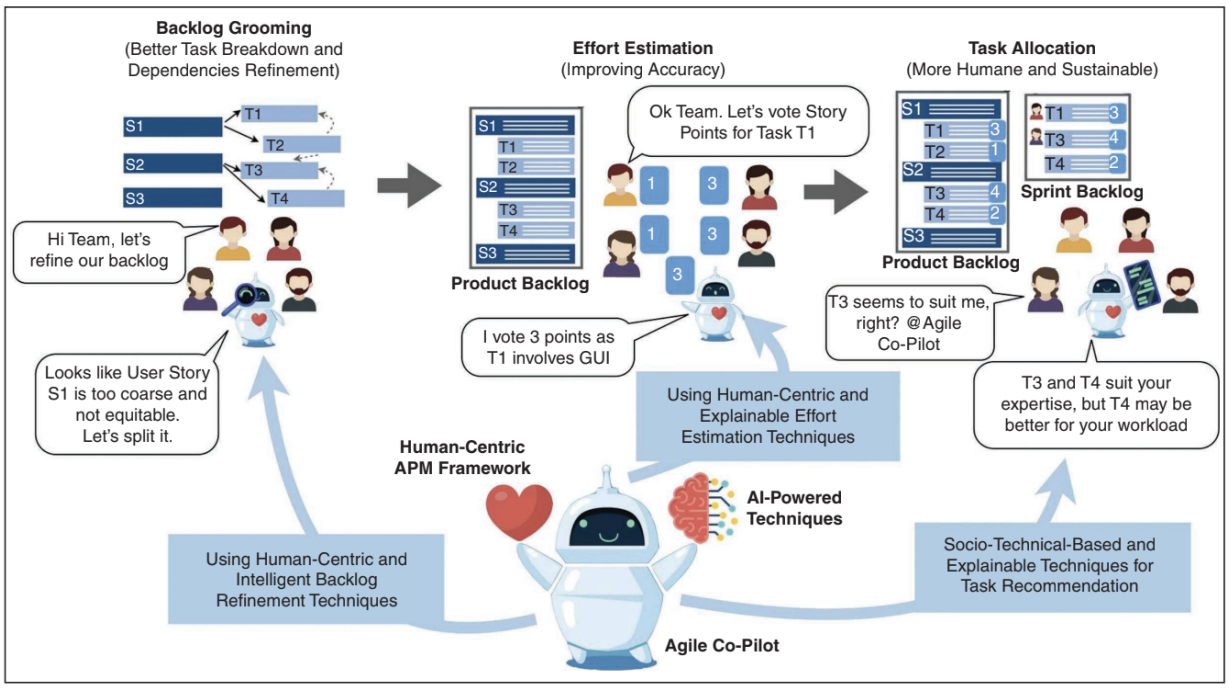

FIGURE 1. A vision of Agile Copilot assisting software teams with human-centered agile project management as part of augmented agile.

Now that we are past the pandemic, the critical need to balance software team productivity with human well-being has been firmly established. Looking ahead to the next era of software project management in the forthcoming world of AI-in-the-loop software engineering and hybrid work, we ask ourselves, is agile (in its current form) enough given the competing demands of productivity and well-being?

Agile Copilot: Heart and Mind Paired Together

We envision a new future of software project management that combines a deeply human-centric approach ("the heart") with AI-assisted techniques ("the mind") to augment and boost current agile practice, i.e., *augmented agile.* One way to implement such a human-centered and AI-assisted approach to agile is what we call the *agile copilot,* an AI based "agile team member" that will provide assistance to software teams in everyday APM activities. Figure 1 depicts our vision of the agile copilot, as it assists software teams with responsible recommendations to achieve more effective backlog grooming, more accurate estimations, and optional task allocations, while applying desirable human values (e.g., fairness, equity) and human factors (e.g., wellness). We explicitly recommend considering these human values, as otherwise, technical needs may dominate with a negative impact on business value in the longer term.

To achieve the "mind," we will apply machine learning and AI models and algorithms to significantly improve the effectiveness of APM activities. As an example, the AI techniques within the Agile Copilot will leverage ML techniques to assist software teams to perform many tasks including.

- Perform agile effort and project health estimation with state-of-the-art AI tools.
- Offer more effective decomposition of epics into user stories, user stories into technical tasks, and better identification dependencies.
- Apply deep learning-based natural language processing techniques for task breakdown and dependencies refinement.
- Improve backlog grooming using 1) human intuition and 2) direct project experience (mined into AI models).
- Apply high-level explanation algorithms to offer succinct summaries of the key features of the current implementation.
- Optimize tests cases (reducing their size, reordering what tests can be run next) using AI prioritization algorithms.

To apply the heart, we will develop a human-centered agile framework and actionable guidelines and embed them into new AI-assisted techniques to boost everyday agile activities. A first step in this direction is to collect empirical evidence from real-world software projects about the human values and human factors that are most pertinent to APM. A socio-technical approach suits this endeavor well, enabling rich findings with nuanced insights on contexts of use.[12] Next, we will recommend actionable guidelines on how software teams can apply our framework to embed human values and factors in everyday APM activities. Applying this "heart" will make APM more human-centered.

To pair the heart and the mind together, the agile copilot will be designed to apply the human-centered APM framework by considering human values and human aspects such as fairness, equity, preferences, and motivations in coming up with AI-assisted backlog grooming suggestions for the team. Similarly, software teams will be able to use the agile copilot to achieve more accurate estimations and optimal task allocations based on an analysis of historical data from similar contexts, while considering desirable human values and factors such as well-being and fairness,[5] human motivation for certain tasks,[4] and preferences for self-assignment.[2]

The unchecked pace of AI development is being met with increasing resistance from the practitioner and researcher communities. Simply appending agile with AI is not a sustainable solution. This is why we propose augmented agile, where the mind (AI) and the heart (human values and factors) come together to improve software practice. It is our belief that augmented agile and our proposed solution, the agile copilot, will usher in another paradigm shift in software project management and propel it into the next era of improved yet sustainable developer productivity, team effectiveness, and software project delivery.

References

1. R. Hoda, N. Salleh, and J. Grundy, "The rise and evolution of agile software development," *IEEE Softw.*, vol. 35, no. 5, pp. 58–63, Jul. 2018, doi: 10.1109/ MS.2018.290111318.
2. R. Hoda and L. K. Murugesan, "Multi-level agile project management challenges: A self-organizing team perspective," *J. Syst. Softw.*, vol. 117, pp. 245–257, Mar. 2016, doi: 10.1016/j.jss.2016.02.049.
3. "16th state of Agile report." Digital.ai. [Online]. Available: https://digital. ai/resource-center/analyst-reports/ state-of-agile-report/
4. Z. Masood, R. Hoda, and K. Blin coe, "Real world scrum a grounded theory of variations in practice," *IEEE Trans. Softw. Eng.*, vol. 48, no. 5, pp. 1579–1591, May 2022, doi: 10.1109/ TSE.2020.3025317.
5. W. Hussain et al., "How can human values be addressed in agile methods? A case study on SAFe," *IEEE Trans. Softw. Eng.*, vol. 48, no. 12, pp. 5158–5175, Dec. 2022, doi: 10.1109/ TSE.2022.3140230.
6. "Your AI pair programmer." GitHub. [Online]. Available: https://copilot. github.com
7. C. Watson et al., "A systematic literature review on the use of deep learning in software engineering research," *ACM Trans. Softw. Eng. Methodology*, vol. 31, no. 2, pp. 1–58, Apr. 2022, doi: 10.1145/3485275.
8. H. K. Dam, T. Tran, J. Grundy, A. Ghose, and Y. Kamei, "Towards effective AI-powered agile project management," in *Proc. IEEE/ACM 41st Int. Conf. Softw. Eng., New Ideas Emerg. Results (ICSE-NIER)*, May 2019, pp. 41–44, doi: 10.1109/ ICSE-NIER.2019.00019.
9. H. Krasner. *The Cost of Poor Soft ware Quality in the US: A 2020 Report*. (2020). Consortium for Information and Software Qual ity. [Online]. Available: https://www.it-cisq.org/cisq-files/pdf/CPSQ-2020-report.pdf
10. M. Fu and C. Tantithamthavorn, "GPT2SP: A transformer-based agile story point estimation approach," *IEEE Trans. Softw. Eng.*, vol. 49, no. 2, pp. 611–625, Feb. 2023, doi: 10.1109/TSE.2022.3158252.
11. M. Choetkiertikul et al., "Automati cally recommending components for issue reports using deep learning," *J. Empirical Softw. Eng.*, vol. 26, no. 2, pp. 1–39, Feb. 2021, doi: 10.1007/ s10664-020-09898-5.
12. R. Hoda, "Socio-technical grounded theory for software engineering," *IEEE Trans. Softw. Eng.*, vol. 48, no. 10, pp. 3808– 3832, Oct. 2022, doi: 10.1109/ TSE.2021.3106280.

ABOUT THE AUTHORS

RASHINA HODA is an associate professor in software engineering at Monash University, Melbourne, Clayton, VIC 3800, Australia. Contact her at rashina.hoda@monash.edu.

HOA DAM is a professor in software engineering at the University of Wollongong, Wollongong, NSW 2522, Australia. Contact him at hoa@uow.edu.au.

CHAKKRIT TANTITHAMTHAVORN is a senior lecturer in software engineering at Monash University, Melbourne, Clayton, VIC 3800, Australia. Contact him at chakkrit@monash.edu.

PATANAMON THONGTANUNAM is a senior lecturer at the University of Melbourne, Melbourne, VIC 3010, Australia. Contact her at patanamon.t@unimelb.edu.au.

MARGARET-ANNE STOREY is a professor at the University of Victoria, British Columbia, V8W 3P6, Canada. Contact her at mstorey@uvic.ca.