Peer Response

by Jaco Espag - Sunday, 10 August 2025, 3:54 PM

Thank you for sharing a really interesting overview of agent-based systems. I found the reference to the BDI (Belief–Desire–Intention) model particularly interesting. It's an elegant way to mirror human reasoning: agents form a picture of the world through their beliefs, shape actionable goals through desires, and then follow through via intentions, delivering both adaptability and purpose to an agent's actions (Dennis and Oren, 2022).

Recent studies continue to advance this framework, for example, Rüb and Dunin-Kęplicz (2020) designed a BDI-based simulation architecture for autonomous traffic agents. It brings together modular design with features for connected and autonomous vehicles, showcasing the BDI models' ability to stay responsive while maintaining clear, consistent behaviour. Likewise, Archibald et al. (2021) proposed a framework for observable and attention-directing BDI agents, enhancing transparency and enabling better human-autonomy collaboration by making agent reasoning more understandable.

It's clear that BDI is both practical and scalable, capable of enabling real-world applications that demand intelligent coordination. As systems evolve, the human-like autonomy offered by BDI will only become more valuable.

References

Archibald, B. *et al.* (2021) 'Observable and Attention-Directing BDI Agents for Human-Autonomy Teaming', *Electronic Proceedings in Theoretical Computer Science*, 348, pp. 167–175. Available at: https://doi.org/10.4204/EPTCS.348.12.

Dennis, L.A. and Oren, N. (2022) 'Explaining BDI agent behaviour through dialogue', *Autonomous Agents and Multi-Agent Systems*, 36(2), p. 29. Available at: https://doi.org/10.1007/s10458-022-09556-8.

Rüb, I. and Dunin-Kęplicz, B. (2020) 'BASTA: BDI-based architecture of simulated traffic agents', *Journal of Information and Telecommunication*, 4(4), pp. 440–460. Available at: https://doi.org/10.1080/24751839.2020.1755529.

Peer response

by <u>Ahmed Ayman Abdelrahman</u> - Thursday, 14 August 2025, 6:00 PM

Thank you, Abdulrahman, for your comprehensive explanation of the shift from centralised systems to decentralised, agent-based architectures. I particularly appreciate your linkage between organisational needs—such as scalability and adaptability—and the modular nature of agent-based design.

Building on your points, I believe one additional strategy for maximising the benefits of agent-based systems (ABS) is the integration of adaptive learning mechanisms into agents. As Russell and Norvig (2021) note, reinforcement learning and other adaptive algorithms can allow agents to refine their decision-making over time, improving coordination and responsiveness in dynamic environments such as supply chains and e-commerce.

Your example of real-time logistics coordination is compelling. In addition to this, predictive modelling can enhance agent performance in anticipating demand fluctuations, transport delays, or supply disruptions. Jennings and Bussmann (2003) emphasise that predictive capabilities can significantly improve resilience by enabling pre-emptive action rather than reactive measures.

Another area worth considering is governance and transparency in ABS. While decentralisation brings flexibility, it can also make accountability more complex. Implementing clear protocols for decision tracking and audit trails could help address potential concerns in regulated industries such as finance or healthcare (Wooldridge, 2009).

Overall, I fully agree that ABS represent both a technological and strategic shift in organisational problem-solving. Combining their inherent scalability with adaptive learning, predictive analytics, and transparent governance can further strengthen their value proposition for modern enterprises.

References

Jennings, N.R. and Bussmann, S., 2003. Agent-based control systems. IEEE Control Systems Magazine, 23(3), pp.61-74.

Russell, S. and Norvig, P., 2021. Artificial Intelligence: A Modern Approach. 4th ed. Harlow: Pearson Education.

Wooldridge, M., 2009. An Introduction to MultiAgent Systems. 2nd ed. Chichester: Wiley.

Peer Response

by Ali Yousef Ebrahim Mohammed Alshehhi - Saturday, 16 August 2025, 2:13 PM

I appreciate your intelligent post about the topic. Your analysis strongly supports decentralised systems as the main reason for agent-based system growth. You explained the practical applications including logistics and simulation very well in your discussion. I want to build upon your points by discussing protective steps organisations can take to guarantee dependable implementation of agent-based systems.

Conflict management represents an essential factor that needs attention. Agents operating in decentralised environments tend to develop objectives which create unintended clashes. The BDI model requires additional conflict-resolution methods and agent communication standards that enable effective negotiations between agents according to Wooldridge (2009). The implementation of autonomy requires proper systems to avoid creating inefficiency alongside system instability.

Robust validation alongside testing represents essential steps which organisations must perform before deploying their systems. You correctly identified that simulations double as predictive models for human behaviour as well as tools for prevention. Organisations should test agent interactions at scale within simulated environments to detect system weaknesses which allows them to modify designs before actual deployment according to Macal & North (2010).

Organizations need to implement protection measures that enable their systems to scale efficiently. The natural modular design of agent-based systems faces performance degradation when scaling occurs without proper management. Implementing monitoring systems together with load balancing solutions enables system stability when additional agents join the system (Jennings, Sycara & Wooldridge, 1998).

Your discussion effectively demonstrates how agent-based systems change the value proposition for organisations while the suggested preventative measures help organisations optimize their adaptability alongside risk reduction.

References
Jennings, N.R., Sycara, K. & Wooldridge, M. (1998) 'A roadmap of agent research and development', Autonomous Agents and Multi-Agent Systems, 1(1), pp. 7–38.
Macal, C.M. & North, M.J. (2010) 'Tutorial on agent-based modelling and simulation', Journal of Simulation, 4(3), pp. 151–162.
Wooldridge, M. (2009) An Introduction to MultiAgent Systems. 2nd edn. Chichester: Wiley.

Peer Response

by <u>Saleh Almarzooqi</u> - Sunday, 17 August 2025, 8:08 PM

You talked about the rise of ABS and its utility. Your coverage on the transition between centralised and decentralised systems epitomises why ABS has been very important in the current changing business world. Classical monolithic models fail to satisfy the idea of scalability and autonomy, and ABS will become an ideal solution, because they allow modular and decentralised control (Cisterna, Bigi & Viti, 2022). This mobility comes in very handy, especially in light of industries that require rapid response to the rapidly changing economic environments (Dai, Li & Wang, 2023).

Your illustrations of ABS utilisation in supply chain management and e-commerce show the positive calculative effect of this method. I concur with the idea that in a logistical process, real-time performance can have a significant effect on the efficiency and flexibility when dealing with multiple actors with varying objectives. Also, it is exemplary that you refer to the agent-based simulations in modelling human behaviour, explaining how ABS may assist companies in strategic planning and control of risks, and providing insights into complex systems that are otherwise difficult to predict.

I also like that you mention to belief-desire-intention (BDI) model, which gives a formal pattern of creating smart agents. It is quite remarkable that in this model, the agents are enabled to make some decisions that resemble how a human being would, since they can adjust to various circumstances that change (Lawyer, An, & Goharian, 2023).

As more in these areas require real-time decision-making, is it possible that ABS can achieve similar things in the improvement of operational efficiency or patient care management?

References:

Cisterna, C., Bigi, F. and Viti, F., 2022, August. The impact of total cost of ownership on MaaS system appeal using an agent-based approach. In *Conference on Sustainable Urban Mobility* (pp. 300-310). Cham: Springer Nature Switzerland.

Dai, M., Li, H. and Wang, S., 2023. Multi-agent-based distributed cooperative control of air-conditioning systems for building fast demand response. *Journal of Building Engineering*, *77*, p.107463.

Lawyer, C., An, L. and Goharian, E., 2023. A review of climate adaptation impacts and strategies in coastal communities: From agent-based modelling towards a system of systems approach. *Water*, *15*(14), p.2635.