



Artificial Intelligence

TU Delft Strategy Development

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Theme 1. Artificial Intelligence (AI)

“AI is essential for achieving the desired level of European strategic autonomy”

*When people think of ‘artificial intelligence’ or ‘AI’, they tend to imagine smart chatbots, self-driving cars, and other high-tech developments. But within the context of open strategic autonomy—the EU’s ambition to reduce its strategic dependencies on hostile global powers—AI also plays a major societal role. **“Artificial intelligence is much more than a technology for pattern recognition. It can help us maintain control over energy, healthcare, and security in line with Europe’s democratic values.”***

“Open strategic autonomy is a very topical theme, but it is not a goal in itself,” says Geert-Jan Houben, Pro Vice Rector Magnificus for AI, Data & Digitalisation at TU Delft. “It is the threat posed by hostile power blocs that makes strategic autonomy so vital. We are suddenly realising that we want to protect our European sectors, critical infrastructure and security in line with our own democratic values.” Such a shift does not happen overnight. A more independent energy system, for instance, is not something that can be achieved from one day to the next. “Artificial intelligence can significantly help us tackle these major societal challenges,” says Houben. “It is much more than a pattern-recognition tool. It can be deployed to help us achieve the level of autonomy we are aiming for in Europe.” But how exactly does that work?

An AI toolbox for strategic autonomy

First and foremost, Europe needs to develop a fit-for-purpose AI toolbox. While the US may seem ahead, with its recent multi-billion-dollar investments in AI and big tech, that perception is misguided, says Houben. “Our goal should not be to build the biggest or most expensive toolbox as quickly as possible. Instead, we must ask ourselves: how can we use AI to genuinely address societal challenges? How can AI support and keep healthcare affordable, or help us counter cyber threats?”

This requires both development with AI—better aligning AI with real-world challenges in healthcare and energy—and development in AI, such as designing generative models to identify patterns in large volumes of medical data. To that, Europe must now add a focus on the desired level of strategic autonomy. “Put simply, we want to retain ownership in Europe over critical domains like energy, healthcare, infrastructure, and raw materials,” says Houben. “AI can help us connect that ambition to values like sustainability and affordability, and ensure these efforts reflect our democratic principles.”

Safe, autonomous and sustainable energy grids

One domain where AI is crucial to strategic autonomy is that of sustainable (electric) energy. TU Delft Professor of Electric Sustainable Energy Peter Palensky notes a dramatic shift in his field: “Sustainability was once the main driver of research into electric energy networks. Now, safety, defence and strategic autonomy are equally strong motivators.” Palensky doesn’t see this as a drawback: “Technological progress in the defence sector often pushes the boundaries of science. Take military bases that rely on their own autonomous power grids— ‘micro grids’. These offer valuable insights for the wider energy transition.”

The growing need to reduce dependency on foreign oil and gas is accelerating the transition. But how exactly does AI contribute? “The shift to electric energy systems places major demands on infrastructure. AI helps us detect bottlenecks and process the massive amounts of data coming from the networks.” To improve grid robustness, Palensky and partners across Europe are developing ‘digital twins’—virtual replicas of energy networks that enable scenario testing and fault analysis. “Within the TwinEU consortium, we’re collaborating on a pan-European electricity grid. Recently, in partnership with Alliander, we submitted a proposal to develop a digital twin for the Dutch grid,” says Palensky. “These projects are expensive, but they help avoid costly mistakes and allow for ‘experimentation’ with the impact of cyber threats.”

Using AI to detect cyber threats

Cyber threats are a real concern for future electric grids, warns Palensky. However, these risks are no greater than those faced by today’s fossil-fuel-based infrastructure. “Electric networks are inherently complex, allowing for layered security and multiple fallback options,” he explains. AI plays a key role here—detecting risks, recognising patterns, and supporting decision-making. For example, AI was used to analyse Russian cyberattacks on Ukrainian power networks, with insights now helping to secure other grids. Palensky and European colleagues are working on cybersecurity through the RESCUE project and on designing the ‘control room of the future’. “People will still be at the controls, now and in the future,” says Palensky, “but AI will be a powerful tool for early risk detection and rapid decision-making. This applies not only to electric networks, but also to other critical infrastructure like industry and healthcare.”

AI Coalition: South Holland as a testing ground

In the Dutch AI Coalition, various partners collaborate on the development and application of responsible AI. One key player is The Hague Security Delta (HSD), the national security cluster. They are now more focused than ever on cybersecurity and safety. “Here in South Holland, we’ve built a strong cluster of businesses, governments and research institutions working on AI,” says Joris den Bruinen, HSD’s Managing Director. “TU Delft is a key partner.” He notes that the entire AI infrastructure is shaped by the push for European strategic autonomy. “This affects everything around AI—data, apps, chips, infrastructure like cloud providers, and the North Sea cables.”

The nature of AI-related questions is shifting. “Together with the police, NFI, TNO and SURF, we’ve been working on public order and safety. For instance, we’re developing GPT.NL, a Dutch language model that understands street slang and criminal communication but is also useful in settings like doctor-patient conversations.” There’s growing attention for cyber threats and securing critical infrastructure. With partners like TU Delft, Stedin and KPN, HSD is building ‘secure by design’ solutions for smart grids. “We use data and AI to better match energy supply and demand, prevent grid congestion, and reduce (cyber)security risks across energy systems.”

Den Bruinen highlights the unique environment of South Holland: “We’re close to the North Sea with its sea cables and wind farms, the Greenport, and the Port of Rotterdam. This setting—combined with our security cluster, renowned research institutions and innovation labs, and a talent pipeline—offers a unique ecosystem. It’s a living lab full of opportunities for societal and commercial challenges around strategic autonomy, AI and cybersecurity.” He also stresses the region’s strength in

addressing ethical questions: “We are deliberately working on how to embed European norms and values in our AI applications.”

Safeguarding democratic values through AI

The ethical side of AI is often overlooked—unfairly, according to Joost Poort, Managing Director of Mondai House of AI in Delft. **“We can only ensure European strategic autonomy if we bring a distinct European identity into the application of AI. That means explicitly incorporating our norms, values, and needs into the AI toolbox we build.”**

Poort, who oversees strategic partnerships and the development of new AI labs at TU Delft, emphasizes ethics-focused collaborations. “Our recently founded Feminist Generative AI Lab a partnership between TU Delft and Erasmus University, uses generative AI to integrate feminist theory and methods. AI is shaped by historical contexts, and those include systematic inequalities.” Another initiative Poort mentions is the AI DeMoS lab, where AI is used to bring multiple (democratic) perspectives together for informed decision-making. “And in the AI Futures lab Rights & Justice, we explore how to strengthen justice and rights in AI by empowering less privileged voices.”

Mondai House of AI

Over the past decades, TU Delft has developed a unique AI ecosystem under the banner of the TU Delft AI Initiative. Alongside dozens of TU Delft AI labs (where PhD candidates and applied researchers focus on societal applications), there are Convergence AI labs (joint efforts with Erasmus University and Erasmus MC) and ICAI labs (in collaboration with industrial partners). The umbrella organisation Mondai House of AI matches research, talent and education with questions from businesses, governments and society. It works closely with start-up hub Yes!Delft and fieldlab The Green Village. Joost Poort: **“Now we face a new challenge: integrating AI within the context of strategic autonomy. We are proactively seeking strategic partners to do this together.”**

Investing in the AI ecosystem

Back to Geert-Jan Houben. In a world of mutual dependencies, it is essential to be selective about where to pursue strategic autonomy. “Pursuing full autonomy is neither realistic nor advisable. Europe must make smart choices and define a clear path toward open strategic autonomy. The earlier examples—energy, cybersecurity, and defence—are part of that, but so are healthcare and infrastructure. When it comes to AI, we must understand what our societal challenges demand so that we can shape AI development and application accordingly.”

Expanding the AI toolbox for strategic autonomy requires significant investment—not only in AI, but also in other key technologies and in social science research. “We must invest wisely. Europe already has ecosystems in place, such as the AI and quantum hubs in Delft and South Holland. With greater support from government and industry, we can scale up and accelerate research.” But ecosystems are not just about research and valorisation, Houben emphasizes. “Training talent is crucial. We’re already seeing how difficult it is to attract, train and retain technological talent.” These ecosystems must offer attractive, competitive working environments. Collaboration within Europe—between governments, industry, and citizens—is key to making this happen, Houben concludes. **“We must do this with and for each other, to safeguard our democratic values and support a flourishing, sustainable economy.”**

