

The Hardest Mile: Understanding the Pilot-to-Scale Gap

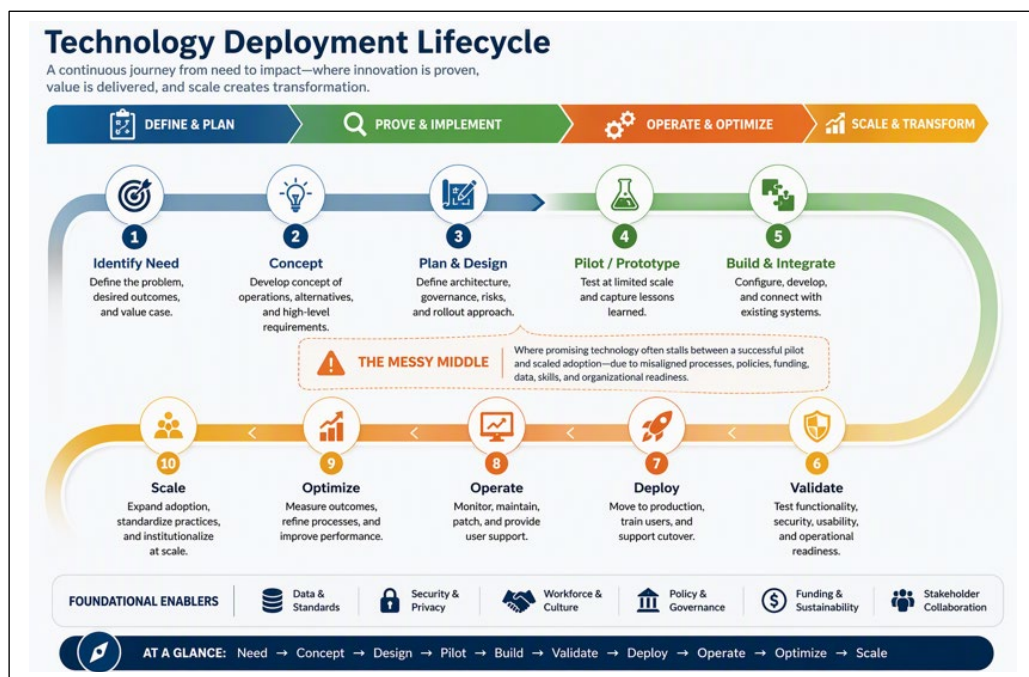
Avoiding “scale fail” and moving advanced transportation technology from successful pilots to sustained, widespread adoption.

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Every new technology tends to follow a similar journey, but the end point of that journey (if there is one) is further than most people think. A new technology capability starts as an idea, that gets shaped into a concept and then is designed, piloted, built, validated and finally deployed into the field. That moment of deployment feels like the finish line. But it isn't. The hardest mile in the deployment marathon is crossing the distance between *proven* and *pervasive*.



The illustration above shows deployment marks the midpoint where the hard work of operating, optimizing performance and, ultimately, scaling begins. The difference between a technology that sees limited use and a technology that transforms an entire sector comes down to those last three phases: operating, optimizing and scaling.

Intelligent transportation systems (ITS) offer a strong example because ITS technologies span the full lifecycle. “Everyday” ITS has already reached widespread deployment. Transportation agencies now treat it as accepted practice and clearly understand its benefits and value. Traffic signal control, safety-focused ITS, dynamic message signs and traveler information operate at scale. Agencies have mainstreamed, standardized and commonly adopted these tools in jurisdictions nationwide.

According to the most recent USDOT ITS Deployment Tracking Survey (2023), almost 80% of surveyed freeway agencies reported deploying at least one ITS safety technology and at least one work zone ITS technology. Nearly all surveyed freeway agencies (97%) and almost 80% of surveyed transit agencies reported using at least one ITS safety technology or work zone method to share real-time traveler information with the public. Nearly all surveyed state DOT districts managing arterials (98%) and nearly all surveyed local agencies managing signalized intersections (94%) reported deploying one or more ITS detection technologies at intersections. These statistics show that transportation technologies can achieve scale. But reaching this level of technological ubiquity has taken a very long time.

Transportation agencies now commonly accept the deployment and use of many mature ITS technologies as part of daily operations. The next generation of ITS has not yet reached that same level of maturity, including connected vehicles and infrastructure, AI-enabled operations and TSMO, and autonomous transportation. These next-generation transportation technologies still cluster around the pilot/build, validate, deploy and early-operate phases. Their basic capabilities are proven. The systems work. They deliver value in the corridors and regions bold enough to invest in them. Yet none has truly crossed the threshold from “deployed in places” to “deployed at scale.”

Crossing that threshold matters. Sometimes time solves the challenge, but this linear path can take decades, as it did with mainstream ITS and other once-revolutionary technologies. Sometimes scale never comes. In other cases, technologies need a catalyst that accelerates growth and moves adoption faster. A factor or combination of factors can initiate, accelerate, enable or drive technology adoption and help scale happen sooner and more efficiently.

Transportation technologies scale when the right conditions come together: mature standards, proven interoperability, clear business cases, prepared workforces and institutions, and public trust. When those conditions align, adoption can compound. Cross that tipping point and momentum builds; fall short and even brilliant technology stalls in perpetual pilot. The important questions are: what factors catalyze that chain reaction toward scale, and what barriers keep connected, AI-enabled and autonomous transportation stuck just short of the growth needed to transform national mobility?

The hardest place in any technology deployment lifecycle is the messy middle. Connected, AI-enabled and autonomous transportation sits there now: past the pilot and proven in the field, but not yet standardized, interoperable, easily replicable, consistently funded or trusted enough by the public and risk-conscious decision-makers to tip into self-sustaining growth. Promising deployments can stall in this zone. Agencies reinvent similar solutions. Deployments address variations of the same risks. Momentum fades one budget cycle at a time because value and ROI remain difficult to quantify.

The technology is not a problem. The problem is that no single agency, vendor or jurisdiction can generate the critical mass needed to catalyze scale alone. Getting out of the messy middle is an ecosystem challenge that requires stakeholder and partner coordination. Catalyzing scale is not about deploying one more pilot. It is about aligning the conditions that allow adoption to compound: mature and accepted standards, proven interoperability and replicability, de-risked investments and procurements, sound business cases, agency and workforce readiness, and public trust.

Read part 2 of this series: *Catalyzing Scale: 10 Factors to Help Close the Pilot-to-Scale Gap*, which explores 10 important factors that can help to catalyze scale for connected intelligent mobility technologies.

Contact us to learn how Battelle helps decision-makers bridge the pilot-to-scale gap with evidence-based solutions that move transportation technology from proven to deployed at scale.