INTELLIGENT LAGOON

Case study
March 2025

How Dynamic State Technology helps Engel GmbH make better decisions and their ISV to deliver intelligent software for less cost

“Intelligent Lagoon gives us new insight into how our business operates and has already shown us potential to save millions of euros per year in even just a small part of our business. What sets it apart is how forward looking and strategic it is: no other technology on the market comes close in results or approach, and we’re eager to roll it out across our organization.”

– Stefan Engleder, CEO, Engel GmbH

EXECUTIVE SUMMARY

In this case study we review how (a) Engel uses DST to avoid unnecessary costs of approximately €2.7M p.a. on €41m of orders (6.5%), and (b) how developing the software solution for the client required c. 60% less effort using DST instead of working around static data. The client is an excellent example of an organization enacting *true* Data Driven Decision Making (DDDM), and it prepares a clear path for agentic AI systems to help the client with their decisions.

Furthermore, Engel and USP can incrementally include more business processes into Intelligent Lagoon, and diverse stakeholders obtain increasingly rich, informative and strategic views of shared resources (accounting, inventory ...) through time.

WELCOME TO A NEW ERA FOR DATA AND DIGITIZATION

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1 Background

1.1 The client

Engel GmbH is a major international manufacturer of large and advanced industrial machines, headquartered in Austria. Turnover for 2023/2024 was €1.6bn.

Figure 1: An example of a large injection moulding machine made by Engel. The machines are made of a steel chassis, an injection unit and clamp, and control circuitry. Image courtesy Engel GmbH.

- Employees: Approximately 7,000 worldwide
- Production Facilities: 9 plants across Europe (5), North America (1), and Asia (3)
- Global Presence: Operations in over 85 countries
- Product Portfolio: Specializes in injection moulding machines and integrated automation systems

- Key Industries: Automotive, medical, packaging, and technical moulding

We worked with key senior people at Engel over the course of the project: the Head of Global Capacity Management, the Manager of Global Supply Chain Purchases, and the heads of material planning and logistics based at Engel's central facilities in Austria.

1.2 Supply chains

When ordering cast steel plates weighing from 250kg and up to 145 tonnes, Engel has historically had a choice between sourcing them from either Europe or China, which is usually cheaper. Delivery of parts to its facilities is possible by road, rail, and by river. Engel wanted to check that they were always picking the optimal supplier and evaluate whether contracting a third supplier in Turkey (for which there is no operational data), could improve the economics. Total order volume for these plates is approximately €41M per year.

While Europe and Turkey are highly reliable sources because of the simple transport mode, the shipping of parts from China can be unreliable: containers get lost at sea, and worldwide shipping disruptions (e.g., Suez Canal blockages), can mean that the part will not arrive on time. In this circumstance it is necessary to urgently order the part in Europe. Engel were able to provide estimates for the frequency of this.

The character of each route is summarised thus:

Route	Production Cost	Transport Cost	Route complexity	Time	Risk
EU	High	Low	Low	Low	-
TR	Moderate	Low - Moderate	Moderate	Low - Moderate	-
CN	Low	Moderate - High	High	High	Occasional

1.3 Challenge

> Each supply chain has different costs of production and transport, intermediate storage, tariffs and different delivery times, which change frequently.

> ... subject to evolving conditions *after* the decision is taken: weather, delays, losses. The outcomes are not deterministic.

- For each order, Engel needs to identify and select the optimal supply chain to minimize cost and hit required delivery dates.
- Historically these decisions have been made by select individuals based on experience, intuition, and potentially outdated information. The route from China is particularly complex.
- To date this has been the only way to operate but with new commercial options and increasing complexity of supply chain routes, the timings, reliability, and costs are not so easily intuited.
- Engel needed a framework to ensure that everyone involved is making the best possible decisions.

1.4 Key questions to be answered

1. What is the best route for any given set of circumstances?
2. Can we evaluate new routes (e.g. Turkey) for which we have no operational data?
3. Can we respond to urgent orders? Will the part arrive on time?
4. Before DST, a few experts pick options based on experience. Can we improve accountability of decisions?
5. Can a digital representation of knowledge allow others to participate?
6. Can we automate this process?

1.5 The ISV

Unisoftwareplus GmbH (USP), a software company based in Austria, has acted as an ISV to Engel since 2015. USP are a shareholder in Intelligent Lagoon and together we developed a software solution to answer these questions.

2 Limitations of static data

Before Intelligent Lagoon and the invention of DST, software developers would approach this problem by building software around *static data*. As discussed in other materials, such data does not and cannot accurately *digitize* business data which evolves through time in a lifecycle, starting from a state of high uncertainty and variability before, gradually, becoming settled facts.

For example: the eventual cost of any chosen route and the date on which the part arrives both start off as uncertain values, and as the part is ordered,

produced, transported, and finally arrives at the production facility, so these data become certain.

The limitations of static data are keenly felt when building software which needs to (a) cope with uncertain, evolving situations and (b) needs to be future-aware – which is exactly the case here.

2.1 Software development with static data

The traditional development process requires the ISV to:

1. Capture business state and persist it in a database
2. Drive state forwards in response to events
3. Write application logic to generate forward-looking views (or revisit past situations)
4. Build interfaces to present these views
5. Configure the solution and deploy it

The first 3 steps are especially necessary to work around the limitations of static data.

2.2 Can AI be applied? With static data, hold your horses!

We discuss the limitations of static data for AI in other materials, but consider these points particular to this situation:

1. Engel want to understand whether they should contract with suppliers in Turkey. There is no historical operational data for this route, only expert knowledge. However historic prices for recent quarters from prospective suppliers have been obtained.
2. Initial conditions (production prices, transport prices, schedules, tariffs etc) are always varying. Supply chain routes also change. Historical assumptions may not apply and inference risks mistaking correlation for causation and hallucinating patterns. (We discuss these limitations, and their solution, in other material.)
3. Each decision has an objectively correct calculable result (weighted sums over possible outcomes, in terms of time and cost).
4. The opportunity exists to give AI – specifically LLMs and Agentic AI systems – *vastly superior information* to make the best decisions. This data can be calculated by DST.

3 How was DST deployed?

3.1 Gather requirements: understand how the supply chains operate

- This documents detailed knowledge of supply chain operations (production, shipping, storage, transport)
- We collaborated with Engel experts to define graphs that capture "what can happen when". The process revealed valuable insights about decision consequences even during requirements phase, getting all stakeholders on the same page

Result: DST Process Graphs define how the business operates (the vertical domain).

- This is a technical and graphical activity, but not a programming one
- Gain complete alignment between customer, analysts, and implementers of the solution

3.2 Build and deploy the solution

Unlike conventional software methodology, DST digitized domain knowledge *immediately,* meaning that the build around managing state is effectively eliminated:

- The process graphs configure DST processes for the vertical domain
- DST manages state evolution in response to events and passage of time in the database
- Forward-looking views are naturally provided, as is the ability to reconstruct the context surrounding prior decisions
- Testing of these parts is done by Intelligent Lagoon, not the ISV

3.3 Deliver high-value, strategic insights to the customer

For any given order, DST calculates the possible business data outcomes in the database, which can then be queried to ascertain:

- Route feasibility (with respect to weight constraints)
- Expected costs and arrival dates with breakdown by scenario (on-time arrival, late arrival requiring emergency order)
- Probabilities of different outcomes
- Expected cost value for each route

- Selection of optimal route based on requirements (urgency or cost minimization)

4 Route to agentic AI and automation

With DST enabling Engel's supply chain decision-making, the pathway to AI-powered automation becomes straightforward:

1. **Data structure ready for AI consumption:** DST's process graphs provide AI systems with explicit causal relationships, probabilities, and business rules—exactly the structured information AI needs to reason precisely and accurately.
2. **Actionable insights without guesswork:** When querying the DST-enabled database, AI systems receive not just data points but complete context—including uncertainty quantification, probability-weighted outcomes, and explicit cause-effect relationships.
3. **From analysis to trusted automation:** Using this structured information, an AI agent can:
    - Evaluate all viable supply routes given current conditions
    - Calculate optimal choices based on Engel's priorities (cost, time, risk)
    - Execute decisions and monitor outcomes
    - Learn from both successful paths and counterfactuals
4. **Practical implementation:** Engel are now ideally positioned to use AI-assisted recommendations, where humans review AI suggestions, then gradually transition to full automation as confidence in the system grows.

We have shown that all these steps are possible using leading AI models.

Unlike approaches relying on static data, DST's patented approach provides AI with a "mental model" of how Engel's supply chain actually operates—eliminating common AI pitfalls like pattern hallucination and assumption injection that would otherwise limit automation possibilities.

5 Outcomes

5.1 Better software, better decisions, less cost

1. With DST it becomes clear that with Turkey an available route, China is not necessarily the best and cheapest option for sourcing plates: Turkey can often deliver with less risk, less time, and at similar cost.
2. Instead of relying on potentially fallible intuition only available to a few key individuals, now every time Engel orders a part, DST computes which supply chain is optimal and should be selected.
3. **By identifying the best path each time, DST gives them the information they need to avoid making sub-optimal decisions which could otherwise incur costs of approximately €2.7M p.a. on €41 of orders (6.5%).**
4. This value increases with volatility of prices and other risk factors – volatile environments are precisely the ones where we need technology to help us.
5. Not only can everyone benefit from the information provided by DST, but the system of data is *immediately* suitable for use by agentic AI systems. No post-processing of the data is required.
6. **By using DST instead of building a solution around static data, a major time-consuming part of software development – handling state - was eliminated. By tracking time spent by our developers, we estimate this saved c. 60% of time.**
7. These DST processes of the supply chain impact cash & accounting and inventory. Now Engel and USP can incrementally add more business processes to the solution, e.g. production, which drains inventory. The views available to stakeholders in accounting and inventory become increasingly complete, informative and rich, through a form of network effect.

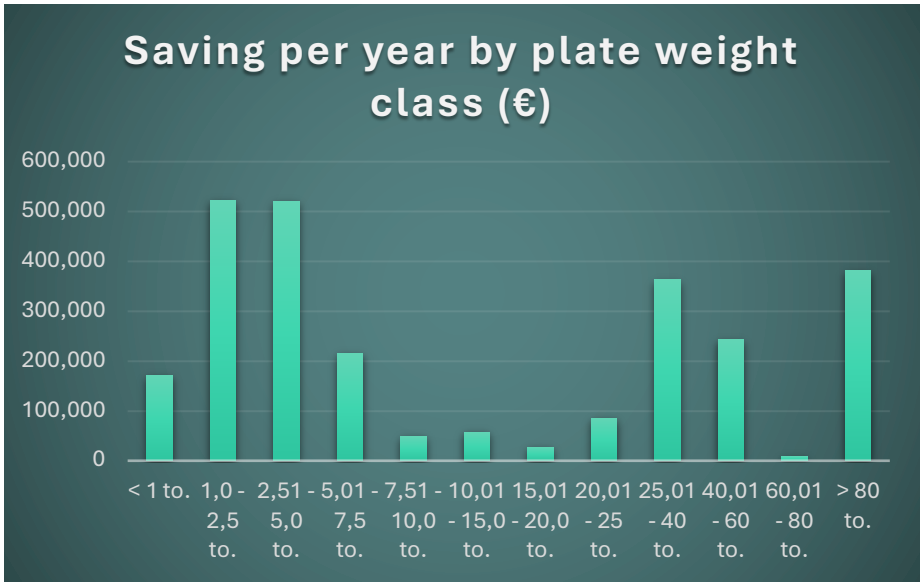

Figure 2: Savings per weight class possible with DST. The savings reflect the frequency of orders in each bin, and orders for mid-range plates are relatively infrequent.

5.2 Engel uses DST for true Data Driven Decision Making (DDDM)

Now Engel has the systematic means to make the best possible decision each time. In our paper, *Why DST enables true DDDM and more efficient business,* we make the case that DDDM should meet the following criteria:

1. Forward-looking
2. Quantifiable
3. Comprehends uncertainty
4. Logical
5. Accountable
6. Complete and coherent [take multiple stakeholders into account]
7. Up-to-date
8. Actionable

We have shown that these criteria are very well satisfied by DST. We finish with answers to the key questions the client had.

KEY QUESTIONS - ANSWERED	
What is the best route for any given set of circumstances?	Now every time Engel orders a part, DST computes which supply chain is optimal and should be selected.
How can we evaluate new routes (e.g. Turkey) for which we have no operational data?	Turkey provides valuable diversification. With DST, we can analyse many scenarios and evaluate new routes and processes as such opportunities arise.
Can we make it on time? (Respond to urgent orders)	DST calculates the expected arrival times of any possible route, allowing constraints to be applied in selections.
Can we improve accountability of decisions?	Absolutely! DST allows the context around the decision to be readily accessed and fully reconstructed, without limitation.
Would a digital representation of knowledge allow others to participate?	DST allows the organization to leverage the knowledge only known to a few key experts who are otherwise not scalable and still fallible.
Can we automate this process?	Yes! We have shown that Agentic AI systems are able to use this information correctly.

5.3 Next steps: incrementally expand and gain more powerful cross-functional views through time

As mentioned, Engel are now in a position to include more processes in the same Intelligent Lagoon instance. With static data, expanding the solution beyond supply chains would be challenging as a new set of requirements around state management would emerge. It would be challenging and time consuming effort for the ISV to provide coherent, cross-functional, future-facing analytics across the enterprise. In all likelihood it would require a complete architectural redesign. With DST this is not the case: it's a natural capability that multiple kinds of processes can be added and drive different views.

In terms of DDDM, adding more processes particularly drives how complete and coherent (point 6) (a) the information is and (b) the coherent decision making can be. The power of AI to make strategic decisions across the whole enterprise increases too (point 8).

NOTE: Further details on our methodologies are available.