"GOOD ENOUGH" IS NO LONGER GOOD ENOUGH

Why Manufacturers Must Adopt Quantum Optimization Tech Now

D-Wave QUANTUM REALIZED. | MANUFACTURINGDIVE

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For decades, manufacturers have battled the same costly and time-consuming inefficiencies. Now, quantum computing can offer a new path to operational excellence.

Relying on legacy classical software solutions, manufacturers have long settled for less-than-optimal solutions to their most complex optimization problems—including chronic inventory imbalances, scheduling conflicts, and unplanned equipment downtime.

These challenges aren't easy to resolve because they're multidimensional, with many moving and interconnected parts to consider: people, machines, schedules, product flows, energy constraints, and more.

Chris Hyatt, a former manufacturing IT leader at Georgia-Pacific and Rainier Advanced Materials, shares a good example: "When a digester fouls, a boiler trips, or a key production unit slows down, it creates a cascading effect across the plant. Energy balances shift, throughput changes, schedules collapse. The optimized plan that people spent so much time putting together goes out the window."

The issue, he points out, is this: **Many current optimization systems assume a steady-state process**. They struggle when variables change minute by minute. In today's complex manufacturing environments, processes and flows have become more interconnected and dependent with less slack and buffer between steps, which in turn demands more agility and capability in planning systems.

Many manufacturers rely on a handful of experts to bring operations back to equilibrium after each disruption. This approach isn't sustainable or scalable—what happens when one of those experts is out sick, takes a week off, or retires?

Despite advances in AI and analytics, the underlying challenges continue to outpace existing solutions. These solutions depend on classical optimization, which can struggle to keep pace with the speed and variability of modern manufacturing, particularly when disruptions demand rapid adjustment. As a result, even highly optimized operations remain vulnerable, especially when trying to sustain tightly integrated environments that must deliver the right products, at scale, at the lowest possible cost.

Quantum optimization can offer a powerful way forward, equipping manufacturers with an ability to solve problems that have historically been too computationally complex, costly, or time consuming for classical solutions alone to handle efficiently.

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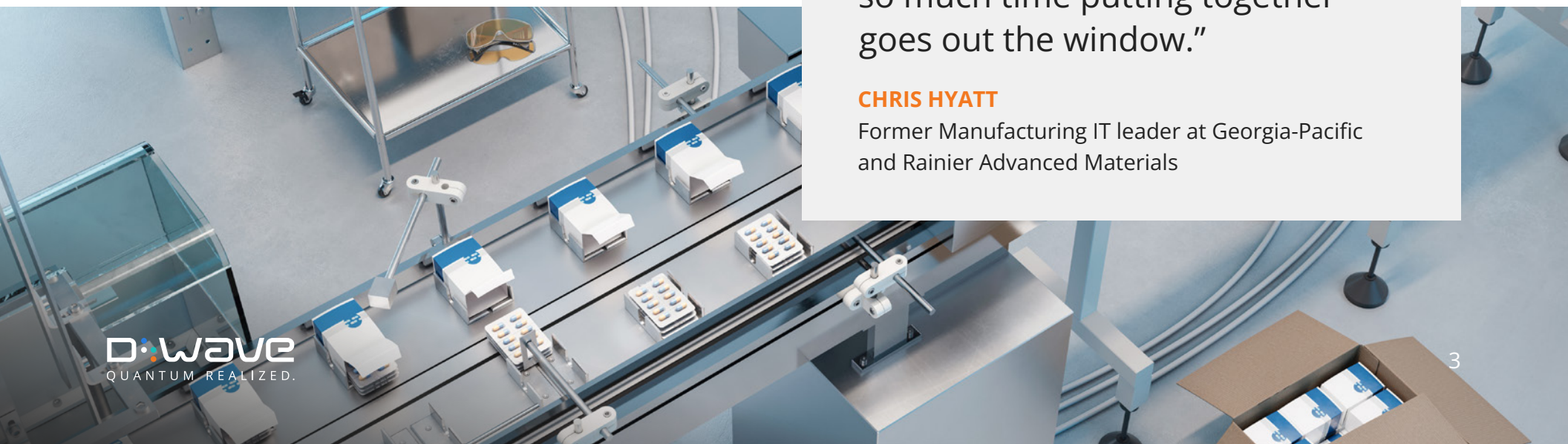

Why Classical Tools Have Reached Their Limits

"Although classical computers have been in development for the last 70 years and are very capable, we think about them as general-purpose tools," explains Murray Thom, vice president of quantum technology evangelism at D-Wave. "But their core machine instruction is to repeat the same operation over and over. They boil every problem down to simple addition and multiplication."

While that approach works for scenarios requiring simple, sequential decisions, it's not designed to take on **high-dimensional optimization problems where one choice constrains another.**

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Minor Changes Become Plant-Wide Problems

Consider large-scale production scheduling across multiple facilities, lines, and products. A change in one product run (rush order, quality hold, un-expected downtime, material delay) impacts:

- Which lines can run what
- When changeovers happen
- Which SKUs are pushed
- Whether downstream packaging can keep up
- How much labor is needed on each line and shift
- Which orders miss, meet, and exceed commitments

Workforce allocation is another common pressure point. When an operator is assigned to a critical line to keep throughput up or recover from downtime, that decision places constraints on:

- Which machines run
- Which certifications are missing from other shifts
- How overtime caps or union rules are hit
- How much flexibility remains to cover call-ins or last-minute change overs

When traditional systems are left to address issues like these, they often optimize one objective in isolation. For example, they may treat operators or machines as interchangeable, ignoring required certifications or maintenance windows. Or they might need to assume average run rates instead of being able to account for real variability in specific products or tooling. The result is often overpromising what the plant can deliver during a shift.

What Quantum Optimization Brings to Manufacturers

Rapid advancements in quantum-powered optimization technologies are redefining how manufacturers get to think about and overcome long-standing operational hurdles.

Because it can efficiently search vast volumes of information, handling additional complexity and constraint combinations to find high-quality, best-fit answers often faster than classical optimization, quantum optimization can solve problems that classical optimization approaches may find too slow or too hard to compute effectively. **The result is often better, faster solutions that account for a greater degree of complexity.**

It's not intended to replace the AI, ERP, APS, or other systems already hard at work inside your plant. In fact, it's quite the opposite: Quantum optimization is a complementary extension of those investments, meant to **improve how they resolve tough challenges.**

Real Examples of the Power of Quantum Optimization

Quantum optimization is not a hypothetical solution of the future. It's already addressing scheduling, sequencing, and resource-allocation problems today.

"When we think about these disruptions, and the trends we see in terms of changing demand, supply chains, and labor pools, the organizations that adapt as quickly as possible will be much more resilient than those waiting it out as if we'll return to the world we were in before," says Hyatt.

Some manufacturers are already taking that path, putting quantum optimization to work and seeing real results.

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BASF Sets a New Benchmark for Manufacturing Efficiency

BASF, one of the world's leading chemical companies, collaborated with D-Wave to build and test a hybrid-quantum application designed to improve efficiency in a liquid-filing facility. In a joint proof-of-concept project, the hybrid-quantum technology set a new benchmark for manufacturing efficiency, allowing a reduction in production scheduling time from 10 hours to just seconds.

"The company has to make decisions about which products are going to be manufactured and how that sequence effects setup time and line resetting," says Thom. "They also have tankers bringing in the raw materials that need to be drained quickly. This involves synchronizing raw-material delivery with the manufacturing and bottling of the products."

The hybrid-quantum application outperformed an existing optimization solution across key operational metrics:

- Reducing lateness by 14%
- Reducing setup times by 9%
- Shortening tank unloading durations by up to 18%

Global Auto Manufacturer Rebalances Production Schedules

A global auto manufacturer faced the increasingly complex challenge of optimizing production sequencing for one of their van lines. With more than 1,500 variants of the van, frequent changeovers were causing inefficiencies that classical optimization struggled to address.

Scheduling 1,000 vehicles with 15,000 constraints could take more than half an hour. The automaker wanted to generate optimized production schedules in less than 10 minutes per 1,000 vehicles (a 50% improvement in efficiency) while:

- Enabling a more balanced workload
- Increasing throughput
- Rapidly adapting to accommodate last-minute changes

By deploying a hybrid-quantum application in production, developed in partnership with D-Wave, the manufacturer reduced scheduling time of 1,000 vehicles from 30 minutes to less than five minutes (an 80% improvement in efficiency). This improvement allows for more flexibility in adapting to changes in demand or parts availability to maintain productivity without disruption.

Canadian Grocer Frees Up Worker Capacity

With demand fluctuating by day and season, manufacturers often face inefficiencies in scheduling their workforce. However, workforce scheduling problems are not limited to manufacturing. Case in point, a large Canadian grocery chain had an ongoing scheduling problem across its 13 brands. While traditional and AI forecasting tools could project what customers might need, the company had difficulty in scheduling their workers, hour by hour, to meet that demand.

The company used a hybrid-quantum optimization application developed with D-Wave to handle two critical jobs:

1. Automatically generate schedules for at-home grocery delivery drivers, cutting the time required to build those schedules by 80%

2. Manage in-store workforce scheduling, keeping in mind department-specific training and certifications, labor rules, seniority, and individual availability

The first phase of the rollout is expected to free up roughly 50,000 staff hours per year by reducing much of the manual scheduling work. Those employees can focus on mentoring new team members, improving store operations, and interacting with customers.

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Integrating Quantum into Your Existing Tech Stack

In manufacturing, quantum optimization typically runs as specialized compute behind the systems you already use, invoked through APIs when you need to solve a hard scheduling, routing, or allocation problem.

Your core systems never lose ownership of your operational data, like orders, assets, employees, and constraints. Business identifiers don't have to leave your environment, which means they're protected from unnecessary exposure and risk.

"To solve most problems, you don't need references to business data," explains Thom. He uses workforce scheduling as an example.

In the case of D-Wave, operational data stays within enterprise boundaries, while optimization problems are abstracted or anonymized (instead of "Amy" and "Bruce," they're marked as "Employee 1" and "Employee 2").

The anonymized data and decision rules are sent to D-Wave's Leap™ quantum cloud service. There, hybrid solvers—using a combination of quantum technology (QPUs) and traditional computing (CPUs and GPUs)—work together to find the best solution.

Once the solvers return results, the optimization model remaps them to actual employees inside your systems.

"This doesn't involve massive IT transformation, either," Thom emphasizes. "**It's simple to integrate.** You can bring a point solution wherever you want to create a new capability, and then yield value in the business relatively quickly."

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Your Path to Deployment and ROI

The adoption of quantum optimization is a journey, not a destination. When you start with a focused proof of concept (PoC) to address one problem area, you can build a solid foundation for a broader, enterprise-wide program that impacts production, logistics, and workforce planning.

“Now seems to be the perfect time to invest capital and resources into manufacturing environments,” says Hyatt.

Many manufacturers probably wonder how they could possibly have the time, resources, or funds to invest in quantum optimization when they may be struggling to utilize their current systems. But targeted PoCs let you start where you are and prove value quickly.

To turn intent into action, it helps to think in terms of three practical moves.

1. Learn about real use cases

For years, manufacturers have acknowledged quantum optimization as a distant possibility. But it’s now a real option. The technology has matured to the point where manufacturers can look at specific, repeatable optimization problems they’ve long struggled with and consider quantum as a way to address them in their current environment.

To set realistic expectations early, spend time learning more about where, when, and how quantum optimization is already delivering value and how it complements existing planning and optimization tools. (Reading this playbook is a good start.)

2. Think about which pain points will make for good PoCs

Prioritize your pain points by asking:

- What exact problems do we need to solve?
- What constraints need to be considered (safety, labor rules, equipment limits, etc.)?
- What data do we have, and how can it drive the decision process?
- What outcomes matter most when quantifying improvements (cost, throughput, service level, energy use, etc.)?

"Once the pain points are documented, we can help identify where quantum could have the highest impact on your business, with the easiest implementation," describes Thom. "We often draw on what we've done for other businesses and give you examples of what the journey could look like for you. From there, we build a PoC at application scale, running your data so you get a sense of the results that can be produced consistently and better understand the possible return on investment from this technology."

3. Pilot and scale into production

Once the PoC proves its value and reliability, the next step is pilot production before moving on to full production.

After it demonstrates expected reliability, quantum optimization can become part of your typical workflow.

“It might be something operating in the cloud and sending a query up to the quantum computer, getting an answer back and using it,” says Thom. “Or it might be integrated into a dashboard that people use on a daily basis.”

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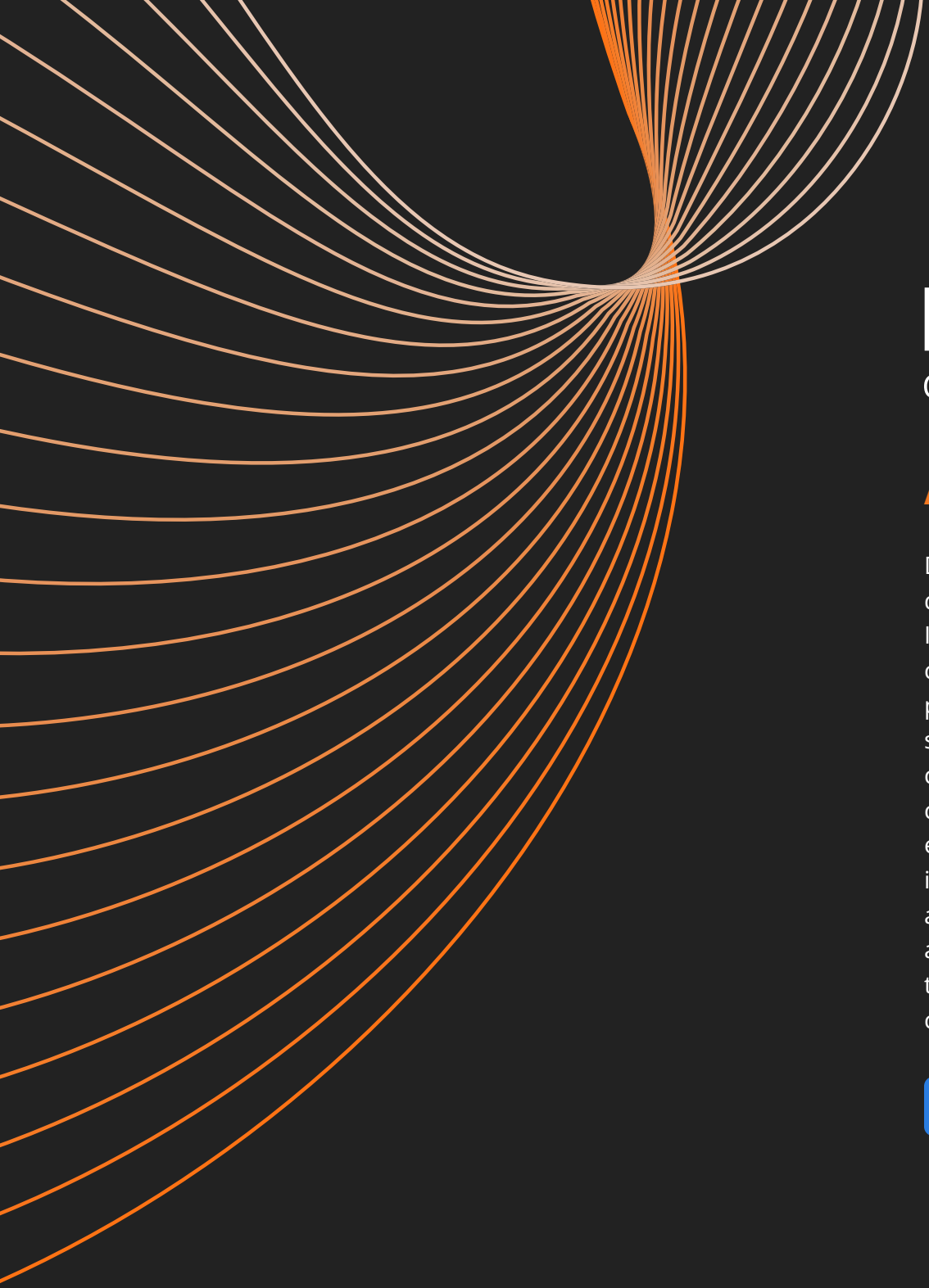
Quantum Computing Is Within Reach Right Now

Real optimization breakthroughs come when manufacturers start reimagining what's possible.

Before you invest more time manipulating results in a spreadsheet or working with legacy tools, consider what quantum computing could do for your operations today: optimize inventory across stages and locations, improve production schedules, allocate resources to meet demand—all with potentially more speed and an ability to handle more complexity than would be possible with classical-only tools.

Where could quantum deliver measurable ROI in your operations?



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ABOUT D-WAVE

D-Wave is a leader in the development and delivery of quantum computing systems, software, and services. It's the world's first commercial supplier of quantum computers, and the first and only company to offer dual-platform quantum computing products and services, spanning both annealing and gate-model quantum computing technologies. D-Wave's mission is to help customers realize the value of quantum today through enterprise-grade systems available on-premises and via its Leap™ quantum cloud service, which offers 99.9% availability and uptime. More than 100 organizations across commercial, government, and research sectors trust D-Wave to address complex computational challenges using quantum computing.

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