


Preparing for the Electrification Tsunami

Battery industry survey cites analytical challenges, resource constraints as major obstacles to product development



EXECUTIVE SUMMARY

For product development executives, the battery has become the focal point of high-stakes and high-pressure decision making. Whether electric vehicles or consumer electronics, products need to get out the door fast while being profitable, reliable, and more compelling than the competition. Historically treated like a black box sub-system of these products, the battery has become an increasingly crucial factor in meeting all of these goals. It has also become an obstacle.

The problem? A laundry list of tradeoffs and tensions.

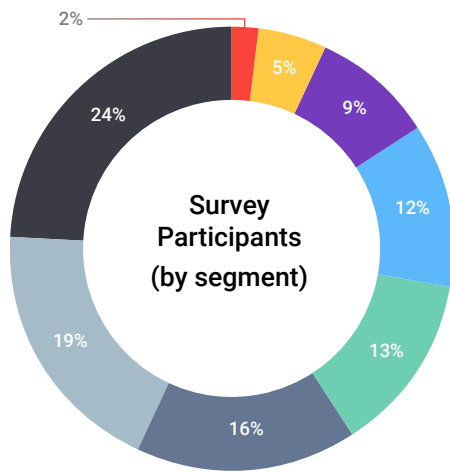
As demand for more advanced batteries grows, many companies find themselves vetting more suppliers and more types of battery materials and chemistries than ever before. Companies are under constant pressure to make the right decisions with their batteries. Those that make the wrong choice face recalls and liability (with costs ranging into the billions), unhappy customers, and loss in market share. Those that spend too much money gut profitability. And those that take the time to conduct more extensive testing may push their products years down that road, without the engineering resources to analyze even a fraction of the data those tests generate.

Not surprisingly, companies are now prioritizing the battery, making the investment in new personnel, equipment, and centers of excellence to accelerate battery development. The thinking is sound: build up in-house expertise and make better decisions in less time — and hit those crucial product goals. But in many cases, that's not happening, and executives are left wondering why. And more importantly: what can they do about it?

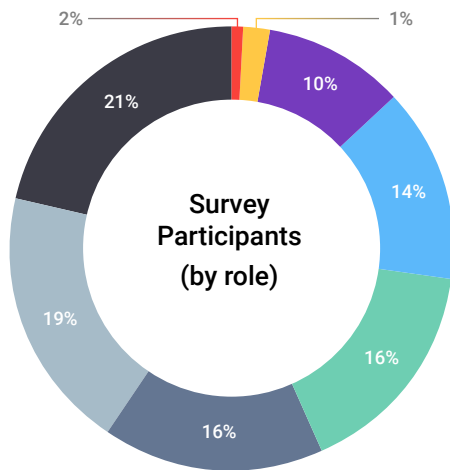
To shed light on these questions, Total Battery Consulting surveyed more than 80 professionals involved in battery development, testing, and decision-making. The results help explain what's behind key challenges companies face: developing batteries and systems quickly, executing the testing and review required to ensure reliability, and turning data into actionable insights. But the survey also points to solutions: ways in which executives can best support their battery labs and teams. The goal is to de-risk and accelerate decision-making. And with the right approach and the right productivity tools, companies can turn their batteries into a competitive advantage.

THE PRODUCTIVITY CRISIS

Conducted in the first quarter of 2019, the survey polled professionals from a wide variety of industry segments, including battery cell producers; battery pack and component developers and producers; companies involved in transportation, consumer electronics, and energy storage; and academic and national labs. Roles varied, as well: participants included engineers and scientists, managers and directors, and sales and business development staff. While more than half of the respondents were based in North America, other regions — such as Western Europe and Japan — were also represented. Markedly, this was an experienced group: nearly 60% of survey respondents had been working with batteries or battery-enabled products for more than a decade.



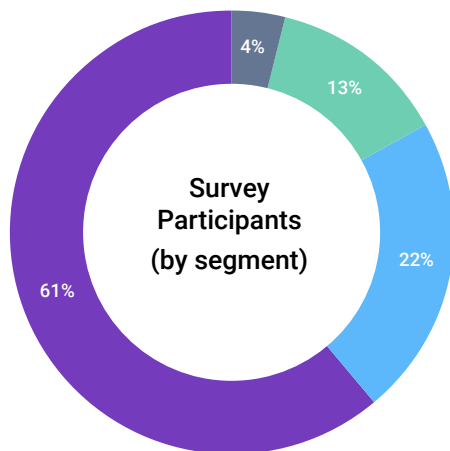
- Transportation
- University/National Labs
- Battery Pack & Component Producer/Developer
- Material Developers
- Battery Cell Producer
- Energy Storage
- Consumer Electronics
- Other



- Director or Above
- Engineer
- Scientist
- Manager
- Business Development
- Other
- Sales
- Technician

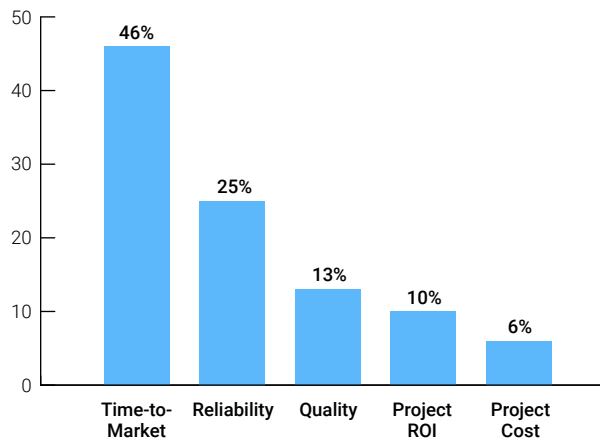
Notably, the survey both confirmed and illuminated the most pressing management dilemmas. Case in point: the productivity crisis. Battery projects tend to take time, often a great deal of it. Nearly a third of respondents noted that their last battery project lasted three to five years. In all, more than 75% spent a year or more on the work. And when asked to name the biggest concern regarding their most recent battery project, the number-one answer – given by 46% of respondents – was time to market. Are these lengthy efforts unavoidable? Or are there addressable factors hindering momentum? The survey results point to the latter.

When asked to note the biggest bottlenecks in their workflow, responses fell into three main themes:

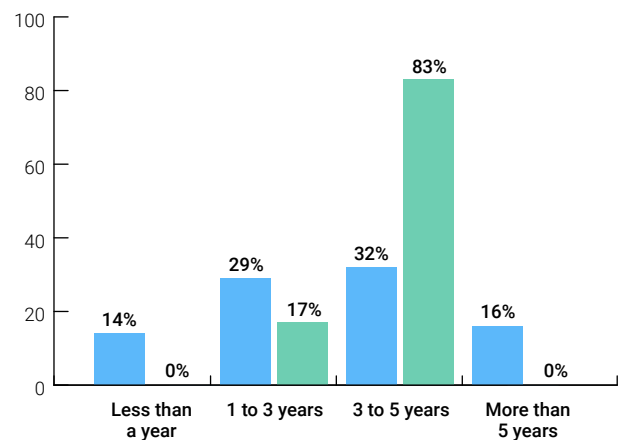


- Less than 3 years
- 3 to 5 years
- 6 to 10 years
- More than 10 years

Top 5 battery project concerns



Length of battery project



- All survey participants who work on battery projects
- Transportation managers and directors who work on battery projects

Scarcity of expertise and resources

Nearly 4 in 10 respondents cited a shortage of battery engineers as a constraint in their development work. An even greater proportion — more than 44% — noted that they had insufficient resources for the number of battery projects underway.

Time-consuming evaluations

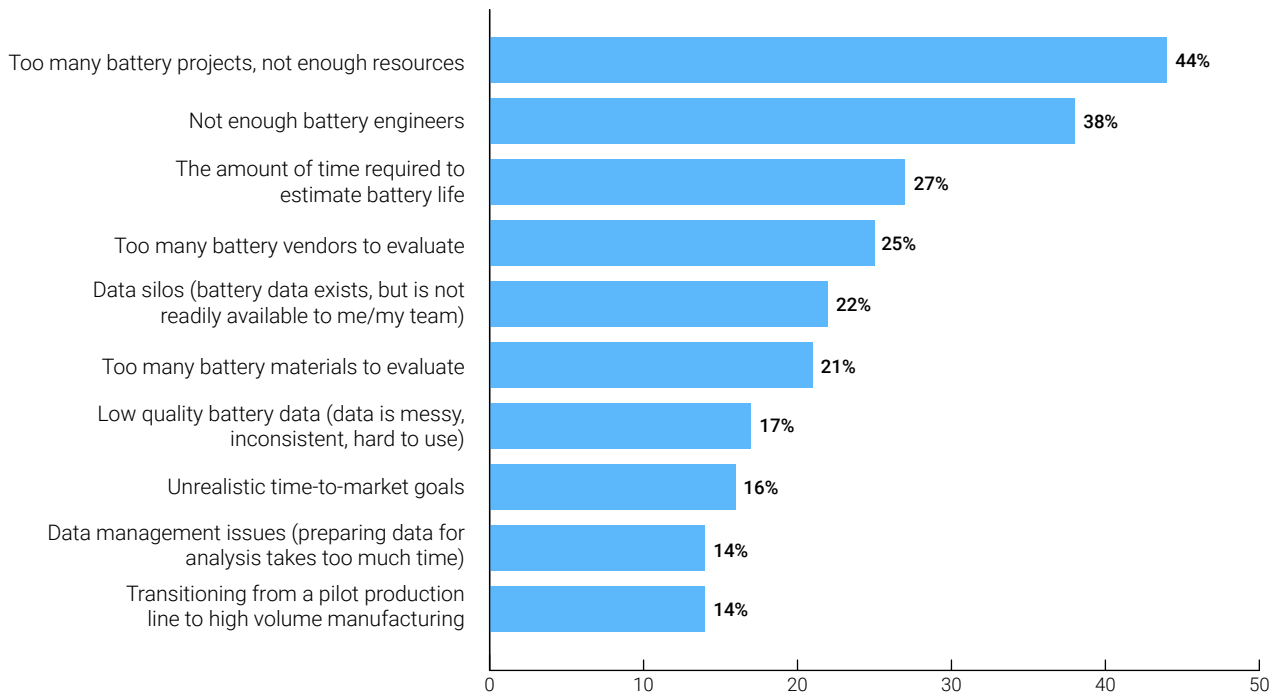
More than a quarter of respondents — nearly 27% — listed the amount of time required to estimate battery life as a key bottleneck. Nearly the same number — 25% — said there were too many battery vendors to evaluate, while 21% said there were too many battery materials to evaluate.

Data that is hard to find and hard to use

Survey participants also highlighted the difficulties of working with battery data. Just under a quarter — 22% — cited the challenge presented by data silos: while the information they needed was available within the organization, it was not readily available to their team. Another 17% noted problems with data quality: often the required data was messy, inconsistent, or hard to use. And 14% of respondents pointed a finger at data management issues: preparing data for analysis just takes too much time.

These themes coalesce into a simple but sobering storyline: if companies are going to speed up projects, boost battery capabilities and quality, and facilitate on-target and on-time decision making, they're going to need a way to work more efficiently with the resources and the data they have on hand. There is power in battery data, but companies are not maximizing its value.

Top 10 bottlenecks in current battery workflow



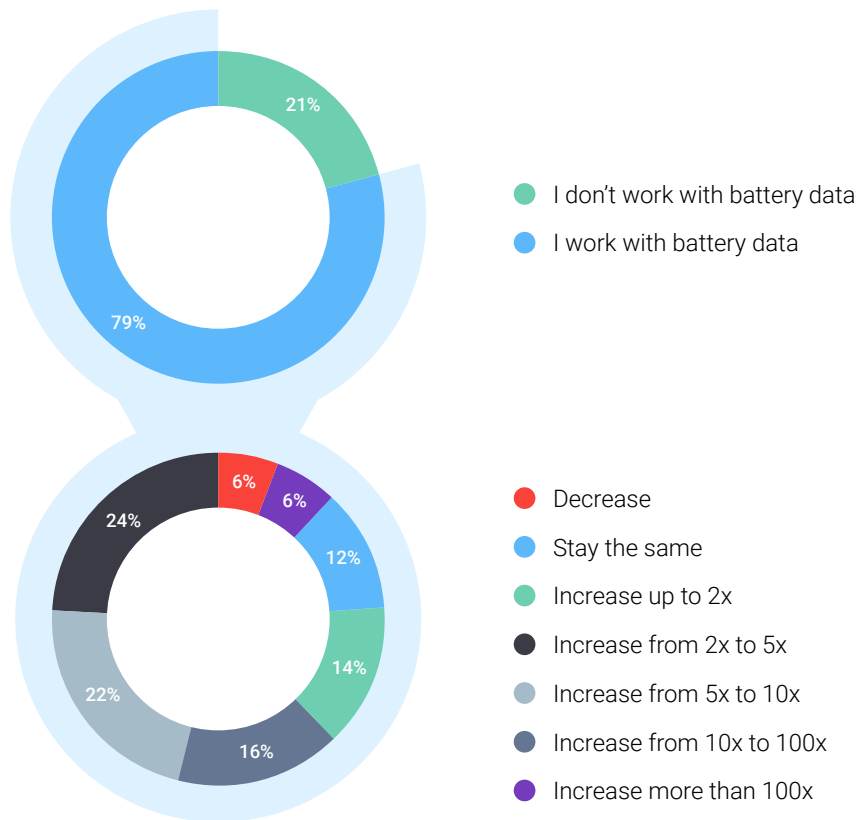
THE DATA-TO-INSIGHTS-TO- DECISIONS CHALLENGE

That last theme – the challenge of working with battery data – is particularly significant. Data volume is going to increase dramatically. Of the survey respondents who work with battery data, 68% expect the volume of battery data to at least double in the next five years. Within the same group, almost 40% believe it will grow by 5x or more in that period, with 6% expecting it to increase more than 100 times over. And as data volumes increase, so too will the pressure on the labs and teams that work with it.

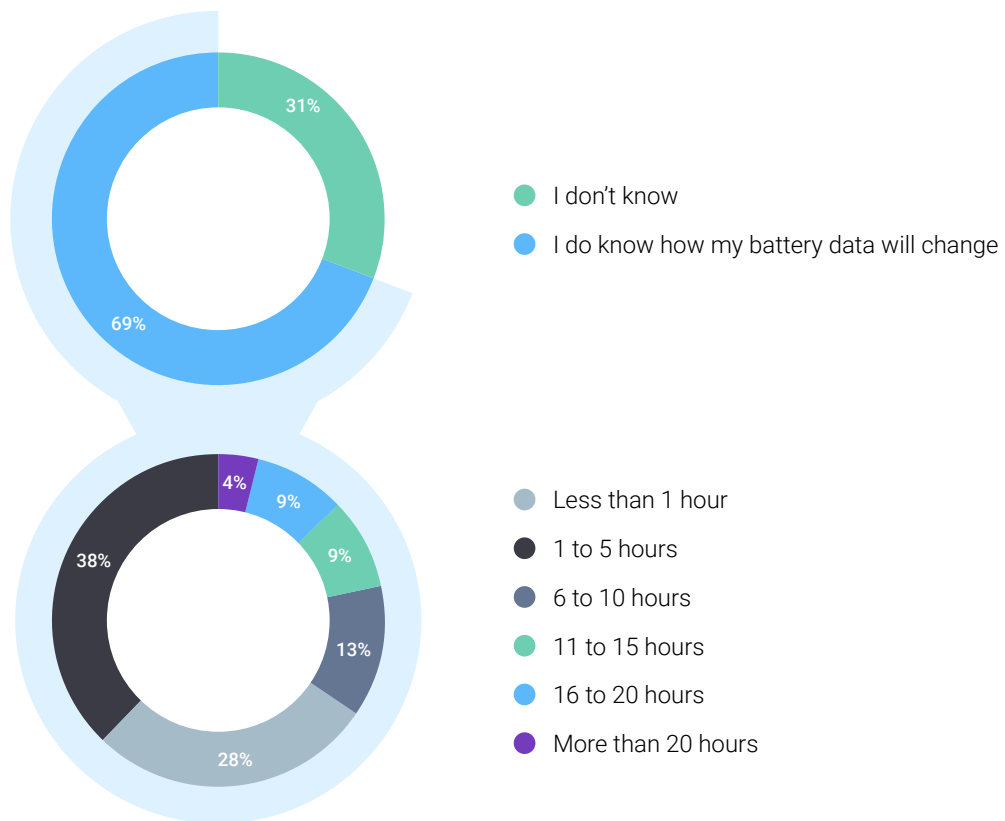
Data management is already a time sink. Nearly a third of respondents spend one to five hours per week searching for and preparing the data before it is analyzed, with 6% of respondents spending more than 20 hours per week on these tasks. And engineers and scientists are not the only ones devoting sizeable chunks of their time to data. The survey revealed that two thirds of managers and directors are working directly with battery data, with 44% of those working with battery data devoting six or more hours a week to that work.

Of course, the idea behind working with data is to gain decision-making insights. The survey suggests that many industry players aren't well positioned to do that – at least not efficiently. Not surprisingly, the survey finds that many participants are already employing multiple types of battery analytics, including real-time analytics (for operational monitoring), descriptive analytics (for evaluating test results), diagnostic analytics (for understanding why something happened), and predictive analysis (for identifying potential performance issues). Yet most players are taking a decentralized, ad hoc approach to analytics. More than half of respondents still use general-purpose spreadsheet software, such as Microsoft Excel, to analyze their battery data.

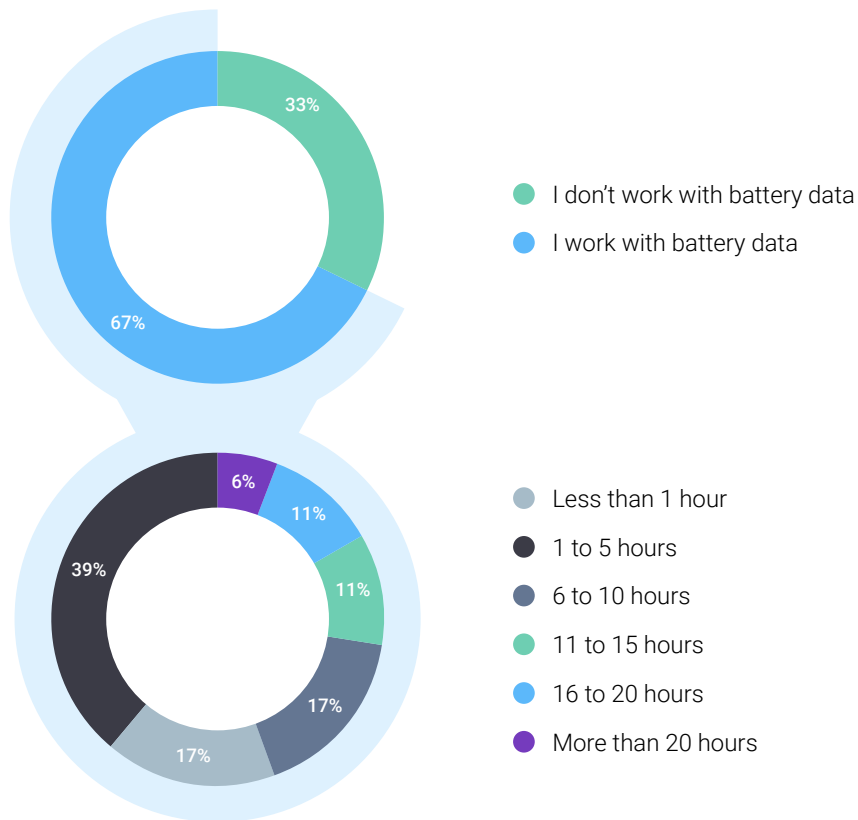
Expectations of volume of battery data change in the next 5 years



Total time spent per week working with battery data (All participants)



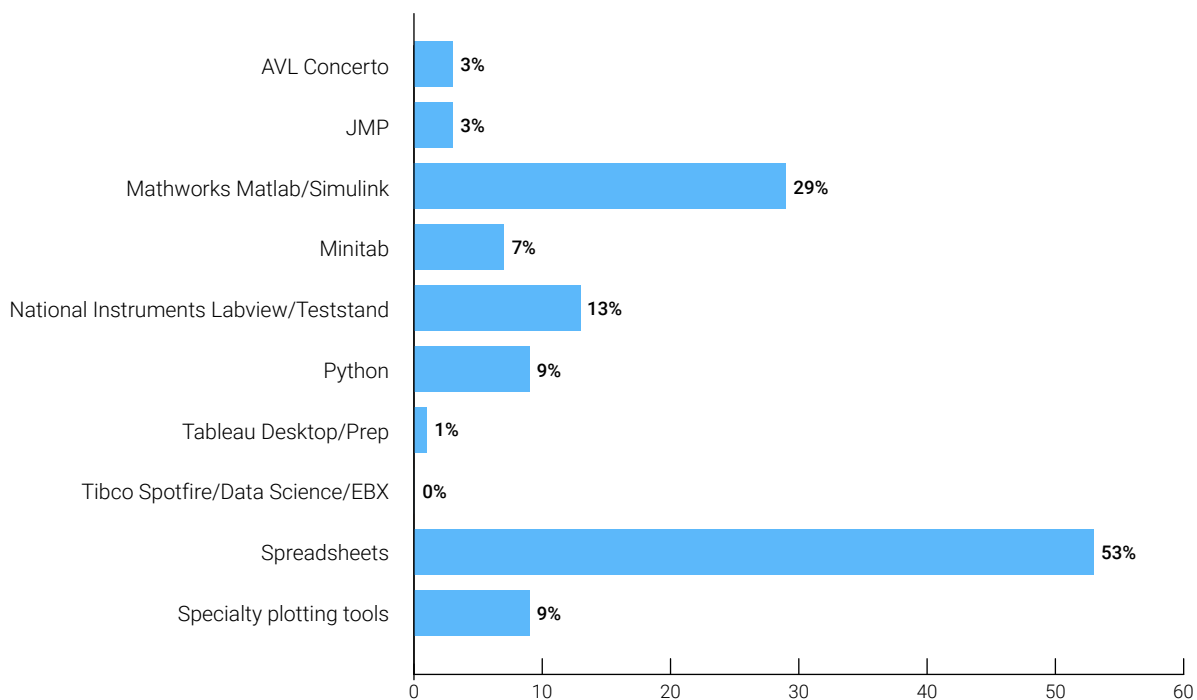
Total time spent per week working with battery data (Managers and directors)



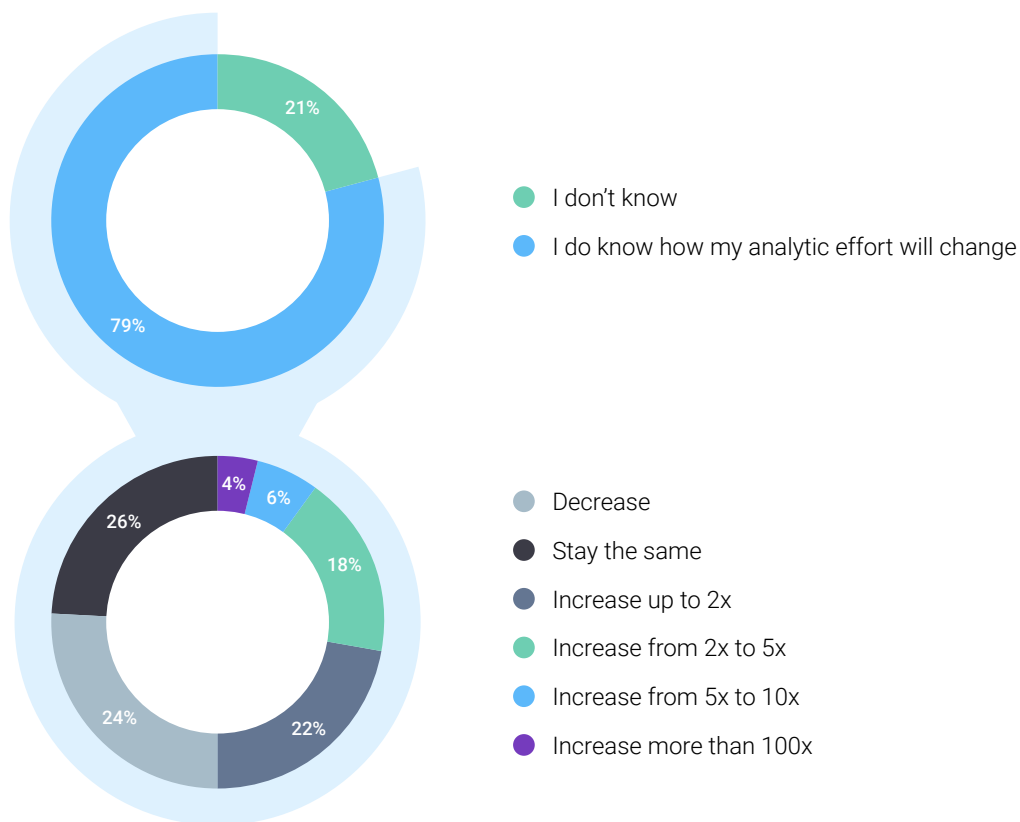
Going forward, the challenges of extracting insights and leveraging them to spark fast-paced but astute decision-making are only going to increase. Not only will data volumes grow, but so too will the complexity of the requisite analytics. For those who responded that they work with battery data, more than 40% of respondents anticipate a doubling or more of analytical effort over the next five years. Nearly 24% expect at least a 5x increase.

Given this backdrop, one conclusion becomes clear: a labor-intensive, time-consuming, ad hoc approach towards managing and analyzing data is neither efficient nor sustainable, and it is holding back progress toward commercial goals. If players don't seek — and prioritize — a more seamless, efficient process for turning data into insights, development times are likely to get even longer, opportunities will be missed, new product lines will suffer, and financial losses will inevitably follow.

Top 10 tools being used to analyze battery data today



Expectations of change in analytic effort of battery data in the next 5 years



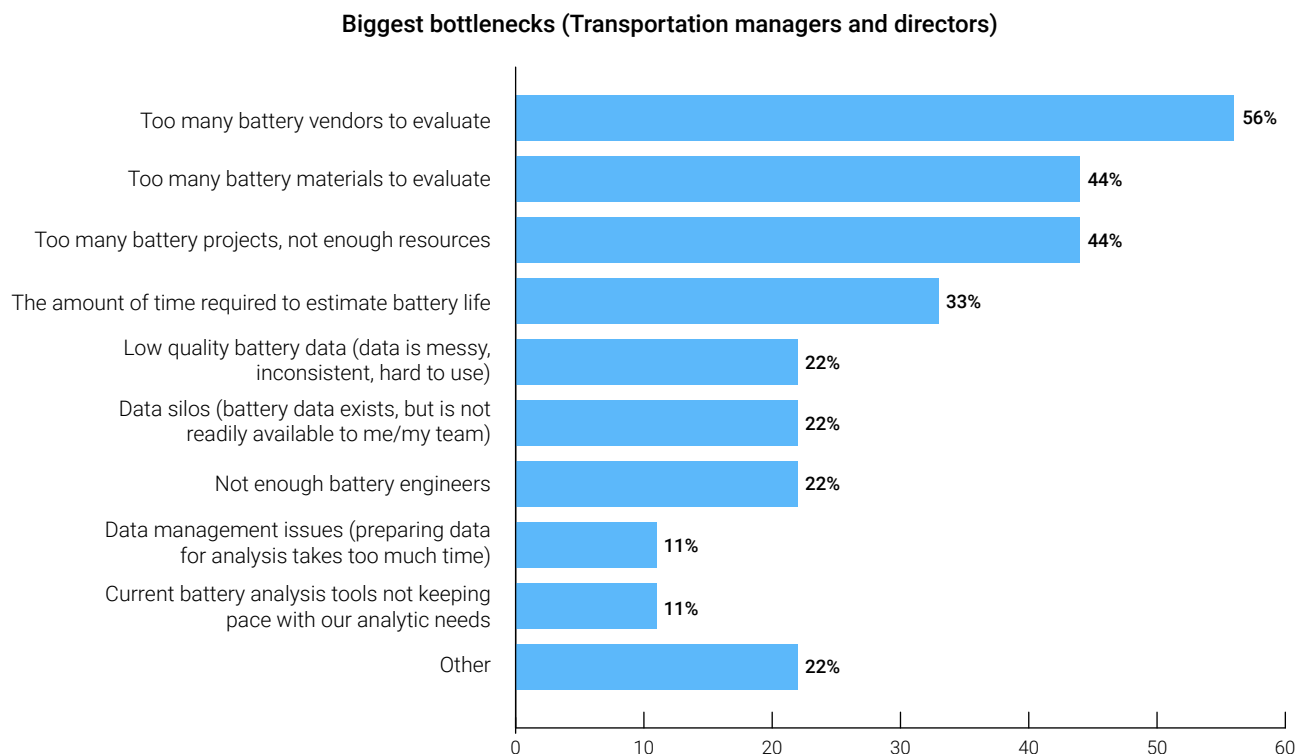
THE BATTERY VENDOR SELECTION AND POLICING PROBLEM

The growing demand for high-performance, high-quality batteries is exceeding the available supply. In fact, demand is so strong across sectors that it is expected to drive a 10x increase in global lithium-ion battery production over the next decade. For many companies, the current imbalance between demand and supply has had negative consequences — in many instances exacerbating the challenges of selecting the right battery in the right timeframe.

With heightened competition between companies to lock in supply, particularly in the consumer electronics and electric vehicle sectors, Tier 1 battery vendors can be extremely selective when choosing their customers. As a result, many consumer electronics companies are working with Tier 2 or even Tier 3 vendors. That means more suppliers to vet, and more time testing and qualifying their batteries. As The Atlantic reported in April 2019, many lithium-ion batteries are produced in China, where it can be difficult to monitor the materials and processes used in battery production.¹

Automakers rapidly electrifying their passenger and commercial fleets are also facing challenges in assuring an adequate high-quality supply. To ensure their battery supply, many automakers are entering into partnerships with battery vendors to secure sufficient volumes. For example, Volvo — whose goal is to see fully electric vehicles account for half of its sales by 2025 — has entered into a multi-billion-dollar agreement with battery producers LG Chem and CATL.

When asked to select the main bottlenecks in their current battery or battery-enabled development workflow, the most frequent response — cited by 56% of responding managers and directors at transportation companies — was the sheer number of battery vendors that need to be evaluated. Another big impediment: the number of materials to evaluate, cited by 44% of managers and directors.



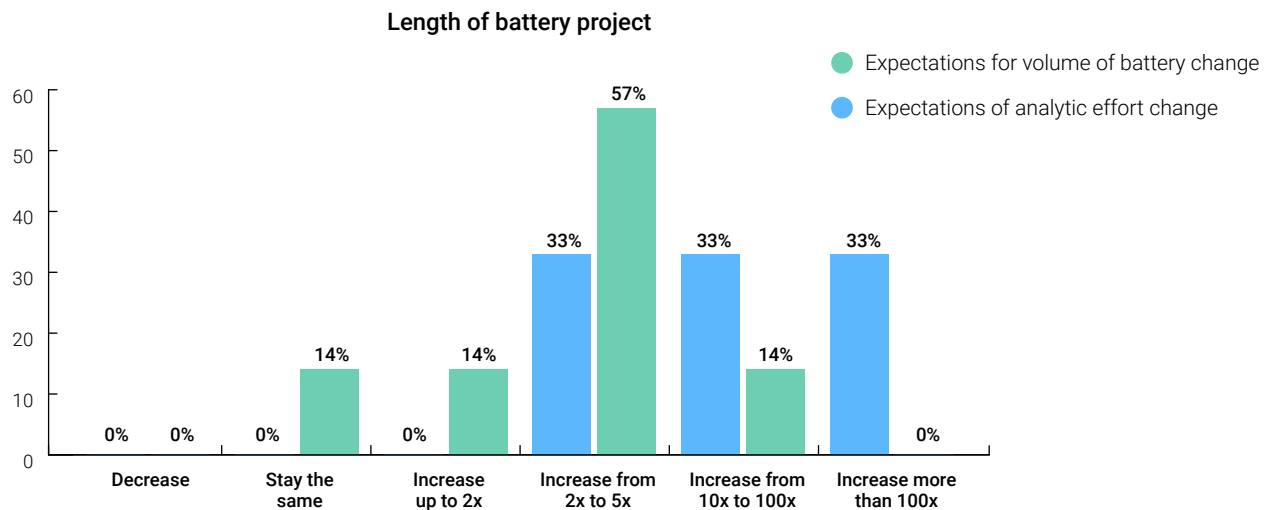
¹ "When Your Amazon Purchase Explodes," The Atlantic, April 30, 2019. www.theatlantic.com/technology/archive/2019/04/lithium-ion-batteries-amazon-are-exploding/587005

For automakers, delays in identifying batteries that provide greater range and lower vehicle costs are especially problematic. Batteries both power vehicles and differentiate them from the competition; incremental improvements will no longer suffice. As Toyota Executive Vice President Shigeaki Terashi put it: “The one who conquers batteries will conquer the electrification of cars.”² And that electrification is increasingly important to vehicle manufacturers’ growth and profitability. According to a report released in March by Allied Market Research, the global electric vehicle market is expected to grow from \$118.9 billion in 2017 to \$567.3 billion in 2025, a compound annual growth rate of 22.3%.

Already, vehicle-related battery projects are time-consuming endeavors: 80% of responding managers and directors at transportation companies say that their last project lasted a year or more. The length can easily rise in the near- and mid-term. Two thirds of transportation company managers and directors who responded with an estimation of a change in volume data and analytic efforts, anticipate an overall increase in data over the next five years – with 44% expecting 5x or more growth. And 86% expect the required analytical effort to increase over the same period.

THE ROAD AHEAD

So what is the path forward? How can companies overcome the challenges and bottlenecks with which they now contend? One approach is to build more battery-related expertise and capabilities – and even battery manufacturing – in-house. Toyota has announced a joint venture with Panasonic, beginning in 2020, to build batteries for electric vehicles with the goal of producing batteries with 50 times the capacity of today’s hybrid-vehicle batteries.³ And multiple automakers are investing in battery-related Centers of Excellence (CoE), including Volkswagen, which has brought all of its battery R&D and related competencies into a single facility and battery factory in Salzgitter, Germany.⁴ In addition, BMW, plans to invest 200 million euros and create 200 new jobs in its Battery Cell Competence Centre in Munich, where experts will focus on cell chemistry and design, and look to improve battery performance, lifespan, safety, and cost.⁵



² “Battery Wars: Japan and South Korea Battle China for Future of EVs,” Nikkei Asian Review, November 14, 2018.

³ “Toyota and Panasonic to Build Electric Car Batteries Together,” Nikkei Asian Review, January 20, 2019.

⁴ “Volkswagen Board Releases €1Bn for Battery Cell Factory,” electrive.com, May 13, 2019.

⁵ “BMW Group Invests 200 Million Euros in Battery Cell Competence Centre,” BMW Group press release, November 24, 2017.

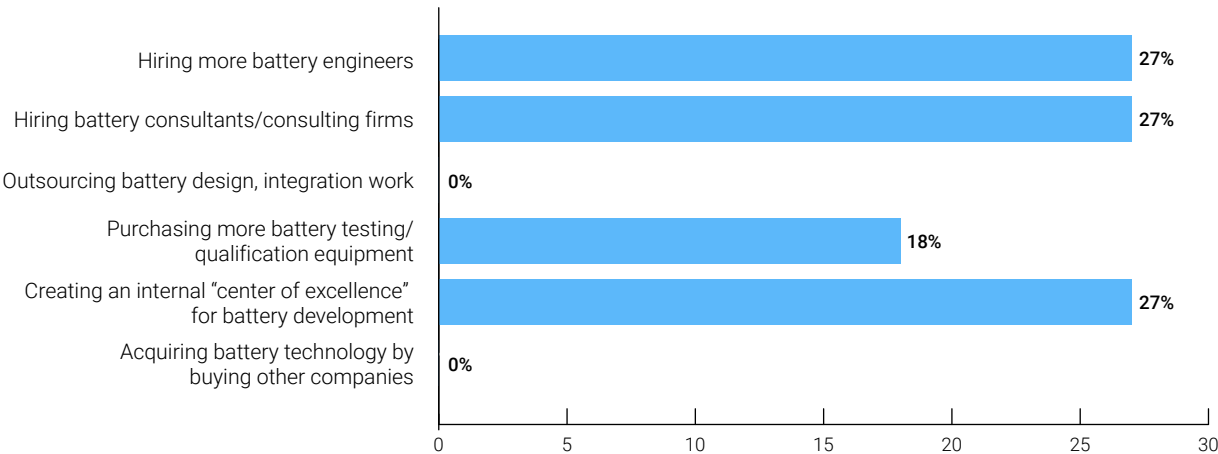
The survey confirmed the trends we see in the news: a third of respondents from transportation companies said they were creating a CoE for battery development; a third said they were hiring more battery engineers; and a third said they were hiring consultants.

The 'build up the lab' strategy makes sense, especially for automakers: 44% of transportation company managers and directors cited insufficient resources as a bottleneck. And resources are being strained at exactly the moment when industry players are betting on ambitious EV game plans. For example, Mercedes has announced that it will invest \$11 billion in electric vehicles by 2022, and BMW expects to launch a dozen different electric car models by 2025 – trends we do not see slowing.

As pressure grows on executives to get more differentiated battery products to market faster, they continue to be hindered by challenges in battery development. The survey shows that the main dilemmas around battery projects today – the productivity crisis, difficulty in quickly uncovering and leveraging insights, and the effort and time needed to evaluate and select vendors – all share a common theme: inefficiency in the way companies use and analyze their battery data. As data volume grows – along with the effort needed to leverage it – the challenges, and the consequences of not addressing those challenges, will grow and could negatively impact a company's profitability.

So while building up battery teams and facilities is important, so too is building up the toolkit to maximize battery insight and shorten time-to-market. By replacing the ad hoc, silo-based approach to battery data and analytics with more automated, centralized, and comprehensive data management, companies can unlock insights that, at present, often take too long to uncover or just aren't uncovered at all. With the right set of data tools, companies can unlock value by making informed decisions faster, maximizing the efficiency of their current battery teams, minimizing risks, delivering differentiated products faster than their competitors, all leading to increased profits.

Addressing development bottlenecks (Transportation)



ENABLING A WORLD OF CLEAN, RELIABLE, AND SUSTAINABLE BATTERY-POWERED SYSTEMS

Voltaiq was founded in 2012 in Brooklyn, NY by Tal Shoklapper and Eli Leland, driven by their mutual desire to tackle the numerous battery development challenges encountered by Tal and Eli while leading two ARPA-E energy storage research projects at the CUNY Energy Institute in New York City.

Battery engineers are routinely confronted with massive amounts of data generated by their internal labs, suppliers, and partners, and their teams typically lack both the IT infrastructure and the number of engineers needed to properly manage and analyze the data volumes they face. In addition, these battery teams are under enormous time pressure to make design decisions that will have significant technical and financial impacts on the products they are bringing to market.

The mission of Voltaiq is to empower the transportation, energy storage, and consumer electronics market segments with a unique, powerful, and easy-to-use analytics platform that enables companies who are developing, manufacturing, or operating these batteries and battery-powered systems to consistently deliver products in their desired market window with industry-leading performance and reliability.

Want to learn more about how Voltaiq transforms battery data to empower people and organizations to be more data-driven in the rapidly evolving electrification landscape? Reach out to our battery experts!

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