Just add weather

How weather insights can grow your bottom line

Executive Report

In this report

By industry, how weather impacts revenues and costs

What inhibits organizations from deriving more insights from weather data

Why weather has a significant impact on business decision-making

How IBM can help

To succeed in today's environment, businesses need to lead through increased complexity and volatility, drive operational excellence and enable collaboration across enterprise functions. They also need to develop higher-quality leadership and talent, manage amid constant change and unlock new possibilities grounded in data. The IBM Business Analytics and Strategy practice integrates management consulting expertise with the science of analytics to help leading organizations succeed. For more information, please visit: **ibm.com**/services/us/gbs/strategy

Don't blame it on the rain

Why do so many executives get a shiver in their bones just thinking about the weather? It's likely because weather often has a largely negative impact on business. Yet according to our recent research, that's not true for all organizations. Many companies are turning weather data into a competitive advantage by leveraging insights to reduce costs and increase revenues. Just how are leading organizations successfully benefiting from weather insights to improve their bottom lines? Stop wondering if a hard rain's going to fall and learn how to put weather to work for your organization.

Executive summary

Almost every weather-related headline in the media or corporate annual reports focuses on the associated negative impacts for organizations. And there's a lot to report: in 2017 alone, there were 330 catastrophic weather events, 31 of which each resulted in damages of more than 1 billion USD.[1] Even "normal weather" impacts nearly every industry on a daily basis, whether through food and heating needs, rates of crop growth, or the efficiency of energy and transport networks.

To better understand how weather impacts organizations globally and across industries, the IBM Institute for Business Value (IBV) in cooperation with Oxford Economics surveyed 1,000 global C-level executives representing 13 industries and 15 countries (see "Study approach and methodology" on page 17.)

Our research indicates that weather has both negative and positive impacts on organizations that can translate directly to income statements. An overwhelming majority of executives say better weather-related insights can reduce costs and increase revenues.

So what's holding them back? The executives surveyed identified six key business and technical challenges that inhibit their organizations from deriving more insights from weather data. Fortunately, these challenges are relatively easy to address. This report identifies lessons learned from companies that have successfully overcome these challenges and shares how actionable insights can help organizations quickly move from "blaming the weather" to capitalizing on it.

99%
of executives surveyed say improved weather insights can reduce annual operating costs

93%
of executives surveyed report that improved weather insights can positively impact annual revenue growth
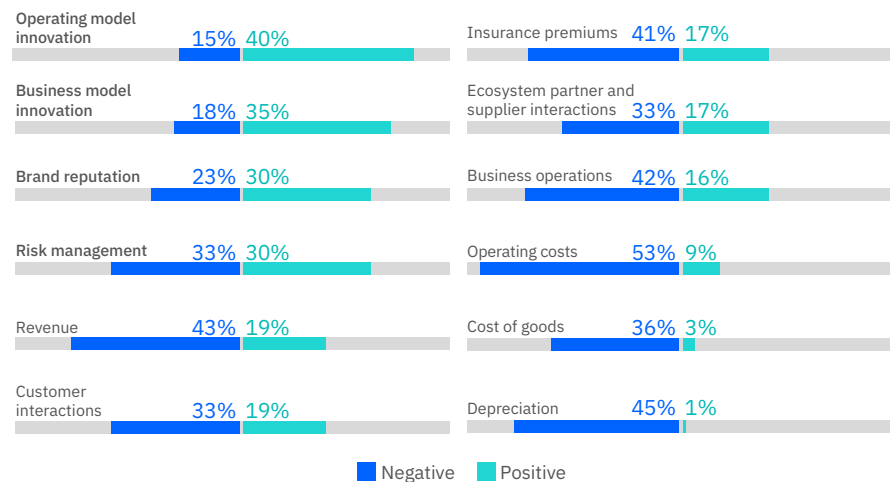
68%
of executives surveyed expect that weather insights as a service would be more valuable than raw data

Weather matters

Fair or foul, weather is indisputably important to organizations. When asked how weather has impacted their organization in the past 12 months, executives responded that it happens in a variety of ways (see Figure 1). While executives cited both negative and positive impacts, the balance tipped greatly toward the negative. More than half (53 percent) identified negative impacts to operating costs. Many also cited negative impacts to depreciation, revenue, business operations and insurance premiums, in that order. By contrast, executives cited operating and business model innovation, brand reputation and risk management as factors that are more positively impacted by weather.

Figure 1

Thunderstruck: How weather has impacted organizations in the past 12 months
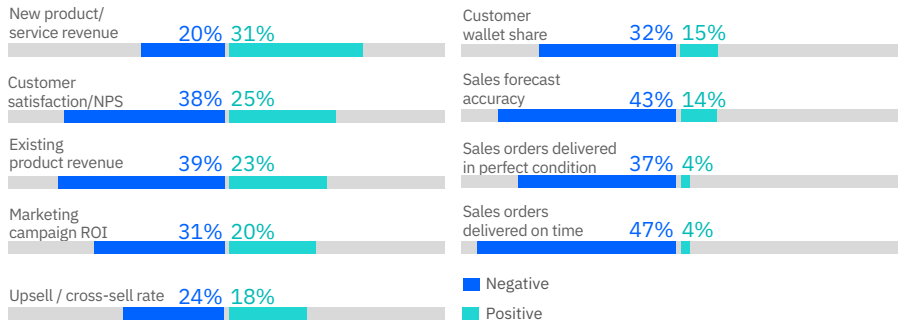
	Negative	Positive
Operating model innovation	15%	40%
Business model innovation	18%	35%
Brand reputation	23%	30%
Risk management	33%	30%
Revenue	43%	19%
Customer interactions	33%	19%
Insurance premiums	41%	17%
Ecosystem partner and supplier interactions	33%	17%
Business operations	42%	16%
Operating costs	53%	9%
Cost of goods	36%	3%
Depreciation	45%	1%

■ Negative   ■ Positive

Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

These impacts—both negative and positive—translate directly to an organization's income statement. A full 100 percent of the executives we surveyed said weather impacts *at least* one revenue and one cost metric in their organizations.

More than half of the executives indicate that at least three revenue metrics are negatively impacted by weather in their organizations, with on-time sales order delivery and forecast accuracy cited as the most negatively impacted (see Figure 2). Only about a quarter cited at least three revenue metrics as being impacted positively, with revenue from new products or services as the most positively impacted.

Actionable insights can help organizations quickly move from "blaming the weather" to capitalizing on it.

Figure 2

Red rain is pouring down: How weather impacts revenue

New product/
service revenue   20% 31%

Customer
satisfaction/NPS   38% 25%

Existing
product revenue   39% 23%

Marketing
campaign ROI   31% 20%

Upsell / cross-sell rate   24% 18%

Customer
wallet share   32% 15%

Sales forecast
accuracy   43% 14%

Sales orders delivered
in perfect condition   37% 4%

Sales orders
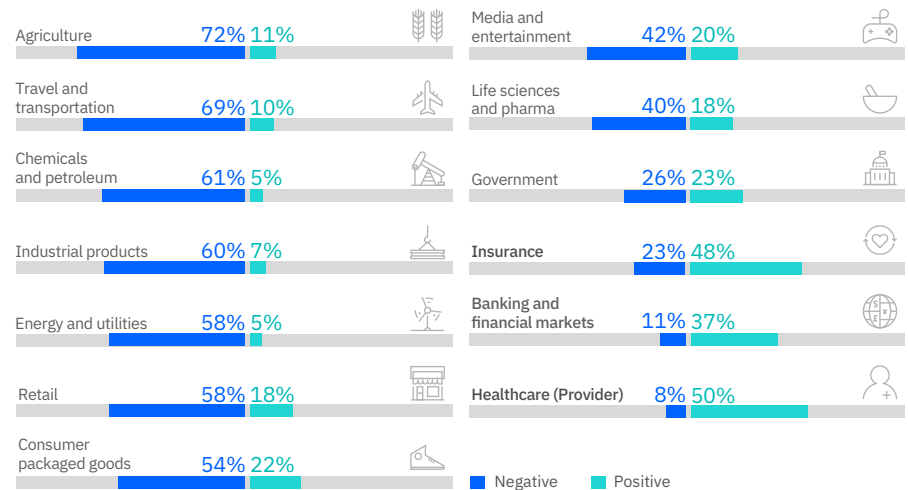delivered on time   47% 4%

■ Negative
■ Positive

Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

When it comes to specific industries, weather can have varying impacts on revenue. Not surprisingly, an overwhelming number of agriculture executives indicate weather can negatively impact their revenues. Half of healthcare providers say their revenues are positively impacted, while government organizations are largely split in their perceptions of revenue impact (see Figure 3).

Figure 3
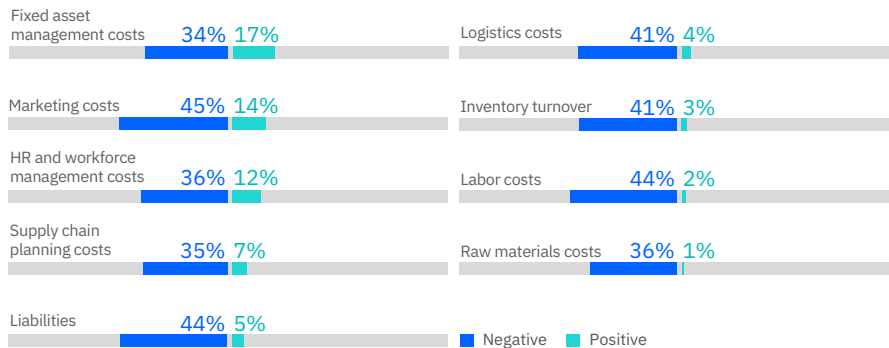*Bad harvest is come: How weather impacts revenue by industry*

Agriculture **72%** 11%
Travel and transportation **69%** 10%
Chemicals and petroleum **61%** 5%
Industrial products **60%** 7%
Energy and utilities **58%** 5%
Retail **58%** 18%
Consumer packaged goods **54%** 22%

Media and entertainment **42%** 20%
Life sciences and pharma **40%** 18%
Government **26%** 23%
Insurance **23%** 48%
Banking and financial markets **11%** 37%
Healthcare (Provider) **8%** 50%

■ Negative ■ Positive

Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

From a cost perspective, 62 percent of organizations say at least three cost metrics are negatively impacted by weather, compared to a mere 9 percent that are impacted positively. More than other metrics, executives cited marketing and labor costs, liabilities, logistics costs and inventory turnover as being negatively impacted by weather (see Figure 4).

Figure 4

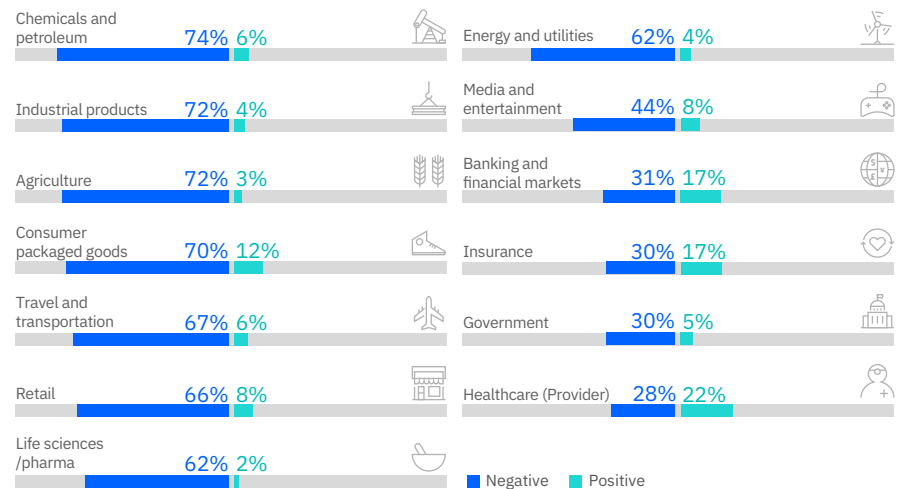*When it rains, it pours: How weather impacts cost metrics*

Fixed asset management costs	34% 17%	Logistics costs	41% 4%
Marketing costs	45% 14%	Inventory turnover	41% 3%
HR and workforce management costs	36% 12%	Labor costs	44% 2%
Supply chain planning costs	35% 7%	Raw materials costs	36% 1%
Liabilities	44% 5%		

■ Negative ■ Positive

Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

Weather also has varying impacts on the operating costs of organizations across industries, and the effects are virtually all negative (see Figure 5). No industry respondents report realizing significant positive impacts from weather on operating costs. Executives in the chemicals and petroleum industry claim the largest percentage of negatively impacted operating costs. And once again, organizations in the agriculture industry say they take a beating from weather, with 72 percent of executives citing negative impacts to operating costs.

Figure 5

Acid rain: How weather impacts operating costs by industry

Industry	Negative	Positive
Chemicals and petroleum	74%	6%
Industrial products	72%	4%
Agriculture	72%	3%
Consumer packaged goods	70%	12%
Travel and transportation	67%	6%
Retail	66%	8%
Life sciences /pharma	62%	2%
Energy and utilities	62%	4%
Media and entertainment	44%	8%
Banking and financial markets	31%	17%
Insurance	30%	17%
Government	30%	5%
Healthcare (Provider)	28%	22%

■ Negative ■ Positive

Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

The value of insight

A vast majority of executives (93 percent) surveyed say better weather-related insights could enable their organizations to realize revenue growth through better use of weather data. At the same time, an astonishing 100 percent of respondents say an improved use of weather data could reduce annual legal, insurance and risk mitigation costs and nearly all (99 percent) say the same is true for operating costs. When government respondents are excluded, then 100 percent of respondents anticipate potential operating cost reduction and revenue growth.

When we asked executives to scope the potential value of better weather-related insights, approximately one in five scoped the potential annual revenue growth opportunity to be between 2 and 5 percent. This opportunity translates to additional revenue growth of up to USD 50 million per USD 1 billion of annual revenue. An additional 62 percent of executives say the revenue growth potential could be up to USD 20 million per USD 1 billion on annual revenue. If you scale this potential opportunity to the *Fortune Global 500*,[2] it could amount to annual revenue growth of more than USD 500 billion.

Executives saw even greater potential for cost reduction. Nearly a quarter of respondents said the opportunity to reduce operating costs could be between 2 and 5 percent. And a majority (58 percent) expect that better weather insights could provide the same cost reduction potential for annual legal, insurance and risk mitigation costs.

Riders on the storm

So why are the weather fortunes of organizations so different? To better understand this dynamic, we identified an elite group representing 12 percent of respondents whose organizations are more positively impacted by weather. Elite group members demonstrated several unique characteristics. They:

– Are largely from a few, select industries. Sixty percent are from the insurance, banking and financial markets and healthcare industries.

– See more potential for increased revenues from better use of weather data in the future.

– Dedicate more staff to analyzing weather data and incorporate weather data into plans months in advance.

– See less difficulty in capturing and analyzing weather data efficiently, and performance at scale.

– Are less worried about the cost of using weather data and integrating it into their organization's systems.

– Find actual historical weather data most valuable.

The value forecast
Because weather impacts business performance metrics, organizations can use performance benchmarking to envisage the potential for improvement and define the associated monetary value of improved performance levels.

The examples that follow show current industry peer group performance for metrics influenced by weather, using data from the IBM Benchmarking database.[3] They were selected to:

– Represent different types of industries (such as goods, services and retail)
– Include metrics that influence revenue and cost
– Reflect metrics on which executives said weather has positive and negative impacts.

Example 1: Financial markets growth from new products and services
Weather impacts the value of underlying assets traded and hedged by financial markets organizations. This is true for traders of commodities that are significantly influenced by weather (for example, energy, oil and gas, or crop futures). It is also true for investment portfolio managers looking to anticipate earnings announcements and movements in share prices based on weather data insights. This data can be used alongside other types of data, such as correlations between weather and satellite imagery of car park fill rates to predict the financial results of many wholesale, retail, transport, hospitality and other venue-based companies. Financial services organizations can gain a competitive advantage by driving new products and services using insights from data not available across the whole market, including many types of weather data.

IBM benchmarking data shows that financial markets organizations report revenue driven by new products and services of up to 11 percent for bottom quartile performers.[4]

Performance levels rise to 16 percent for median performers and 18 percent and higher for top quartile performers.[5] In this scenario, a financial markets organization that improves its proportion of sales from new products and services from 11 to 16 percent could potentially increase revenue by USD 50 million for every USD 1 billion of existing revenue.[6]

Example 2: Retail growth from improved upsell/cross-sell rates
Weather impacts the propensity of customers to buy everything from food and drink to clothes, drugs, fuel and tools. Insights from weather data enable store retailers to stock and position products by individual store location. The impact is measured by improved in-store upsell/cross-sell rates.

Benchmarking data shows that the bottom quartile retail performers report in-store upsell/cross-sell rates of up to 10 percent while top performers report 22 percent or more.[7] Median performers are at 14.5 percent.[8] A retail organization that improves its in-store upsell/cross-sell rate from the bottom quartile to the median could potentially increase its revenue by USD 45 million for every USD 1 billion of in-store sales.[9]

Rain or shine?
The value of better weather insights can extend beyond cost reduction and revenue growth opportunities. A majority of executives say weather has a significant impact on business decision-making within their organizations (see Figure 6). Sixty percent told us that weather either influences all human decisions or triggers automated decisions related to worker safety. And many respondents declare that weather plays a significant role in decisions ranging from customer interactions and staffing to transportation scheduling and supply chain management. Improved weather insights can enable organizations to improve decision making and performance in these critical areas.

Figure 6

Lifting the fog: Where weather influences all human decisions or triggers automated actions
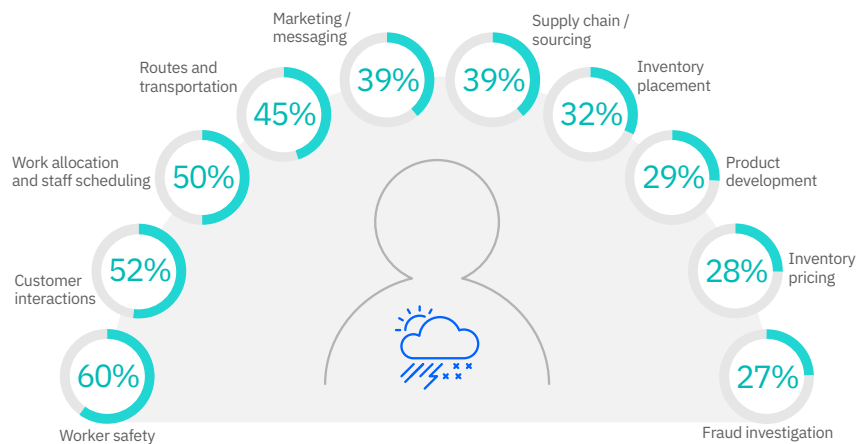
Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

Nearly all executives surveyed (96 percent) also said they incorporate weather data into their organizations' operational plans. One in five indicate they integrate weather data into operational plans months out, while a little more than half say it is integrated into plans weeks before they go into effect.
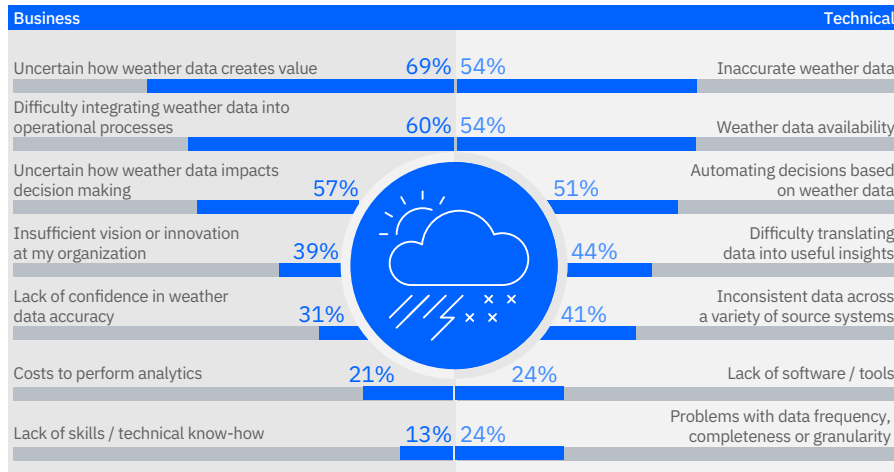
What's hindering growth?

Nearly half of executives say weather insights create a competitive advantage for their organization and many are already acting on their instincts. Sixty-three percent state that their organizations have staff dedicated to analyzing weather data and more than half say senior executives in their organizations are considering using weather data.

However, many leaders struggle to put weather insights to work. We asked executives what's inhibiting their organizations from deriving more insights from weather data. They identified multiple business and technical challenges (see Figure 7).

Figure 7
The storm wall: What's inhibiting executives from gaining better insights from weather data

Business	Technical
Uncertain how weather data creates value — 69%	54% — Inaccurate weather data
Difficulty integrating weather data into operational processes — 60%	54% — Weather data availability
Uncertain how weather data impacts decision making — 57%	51% — Automating decisions based on weather data
Insufficient vision or innovation at my organization — 39%	44% — Difficulty translating data into useful insights
Lack of confidence in weather data accuracy — 31%	41% — Inconsistent data across a variety of source systems
Costs to perform analytics — 21%	24% — Lack of software / tools
Lack of skills / technical know-how — 13%	24% — Problems with data frequency, completeness or granularity

Source: IBM Institute for Business Value 2018 Global Weather Study Survey (n=1,000).

Nearly half of executives say weather insights create a competitive advantage for their organization and many are already acting on their instincts.

Two-thirds of executives say weather insights as a service would be more valuable than raw data alone.

Uncertainty about how weather data creates value topped the list of business challenges, followed by difficulty integrating weather data into operational processes and uncertainty about using weather data in decision making. Costs related to analytics and lack of technical skills were lesser concerns.

The accuracy and availability of data, and automating data-based decisions topped the list of technical challenges encountered by organizations integrating weather data into day-to-day business practices. We found that a large majority of organizations use weather data from a variety of sources. While only 35 percent of organizations obtain data as a service from a vendor, two-thirds of executives say weather insights as a service would be more valuable than raw data alone. Less than a quarter of respondents identify a lack of software and tools as a barrier.

Growing tips for your bottom line

So how can organizations clear these obstacles and begin to capitalize on weather insights? Many pioneering organizations have successfully overcome these challenges. Organizations can adopt these leading practices to address their most pressing business and technical challenges.

Business challenge	Leading practice
Uncertainty about how weather data usage can create value	You can't control the weather, but you can control *for* the weather. Aim to have a clear strategy and understanding of how weather impacts functions across the organization. Start with a Design Thinking workshop and include senior leaders from business units across the organization. Uncover the quick hits — projects that deliver high value and are feasible to implement — and build out a longer-term plan to use weather data insights.
Difficulty integrating weather data into operational processes	Weather insights should further enable data-driven decision making and automation for operational processes, not add additional complexity. Aim to couple weather data with their existing modeling tool sets. Learn from historical data and become more predictive by tying in factors such as current on-demand weather data and future forecast data along with real-time alerts to help build a comprehensive picture of the business impact of weather.
Uncertainty about using weather data in decision making	Don't focus on data, focus on decision support fueled by data. Most organizations are looking for creative ways to identify and confirm rapid, scalable and cost-effective ways to design, test and deploy transformational changes, including weather-based decision making. Seek experienced, collaborative partners that can co-create and experiment with you on agile, rapid prototypes to build strong business cases and trust.

World Fuel Services integrates weather data into operational processes

World Fuel Services (WFS) provides energy procurement advisory services, supply fulfillment, and transaction and payment management solutions to commercial and industrial customers, principally in the aviation, marine and land transportation industries. WFS deployed the myWorld app, which is designed specifically for business aviation and gives users a single platform to efficiently access fuel, weather, complex flight planning, a services engine, and airport, handler, country and regulatory data.

The app provides users with complex information and calculations embedded directly into the flight plan process, and incorporates advanced features and functionality to support pilots from fuel to flight — both on the ground and in the air. WFS successfully integrated weather data into the app to provide key features such as integrated weather graphics and vector content overlaid on interactive maps.[11]

You can't control the weather, but you can control for *the weather.*

Idaho National Lab integrates weather data into decision making

In its continual search for innovative methods to enhance roadway safety and mobility, the Idaho Transportation Department (ITD) partnered with the Idaho National Laboratory (INL), one of the primary national research laboratories under the U.S. Department of Energy. Inclement and unpredictable weather, resulting in road delays and closures, disrupts business operations, creates unnecessary operational costs and increases the risk of employee accidents. To better understand the weather and impact on operations, INL worked with IBM to develop a high-resolution weather forecasting model using artificial intelligence.

The model analyzes video images from Road Weather Information System (RWIS) cameras and interprets road conditions. It has the ability to learn based on initial input from the users, and accuracy improves as more video images are analyzed. Analytics provide a means to automatically screen camera images in real time to identify hazardous driving conditions, providing a means to validate data from road sensors. The result is a library of customized forecasts for contiguous small segments of the INL bus route network.[12]

Technical challenge	Leading practice
Inaccurate weather data	Conduct due diligence when seeking a weather data provider and select an organization with high quality and reliability. Also seek out a third party to verify weather data provider accuracy claims. Raw data often does not lead to value directly — deriving value requires transforming the data into insight with the use of skilled meteorologists and data scientists.
Weather data availability	Picking a weather data supplier is critical. Select a weather data provider that has a global scale, solutions and up-time to meet requirements. Weather data is not "one size fits all." Different use cases require different types of data, even industry-specific variables, at different temporal and geospatial granularities.
Automating decisions based on weather data	Use data science to identify trigger levels when weather affects your business and apply automation to take business action when those trigger levels are likely to be exceeded. Modernizing and automating decisions based on new data can enable faster time-to-value, reduced risk and increased customer satisfaction. Analytics on relevant data, including weather, should drive toward creating insights and then taking valuable actions.

NASCAR partners with The Weather Company to optimize weather-related decision processes

The National Association of Stock Car Auto Racing (NASCAR) is an American auto racing sanctioning and operating company best known for stock-car racing. NASCAR partnered with The Weather Company to incorporate hyperlocal weather data and forecasts to improve race-day operations and fan engagement. The partnership lets NASCAR use weather forecasting and analytics to improve planning, and identify optimal times and locations to run races each season. In addition, Flagship Solutions Group, in collaboration with The Weather Company, provides critical weather information to NASCAR through an advanced weather insights dashboard. The dashboard integrates with NASCAR's racing operations and decision support system. The partnership also allows NASCAR fans to track race-day conditions on NASCAR.com from days before a race to the waving of the checkered flag.[13]

WEATHERfx and Walgreens team up for automated advertising

Walgreens, a retail drugstore, has provided care services to communities across the United States for more than a century.[14] Recognizing that weather impacts symptoms of many medical conditions and that consumers use weather information to manage treatment, Walgreens leveraged advanced weather data solutions from Watson Advertising. The solutions help Walgreens reach and engage consumers when and where symptoms are likely to flare up, or prescriptions are most likely to be filled. By identifying the right consumers and reaching them in the right moments, the store improved store traffic and key advertising metrics.[15]

Are you walking on sunshine or seeking shelter from the storm?

– In what ways is your organization capitalizing on weather insights to reduce costs and increase revenues? How could you benefit from greater weather-related insights?

– To what degree are weather-related insights influencing decision making about your critical processes? Where is there room for improvement?

– How is your organization integrating weather insights into operational planning? How could you improve planning with better weather insights?

– What is your plan to consider using weather insights as a service? How will you access the necessary capabilities to realize the potential of weather-related insights?

Study approach and methodology

In cooperation with Oxford Economics, the IBM Institute for Business Value surveyed 1,000 C-level executives representing 13 industries and 15 countries, including 250 from North America, 50 from Latin America, 200 from Western Europe, 150 from the Nordics, 100 from Australia and New Zealand, 100 each from Japan and India, and 50 from China. Respondents were asked a series of questions about how weather impacts their organizations, the potential they say exists by improving weather-related insights, and challenges they encounter in gaining weather-related insights.

About the authors

Gillian Orrell is the European Benchmarking Leader in the IBM Institute for Business Value and a globally recognized subject matter expert for benchmarking. Gillian can be reached at gillian.s.orrell@uk.ibm.com and on LinkedIn at www.linkedin.com/in/gillian-orrell-b037084/

Len Polhemus is the IBM Services Lead for Watson Advertising and The Weather Company. Len can be reached at lpolhemus@us.ibm.com and on LinkedIn at www.linkedin.com/in/lenpolhemus/

Catherine Reese is a Partner and the IBM Services Integration Executive for The Weather Company within the Cognitive Business Decision Support service line of IBM Global Business Services. Cathy can be reached at croden@us.ibm.com and on LinkedIn at www.linkedin.com/in/cathyreese/

Dave Zaharchuk is Research Director for the IBM Institute for Business Value and responsible for directing thought leadership research on a variety of public and private sector issues. Dave can be reached at david.zaharchuk@us.ibm.com, on LinkedIn at bit.ly/DaveZaharchuk and on Twitter @DaveZaharchuk.

Related IBV reports

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Antoine, Patrick, Steve Harding and Lyubov Zeylikman. "Data-driven dividends: Get more from your data." IBM Institute for Business Value. August 2017. ibm.biz/datadividends

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Notes and sources

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2   2017 Fortune Global 500 List. https://fortune.com/global500/list/

3   The IBM Institute for Business Value (IBV) Benchmarking database encompasses over 1,000 business and process performance metrics and data from more than 27,000 business entities from more than 76 countries. For more information, visit: https://www-935.ibm.com/services/us/gbs/thoughtleadership/benchmarking/

4   Open Standards Benchmarking data. IBM Institute for Business Value Benchmarking database.

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