

Value-based predictive notification improves production and performance

ABB's technology-enabled services use predictive notification in a value-based service strategy for industrial producers. Predictive notification with the right people in the right place protects and enhances production, equipment availability, process performance and product quality.

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Notifications are ubiquitous. Our smart phones receive notifications from “apps” informing us about appointments, software updates or even stock performances. We clearly think that notifications make our lives better. Why then are notifications not used routinely to improve industrial processes? The answer is because notifications tell us what has already happened. In an industrial setting, that could be a costly equipment failure. What if we could accurately predict what will happen, and send notification with enough time to act to avoid negative events, and exploit positive ones?

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ABB has 137 expert service engineers utilizing advanced digital services to bring over \$60 million in value to its customers. ABB's experts evaluate predictive notification, identify problems and develop predictive maintenance programs based on value to deliver optimal advanced services in real-life industrial settings →1.

Historical perspective on predictive strategies

ABB recognizes that proactive service strategies with predictive notifications would be valuable to producers. Not only can failure be avoided and equipment maintenance improved, but the addition of a value-based predictive notification program also improves industrial processes. ABB experts have evaluated the problems with predictive strategies in the past.

Indicative strategies developed in the 1950s and 60s are still used today, such as when bolt-on machinery and software measure properties on-line to enable more and better products to be produced faster.

The earliest predictive control algorithms were developed during the 1970s and 1980s, setting the stage for software to eliminate the need for physical measurements. The resulting capabilities translate to a level of sophistication and sensitivity impractical for use beyond academia.

A practical, yet expensive, predictive method, condition monitoring, developed in the 1980s and 90s, detects impending equipment failures and notifies personnel to act. This is, however, expensive to deploy.



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01 The right people receive and act on predictive notification.

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02 Criticality ranking.

Nowadays, industrial producers contract with companies to regularly come on-site, make measurements and ensure that mechanics operate within set ranges. Although cost-effective, this strategy does not eliminate catastrophic failures, which occur between service visits.

Another problem faced by suppliers is a loss of talent. Cost pressures lead producers to reduce process-engineering staff. In advanced economies, many experts are approaching retirement.

Level	Effects (any of the following)
A	Loss of life, body part or lost time accident. Unit shutdown, immediate penalty cost. Regulatory non-compliance. Equipment damage over \$ 100,000.
B	Personal injury. Definite loss of production. Probable penalty cost or personnel injury. Equipment damage > \$ 10,000 and < \$ 100,000.
C	Could lead to personnel injury. Possible loss of production. Could lead to penalty cost. Possible equipment damage < \$ 100,000.
D	No risk of personnel injury. No effect on production. No regulatory non-compliance. Equipment damage < \$ 10,000.
Minimal	No effect on production. Repair costs < \$ 1,000.

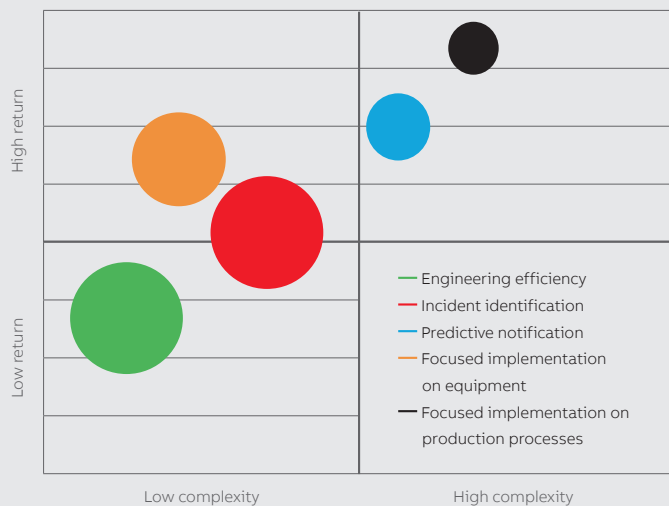
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For service strategies to be successful, expertise must be maintained.

A final roadblock to predictive notification is the reluctance to use remote-enabled technologies in industrial settings. Producers, fearing that

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someone could induce failure, are hesitant to allow remote connection to process control systems. Improvements in secure communications and cyber security safeguards reduce apprehension, yet industrial producers remain reluctant.



Note: Circle size is proportional to sample population surveyed

The path to predictive notification

ABB developed a stepwise approach to achieve effective application of predictive notification with challenges in mind. First, choose the equipment or processes for which conditions should be predicted. Second, expedite expertise through identification, sorting and prioritizing of problems to provide guidance. Third, assess the value of digital services, which maximizes ease and value of improving equipment services and processes.

- Choose what to predict: A producer must select the specific facility’s equipment and processes for which predictive notifications are to be received. A criticality analysis of equipment and processes will determine what could happen if something were to go wrong, and how that would adversely affect plant performance. A criticality ranking is applied to equipment or processes, ranging from the biggest safety production or cost impact, to the smallest →2.
- Expedite expertise: Many producers contract for condition monitoring, which means expertise depends on the person providing the service. Knowing how to capture an expert’s knowledge, and deploy it in easy, repeatable ways leads to effective completion of time-consuming elements of the job.
- Assess the value: Primary value areas were identified in a sample of 111 industrial producers located in North America, South America, Europe, Asia, the Middle East, and Australia and comprising a variety of processes (cement, chemicals, mining, metals, oil and gas). ABB identified and measured the value delivered by digital services, including predictive notification →3:

Digital services values

Engineering efficiency: The goal is to reduce diagnostic troubleshooting time by gathering and processing high volumes of production data. Value is reached by performing diagnostics faster. Producers easily understand the value, yet returns are lower than those of other values.

Incident identification: Rapid identification of incidents, such as equipment failures, is made through automatic analysis of high volumes of

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A criticality ranking is applied to equipment or processes, ranging from the biggest safety impact, production or cost, to those with the least.

data. Producers easily recognize the value of this service, characterized by a moderate return, and yet it is more difficult to achieve than other values. ABB collects and categorizes the data into key performance indicators (KPIs) →4. The KPIs are tracked using main indicator bars that increase as the subset bars increase, representing prioritized collections of discrete events that need attention.

— 03 Digital services are represented according to value and relevance to the sample population as indicated by the size of the plot points.

— 04 Pareto charts of KPIs from an operator interface.

Focused implementation on equipment: Values are obtained from improved equipment performance to identify an improvement opportunity. An enhancement is then performed quickly and efficiently, resulting in a high return. Delivery of this value can be complex, but original equipment manufacturers (OEMs) can usually achieve this value relatively easily.

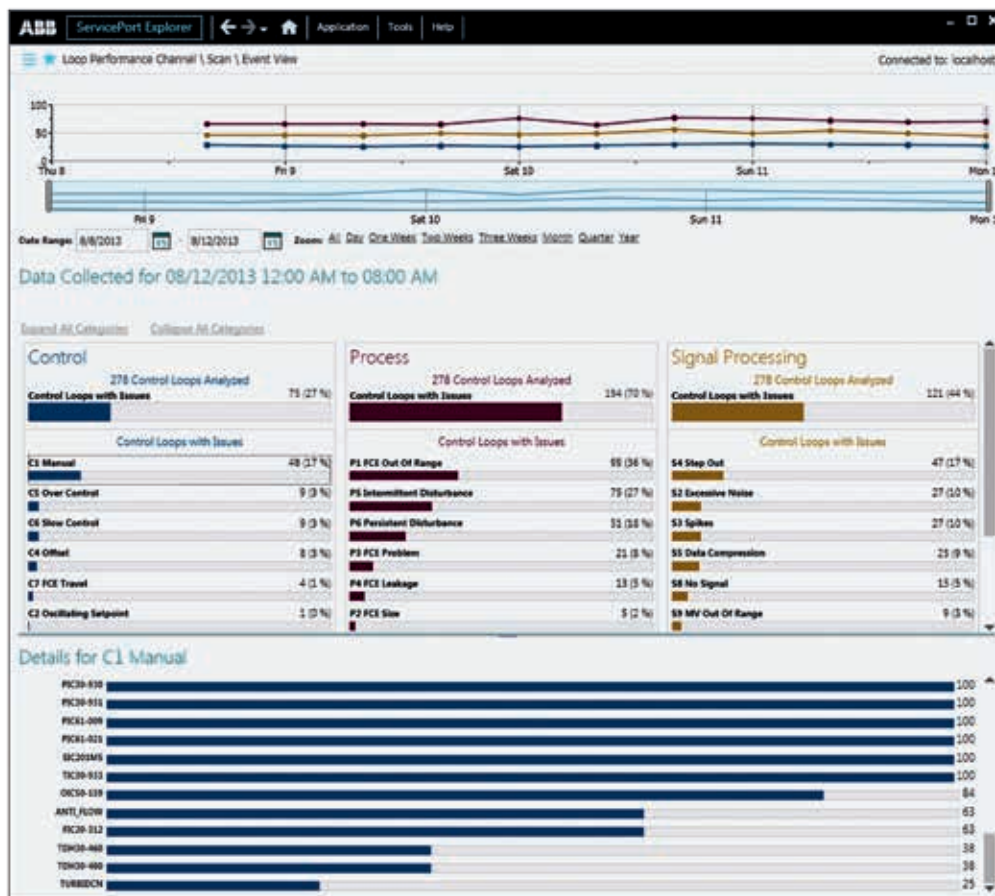
— **Predictive notification: The goal is to expeditiously analyze, identify and categorize discrete events to produce patterns that predict failures.**

Focused implementation on the process: The aim is to optimize production, quality, or cost to produce results. The value derives from using services to identify improvement opportunities, and assigning the right skill to deliver services to improve performance. The value can be complex to deliver, yet has a high return. This is the hardest value to achieve, and is realized by a smaller population of producers.

Predictive notification: The goal is to expeditiously analyze, identify and categorize discrete events to produce patterns that predict failures, then alert personnel to take action rapidly. This value has moderate complexity, and yields a high return.

Focused implementation on equipment and focused implementation on processes rely on information delivered through predictive notification. These three service strategies address the overall equipment or process design, or maintenance path, to avoid repetition of negative events, making equipment and process availability optimal.

ABB's assessment shows that providing a predictive notification to personnel, with a recommended action, results in an action taken. The beauty of implementing these service strategies together is that the response will likely produce a high value.



Case study

A plant in the United States manufactures products for food and beverage consumption, relying on quality. The plant uses quality control systems (QCS) to operate machines and advanced digital services for early detection of potential QCS issues. Predictive notifications are provided to help the plant identify and mitigate problems that could cost millions of dollars in lost production.

Application

The digital services utilized by this plant automatically gather and analyze data from the QCS, present views of KPIs that help identify variables that impede productivity, and provide recommendations for action. These services identify, categorize and prioritize opportunities to improve equipment availability, process performance and product quality through visualization and analysis of instrument stability, control utilization and process variability. Service engineers address problems on-site and remotely.

Users view, analyze and scan data to produce a summary of KPIs ranked by severity; events are tracked, by setting parameters for KPIs that create customized displays of occurrences that fall outside parameters. KPIs that track outside predetermined parameters trigger predictive notifications →5.

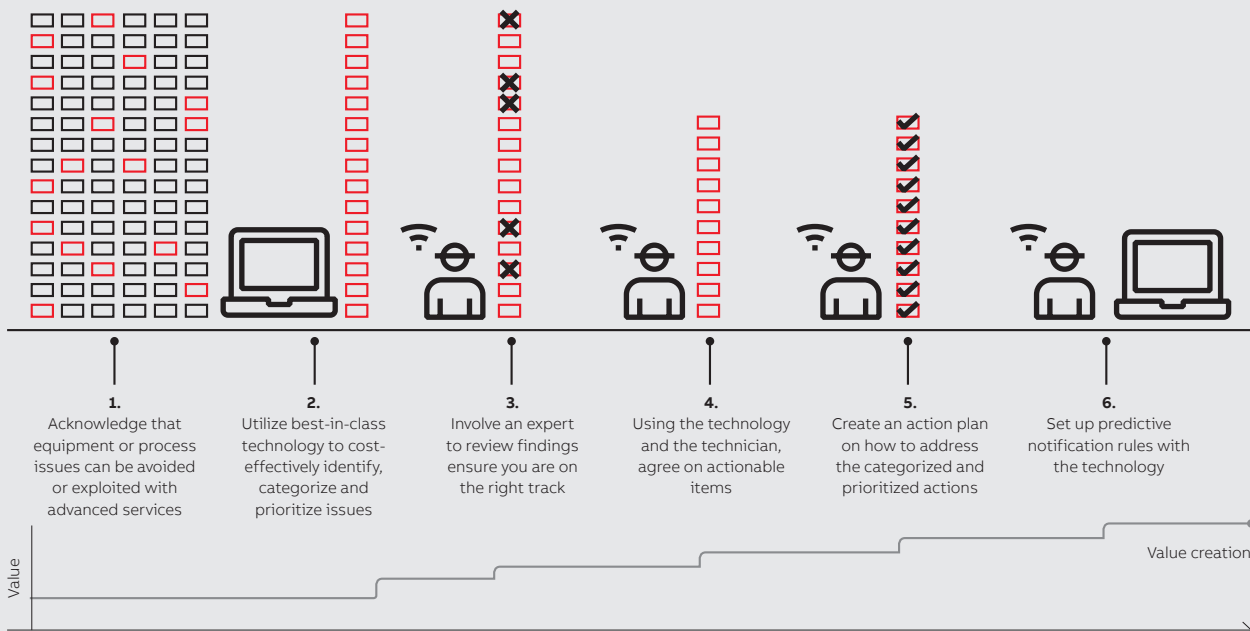


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Notification

Service engineers track KPIs by setting predictive notification parameters that notify if an instrument reading exceeds parameters. An engineer at this site received a predictive notification before arriving at work on a particular day, alerting him that the threshold for an instrument had been exceeded.

Once at the plant, the engineer investigated the issue using data views. A large bar in a Pareto chart on the display confirmed that an instrument's limits have been exceeded. The engineer studied the raw data view and the severity levels to verify the extent of the problem, and determined the necessary action to avoid downtime. The replacement of an instrument was scheduled during a planned outage.



— 05 A predictive notification sent as an email that prompted an ABB engineer to act and avoid unplanned downtime.

— 06 A well-designed predictive notification program that focuses on high-value actions.

— 07 Rules established for the predictive notification program.

Reference

[1] Biro, D., "Are you on track? How Predictive Notification keeps production on track," ABB White Paper, p. 18, 2015.

Mitigation

An emergency instrument replacement would have led to lost production, a costly event. The action taken by the engineer after receiving the predictive notification mitigated quality losses and unscheduled downtime of more than \$100,000. The plant continued to have high equipment availability, stable processes and good quality.

Digital services that use predictive notification are the most effective form of delivering advanced expertise in today's production environments.

Preparing a predictive program

ABB established a technology-enabled predictive notification stepwise program to successfully deliver advanced services that improve equipment availability, plant performance and product quality →6:

- Agree that equipment or process issues can be avoided or exploited accurately and cost-effectively with digital services. No value can be achieved if a producer does not believe problems can be mitigated through digital services.
- Use best-in-class technology to effectively identify, categorize and prioritize issues. Suppliers have different capabilities and specializations such as equipment areas, production or business processes, and industry equipment. Producers must identify suppliers who can provide the best technology and applications for the plant's equipment and business processes.

- Involve an expert to review findings to ensure that preparation is on track. Producers should have access to experts who are knowledgeable and experienced. They ensure that value-added KPIs are used to develop effective predictive notifications. For many, this knowledge can be found among OEMs.
- Agree on actionable items using the technology and technician. Once the best available technology and the most value-added KPIs are chosen, agree on actions to take when parameters are exceeded. Producers should collaborate with those who will take actions to ensure commonalities.
- Create an action plan to ensure the agreed-upon actions can be taken quickly and efficiently when parameters are exceeded and a predictive notification has been sent. Determine who will act; what will be done; where will it be done; where are the tools and/or parts; when will the action occur. The action will be taken.
- Set up predictive notification rules. Use the analyses, issues and processes, and KPIs, and establish thresholds that will drive the action →7.

Digital services are the most effective form of delivering advanced expertise in today's production environments. Predictive notification of impending issues provides producers with the primary value opportunity to improve equipment availability, process performance and product quality. Nonetheless, even the best digital services and predictive notification are only meaningful if the right people in the right place receive the notifications and act. Only then can digital services and predictive notifications truly make lives better. ●

