

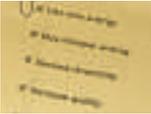
# ABB Review

Special Report

Industrial  
Services



**ABB**

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## What really counts for customers is the *total cost*!



ABB's customers not only look at the purchase price of our products and systems, but also increasingly at the economic impact of performance and operation over these assets' entire lifecycle. Besides adding a new dimension to our thinking, this provides us with challenges that are having a significant impact on our R&D portfolio.

*Industrial<sup>IT</sup>* is a case in point. Its unique and innovative architecture allows real-time energy consumption management, so plant performance costs can be optimized relative to the desired production level. Customers are able to access information which can be used for lifecycle optimization of plant assets, ranging from field devices, control systems and automation devices, through resources such as energy and manpower, to major plant infrastructure.

The design of *web-based solutions*, including portable data collectors and automated diagnostics functions, is also influencing our R&D efforts. These enable service centers to monitor large numbers of machines over greater dis-

tances, and do it more efficiently. Using standardized equipment and methodology, customers in remote locations can collect raw data and then transmit it to ABB experts in service centers where, after analysis and interpretation, it is transformed into information for initiating action back in the plant.

Other impacted areas are *value-based productivity solutions* that eliminate waste from our customers' processes, and *risk-based inspection* to help businesses plan preventive maintenance and minimize the risk of failure.

Generally, we see a clear trend toward the use of more intelligence – more electronics, more sensors and more computational power – in our products and systems. This enables us to collect large amounts of data from our customers' plants which we analyze and then use, for example by means of diagnostics, to optimize costs. Other factors reducing service costs are our R&D investments in modular product design, in technology platforms, in smart products, and similar.

Optimizing the 'total cost' is, of course, not just about technology. People and organization are also important. Being a global organization, we are always close to our customers and understand their requirements. Our companies have well-trained people with access to all the know-how they need to act quickly.

Training is too often overlooked as a means of increasing performance and efficiency without investing in capital. ABB can also help in this area, for example through *interactive e-learning* courses based on the latest web technologies.

*Support<sup>IT</sup> applications* provide engineers with access to several different web-based applications to allow easy and speedy access to process and component data when problems arise.

Efficient knowledge management is a core value adder in ABB Performance Services, in which ABB offers customers broad-based, long-term outsource services that include Maintenance Performance Management and Automation Performance Management.

In this Special Report we are proud to present ABB's approach to advanced services, including consultation and web-based training, data gathering and analysis. These services enable industrial and utility customers to optimize the overall lifecycle of their assets. Utilities' concerns are also addressed in another Special Report on power transmission that emphasizes ABB technologies for preventing black-outs.

Markus Bayegan  
Chief Technology Officer  
ABB Group

## Industrial services: providing certainty in an uncertain world



**A**BB is a leading provider of power and automation technology. We are the world's top supplier of process control systems, motors, and drives. We are also first in power transmission and distribution equipment. ABB was the first company in the world to sell 100,000 robots. We dominate our target markets for turbochargers, and we have leading positions in low-voltage products.

We have an installed base of more than US\$ 100 billion of automation products and systems worldwide. That's a lot of customers. These customers choose our products for a variety of reasons: technology; process and/or industrial knowledge; value-added service; or because they can be sure of receiving the same quality products and services anywhere in the world.

With this market position and installed base comes the *responsibility* of ensuring our customers' continued asset performance. We want to ensure our customers' success, and that includes helping them navigate through a dynamic economy, fueled by continuing economic and geopolitical concerns.

This economy does not depend on bullish expansion, but rather stable, predictable, and reliable steps to counter uncertainty. In a market environment of slower demand and excess production capacity, the lowest-priced or highest-quality products gain a competitive edge. Low-price and high-quality requirements squeeze margins, however, making it tough to meet shareholder expectations. So instead of focusing on capacity and new markets, manufacturers must focus on improving the performance of existing assets. Industrial services can help.

### **Service delivers reliability**

Reliability is influenced by the way customers choose and manage assets. To choose reliable suppliers, many companies foster an environment of supplier teamwork, and are often willing to pay a premium for the ones that best support their success. In turn, suppliers must help to ensure optimum performance of what they supply by providing comprehensive service support:

- *Where it's needed* – Products, parts, and repair centers must be located where they are needed geographically, increasingly important in a global economy.
- *When it's needed* – Cost-effective support

and remote access to experts must be readily available either physically or through web-based technology.

- *How it's needed* – Maintenance and field services must be flexible enough to meet a variety of customers' demands, from telephone support to long-term service and maintenance contracts.

As a truly reliable supplier with the infrastructure and determination to back our claims, we must ensure our customer's ability to optimize assets and to become reliable partners for their own customers.



## **Service delivers stability**

When it comes to assets, most companies choose the best they can find and afford. But the dynamics of normal production, especially in an uncertain economy, mean these assets operate in an inherently unstable environment. Any piece of equipment, especially sophisticated assets such as automation products and systems, must be monitored continuously to ensure optimal performance and stability over time. Companies must ensure that equipment operators are able to deal rapidly with stability issues by adjusting the asset to optimum operating conditions. This is

best achieved through proper training and support. The asset supplier, who knows the asset best, and who has a vested interest in helping customers make the most of their equipment, is often best suited to provide this level of training and support.

ABB is committed to providing lifecycle optimization services for customers. We consider the entire product lifecycle and business relationship, putting a structure in place to support each customer with a clear service and migration path. This approach can help to optimize a future move to new features, more efficient

technology, and/or a different type of product if necessary.

## **Service delivers predictability**

Predictability can be experienced in a number of ways. Choosing a qualified supplier is the main driver of predictability. Involving the supplier in asset installation and commissioning is also a positive measure. But predictability is not just a driver of asset performance; it is also a performance indicator for the business itself. Predictable revenues and profits are the goals of every manager and shareholder. A key way to ensure financial predictability is to choose business models that provide the most flexibility.

In an economic environment where companies must tread carefully, over-investing capital in production up front leaves little room to maneuver in the dynamics of uncertainty. Choosing a business model that provides flexibility is safer. One way of doing this is to outsource non-core activities so that a supplier, like ABB, shares the risk. This allows the company to focus attention on improving core performance, while ABB focuses on providing the performance management services that are core to our business.

## **Our proposition**

We are all manufacturers. To succeed, we must ensure maximum performance from the products we provide. This report is designed to share some of ABB's advanced service approaches in an effort to stimulate creativity and make the most of your – and your customers' – assets.

We are committed to providing stability, predictability and reliability to you through industrial services. Our goal is to help you meet the expectations of your customers and shareholders amid the uncertainty of today's business environment.



Dinesh Paliwal  
Member of the Executive Committee  
Head of Automation Technologies  
worldwide  
ABB Group



# Performance-based services for industrial markets

Bradley J. Kramer



**Manufacturers can no longer afford to install equipment and forget about it. Sustainability and return on investment have become fundamental issues. However, years of downsizing and emphasizing core competencies, as well as the pace at which automation and computing technology become obsolete, mean that manufacturers can no longer solely rely on internal staff to meet the demands of designing, implementing and maintaining their automation technology.**

**This shift brings new responsibilities to engineering and automation technology firms. It requires suppliers to take responsibility for the performance of their products and solutions over time, not just at implementation. ABB is committed to this goal with performance-based services that incorporate new and innovative ways to bring value to ABB clients.**

It is widely accepted that an industrial or product-based company's strategic advantage is based on its core competencies, such as its high value-added internal activities [1]. Oil & gas is a prime example of a sector where this is the case. For example, companies that sell and distribute oil and gas are increasingly narrowing their focus on this portion of their core business. This means outsourcing the design and construction of new plants, as well as the ongoing management and lifecycle support of these production assets.

The change of strategy now requires suppliers to take responsibility for the performance of their products and solutions not just at implementation, but also over time. In an environment where an oil platform or a power station is capable of producing over US\$ 1 million of product per day, reducing the time to implementation and enhancing lifecycle reliability can bring about a significant improvement to the process and manufacturing industry's flexibility and profitability.

After years of downsizing and emphasizing core competencies, manufacturers can no longer rely on internal staff to meet the demands of designing, implementing and maintaining their automation technology. Instead, innovative partnerships that emphasize shared risk, common objectives and business benefits tied to client results are redefining the typical vendor/client relationship. Technology is no longer a sufficient differentiator. Manufacturers can and should expect industry-specific solutions that impact overall operational efficiency, including cost, productivity and quality.

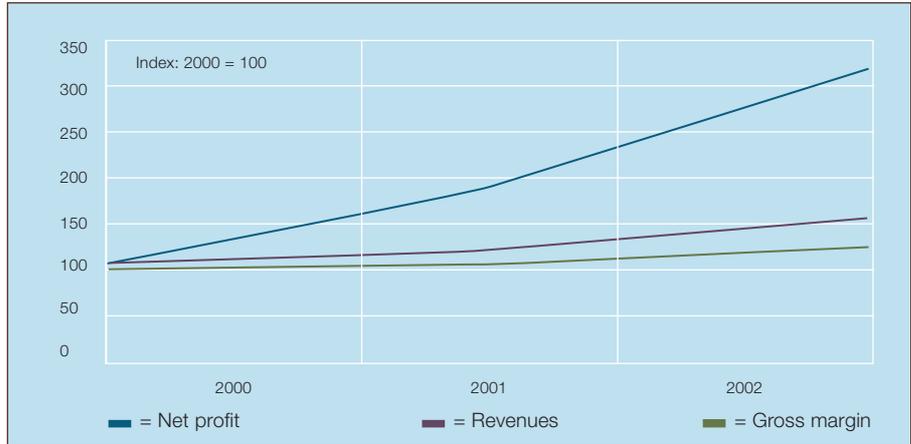
Focusing on core competencies is one aspect, but companies are also looking at another: the sustainability and return on investment in plant equipment.

**Asset efficiency:**

**Beyond cost cutting**

Over the last decade, companies have made attempts to improve the productivity of their assets. They have created just-in-time inventory systems, improved

Core focus leader: oil and gas  
Shell Europe's fuel-retailing growth



Royal Dutch Shell's European operations were recently refocused to reduce capital spending, forcing the operations to optimize the return on their existing assets and to 'earn the right to grow' through selective capital investment. This increased financial flexibility has resulted in improved returns for the company. Source: Royal Dutch Shell

working capital and outsourced non-strategic activities to more efficient suppliers. While these efforts have been necessary and are important, pressure from the investment community to improve shareholder value continues to increase. This persistent pressure for improvement is driving a renewed look at asset productivity gains. Three powerful trends are at work [2]:

*The exhaustion of traditional cost cutting:*

For more than a decade, companies have cut costs in order to reduce operating expenses and improve margins. One unintended consequence of this has been intense price competition that has driven margins downward in many businesses. The result has

been to sharply limit the capacity of margin improvement, pushing a growing number of companies to look at increasing asset efficiency as an alternative.

*The downside of growth:* Growth has been an important and necessary priority for most companies. Unfortunately, this growth has frequently come at the price of a neglected, bloated balance sheet. As companies continue to provide their shareholders growth with above-average returns, they will have to focus on improving their asset productivity to assimilate acquisitions or free cash for new investment.

*Changes in the structure of industry.*

Economic and technological forces are driving long-term changes in the structure of industry. Outsourcing and the improved coordination made possible by information technology investments allow the 'deconstruction' of integrated businesses and

expose subsidized, poorly performing assets. Vertical integration and asset ownership are no longer competitive requirements in many industries. Business models based upon minimal asset

The change of strategy requires suppliers to take responsibility for the performance of their products and solutions not just at implementation, but also over time.

ownership and high levels of asset productivity, will enjoy the greatest success in this environment.

**The convergence of process automation and IT**

Another market force shaping the automation technology market is the convergence of Information Technology (IT) and process automation. In recent years, infrastructure within the process automation domain has evolved steadily toward commercial, off-the-shelf hardware, software and networking technology. As this occurs, the boundaries between information and process technology become blurred, and companies are beginning to consolidate these functions. IT professionals already accustomed to outsourcing models are now becoming involved in process technology decisions.

The practice of outsourcing plant automation technology is gaining rapid acceptance among firms already experienced in outsourcing IT functions. ABB recognizes this trend and has embodied it within its Industrial IT strategy.

**New risk-sharing relationships**

The evolving trend is toward usage and

performance agreements in a given asset class within the facility. The full implementation of this model provides process and manufacturing industries with automation products, applications and services under a usage-based, integrated lifecycle services model. The best arrangement is when the client and automation provider work as an integrated team. Together they develop a business model that supports both the client's top-level business objectives and aligns the automation solution set with the client's profit engine.

The resulting business case identifies sources of value that can be derived from the implementation and long-term support of automation and power management solutions. ABB has met this need with its Automation Performance Management program. Under this arrangement, ABB will share or accept the transfer of risk for technology and

**Innovative partnerships that emphasize shared risk, common objectives and business benefits tied to client results are redefining the typical vendor/client relationship.**

performance results. In return, ABB and the client share the additional benefits created. These relationships also allow partners to leverage their joint size and scale for the benefit of both. It means taking a long-term view of efficiency and saving money rather than relying on a strictly transactional model.

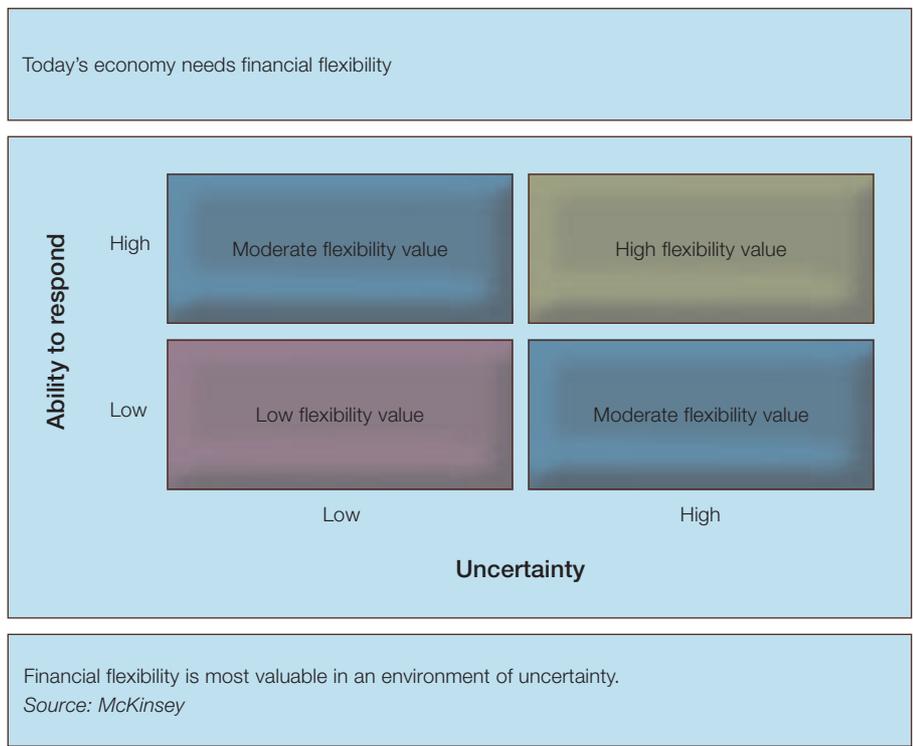
Typical sources of value for the client include:

- Process and production optimization
- Business application and decision support tools
- Fewer incidents and a reduction in production stoppages
- Reliability and utilization improvement
- Technology refresh
- Improved plant safety.

**Successful upgrade of an oil refinery**

In 1999, a major integrated energy company signed a 10-year outsourcing contract, with a value of US\$ 250 million, to modernize one of its refineries. Multi-year investments in state-mandated compliance initiatives had allowed this particular facility's automation technology to become obsolete. Advances in industrial automation, coupled with the almost continual migration of integrated computing platforms, added significant challenges. One of these was an estimate for almost US\$ 200 million received by company managers to upgrade the automation control platform and 50,000 instruments at the site. But more importantly, this facility needed to find an execution model capable of implementing a solution with severely limited internal engineering resources, and a long-term support strategy that kept them from repeating this cycle in coming years. Faced with this situation, senior company managers were determined to find a new approach.

At the same time, new business models were being developed within the auto-



mation technology industry to meet these challenges. In the end, the client implemented a co-sourcing model to deliver automation functionality to the plant on a performance-based model. The client now pays for this functionality on a monthly basis within the framework of a service contract. By adopting this execution methodology, both human and capital constraints could be removed, and the modernization, originally planned to span eight years, can be accomplished in three years. Both sides agree that the results of this innovative approach have been remarkable, and the client claims the modernization effort has been the fastest in the company's 100-year history. Senior managers estimate the program will be worth US\$ 60 million per year in enhanced yield, and approximately US\$ 9 million per year in reliability improvements.

#### Financial flexibility

The financial advantages gained by manufacturers when they outsource agreements are enormous. In addition to reducing the production asset base and driving key financial objectives, the best arrangements offer the client an opportunity to move fixed costs to variable costs closely linked to production. These arrangements can also avoid significant capital expenditure requirements and replace them with smooth, predictable annual cash flows. Tying compensation to plant results ensures consistent alignment with the client's business priorities. ABB believes the performance aspects of compensation are critical to drive appropriate behavior and focus.

ABB is committed to the idea that clients should get much more than a robust product suite from their automation technology supplier. Having an intimate knowledge of our client's processes and how our solutions impact a client's revenues is essential to



this new relationship. More importantly, ABB is committed to staying around to ensure that performance is achieved on a daily basis, to guarantee the conditions that are essential to a healthy business environment.

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#### References

- [1] **C. Zook, J. Allen:** Profit from the Core: *Growth Strategies in an Era of Turbulence*. Harvard Business School Press, 2001: 11.
- [2] **R. Nicol, P. Amoyal:** Asset productivity: the next wave. Internal Innovation Series, The Boston Consulting Group, 1999, 1.

# Real-time energy performance management of industrial plants using Industrial<sup>IT</sup>



Trond Haugen, Jan Wiik, Edgar Jellum, Vidar Hegre, Ole Jakob Sjørdalen, Gunnar Bennstam

**Lower energy consumption, cheaper energy, less downtime, higher product quality, better asset utilization, improved safety... industry's wish list is long. Yet it is also realistic. ABB developed its Industrial<sup>IT</sup> information architecture so that performance criteria like these can be managed efficiently, in real time. And it can be implemented step by step, as ambition and insight grow, with just a minimum of engineering effort.**

Industry runs on energy. Every industrial process depends on it. Across all industries, on average, energy consumption accounts for around 5% of the value of shipments. In some process industries this figure can rise to as much as 70 or even 80%. But it's not only cost that's important: the amount of energy used also has an impact on the environment. On top of all this, there is the quality and reliability of the power supply to consider, since these can affect product quality, output, asset utilization and safety. Most of these factors will, at some time or other, influence every branch of industry, but, inevitably, any one industry will want to focus on those specific to its own energy management needs (see panel) [2,3].

In spite of increasing recognition of the need for energy management, manufacturing industries typically focus on production throughput and quality. The result of this is that there is little awareness and knowledge of the key contributors to energy loss, preventing any kind of improvement in real time. Also, the deployed tools and systems tend to be scattered around the plant, with users focusing on only part of the picture. Multiple data sources add to the misery. It's hardly surprising, then, to learn that management of energy-related data is often inefficient and inconsistent.

Energy management, like any improvement program, relies on collecting data, identifying opportunities, setting targets,

## Industry's 'to do' list

Industry's drive for more efficient energy management is concentrated in three main areas [1].

### *Reduce energy consumption*

- Review maintenance and operating procedures.
- Modify existing equipment and processes (eg, by retrofitting). Alternatively, modifications can be incorporated in new designs.
- Utilize assets more efficiently after carefully examining production processes, schedules and operating practices.

### *Reduce cost of energy or increase selling price*

- Plan and schedule production according to time-dependent tariffs; shift consumption to low-cost time slots; sell own surplus generation capacity at high cost.
- Monitor energy use; verify utility bills.
- Schedule production to avoid power peaks that may violate utility contracted limits. Monitor tie lines; shed loads.

### *Increase availability and quality of service*

- Schedule production to avoid power peaks that may violate equipment capacity limits. Monitor capacity limits; shed loads if needed.
- Monitor quality of utility service.
- Automatic switching of capacitors.
- Automatic start-up of standby generators.

implementing changes and monitoring results. Efficient access to the *right information* is key.

Although different information is required for different tasks and for different users, most of it can be derived from core energy data, eg consumption, losses, efficiency and availability **1**. What is usually missing is a means of efficiently organizing and aggregating the energy-related data. Consistent information should be presented to the plant operators in real time, when required in views designed for specific users, to support their improvement decisions. ABB's Industrial<sup>IT</sup> solutions were developed to do this, and much more.

**The importance of 'context'**

Having determined that every user involved in energy management should be provided with the right information at the right time, the next issue has to be 'Which data?' Large quantities of data are normally available, but often they are of



little benefit to the user for one simple reason: they cannot easily and efficiently be put into the proper context. This is a major omission, since organizing and putting data to good use benefits users more than simply adding more specialized functionality to the existing portfolio of energy management software.

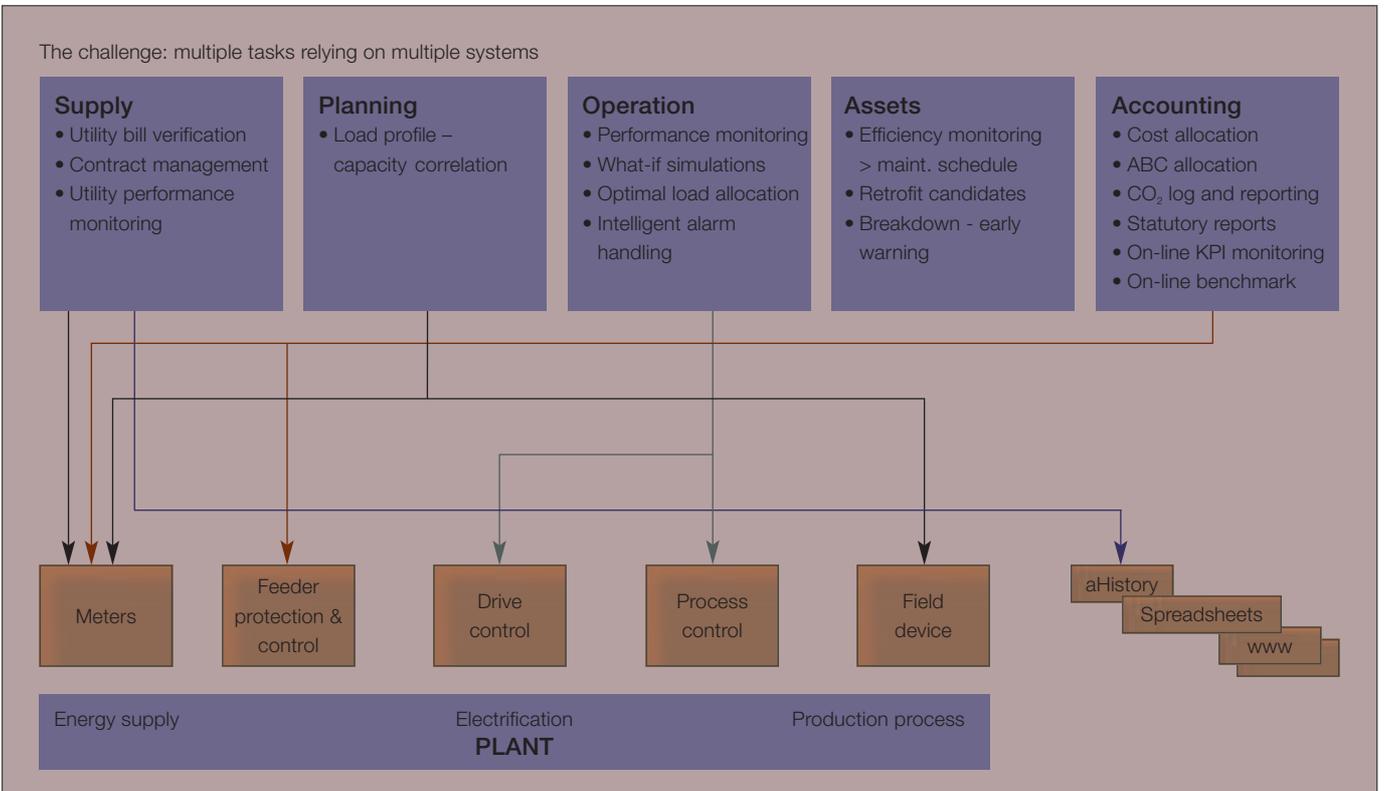
When the performance data are provided in context, improvement targets

can be defined and monitored. It is also important that the tools and methods used support step-wise improvements and changes.

**Goodbye to the 'forklift' approach**

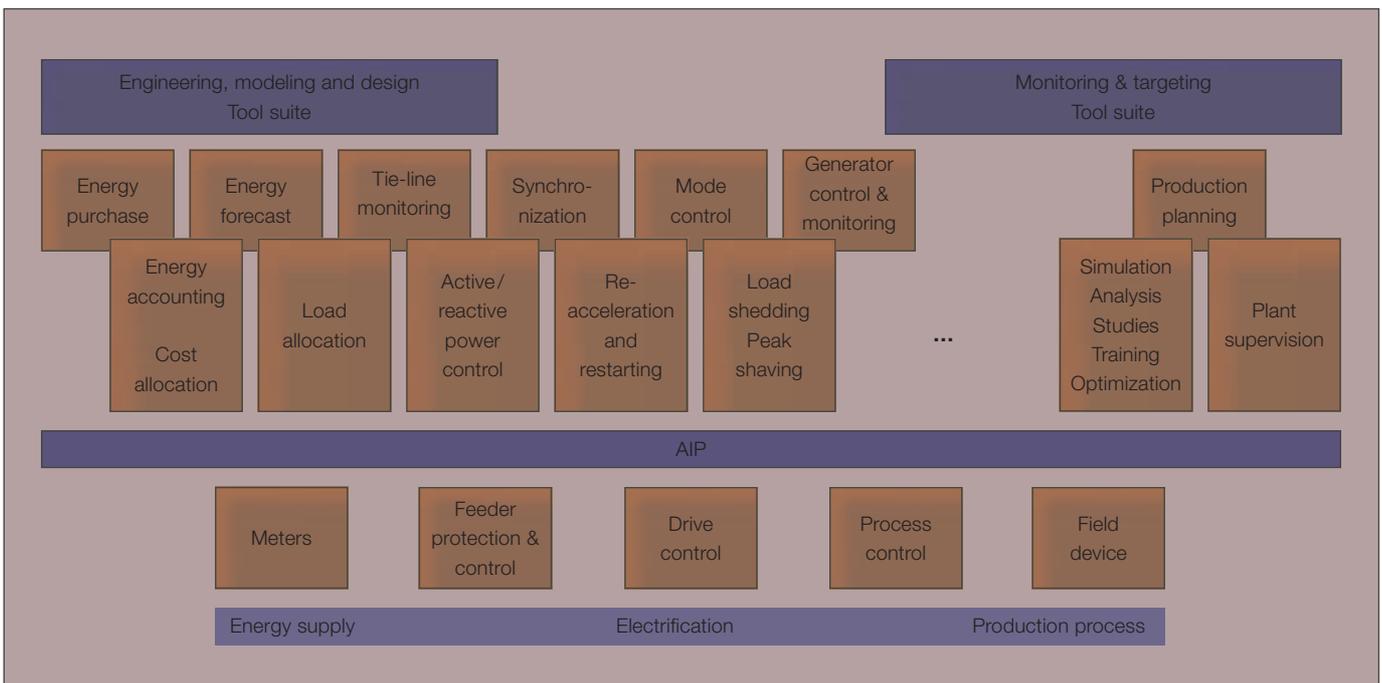
**2** shows the range and diversity of the functions and systems involved in energy management in industry. As is seen, the number and complexity of the systems, databases, process models and applica-

**1** In an industrial plant, energy-related information is required from a wide range of systems for many different purposes.



2

Typical scope of functions and systems required for energy management. ABB's Aspect Integration Platform (AIP) facilitates their integration, allowing data sharing, one-time entry of information for multiple applications and easy navigation.



tions that are used can be considerable. Given such complexity, the 'forklift' approach – in which all the existing software applications are replaced by new

ones – is hardly feasible. Luckily for industry, it is also no longer necessary. With the help of ABB's Aspect Object™ technology and its software architecture,

the Aspect Integrator Platform (AIP), all the systems can be made to communicate with each other – providing users with consistent, timely and relevant information, configured exactly as required.

3

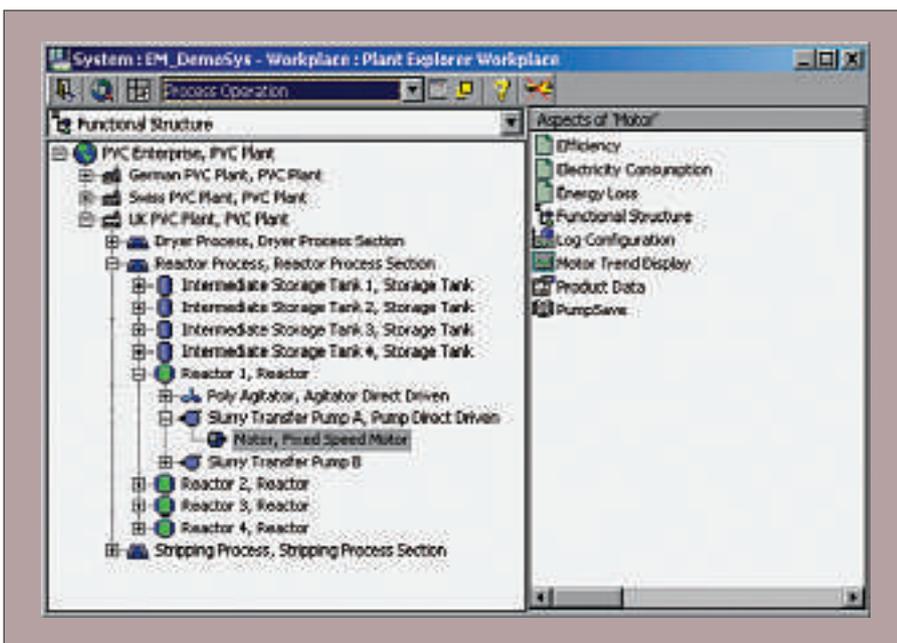
Plant components are organized hierarchically as 'Objects'. Each Object has 'Aspects' associated with it. Energy-related Aspects of the Object 'Motor', for example, are efficiency, electricity consumption and energy loss.

To understand better how ABB's Industrial IT architecture works, it is useful to consider its implementation in an actual industrial plant. But before we do, let's look at how Industrial IT organizes information, and at the terminology used to describe it.

**Industrial IT – the technology**

Information and functionality are structured in Industrial IT by organizing plant components, referred to as 'Objects', into structures, and relating real-time information and/or functionality, or 'Aspects', to them. The Aspect Objects™ can be defined at various plant levels, which could be a motor, a reactor, even an entire plant.

By structuring Aspect Objects in this way, Industrial IT provides a powerful tool for searching and summarizing information. And it gives information about the functional breakdown of the plant.



Information can be accessed with the desired level of detail; for example, the user may wish to know the energy consumption of the whole plant, of a specific process section, or of a component.

The different items of energy information are related to the Aspect Objects using designated Energy Aspects. These Aspects provide uniform access to the different items of energy information. For example, users access the energy consumption of a single pump in exactly the same way they would access the energy consumption of a whole plant [3].

More than 65 % of all industrial electrical energy is consumed by motors. Using ABB analysis and improvement software, energy information can be efficiently exploited in this area.

The Efficiency Aspect is calculated using input from other Aspects, such as electricity consumption and product data, as a basis. The calculation model is preset once for all motors. Once the structure is set, Aspects can be aggregated at any desired level with just a few mouse clicks [4, 5].

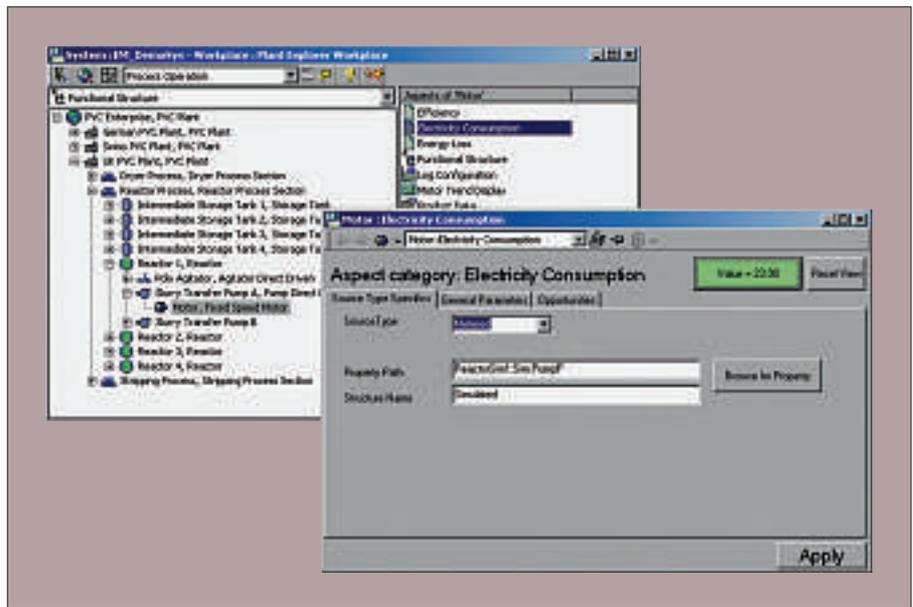
### The 'process to boardroom' perspective

Now let's assume that the CEO of, say, a PVC plant has just left the boardroom and is wondering how he will deliver the 10% annual reduction in energy use that he has just promised, let alone systematically track and report actual consumption. And do it all without diverting his scarce human resources from their main job of getting the product out on time and exactly according to the specification.

With Industrial IT, his organization will not have to spend additional resources to *monitor* energy performance; it is automated and consistent, with alarms and events that can be assigned to alert

4

Aspect information is easily configured. The information may be meter readings, calculations or come from aggregated sources on a given path..

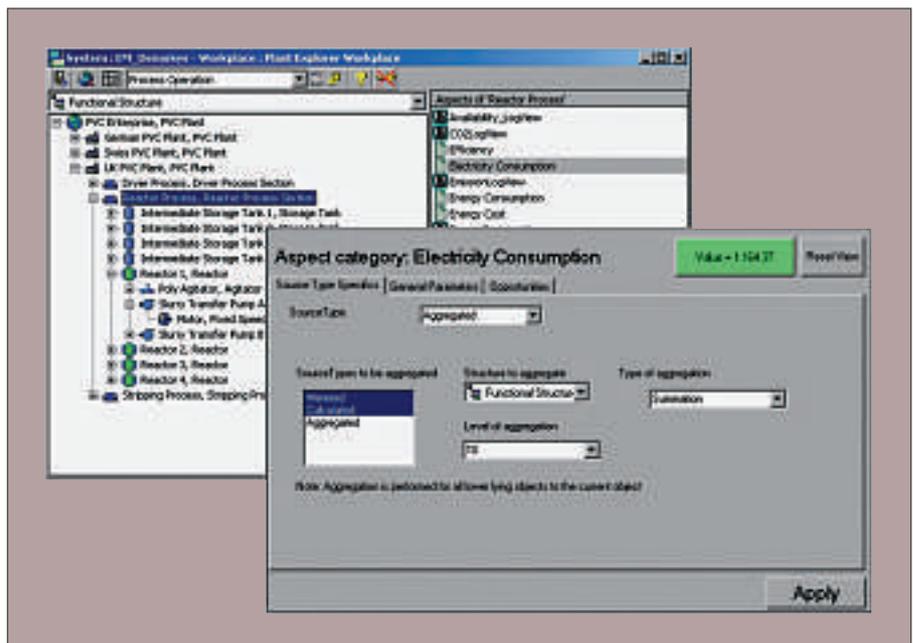


personnel should production be off target. In addition, he can search for *improvement potential*, or use benchmarks to compare units within his plant, or compare his own plant with world-class performers.

The CEO can drive *accountability* by assigning targets and actual results according to responsibilities. Energy data is automatically and consistently aggregated in the appropriate line of command.

5

Energy-related information can be aggregated from energy Aspects of plant components at any plant level in real time. Here, the electricity consumption of the reactor process section is aggregated from the consumption of Objects at lower levels.



Information that needs to be read and entered manually, estimated, or is only available with limited resolution, should not be neglected either. Starting with whatever is available, sophistication – data and optimizers – can be added, step-by-step, down the line.

Industrial IT offers a true ‘process to boardroom’ perspective; one that enforces strict organization of data whilst enabling flexible monitoring and retrieval of information, for predefined use as well as for ad-hoc purposes. And, once implemented, it drives improvements, raises performance awareness and assigns accountability.

### From key performance indicators to improvement opportunities

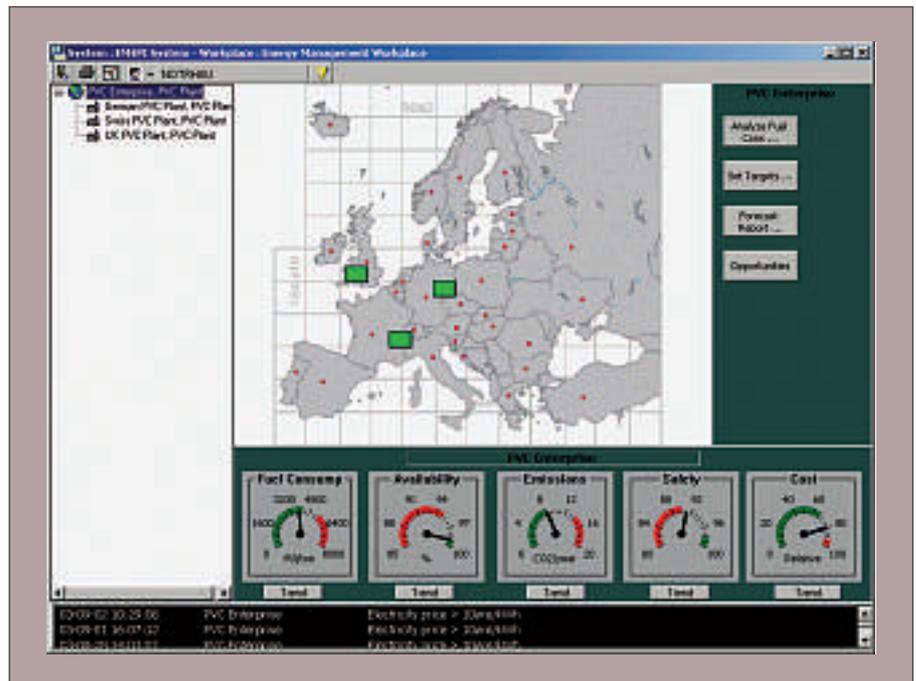
For our CEO to meet his commitment to reduce energy consumption, he and his staff need a whole range of information, and especially the key performance indicators that will show them how they are progressing. A collection of these indicators can be seen on the sustainability dashboard in 6. The dashboard is also a starting point for navigation, providing the user with a first view of the ‘drill down’ capabilities that will let him explore details and improvement opportunities.

To identify improvement opportunities, the user first investigates the KPI specifics and searches for improvement potential based on actual performance data. Industrial IT assists with decision-making by drawing the user’s attention to ‘hot spots’, such as compressors, pumps or heaters, whose operating ranges or scheduling can be changed to make them more efficient. The operational history and statistics are also provided, along with equipment ratings for a more detailed analysis. The user can even search the entire plant for the components or processes that contribute most to energy loss 7. Information from other Aspects can be searched and analyzed in a similar way.

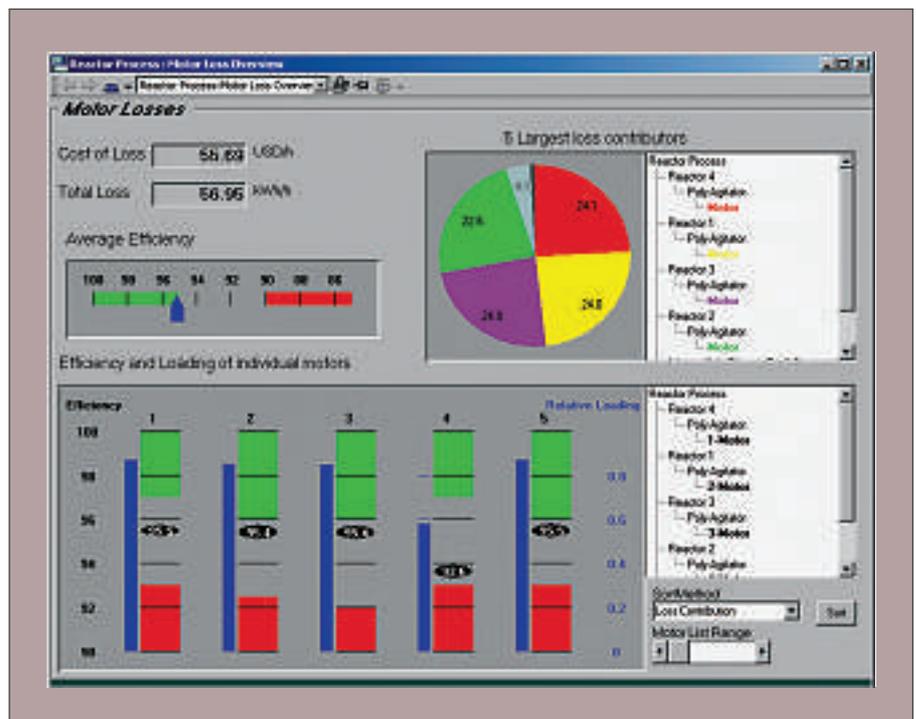
### Improvement software

More than 65% of all industrial electrical energy is consumed by electric motors, making them easily *the* target when talk

6 The sustainability dashboard shows the user actual performance indicators and targets – in this case at the enterprise level, with drill-down opportunities.



7 Objects throughout a plant can be searched. Here, the user has found the 5 main contributors to loss in a PVC production facility.

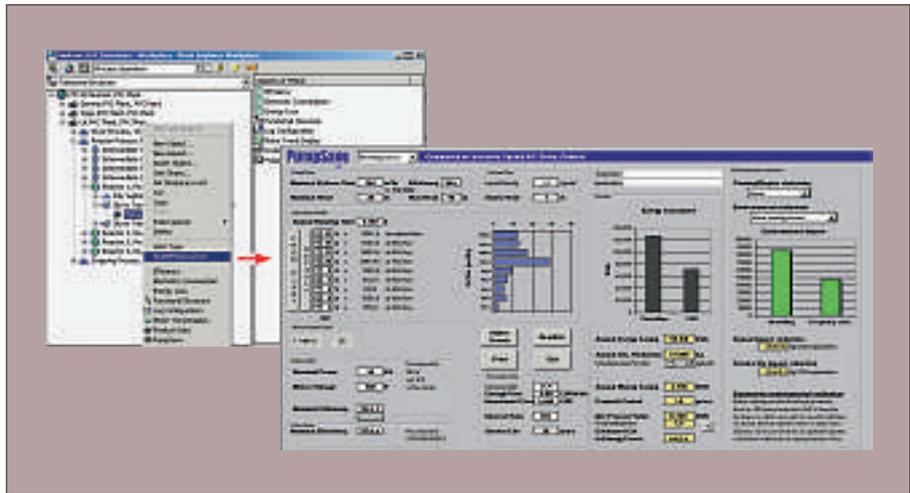


turns to saving energy or reducing environmental impact. ABB offers a range of analysis and improvement software with which energy information can be efficiently exploited for the more efficient use of electric motors.

Three stand-alone tools are available to help plant owners with decision-making:

- The *drive efficiency* tool calculates the efficiency of an existing AC drive system and compares it with that of a new, more modern system.
- *FanSave* and *PumpSave* tools calculate the saving and payback time for the replacement of an older flow control method by AC drive control. (8 shows the PumpSave tool integrated with the AIP.)

8 Analysis of motor efficiency based on real operational history and motor and load ratings. The tool suggests potential financial and environmental benefits of replacement.



The Aspect Integration Platform enables the drive and motor software to be run continuously, and also retrofit analyses and financial impact calculations to be run using real plant data. An efficient roll-out is facilitated, with relevant tools made available to all

### ABB's Aspect Integration Platform enables drive and motor software to be run continuously and retrofit analyses and financial impact calculations to be run using real plant data.

motor Aspect Objects, irrespective of the load Aspect Objects.

Of course, it is not usual to check the motor efficiency, loading, environmental impact, and so on, every day. However, a typical large plant has hundreds of motors, and while their individual consumption might not be significant, the aggregated consumption might well be.

The benefits that come from combining Industrial IT-based energy management with the right tools come to the fore

when shutdowns are planned. Then it can be used for a plant-wide motor analysis, or to draft a list of retrofit candidates based on the required payback period. And that's not all! The financial and physical impact of

energy-saving and environmental improvements can be aggregated, as can the cost of the respective investments.

For additional improvements, other ABB or third-party software products and tools can be integrated, allowing dedicated and maximum use of the energy data made available by Industrial IT and Energy Aspects.

#### The performance manager

Industrial IT, by enabling plant-wide data to be efficiently organized, supports the

acquisition, analysis and aggregation of energy-related information, as well as the integration of improvement software. And there is no need to invest the considerable effort in engineering and configuration that is required, for example, when traditional historian-based solutions are used.

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#### References

- [1] IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE STD 739 – 1995
- [2] **C. Resnick:** Energy management and optimization systems providing documented savings and ROI. ARC Insights no. 2001-047M, ARCweb.com, Oct. 2002.
- [3] **D. Forsyth, B. Ahmad:** Importance of energy management systems in the deregulated power market. EXFOR 2003, 89th Annual Meeting of the Pulp and Paper Technical Association of Canada, Montreal.
- [4] Manage your energy resources and reduce costs. ipw Internationale Papierwirtschaft International Paperworld 4.2001, 23–26.



# Transforming non-core processes through maintenance partnerships

Magnus Pousette

**In the current business environment, manufacturers are being forced to find new means of creating reliable and lean production processes. Many executives realize the need to increase their overall equipment effectiveness, and see the outsourcing of non-core activities as a necessary tool in achieving this. But in a business environment where competition is intense, simply outsourcing certain activities may not be sufficient.**

**Many companies have recognized this, and have established partnerships with outsourcing companies. Such partnerships create high-performance support operations that keep abreast of industry best practices. But the boldest executives take it a step further. They are partnering with firms that can support or even drive enterprise transformation. This goes beyond re-engineering the outsourced function to include managing cultural change and the critical core processes of their own firms.**

**ABB is actively involved in this kind of transformation with many customers. With experience managing activities at 150 customer sites worldwide, ABB knows that it must drive this process together with the customer and embrace aggressive change to make it happen.**

Creating reliable and lean production processes while shortening product lifecycles focuses attention on the need for improved equipment lifecycle management (ie flexibility, maintainability, equipment life-cycle profit, etc). Support processes, such as maintenance, become more and more critical, and the need to keep abreast of best practices increases.

**Maintenance as a value driver**

Some maintenance suppliers concentrate only on delivering reduced costs for their customers. Some take it to the next level and also focus on maintenance-related availability in customers' production processes. Several studies, however, have shown that the biggest potential for financial improvement in the industry lies not in reducing product quality defects, but in reducing downtime and increasing the production rate of production equipment. Not surprisingly, improvements in these areas also lead to fewer quality defects. Because of this, ABB's approach is different to that of other companies: it focuses on the customer's bottom-line result.

The change in focus from strict direct maintenance cost to production-oriented goals and the

customer's bottom line gives operators and maintenance personnel new roles. No single department is responsible for overall equipment effectiveness and the company's bottom-line result. ABB, with experience managing maintenance activities at 150 customer sites worldwide, has been leading this transformation. The company's experience shows that such transformation demands a new culture, and one with a flexible workforce.

In this culture, continuous interaction between operators and maintenance personnel should be the norm. If both maintenance technicians and operators strive to work with each other, and have the same goals and key performance in-

dicators, improved equipment effectiveness will result ■.

Such interaction will require a greater level of knowledge on the part of the employees, and that means having a culture that supports learning. The operator's role will extend significantly from running the equipment to participating in preventive maintenance of the equipment. In addition, the operator will work with maintenance personnel in overall equipment effectiveness improvement groups. Maintenance staff will become more involved in increasing production capacity (measured as increased overall equipment effectiveness values), as well as in increasing the efficiency in maintenance work.

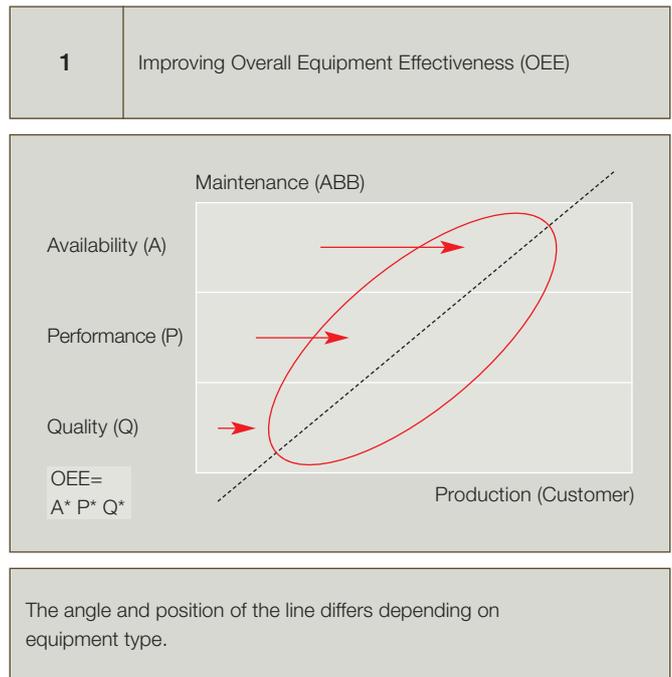
By engaging in partnership relationships with outsourcing companies, executives create high-performance support operations that keep them abreast of industry best practices.

must be educated. Naturally this takes time, but with a little patience, effectiveness will thrive.

The following case studies illustrate ABB's strength as a maintenance partner in two different industries.

**A metals company in Finland**

"High quality and cost effectiveness with a light balance sheet" is the way Outokumpu Harjavalta Metals Ltd. now describes its production philosophy. Three years ago, the Finnish company decided that, in order to secure its business, it



needed to network all supporting services and concentrate on its core business: copper production. According to Pentti Ahola, director of Outokumpu Harjavalta Metals Oy, the change in strategy was necessary because of the serious problems associated with the availability of nickel at the end of the 1990s. "We incorporated the nickel business into a separate corporation. As part of our strategy change, we also decided to outsource all supporting tasks, from security to maintenance." Therefore, the company had to find strong and specialized partners for both these areas. In the end, ABB was selected as the maintenance partner for the Harjavalta works.

**Reduced headcount and smooth transition**

Outsourcing supporting services meant that Outokumpu Harjavalta Metals was able to halve the number of employees to around 450. Only one Outokumpu employee is now working in maintenance at the Harjavalta site, with the main task of interfacing with ABB. Mr Ahola said that ABB's take-over of the maintenance function was well designed and exemplary. He added that "Outokumpu maintenance personnel were taught ABB values and service standards. Tasks and responsibilities were efficiently re-assigned, and this shows in the results. Last year was our

best ever, both operationally and in terms of production.”

**Financial success**

Maintenance costs have dropped significantly since ABB took over Outokumpu’s maintenance functions. The first year resulted in savings of 3%, and cost savings from last year amounted to 10% compared with the time before ABB. There was also a dramatic 50% decrease in the number of working hours lost due to accidents.



Utilization of the nickel smelting capacity has increased smoothly by 6% during the last four years. The operational level of the copper smelting units is also increasing.

**A pulp and paper plant in New Zealand**

In 2002, Carter Holt Harvey, a subsidiary of the pulp and paper giant International Paper Corp., concluded it would either have to significantly cut the Kinleith mill’s operations and maintenance costs, or shut the plant down. Carter Holt Harvey realized it was not possible to implement all the changes themselves. Therefore, they showed their confidence in ABB’s ability to help them by awarding the company a five-year maintenance services contract with a value of US\$ 50 million.

**Global expertise**

At most process and manufacturing plants, the maintenance team consists of local employees. Even though they have

a thorough understanding of the plant and its equipment, their experience is limited to that particular facility. On the other hand, ABB provides a business manager who can draw on ABB’s experience at all kinds of plants around the globe; from pulp and paper to pharmaceuticals. Instead of simply maintaining the equipment, the business manager seeks ways to improve the entire operation by:

- Reducing maintenance costs
- Helping the team make the equipment they have run better and produce more products with fewer rejects.

Peter Springford, Chief Executive Officer of Carter Holt Harvey, said that “Carter Holt Harvey’s relationship with ABB will play an important role in giving the mill a sustainable future. In the intensely competitive global pulp and paper market, and against the backdrop of low pulp prices and a rising New Zealand dollar, Kinleith has to change if it is to survive.”

By applying the experience it has gained at other process plants around the globe, ABB will not only reduce the Kinleith mill’s annual maintenance expenditures, but also work on improving its overall plant operations, including changing the culture.

ABB’s maintenance performance man-

agement contract at Carter Holt Harvey is a shared risk/shared reward engagement. If ABB provides financial improvement exceeding agreed performance, the company shares in the value created through a bonus. Likewise, if ABB performs below agreed improvement, it receives a reduced payment. The cost reduction and productivity improvement agreed upon is illustrated in **2**.

ABB expects to achieve US\$ 42 million in productivity improvement and cost savings for Carter Holt Harvey as a result of streamlining maintenance functions and increasing plant efficiency.

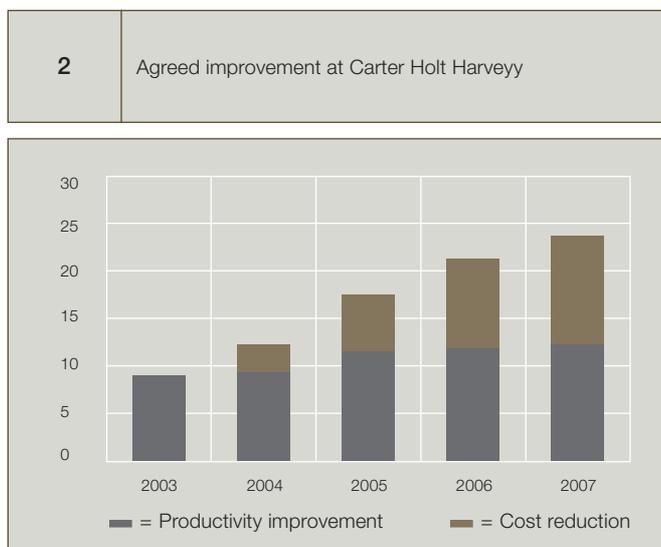
**Understanding the customer is key**

Rapid transformation of an enterprise means handing over some of the critical processes to a specialist company that can give them a competitive edge. But performance-based contracts like the ones at Outokumpu or Carter Holt Harvey are not off-the-shelf solutions. They must be tailored to fit the specific circumstances of the company.

Drawing on experience gained developing these types of solutions in a variety of industries with customers in different situations over many years, ABB was able to design a flexible but cost-efficient process from start to implementation. This process ensures that potential is addressed and risk is minimized for both parties.

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# Asset optimization solutions

Hartmut Wuttig



**Changing business paradigms are defining new rules for success in today's global markets. With Asset Optimization, ABB offers a comprehensive program for the complete lifecycle optimization of plant assets, from field devices, control systems and automation elements, through intermediate resources such as energy and manpower, to major assets of plant infrastructure. Its core feature is an innovative automation architecture with new communication capabilities and products that allow accessing of all asset-related information.**

Companies in the process and utilities industries constantly strive to optimize the lifecycle costs of their plant investments. They search for tools that reduce the maintenance effort for all plant equipment, extend the life of critical capital equipment and increase the utilization of the existing asset base, thus improving total plant availability and productivity.

There is a sense of urgency for plant managers to examine plant assets and continuously question such key aspects as:

- Efficiency
- Utilization costs and their trend
- Current operating conditions and their impact on life expectancy
- Potential for a facilitated maintenance schedule, without risking a degradation of safety and efficiency

However, faced with the ever-increasing competitiveness of today's global markets, companies need also to focus their human and financial resources on core competencies. They increasingly outsource support services,

such as information technology and automation solutions, that are not part of their specific know-how. These conflicting trends create a strategic challenge for the plant manager. How can he best focus on the unique competencies of his company, while relying on a dwindling staff to provide the comprehensive information needed to optimize his plant assets?

ABB is sensitive to these challenges and is aware of the customer's eagerness for a comprehensive solution from its au-

tomation supplier. As part of its Industrial IT program, ABB offers 'Asset Optimization'; this combines the industry's best knowledge base and most comprehensive scope of supply with innovative and new approaches to enhance plant asset productivity and profitability. The company leverages its own experience in the design and manufacturing of plant equipment, combined with its leadership in process automation and vast know-how in industry-specific applications, to lend credence to its ability to analyze, monitor and help optimize the performance of all plant assets.

ABB's Asset Optimization is a comprehensive program that focuses on complete lifecycle optimization of plant assets, from field devices, control systems and automation elements, through intermediate resources such as energy and manpower, to major assets of plant infrastructure, such as the heaters and generators of a facility.

**Automation architecture offering access to asset-related data**

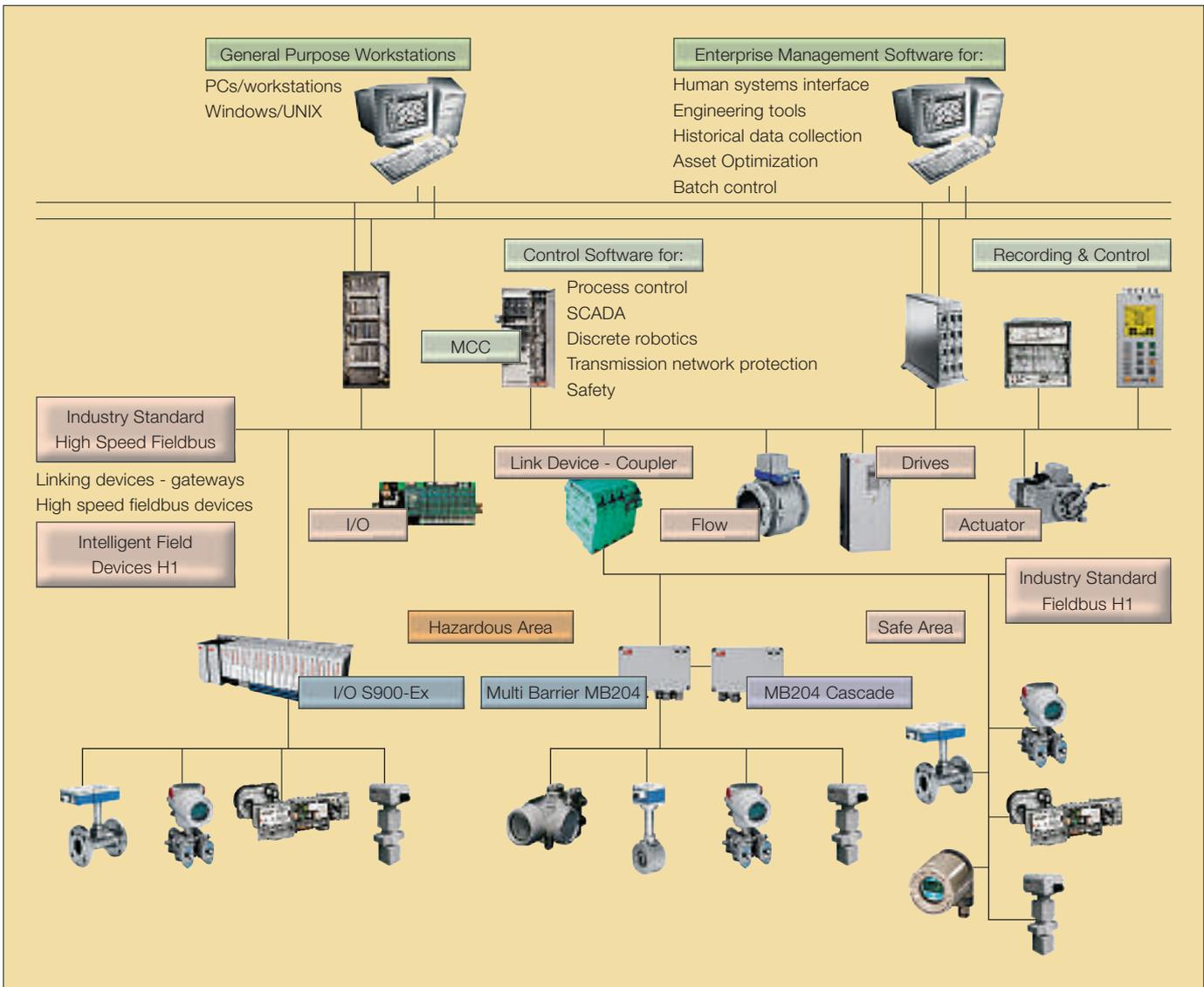
ABB has set forth an innovative automation architecture using the most advanced information technologies,

including integrated fieldbus solutions, to provide communication capabilities and products for accessing all asset-related information. ABB also offers a suite of applications, providing decision support for lifecycle asset optimization from the plant design stage through the maintenance and disposal phases.

**What is the implicit power of this architecture?**

First, it addresses a customer's need to monitor and optimize plant assets in real time. Today's business paradigm of 'Internet time' is filtering down to the

1 Automation architecture with communication capabilities and products for accessing all asset-related information



enterprise operations level. If plant managers do not fully control the incremental cost of production and the corresponding incremental revenue at any given moment, they will be at a disadvantage in the fiercely competitive, wide-open global markets to come.

Second, this architecture can easily and quickly identify differences in performance between two or more similar assets (eg, heat exchangers of similar capacity, pressure transmitters on the same process), or groups of assets (eg, production plants of similar design, all the control valves in similar plants). Detailed audit trails record the asset's maintenance history and inform about impending trouble. This early warning capability averts unscheduled plant shutdowns, and allows enterprises to maximize their plants' uptime and operate them closer to their design limits, thus maximizing Overall Equipment Effectiveness (OEE) and profit.

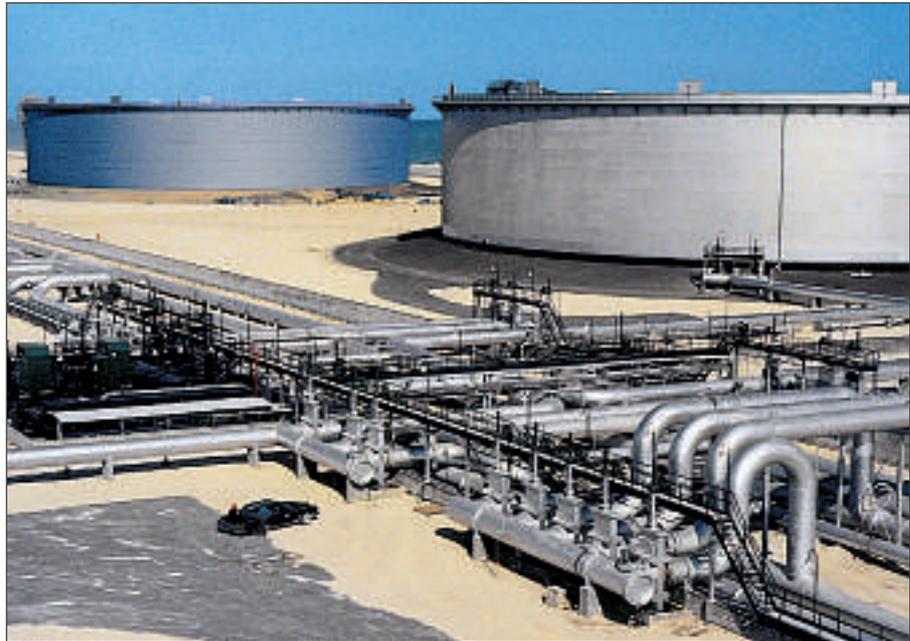
Third, this architecture provides the infrastructure needed to monitor and record asset performance, both physical and financial, over the assets' entire life span. Managers have the opportunity to utilize this information to set future performance and profitability goals. The accumulated knowledge base and decision support infrastructure greatly assists management personnel in deciding when asset disposal is warranted, as it is based on rigorous performance metrics.

Fourth, this solution is provided by the market

leader in industrial automation. ABB has the staying power, the breadth of products and the application experience that allow the end user to focus on his primary task, manufacturing competitiveness, while relying on his automation supplier to provide state-of-the-art solutions for lifecycle optimization of his plant assets.

How can a plant manager best focus on the unique competencies of his company while relying on a dwindling staff to provide the comprehensive information needed to optimize his plant assets?

2 ABB offerings in the petroleum and petrochemical industries include a Planning, Scheduling and Blending Simulator which analyzes day-to-day tankage operations and quantifies the economic risk associated with having more or less tankage inventory.



#### Multiple levels of support

At the field device level, ABB has developed, throughout its entire product range, intelligent instruments that provide inherent features for tracking instrument performance, status and maintenance history, thus allowing preventive maintenance through early detection of degrading functionality.

At the communication level, ABB supports customer 'freedom of choice' in the selection of instrumentation and associated communication

protocols that best fit their application. ABB ensures compatibility of its products (instruments, systems and engineering tools) with the emerging fieldbus standards (Profibus, Foundation Fieldbus, LON). Fieldbus is a powerful technology that enables the wealth of information available in intelligent field instrument to be accessed and then uti-

lized in innovative preventive maintenance and asset optimization schemes. However, the digital fieldbus architecture is only one option for realizing the many benefits of asset optimization; much can already be achieved with conventional 4-20 mA or HART hybrid communication.

At the automation system level, ABB is implementing a unique, state-of-the-art, object-oriented infrastructure for its automation platform, further enhancing the Industrial IT paradigm. A key feature in this respect is the ABB Object Model, an object-oriented approach to the description of plant components such as motors, valves, etc. This tool brings together information about configuration, control, topological location and functions as 'objects' and associated aspects (ie, attributes). It allows for continuous allocation of all plant data to dedicated objects, such as automation tasks, local plant structures or maintenance work schedules.

Information management is essential for understanding asset performance and designing procedures for optimizing assets over their lifecycles. ABB provides

a suite of applications that support lifecycle asset optimization with different levels of sophistication.

ABB has been a pioneer in channelling the power of the Internet to realize the benefits of enterprise communication and e-Commerce. Our Process Information Web Server was one of the first of its kind in the industry. As

part of Asset Optimization, we are using it to host asset-related documentation. Its Web

access facility is used for ordering replacement parts, and allows remote plant diagnostics and maintenance. The Loop Auditor diagnoses maintenance needs on a control loop basis, and thus is perfectly comfortable with conventional field devices, which comprise the huge majority of the worldwide installed base. It collects short-term loop characteristics, applies them to its own fuzzy logic engine, and determines impending fault scenarios and associated probabilities. A Loop Optimizer also proposes new tuning parameter values that will

improve the performance of the control loop. The Enterprise Historian provides an open, distributed, data-redundant platform for information management. This allows users to store, manipulate, display and report time-tagged process information as well as event-based transaction information, enabling tactical reporting, event analysis, performance

monitoring, and strategic studies for process improvement. ABB has integrated the Pavilion suite of software

into its Enterprise Historian. This powerful combination lets users perform data mining and analysis, which can later be applied to production improvement and unique product applications, such as non-linear model predictive control and optimization.

ABB has provided interfaces to market leading CMMS (Computer Managed Maintenance System) products, such as Maximo, IFS Maintenance Module and SAP-certified interfaces to the SAP PP-PI and PP-PM modules. These latter interfaces allow a

state-of-the-art generation of maintenance work orders that integrates real-time information from the control system, rather than blindly following a calendar-based maintenance schedule. The obvious benefits are longer uptime and reduced maintenance costs.

ABB has long championed asset performance and lifetime assessment applications and has been providing industry-

specific applications to its customers for some time. In the petroleum and petrochemical industries [2], for instance, ABB's Planning, Scheduling and Blending Simulator analyzes day-to-day tankage operations, evaluates current and future production capacity, and quantifies the economic risk associated with having more or less tankage inventory. The plant manager can quickly determine how to best manage his products inventory for optimal economic returns.

In electric power generation, ABB's OPTIMAX solutions give power plant managers a number of different possible perspectives with regard to the efficiency and expected performance of assets such as boilers or turbines [3]. They can compare similar assets within a plant and estimate their remaining life. For instance, MODI, a component of the OPTIMAX suite, monitors the state of the process, performs diagnostics and informs the operator at an early stage whether a fault is about to occur. On Target is another component that detects off-model behavior of a (conventional) field device before it fails, giving operators sufficient time to schedule preventive maintenance and avoid costly process downtime.

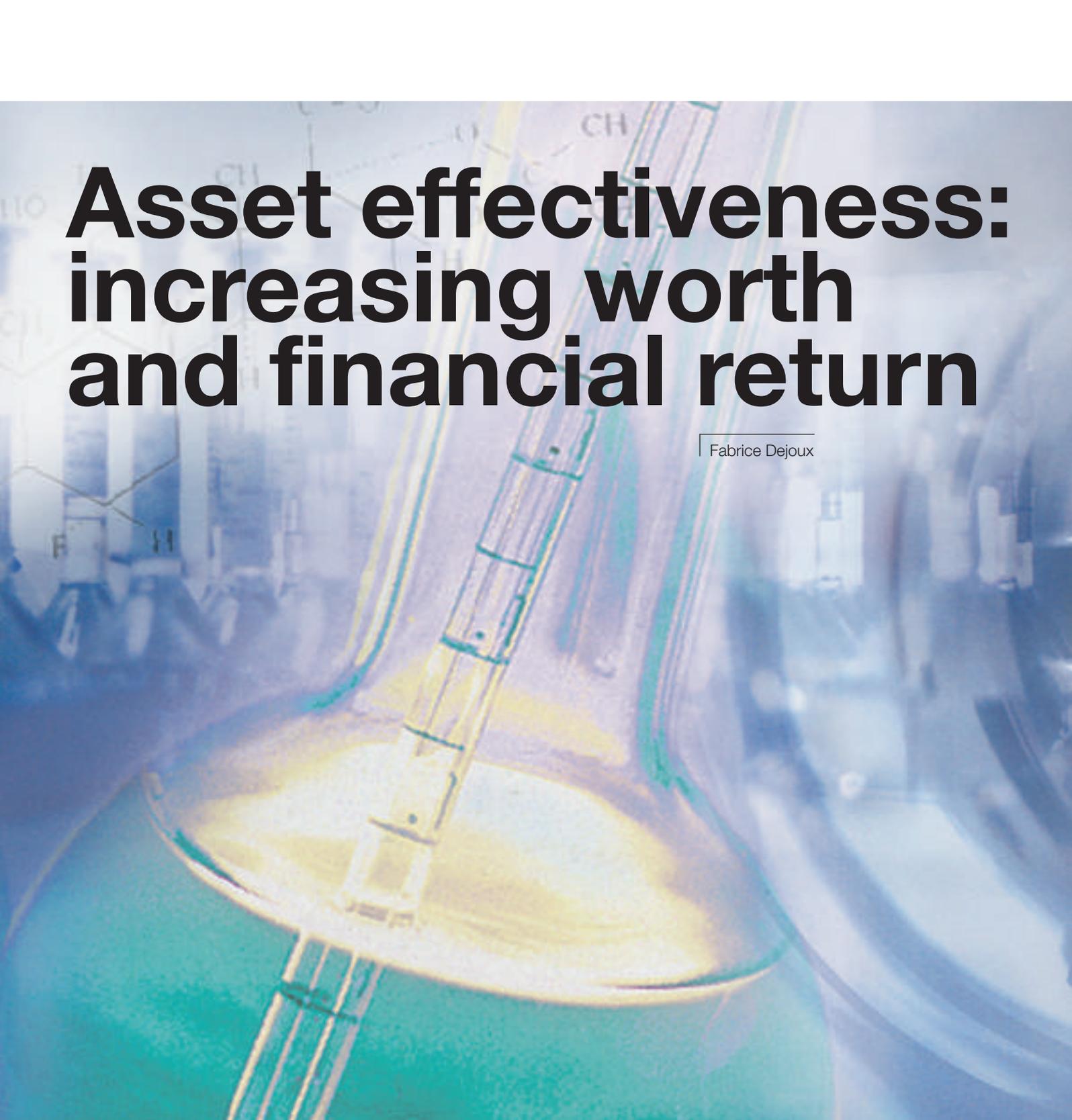
Similar Asset Optimization solutions exist for pulp & paper, cement and metallurgy applications, to name a few. Asset Optimization, along with the other structural elements of the Industrial IT paradigm, has brought a unique approach to solving automation issues. ABB is now stepping forward as the premier provider, offering plant managers the experience, resources, scope of supply, global organization and staying power that will address the concerns of the new millennium.

## ABB provides a suite of applications that support lifecycle asset optimization with different levels of sophistication.

3

Power plant managers need to be able to compare assets within a plant and estimate their remaining life. Monitoring of the state of the process enables operators to schedule preventive maintenance and avoid costly downtime.





# Asset effectiveness: increasing worth and financial return

Fabrice Dejoux

**ABB has developed a comprehensive set of solutions for process industries to optimize asset management and improve performance. As a first step in improving a company's bottom line, ABB assesses the performance gap between current performance and the relevant 'best in class.' Then, using its considerable experience in maintenance and its knowledge of industry, ABB commits itself to delivering customized solutions that support maintenance excellence, improved asset performance and overall cost reduction.**

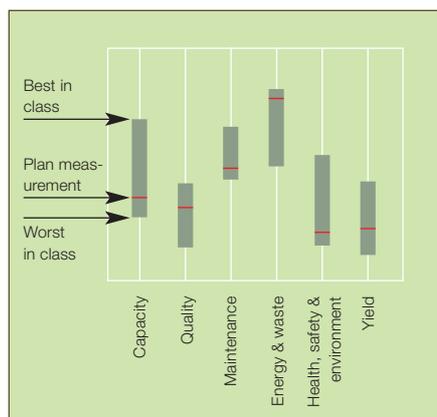
First-hand experience, technological capability and industrial knowledge have positioned ABB to help many customers in manufacturing and maintenance around the world find answers to the following questions:

- How do these customers compare to world-class performers?
- What has the greatest impact on shareholder value for that customer: asset effectiveness or reduced costs?
- How does ABB deliver actual, lasting improvements, rather than 'flavor-of-the-month' initiatives?
- How can ABB improve the reliability and safety of the customers' operations?
- Where are the hidden improvement opportunities, and how much are they worth?

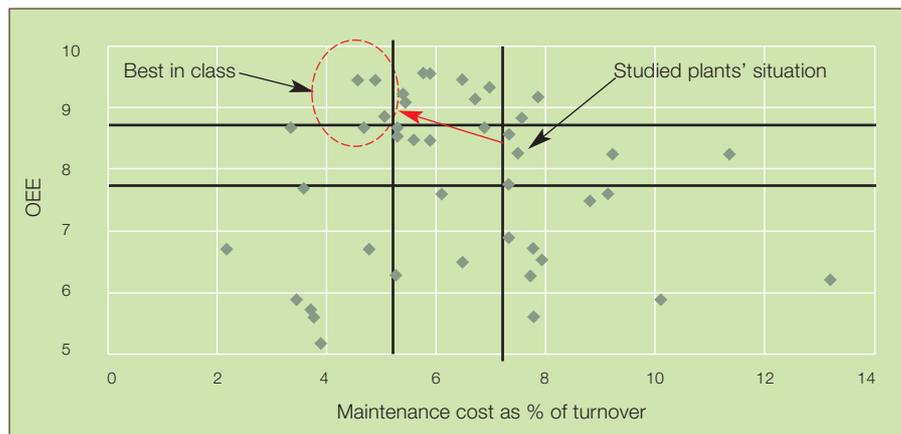
The following case studies will show that ABB has developed the tools, methods and training required to ensure continuous improvement and sustainable results in different applications.

### A US chemical company

Working with a US-based world leader in commodity and specialty chemical products, ABB assessed in detail the company's current performance and identified gaps and opportunities for improvement. The customer's manufacturing strategy was reviewed and translated into a regional asset management strategy, complete with concrete plans at local and plant levels. ABB defined



Example of the benchmarking report that helps assess financial opportunities (Based on 232 plants in the same industrial field)



Example of the earning opportunity in overall equipment effectiveness and maintenance costs for a studied plant: US\$ 12 million profit potential per year by lifting performance to 'best in class' level.

specific and sustainable measures, including management processes and technical solutions, in order to achieve maintenance excellence and reduced manufacturing costs. These measures were defined by addressing quality, production waste, energy management and yield.

The new strategy was implemented through a performance-based, long-term partnership agreement which resulted in an 8% improvement in asset effectiveness, reduced manufacturing costs and improved earnings.

Building on this performance partnership, a joint research and development program is now working on the next generation of production assets. These assets will deliver a competitive advantage to the customer, based on a shared understanding of key performance drivers and of their process and business issues. By combining world-class maintenance practices with sound industrial and process expertise, ABB has been able to deliver improved performance and reduced costs.

### Typical results

Most companies experience a reduction in maintenance costs of up to 20% in the first few years. On a more impressive note, these savings are often even surpassed by improvements in asset effectiveness equal to as much as 10 times the maintenance cost savings!

This outcome is a direct result of ABB's process expertise, especially in highly specialized fields such as:

- Process optimization
- Energy management
- Hazardous area management
- Risk-based inspection
- Engineering design services

So how does ABB approach its goal of helping a company improve its bottom line? In a typical situation, the company starts by reviewing the opportunity through a benchmarking process. This

provides a reliable view of the value of performance as well as practical improvement opportunities.

Most companies experience a reduction in maintenance costs of up to 20% in the first few years, with even higher improvements in asset effectiveness

opportunities, while at the same time establishing a firm platform for planning sustainable improvement. The basis for this improvement is ABB's methodol-

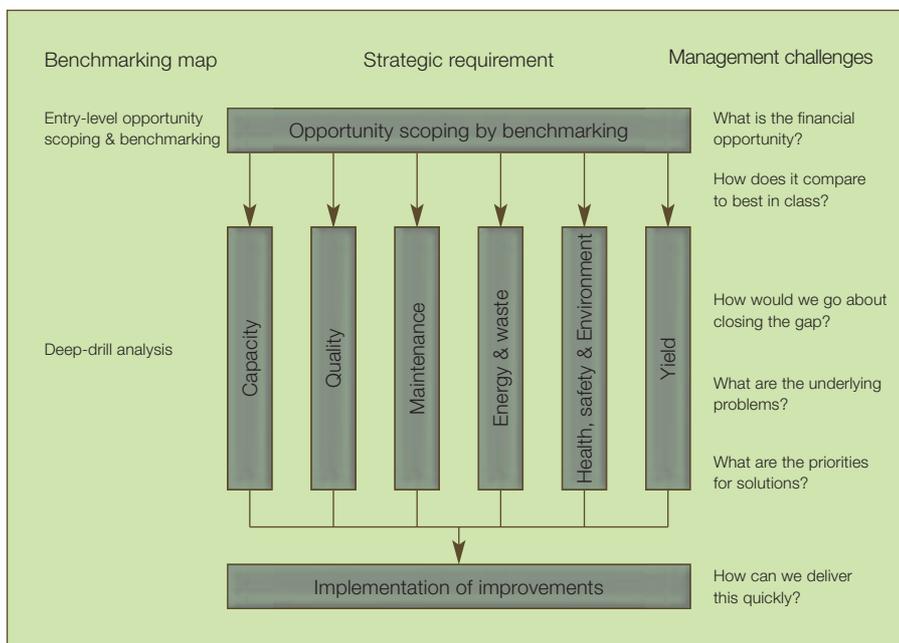
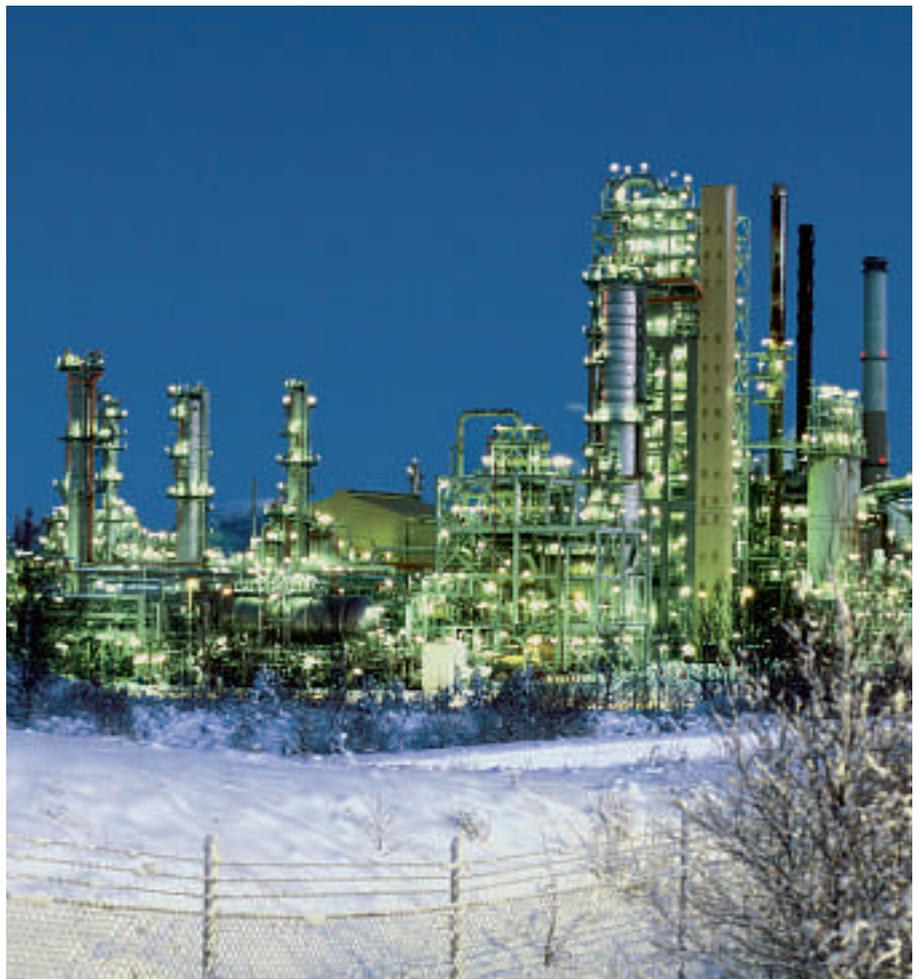
ogy, knowledge of industry and extensive customer database. In most cases, the opportunities for performance improvements exceed the potential cost savings.

**An oil company in Europe**

ABB is working with a major American oil company to manage the performance of several thousand of its fuel stations across 18 countries in Europe. ABB's strategy ensures optimum, standardized results across Europe, signifi-

One customer's benefits included a dramatic reduction in non-core activities such as administrative work and accounting.

cantly reducing costs while achieving a very high safety performance. Moreover, the strategy is designed to develop the service over the entire asset lifecycle with innovative solutions for improving reliability from the design stage, for re-



ducing energy needs, and for providing web-based user access.

Other benefits achieved with this customer include a dramatic reduction in non-core activities such as administrative work and accounting. Now the customer receives a few invoices per month instead of a few thousand. The project demonstrates the value ABB can add to the management of large numbers of remote sites.

Process followed by ABB to assess opportunities and deliver improvements

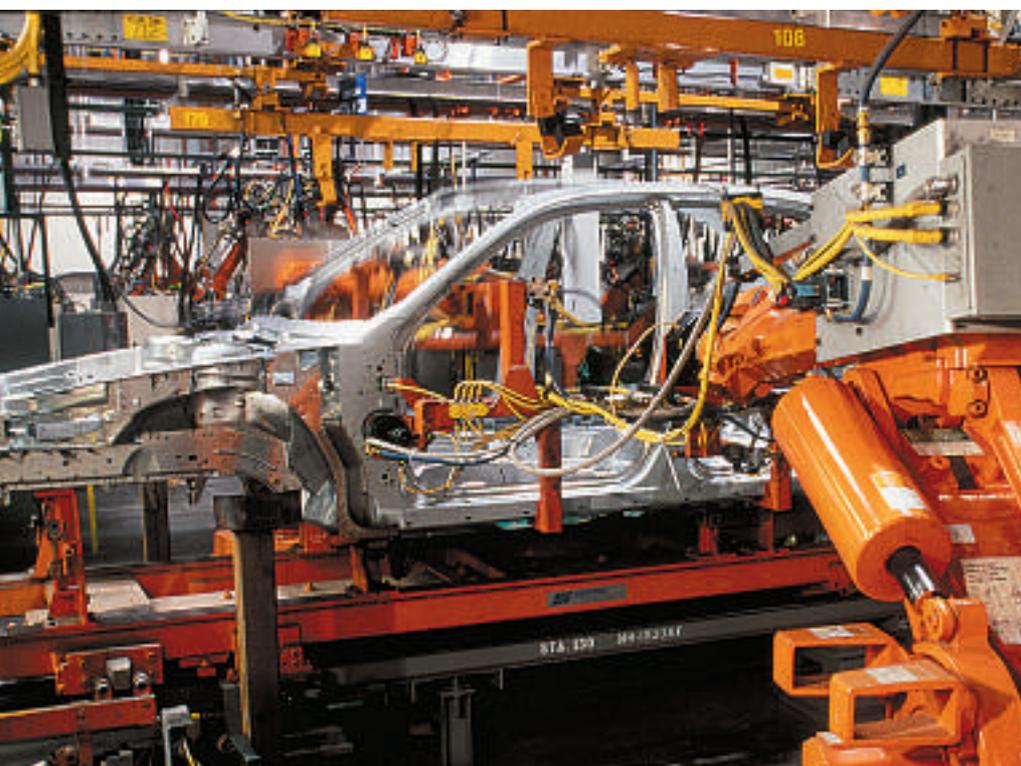
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‘Emerging technologies’ is a term probably heard most often in the world of research and development, and is usually associated with new products. In general, such a term does not tend to appear in the same sentence with ‘after sales service and support.’

Yet for companies like ABB with a huge client installed base, advances in technology are changing the way firms approach the subject of support. In addition, these same advances are directly helping clients improve their return on assets.

# Remote services: High tech means high service performance

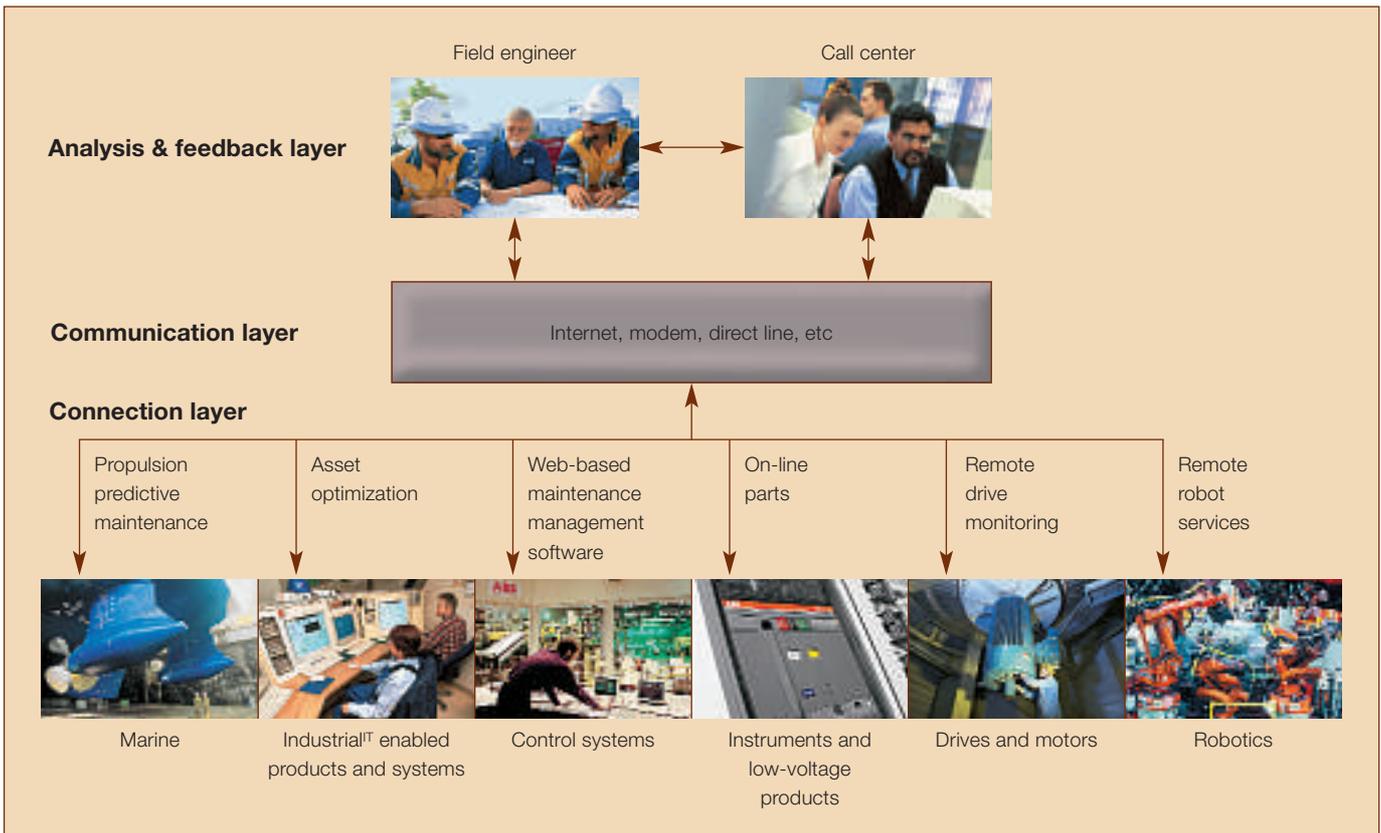
Gordon Cheever



With an installed base of more than US\$ 100 billion of automation products and systems worldwide, ABB is constantly working on ways to improve how these systems are supported. Remote services use existing and cutting-edge technologies to support field engineers, irrespective of location, in ways only dreamed of five years ago. The Internet, together with advances in communications and encryption techniques, have contributed enormously to this.

Remote service developments are a direct result of clients’ changing needs. ABB has been told clearly in almost every industry it serves that it must continue to improve the return on assets of the systems it delivers. This does not mean customers want less support, but rather more support at lower costs.

Remote services are designed to maximize knowledge bases in the most cost-



Remote services use existing and cutting-edge technologies to support on-site and field engineers, thereby ensuring the best knowledge is in the right place, at the right time to support the clients' assets.

effective manner. The result should ensure that the best knowledge is in the right place, at the right time, to support the clients' assets. With a large number of different types of products, this can be a complex undertaking.

The following examples illustrate how remote services in use today are giving customers more value at less cost:

### Remote robot support

When an issue arises concerning an installed robot, the on-site plant engineer calls ABB's global robotic expert center. The plant engineer then creates a direct link between the center and the installed equipment, but only after ensuring all local safety requirements are in place. Off-site experts review the equipment, diagnose the problem and either take direct action or provide instructions to the site engineer, who can then solve the problem.

The robot can also diagnose the problem itself, and then call the ABB global robotic expert center for support. However, this raises safety concerns at the site. A balanced compromise is reached with a combination of automatic and manual processes.

### Remote Asset Optimizer

The Asset Optimizer, from ABB's IndustrialIT product portfolio, takes remote services a step further. The asset monitoring software acquires and analyzes asset status and condition information. It then notifies operators and maintenance personnel when an abnormal condition has occurred that requires some form of main-

tenance action. External communications may also be set up to automatically call, email or page service personnel.

In addition, the Asset Optimizer can be directly linked to most computerized maintenance management software systems for automatic work order generation.

### North American automotive manufacturer

A large North American automobile manufacturer is currently using ABB's Asset Optimizer. Asset information is provided locally for operating personnel, as well as remotely to the offices of the plant manager and plant engineer. In addition, it is directly linked to an on-site computerized

Advances in technology are changing the way firms approach the support of installed equipment, as well as helping clients improve their return on assets.

maintenance management software system.

The client has chosen to use overall equipment effectiveness calculations to establish current and future benchmarking standards. As issues arise on-line, the Asset Optimizer can generate automatic emails or pager notifications to service personnel for further actions.

### Remote condition monitoring

ABB holds the view that technology for technology's sake is not always the best solution. When it comes to vibration analysis in condition monitoring, for example, the company balances its services to provide a cost-effective, tiered approach. This means that an appropriate technical solution is determined based on the consequences of the asset failing and/or its cost.

Take the case of a simple low-cost motor in a non-critical application that is best supported when data is gathered manually. Vibration data is collected using small handheld devices. This data is then loaded onto a PC where a software program 'decides' whether the vibration data is within specification. If not, the system will then automatically upload the data to global ABB condition monitoring experts where another more in-depth software program screens it for recommendations. It then passes the final data and pre-analysis to dedicated vibration experts. A final review is done, and recommendations or work orders are sent back to the local site. In general, the level of automation for this process is based on asset costs versus human intervention costs at the client's site.

The systems for high-cost critical assets automatically and continuously monitor vibration data and provide specific analysis and work intervention 24 hours a day.



### Remote knowledge

Ensuring good asset performance does not always necessitate physical presence. In most cases, it is enough when the appropriate knowledge is available at the asset location.

ABB's global online knowledge management system and the newly released Industrial IT Knowledge Navigator ensure that the appropriate knowledge can be accessed remotely anywhere in the world. This global infrastructure contains over 60,000 documents as well as new cases that 'learn' as the system is used. The structure also contains audio-visual instruction sets that allow users to refresh their knowledge.

### A US paper company

A paper company in Ohio recently installed ABB's Support<sup>IT</sup> Knowledge Navigator. The Knowledge Navigator allows the operator to directly connect

to ABB's global online knowledge management system from the operator panels. By using the Knowledge Navigator, the operator can try to resolve automation issues without having to wait for maintenance support.

Knowledge Navigator reacts to system-generated alarms. In the event that an alarm occurs, the system will automatically search ABB's knowledge management system for possible solutions. The operator reviews the resulting solutions and decides if action can be taken, or if the issue should be passed on to the maintenance group.

The use of remote support allows customers to benefit from the vast knowledge reservoir existing within service support organizations. ABB is using technology to improve our most important asset, our people, and to make this asset available to support customers where needed.

ABB must continue to improve the return on assets of the systems it delivers. This doesn't mean customers want less support, but rather more support at lower cost.

**Gordon Cheever**  
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# Web-based data collection and analysis

Alan Friedman

**In today's business climate, service centers are being asked to monitor more machines over greater distances, and do it more efficiently. New technology available within ABB is helping to get more efficiency out of the company's global vibration analysis services by standardizing vibration equipment and methodology, automating analysis functions and facilitating the transfer of raw data to and from clients in remote locations.**

**This technology comes in the form of web-based systems with automated diagnostics, online systems and integrated portable data collectors. Together, these features make it easier for ABB service centers to test more machines and get more important information into the hands of those who need it.**

ABB's experience and innovation has been incorporated into a number of well-proven products and services specifically designed to meet the demands of service centers worldwide. As part of this portfolio, the company has integrated individual technologies to provide a highly automated, efficient and successful service program for its customers. The success of this program can be seen in the work ABB is doing with a global original equipment manufacturer (OEM) in the heating, ventilation and air conditioning (HVAC) industry. ABB is helping this OEM provide a complete condition-monitoring program to its clients.

The OEM has pursued condition monitoring as a way of distinguishing itself

from the competition by offering clients additional service options that augment their warranty agreements. With such agreements, clients can receive discounts on warranty packages if they agree to use the OEM's condition monitoring service as part of their maintenance practice.

By having service personnel visit clients more often, the OEM has found that they can generate more service and sales opportunities. In addition to providing the benefits of vibration analysis and condition monitoring to the client, the OEM has realized previously untapped sales and service opportunities by simply having a reason to send a service person to a client site. In fact, the OEM has recorded an increase of

\$1.25 - \$1.50 of additional revenue for every \$1 of warranty service sold.

ABB currently supports some 65 service centers in the US and 4 in Canada. Several more are located in China and on the Pacific Rim, and the number continues to grow. To initiate a condition-monitoring process, for example in the US, ABB mails a pre-loaded data collector to a service center. Service personnel then visit their clients, collect data and mail the collector back, where it is unloaded. The data is analyzed at ABB and a report is e-mailed (or surface mailed) directly to the service manager, who then presents it to the equipment owner. The report is branded with the OEM's name and logo, and is presented to the client as part of the OEM service offering.

As the program evolves, more and more service centers, especially those outside the US, are purchasing their own data collectors and are transferring data back to ABB for analysis. Additionally, the OEM is beginning to test new equipment as it rolls off the assembly line to establish baselines, and is including sensor mounts and barcode identification tags directly on the equipment. The OEM currently produces about 1,500 new machines per year. This process makes future condition analysis more accurate and cost-effective. The machines can be traced, via serial number identification, throughout their entire useful lifetime.

The OEM's technical center retains a synchronized database of all machine tests and ABB analysis results. This allows them to support the service centers directly when questions arise and provides the information necessary to understand how their machinery degrades over time. Ultimately, this information allows the OEM to improve its machinery design and remain a leader in a competitive market.

The OEM has been pleased with ABB's support and has realized numerous benefits by allowing the company to standardize and streamline the OEM's vibration analysis offering to its clients. The sections that follow will discuss the technologies and methodologies that make ABB's vibration services uniquely efficient.

### Automated diagnostics – turning data into information

The ability to quickly analyze large amounts of data and accurately identify machines with problems is a key element for efficient vibration services. In a typical plant, about 10 – 20% of all machines tested will have inherent mechanical faults. Within this group, far fewer will require immediate service.

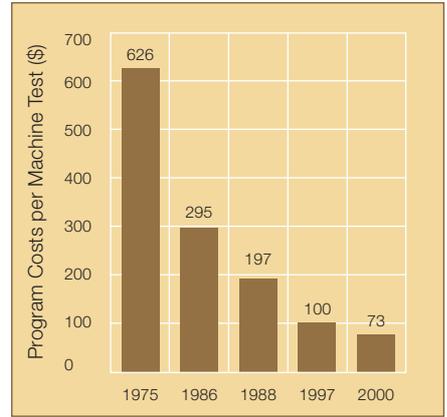
The distinguishing feature of ABB's rule-based, automated diagnostic system is that it identifies problem machines and focuses on manually reviewing the data from these machines. This approach is far more efficient than analyzing data from every single installed machine.

The efficiency of this system is unrivaled, and its accuracy, ease of configuration and ability to reduce analysis time and costs are well documented. Customers who use this automated approach typically receive a 20:1 benefit-to-cost ratio. An independent study carried out for the US Navy found that users receive objective results that are as accurate as analyses performed by engineers or vibration specialists with 2 to 4 years experience [1].

The diagnostic system contains over 4,500 individual fault templates. These templates are based on empirical data acquired from hundreds of thousands of machine tests conducted over more than twenty years. They can be applied to more than forty general machine component types, including motors, pumps, fans, blowers, gearboxes, compressors, generators, turbines and machine tools.

The system analyzes machine test data in a matter of seconds and produces a concise report that lists specific mechanical faults, the severity of each fault and an overall recommendation [2]. Compared with systems that simply indicate that a machine is in 'alarm' mode, this very informative diagnosis illustrates how ABB turns data into information. The efficiency of the diagnostic system is such that, with minimal manpower, it allows ABB to process over 3,000 ma-

**1** Cost reductions realized by the US Navy since 1975, when vibration services were first implemented

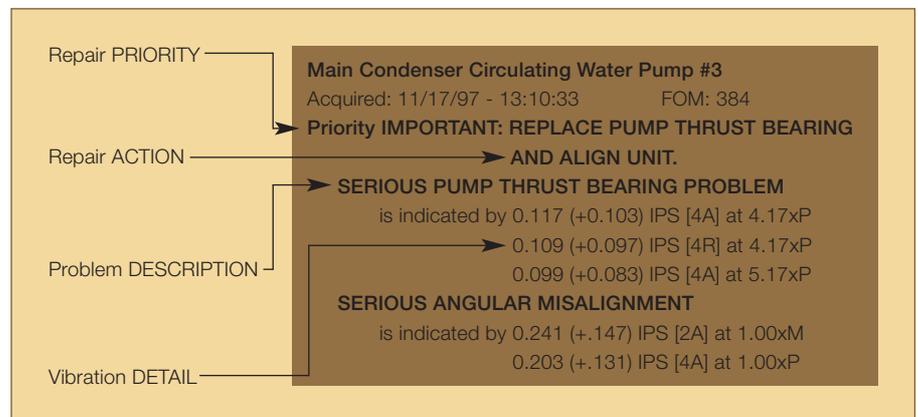


chine tests per month worldwide, thus providing concise and accurate machine condition reports.

### ABB Watchman®: Full-time online monitoring

Another solution uses online monitoring of permanently installed data acquisition components to determine a machine's condition. ABB Watchman® from ABB's IndustrialIT solutions portfolio is an accurate, cost-efficient analysis service provided to remote clients [3]. This service reduces the labor burden associated with portable vibration programs, and monitors the machines with greater frequency and effectiveness.

**2** Typical automated diagnostic system report



Users are alerted to machine degradation that takes place over time. Diagnostics are provided in the form of concise reports describing specific faults, the severity of each and recommendations for remediation.

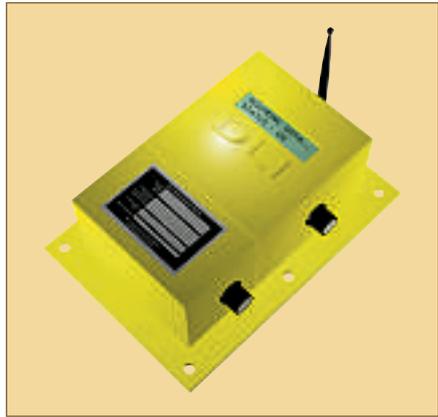
ABB Watchman® Sprite runs on a Windows® embedded XP platform, and because of this it can be easily adapted to take advantage of evolving computer technology to enhance its capabilities. In addition, the system is easily customized for different applications and is equipped to accommodate wireless network and cellular communications capabilities.

It is based on 4-channel data acquisition hardware that can be multiplexed in increments of 16 channels, providing a capacity of up to 512 channels. Even though up to 512 channels can be monitored from each unit, the design philosophy of the system makes it advantageous to locate individual units on or near the machines of interest and network them via IEEE 802.11 Standard networks (WIFI). This capability significantly reduces cabling costs and allows the system to be easily expanded.

By offering ABB Watchman® Sprite as an upgrade to the equipment they sell, OEMs, such as the HVAC manufacturer described earlier, can effectively increase overall profit potential. Furthermore, ABB Watchman® Sprite allows OEMs to offer the advantage of increased reliability because ABB Watchman®-equipped machinery communicates directly with service centers and with ABB when problems are encountered. So, rather than test machines only when service technicians can visit customer sites, they are tested every few minutes. This is a major benefit to clients who use equipment in critical applications.

It is important to note that ABB Watchman® Sprite is not a protection system, nor a simple alarm system, and is not designed to shut down a machine in the event of an alarm. It can, however, be used with protection systems if this functionality is required.

**3** ABB Watchman® for online monitoring of permanently installed data acquisition components



**4** ABB Watchman® DCX portable data collector/analyzer



**Database replication – sharing data efficiently**

Database replication allows two or more databases to be synchronized automatically via the Internet or other computer networks. This means that data collected at remote sites using portable or online systems can be transferred automatically to central sites for analysis and review. Additionally, database changes made at a central office can be implemented transparently at all desired remote sites. These changes include updates to test configurations, alarm criteria or edited fault diagnosis

reports. Ultimately, database replication simplifies the task of remote information management.

The database replication network is set up like a secure, encrypted mailbox located on an FTP web server. Databases periodically check to see if changes have been made to other databases, and then automatically synchronize and update themselves as required. They can be configured to automatically check in as often as is deemed necessary, and they generate detailed messages when changes have been made. Database



replication is achieved via the transfer of small files and requires minimal bandwidth.

The practical benefits of this technology are that it allows multiple sites to work independently of each other and then synchronize their information. It also allows the secure movement of data between remote sites in the presence of firewalls. Using database replication, an ABB Watchman® system installed in a copper mine in Chile can be monitored, updated and managed from an office in New York.

### Web Connect – distributing results

ABB's Web Connect service provides the most efficient and cost-effective means of getting important data to the people who need it. Users can access automated diagnostic reports, review diagnostic reports, machine history, trends and raw vibration data directly through a standard Internet browser. Web Connect employs the above-mentioned replication technology to allow remote sites to synchronize with a database on a central web server. The active server database is visible on the web, thereby allowing any number of authorized indi-



viduals to access information of interest without having to purchase proprietary software.

Via Web Connect, the office in New York can make information from the ABB Watchman® system in Chile available to the mine's owners in Canada, as well as to local service providers in Chile. Additionally, if the New York office is given the task of reviewing vibration results, these edited reports can be accessed via the Internet.

### Portable data collectors

In many cases, companies monitor critical plant assets online, yet ignore their important auxiliary equipment in this respect. For optimum performance, auxiliary equipment should be monitored with portable data collectors. Lightweight and easy-to-use walk-around data collection systems are ideally suited to this application. Such systems can be pre-loaded with routes for on-going monitoring programs, or may use embedded software that allows service per-

sonnel to define tests and troubleshoot machines in the field. The data collectors mentioned below use the same software and database as the ABB Watchman® system, thereby allowing online and walk-around data to be integrated into a single program.

The ABB Watchman® DCA-31 is a robust, lightweight data collector that is perfect for collecting route data 4. Once stored, the data can be downloaded and analyzed at any time using a host PC.

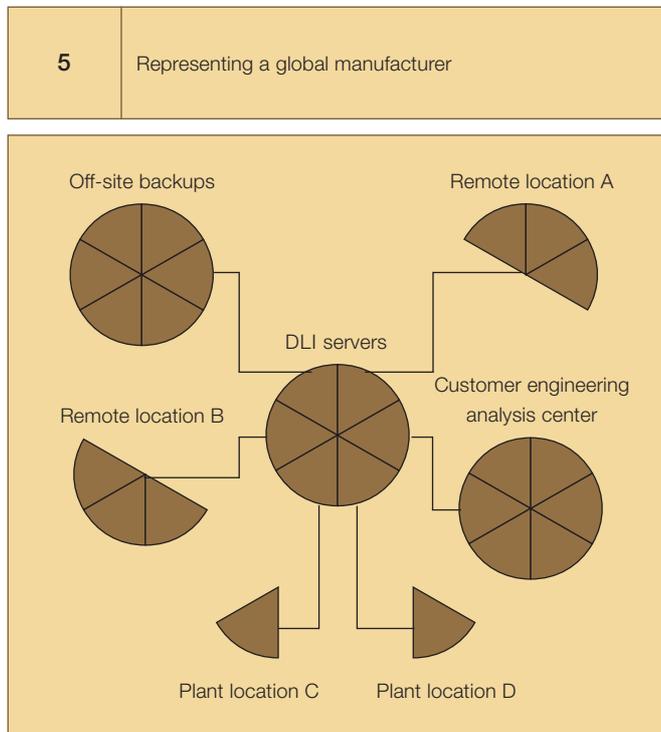
The ABB Watchman® DCX data collector/analyzer is an all-in-one tablet computer, vibration data collector and machine analyzer 4. It is based on the same 4-channel data collection PC card found in the ABB Watchman® Sprite, and an industrial mobile computer. This unique design means that all of the 'host' software can be downloaded to the data collector, allowing the user to run the automated diagnostic system while standing next to the machine of interest and to conduct further tests if necessary. In addition, the design allows users to benefit from the commercial PC market and is platform-independent, thereby making upgrades inexpensive and easy.

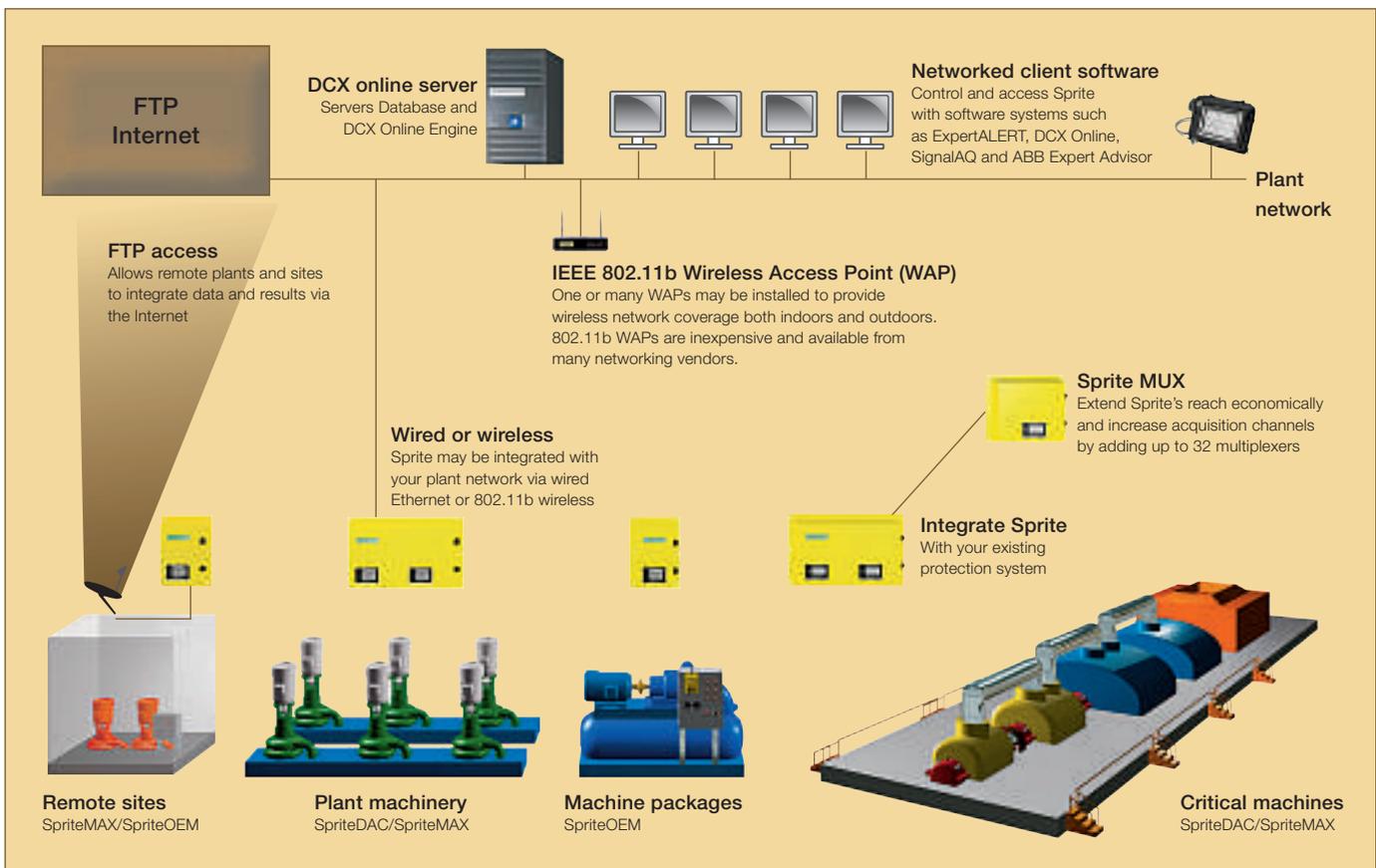
The DCX is especially popular among service organizations because the user has all of the tools necessary to perform on-site data collection, analysis, troubleshooting and balancing. Furthermore, the user can write reports, connect to the Internet and e-mail the reports or replicate data to a central site for further analysis. The advantage of having a Windows® XP-based computer and a data collector in the same product is that it can be used for virtually any application.

### Putting it all together

The following example illustrates how ABB has implemented an efficient and successful machinery condition analysis service program for a global manufacturer using the technologies described above.

The manufacturer's service headquarters is located in the United States (the customer engineering analysis center in 5).





The company also maintains one regional service center (remote location) in the US and one in Europe. The main office requires online access to machine condition information so that it can better manage global operations, help acquire parts and plan work packages. The regional service centers are only responsible for facilities in their respective regions (plant location).

In the current implementation , ABB is responsible for configuring and maintaining the databases for each site. This includes analysis, baseline criteria set-up and the entry of edited reports and recommendations into the database. The company also maintains the master database that includes information from all of the manufacturer's facilities. This is particularly useful because, as many of the sites have the same equipment, vibration

signatures can be compared between like units at different sites. The master database replicates with the client's, giving the service headquarters access to information about each site, and also with the two regional offices. Finally, each individual facility has a copy of its own replicating database containing only information specific to that site.

The master database at ABB is available on the Internet via ABB's Web Connect service, and can only be accessed via a web browser by authorized personnel. The active web pages, which are customized and branded with the client's logo, contain complete machine history, notes, comments, recommendations, trends and raw data.

Currently the client is employing walk-around data collectors at each facility,

but it is possible at any time now or in the future to add ABB Watchman® on-line systems to automate the data collection process. As ABB Watchman® Sprite is based on the same software architecture as the portable systems, integrating it is a simple 'plug and play' process.

**Alan Friedman**  
ABB Automation Technologies

# Closing the manufacturing productivity gap through service solutions

Jo Pauwels



**The potential for improvement in many companies is substantial. A typical company today operates at 60% overall equipment effectiveness when it should be targeting 85%. One reason for this is that companies lack the means to measure productivity with the required accuracy. Some companies don't measure it at all, while others measure it manually, providing results that are neither in real time nor accurate. Other reasons include poor or non-existent preventive or predictive maintenance, an insufficient stock of spare parts on site, a lack of trained personnel and inadequate production processes.**

**In response to the need for improved asset effectiveness, especially in the automotive industry, ABB has created value-based productivity solutions to specifically remove sources of waste from customers' production systems. The end result ensures more added value and improved productivity.**

**I**ntense competition in the automotive industry is forcing original equipment manufacturers (OEMs) and tier one suppliers to think about ways of getting more from their existing equipment, and avoid having to invest in new systems. If the existing production plant can be made more productive and last longer, further substantial investment can be avoided. This means that maintenance and process improvement take on greater importance. ABB is responding to this need by moving from service products to service solutions.

## **From service products to service solutions**

One of ABB's great strengths is that the

company has in-depth expertise in manufacturing processes, and for more than 10 years, it has operated a service business for discrete manufacturing industries. This provides service 'products' such as spare parts, training, technical support and field service. ABB has also provided maintenance performance management aimed at taking full responsibility for the management, engineering and execution of maintenance for a customer. With the creation of value-based productivity solutions, ABB makes use of the already proven service products in its portfolio.

Value-based productivity solutions start with a detailed customer assessment by

ABB specialists according to a well-defined methodology. The specialists who perform the assessments and design the solutions are the same ones who design, manufacture and install the equipment, so they know the processes in an assembly plant and can offer excellent process improvement solutions. The end result is a customized solution.

## **Value-based productivity solutions for a major automobile manufacturer**

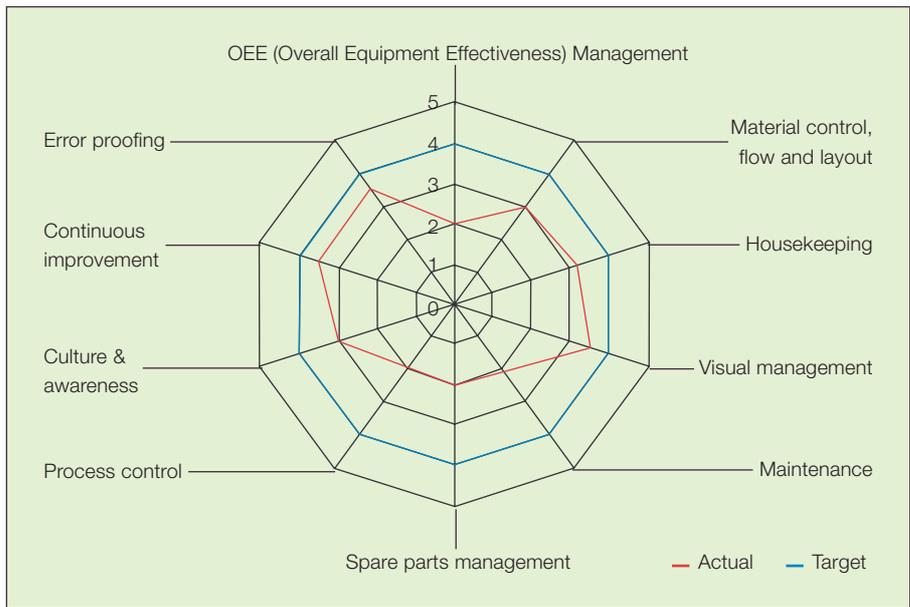
A major automobile manufacturer in North America recently worked with ABB to improve overall equipment effectiveness at its axle plant. Together with the customer, ABB engineers conducted a productivity assessment and

created a 'current-state' model using ABB methodology and simulation software. The assessment identified items that could be immediately implemented to quickly add value. Long-term productivity improvement projects were also identified and tested using the simulation model to accurately gage project return on investment.

Within four months of the assessment, productivity in one line increased from 90 jobs/hour to 120 jobs/hour, saving the plant more than US\$ 2 million in annual overtime premiums. Nine months after the assessment was completed, the production line averaged more than 140 jobs/hour.

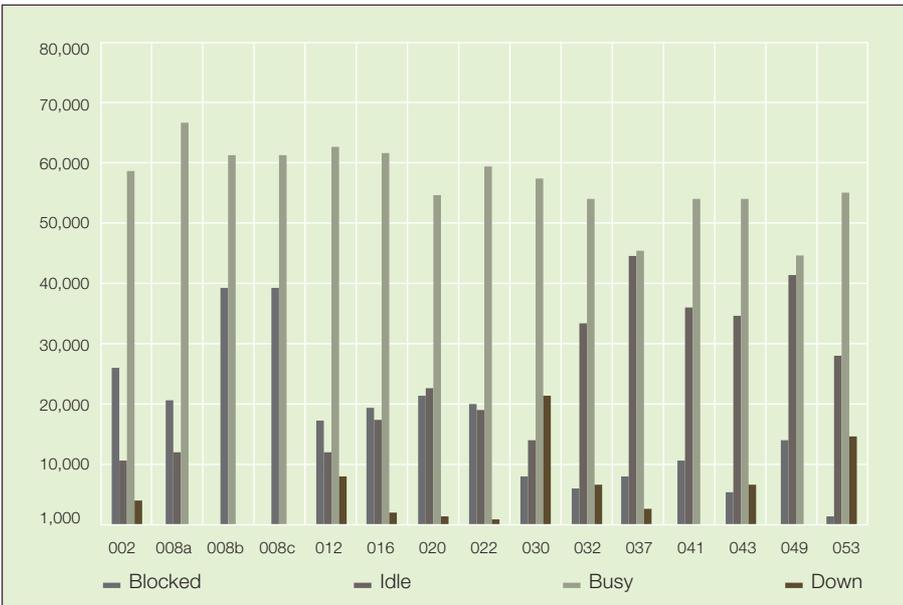
Recently completed long-term improvement projects now have the line tending towards 160 jobs/hour, and overall equipment effectiveness has improved from 45% to 78%. Such a significant gain in productivity has allowed the plant to decommission an older line, making room for more product lines.

Qualitative improvement potential



During the productivity assessment process, the qualitative findings are used to focus on areas with the most potential for improvement. Production losses resulting from ineffective manufacturing processes are then quantified in the second phase of the assessment.

Quantitative improvement potential



Output from the quantitative assessment depicting the percentage of time each operation on the line is blocked, starved, running, or in a breakdown. ABB uses a variety of data collection techniques during the productivity assessment to identify production constraints and losses.

This example represents a solid model for improvement in other departments.

**Closing the gap**

Value-based productivity solutions are already attracting considerable interest, particularly from tier one suppliers. Because they are smaller and newer than big OEMs, tier one suppliers do not possess the same level of maintenance staff, and therefore require greater support from their partners. This is exactly what ABB and its service specialists provide. Closing the gap between actual and potential overall equipment effectiveness is what value-based productivity solutions is all about.

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When companies invest in plant equipment, they want to feel assured that these newly acquired assets will be productive for many years. Naturally, the probability of component or system failure occurring increases after several years in operation, and the consequences of this vary depending on the type of failure. Whatever the outcome, managers inevitably ask themselves if such events could have been prevented, and can be prevented from happening in the future.

Maximum asset utilization is best served by providing preventive maintenance for products and systems at a certain point in their lifecycle. To this end, ABB has created lifecycle management programs that ensure customers get the best possible return on their assets, and benefit from a smooth transition to new generations of products.

# Lifecycle management for improved product and system availability

Kai Ola

Without proper servicing, the probability of mechanical components in rotating machines failing after a certain time is high. Therefore it is accepted practice to perform preventive maintenance on rotating machinery to significantly reduce the risk of this happening. Unfortunately, the same cannot be said for products with electronic components. There is still a commonly held belief that these prod-

ucts do not require specific maintenance.

Based on ABB's experience, however, the probability of failure of products with electronic components increases after several years in operation. In many cases, the main reason for this is aging electronic components, and these can have serious consequences. This is why ABB recommends preventive mainte-

nance for products and systems at a certain point in their lifecycle.

ABB's lifecycle management programs for its products and systems exist to provide customers with the best possible return on their assets. A comprehensive set of standardized service packages, such as preventive maintenance, have been productized and accommodated to different lifecycle phases of

various products and systems, to maximize availability and performance.

The following examples illustrate how two companies have benefited from ABB's lifecycle management programs. As a side note, assets in the examples have been in continuous operation for more than 10 years.

### A steel rolling mill in Finland

In 1986, a hot steel rolling mill in Finland installed an ABB drive system on the furnace and transport rolls. Preventive maintenance of the system was performed annually by the mill operators. In 1998, the failure rate started to increase, causing production losses.

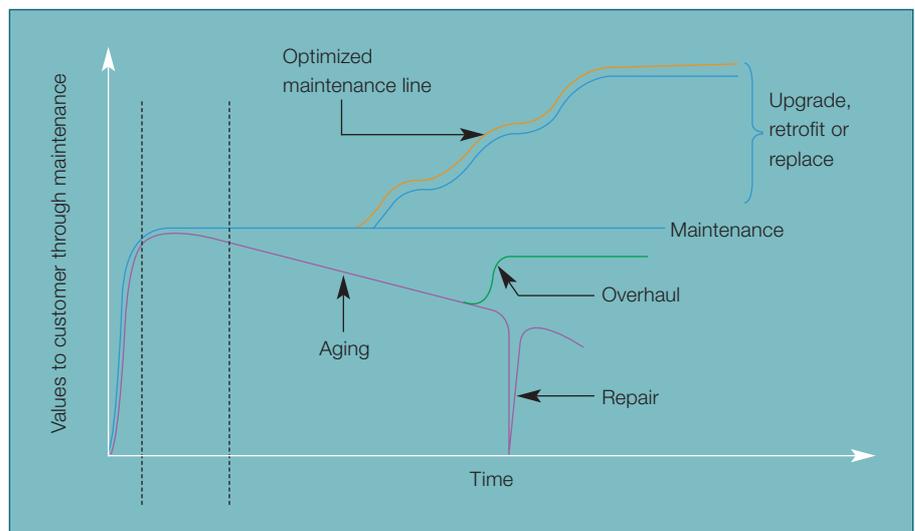
Because the customer wanted to ensure trouble-free operation of the drives for the next 10 years, ABB was asked to investigate the condition of the drive system at the beginning of 1999. As a result of this investigation, preventive maintenance and upgrades were carried out in August of that year. The system was disassembled and cleaned carefully and much of the electronics was replaced. In addition, the drives system software was updated.

The reliability of the drive system increased dramatically. Repair costs have dropped significantly, and only one electronic failure has taken place since August 1999.

### A paper mill in the USA

A paper mill in Kentucky had been experiencing increased downtime because

## 2 Lifecycle of a plant



of its drives, which had been installed on a paper machine and winder in 1991. To achieve better availability, ABB recommended that a preventive maintenance program be introduced.

After 10 years of continuous operation, the mill decided to update some of the drives through ABB's preventive maintenance program. Preventive maintenance kits were supplied to maintenance engineers working at the mill, and during a scheduled shutdown in October 2001 these engineers updated the drives under ABB's supervision. This operation dramatically improved the availability of the drive systems.

The graph in 1 shows paper machine downtime due to drive failure in the paper mill from the beginning of 1999 until the middle of 2002. After the October 2001 shutdown, the downtime figures for 2002 show a significant reduction compared with the previous three years.

With each hour of downtime costing slightly more than US\$ 10,000, the return on investment of the mill's preven-

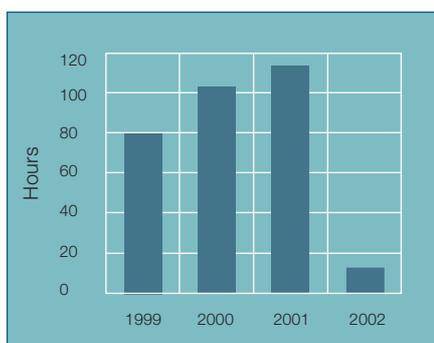
tive maintenance project has been very high: as of July 2002, approximately 0.5 hours of downtime was attributed to the drives which had not yet been updated, and 0 hours on the updated ones.

A similar preventive maintenance project for the drives not updated during the shutdown was carried out in 2003.

ABB is able to provide productized services to extend the life of its clients' assets because

the company understands the characteristics of its products over the entire lifecycle 2. Thanks to the preventive maintenance projects described above, the clients expect to utilize their assets for at least another 10 years. ABB's product lifecycle services are built for optimized asset reliability and efficiency.

## 1 Drive downtime (US paper mill)



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Tony Musgrave

# Winning the battle with downtime



**In continuous manufacturing 90 percent of all potential failures are likely to be caused by just 10 per cent of the installed equipment. When planning preventive maintenance, it therefore makes good business sense to focus on this high-risk group. Risk Based Inspection (RBI) lets you do exactly that. Recent experience has shown that ABB customers can benefit from a dramatic saving in time and cost by using this tool.**

**P**lant engineers fight a continuous battle with downtime. Although key contributors, maintenance and repairs are not, however, the only cause for concern; increasingly, it is the threat of business interruption, with its effect on output and profitability. The viability of a process, even the business itself, may be on the line as a result.

ABB Eutech<sup>1)</sup> has developed a Risk Based Inspection (RBI) method that enables companies to substantially increase plant reliability, reduce the number of plant failures and cut the time required for regular inspection/maintenance.

Recent results with four customers in the chemical and petrochemical industry

provide compelling evidence of major savings. The total cost of inspection, for example, could be reduced by 49 to 80 percent. Average inspection intervals were increased by between 35 and 57 percent, with an average increase of 44 per cent. And more than half the plant equipment could be removed from the invasive inspection programs.

#### Typical recent results

Study	A	B	C	D
Average inspection interval before/after RBI study (months)	31/44	No data	54/85	48/65
Vessels moved to non-invasive inspection	16 out of 26	76 out of 157	90 out of 179	41 out of 82
Reduction in inspection costs	58%	49%	61%	81%

<sup>1)</sup> ABB Eutech is the process solutions center of excellence within ABB's petroleum, chemical, life science and consumer goods industries business area.

The bottom line is that RBI reduces downtime, planned or unplanned, for a saving in maintenance costs. The time and capacity/availability that is released as a result has a direct, positive effect on a plant's output.

### The principles of RBI

RBI is a knowledge-based method that uses risk as a basis for prioritizing and managing an inspection program. In this definition, 'risk' is seen as the result of the probability of future failure and the likely consequence of that failure.

Generally speaking, the level of risk associated with the different pieces of equipment that make up a plant is variable. However, this fact is seldom reflected in the inspection routines applied across the inventory of equipment. Risk based inspections focus the inspection and maintenance effort on those areas where the risk and its potential effects are greatest.

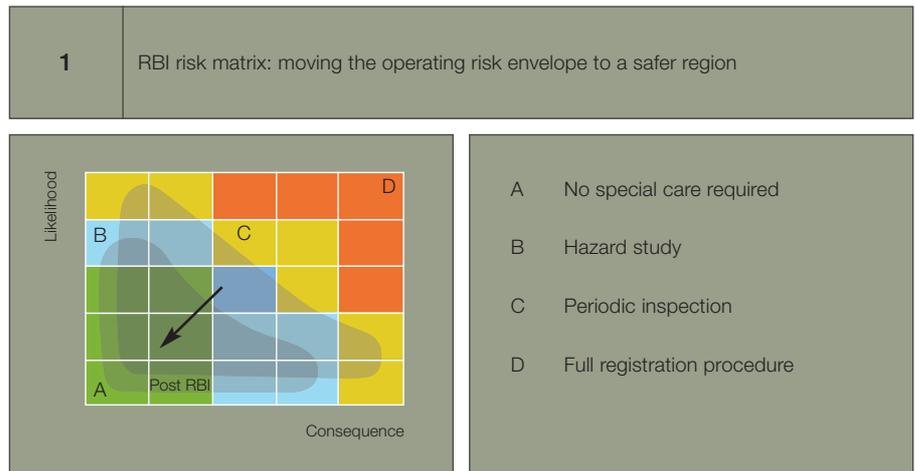
The prime objectives of an RBI program are to:

- Focus effort on identifying and reducing the safety and business risks.
- Achieve increased plant availability by ensuring that outages only take place for essential inspections.
- Reduce the maintenance costs associated with unnecessary or excessive dismantling and preparation.
- Improve safety by getting rid of hazards associated with preparing for inspections.

RBI is becoming the preferred tool by which 'good engineering practice' is measured. Its predictive approach is designed to eliminate excess and inadequacy by concentrating inspection effort on real risks 1. Use of RBI has shown to be effective in reducing the number of unforeseen breakdowns.

### The ABB approach to RBI

ABB's RBI process is built around an asset care strategy that is designed to monitor the plant throughout its life-cycle. This involves the acquisition of detailed knowledge and requires a good understanding of the behavior of every



component in the plant under its current duty conditions. Multidisciplinary in its approach, it looks at parameters such as the design/construction quality, inspection/maintenance history, and the service conditions, including normal and abnormal excursions. The review identifies all failure mechanisms and associated risks.

This accumulated knowledge and experience helps engineers to decide what equipment needs to be inspected and when, as well as to establish where failure would be least acceptable and cause the most problems. This makes it easier to see where effort has to be focused in order to maximize the return. It facilitates the optimization of examination intervals whilst at the same time identifying equipment for which non-invasive examinations would be equally effective.

Up until now, ABB's experience has been mainly with pressure vessels. However, exactly the same approach is adopted when assessing risks for rotating equipment, critical instrumentation and structures.

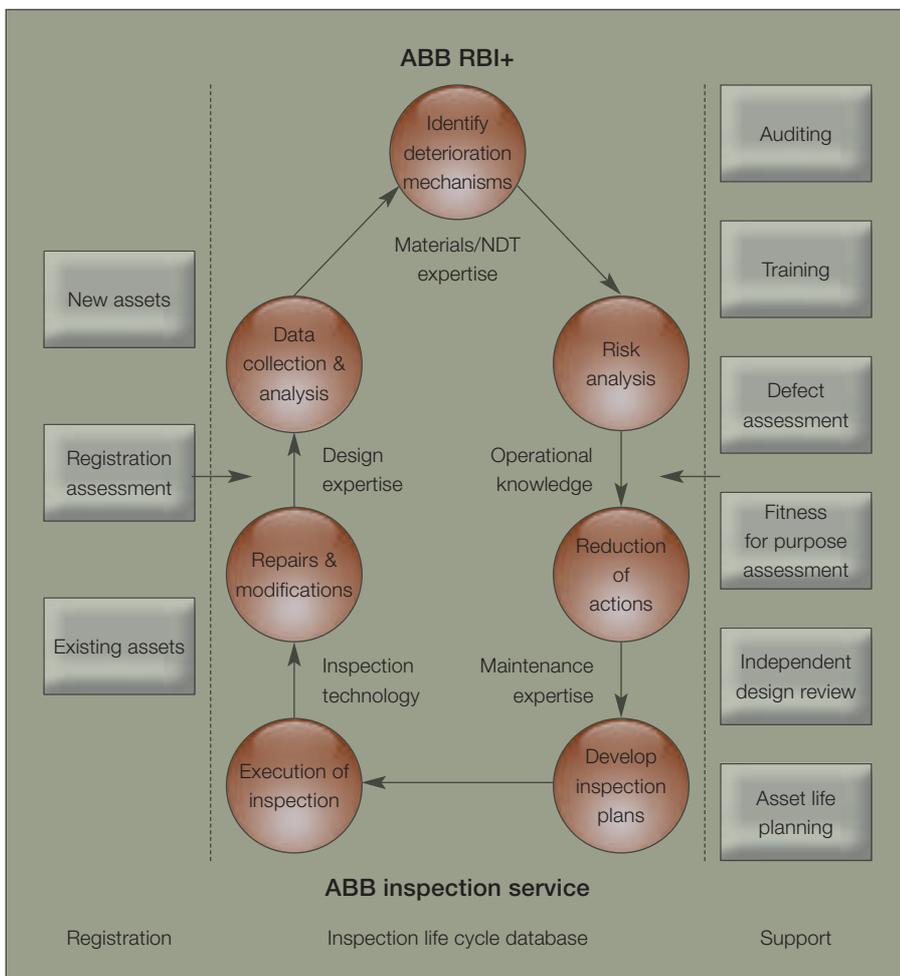
For Victrex, a UK polymer producer, the potential financial benefit of reducing downtime through RBI was estimated to be almost \$10 million.

The company's RBI approach relies on harnessing company and consultants' expertise as well as the use of sophisticated software tools.

ABB has refined its proven RBI approach into an efficient, streamlined solution called Risk Based Inspection+® 2. The result of experience gained through hundreds of projects, it focuses on delivering tangible results by:

- Accumulating comprehensive knowledge of the risks associated with specific plant assets.
  - Significantly reducing the total cost of inspections.
  - Achieving longer intervals between inspection/maintenance turnarounds and reducing the time needed for them.
- Ensuring much improved equipment availability and reliability, and minimizing unforeseen breakdowns, resulting in more uptime.
- Building greater confidence in equipment integrity.
- Providing an established path to all necessary regulatory approvals.

An outstanding example of the success of Risk Based Inspection+ implemented in close partnership with a customer is a project ABB undertook recently for Victrex plc, a UK polymer producer.



ence to output, efficiency and profitability of the plant.

Before RBI the inspection regime was prescriptively invasive on all items, regardless of the risks associated with them. It is a fact that, very often, extensive inspection during the shutdown periods reveals no deterioration. However, there are occasions when unexpected problems are found, and these can lead to unplanned repairs that increase the outage time.

All inspection and maintenance work on the main pressure vessels must comply with Pressure Systems Safety Regulations 2000. These look mainly at how the safety performance and condition of the vessels reduce workplace risks as far as is reasonably practical.

As a Victrex engineer puts it, “The total cost of inspection includes decommissioning, decontamination and preparation for internal inspection. All this time and effort just to find that, more often than not, everything is OK! This led us to question our approach.”

It was this questioning that steered the company toward a knowledge-based approach to understanding the behavior of the plant.

The RBI objective was to raise plant availability from 80 to 85 per cent – from 290 days to 310 days per year – which is the ‘world-class standard’ for similar batch specialty chemical processes.

It was concluded that the main contribution to increasing plant availability would come from a reduction in the annual shutdown time. This would need to be cut from 35 days to 21 days.

The potential financial benefit of saving a large amount of downtime was estimated to be almost \$10 million. Such an amount would result from an improved gross margin and reduced short-term investment needs.

None of this means that future plant expansion is ruled out, but Victrex’ immediate priority was to get the

### RBI delivers for Victrex

Victrex manufactures PEEK™ polymer, a high-performance thermoplastic with exceptional chemical, wear, electrical and temperature resistance. It is used in critical applications in the industrial, automotive, electronics, medical, aerospace and food industries around the world.

The company is actively expanding its markets for PEEK polymer through intensive marketing, customer-focused service and a commitment to product quality. Victrex is in the fortunate position of enjoying very high demand for its product. Its major challenge is to increase production while controlling overhead and investment costs.

Working with ABB, Victrex engineers were aiming to break out of the vicious loop that had always linked higher output to investment in new plant. The general rule was that an annual increase of 100 tons in output always required an investment of \$1.5million.

In recent years output has been raised from 1000 tons per year to 2000 tons in two jumps of 500 tons, first in 1996 and then again in 2000. In each case almost \$10 million was invested in new plant <sup>3</sup>.

### Saving time, saving cost

The inspection and maintenance routines were a prime target for close examination. It was seen that time and cost savings could make a vast differ-



## ABB Risk Based Inspection+<sup>®</sup> in brief

### Approach

- What equipment should be inspected? Where would failure be unacceptable?
- Where should effort be focused?
- Which techniques should be used?
- How can the examination intervals be optimized?

### Benefits

- Increased knowledge of the risk of operating assets
- Significant reduction in the total cost of inspection
- Longer turnaround intervals, and reduced turnaround durations
- Improved equipment availability and reliability, helping to maximize uptime
- Increased confidence in equipment integrity
- Established path to regulatory approval

most return from its existing facility before embarking on further major investment.

For both ABB and Victrex there were some essential steps in ensuring that RBI delivered the desired benefits. Above all else there was the need to harness all existing in-house knowledge and experience and link it to ABB expertise. As a starting point, the in-house team members were to pool all their knowledge and experience. This data, both qualitative and quantitative, together with historical records of previous inspections and a thorough analysis of the causes of lost output in the last 12 months, provided the basis for the knowledge base on which the RBI plan would be developed.

A full understanding of the results of past inspections of pressure vessels during shutdowns was vital, since preparing for and carrying out invasive inspections accounts for much of the time and effort involved in a shutdown. Knowing and understanding the failure mechanisms each item is susceptible to, and where to look for them, helped the team decide on the adequacy of non-in-

vasive inspection. This proved to be a major benefit. Thoroughly gathering and assessing salient historical data, plus the use of ABB advanced software tools, enabled the team to develop an inspection routine that prioritizes and responds to risks and foreseen failure scenarios. It also minimizes the risk of unexpected failure.

Having carried out the full review and created an RBI program, the results have proved immediate and impressive. The first shutdown to be affected, in October 2001, required only nine days. The necessary engineering and maintenance work was completed in four days. The total cost of the exercise was half the amount budgeted.

The next shutdown period, a little less than a year later, was cut from 35 days to 20 days. The team expects shutdowns to be kept to this level in future years as some of the equipment gets older and wear and tear increases.

Besides the welcome time saving it provides, RBI has met and exceeded expectations. During a recent period of high demand, the gross margin has

been improved by more than \$9 million over eighteen months of operation and other savings on capital investment and associated depreciation exceed \$3 million. Year on year shutdown savings are running at almost \$100,000. Victrex engineers admit that their initial desire to apply RBI was an act of faith. They saw the opportunity and believed that the goals would be achieved, but they had no previous experience to refer to. As Andrew Anderson, Engineering Manager of Victrex says, "The past experience, professionalism and expertise of ABB were vital elements in steering the work forward and in providing the confidence in the achievability of our objectives."

The Victrex experience shows quite clearly that Risk Based Inspections can provide the benefits businesses need to save on preventive maintenance while minimizing the risks of failure.

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# The overlooked asset: **human performance**

Daniel Mantey

Planes, trains and automobiles are designed to transport people and goods from one place to another. But these forms of transport are useless without trained human beings behind the wheel or at the controls. Even the best automated production lines and processes can do little until a trained person applies them to a business or production task. In fact, our ever-more modern production facilities are nothing more than depreciating assets without a skilled workforce to engineer, operate or maintain them.

The technological capabilities that provide such modern production facilities have also displaced part of the workforce. As a result, the need for well-trained personnel has increased. Most of us realize that there is more technology available today in industry than people know how to use. The situation is made more complex by a world in which technical education is often considered an after-market add-on. Training is an often-overlooked means of increasing operational performance and efficiency without investing in capital. ABB helps its clients achieve the correct balance by analyzing the business need and identifying the required outcomes before a training solution is considered. Think of it as a strategic shift from a training organization to human performance consultants.



Researchers at Watson Wyatt<sup>1)</sup> consulting firm found that, overall, good people practices help to increase a company's value. To be more accurate, their study found that scoring high in key areas of human capital management relates to about 30 percentage points in terms of market value or return to shareholders. Interesting infor-

mation, but information that won't be found in most companies' annual report because spending on education and training isn't publicly available.

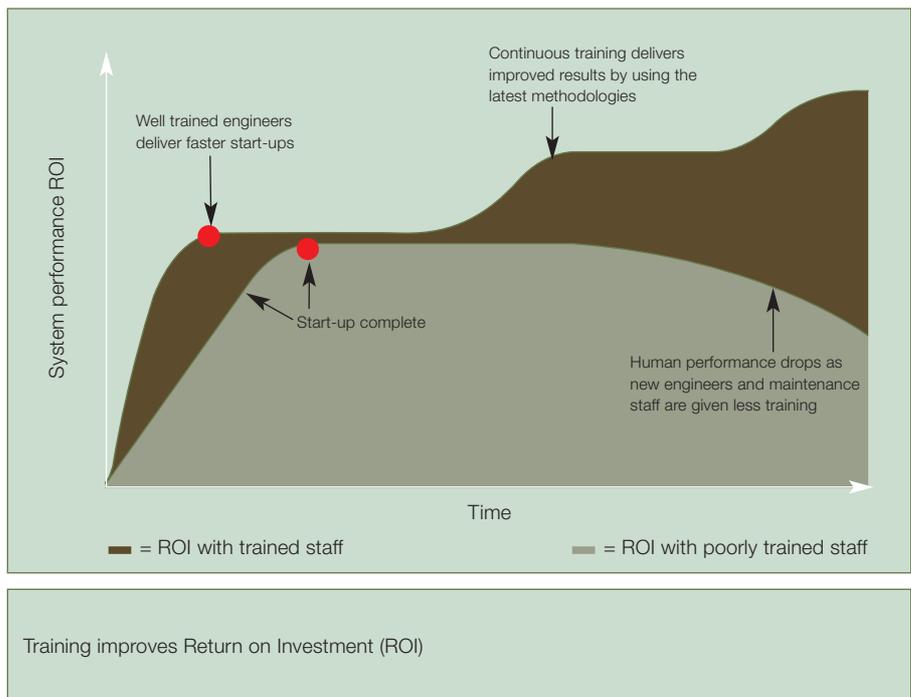
Even though we are in the midst of a knowledge era, today's accounting systems and reporting requirements are still firmly rooted in the industrial era. Ana-

lysts and experts agree that nearly 75% of the sources of value in a company are never reported. Indeed, spending on training and education is treated as cost rather than investment, and in the absence of any requirement to publicly report such investment (cost), not a single Fortune 500 firm reports how much it is spending on education and training.

<sup>1)</sup> Watson Wyatt's Human Capital Index year-long study was based on a comprehensive analysis of human resource practices at 405 publicly traded companies, with at least three years of total returns to shareholders and a minimum of 100 MUSD in revenue or market value.

As technology continues to advance, the need for technical education becomes ever more critical. Research has shown that most people use only about 40% of the technologically designed features available to help companies be more profitable and competitive.

Technological change is constant, employee turnover is high, and globalization and economic uncertainty seem to be the norm. All of the above create cost pressures which make it difficult to prioritize training investments. ABB believes it is its duty to ensure that customers are able to take maximum advantage of every bit of technology ABB brings to market. Therefore, the company helps its clients by prescribing human performance solutions to help companies improve their operational performance without investing in capital.



### Competence development

ABB has numerous training programs that target mainstream audiences, but the company also realizes that many customers require customized programs. Through ABB's competence development practice (CDP), training professionals work with these customers to identify business problems, analyze gaps between expected and required outcomes, and then deliver training solutions to fill the gaps. CDP, a proven training tool, focuses on delivering solutions that are tied to customers' business objectives and the needs of the operational staff.

Research has shown that most people use only about 40% of the designed features available to help companies be more profitable and competitive

Recent research from the corporate executive board's learning & development roundtable says: "Organizations that closely align training offerings and business needs have instituted clearly defined protocols for eliminating low-impact courses." In other words, CDP delivers a tangible return on client investment.

### The Weyerhaeuser experience

At the Weyerhaeuser's Dryden pulp and paper mill in Canada, it was necessary for employees to learn how to use new technology for air emission upgrades. ABB used CDP to prepare Dryden's

workers for the changes ahead. According to Stefanie Armstrong, training coordinator for the Weyerhaeuser Company, "ABB was the only supplier to offer a training

package in line with what we were looking for. The company's logical approach made good sense to us." She was so convinced of the value of CDP that she co-presented her experience together with Rick Tarbutt, manager of ABB University in Canada, at 'Exfor', the annual Canadian pulp & paper conference.

Many of ABB's key accounts have utilized this service to establish performance improvements that truly address customers' key objectives and resolve day-to-day problems.

### Changes in the economy affect training delivery

Because technology is continually changing, workers need to be educated to keep up with such changes. But continuing cost pressures mean that organizations can no longer afford to include extensive travel and lodging costs in their training budgets. This means that innovative ways of delivering and monitoring training with the highest efficiency at the lowest cost are required.

Instructor-led classroom training, which currently accounts for 78% of all learning methods, will have to be minimized. Tomorrow's trainers will have to deliver cost-effective training programs that take place without workers having to travel or take time away from the job. For this reason, blended training approaches, now adopted by ABB University, must combine technology-based training with traditional instructor-led classroom training.

### Blended learning model

A blended learning model builds up and strengthens the learning experience, while greatly reducing travel-related time and costs. This four-tier model reinforces learning by:

1. Providing performance support and reference information that delivers conceptual awareness and understanding.
2. Providing interactive learning using computer-based training modules, web-based training modules, simulations and interactive games.
3. Working with peers in a virtual collaborative learning environment to develop analysis and problem-solving skills. Such a learning environment is created using live virtual classroom learning, e-Labs, live virtual conferences, and virtual teaming and collaborative sessions.
4. Providing experienced-based learning in a face-to-face environment to develop higher-level evaluation and decision-making skills. This is done via workshops, mentoring, case studies and role-playing.

Complete learning solutions deliver results by closing the gap between system performance and human performance. More importantly, these solutions address the full learning cycle so customers always realize continuous, optimal human performance and operational efficiency without experiencing the usual dips in productivity associated with traditional, event-driven training.

Traditional learning often means an employee must abandon work for a speci-

fied period of time. In many cases, the training program does not adequately relate to a worker's every-day role, so the impact of what has been learned is quickly eroded. The key to avoiding this is to embed learning into core business processes. The on-going learning process must combine structured learning events with interactive and collaborative learning in every-day roles. This approach goes a long way toward making learning more meaningful and therefore less likely to be forgotten.

### Internet-based learning

Internet-based learning solutions include live, virtual-classroom sessions via a desktop computer, with the opportunity to record, archive and play these sessions later. The virtual classroom medium is perfect for advanced system and feature technology training, as well as follow-up and refresher training. Even though these solutions are extremely cost effective, the physical presence of an instructor is still necessary to guide and reassure people during the course. This kind of training usually involves live product or system application sharing, where students are given participative and collaborative tasks during the session. This adds to their learning retention as well as keeping them engaged.

Online conferencing is also a useful tool. With key development centers in

Finland, Germany, Sweden and the USA, ABB relies on online conferencing to conduct development workshops, eliminating the need to travel and the expense of conference calls.

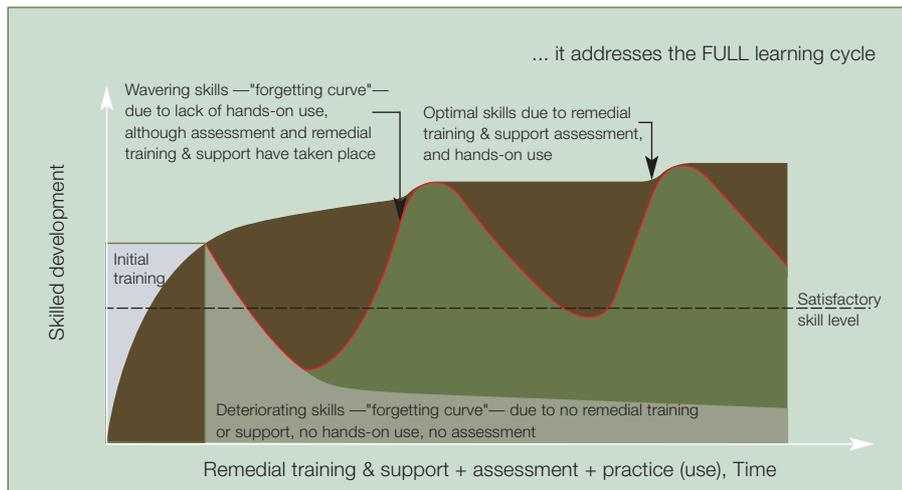
Technology-based training is an area that is growing at a fast pace. However, it does not completely replace traditional instructor-led training which will continue to play a key role in training delivery.

### Learning management system

When moving from an instructor-only training curriculum to a technology-based one, tools such as learning management systems (LMS) assist with the transition. An LMS provides the tools necessary to integrate the process of scheduling, delivering, and evaluating curricula. In addition, it supports both instructor-led and technology-based training. A powerful LMS has the ability to launch, track, and report information from courses produced by a variety of content owners/providers, and can integrate with other business critical systems.

The result is improved customer satisfaction through e-commerce abilities, online reports, course enrollment details, personal transcripts, web-based training course access, course information and site navigation in multiple languages.

ABB's human performance solutions help companies invest in human performance capital without exceeding their existing operational budgets. The overall result to date has been significant improvements in both operational and staff performance.



Why blended learning works so well

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# Applied knowledge management in services

Som Chakraborti

ABB has always been aware that an ever-changing business environment continuously challenges a company's competencies. To help companies face this challenge, ABB began some years ago to investigate ways to efficiently share and apply company-wide knowledge to provide high value-added services to customers.

In 2003, ABB launched a Knowledge Management program that supports customers in meeting their asset performance objectives. The program focuses on the networking and sharing of knowledge and best practices within the ABB global service organization. It provides direct real-time support to the service organization, especially the site teams.

Efficient Knowledge Management is seen as a key metric to the success of ABB's service business. In the initial phase, the program supports the ABB Performance Service (APS) business, which encompasses the following types of contract:

- *Maintenance performance management:* This is a client-specific maintenance outsourcing agreement. It leverages ABB knowledge and expertise to enhance overall equipment effectiveness through operational and maintenance best practices.
- *Equipment performance management:* This is an agreement where ABB assumes responsibility for the management and improvement of a specific class of assets such as motors, drives, breakers and transformers.
- *Maintenance consulting services:* Maintenance consulting services are short-term consulting engagements supporting client-driven requirements. This provides benchmarking and best practice comparisons, and delivers guidance for improvement of overall equipment effectiveness and operational excellence.

- *Automation performance management:* This is the latest ABB Performance Services evolution that leverages product expertise and maintenance experience. This offering is a performance and usage agreement providing automation asset management under a co-sourcing or outsourcing arrangement.

Fundamental to this program is ABB's knowledge management system, APS-webs, which is used to support service professionals worldwide <sup>1</sup>. This platform captures, organizes and develops service knowledge within ABB and integrates it with the service business.

Knowledge Management helps:

- Global sharing and teamwork
- Continuous improvement of service delivery
- Capture of knowledge as assets of the company
- The re-learning of ongoing service skills and competencies
- Foster innovation

## The competitive advantage

Even though business leaders wonder if Knowledge Management is just another trend (with no industry-wide definition), or if it has any business impact, it is capturing the attention of many companies.

Many companies realize the knowledge that sets it apart from its competitors is often locked away in the heads of a few employees or in documents spread across individual desktops. This has prompted them to make significant investments in knowledge management systems. IBM and Ford, for example, have Chief Knowledge Officers to spearhead their knowledge management efforts, so that employees have access to the firm's store of best practices and experiences from across the enterprise. Several field studies have shown why and how firms use knowledge management <sup>2</sup>.

For ABB, such a system is a necessity. Because the company delivers service solutions to its clients worldwide, ABB service professionals are spread around the globe at various customer sites. It is

critical that these professionals have access at all times to company-wide knowledge such as best practices, experiences, contracts and a network of service experts. These, when made available to ABB service professionals worldwide, help ABB to better deliver service contracts.

### Knowledge management framework

Even though many people use the words *information* and *knowledge* interchangeably, they are not the same. Information refers to any content that can be communicated, independent of the format of the content. Knowledge, on the other hand, refers to content communicated within a *context*.

There are two main types of knowledge: *tangible* and *tacit*. Tangible knowledge can be captured and represented physically, and transfer of this knowledge to other people does not require human interaction. An example of this is a typical Microsoft word document. Tacit knowledge resides only in the heads of employees (or knowledge workers), and transferring tacit knowledge always requires human interaction. Exchanging ideas during a coffee break is an example of tacit knowledge transfer.

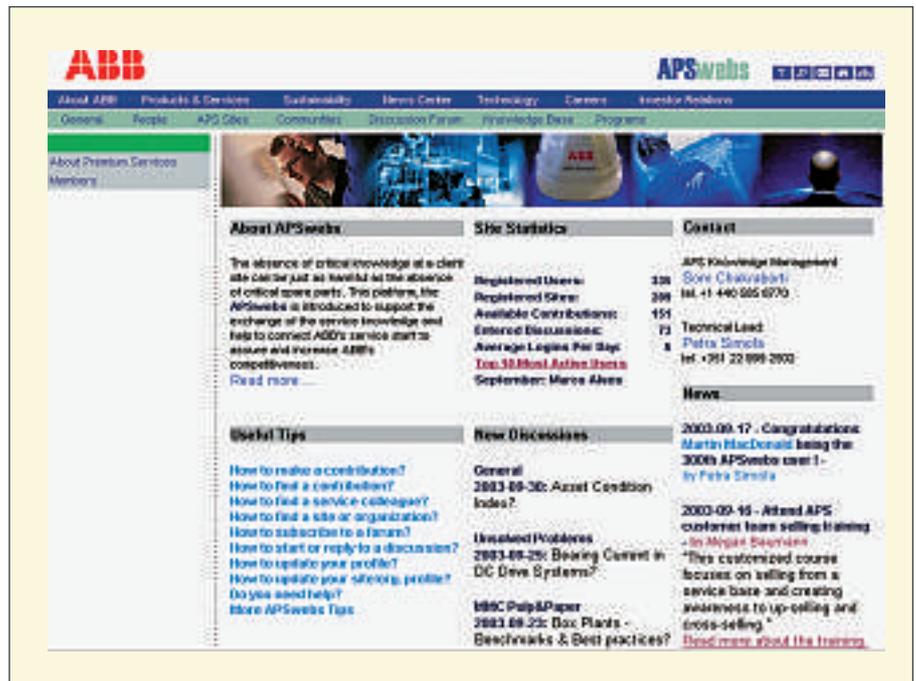
Any knowledge management solution must address both the management, and transfer of tangible and tacit knowledge objects.

### Managing tangible knowledge

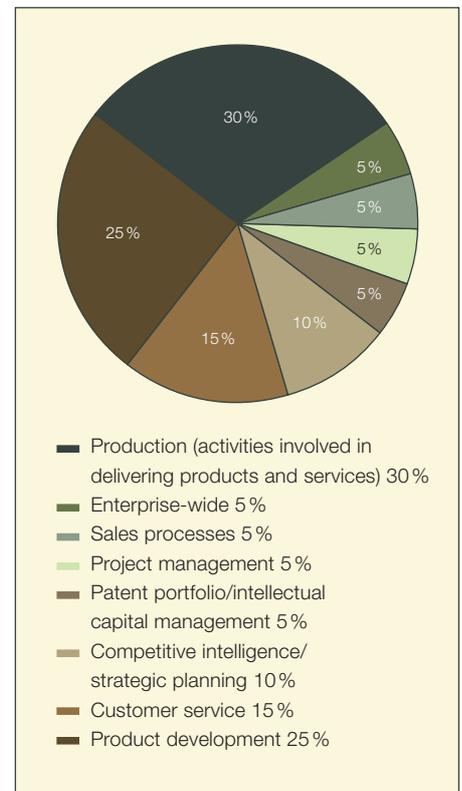
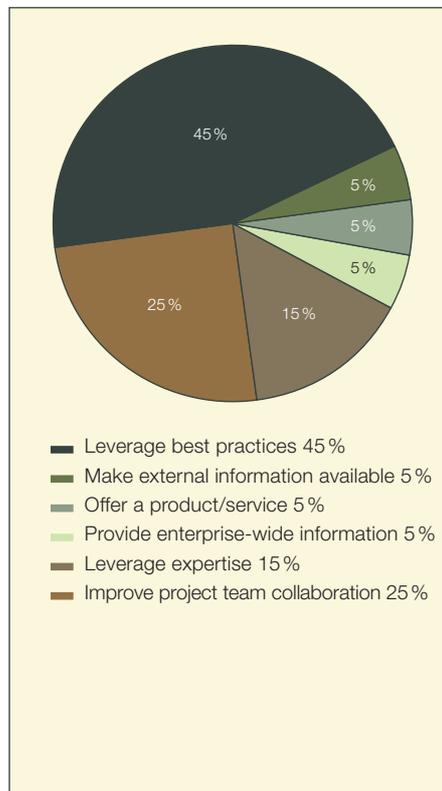
This uses a *storehouse model* which creates repositories of data across the company. The content associated with tangible knowledge can be categorized as either: structured or unstructured. In fact, tangible knowledge of an enterprise always consists of structured and unstructured content. Downloadable training modules are a good example of structured content. E-mail messages and scattered documents are examples of unstructured content.

In 1998, a CIO Magazine [1] study advocated a framework for managing tacit knowledge. The study stated that an enterprise should:

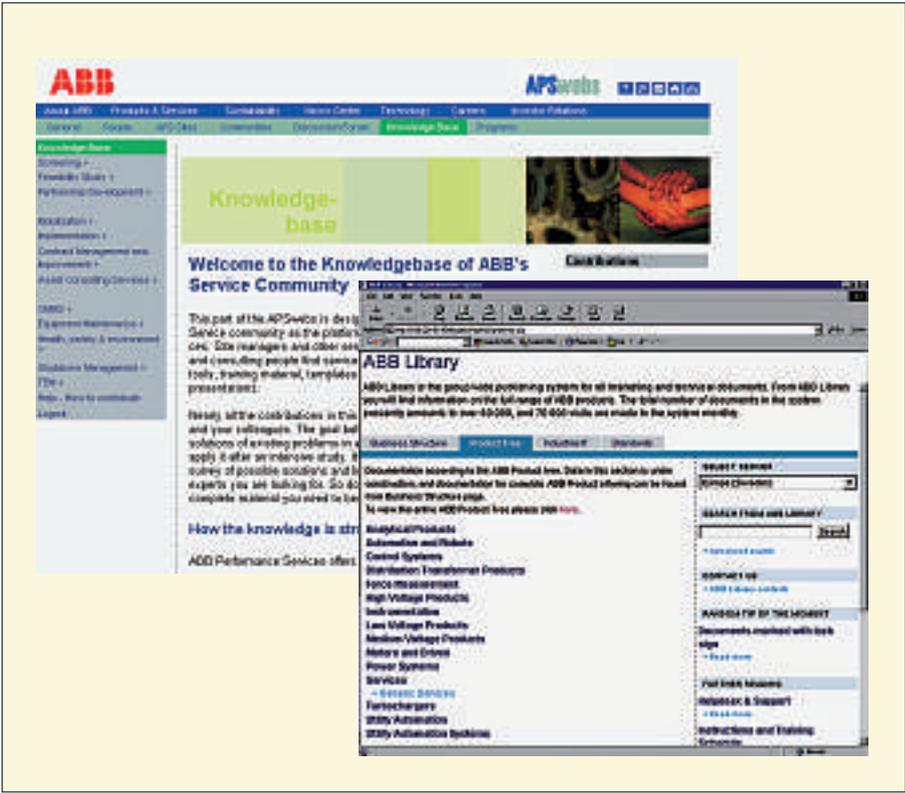
1 ABB's knowledge management system is known as APSwebs



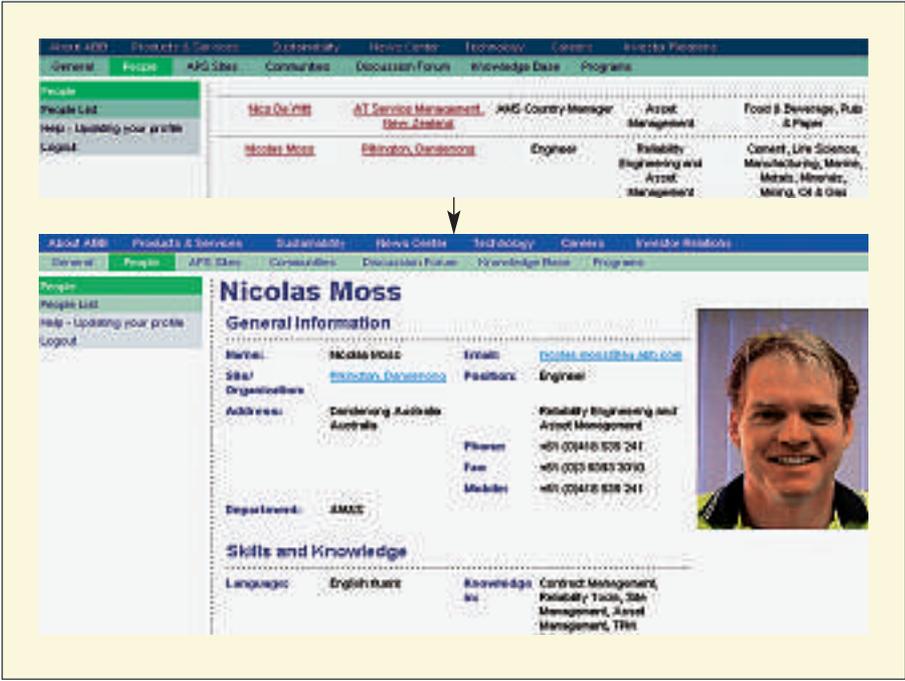
2 Why and how firms use knowledge management



3 APSwebs can access content from ABB Library, ABB's document management system



4 Finding people and skills on APSwebs



- *Make knowledge useful* – Given the geographical spread of ABB, especially the multitude of service resources around the world, a professional could spend a lot of time trying to find the correct information. The knowledge management system must organize all structured and unstructured content so they can be easily located. One way to organize content is through a hierarchy that mirrors the structure of the business. For example, ABB's service business might organize its content by industry markets, and then by contract activities, followed by asset class, etc.
- *Make knowledge accessible* – Given the amount of data available, robust searching is critical when it comes to locating the correct knowledge. Content is usually searched based on metadata and keywords. This type of search can also be combined with *case-based reasoning* to locate the relevant content faster. For example, an ABB service professional working on shutdown planning at a paper mill in New Zealand could type "best practice for paper mill shutdown planning" to look up experiences from other parts of the world.
- *Manage knowledge storage* – Effective searching requires a common repository that can hold a variety of content formats. The formats might include simple text files, graphics files, and movie or WAV files. The repository should also allow access to content maintained in other data repositories. To illustrate this, APSwebs can access ABB product content maintained in the ABB Library, ABB's document management platform 3.
- *Package knowledge and publish* – The growth of a knowledge management system is an indication of how easy it is to get new knowledge objects into the system. Packaging knowledge will help ensure that it proves useful, provides value and encourages reuse to address business issues. Packaging content is labor-intensive but critical. Merely posting an experience report or a results summary on APSwebs doesn't help. The knowledge contributor needs to assess its value and package it in

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Customer site information on APSwebs

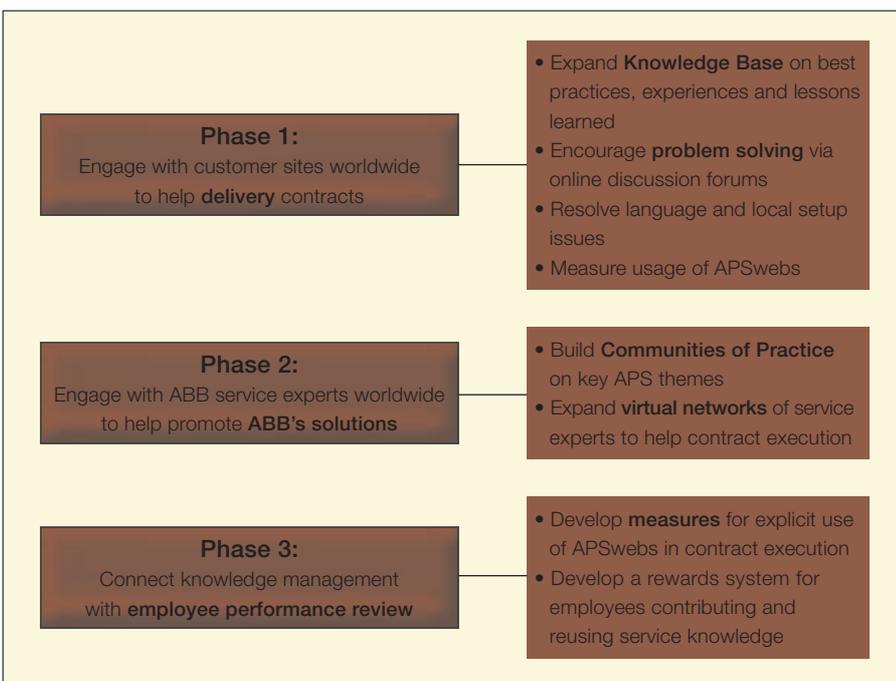


such a way that its usefulness is readily apparent. A standard template is often useful in packaging a knowledge object and should include all

key elements of the knowledge object. For example, an ABB service professional submitting an experience using a standard template in mainte-

6

Roadmap of ABB performance services knowledge management



nance best practices from a paper mill would include: other industries applicable, the industrial or business processes applicable, equipment applicable, a summary of the experience along with appropriate attachments and contact information.

#### Managing tacit knowledge

This uses the pointer model where users are directed to an individual who has expert knowledge in a particular area. Because tacit knowledge resides in people's heads, managing it essentially means managing human expertise across the firm and making the collective expertise accessible to users. In this case, people can search for knowledge experts similar to the way they would search for tangible content. Once identified, however, there needs to be a virtual network created to host interactions between the user and the expert. The interaction could be synchronous, in real time via instant messaging, or asynchronous, such as an online discussion board. APSwebs helps identify experts and skills needed by a user, virtually. The system hosts:

- **People, skills and sites repository** – All ABB service professionals worldwide can search for particular skills and edit their information **4**. ABB service professionals can also view contracts pursued by peer ABB service sites around the world. In addition, APSwebs maintains up-to-date information on all of these sites **5**.
- **Communities of Practice** – Service experts, identified by a particular service area, form virtual networks to solve customer problems and review ongoing development of service solutions. For example, a Community of Practice network has been started on the subject of Equipment Performance Management for the global development team. This community can link experts from various customer sites, and offer support on Equipment Performance Management contracts.

Global companies with excellence in knowledge management have used both models, i.e. tangible and tacit. As for ABB, the goal of its Knowledge Man-

agement program is to retain and reuse the tacit knowledge by converting as much of it as possible into tangible knowledge.

**Knowledge management deployment**

**APSwebs rollout**

The APSwebs system is being deployed to all ABB performance services operating sites worldwide. 6 illustrates the key phases of the overall deployment.

Supporting the operation teams by giving them access to the appropriate knowledge and expertise so they can better deliver the client contracts is the highest priority of the program (Phase 1). Country clusters, based on geography and uniqueness of contracts, have been formed. These country clusters help the AT Service Knowledge Management team engage faster with various service sites.

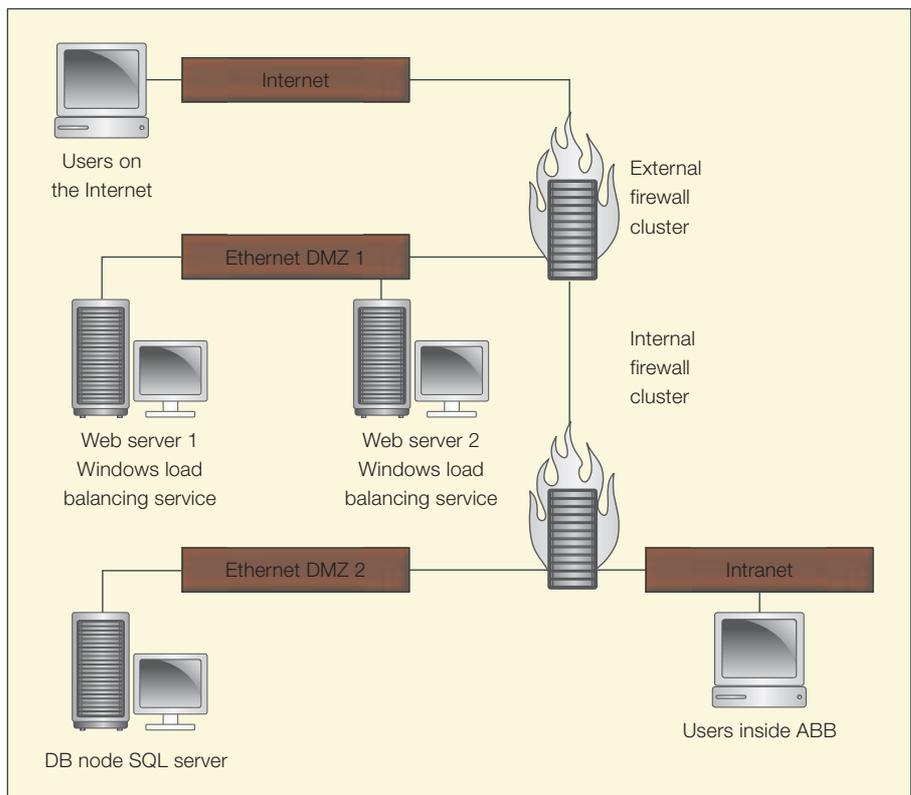
Communities of Practice are formed by identifying solutions and services from ABB’s portfolio such as: equipment performance management, shutdown planning, total productive maintenance, safety, and health & environment. The establishment of Communities of Practice serve as building blocks for applying organizational knowledge (Phase 2). Human capital is leveraged and the knowledge is captured as the virtual networks are formed within ABB.

Phase 3 focuses on integrating APSwebs as part of the employee performance evaluation system. This would require local ABB service operations to include knowledge management as an element in performance evaluation. High-impact initiatives are supported by explicit change management efforts, such as usage promotion and measures to reward use of the firm’s Knowledge Management system. For example, Ernst & Young Cap Gemini [2] has tied the use of its knowledge management system (called *KnowledgeWeb*) with the annual performance reviews of employees.

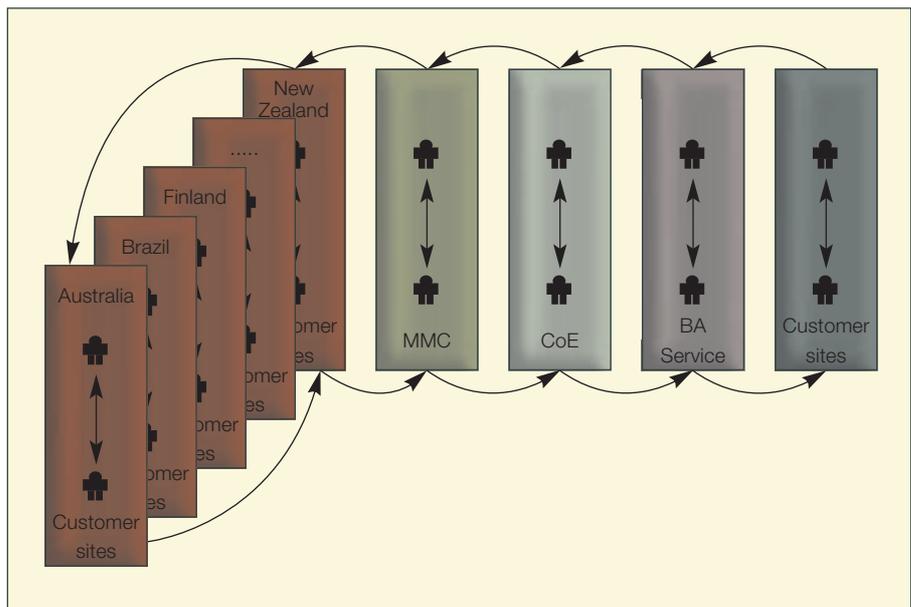
**APSwebs infrastructure**

The APSwebs platform is based on the ABB Premium Services infrastructure 7.

7 APSwebs architecture



8 Closed loop of knowledge brokers



This infrastructure allows a simple user intuitive Web front end. The system is hosted in a secured environment, which is maintained by ABB's Information Systems organization.

The knowledge management team can also look at usage statistics in real time. These statistics offer valuable information on customer sites where usage levels are high or satisfactory, as well as sites where further training is necessary.

**Integrating multiple knowledge centers**

The ABB service organization has a network of knowledge brokers spread across the world. These brokers are key centers of expert service knowledge. The table shows a partial listing of these knowledge assets. It should be noted this list is independent of the customer sites worldwide where a vast amount of tangible and tacit knowledge is being generated.

As a part of the ABB service knowledge management charter, APSwebs is integrating these knowledge centers in a closed loop to channel information to the customer sites 8.

**The net result**

The formation of a network of customer sites in all operating countries using APSwebs for superior contract delivery is shown in 9. APSwebs gives ABB professionals access, at all times, to information and analysis generated by knowledge brokers and customer sites situated throughout the global organization 10. This is a virtual example of ABB professionals reaching out to an expert with a required skill from another client site.

**Leadership in knowledge management**

CIO magazine [3] researched 33 firms with high-impact knowledge management programs. The results of the research showed that leaders in Knowledge Management were separated from those lagging behind because:

- 1) They have a clearly articulated *vision* of what knowledge management is about.
- 2) They have *knowledge champions* who are supported by top management.

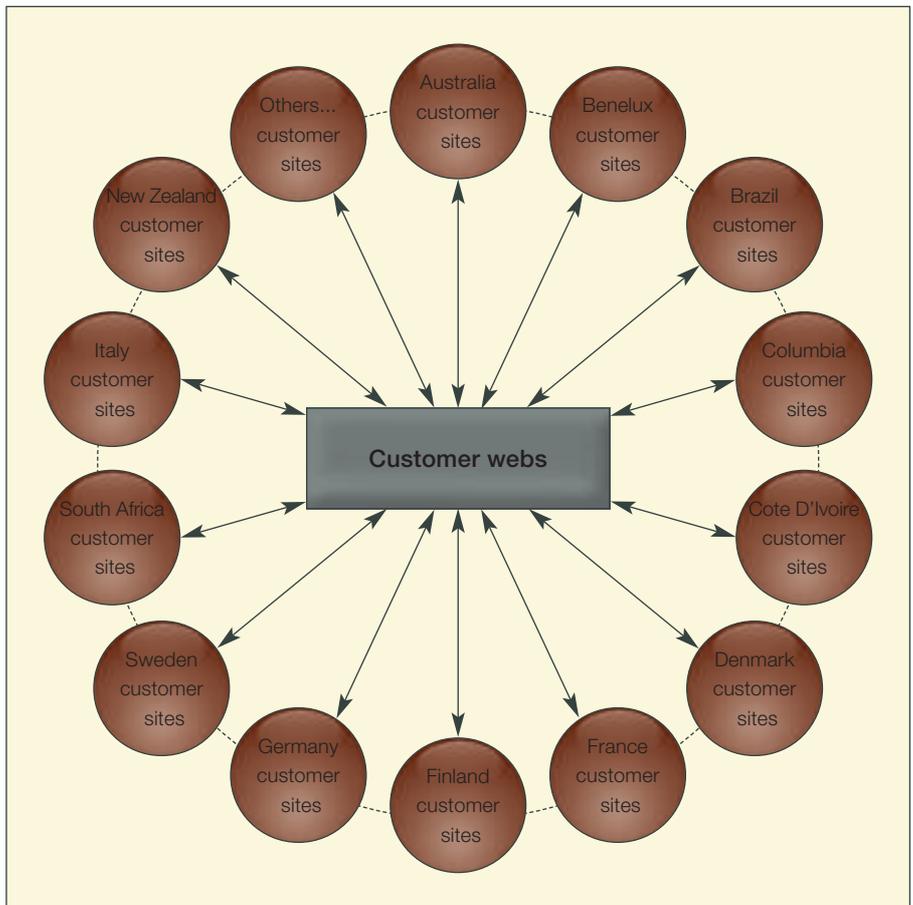
Partial list of ABB service knowledge assets

Knowledge broker	Assets
Maintenance performance centers – pulp & paper, metals	<ul style="list-style-type: none"> <li>■ Maintenance standards</li> <li>■ Contract support</li> </ul>
Centers of excellence	<ul style="list-style-type: none"> <li>■ Expert knowledge in industry best practices</li> </ul>
ABB University	<ul style="list-style-type: none"> <li>■ Knowledge of ABB products &amp; systems</li> </ul>
Robotics, automotive, & manufacturing Business Area service	<ul style="list-style-type: none"> <li>■ KnowledgeNet: knowledge base for ABB robots</li> </ul>
Automation Technologies service - Finland	<ul style="list-style-type: none"> <li>■ Service database</li> </ul>

- 3) They have a *holistic perspective* that embraces strategic, technological and organizational perspectives.
- 4) They use *systematic processes and frameworks*.
- 5) They use *effective communications*, using all the tricks of marketing and public relations.
- 6) There is *effective interaction* at all levels with their customers.

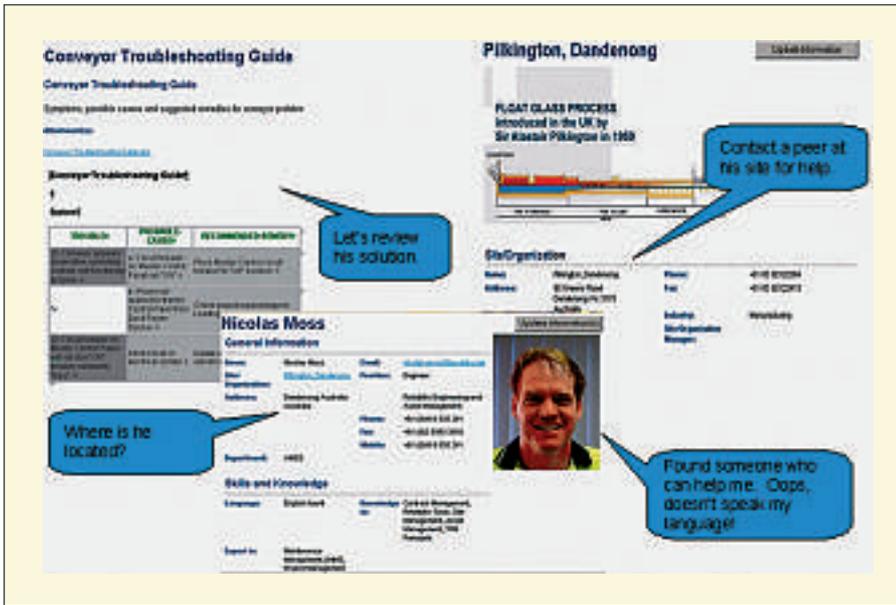
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The network of customer sites leveraging APSwebs



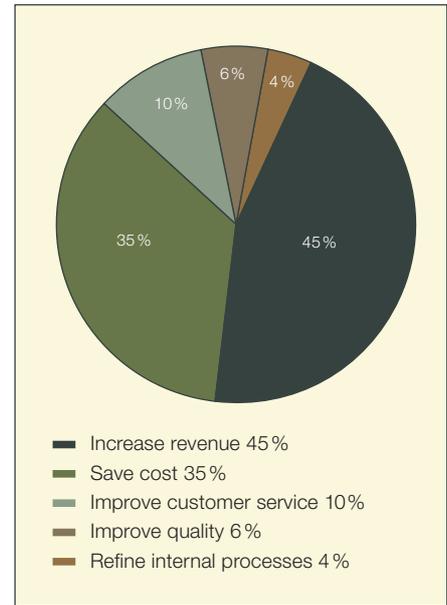
10

Cross-referencing people, sites and skills for ABB professionals



11

Business objectives of knowledge management programs from a CIO magazine survey



- 7) They demonstrate *good teamwork*, with team members drawn from many disciplines.
- 8) They have a *culture of openness* and inquisitiveness that stimulates *innovation and learning*.
- 9) They develop *incentive* and personal development programs to change behaviors.

The 33 knowledge-based firms surveyed by CIO Magazine were: 3M Analog Devices, Anglian Water, Arthur Andersen, Booz Allen & Hamilton, BNFL, Buckman Laboratories, BP, CIBC, CIGNA, Dow Chemical, DTI (UK), Ernst & Young, Glaxo Wellcome, Global Knowledge Network, Hewlett Packard, Hoechst Celanese, Hoffman La Roche, Hughes, IBM, ITESM, (Mexico), MITRE, Monsanto, Motorola, Price Waterhouse Coopers, Rover, Skandia, AFS, Standard Life, Steelcase, Teledyne, Thomas Miller & Co, Unipart, US Army, and Xerox. Many more firms are being added to this list as they excel in their Knowledge Management programs.

Another CIO Magazine study involving 83 firms categorized programs as high-, medium- and low-impact. To qualify for inclusion, the programs had to be linked to a strategic business activity and focused on effective reuse of knowledge. They were judged on factors such as a clear recognition of benefits, employee usage levels, and levels of enthusiasm. The business objectives covered in the study are summarized in [1].

**Make it relevant**

Most investments in knowledge and packaging are wasted unless the results are relevant to a target audience. Successful knowledge management involves more than investing in technological infrastructure and telling employees to use it. To capitalize on the wealth of intelligence available in an organization, knowledge must be packaged in such a way that it's insightful, relevant and useful. Knowledge management is not merely about cost reduction. Within successful companies, the primary knowledge management objective is to

leverage best practices across the enterprise to improve performance.

That is what ABB is doing with APS-webs. Launched during the first quarter of 2003, the propagation of the knowledge management philosophy across the organization is an ongoing effort. ABB's service knowledge management teams expect to touch every customer site and more specifically, every member of the service organization worldwide. A key point to note is that knowledge management is a means to an end, not an end in itself.

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**References**

[1] CIO Magazine: Enterprise Section 2, April 15, 1998, [2] Ernst & Young Cap Gemini, firm sources, [3] CIO Magazine, February 15, 1999

# Support<sup>IT</sup> Knowledge Navigator

## An Industrial<sup>IT</sup> service tool

Carsten Beuthel, Ulrich Topp, Paul George

**Maintenance of sophisticated control systems is a demanding job that keeps service engineers constantly on their toes. One very important aspect of this job is the ease and speed at which an engineer is given access to the required process or component information. How this is done can make an already difficult job even more difficult, or easier.**

**System information can now be accessed electronically but this also brings its own problems. An engineer still needs to be very specific in his requirements. He needs to know the components in the process, how they are connected and the parameters, before he can correctly discover the current status.**

**ABB offers several different web applications that help with this problem, and for most service engineers these tools are very useful. But with so many unknowns, it becomes difficult to find the right information in a very limited timeframe. ABB's Support<sup>IT</sup> Knowledge Navigator project was initiated to overcome this problem by automatically inserting the missing information.**

In the not-to-distant past, information about installed components could be found in folders or on a service engineer's desk. A vast amount of time was often spent delving through mountains of paper to extract the required information. Having found what they were looking for, engineers often had to deal with another problem: inadequate updating left many documents incomplete or outdated.

Even though system information can now be accessed electronically, an engineer still needs to know exactly what to look for. When in doubt, physically walking to the component, noting specific information and comparing the data to some connected information sys-

tem will of course work. If a problem exists, the engineer is in a better position to search for the correct documentation or seek further help.

Recent studies have shown that critical problems arise in the service business due to a lack of information or incorrect information. This leads to errors in failure diagnosis, which often means the wrong expert is called. The result is confusion and difficulty in resolving the problem.

Tools are available, such as ABB's SolutionsBank, that use 'wizards' to lead the user to the requested information, but these still require the user to make specific requests. At the end of the day,

there are just too many unknowns to acquire the correct information. ABB's Knowledge Navigator was designed to overcome this obstacle.

The concept of Knowledge Navigator is based on ABB's Industrial<sup>IT</sup> technology. This tool provides a set of Aspects and Objects for creating maintenance displays in Industrial IT control systems. This enables service and support engineers, operators and management personnel to access technical information, help and hints for running a plant more efficiently.

The Knowledge Navigator maintenance display is the user's central mechanism for accessing all necessary system information. It consists of a graphical display

with Objects representing a specific asset that is part of the installed system. Built on ABB's Industrial IT Aspect Integrator Platform, Knowledge Navigator links an Industrial IT control system and its engineering resources with external sources such as SolutionsBank, ABB's e-mmediate agent and ABB University [1].

### Architecture

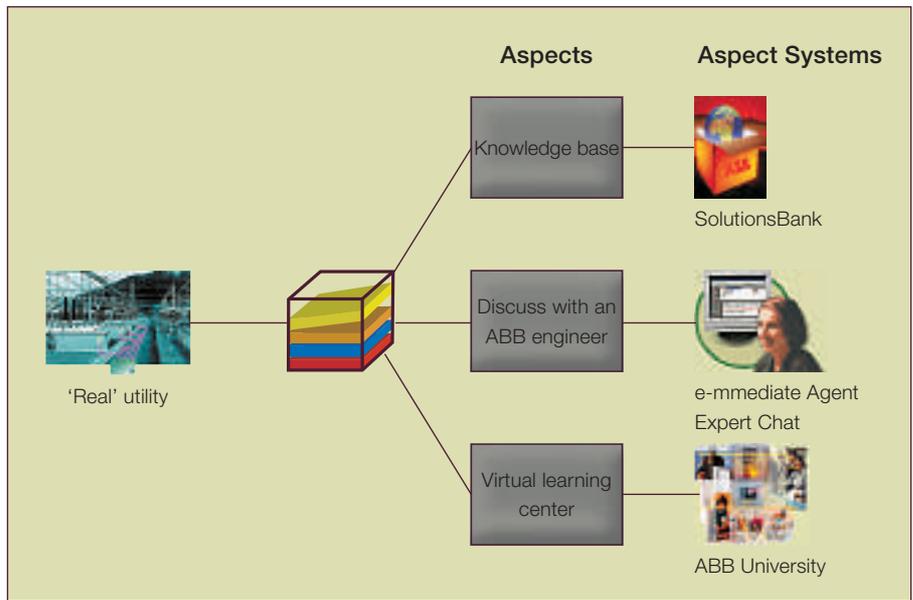
The Support<sup>IT</sup> Knowledge Navigator uses process graphics and the Aspect Directory, available on any ABB Operate<sup>IT</sup> Process Portal application, for accessing implemented services.

A real object is represented in the Process Portal by an Aspect Object. Each Aspect Object has properties, such as a name, component type, its configuration in the engineering tool or the current status, which describe the object. All this information is available as OPC data items for any application.

In the Aspect Directory, the Aspect Objects are sorted hierarchically and each instance refers to a specific object type which belongs to an object category. Each object type has a special set of Aspects, such as configuration data, faceplates, symbol information and control configuration. These Aspects are inherited when a new Object is instantiated in a hierarchical structure such as a Functional Structure [2].

Knowledge Navigator is formulated as a set of Aspect Systems that are added to the desired Object types and categories, which will later refer to service information. When an Object is instantiated, all Knowledge Navigator Aspects automatically become available.

## 1 Architectural overview of Knowledge Navigator



When a user selects a Knowledge Navigator Aspect, the Aspect starts building a query from the information specified in the Object's relevant Aspects. Additionally, a global configuration Aspect is used to provide general information about the customer's site, the database to refer to, and the required login information for this database. The advantage of this procedure is that the system only needs a minimal amount of pre-configuration effort. The Object type definition has only to be defined once which is typically done by the entity providing the solution in SolutionsBank. These entities know about the Object types used in their specific focus areas. Their task is to add the Knowledge Navigator Aspects to the appropriate Object categories and types, and fill them with a minimum of information, typically the Object name.

The entities can also point to other Aspect System information, which does not come with the standard package. This pre-con-

figuration data is stored in an extra aspect that is made available to any other application which might want to make use of the Knowledge Navigator features [3]. The Object types can then be released and distributed to customer sites.

Currently, the following Knowledge Navigator Aspects have been developed and tested:

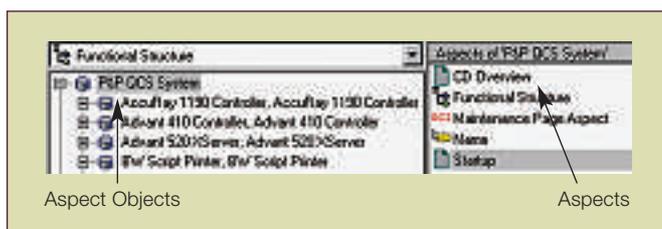
- Technical information such as release notes, feature changes, etc.
- Equipment manuals and user documentation.
- Aspects that identify and fix problems.
- Entry into an online chat-session with a service engineer.
- E-Learning courses available over the web.
- Online Parts ordering.

These Aspects are an integral part of the Process Portal application, and can be accessed through the Knowledge Navigator maintenance display by users with proper authorization [4].

### Pilot application

Knowledge Navigator was successfully installed in a paper mill near Jackson, Mississippi in the USA. Previously, a

## 2 An Object instantiated in the functional structure



new ABB quality control system based on Industrial IT technology had been installed. Two months after installation, a follow-up interview was conducted with the service personnel.

All of those interviewed agreed that the system saved them an enormous amount of time compared with the previous system. With one mouse click, the appropriate information and set-up of installed components is presented on the maintenance display. Information regarding all components can be retrieved from one location. The Process Portal locates the necessary search criteria and displays the results to the user.

In addition, the engineers stated that the Knowledge Navigator maintenance display allows them to view a process from anywhere in the plant with a display that is familiar to them. This, they said, enables them to locate problems and information quicker and easier than before. In addition, images are provided for each component. These combined benefits allow them to extend the functionality in answer to everyday demands.

The power of Knowledge Navigator's maintenance display is illustrated in the following example. In the pulp and

paper mill mentioned above, engineers discovered a control fault with a paper machine. The system status information was unreliable, and because the source of the problem was hard to detect, engineers had to devise a less-than-satisfactory solution to keep the machine in operation. Using Knowledge Navigator's maintenance display, service personnel were able to track down the component suspected of causing the problem. Information about this component was then found by searching the control net-object entries of SolutionsBank.

ABB's Support<sup>IT</sup> Knowledge Navigator helps engineers easily find the information needed to solve typical service engineering problems by using information collected from other sources, such

as applications running on the Process Portal. But there are some constraints. To ensure that optimum performance is achieved, the system requires the service engineer's workplace to be connected to the Internet and the control system, at the same time. This is not a popular solution with customers who are concerned about network security. But because the future role of

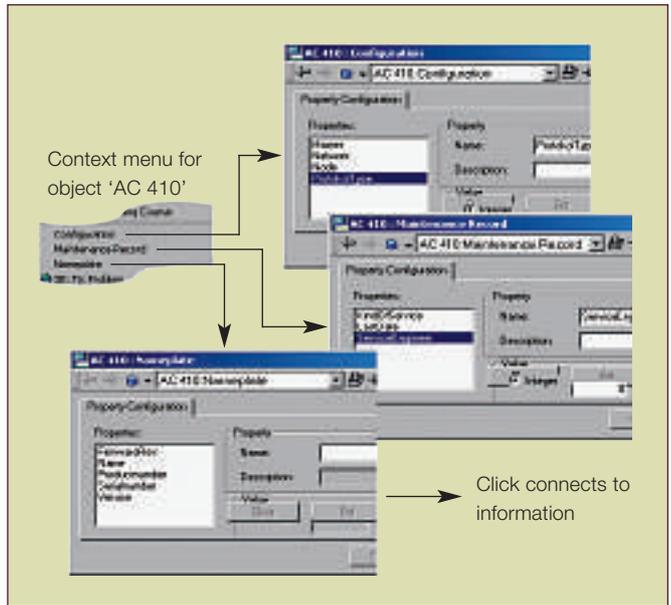
Knowledge Navigator in automation technologies is seen as being important, network administrators should ensure the required network protection is in place.

The full potential of ABB's Support<sup>IT</sup> Knowledge Navigator in the Industrial IT world has yet to be exploited, but the results to date show a tool that will greatly enhance future services for ABB customers.

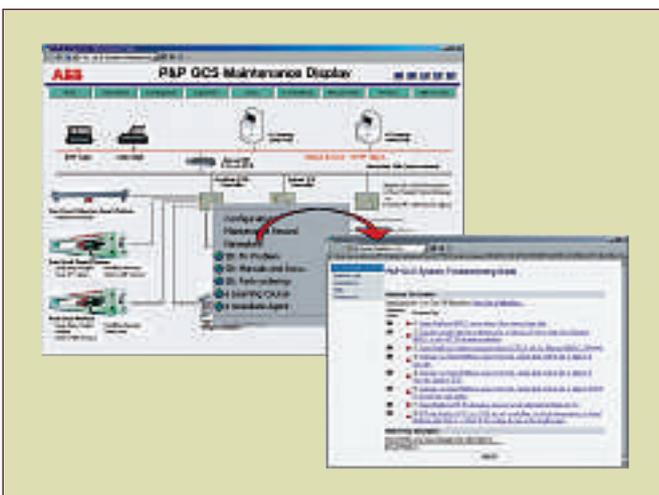
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**3** Standard Aspect configuration



**4** Maintenance display with troubleshooting example



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