

Steeling the show

IBM and ABB are raising the bar in steel manufacturing excellence

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The steel industry of today faces multiple challenges: Some of these are due to the recent rejuvenation of the industry, with consolidation and expansion occurring around the globe. Companies in developing nations are building new mills, while more developed countries are modernizing their existing mills. World steel production has climbed 50 percent since 2001,

and world usage is following closely with 50 percent growth expected between 2001 and 2010 [1].

The rash of consolidations and expansion shows an industry trying to reconcile its costs and market share. Labor and other operating costs still account for about 27 percent of steel-making costs (on average). The drive

to get bigger and better is felt throughout the industry. CEOs and their teams know that they need to improve operationally, defining a major part of the operational agenda for steel manufacturers as: "How can we improve core processes using advanced technology to increase competitiveness and better serve our customers?"



While steel companies have invested billions of dollars in new mill equipment and modernization, many of the core manufacturing processes are left to simplistic planning systems and outdated shop floor applications that don't provide the capabilities required to run the plant in the most efficient way.

There has been some ad hoc creation of systems to attempt to improve this situation, but most companies still conduct in-house operations through simple tools, spreadsheets, or applications that are not integrated. These approaches still rely largely on the operator's experience and require considerable manual intervention. The reliance on these simple tools characterizes a peculiar weak link or gap in the management of steel manufacturing operations – the lack of integration of business systems with the automation and process control systems. This results in inherent barriers and challenges that steelmakers experience daily. These include:

- Disconnect between the plan and execution
 - Operations in silos
 - Complexity of steel manufacturing
- These are discussed in the following.

Disconnect between the plan and execution

Putting together a plan or schedule requires significant effort to generate a single feasible solution. Manufacturing variability, such as quality problems, equipment breakdown and changing business conditions – such as the need to process a rush order – demands continuous adjustments in the schedule. This means that production personnel are left to struggle to overcome these variables.

Operations in silos

While everyone is trying to optimize his or her part of the process, the overall throughput of the company requires:

- A broader view of the production constraints

Footnote

¹⁾ A tundish is a receptacle used in metal foundries to hold molten metal, typically in a continuous flow process.

- Coordination between upstream and downstream operations
- Full visibility of the entire order book and available inventory, including the specifications of each order and actual characteristics of each piece of metal

When companies lack global visibility and properly synchronized operations, this typically leads to inflated lead times. This lack of vision and integration also affects on-time delivery and drives operational costs up.

Complexity of steel manufacturing

The scheduling of melting shop operations is a critical task for any steelmaker, and it directly affects how well the

facility is operating. Companies need to consider several optimization objectives simultaneously – for example:

- Maximize caster uptime
- Maximize tundish¹⁾ life
- Minimize grade transition
- Minimize width changes
- Maximize on-time delivery

The schedule should consider the balancing of the pig iron supply from the blast furnaces with a large number of physical and metallurgical constraints and other business rules.

Failure to manage these processes effectively results in poor operations performance. From a revenue perspective, these shortcomings can cre-

Factbox 1 IBM and ABB Strategic Alliance – a brief background

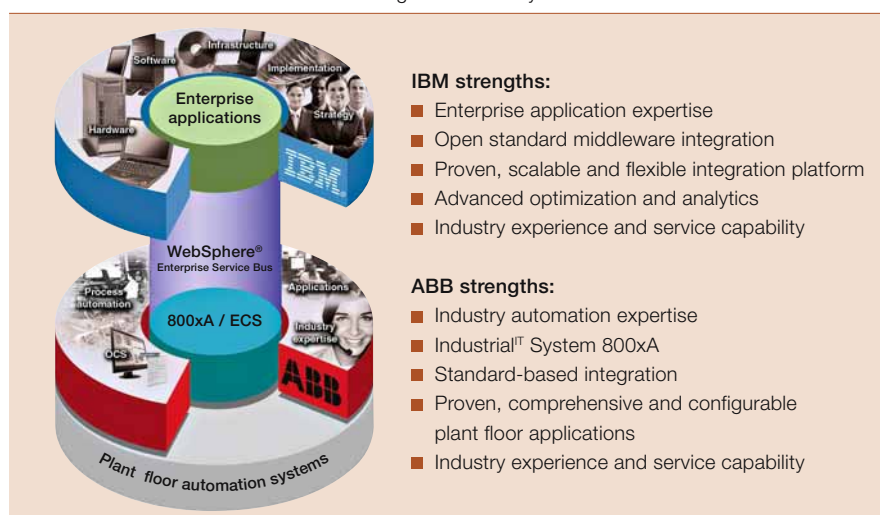
People know they can expect a lot from an industry leader. Now imagine what they can expect when two global industry leaders get together.

IBM has long been both a supplier to, and customer of ABB. Historically IBM has supplied various products and components for ABB's process automation systems. In turn, IBM was a significant customer of ABB's power business. Both companies have similarities in terms of organization and global presence, and complementary services and products. This led to a deepening of cooperation between the two companies, resulting in ABB outsourcing much of its IT support to IBM.

In 2004, a Strategic Alliance was formed between ABB and IBM, focused on developing "vertically integrated" solutions for industry. The joint solution for steel is one of the latest evolutions. The combined business and industry expertise and product portfolio of ABB and IBM provides manufacturers in the process industries valuable partners to achieve the next great leap in productivity.

The ABB and IBM alliance delivers solutions aimed at improving plant performance and integrated business processes by integrating strategy, people, business process and technology components to deliver new capabilities for process manufacturing business transformation.

1 IBM and ABB have combined their strengths as industry leaders



Operational excellence



ate customer satisfaction issues, such as delays in delivering orders as promised, decreased flexibility or even affect the quality of the products. In the worst-case scenarios, plants can suffer production standstills and gross under-utilization of high fixed-cost assets and resources. From the market’s perspective, the worst case might include higher product prices, reduced competition and profit reduction.

IBM and ABB have combined their strengths ¹ to create a unique offering that adopts the latest software technology and the extensive industry experience and services of both part-

ners to help steel companies overcome challenges and achieve levels of efficiency not previously thought possible ^{Factbox 1}.

The IBM and ABB combined solution

The combined solution of the two companies leverages the capabilities of ABB’s Collaborative Production Management (CPM@Metals) [2] and IBM’s Production Design and Operations Scheduling (PDOS) solutions [3,4]. This collaborative offering, called Dynamic Production Scheduling and Execution (DPSE) [5,6], helps bridge the gap between business systems and automation or process control systems ².

The solution is designed to address the needs of all or part of the steel value chain in integrated steel plants and mini-mills – including:

- Primary yard
- Coke plant
- Sintering plant
- Blast furnaces
- Steelmaking shops
- Hot and cold rolling mills
- Finishing lines
- Shipping yards

DPSE uses advanced optimization algorithms that were designed by IBM Research Labs, working with leading steel companies around the world. The solution generates optimized production designs for slabs, coils and plates, as well as detailed production schedules for the entire mill. Companies can implement the optimization modules gradually, reducing time to value and enabling the steel producer to move toward global optimization.

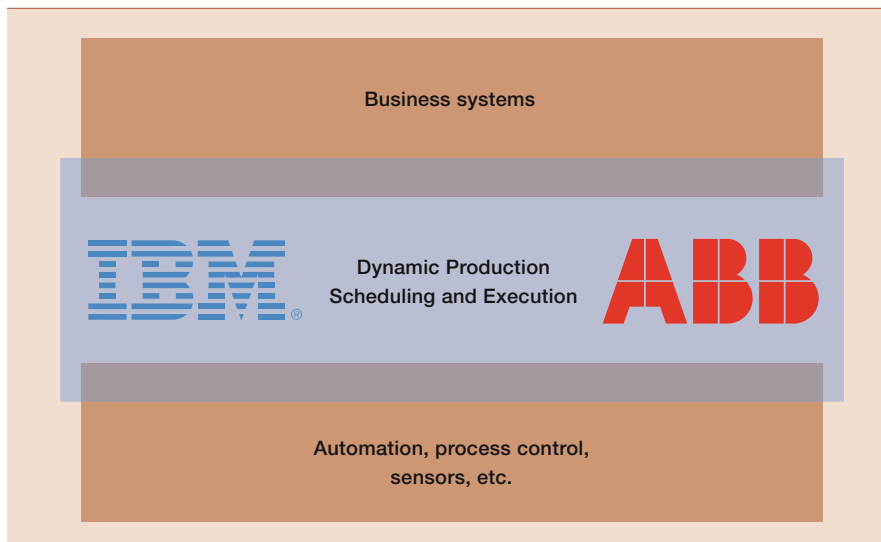
The solution also delivers information that helps improve production activities, from order launch to finished goods. It provides:

- Timely order and inventory data
- Short-term detailed order (piece by piece) sequencing and material allocation capabilities
- Manufacturing instructions
- Production supervision and pacing
- Process optimization
- Information about the actual production status and product quality results

DPSE is designed to enable users to achieve high efficiency in the production process. Its functions support the individual needs of the planners, mill management, operators, quality inspectors and process engineers in carrying out their operational tasks.

DPSE is composed of a comprehensive and configurable suite of modules covering all steps needed for efficient scheduling, rescheduling and manufacturing during steel production. It leverages IBM’s extensive experience in implementing business systems (using SAP, Oracle Manufacturing and others) and leverages ABB’s automation process control expertise. It enables the constant monitoring of all the critical key performance indicators (KPIs).

² Dynamic Production Scheduling and Execution (DPSE) is a collaborative solution by IBM and ABB





DPSE complies with industry standards – for example, OPC and ANSI/ISA-95 – in order to allow the system to operate with multiple existing systems. It supports ISO 9000 compliant manufacturing and is adaptable to individual plant equipment and operation practice. In addition, DPSE is operator-friendly and reliable.

Making the transformation

In building best-in-class manufacturing enterprises, the aim is not to relieve experts of decision making, but to provide them with tools that supply them with accurate information. This allows them to better use their time and expertise to analyze different alternatives and business scenarios. It allows them to come up with the best alternative for their operations as quickly as business need dictates.

IBM and ABB have combined forces to help steel companies overcome challenges and achieve efficiencies not previously thought possible.

However, technology can only take an organization so far. The adoption, training and use of software, as well as its integration into the organization (both technologically and culturally), determines its overall success. Specifically,

the success of such a system depends on how it is supported, including its accessibility, its usability, the quality of the data it uses, and the processes it enables. The supporting resources and infrastructure must be responsive to the new system so that better schedules and coordination can be implemented successfully on the plant floor.

Steel companies considering adopting advanced technology to increase competitiveness and better serve their customers should undertake some critical activities. This will ensure that their initiative becomes a strategic and valuable productivity enabler and not an underused software launch that is never properly adopted. These activities include:

Align the project with company's business goals as they are directly related to the internal and external drivers for the companies. Companies need to make sure the goals defined for the project support their objectives.

Develop an understanding of the current state of operations, including the level of maturity of the “intangible” practices and their relative cost to the organization.

Evaluate the current expertise and skill sets of key operators to understand how they perform their jobs, how skills and knowledge vary across units, and how their participation

affects the greater productivity of the plant or plants.

Understand the capabilities of the software for production design, operations scheduling and operations management. Decision makers need to take a complete view of the software capabilities available. However, it's important to focus on business results rather than on implementation of a specific feature or function.

Develop an operational blueprint and road map that show the operational vision for improvement and a practical, multiphased approach for achieving it. This is a valuable tool for bringing the organization on board.

Building a numbers-driven business case that shows projected costs and benefits. This involves using qualitative as well as quantitative measures. Comparing the current state to the desired state might be tricky, as many of the displaced or mitigated costs will be non-system attributes. Also, it is important to calculate the entire cost of ownership for the new system.

Build consensus and advocacy for making the change among key operational leaders. Organizational commitment is necessary to see the improvement through to the end.

Understand and plan for training and knowledge management programs to

Operational excellence

support the shift. Communications and change management are necessary for the program to be adopted and successful in the long run.

Reaping the rewards

The ability of any innovation to achieve manufacturing excellence ultimately comes as much from the bottom-line benefits it delivers as from the problems it solves.

In the capital-intensive arena of steel manufacturing, return on capital employed (ROCE) can be one of the most valuable measures of success. Considering a typical (and hypothetical) steel manufacturer with a five-million-ton capacity, \$750-per-ton average sales price, \$3.75 billion in revenue and \$3 billion in asset investment. Such an operation spends 16 percent of its costs on operations. By relying on simple tools or spreadsheets, they could be missing opportunities to reduce operating costs by two to 20 percent, reduce inventories by five to 40 percent, increase pro-

duction throughput by two to five percent, and increase revenue by two to five percent. For example, a reduction of four percent in operating cost to produce slab can result in a \$3-per-ton benefit, helping our hypothetical steelmaker to save \$15 million per year in added margin. An \$8 per ton improvement is \$40 million in new margin. ROCE is directly affected.

Leaders in steel production understand that they must look for new levers when it comes to getting more from their steel-producing fixed assets. These levers can include the adoption of advanced software tools supported by the experience of global technology leaders such as IBM and ABB to allow these companies to exploit their improvement potential fully. Ultimately, a better approach means better ROCE and better business: more productivity, better margins and improved competitiveness.

Factbox 2 exemplifies some of the key enablers of IBM and ABB joint offering.

Factbox 2 Steelmakers' challenges and the key enablers of IBM and ABB joint offering

Increase productivity	Increase revenue and market share	Reduce operating costs	Reduce inventories
Better utilization of capacity	Reduced number of lost sales through better inventory search	Minimized rework considering route compatibility	Reduced unused weight and waste
Maximized average slab weight	Higher flexibility to handle smaller orders	Higher manpower productivity	Reduced slab inventory due to better designs
Minimized number of slab and coils to fulfill orders	Improved ability to fulfill high-priority orders	Minimized cutting waste and surplus	Reduced inventory of slabs and coils due to better designs
Higher caster up time	Faster responsiveness to customer inquiries	Minimized waste due to grade transitions	Reduced surplus due to better cast and charge design
Higher hot charging ratio	Higher quality due to less radical gauge and grade changes	Reduced hauling costs for the slab yard and hot mill	Reduced work in progress due to better synchronization
Better production flow due to higher synchronization among facilities	Improved on-time delivery	Higher flexibility to cope with unexpected situations	Reduced finished goods inventory due to better delivery performance
Reduced downtime, and improved yield	Improved quality due to better process control	Better utilization of production assets and reduced maintenance costs	Reduced scrap due to lower deviations and higher consistency

Maximized benefits

As the steel industry has rejuvenated, steel producers have been investing billions of dollars in building new mills and modernizing the existing ones. IBM and ABB have combined their complementary expertise to create a comprehensive offering to enable steel producers to operate at levels of efficiency not thought possible before, maximizing their return on investment.

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Factbox To learn more ...

For additional details and to further understand how the joint solution – Dynamic Production Scheduling Execution – can help customers achieve levels of performance previously not thought possible, please contact either IBM or ABB. Experts throughout the Centers of Excellence of both companies around the globe can show it in action and work with customers to tune these solutions for their clients on an engagement-specific basis.