

# Mine of the future

## Technology convergence advances mining efficiency and productivity

**EDUARDO GALLESTEY, CLIVE COLBERT – “Out of sight, out of mind” is an adage that could have been made for the mining industry. Mines are often in remote areas, can be underground and are seen only by a few. Yet everyone touches the metals and minerals they produce on a daily basis – from humble cutlery to high-tech phones there is very little that does not contain mined product. And that is not to mention the mined fuel that powers the world. Despite this pervasiveness – and a millennia-long history – mining has lagged other industrial sectors, like oil and gas, in terms of technology. But the industry is now at the start of a radical technological transformation that will be brought about by the integration of information and equipment – from rockface to factory – into one coherent extended automation platform.**

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### Title picture

Total integration of all data and equipment will be the hallmark of the mine of the future. Already, systems are being put in place to facilitate this sea change in the industry. Among the many benefits will be the ability to remotely control mines, which are often in far-off locations.

**A**lthough demand for commodities is growing in the long term, the mining industry currently faces a unique set of challenges: Competitive pressure is driving miners to find ways to increase the production rate of their operations, reduce the cost per ton produced and extend the life span of mine sites or establish new ones. People and asset productivity has to rise too as flat underlying commodity prices, rising production costs and high price volatility (caused, in part, by supply disruptions, tight markets and new pricing systems) are currently forcing miners to reduce capital expenditure → 1-2.

Indeed, productivity improvement is now fast becoming a key competitive differentiator and is being built in to financial projection models.

Rising energy costs mean this all has to be accompanied by reduced energy consumption and reduced carbon dioxide emissions. Mine operators are also hav-

ing to look to ever more remote and inaccessible orebodies, and dwindling high-quality deposits. At the same time, miners must strive for higher workforce safety and fewer accidents – mining has, over the years, become much safer, but the number of accidents and fatalities is still at an unacceptable level.

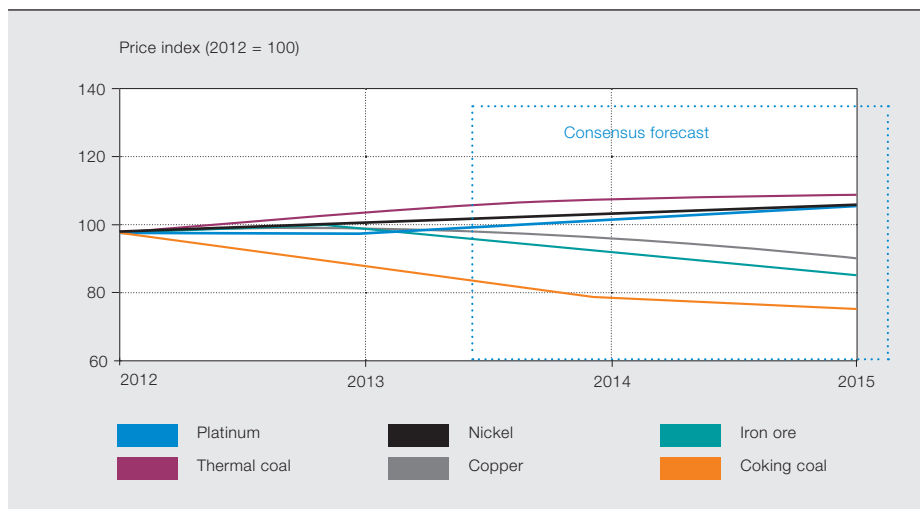
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Although demand for commodities is growing in the long term, the mining industry currently faces a unique set of challenges. The solution to these, and the future of mining, lies in automation and integration.

Added to all this is an aging workforce. In common with other industries, the age profile in mining is slowly creeping up and retiring workers are leaving with valuable know-how and experience. The situation is exacerbated by the remote and inhospitable location of many mines, which makes it difficult to bring in experts and recruit and retain competent staff.

The key to the future of mining lies in total integration. For example, with a modern automation platform such as ABB's Extended Automation System 800xA, an entire mining operation can be controlled.

1 Commodity prices have not performed well in recent years, making productivity improvements all the more urgent.



The solution to all these challenges, and the future of mining, lies in automation and integration of information and the use of that knowledge for real-time optimization of the mining processes.

**An integrated view**

Automation is not new to mining, but the automation employed in mines is generally more basic than in other industries and is often limited to simple control of motors, equipment or certain parts of processes.

Further, mines tend to have a large number of independent pieces of equipment and systems from different suppliers.

The key to the future of mining, then, lies in total integration of data and work processes. For example, with a modern automation platform such as ABB's Extended Automation System 800xA, an entire mining operation can be controlled: The System 800xA automation platform can handle traditional process-control systems, distributed control systems (DCSs), safety systems and electrical equipment such as drives and motors, as well as production planning, power management, maintenance, asset management, enterprise resource planning and documentation systems. These can be integrated into one single control environment. The system can integrate

Integration of underground communications also improves production efficiency: Once a communication infrastructure has been established underground entirely new worlds of data exchange possibilities open up.

different users, live video, voice and public-address systems, plus Web applications and devices. Besides ABB products, third-party products can also be integrated in the process workflow.

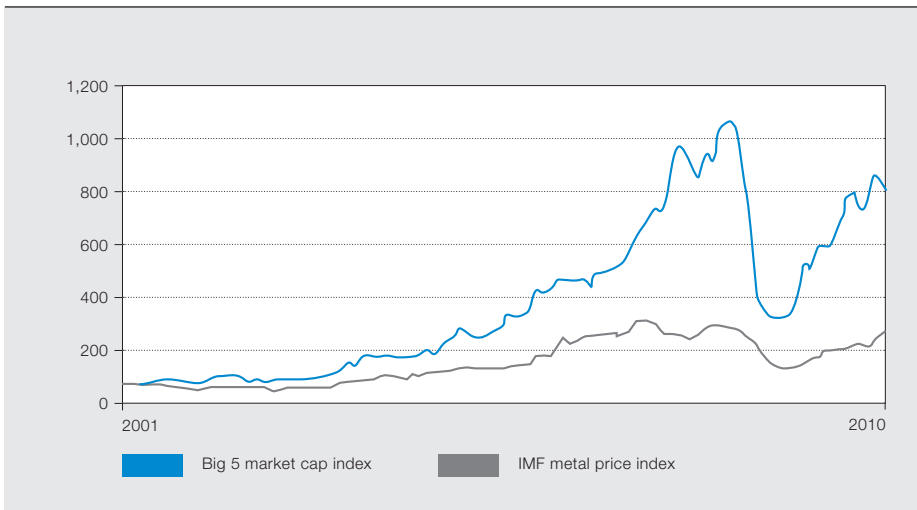
This convergence channels more and more information from real-time systems into software, enriching four key

Each of these "islands of automation" can have its own data, data format and interfaces, and operators and control-room staff must scrutinize a multitude of conceptually disconnected screens in order to coordinate different parts of the process.

areas that will enhance efficiency, responsiveness and profitability across the mining value chain:

- Intelligent production, and higher people and asset productivity
- Intelligent response to critical asset condition

2 High price volatility makes it all the more important to have a detailed view of the entire mining process – from rockface to end customer.



In ore-processing plants, the biggest uncertainty is the ore properties. Plants can react faster to variability if the ore properties are quantified ahead of time.

- Demand-driven planning
- Reduced energy consumption and waste

### Intelligent production

Data integration can dramatically improve production efficiency and productivity → 3. Some examples are:

#### Process optimized according to ore properties

In ore-processing plants, ore properties are the source of the biggest uncertainties. Plants can react faster to variability if the ore properties are quantified ahead of time. Extended automation makes this possible, as material movements and ore grades are tracked all the way from the mine to the processing plant.

This information can also be used by process optimization controllers that use these forecasts to make predictive adjustments to the grinding and flotation circuit according to the exact now known properties of the ore. The result is higher equipment utilization, increased recovery and lower energy consumption.

#### Production targets optimized according to market conditions

While some miners already have advanced process control (APC) solutions for real-time beneficiation (grinding and/or flotation) process management, most are unable to easily align this with the real-time conditions in the market. For instance, miners are unable to contextualize information on relative product pricing, data on ore and information from sales contracts, because this information

is stored in disparate systems, often in a completely different unit from the control room operators.

Convergence of business IT systems and process control systems will allow the APC systems to refine the process set points to maximize financial returns for the current feed material and product pricing based on information from the sales and global pricing index.

#### Wireless communications enable just-in-time optimal process management

Integration of underground communications also improves production efficiency: Once a communication infrastructure has been established underground and the mobile and fixed equipment fleet has been computerized, entirely new worlds of data exchange possibilities open up. For example:

- The results reported by mobile equipment, such as online production status and production reports, analyses and statistics, can be retrieved. Further, the location and status of mobile equipment, including their local environmental data, can be monitored online.
- With this information, new drill plans and loading sequences for the production machines can be calculated and supplied in a timely manner to the operational teams underground for execution.

ABB and Atlas Copco Underground Rock Excavation, Sweden, have developed an innovative mobile integration system involving the System 800xA auto-

A modern asset optimization system can help mines to go from reactive to predictive maintenance strategies, avoiding unnecessary maintenance and reducing operating costs.

**3 Effective integration of data from across the enterprise is essential to improve efficiency and productivity.**



mation platform and Atlas Copco mining machines. The solution is currently installed in a mine in Kvarntorp, Sweden. This technology will offer mine operators unrivalled process control opportunities and information.

The communications infrastructure is invaluable for asset tracking too.

**Intelligent response to asset condition in real time**

Failure of a critical production asset can have a catastrophic impact on production targets. The loss resulting from a main conveyer failure, for example, can run into hundreds of thousands of dollars per hour.

A modern asset optimization system can help mines to go from reactive to predictive maintenance strategies, avoiding unnecessary maintenance and reducing operating costs. Extended automation solutions such as System 800xA can integrate modern maintenance systems from suppliers such as IBM, SAP or Ventyx. Real-time data on asset conditions can then be used to streamline maintenance effectiveness and enable condition-based monitoring.

In the case of the conveyer system above, if an asset monitor was to detect an abnormal condition, an alarm would be generated and the control system could slow the drive to reduce failure risk. Once integrated, these systems would connect directly into the IT sys-

tems and automatically raise a work order with the site maintenance crew. Once the crew completes the work, the completion could be instantly reported, allowing the control system to return systems to their normal state in the shortest possible time.

**Demand-driven planning improves profitability**

The mining supply chain extends from the extraction of raw materials through the transport of products to the end customer. To achieve production and productivity targets, mining companies need to achieve high operational performance and efficiency across supply-chain processes.

Better integration and automation across processing plant operations, mine planning and asset maintenance/management will guarantee the right product is available at the right time. It will also make sure that customer orders are accepted only when the supply chain can deliver them, thus improving negotiating power and risk management. In addition, this unified view ensures that equipment maintenance can be scheduled to minimize impact on production schedules while maintaining the required level of availability.

**Reduced energy consumption**

Improvements in energy efficiency can be driven not only by improvements in mining processes and technologies, but also by greater visibility and process

#### 4 Visualizing System 800xA in a mobile environment to improve supervision, control and maintenance at the Boliden Aitik copper mine in northern Sweden



control across the value chain through information integration and process optimization.

For example, ventilation can consume as much as 50 percent of the total energy expended in underground activities, so ABB has now developed a new unique method for mine-wide coordinated control of fans and air regulators to achieve

#### Remote operation centers enable the vision

Mines of the future will be run from remote operation centers. Data from all parts of the operation will flow together to allow precise management of mining – from rockface to end customer – and resources and production to be optimized across multiple sites. A relatively simple example of mine/factory confluence can already

be seen in an integrated power generation and coal mining company in Europe: When stock levels at the plant get low, an automatic message is sent to the fully automated mine, which digs, blends and mixes the coal automatically for delivery to the power station. Completely

automated and optimized through one central control room, it represents the ultimate goal of future mining projects.

## Better integration and automation across processing plant operations, mine planning and asset maintenance/management will guarantee the right product is available at the right time.

an energy-optimized and reliable solution that automatically feeds air to where it is needed.

Information convergence can reduce mining energy demands in a number of other ways too – for example, by forecasting energy requirements to exploit off-peak energy, modeling “what-if” scenarios for energy-intensive production steps and giving insight into the energy profile of a site.

#### Future mining

ABB is committed to the mining industry and has a research program that covers all relevant topics – from sensors to modeling, visualization and optimization.

A holistic approach to the entire mining operation will feature smart devices and equipment – enabled for autonomous configuration, efficient operation and

self-diagnostics – as well as software that delivers total, real-time transparency for the operators → 4. This provides visibility of resources across the mine; intelligent production based on near real-time demand, market conditions and available ore types; and an optimal response to critical asset conditions.

By harnessing the full potential of extended automation and by bringing people, equipment and systems together in a fully integrated environment, ABB firmly believes that mining companies can vastly improve productivity, workforce satisfaction and safety. The automation journey for the mining industry has just begun.

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