The Internet of Things – which is an essential part of the German initiative Industrie 4.0 – is synonymous with the digitalization of industrial processes. While some industries are far along in the digitalization of manufacturing processes, others like the minerals sector still have some ground to cover. Technologies are available today to help mining companies increase digitalization and at the same time tackle the woes plaguing the industry.
Declining grades. Price volatility. Project suspensions. These are just some of the lesser-than-pleasing trends that companies in the minerals industry have to contend with. Unfortunately, there is no indication that these challenges will let up anytime soon. Part of the answer, it seems, can be found in how mining firms organize themselves and their business processes.

This is the general tenor in “Tracking the trends 2015,” a study from the Deloitte consultancy firm on the mining industry. The study lists the top ten issues mining players can expect to confront this year and strategies to buck the trends. The first three deal with improving operational excellence, among others by collecting and using data intelligently; embracing innovation, including technologies and applications now used in other industries and applying them to solve problems in minerals production; and reducing costs, particularly for energy.

“Tracking the trends 2015” also includes quotes from experts, which together paint a future of increased digitalization. Their overall message is that by adopting innovative technologies and making increased use of information technology (IT), mining companies can put themselves in an even better position for the next upswing. Simply put, digitalization can be seen as a valuable tool to help mine managers to do their jobs even better.

More digitalization

The idea of expanding the use of technology and IT to gain a competitive advantage is nothing new. Basically, this is the cornerstone of a movement to embed more and more objects with electronics, sensors and software, and allow the objects to communicate with one another via the Internet. Fittingly, the term Internet of Things has been coined for the trend. For many branches of industry, the Internet of Things is seen as a spearhead for a revolution in manufacturing. In Germany, the Internet of Things is an essential part of an initiative called Industrie 4.0 – an initiative of the German automation industry sponsored by the German government. Its objective is to define the way forward for manufacturing companies in the Internet age.

Thomas Walther, who is in charge of Minerals Automation at Siemens, says that Industrie 4.0 means introducing more intelligence to a process industry over the entire lifecycle: “From planning to commissioning, including operations and maintenance, more steps that were previously completed manually will be done without human intervention.” Some industries have been quick to adopt a higher degree of digitalization in their processes and are already closer to this vision of Industrie 4.0. A forerunner in this regard is the automobile industry. The mining industry, however, is still at the beginning. As suggested in the Deloitte trend study, it is time that mining companies embrace innovations that have proven their value in other sectors. When thinking about where Siemens can offer well-proven elements from other industries for the specific challenges of the mining industry, three solutions stand out in particular: end-to-end process automation.
and instrumentation; the engineering and application software Comos for the entire plant lifecycle phase which in turn serves as a basis for completely digitalized production; and a software platform like XHQ (eXtended Head Quarters) that collects data from a number of sources to give decision makers and management a real-time condensed overview of all information so they can make the best decisions possible.

**Automation: the basis**

For quite some time, Siemens has been laying the groundwork for digitalization. The introduction of Totally Integrated Automation (TIA) in 1996 enabled the coordination of components in production processes, allowing companies to closely integrate their software and hardware. Siemens has since continuously enhanced the TIA offering. In 2007, the company introduced a comprehensive family of product lifecycle management (PLM) software products, to which it is continually adding more modules. The aim of PLM software is to optimize product development. And to achieve this goal, design, prototype development and simulation take place in the virtual world so that development times can be significantly reduced.

In the mining industry, the groundwork for the journey toward digitalization starts with rock-solid automation – automation that boasts the highest availability, reliability and efficiency possible. Automation can be seen as the brain, a closely knit network of sensors and instruments as the eyes and ears, and integrated drive systems as the body. Minerals Automation Standard is Siemens’ process control system for the specific requirements of the mining industry. Minerals Automation Standard is closely related to Cemat (see page 40), the market leader for process control systems in the cement industry. More than 40 years of matured
Industrie 4.0

As manufacturers look to the future, they are examining how advanced information and communication technologies can boost value creation. In Germany, this development is called Industrie 4.0. Similar initiatives have been launched in other European countries, China, the United States and elsewhere. Industrie 4.0 aims to achieve production-related advantages by creating a networked, flexible and dynamically self-organizing manufacturing process for highly customizable products. Over the next 15 to 20 years, it is expected to be accompanied by a paradigm shift that could justifiably be called the fourth industrial revolution. The result will appear to be revolutionary from today’s point of view, but ultimately it will involve a large number of development steps in a process of evolution.

The first industrial revolution was triggered by the invention of the steam engine and the mechanization of manual work in the 18th century. The second revolution was made possible by the introduction of electricity and involved the use of mass production techniques in the early 20th century, and the third was ushered in during the past few decades by electronic systems and computer technologies for automating manufacturing and finishing processes. Now the rules are changing again in many sectors, due to the digitalization of the entire value chain and continuous and pervasive access to a comprehensive range of information in the form of virtual models, data and knowledge.

Anglo American counts on Minerals Automation Standard

“For future developments, Anglo American Platinum will be focusing on digitalization and automation of its production processes. The Siemens Minerals Automation Standard will be key to meeting these requirements and it offers an ideal basis for economical and future-proof solutions.”

Gary Humphries, Head of Process Control at Anglo American Platinum Limited

functionality for automation of cement plants and for typical mining automation application functions are combined in the solution. With the migration concept integrated into the automation, the investment of a client is protected and at the same time the operator can profit from the latest innovations in the software standard.

Minerals Automation Standard ensures that operators receive the best support for performing their duties. Innovative and proven functions for operation and integrated maintenance functions assist in fast diagnosis of potential faults – even before the appearance of a problem. Downtimes are thereby reduced. The mining-specific library provides the best route to increased operational efficiency. Especially in regard to engineering: predefined and proven functional modules and faceplates for many applications and processes make engineering easy, fast and reliable. Minerals Automation Standard utilizes the modern process control system Simatic PCS 7 with its open, flexible and scalable architecture as its system platform. The advantage of a high level of automation is that operators know the status of each piece of mechanical equipment.

Only when a control center has access to all the data at a mine can it begin to leverage that data to improve overall day-to-day operations. Automation alone isn’t enough – everything has to be connected with one another. However, mines are generally in remote areas with a harsh environment. Furthermore, great distances between the different process steps are the norm – for example excavation at the top of a mountain and beneficiation in a lower-lying valley. It therefore takes special technology to connect the process automation and individual plant sections as well as mobile equipment like trucks in the different parts of a mine. Standard communications networks fit for harsh environments like products in the Ruggedcom portfolio from Siemens do the job. They link everything at the field level and transport the data into the overall network. Adherence to international standards such as IEC 61850 and IEEE 1613 ensure reliable communications and secure transmission.

High levels of electromagnetic inter-
and not just in the operations phase:

Siemens that can help save money, is, though, another solution from out an audit a great deal easier. There automation, of course, makes carrying on-investment calculation. End-to-end tion. The audits also include a return-
tify potential to reduce energy consump-
on all consumers in a mine and to iden-
tures from a single source

Savings with smart engineer-
ing and beyond

The Deloitte study calls on mining operators to reduce costs, particularly with energy. Siemens has a wealth of experience in this area, for example with highly efficient drive trains in which all components are ideally de-
signed to fit with one other. For exist-
ing systems, Siemens performs in collaboration with customers energy audits to produce a transparent picture of all consumers in a mine and to iden-
tify potential to reduce energy consump-
tion. The audits also include a return-
on-investment calculation. End-to-end automation, of course, makes carrying out an audit a great deal easier. There is, though, another solution from Siemens that can help save money, and not just in the operations phase: Comos, the plant engineering software platform. The software solution con-
tains applications for all plant lifecycle phases, from engineering and opera-
tions to modernization as well as dismantling.

At the heart of a plant operating with Comos is a common database. Because all data is always available and up to date, it depicts the actual as-built status of a plant at all times. This is especially helpful in planning modernizations, since there is no need to catalogue the current status of a plant with the arduous task of up-
ning old plans. Formerly separate fields such as process technology, mechani-
cal and electrical engineering and con-
trol technology are all combined into the standardized data structure of Comos. Furthermore, Comos simplifies data exchange between partners and suppliers, thereby helping to avoid misunderstandings.

A special aspect of Comos is the range of software solutions for the en-
tire plant lifecycle. Three applications come to the fore in the engineering phase: Comos Platform provides a basis for effective overall data management. The creation of process data and all aspects of process engineering are covered in Comos Process. Comos Automa-
tion supports electrical engineering for a plant through to full automation cov-
ering all processes relevant to electrical, instrumentation and control engineer-
ing. Comos Automation also has a Simatic PCS 7 interface for exchange and software engineering with a dis-
tributed control system (DCS). All data created during the engineering phase can be reused in the operational phase.

For the operational phase, Comos Operation assists in implementing an efficient plant support strategy. Available applications include solutions both for maintenance during ongoing operations and overhaul during shut-
down. Comos Lifecycle supports com-
prehensive information management throughout all plant lifecycle phases. The benefit is maximum reliability in decision-making. Plant operators have worldwide access to data and docu-
ments, so they can react quickly to changing market demands. “Perhaps one of the greatest advantages of Comos is that changes made in one application are immediately reflected in all other applications,” says Walther. Cement plants operating with Comos enjoy significantly lower costs – by approx-
imately 60% – and less effort and time are needed for daily operations. And with completely up-to-date engi-
neering models, it is not unheard of for throughput time to be reduced by more than 50%.

A number of industries are already benefiting from Comos. In pharmaceu-
ticals, the Swiss company Novartis Pharma AG in close cooperation with Siemens launched a program for a standardization of its engineering worldwide. Since 2004, Novartis Pharma has been successfully using the Comos software solution for the pur-
poses of plant engineering, lifecycle data management and plant document-
ation. In the meantime, the entire en-
gineering at the main production sites – including process technology as well as electrical, measurement and control technology – has been carried out exclu-
sively with Comos. The customer reports significant improvements in terms of efficiency and quality.

The big picture with XHQ Enterprise Operations Intelli-
gen

Comos offers worldwide access to data and documents, but that is generally not enough to make the most informed decisions. Therefore, Siemens offers XHQ Enterprise Operations Intelligence; XHQ stands for eXtended Head Quar-
ners. Originally created for the oil and gas industry, XHQ has long found use in other sectors to aid in improving operational excellence through the collection and intelligent use of data.

Operations personnel throughout all levels of a manufacturing organization typically struggle to pull together a complete, timely picture of a situation. Like missing pieces of a puzzle, critical information is often scattered throughout a variety of databases, enterprise applications and operational systems in a wide range of formats with a confusing mix of unrelated contexts. Only when this information comes together in a meaningful way can it be used to react to a given situation. Therefore, XHQ extracts, aggregates, relates and presents operational and business data from a variety of information sources—enterprise resource planning (ERP), data warehouse, production databases, document management systems, process historians and manufacturing. XHQ provides users with a wide, unique range of coherent, up-to-the-minute information. This data is then used to monitor performance and make better, more informed, actionable decisions—for greater efficiency and reduced costs. XHQ can be easily customized for each user.

The true advantage of XHQ comes from the fact that decision makers have relevant, personalized and easy-to-understand information at their fingertips. Production plants can be tracked in real time, and the data can be compared, for example, with price indices, KPIs and other company production sites, wherever they may be. This information allows operations performance to be taken to the next level. Answers to questions such as how am I doing against objectives, how are we doing collectively, and what should we do in this situation given current conditions can be answered easily with XHQ.

For the mining industry, XHQ gives operators access to real-time information that can strengthen the ability to maintain performance of equipment used for mining operations. With XHQ, operators can monitor equipment performance within specified operating parameters, based on a metrics strategy. Operators can reduce the probability of operating limit exceedances using alarms, alerts and notifications to ensure the most effective troubleshooting. Access to this equipment health monitoring data can be made available to operations managers, equipment operators, sensor vendors and service personnel to provide important transparency for equipment health, and thus can be used to improve and sustain mining operations.

Influenced by a successful implementation of XHQ and a Manufacturing Execution System (MES) over the last seven years in its steel plants, a Brazilian customer selected Siemens business Chemtech to deploy XHQ and MES to control the entire iron ore production chain from the Casa de Pedra mine to the port of Itaguaí. XHQ is totally integrated with MES so that operators can manage the production and logistics of the mine-port supply chain. Custom KPIs and a drill down to individual segments are established according to the needs of each user. XHQ consolidates data generated by MES in a standardized and simplified way, guiding the analysis of managers and supporting the decision-making activities of process coordinators.

**Great potential for minerals**

All of the solutions described above are available today—and they have been individually employed at mining sites all over the world. “Until now, there still isn’t a mining industry reference in which all the solutions we mention here have been installed,” says Walther. However, as more and more companies make investments in digitalization, he is optimistic that it won’t be long before there is one. The willingness to invest in measures to increase productivity looks good.

The BN Americas Mining Survey 2015 reports that 93.5% of mining company respondents are planning to make investments in 2015 to improve productivity. One aspect includes automation and technical improvements, and better equipment maintenance practices. In all cases, Siemens has extensive experience. Those who embrace a higher degree of digitalization will increase their flexibility and be able to more quickly adjust to changes in the market. The problems facing the minerals industry today do not look like they will be gone anytime soon. The possibilities of digitalization, however, can ease the way. Siemens is using its expertise to help the minerals industry become more effective and save money. The only prerequisite is a willingness to embrace innovation. With more digitalization comes access to the most up-to-date information. So whether we’re talking about price deterioration or lower ore grades, operators can find the best solution to ensure profitability.