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# MINING INDUSTRY FROM TRADITIONAL TO INTELLIGENT INDUSTRY IN CONSISTENCY OF THE EUROPEAN UNION REQUIREMENTS

**MARIA DANIELA STOCHITOIU[1], ILIE UTU[2]**

**Abstract:** In order to benefit today from all the advantages of the intelligent production of tomorrow, the connection between the real production and the processes based on digital data is necessary. To be successful in the future, too, standards and guidelines must be open to development. This means that changing framework conditions and new business models can be provided for, too. Smart engineering represents the base for tomorrow`s intelligent mining production in the use of consistent digital information.

**Keywords:** sustainable development, primary energy security of supply.

## 1. FEATURES OF INTELLIGENT INDUSTRY

The rise of new digital industrial technology, is a transformation that makes it possible to gather and analyse data across machines, enabling faster, more flexible, and more efficient processes to produce qualitative produces at reduced costs [9].

The so-called fourth industrial revolution or intelligent industry is now upon us with big data, connectivity and automation. The current level of innovation and strategic partnerships within the mining technology space demonstrates the agility of businesses and bodes well for the future of the industry [1]. The continuing trend in the development and application of technologies in the mining sector will no doubt influence how the industry will look in the medium to long-term, which is therefore a credit to foresight and lateral thinking, whether this results from cross-sector alliances or/ and responding directly to practical needs [10].

Industry 4.0 is a name given to the current trend of automation and data exchange technologies. The four principles are followed:

- interconnection: the ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet.

[1] *Ph.D., Associate Prof. Eng., University of Petroşani, danielastochitoiu@upet.ro*
[2] *Ph.D., Associate Prof. Eng., University of Petroşani, ilieutu@yahoo.com*

- information transparency: the transparency afforded by smart industry technology provides operators with amounts of useful information needed to make appropriate decisions. Inter-connectivity allows operators to collect immense amounts of data and information from all points in the manufacturing process, thus aiding functionality and identifying key areas that can benefit from innovation and improvement.

- technical assistance: the ability of assistance systems to support humans by aggregating and visualizing information comprehensively for making informed decisions and solving urgent problems on short notice. [7].

- decentralized decisions: the ability of systems to make decisions on their own and to perform their tasks as autonomously as possible.

The basic principle of Industry 4.0 is that by connecting machines, work pieces and systems, businesses are creating intelligent networks along the entire value chain that can control each other autonomously. In order to establish the new requirements, interdisciplinary competencies are growing an importance, which is why it is necessary to adapt the skills and abilities that are taught for the various trades.

## 2. THE EVOLUTION OF EXPLOITATION INDUSTRY

Technological advances can now provide an automated and better standardized process that achieves consistent production levels from previously laborious processes. The production of low –margin bulk minerals has been developed with more advanced equipment that is not only remote-controlled but incorporates the ability for output levels to be far less variable.

The concept of remote controlled mining, introduced thirty years ago, and demonstrates how forward thinking the industry is in terms of reducing the human element involved. It also highlights the level of sophistication this has now reached, with advanced capabilities now constantly feeding into its evolution [2].

In the mining sector, technology is not restricted to automation, for example, sorting machinery uses this tool to separate valuable mineral ores from waste rock, significantly reducing the time. Incorporating individual solutions like this is now commonplace, but the mining sector's leading players have the internal capacity, funding and resources required to develop their own technology, helping to push the innovation boundaries further [11], [12].

Mining, a conservative and traditional industry, has shifted its focus to efficiency and productivity only in the past decade. Despite the dominance of continuous processes in mining, at an abstract level, a mine site is not much different to a factory for discretely manufactured goods when it comes to efficiency, productivity and the entire value chain [3], [4].

As a consequence, advances and developments of intelligent and smart factories once adapted and transferred to the specific requirements of mine production and the mining value chain as Mining 4.0, will be the main driver and cornerstone of digitization and the development of smart mines.

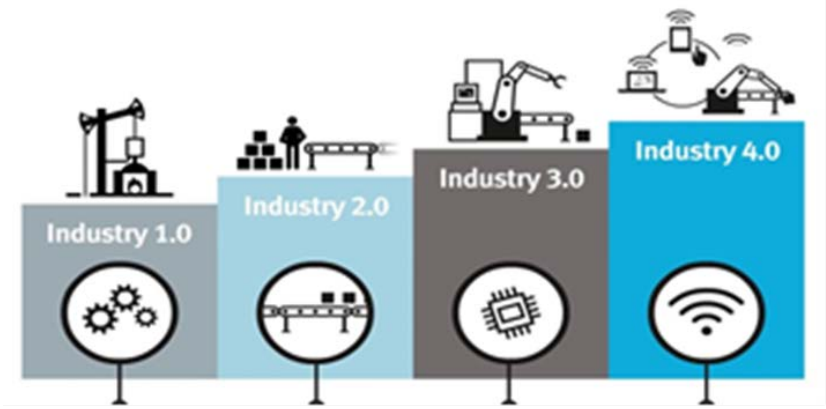


**Fig. 1.** Transition from 1st to 4th industrial revolutions in mining

The first innovation in mining started from mechanization using hydraulic drills, and steam powered engines (fig.1). The second revolution started with the mass production and assembly lines along with electricity, giving miners more access to more and better equipment with the aid of electricity. The third revolution starts with computers and automation, giving way to various mining robots to perform dangerous excavations and also to lift heavy materials. And lastly, and the current industry are in is the fourth revolution or "Industry 4.0".

## 3. THE POSSIBILITY TO SHAPE THE INTELLIGENT PRODUCTION FOR TOMORROW

The answer to this question lines in the new opportunities in which people, machines and data can interact. The smart industry combines the real world of production with the virtual world of information and communication technology; therefore traditional industrial processes are supplemented and optimized by the digital world [6]. This creates the foundation for the series manufacturing of individual products to a high standard of quality.

In order to establish the new requirements, interdisciplinary competencies are growing in importance, which is why it is necessary to adapt the skills and abilities that are taught for the various trades [5].

Modern SCADA (supervisory control and data acquisition) systems feature considerable flexibility and power, permitting applications where a wide variety of industries and applications can be monitored, controlled and analysed with this software. One such industry is mining, where a number of subsystems have to be integrated into one view console to form a comprehensive overview of the mine (like reticulation, environmental monitoring, asset tracking, etc.) [12]. The system is an environmental monitoring system and its main function is to collect environmental parameters (like CO and methane gas, temperature and humidity, status of ventilation fans and dam levels, and many more operational parameters which are essential to the safe and effective operation of a mine) and then transmit these parameters via a telemetry network to a SCADA system.


**Fig. 2.** The management scheme of the industry processes

A customized approach supports the principal need for technological solutions:
- to increase the level of automation throughout the entire mining industry,
- increasing accuracy,
- reducing human input in the process.

There are many technologies/methods can be involved and these include:

- drones. Drones in mining are used for exploration of mining sites by taking images and videos that are relayed to the operator. These data are therefore used for planning, and mapping.

- 3D mapping. Mapping mining sites helps mining companies to evaluate ideas and plans, where to drill and make tunnels and routes, to gather more materials at a reduced cost. It also lessens the risk of tunnels collapsing which will save lives and costly equipment.

-robots. The mine inspector robot carries a high-definition camera that scouts dangerous areas to ensure the safety of miners.

The modern industry is still improving and has growing innovations involving advanced engineering, etc. The use of data-mining as an analytical tool has been increasing in recent years; and the emergence of new manufacturing paradigms such as the Intelligent Industry initiative have led many smaller manufacturers to look at utilizing these powerful techniques; however, practical applications are still in their infancy, and remain out of reach for many of these manufacturing enterprises.

Mines and open pits are obvious places where explosions can occur. But they could also happen where the flammable vapours, gases or combustible dusts are likely to occur the quantities of sufficient to cause a fire or explosion. While national regulation exist appear the necessity that international approach to increase safety where workers and communities are exposed to high risk of explosions occurring.

The equipment used in these environments and especially in the mining industry is increasingly based on a single engineering approach and on fundamental principles of explosion protection, which have been applied in industry and mines for over 100 years. These are codified in international standards such as the IEC60079 series.

Minimum requirements for improving the health and safety protection of workers potentially at risk from explosive atmospheres should be taken into account: likelihood and duration of the presence of the explosive atmosphere; likelihood of ignition sources being present, activated and becoming effective; materials and methods used and their possible interaction; the extent of the expected impacts of explosions. [13]

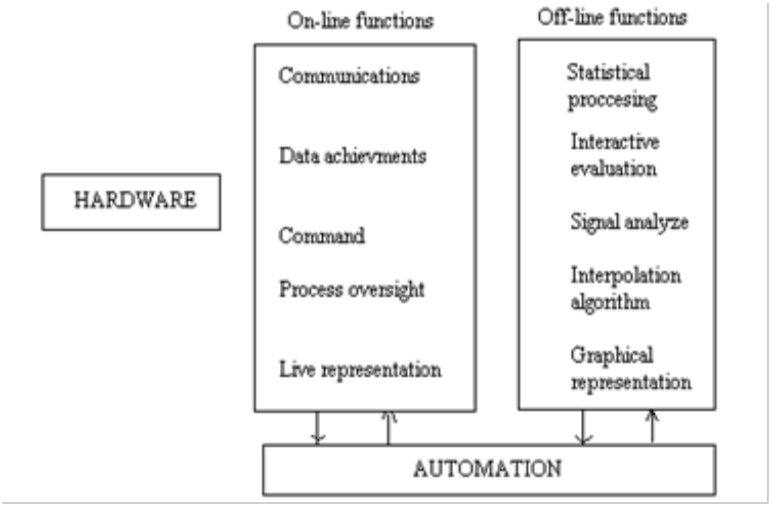


**Fig.3.** The software functions for smart measurements systems

The main advantage of measurement system commanded by PC compare with the classic methods of measurements is consisting in the larger opportunities of configurations (fig.3). The solutions and intermediate results have to repeat for every domain for classic apparatus, the PC numeric measurement system realise the same function only changing the customers interfaces. Using standard software (S-Soft) associate to measurement devices it can realize modern updated acquisition data, process monitoring, control and results analyses [9].


**Fig.4.** Standard elements through the computerized measurements system

The Standard In the software domain can emphases more aspects as shown in above figure. It should take into account the compatibility between different software

productions which have the purpose to fulfil the same scope or function (fig.4).

Basically, the smart industry is the combination of information and communication technologies into the electric transmission and distribution networks for mining process [8].

An important role of distributed energy systems in combination with power electronics devices is considered and will have a huge impact on future electrical supply systems and lead to many financial benefits, the challenges for a self-healing power grid in reliability, efficiency, security and resilience of energy infrastructure.

## 4. CONCLUSIONS

In order to establish the new requirements, interdisciplinary competencies are growing in importance, which is why it is necessary to adapt the skills and abilities that are taught for the various trades.

Modern SCADA (supervisory control and data acquisition) systems feature considerable flexibility and power, permitting applications where a wide variety of industries and applications can be monitored, controlled and analysed with this software.

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