**15. Mining 4.0 - Utopia or Dystopia**

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In previous chapters, we have described various development opportunities for future mining work. Here we will try to summarize our experiences in two extremes, a negative dystopian development and a positive utopian. The two visions are read and illustrated on [www.xxxvv](http://www.xxxvv). The chapter concludes with six recommendations on how to start shaping the future of Mining 4.0 on human terms

How will Mining 4.0 affect tomorrow's mining work? There is no clear answer to that question. There is no inherent technological determinism in the development; it will depend on the choices that we make. It's up to us. The dystopian scenario gives this miserable picture:

*You have to be grateful that you even have a job. Most of the jobs have disappeared, and the entire municipality is depopulated. There are some qualified jobs located in the control center above ground, but most of these jobs have moved to town and are carried out remotely via the net. Some work is even done from India. It's not just an A and B team anymore; we now also have a C team. What remains is mostly maintenance work. We are wearing augmented-reality glasses and carrying out tasks according to the instructions that we get from central maintenance or a machine supplier. Sometimes we have to put on an exo-skeleton* *if there is heavy lifting.*

*But everything is not bad. The work is not as dangerous as before, because we do not work at the front nowadays, and there are no diesel vehicles anymore. Underground everything is automated, but of course we must install the electricity and access points, and then you notice that the company has reduced the ventilation. The blasting gases still remain far into the shift and you can feel your heading getting heavier as the day drags on. What I miss most is my workmates; we have our mobile phones and tablets so that we can keep in touch with each other, but it is not the same as when working with the boys.*

The utopian vision becomes much more pleasant to accept:

*Most of the underground work is automated and no one works near the front anymore. The production control takes place from a bright and pleasant control room above ground. The routine monitoring work has been automated; with AI you get a better stability in production. Our professional role has been extended to include the entire value flow, from mountain to customer. If we see an opportunity for improvement, we can switch over to our digital twin to experiment and test the outcome.It is always fun if you can trim the production; and then not only financial measures apply, but also so-called green measures, such as saving water or reducing greenhouse gas emissions. We are quite proud that our company takes a great social responsibility, not only for the environment but for a prosperous society that can offer a rich social and cultural environment.*

*When something goes wrong in the production, it is indicated in our mobile phones and usually we can solve it with a few keystrokes. But sometimes we have to go into a VR model and maybe direct a robot to a crusher to break apart a boulder. If the error has not occurred before, we sometimes have to go down into the mine to understand what has happened. When we are forced to go down into the mine, we always wear a safety vest with sensors so that one can follow where we are and warn if any dangerous environmental factors appears, or if something seems strange to our health.*

*Last month my daughter even started working for the company. She is a computer science major but works as much with my colleagues as she does with a computer. For a long time, I thought I would be the last miner in the family. It feels good to know that there will be a new generation, and that young people have stopped moving away. It seems the company’s investments in the community, and insistence on training and using locals, really payed off.*

The scenarios are exaggerated but probable. Mining 4.0 can definitely represent a positive development, but there are many questions that must be cleared. Based on our experiences and and previous research, we want to bring forward six recommendations that can be considered as a beginning of a road map for developing Mining 4.0 on human terms:

* We need more ways of measuring success, ways that capture social factors.
* Any reduction in the workforce must be managed with great transparency and in close cooperation with the trade unions.
* All employees must be included in competence development; leave nobody behind.
* Create a flat organization that empowers employees and encourages their creativity.
* Handle privacy and integrity issues in close cooperation with the trade unions and workers.
* Embed all changes in a context of great social responsibility

It is important that the mining industry is active in creating Mining 4.0, but we also know that it will take time and there will be many obstacles along the way. To succeed we must be vigilant and attentive to all aspect of modern mining – future as well as past.

**References**

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