

Breaking Down Organizational Silos through Normalizing Uncertainty

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Paradox of Uncertainty

- We are in Stochastic Mine Planning Lab where uncertainty is being celebrated as something “great”¹
- Thanks to digital revolution, engineers found ways to increase mineable resources by taking advantage of stochastic nature of an orebody.
- However, in the human context uncertainty means unpredictability, which could result in insecurity and conflicts.
- The objective of the presentation is to ascertain that uncertainty can, if it is properly managed, also lead to breaking down of silos in mining companies.

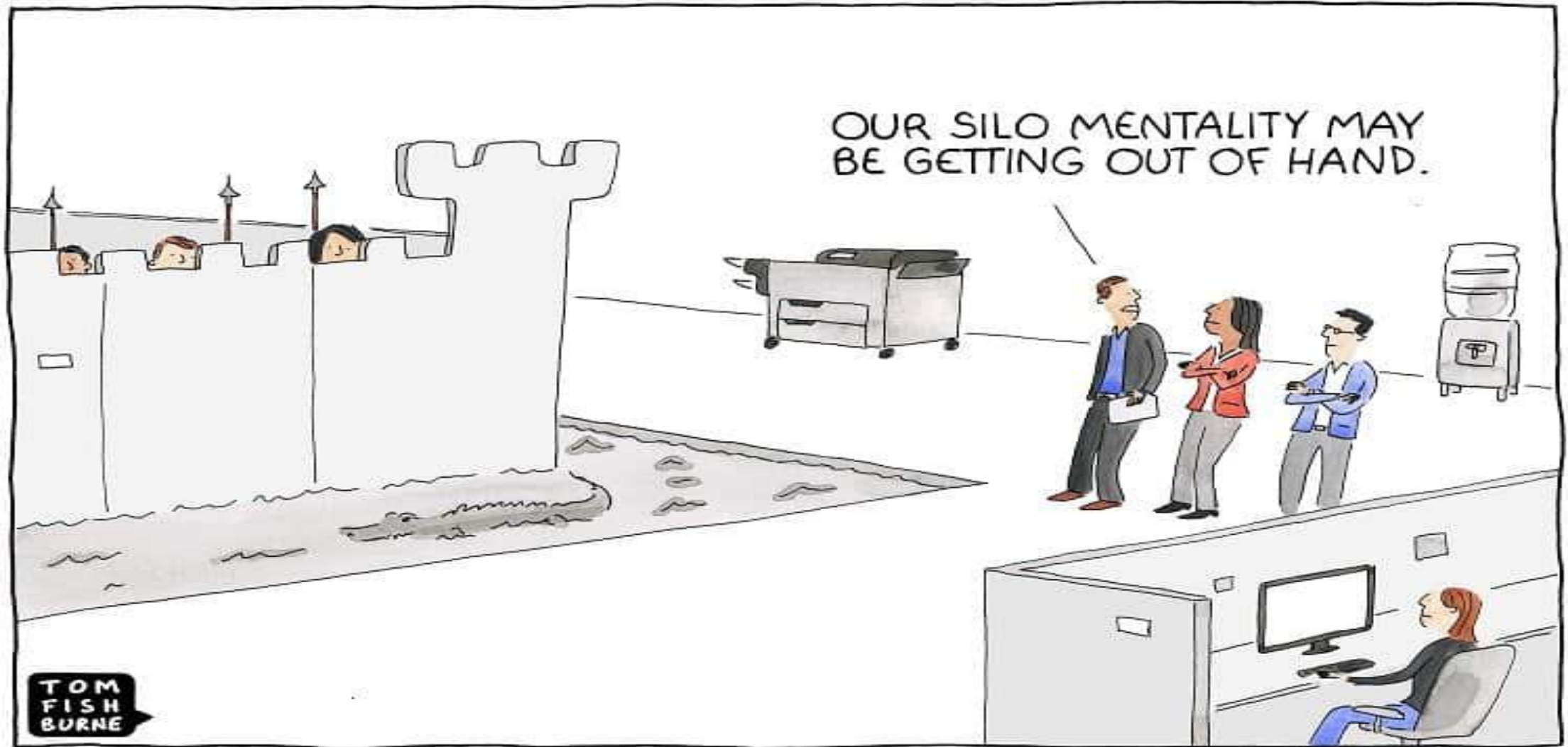
¹ Stochastic Mining Concepts, Applications and Contributions – Roussos Dimitrakopoulos

Topics to be covered

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1. Introduction – silos are everywhere.
2. Effects of silos due to uncertainty in mining.
3. Minimizing uncertainty – a technological approach.
4. Breaking down of silos – a behavioural approach.
5. Organizational restructuring to sustain behavioural changes.

Everyone Talks About Silos, but..



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Silos Are Everywhere and Flourishing

- **The Silo Mentality is a mindset**
 - ✓ not wishing to share information with others.
- This type of mentality will reduce efficiency and is bad for moral,
 - ✓ **May contribute to poison company culture.**
- In spite of all efforts, silos have not disappeared.
 - ✓ **It is the duty of the executive leaders to break down silos.**²

Mining is Special with Mother Nature its Supplier

- Ore is varied and non-homogenous
- A mining company owns its resources
- Its employees characterize the ore body
 - ✓ **Plan, excavate and blend the feed for the process plant.**
- Since variability cannot totally be eliminated,
 - ✓ **plants have to balance between grades and recovery**
 - ✓ **results are not always optimal**
- When things go invariably wrong
 - ✓ **who is to blame?**

Who is the Culprit?



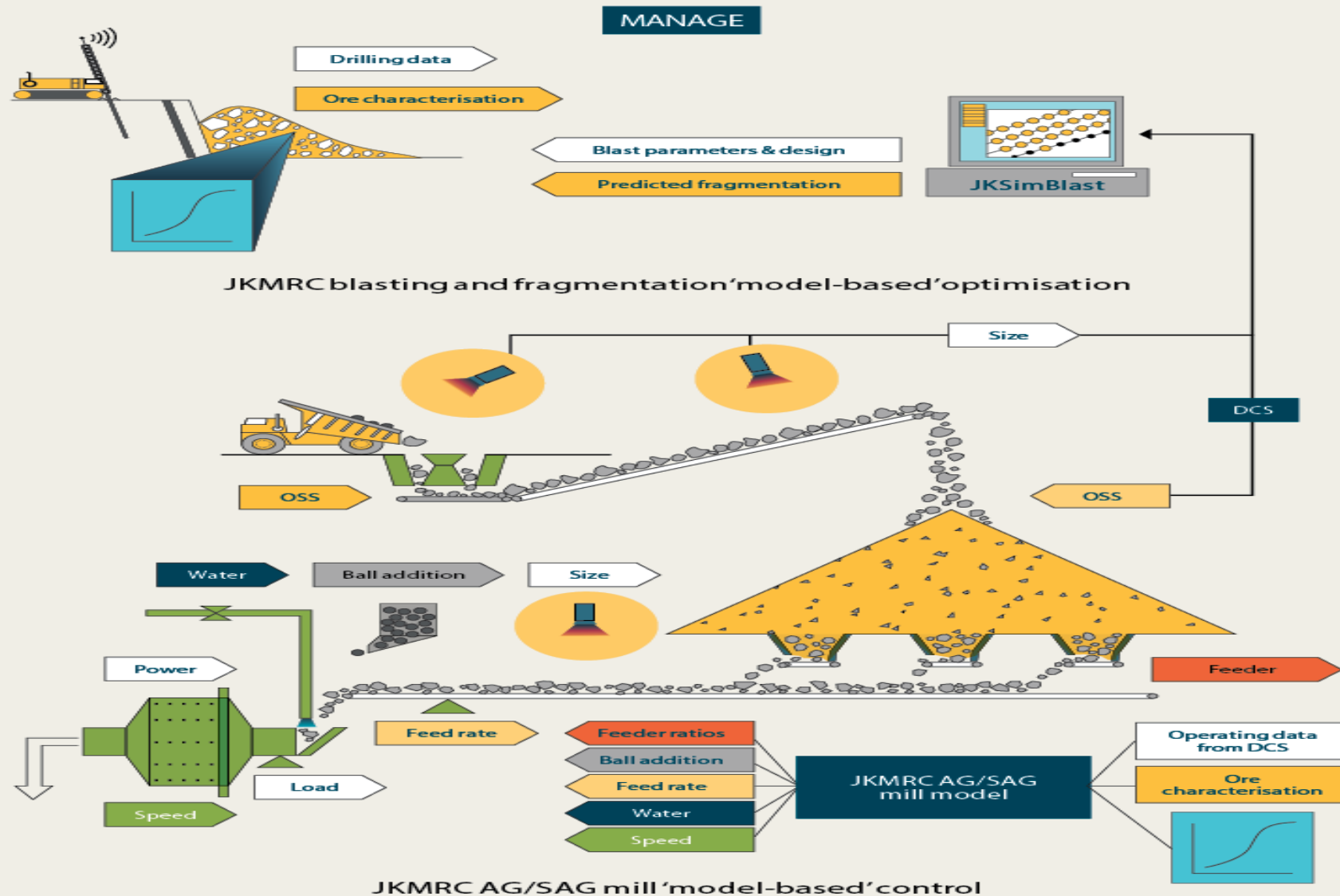
SO, NOW WE HAVE ASCERTAINED WHO IS RESPONSIBLE....

Four Solitudes – When Doing the Best is Not Enough

- Four functions are collectively responsible for quality of concentrates:
 - ✓ Geology
 - ✓ Mine planning
 - ✓ Mining operations
 - ✓ Process plant
- Each speaks different languages and focuses on optimizing its own area.
- **Conflicts are natural when results are sub-optimal.**
- Each thinks:
 - ✓ **We are doing our jobs the right way.**
 - ✓ **Others are not competent.**
 - ✓ **They should bring their own houses in order.**
- **Ultimately, the whole organization suffers.**

If it Cannot be Fixed, Automate.

Figure 1. Extract from the Julius Kruttschnitt Mineral Research Centre's 1999 Mine to Mill brochure.



Effective utilisation of Split-Online™, JKSimBlast and the JKMRC AG/SAG mill model can deliver significant increases in productivity.

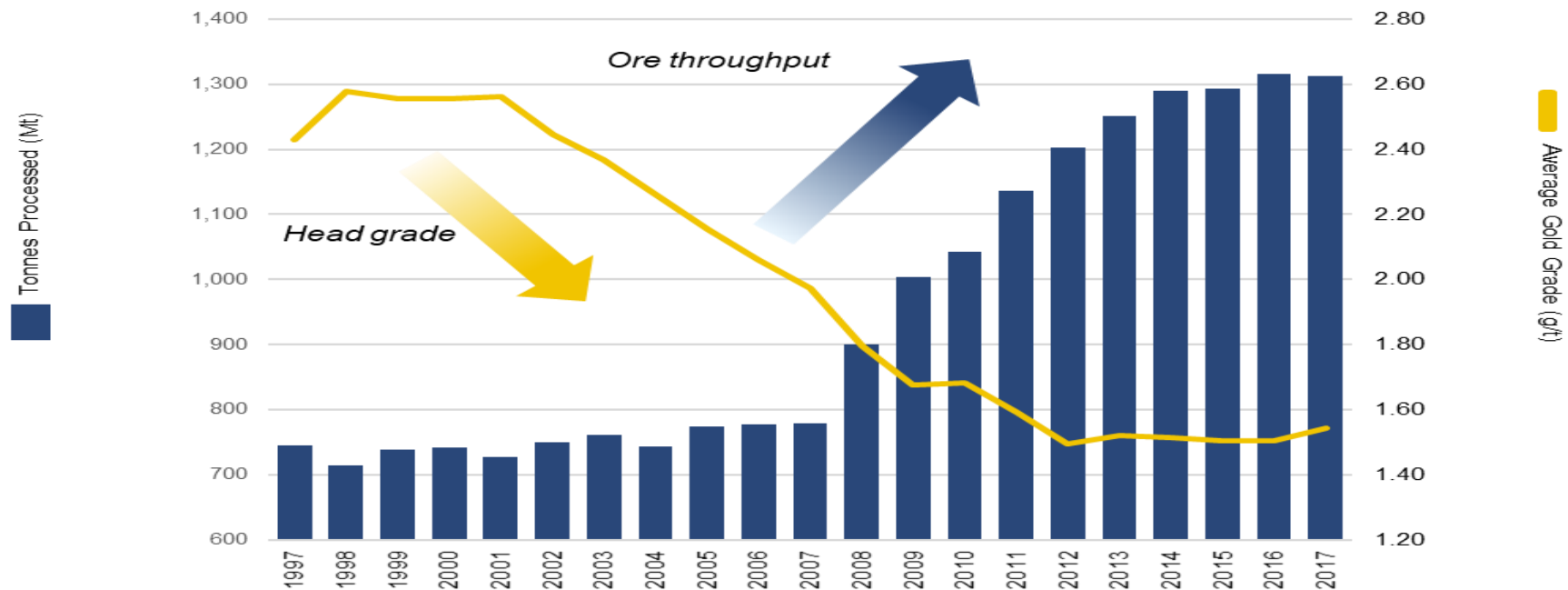
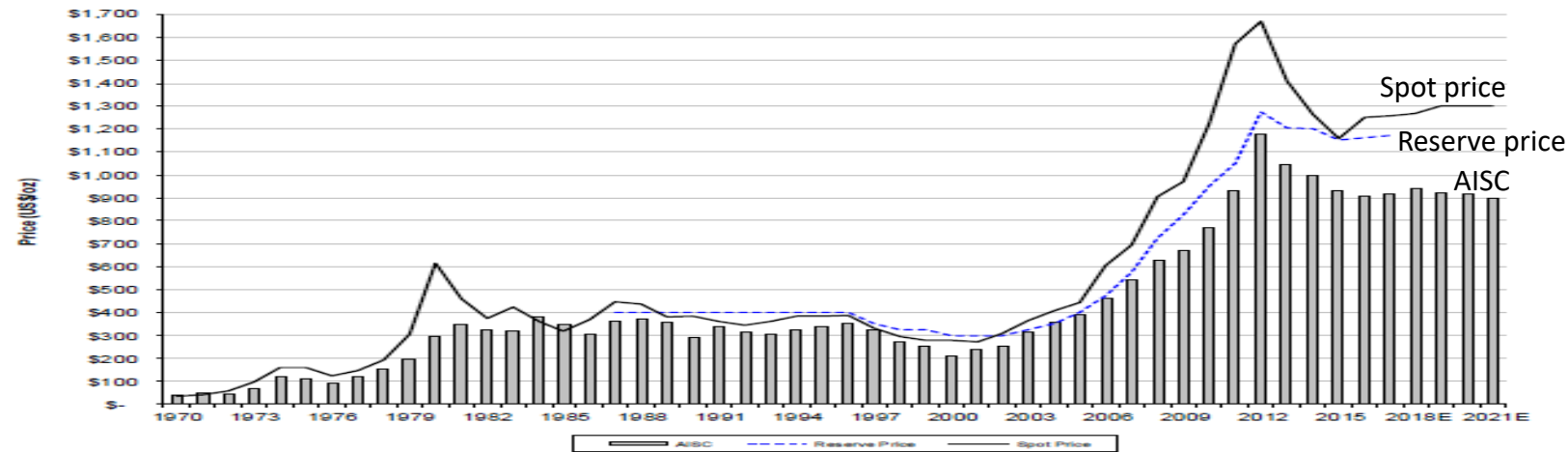
In Technology, We Trust!

- Mine to mill automaton was developed in the 1990s to increase productivity³.
 - ✓ Need to survive in persistently low metal price environment
- This advancement was made possible by:
 - ✓ Research and development in fundamental knowledge and sensor technology
 - ✓ Availability of high speed digital tools to manage a vast amount of data
- The projects were successful in achieving 10-20% improvements:
 - ✓ **Through management support and co-operations between all functions**
 - ✓ **Developers hoped for more gains through continued co-operations**
- In time, functions retreated back to their silo mentality.
 - ✓ **Understanding in human behaviour was needed to sustain gains through technology**

³Based on “ The ABC of mine to mills and metal price cycles by P. Cameron, D. Drinkwater and J. Pease – Feb. 2017

Back to Square One: Costs Gone Up & Grades Deteriorated

(Ref. Scotia Capital-Gold Statistics, Feb. 2019 & National Bank Financial Markets)



Automation 2.0 in the Digital Age of IoT and AI

- Mining is challenged in the aftermath of recession that began in 2012:
 - ✓ **Falling metal prices**
 - ✓ **Rising costs base and falling grades**
 - ✓ **Need to survive in volatile macro-economic environment**
- Mining was connecting autonomous equipment and remote operation of equipment to build “mines of the future”.
- **Next phase: collecting all data and optimize by using massive computer power.**
- **Some Consultants are advocating an all embracing digital transformation to develop smart mines.**
- **Might there be an ultimate technology based solution for mining’s salvation?**

A Formidable New World of Smart Mines

CSC

The Smart Mine EVOLUTION

CSC provides a wide range of technology and business solutions to natural resources companies like BHP Billiton, Rio Tinto, Woodside Petroleum, Chevron and Inpex. Our services include mine IT planning and execution, logistics, equipment tracking, information and technical data management, and remote communications.

To help these and other miners meet their business and financial goals, we combine industry-specific knowledge with technical insight and process expertise. We have a deep understanding of capital projects, geosciences data management, mine operations planning, plant operations, orebody modelling, fleet management, and stockpile control and accounting. We combine this industry knowledge with expertise in aligning IT priorities to business goals; implementing and optimising IT architectures and value chain optimisation, including supply chain management.

CSC is a Fortune 500 company recognised by over 150 analysts for the provision of enterprise outsourcing, application development, enterprise architecture services, complex systems integration, performance engineering, program and change management. These credentials are supported by ITIL and ISO accreditations and CSC's global Catalyst methodology which provides a common framework, language, and processes to deliver

consistent, efficient and high-quality services and solutions.

By partnering with CSC, you get access to our 98,000 staff operating in over 40 locations throughout the world and a rich heritage of supporting natural resources clients and their global operations. Contact us today at csc.com/natural_resources

FUTURE INSIGHTS

Insights from our experience can enhance future mine planning.

1 REMOTE OPERATIONS CENTRE (ROC)

Our experience in command and control centres provides a competency to architect a 'network centric mine'. This approach supports the co-location of expertise to make better operational decisions through enhanced visibility and optimisation of people, equipment and assets.

2 FUTURE WORKER

Our extensive research into smarter PPE has resulted in 'smart-glasses' and hands-free voice and video. Field-workers are linked to remote experts allowing visual work instructions to be displayed in real time. This will improve time-on-tools and lower head count on site.

3 AUTOMATION

We deliver advanced automation solutions to industries such as defence, aviation and aerospace. Technologies such as Industrial Wireless, systems integration, fleet management, and Geospatial Information Systems can be used to support the complex automation of components throughout a mine site.

CAPITAL PROJECTS

CSC's role in end to end mine planning reduces capital investment and risk.

4 MINING REFERENCE MODEL

Robust architectures and processes developed over 15 years combine the shared knowledge of our mining industry experts, who've designed and built fully integrated solutions in operations around the world. This helps us deliver capital projects quickly and brings discipline, ensuring all functional requirements are delivered and can support a standardised approach across multiple mines.

5 PROVEN EXPERTISE

Our consultants have a wealth of experience working on major projects, in many geographies, with clients around the world. They provide engineering discipline to the delivery of ICT projects in a mining environment. Their operational expertise adds insight to mine planning with an eye on business process redesign and the entire mining value chain.

6 OPERATIONAL SUSTAINABILITY

Our engineering approach combined with our experience, delivers sustainable system design that can evolve with the changing operational requirements over the life of the mine.

SAFETY

Our culture of safety is demonstrated by our accreditations in occupational health and safety. In mining, our Licence to Support certification enforces the safety of our field service and onsite personnel

WORKFORCE MANAGEMENT

Our integrated solution streamlines travel, site access and contractor management resulting in reduced compliance risk and increased efficiency

COMMUNICATIONS

As systems integrators, we provide telephony, wireless data and two-way radio communications that create a safe and informed environment

ENABLING A SMART VALUE CHAIN

Decisions on your mine - during plan, build and operate - are all about optimising value and safety. Our combination of integrated solutions and services enable optimisation from the long term mine plan to the short term logistic schedule

REAL-TIME DECISION MAKING

We provide collaboration tools, accurate data and timely analytics to enhance decision support systems across the value chain

TRANSPORTATION AND SCHEDULING

Our integrated logistics capability can connect multiple systems to optimise product movements, rail/port operations, through to product delivery

UNDERGROUND

Our Decline Traffic Information System uses RFID tags, readers and antennas to increase productivity and improve safety in a hostile environment

MAINTENANCE

Our material, repairs and overhaul capability allow us to enhance planning and operations, maximising equipment reliability, lifecycle and production throughput

MOBILITY

Our wide range of fully-integrated mobility services support the remote dispatch of work orders, tracking of fixed assets, mobile assets and people

SOLUTION MODELS

Why choose CSC? We deliver flexibility, scale and in-depth knowledge of your industry.



BROKERAGE
Balanced and objective advisory services from industry experts



TURN-KEY
Highly efficient, industry-specific, standardised platforms that provide high value



FIXED PRICE
Confidence in our ability to deliver on-time and on-budget



AS-A-SERVICE
A mechanism for providing cost predictability and control



RISK AND REWARD
Innovative solutions that will deliver value to your bottom line



EXPERTISE
Combining industry-specific knowledge with technical insight and process expertise

CSC Proprietary

A Stochastic Pattern may not be Accurately Predicted.

- IoT and AI can improve understanding of orebodies, but:
 - ✓ cannot totally eliminate variability
 - ✓ cannot prevent periodic upsets
- Digitization should be carried out in a step by step:
 - ✓ **Existing systems are delivering 70-80% of benefits of automation**
 - ✓ **Last 20-30% will require enormous time and resources⁴**
 - ✓ **Taking on too big projects could be wasteful**
- What are needed to be ensured:
 - ✓ **People are talking to each other**
 - ✓ **Instead of blaming, cooperating to solve issues**
- **How would we dismantle entrenched barriers, which are embedded in the culture?**

⁴ Cameron Harris : So we have survived, what now?

Change begins when Uncertainty becomes a New Normal

- As the first step, Management team must propagate a clear message to all employees:
 - ✓ **Uncertainty is a norm in mining**
 - ✓ **Things could always go wrong.**
 - ✓ **It does not have to be somebody's fault**
- Messaging might not be enough to instill trusting relationships.
- Relationships have to be redefined as between internal customers and suppliers:
 - ✓ **Each has to serve its customer's needs**
 - ✓ **Customer has to communicate with supplier**
 - ✓ **Both have to be transparent to each other**
- Management must ensure that the process is properly followed.



All Customers Count, Also Internal Ones⁵

- **“Our customers are the reasons for our existence” – W. Edwards Deming**
 - ✓ This is often overlooked in captive internal customer-supplier relationships.
- Because of uncertainty, it is critical in mining operations to have awareness of:
 - ✓ **Interdependency between functions to satisfy common external customers (Figure 1)**
- Serving external customers needs requires satisfying demands of internal customers
 - ✓ **Institute understanding and satisfying needs of internal customers (Figure 2)**
- Satisfaction of external customers' requirements is possible only when:
 - ✓ **Customers will specify their service requirements to their suppliers**
 - ✓ **Service levels have to be based on consensual agreements**
 - ✓ **Each supplier delivers right intermediate products/services to its internal customers**

⁵Based on Author's Edumine course – Achieving Sustainable Improvement through Behaviour Change

Satisfaction Through Eyes of Customers



Figure 1 (Ref. Glen Steyn and Associates – Core Competencies)



Figure 2 (Ref. C³ Plus Consulting – Lean QCD)

Trust, but verify – Words do not count, but Actions do!

- Establishment of a formal structure is simple,
 - ✓ **But, changing mindset and ingrained silo culture will be difficult.**
- People want to see others change first before they are willing to change themselves
 - ✓ **It might take five years or longer to change the culture.**
- Employees should receive training to adapt to the new way
 - ✓ **Acceptance will happen when employees see that management is committed**
 - ✓ **convinced of benefitting themselves.**
- **Setting measurable goals and communicating successes will help buying into the process.**

The customer is
not always right,
but they are always
the customer!

~Shep Hyken

www.Hyken.com

Sustaining Cultural Transformation Process

- Normalization of uncertainty is the start of a paradigm shift,
 - ✓ **Internal customer and supplier relationship is the key to breaking down of silos**
- Sustaining the process requires a strong CEO commitment with the support from a full time champion, who will be dedicated to administer the process.
- S/he should be an honest broker respected in the organization to ensure:
 - ✓ **The process is fair and based on consensus**
 - ✓ **Resources are allocated to support desired service levels**
 - ✓ **The system is working on a mutual trust basis**
- This will lead to:
 - ✓ **Early recognition of problems**
 - ✓ **Prompt initiation of remedial actions**

Listening to the Voice of Customers

- Critical factors to sustain the process:
 - ✓ **Maintaining dialogues between functions.**
 - ✓ **The process is mutually beneficial.**
- Maintain confidence in the process, management must ensure:
 - ✓ **The operation is guided by the voice of customers**
 - ✓ **The relationships work both ways.**
- The hallmarks of customer focused culture are as follows:
 - ✓ **From a concern about themselves to a concern for customers**
 - ✓ **From suspicion to co-operation**
 - ✓ **From withholding information to sharing**
 - ✓ **From turf protection to commitment to a common goal**
 - ✓ **From quantity to quality**
 - ✓ **From blaming to motivating**
 - ✓ **From isolation to understanding the dual position as customers and suppliers**

**If it is properly managed, uncertainty can be “great”
to expand possibilities.**



Thank you, any questions?