

Leading in complexity - Turning around the worldwide decline in mining productivity

The following is the transcript of a lecture delivered at the Da Vinci Institute: School of Managerial Leadership on 29 March 2016 by Hendrik Lourens.

Overview

What do leaders need to do to ensure the success of their organizations? All situations are not created equal and for leaders to be successful they need to realize that different situations require different responses.

Today I will use the Cynefin Framework to show the consequences of ignoring this advice and how to successfully navigate the issues business leaders are challenged with. The Framework introduces the principles of complexity science to managers and guides them in navigating the environment they face. An article on this framework "A leader's framework for decision making," published in the Harvard Business Review, was selected as the 2007 Best Practitioner-Oriented Paper in Organizational Behaviour by the Academy of Management.

We will get back to the Cynefin Framework later, now I would like to start with a story that demonstrates the importance of making sense of the environment before embarking on a leadership initiative or trying to lead.

In 1982 the Nummi plant in Fremont California was shut down. This was a General Motors plant and it had a troubled history. The workers were mostly African American and Hispanic and for years the plant had struggled terribly with productivity and quality problems. Furthermore, they had severe employee issues with alcoholism, absenteeism and even sabotage. So when sales volumes decreased GM management jumped at the opportunity to shut this plant down. But in 1984 Toyota signed a joint venture agreement with GM and it was decided to restart the plant. GM strongly advised Toyota to rehire the management whom they believed were of high quality and under no circumstances to rehire the previous workers. It is rumoured that GM top management referred to these workers as "the worst in America". Toyota did the opposite: they rehired all the former workers and none of the management members.

What happened? Within a year the plant outperformed most of the GM plants in the US and in the next year it outperformed most of the plants in Japan. Same workers, same equipment but different leadership style/managers. What did Toyota do differently? Toyota believes that once management has designed the manufacturing plant and decided on the specifications, the plant employees cannot be held responsible for cost. Their only concern is producing efficiently and to the right quality. Provided that the required production rate is maintained, the cost will take care of itself. (When we compare Toyota plants to most American ones we see that they employ about 1/6th the number of accountants for a given output.)

How did we get here?

What is making effective leadership so difficult in business? - Mining as an example

I want to use the example of mining today to illustrate that even when we do proper sense-making and know what to do success is not guaranteed—not when the predominant world view forces decisions, which belong in the Complicated Domain, to be made in the Obvious. Mining is a good example due to its relative simplicity compared to other Industries. In mining, firms are price takers, so management's attention is predominately focussed inwards, trying to maximise production for the lowest cost possible.

I will try to show the consequences of this mismatch in mine closure, job losses, low employee engagement and difficulty in becoming sustainable and managing according to the triple bottom line. In fact, miners spend a great deal of time and money on all sorts of interventions to try and address these issues. I will talk today about an intervention that moves mining management from the Obvious to the Complicated Domain, and which solves all of these problems at once, at a fraction of the cost of traditional interventions.

The problems in mining

Mining productivity is at an all-time low. In the 1990s in deep level, narrow reef chromium, gold and platinum mines an average advance of 24 m per day was achieved. Today the average is around 8 m per day. A McKinsey report from 2015 shows that worldwide mining productivity has decreased by 29% over the last decade. This is happening on all continents in all mining jurisdictions. How is this possible? What mechanism could be responsible for the synchronized decline? Mining especially is under severe economic pressure and mine closures are decimating employment (could easily reach 100 000). To add insult to injury, the 2013 Gallup poll shows South African workers as the third most actively disengaged in the world, tied with Syria. (Actively disengaged workers are not just sitting around doing nothing, they are actively looking for ways to damage the organisation they work for and ways to dismantle others who are succeeding.)

We only have to look at the Marikana massacre to see that pursuing profit only can have tremendously negative consequences. Lonmin lost 99% of its value in less than 5 years. This leads us to what is required to manage the triple bottom line of "People, planet and profit". An enterprise dedicated to the triple bottom line seeks to provide benefit to many constituencies and not to exploit or endanger any one of them. However, addressing the aspects of the triple bottom line separately is time consuming and ineffective. In a pressured environment of low profitability, low engagement it is not possible to look after the planet. Survival is the first priority.

So if any of the triple bottom line items are negatively affected we cannot sustain our business performance.

Lack of leadership ability at middle management level

I often hear business people and consultants say that we suffer from a shortage of good leaders and workers, especially in mining. May I see by a show of hands who here has come across this? Who would agree with this statement?

Are there systemic anomalies in the situation just described?

Identifying anomalies often leads us to identify new ways of doing things which leads to success. There are examples where companies have managed to fix their leadership problems and achieved brilliant financial results with highly engaged employees in a short period of time.

So I would like to tell you the story of a mine in Lesotho.

In 2014, a Productivity Platform (we will discuss the details of this methodology later) implementation on a mine in Lesotho led to a transformation in production and employee engagement. The mine was 3 months behind on its payments to suppliers and had reached the end of its life. I was assured that the local workers and managers were not of a high standard; literacy and numeracy levels were problematic; they were not accountable; not willing to take initiative. When I looked around I saw confirmation of this.

In most organisations, as we move higher up in the hierarchy, the understanding of the issues faced on the ground becomes less clear. The production process in mining is subject to high variability and interdependency and obtaining good production flow requires management and workers to have the same view of what is happening. To create visibility, we captured the production flow on large sheets of paper and used colour codes to indicate the health of buffers and production rates. The managers and workers from all functional departments received 2 weeks of training around the principles of operating the Flow Room. Then we had to stop our support for about 3 months due to the unstable political climate, amongst other things. In much of this period of instability, the better-qualified South African personnel were unable to enter Lesotho.

But on re-entry, a miracle seemed to have taken place. The red had disappeared off the board, replaced by green. Having been described as “not of a high standard and not accountable” 3 months earlier, the Lesotho workers at this site rose to the challenge and exceeded all expectations. Production and profits were substantially higher, such that head office decided to extend the life of the mine for another few decades and payments to suppliers were up to date. Now workers maintained that their managers were demonstrating good leadership ability. This was not the case before. At the same time managers expressed surprise at the improvement in performance of employees.

How is this possible? What happened?

I believe that we need to evaluate the circumstances under which we apply the term “good leaders” to managers. When we look at the performance of a company doing well, like Apple under Steve Jobs, we call Steve a visionary, demanding, no nonsense, driven, tell-it-as-it-is manager. However, if Apple were to have had a number of poor years, we would read articles about Steve being a psychopath, micromanager, bully, control freak. So depending on whether the company is successful or not we decide whether the CEO is a leader or not. When business people tell me we have a crisis of leadership I understand from that that their senior managers are not achieving the results that are required, or were achieved before.

When mine performance starts to degrade members of the production department and specifically the mining manager are usually the first suspected of being poor leaders, not only by their colleagues at the mine but also at head office. Not only are their leadership skills questioned but all sorts of negative personal characteristics start to be ascribed to them. This is called the **fundamental attribution error**. John Sterman, a systems thinking and modeling expert at MIT, has the following to say about the fundamental attribution error:

“A fundamental principle of system dynamics states that the structure of the system gives rise to its behaviour. However, people have a strong tendency to attribute the behaviour of others to dispositional rather than situational factors, that is, to character and especially character flaws rather than the system in which these people are acting. The tendency to blame the person rather than the system is so strong psychologists call it the ‘fundamental attribution error’.

In complex systems [referred to as complicated in Cynefin terms] different people placed in the same structure tend to behave in similar ways. When we attribute behaviour to personality we lose sight of how the structure of the system shaped our choices. The attribution of behaviour to individuals and special circumstances rather than system structure diverts our attention from the high leverage points where redesigning the system or governing policy can have significant, sustained, beneficial effects on performance. **When we attribute behaviour to people rather than system structure, the focus of management becomes scapegoating and blame rather than design of organizations in which ordinary people can achieve extraordinary results.”**

Leadership

At this point I want to present a definition of leadership that I have found quite useful. I found this on a door in an old Iscor mine. The sign was already yellow and probably more than 20 years old.

Immediately we have to ask, what is the best interest of the company, and how do we ensure workers want to perform?

What is in the best interest of the company?

Systems thinker Russell Ackoff said that when he asks businesses or academics whether they agree with

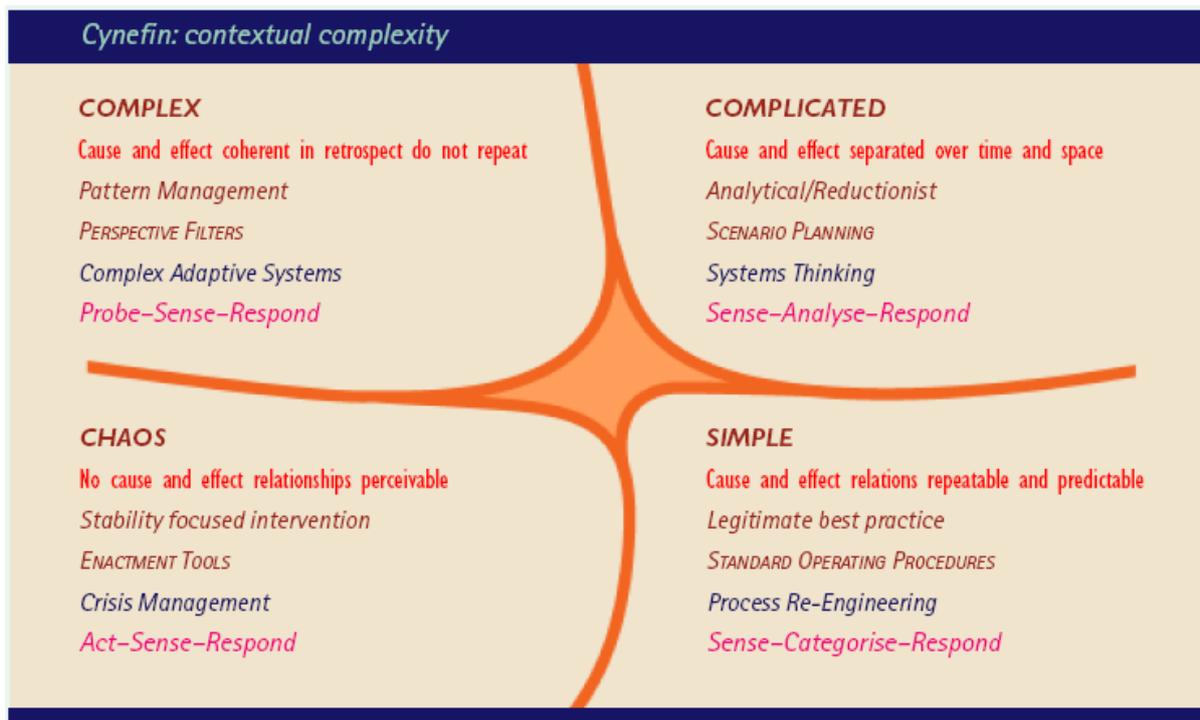
Einstein’s statement “We cannot solve our problems at the level of thinking that caused them in the

“Leadership is a process which creates an environment in which people want to perform. It excites employees and inspires them to focus on the interests of the group and the organisation.”

first place” everyone agrees. When he then asks “What is the current level of thinking in business” no one can articulate that. In the same way that a deep sea fish does not know that it is swimming in water (since it has not experienced air or space) we operate from a world view that we never examine.

How the productivity slide starts in a mining environment

To answer the question around “best interest” the CYNEFIN framework is useful. It was developed by Dave Snowden of Cognitive Edge. To be successful, managers have to adapt their Leadership style to the reality of the environment they face.



The **Simple/Obvious Domain** is the domain of best practice. To be successful in this domain we should ensure that we measure the efficiency of each machine and person, and force continuous improvement onto these. Cause and effect is simple, reproducible and everyone agrees as to how best to perform certain tasks. As a result, the command and control, vertical coordination, centralisation management styles work well here. (Taylor first proposed this way of working)

The **Complicated Domain** deals with good practice, many solutions are possible and it is not clear which of these are the best. Cause and effect is separated by a time delay and only those who work close to the issues being faced (experts) can make sense of it. This is the domain of systems thinking.

Russell Ackoff put forward two important guidelines for managing systems, a) if we optimize a system we will have parts of the system not optimized, b) if we try to optimize all the parts we will have a system that is not optimized. Striving for maximum efficiency in every part of the production chain will cause suboptimal results. To obtain the best results in this domain we have to manage the pattern of relationships, not the parts.

In reality, **mining managers face process dynamics that are mainly in the Complicated domain** (close to the Complex Domain).

Why do I say this? The effect of variable geology, equipment availability and personnel on the production flow for each mining cycle cannot be predicted in advance-the inherent variability is too great. At the same time all the production departments in mining and processing are tightly interconnected and interdependent. Should a production department suffer equipment failure, it effects all departments upstream and downstream. We can demonstrate this by considering a pipe through which water is flowing. If we block the flow in any section of the pipe, upstream water movement stops and downstream all sections starve as water flows away. Upstream as well as downstream no work is possible while the blockage exists. The timing, duration and position of the blockages cannot be predicted in advance, although it can be described statistically.

A secondary effect is that each production stage can affect the ability of following stages to reach the required production rate (cause and effect separated over time). For example, the quality of drilling work will have an effect on the blast quality, which will with a time delay affect load and haul departments.

The strength of these cause and effect interactions are clear to experts and partially to many of those working in close proximity to these activities. Interaction effects are numerous, present in every blast-blast cycle, repeatable and the strength of these effects are broadly linear. (In “A Leadership Intervention for Mining- Scrum Production Flow” I deal with this in much more detail.)

Many aspects of human behaviour and dynamics in mining are found in the Complex domain. There are cause/effect relationships but they are non-linear nature and the large number of agents affecting the situation makes conventional analysis ineffective. Attempting to manage this situation by new policy or procedure flowing from the top will cause new emergent patterns. A significant number of causes arise from the unseen/misunderstood parts of the production process which cause workers to be punished and rewarded for events over which they have no control. This is not an effective way of managing employees. We want to shift the human behaviour closer to the complicated zone where we can be in command without having to over constrain behaviour.

Managing as if we are working in the Simple/Obvious Domain

If we were to visit a mine today, the chances are good that we will find an environment with top down control, vertical coordination, high centralization, with limited ability to coordinate horizontally at the lower levels. The SAP system ensures that any deviation from the mandated way of operating is quickly identified and corrected. The fact that production departments are tightly coupled, interdependent and subject to extreme variability does not enter into the best practice management model. When production ends up well below historic norms, process engineering, standard operating procedures and local efficiency of the factors of production are driven even harder. This is done by strengthening top down coordination and control with the help of more computer generated data. In this manner both mine managers and their heads of departments are disempowered. **In Cynefin terms the system is being over constrained by mandated policies, goals, objectives, budgets and schedules.**

In order to manage this way, managers have to try and force certainty on situations that are inherently uncertain. The hierarchical structure forces mid-level managers and workers to pretend that reality corresponds to measurements and long-term plans. After a while, with results deteriorating further, head office starts to decide what interventions are required on the mine. In the minds of mine managers, the production volume KPI slips in importance, and diametrically opposed KPIs (local efficiency measures) rise. Unfortunately, data cannot capture the interdependencies and patterns of relationships between departments. Hours spent every day going through the efficiency numbers of the previous day do not tell us what to do differently tomorrow. In TOC this is called “trying to optimize within the noise”.

This behaviour can be likened to the captain of a ship standing at the stern and analysing the wake of the ship to determine how well it has been moving towards its objective. What is needed is for him to be at the bow, steering the ship towards its target.

No one has an overview of the production system as a whole or of how actions of the production and support departments are taking the company towards the goal. In addition, employees are blamed and rewarded for events over which they have little control. Teamwork and trust cannot exist under these circumstances. Little wonder employee engagement is poor. This is also why management is being overwhelmed with the need to constantly coordinate and control every aspect of mining. Many hours are used up by meetings that do very little to improve the production flow.

What forces managers into this situation? A variety of factors. Firstly, and most importantly, Westerners subscribe to a world view called the Cost World Paradigm. According to this view, every cent saved translates to a saving for the overall system. Combined with quarterly financial pressures, the relative inexperience of many managers involved in mining, and the ability to quickly obtain detailed efficiency measurements and cost data on factors of production the inevitable result is that mines are managed as if situated in the Simple Domain. Then the Throughput World paradigm, held by systems thinkers, holds the complete opposite view. According to this view cost cutting and driving efficiency of the parts is at the expense of the whole and detrimental to profitability. We need redundancy in the system to absorb shocks and to recover quickly from these shocks. When the flow of the overall system is optimized the costs will automatically adjust to the lowest level possible and profit will be maximised. This is in line with the Toyota philosophy.

In Disorder, close to Chaos

We have now created a negative feedback loop. As productivity reduces Simple Domain actions are driven harder and the system gets more constrained which leads to further reduction in productivity. Historical figures show that the mine is now running substantially below production capacity. Managers are overwhelmed by the amount of information they need to track and interventions required to prevent stop/start production flow which has become the norm. We are now in full FIREFIGHTING mode.

Mine CEOs and especially mining managers are regularly replaced but to no avail. Consultants are brought in and the best people are assigned to the mine but results do not improve. Scrutiny from head office increases and with the help of SAP local efficiencies are driven harder. It seems as if there are no leaders around anymore and every department is fighting for its own survival.

To survive in this environment, employees hide critical information from colleagues and superiors; blame shifting becomes the survival method of choice. At head office managers and workers start to be seen as untrustworthy, unaccountable and of low ability. Production employees are aware that they as a department they are not succeeding and engagement is low. There is no spare capacity to drive triple bottom line initiatives. **As the system is constrained even further and losses increase, it moves into chaos.**

In chaos

After many months in Disorder the mine tips over into the Chaotic Domain. The mine management gets a last chance to turn the mine around. If there is no improvement the mine will be shut down in 3 months. With the current downward commodity cycle many mines have landed up in disorder and a significant proportion are in chaos. But in most cases these mines can be turned around in a short period, 3-5 months, by helping managers to lead from the Complicated Domain.

How do we move through the Complex into the Complicated Domain?

For this we use the Productivity Platform methodology. It was originally developed by my colleague Arrie van Niekerk of Tavanec. This moves the mine from Disorder (or Chaos), through the Complex into the Complicated Domain. The Complicated Domain is the domain of experts and is where we are able to get the greatest efficiency out of our mining system. Principles of Dialogic Organisation Development and Theory of Constraints are fundamental to the success of this methodology.

The first step is to change the prevailing management and employee mental models as to what best practice looks like. In the Complex Domain we start making them aware that the pain they are experiencing is inflicted by the world view they hold. We show them how driving local efficiencies cause outcomes which is not efficient and cause pain to all involved. Instead of focussing on the parts, they need to focus on the production system as part of a larger whole.

The generative image we use is that of "Flow". The conversations thus begins to be directed towards increasing Flow, to protecting and managing bottlenecks and dealing with other obstacles to Flow.

Cultivating the Desired Culture Every Day

Managers and employees across all departments have the *same visual picture* of what is happening and can support one another in preventing the development of obstacles to flow. At the same time team members start to hold each other accountable for performance.

We connect the different functions across their silos and dramatically improve communication and understanding of the total flow process.

Comments about other departments became overwhelmingly positive. "The leadership of the production department has improved tremendously", "The planner has really surprised me with the level of ownership and improvement in skill", "Maintenance is doing an excellent job", "Communication and coordination between departments have increased substantially", "We can produce much more than what we do right now", "It is fun to be at work", "Our managers know what they are doing and are listening", and "The youngsters have really come to the party".

We create a safe environment for dialogue, making sure critical information is visible and regularly updated. We maintain the conditions where emergence can occur. Success is certain, but since the new way of working has emergent properties we cannot predict when it will happen.

In the Flow Room we strengthen conversations and dialogue which will lead to support departments understanding their critical role in promoting flow.

Discussions around coordination now include top, mid- and lower level management, across functional departments. Recurring problems (often policy related) experienced at mid- and lower management level are addressed on the spot by top management, since they have a full picture of what is happening.

We know we are close to success when after every Flow meeting, groups of people spontaneously self-organise to discuss issues that arose or actions that need to be taken. “Don’t run away, when I’ve had a chat to Peter I still need to discuss something with you,” is a typical example. *In CYNEFIN terms we are running safe to fail experiments to identify and practice more effective ways of running the production cycle and management meetings.*

Managing in the Complicated Domain

In the medium term we prefer to manage mine production in the Complicated Domain; this leads to maximum profitability. This is in line with Einstein’s admonition to make things “as simple as possible, but not more simple”. In order to do this, we need to make some changes.

Rather than trying to schedule everything, we acknowledge that variation will exist and mitigate it by putting in buffers and make the interdependency of departments creating flow visible. We focus our efforts on the bottlenecks and the buffers that protect these. *In Cynefin terms, we manage the emergence of beneficial coherence with attractors within constraints (boundaries).*

In this way we are able to reduce drastically the amount of information that managers have to deal with daily, and we are able to attain “superflow in a spirit of calmness”.

The results

I mentioned that over the last decade mining productivity has decreased by 29% worldwide. And that metres advanced in narrow reef underground mines reduced from 24m to about 8m per day. In more than 70 implementations of what we call the Productivity Platform we have seen production increases of between 7–50% (average 25%) and cost reductions of 10–30% per ton. The intervention typically delivers within 3 months and with the use of only 1 consultant.

In particular instances the results were truly spectacular. Underground gold mine Shaft 4# (+60%), Shaft 7# (+55%), Shaft 5# (+50%), Open cast Platinum mine (+45%).

The top mining consultancy firms would never dream of guaranteeing results remotely like these in such a short period of time or with just 1 consultant involved. And yet my colleague Arrie and I have done this with minimal effort. In all these examples the workers maintained that the company leadership had drastically improved. Firefighting stopped and employee engagement increased dramatically.

Summary

Our discussion today was about the journey we take managers on from Disorder to Complex to Complicated, to remedy the consequences of long-term exposure to the Obvious Domain. Along this journey the managers and employees learn along the way how to make increasing sense of their world and get better at acting appropriately in it.

If we manage the parts for efficiency in the Obvious Domain, we prevent teamwork across departments and we cannot have high-performing teams. We thus create the problems with profitability, engaged stakeholders and environment mentioned earlier. By managing from an area situated in the Complicated Domain, close to the Complex Domain, we are able to achieve the triple bottom line at a fraction of the cost and effort currently being expended.

Jeff Sutherland who wrote the book *Scrum: The Art of Doing Twice the Work in Half the Time* comes to a similar conclusion regarding maximising productivity. He quotes research which shows that the best programmer can typically complete a task in 1 hour when the worst in a group will take about 10. But when teams program together the difference between the worst and best is a factor of 2000. So managers should concern themselves with how teams work together much more than with the skill of individual workers. And yet, this is where most effort is expended. He maintains that the problem is not one of inherent ability but one of using inappropriate ways of working together. And for this *leadership* is required which creates the platform where creativity can emerge, every voice can be heard and effective teamwork can occur. The Productivity Platform makes this possible.

Successful miners have realised that the problem with poor results is almost never due to poor workers, the problem needs to be addressed elsewhere. Given the speed at which the Productivity Platform delivers it is almost never too late to do something about poor mining sustainability.

Thank you very much.