**INCREASING THE ROLE RELATIONSHIP KNOWLEDGE AND ITS POSITIVE EFFECTS ON COMPETITIVENESS AT FORDING RIVER OPERATIONS**

by

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Abstract

To become more competitive, Fording River Operations must increase the knowledge base that its employees currently have. Fording River employees have good service knowledge, but the knowledge and understanding of the interaction between different roles in the company or how they relate to one another is limited. This is leading to poor decisions and increased operational costs. This paper will show how a different orientation program for new employees, continued learning for existing employees and focused teaching for high networking individuals will increase the role relationship knowledge and therefore reduce cost for the operation. The paper will also explain the correlation between increasing the level of role relationship knowledge and the benefit it gives the employee. This includes better decisions from increased information and the potential for monetary rewards through profit and gain sharing incentives.

**Keywords:** Role Relationship Knowledge; Service Knowledge; Increased Competitiveness

Dedication

*To my wife Corette, who has given up her time so that I could expand my learning and further my career. Thank you.*

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Thank you to my fellow teammates in Team Revolution. You have helped me to complete this endeavour and make long nights of studying tolerable.

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Glossary

|  |  |
| --- | --- |
| HQHCC | High Quality Hard Coking Coal |
| LOM | Life of Mine |
| MTCC | Metric Tonnes Clean Coal |
| Pit Utility Worker | An entry-level position for the mine. Duties include spotting haul trucks, moving power cable, and general mine labour duties. |
| Role Relationship Knowledge | The knowledge of all the different roles in an organization and how they interact, including how the consequences of one action can interfere with others’ responsibilities |
| Service Knowledge | The knowledge of how to perform a position or role in the company. Example: Haul Truck Driver |
| SP&PTrades | Standard Policy and ProcedureAny maintenance certified repairperson, Mechanic, Welder, Millwright, Electrician, etc. |
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# Introduction

Teck Coal, a business unit of Teck Resources Limited, operates six open pit coal mines of which Fording River Operations is the largest. Its rated capacity is 10 million metric tonnes of metallurgical coal, primarily for steel making. With its current logistical challenges of being located in the South Eastern British Columbia, Fording River must look for new ways to be more competitive. Without new competitive methods of operation, Fording River will continue to be a higher cost operation than those competitors located in Australia. While the market for coal is currently tight, the coal price historical trend follows a sinusoidal wave of peaks and valleys. As a result, Fording River must put itself in the best competitive position to be prepared for a dip in the market.

Conventional means of cost reduction such as productivity improvements and efficiency gains are progressing. With a requirement for more workers, labour reductions as a cost saving measure are not possible. These common methods are also being used by other mines and therefore do not put Fording River in a more competitive position. Because of this, Fording River must look to different methods for cost savings. The most available source of cost reduction is accessing the intangible assets that it has on site.

Fording River has 1135 employees, with a collective knowledge that addresses all strategic, tactical and operational aspects of the mine. Focusing on role relationship knowledge, which I define as the knowledge of the interaction of different roles or jobs in an organization, and the consequences or connections between them, I explain that this type of knowledge is lacking at Fording River, to the extent that it negatively affects productivity and cost performance. Consequently, a number of recommendations will be offered to encourage and exploit this type of knowledge. Fording River employees will be able to make better decisions, make the site more productive and will benefit by realizing better than previous profit and gain sharing incentive payouts.

To guide the reader to this conclusion, the paper will begin by outlining the potential opportunity that exists. It will provide the reader with background information on coal mining and the steel making process. The information used will highlight the number of roles that exist and why the interactions between them are important. The significance of Fording River to Teck and the benefits of success will also be presented. To define the opportunity further, important cost drivers will be shown.

By preparing the reader with background information, the solution of role relationship knowledge will be introduced. The paper will discuss the current knowledge base that Fording River employees currently have and why it is not sufficient. It will analyze the employee demographics and the effects of introducing new information. To define further the benefit of role relationship knowledge, current literature on competitive improvements based on knowledge will be reviewed.

To complete the paper, a strategy for implementing the change is presented. This will outline how quarterly meetings, review meetings, focused learning groups and a different new hire orientation will allow all employees to start learning about role relationships and how they can improve work habits. The implementation of the new learning methods and the knowledge change in general will be judged based on John Kotter’s guiding principles. These eight principles will be looked at closely to determine if the urgency is enough for change and if the steps are being followed.

# Improvement Opportunity at Fording River Operations

The aim of this chapter is to explain the need to improve performance at Fording River by improving role relationship knowledge of the employees. This opportunity stems from increasing Fording River’s competitiveness through means other than standard cost reduction techniques. It will show the importance of the steel market and how the demand for steel correlates to the demand of metallurgical coal. Through a review of the steel and coal mining process, the different interactions will be highlighted and their effect on costs. The chapter will then outline the importance of cost reduction and the main cost drivers for Fording River Operation.

## Teck Resources

Teck Resources is a global mining company that prides itself on safe, sustainable mining. It has revenues in excess of $7.5 billion and profits exceeding $2.7 Billion (Teck, 2010). It is divided into four main business units: Copper, Zinc, Energy, and Coal. Each of these business units plays an integral role in the company’s strategy. They help to fulfil the company objectives, which are to maximize cash flows through prudent capital and operating expense control in order to eliminate our term debt and achieve balance sheet ratios that are consistent with an investment grade rating. In addition, Teck Resources will continue to strive for improved performance in all aspects of our work through the pursuit of our Operating Excellence program and the ongoing development of our next generation of management (Teck, 2009).

To understand better the makeup of Teck Resources and show the importance of Fording River, the main business units are discussed.

### Non-Coal Business Units

The non-coal business units consist of Copper, Zinc and Energy. The largest non-coal unit by revenue is Copper. The Copper business unit has a capacity to produce over 300 tonnes of copper annually (Teck, 2009).

The second largest non-coal business unit by revenue is Zinc. The main use for zinc in the world is for protection of metal against corrosion. As noted in the Teck 2009 Annual Report, 50% of the world’s production is used for galvanizing steel. At the Trail smelter, zinc is refined of which 80 percent is sold in Canada and the US (2009 Annual Report).

The last non-coal business unit is Energy. This business unit is focussed on growing the asset base of Teck Resources through partnerships in the oil sands of Northern Alberta. Currently Teck is partnered with Suncor and UTS. Currently there are no revenue producing projects in the Energy business unit.

Figures 1 and 2 show the relation of Copper, Zinc, and Coal. It shows that the main revenue and profit driver for Teck Resources is from the Coal business unit.

Figure 1: 2010 Revenue by Business Unit

(Teck 2011)

Figure 2: 2010 Operating Profit by Business Unit

Before Depreciation and Amortization (Teck 2011)

### Coal

The coal business unit of Teck Resources is the major contributor of revenue, producing $4.35 Billion in 2010. The business unit, which is referred to as Teck Coal, is comprised of six mines, five of which are in British Columbia, Canada, and one in Alberta, Canada. In relation to global companies, Teck Coal is the second largest producer of seaborne coking coal and its annual production is 22 to 25 million MTCC. The largest of Teck Coal’s mine is Fording River Operations. Fording River’s annual production is 8.6 million MTCC for 2011. This represents approximately 35 percent of the total coal that Teck Coal will produce. This majority of this production is High Quality Hard Coking Coal (HQHCC), which is a key ingredient in the steel making process. Steel uses include buildings, automobiles, windmills and other common items in the world today. Due to demographic shifts in countries such as Brazil, Russia, India, and China, there is a demand for steel that is constantly growing. Figure 3 shows the projected growth in Steel for the world.

Figure 3: World Steel Production (million tonnes)

(Teck 2010)

This steady increase has put pressure on the coal industry to the extent that prices have surged to record levels. Spot prices have reached $380/tonne of clean coal. Although steel usage is forecast to rise in the short term, the historical coal cycle of highs and lows will undoubtedly repeat itself and prices will fall. In anticipation of this, Teck Coal and Fording River must be prepared by being as competitive as possible.

## Steel Making Process

The business sector that Fording River is in is to mine coal for the steel making industry. This coal is not directly used in the production of steel. It is used to make coke, which is one of the main ingredients in the making of steel. This is done through a process of heating the coal in an oxygen deficient atmosphere to 1100 degrees Celsius. A chemical change occurs and the end product is a concentrated carbon substance called coke.

The main property that steel makers look for in coke is the Coke Strength after Reaction (CSR). The higher the CSR number the better the coke will perform in the blast furnace. The properties of coal that affect the production of coke are ash and volatile matter. Ash and volatile matter affect steel production by creating by-products and influencing efficiency of the coke making process. A lower ash coal is desirable because it has higher carbon content and a volatile matter percentage in the 23-29 range is desirable for the correct amount of off gassing to be present in the coke and blast furnace process. To make the best coke for the blast furnace, customers will blend various coal products to meet their specific needs.

After the coke is produced, it is sent to the blast furnace. Here it is charged with limestone and iron ore. The coke, limestone and iron ore mixture is placed in the top of the blast furnace and flows though three zones: pre-heating, reduction of iron oxides and the melting zone. Hot air is introduced at the bottom and any waste gasses are collected and used in a by-product plant. Once melted, the resulting product, called pig iron, is collected and sent for further refining into finished steel

Although this is just a brief description of the steel making process, the steel making process cannot succeed without the coke made from metallurgical coal. If the coal is not mined and processed economically, the mine supplying the coal will cease to be in operation. As the number of mining companies in the high quality coking coal business is shrinking, those that are still in business must be as competitive as possible.

## Coal Process

The previous section outlined how coke made from coal is used to make steel. To understand better how coal is mined, transported to the coast, and loaded onto vessels, a review of the process is needed. This will highlight interactions between the various types of work involved in mining and transportation and show how a lack of proper knowledge can be cause waste and inefficiency.

Figure 4: Coal Process Flow Chart



(Source by Author)

Permitting and Exploration are the first steps to determine if mining is allowed and where the coal seams are located. Permitting is done in conjunction with Federal and Provincial governmental bodies and exploration through drilling and core sampling. Cores samples are analyzed to define and model the coal seams. Based on location and the amount of rock, or waste, that needs to be moved, an economic model is made. Based on the current and forecast price of coal, this model may or may not lead to starting an operation.

If the project is feasible, then the next step is to mine the waste off the mountain to get to the coal seams. This is done by blasting the rock and then digging and hauling it to a spoil. With the waste removed, the coal seam is exposed. To get the maximum yield from the coal, it must be properly cleaned and hauled to either the stockpile or the process plant. To assist the haulage of coal, there is work from support equipment such as dozers, graders, backhoes, and loaders. Here is one example where the interaction between mining and processing is important. Proper techniques in the mine will affect the final production of the coal. Because there are still some departmental silos at Fording River, the employees in those departments are focussed only on their individual roles and the success of their own departments. If these silos were broken down and the information regarding other departments’ challenges recognized, there would be more onus on the employees to perform their role better, for the benefit of the whole. This can be done by increasing the understanding of the roles in other departments and the effect of one department on another.

Prior to the process plant, the coal is blended to meet the customer requirements. Certain customers want a low ash coal with a higher volatile matter, and some want low phosphorous. Fording River produces six main products, Standard, Premium, Eagle and variations of these with lower phosphorous content. The associated qualities are shown in the following table.

Table 1: Fording River Coal Products

|  |  |  |
| --- | --- | --- |
| **Component**  | **VM ( % Volatile Matter)**  | **Ash (%)**  |
| Standard  | 23.3  | 9.5  |
| Standard Low Phos  | 22.7  | 9.45  |
| Premium  | 26.2  | 8.8  |
| Premium Low Phos  | 25.6  | 8.8  |
| Eagle  | 27.3  | 8.5  |
| Eagle Low Phos  | 27.3  | 8.5 |
| Eagle High Ash  | 27.0  | 9.8 |
| Preagle  | 26.5  | 9.0 |

(Teck, 2010)

Once the raw coal is blended on the raw side of the plant, it is fed into the process plant to be washed and dried. By washing the coal, the ash content is reduced and the majority of the rock is removed from the coal. Once washed, it is dried to reduce the moisture content.

Once the coal is dried, it is stored until it can be loaded on a train and sent to a port or certain North American customers that are accessible by direct rail. At the port, the coal is stockpiled and further blended before being loaded onto a vessel. The delivery of coal to the customer and the return of the vessel to the port can take over 40 days. Once at its destination, the coal is unloaded and stored before being used in the production of coke and steel.

The open pit method for coal mining that is used by Fording River has been discussed briefly. It is capital intensive and significant amounts of capital are associated with maintenance and labour costs. Over 60 haulage trucks, 5 large class shovels, 3 smaller class shovels, 4 loaders, 15 dozers and numerous other pieces of support equipment are in operation. The success of the mine is dependent on these machines running efficiently and smoothly within their designed capacity and purpose. Whenever equipment is down or running at less than peak performance, the waste cannot be moved, the coal exposed and the coal processed efficiently. If it is not processed, it cannot be railed to the port and sold. To this extent, the majority of employees recognize that there is more than one truck in the fleet, and the more that are running will make it easier for the Mine Operations department to reach its targets. However, this limited knowledge also breeds the attitude that, “There is only one truck down, there are still lots running.” While the statement may be true, the attitude it expresses does not help the production of coal. Every available truck is needed to move the associated waste. If the mechanic is thinking only about the truck getting back to Mine Operations and not the impact on waste removal, then there is an adverse affect on coal production and subsequently on revenue. When it can take eight or more loads of waste to be mined to access one load of coal, the longer a truck is down because the perception is that there are ‘lots’ running, then coal production is affected. This highlights one of the interactions between maintenance and proper, cost effective operation of the equipment and that attitudes can be formed from lack of knowledge.

## Importance of Cost Reduction

Knowledge alone will not increase the competitive position of Fording River. The corresponding reduction of costs associated with better decision making and employees that are more productive will make it more competitive. This section will review the challenges that Fording River has in relation to costs and sets the stage for the opportunity that an increase in role relationship knowledge will bring.

Despite Teck Coal being the second largest supplier of seaborne coking coal in the world, it has been in the fourth quartile for cost in the industry. One of the main disadvantages is the distance to port from the mines. It is approximately 1200km to the nearest seaborne port accessible to vessels for overseas sales. The route passes over the Canadian Rocky Mountains, and the steep grades limit the size of the trains used for transporting coal. In contrast, BHP, located in Australia, has approximately 200km to port and due to the flat terrain, can use longer unit trains than those in Canada. The logistical disadvantage relates to costs being between 30 to 50 percent higher as compared to production and transportation of coal in Australia. This cost is a fixed multiplier to Teck Coal and cannot be reduced significantly. To this end, competitive advantage can be gained through cost reduction at the mine site.

To keep costs low at the mine site, management controls spending and makes production decisions. This is achieved through proper maintenance of equipment and efficient mine plans. With careful planning and execution, costs are limited and there is a benefit to the Operation. In addition, there is a potential benefit to the individual employee. Currently, there are profit and gain sharing incentives at Fording River. These incentives, which are specific to Teck Coal and Fording River respectively, allow the employees to share in the success of the company. A certain level of success results in an increase in one’s annual salary.

To put the costs in perspective, in 2007 the coal price was in the $100/tonne range. With site costs at $40 to $60 per tonne, the mines were not making a great deal of profit. The total coal profit was $249 million. In 2009, coal profits were $1.8 billion. To continue to show good profits in good and bad times, cost control is imperative. With any reduction in coal price, there is a potential for a drop in profits. Teck must be aware of this and prepare when capital is available.

Aside from the pure financials, other costs in the mine are a result of political and environmental impacts that the company has limited ability to influence. In British Columbia, a Carbon Tax is a reality. Depending on the industry, the tax varies. In the open pit coal mining industry, the major taxable items are diesel, natural gas, and coal burned. As stated in the Teck 2009 Annual Report, the carbon tax payable is forecasted to be a $35 to $40 million dollar cost for the British Columbia Operations of Teck. There are ways to reduce the use of these fuels, but the mining industry is incapable of eliminating them. Because of this fact, the costs associated with the carbon tax cannot be avoided. The tax cost is not a function of poor mining practices, but any fuel reduction due to improved mining lowers the tax burden and improves market performance.

Some of the overall production and operation costs have been mentioned, but a more detailed look at the main cost drivers is required to reinforce the need for change. The main cost drivers for Fording River on site are maintenance and labour costs and supply logistics.

### Site Costs

To keep the numerous pieces of equipment running, preventative maintenance is performed at regular intervals. In addition, the various parts that wear easily must be replaced. Failure to replace these parts in a timely manner will result in a complete failure or an unforeseen breakdown, both of which increase costs at the operation. The environment that this equipment operates in is one of the harshest in the world and regular wear and tear reduces the service life of the equipment. At Fording River, the annual cost of maintenance is 30.6 percent of total cost.

In relation to labour dollars, the more equipment brought into the mine, the more people are needed to run and maintain the equipment. Fording River currently has over 1100 employees. Hourly wages and benefits combine to make labour costs 30.8 percentage of total costs. The remaining costs are associated with operating and administrative expenses.

All of these types of costs can be reduced through proper training and knowledge. With increased knowledge of how each individual’s actions interact with the whole will allow for even further cost reduction.

### Logistical Costs

Once the coal is cleaned, it must be railed to a port and shipped to the customer. To accomplish this, Teck Coal uses Canadian Pacific (CP) and Canadian National (CN) Railroads. The majority of coal is railed via CP and this cost although semi-dependent on coal price is approximately 20 percent of the total cost to produce a tonne of coal. The amount paid to the railroads is based on the amount of tonnage railed on a per train basis.

Once the coal is at the port, it is shipped to customers. This is done through various shipping companies, and the cost is dependent on the amount of tonnage placed on the vessel. The cost of shipping is normally borne by the customer, but the port storage and operations cost is a cost to Teck and is approximately 15 percent of the total cost to produce a tonne of coal.

Improper mining and transportation techniques at the mine site will result in the processing plant having a harder time cleaning the coal, resulting in lost coal and higher costs. More dust suppressant is required prior to train loading for finer coal that can be one result of poor mining practices. An all-encompassing understanding of the knowledge of mining, including the different techniques involved and their effect on coal production is crucial for continued improvement and lower costs.

## Competitor Costs

The number one supplier of seaborne coking coal is BHP. Their main operations are in Australia. Because of their close proximity to open water, their logistical costs are significantly less than that of Teck Coal. This potentially allows them to accept lower prices for coal and still make higher profits than Teck. As stated earlier, to reduce this advantage, Teck Coal Operations’ must continue to look for cost reductions at the mine site.

## Current and Typical Cost Reduction Techniques

To improve its position, Fording has embarked on many initiatives to reduce costs. These initiatives include strategic sourcing, reduced freight rates, and employee development. Another major initiative that Fording is undertaking is reducing maintenance costs by completing routine maintenance at strategic intervals. The initiative also considers what the appropriate costs should be and what equipment should be used. Through better planning, scheduling, and execution, maintenance on heavy equipment is safer, quicker, and more efficient. To show improvements and reduced costs, key performance indicators, are recorded and reviewed. In addition to these initiatives, other possible cost minimizing activities such as labour force reduction and production slow down are not being done. These are not being done because the margins are too lucrative right now. Production needs to increase to capture value, meaning more equipment, which requires more employees.

These techniques reduce costs, but the reduction is finite and Fording River is not the only company applying them. If every mining company reduces their costs through more efficient maintenance, there is no advantage to Fording River and Teck. Fording River needs something else.

# Defining the Role Relationship Opportunity

The previous chapter defined an important opportunity that exists at Fording River. The opportunity is that an increase in the role relationship knowledge of employees or the knowledge of different roles and their consequences or connections can put Fording River in a more competitive position. This chapter will define the opportunity so that the reader will understand the existing knowledge base of Fording River employees and why increasing it will be a benefit. By showing the demographic structure of Fording River, this chapter will also show why different learning techniques must be used. In addition, current literature on the subject of knowledge and its relation to costs will be investigated. The chapter will end by presenting the role that Senior Management has in increasing the role relationship knowledge of employees.

## Knowledge Base of Fording River Employees

Fording River currently employ 1135 people. The employee compliment is comprised of hourly employees and permanent staff. Fording River has new employees with less than a month experience up to 35-year veteran employees. The following graph shows the years of service for the hourly employees. If one were to graph the permanent staff, the trend would be similar; a significant number of new employees and an equally large number of seasoned, experienced, and ready to retire employees.

Figure 5: Demographic split of Fording River Employees by years of service

(Figure by author, data from Teck 2010)

What this graph shows is that there is a particular window of time occurring over the next five years when almost all of the long-term employees will be retiring and the vast majority of the workforce will have less than ten years of experience. While this presents a risk in that some types of service knowledge will be in shorter supply, it also presents a great opportunity to bring in a new way of thinking, one that focuses much more on plant wide productivity and cost elimination, and somewhat less on the immediate interests of each individual employee or work grouping. As will be argued, this will require new ways of thinking about education and knowledge development, linked to the development of new attitudes about the relationships between different job functions across the site.

Employees come from various professional backgrounds such as engineering, accounting, and trades, and all with varying education levels that range from grade 12 schooling to university degrees. Depending on the employee’s role, there is job specific or service knowledge training. Those in the Operations department train on how to operate heavy equipment such as 320 tonne haul trucks, large class shovels, loaders and bulldozers and those in the Plant are trained to operate the process plant and thermal dryer. Each of these roles requires significant training and the employees are evaluated based on their skill levels. Training is accomplished through different methods, but mostly through hands on experience, computer based training modules, and reading procedures. In the Maintenance department, most employees are certified tradespersons. These employees also receive job specific training normally suited to maintaining the equipment or safety based training through the same previously mentioned methods.

For most employees outside of the senior management ranks, the overall business knowledge of the operation is limited. They only know their specific job and its relevance to their department. In the case of the largest department, Mine Operations, most employees know the function of this group; remove the waste, load the coal, and bring it to the plant. For the various other departments, their function is less obvious. Engineering develops the mine plan, Maintenance repairs the equipment, Warehousing obtains and secures parts, and the Plant cleans the coal and loads the train. For the most part this is enough knowledge to get the job done. As long as the employees in their respective departments know the basic tasks, drive the truck, change brakes etc., and then all the jobs are completed and the coal is shipped to port. Relatively few employees know the financial impact of poor operational practices; how each job contributes to the overall cost of producing coal. Those employees that drive haul trucks do not know why dumping waste or coal in the wrong spot will require extra effort to manage. They know that it is wrong, but only because they have been told that it is wrong. Current teachings do not explain well enough that dumping incorrectly will result in extra effort by the dozers and loaders to remove the material that is in the wrong spot, thereby increasing costs. Because the dozers and loaders are cleaning up a mistake, coal quality is also negatively impacted. The dozers and loaders are not doing their regular job of cleaning and loading coal causing high rock diluted coal to be sent to the plant. The result is that based on a poor choice made out of ignorance, the haul truck driver has directly affected the efficiency of the coal plant and therefore increased the cost of a tonne of coal. Every time cost increases, the potential monetary reward from profit and gain-sharing programs is reduced.

This lack of role relationship knowledge allows departmental silos to continue to work apart in an effort to achieve individual success. Different departments without knowledge of the big picture are addressing current challenges for coal. When more coal is needed for the Plant, a shovel is moved to a different coal recovery heading. Is it in the plan for the shovel to be in this new heading? Engineering knows where the shovel should be to meet plan, but because the coal model is slightly inaccurate, the coal is not available. A different heading is required to meet the plan. Current hourly employee and some management level thinking is to get the coal out regardless of plan. There is still a belief that if a crew moves more waste regardless from where, they will be rewarded for their effort. It does not matter to them that they moved only a fraction of the required coal because their waste numbers are above target. These employees are not making decisions based on relationship knowledge.

If the status quo is what is desired, then role relationship knowledge is not required. For a more competitive position, a change is required. If all employees knew more about the entire coal process, and how each role affects the cost of coal, the middle of the night decisions would be thought out to a degree that would lead to a path that is in line with the overall direction of the mining plan. It may vary slightly, but is in the general direction.

To further the case that more role relationship knowledge is required, the following examples are given.

- When loading coal into the Breaker for processing at the Plant, the load counts for three different seams of coals are 3:2:1. This tells the loader operator that three loads of seam 1, then two loads of seam 2 and one load of seam 1 are required and then the pattern starts again. While this pattern is simple to follow, many of the operators do not know the significance of this. The different qualities of the coals are blended in such a way that the Process Plant can wash the coal effectively and without changing settings. Many times the loader will do a count of 6:4:2 or 9:6:3. If the stockpiles of the seams are geographically far apart, these counts speeds up the loading of the Breaker through less travel and the Plant can run faster. This does not however lead to effective blending and the efficiency and productivity of the Plant is reduced. If the Operator was aware of the ramifications of doubling or tripling the load counts, the consequences could prevent the Operator from deviating from the counts. Running the Plant faster does not always equal more coal.

To quantify this example the value of consistency can be examined. When blending raw coal for the Plant, consistent feed equates to fewer changes required in the process. The feedstock to the Plant contains both coarse and fine coal and rock in certain qualities. These size fractions are processed differently. Coarse coal is processed in approximately 15 minutes whereas fine coal takes approximately 1 to 3 hours. When the actual load counts do not match the planned counts, the process operators must react to maintain quality standards. This reaction results in lost coal because the current plant settings do not match the new feedstock. Lost coal equals lost revenue. The service knowledge of the loader operator is to feed coal to the plant. The service knowledge of the process operator is to process the coal supplied to the Plant. Because the relationship of the loader operator’s actions to the process operator’s actions is unknown from a lack of knowledge, the loader operator does not realize the effect his decision is making on the Plant and the revenue to Fording River. If the load counts that were multiplied were heavy with coarse coal, then the processing time would be reduced and the offsetting quality of the fine coal would not be captured. This can result in an off-specification train that could also lead to monetary penalties to Fording River; past penalties have been ten to twenty thousand dollars for an off-specification shipment.

* During spring break up, the haul roads are very rough and can cause damage to the frames and components on the haul trucks. Many Operators still think that their role is to get as much waste moved as possible. This results in driving as fast as the speed limit allows in an attempt to be a better Operator. The knowledge piece that the Operator is missing is the link between his speed and the cost to repair the haul truck. Driving at the maximum allowable speed during spring break up leads to increased frame cracks and suspension damage. Not only do repair costs increase, but truck downtime also increases, since it takes longer to fix the truck. How much did getting one load of waste to the spoil faster gain the operation?

This example can be quantified using the relationship of the haul truck driver and that of strip ratio. A common strip ratio for coal is 10:1. It takes 10 loads of waste to move one load of coal. When a haul truck driver operates their truck too fast and damages it to the point of being shut down, the potential lost revenue can be determined. The majority of haul trucks at Fording River haul 320 tonnes of material as their payload. If the distance the haul truck travels during a shift allows the truck to make 10 trips, and the truck is down for one shift for repairs due to speed related damage, then there is a loss of one load of coal. If the yield of this coal is 60 percent, the total amount of coal not hauled and processed is 192 tonnes. At spot prices as high as $380/tonne, this equates to a lost revenue of over $70,000. The service knowledge of the haul truck driver is to move the waste so that the coal can be uncovered. Although moving waste faster exposes coal quicker, it is at the expense of increased downtime. If the haul truck driver was knowledgeable about the relationship between his speed and the resultant damage and lost revenue, then better decisions can be made.

These two examples show a small fraction of the role relationship knowledge gap that most of the employees at Fording River have. They focus on their job and want to do it to the best of their abilities. This however, will not lead to a more competitive operation. An opportunity exists to teach and empower employees with the knowledge of what their decisions can do to reduce cost or increase revenue. The above examples have explained that an opportunity exists to increase role relationship knowledge and that if the employees are exposed to this, better decisions will be made. These decisions will lead to lower costs and increase profitability. What is missing in these examples is the role of employee attitudes and their affect an employee’s decision.

The attitude of employees at Fording River range from the happiest, never grumpy employee, to the employee who is never satisfied and thinks something is always wrong. These attitudes shape the decisions and motivation of the employee. A lack of information on the side of the employee can further the negative attitudes and produce even worse decisions than decisions made without role relationship knowledge The negative employee does not usually care about the company and without the knowledge has the excuse to make the wrong decision. Increasing the role relationship knowledge to even the most negative employee will remove the excuse and potentially improve the employee’s attitude.

In all the examples, when the proper decision is made, a better outcome occurs. These better outcomes, lead to equipment performing as designed, coal being the correct quality and productivity increasing. When this happens, costs lower and revenues increase. This has a positive effect on profits, which in turn has a positive effect on profit and gain-sharing programs.

## Educating Employees

To see why the service knowledge of employees is more prevalent than role relationship knowledge, employees on site education must be investigated. The investigation will focus on two groups: new hires and existing employees. As was shown in the demographics of Fording River there is a definite split between new hires and existing employees. This split is important because it determines how they are exposed to new information.

### Existing Employees

From the demographics of Fording River, less than 60 percent of the hourly workforce has been at the site for greater than five years. Almost a third of employees have less than 2 years experience and a third have over 25 years. Each of these demographic groups responds differently to information. Many of the longer-term employees have a ‘seen it all’ and ‘done it all’ mentality. This can lead to a challenging situation to introduce new ideas and new ways of thinking. Because those employees have worked for different senior management teams, they are suspect of the latest ‘boss’ and his great ideas. Historically, there has been great tension between the hourly ranks, which are unionized, and the staff employees, particularly senior management. There is a feeling that management is trying to force information flow. Because of this mentality, or attitude, it is important to show that any new information has a direct benefit to the employee and that any new techniques or way of doing a job is important. Ideally, this comes in the form of a safer technique or a more efficient one. Any new technique must adhere to union collective bargaining agreements.

The current method for updating existing employees is through yearly Standard Practices and Policy (SP&P) review, Quarterly meetings, and monthly safety meetings.

SP&P’s are an important part of transferring new knowledge and recollection of existing knowledge of employees. Employees are first exposed to SP&P’s when they are hired and then they must conduct an annual review of key SP&P’s that are relevant to their job. Because Fording River is always trying to improve, these documents can change based on new techniques that are implemented, best practices from other sites, or a complete change in job function. When this happens, it is imperative that the SP&P’s be updated and the affected employees review the amended document. Although it is a necessity to review these documents, the way employees learn or absorb the information is being analyzed and new ways to digest the information are being tried. One way is through computer-based training (CBT). CBT provides a more interactive way for the employee to learn and review material; it utilizes different learning methods beyond just reading.

The quarterly meeting is held by the General Manager in conjunction with Department heads or designates. This meeting is designed to give the whole mine site an update on various topics including safety and production statistics, marketing updates, current challenges and things to come. These meetings are an avenue for the employees to ask questions directly to the General Manager and to department heads. On occasion, they have turned into sessions where employees vent concerns that have already been discussed with the direct supervisor or department head. The meeting is seen as an avenue to go ‘right to the top’. Because of this, site-wide information is often lost and so is the chance to communicate important role related information.

The intent of monthly safety meetings is to present the relevant safety message and solve safety issues. It is also an avenue to pass on information to the crews. By the Health, Safety, and Reclamation Code for Mines in British Columbia, each employee must be able to attend a safety meeting each month (2008: 1-9). In the case of Fording River, each crew in each department must have a meeting. The generic content is produced through the loss prevention department, and the respective departments add any department specific information. While these meetings are generic in nature, the success of delivering information is dependent on the presenter. If the presenter is less than captivating or not well spoken, the safety message is lost and the employees in attendance tend to lose interest. In conjunction with these monthly meetings, there is a huge opportunity for enhancing the role relationship knowledge of the employees that can be geared towards the specific department holding the meeting.

### New Employees

New employees are open-minded giving Fording River an advantage when it comes to what their expectations from the mine site. Many of these employees have never worked in the industry and therefore do not know what a day in the mine is like. What is important to note is that these employees have no preconceived ideas of how things should be and they have no experience that influences their views. They have chosen to work at Fording River for various reasons, and each brings with them different backgrounds and fresh ideas that should be capitalized on.

In order to capitalize on the excitement and enthusiasm of new employees, it is vital that the expectation of management be set out clearly during the mine site orientation. The interview process has sold the new employee on the benefits of working for Fording River, but at the new hire orientation, they are getting their first impression of the site and their employer’s expectations. New employees have been hired for a certain purpose, but the orientation is the opportunity for management to introduce the business; how each individual can play a part in making Fording River a competitive operation.

The current orientation is designed to expose the employees to the risks and safety measures of mining. Rules are reviewed and an acknowledgment given by the employees that confirm they have read and understood them. Rules such as the prohibited use of drugs and alcohol, discipline policy, start and stop time, treatment of employees, hot work, and lock out, are all covered. The new hires are shown where their lockers are, were first aid stations are and how to contact it if required. They are also shown some powerful videos that show how un-safe choices affect the employee and their family. Recently, all new employees have been given a tour of the three main areas of the operation – the mine pit, maintenance shop, and process plant. An attempt is being made to show new employees the interaction of different areas of the operation. This began because department heads realized that many of the older employees were never exposed to other operational areas. Because all unionized positions, other than trades are hired at the entry-level position of Pit Utility Worker, the usual course of an employee’s career is spent in one department. As a result, these individuals never did see the workings of other departments in the coal process to gain an appreciation for the challenges they face.

Currently, both new and existing employees are not exposed to the entire coal mining process; therefore, they are not as productive as they could be. To walk a mile in another’s shoes, is a saying that suggests that by gaining a different perspective and understanding the opposite view, one will come to appreciate the challenges others face. By doing so, one can make better decisions. This is the entire premise behind role relationship knowledge. By knowing how each department influences the coal mining process, each employee will recognize the consequences of their actions both positive and negative. This will lead to a more productive work force and will reduce cost.

## Reducing Cost through Knowledge Management

In the past, there were many ways to increase a company’s competitiveness. This could include getting products to market quicker, using lower paid labour, using different materials, or finding less expensive capital resources. For companies from the developed world, these techniques are commonplace. To achieve a true competitive advantage, the knowledge of employees must be managed. “There are many ways to keep busy in business, and to expand revenues. There is only a diminishing subset of strategies for creating attractive profit margins. In the end, heightened competition comes down to developing and owning intangible assets” (Vargas–Hernandez and Noruzi, 2010: 183).

From Kaplan and Norton, “no asset has greater potential for an organization than the collective knowledge possessed by its employees” (2004: 63).

### Intangible Assets

Vargas-Hernandez and Noruzi, Kaplan and Norton all recognize the need for management of knowledge in the workplace and its positive effect on competitiveness. Specifically, Kaplan and Norton state, “unlike financial and physical ones, intangible assets are hard for competitors to imitate, which makes them a powerful source of sustainable competitive advantage” (2004: 52).

While “intangible assets seldom affect financial performance directly, instead, they work indirectly through complex chains of cause and effect” (Kaplan & Norton, 2004: 54). Studies have shown that effective decisions making leads to more knowledge creation. The greater the knowledge creation is, the greater the amount of innovation. The greater the innovation is, the better the market and financial performance (Soo, Devinney, Midgle & Deering, 2002: 135). To define these intangibles assets in relation to different types of knowledge, this paper focus on service knowledge and role relationship knowledge. As stated earlier, role relationship knowledge is the knowledge of the interactions of different roles or jobs in an organization, and the consequences or connections between them. Although role relationship knowledge is crucial to increased performance, the building block to being productive is service knowledge.

Figure 6: Knowledge Pyramid

Service knowledge is the knowledge that employees must have to perform a role or position in the company. It is the knowledge that enables one to drive a haul truck, load a train, or fix an oil leak. Many employees have vast amount of service knowledge. This is important because the base of any triangle needs to be solid. Role relationship knowledge is important and it will enable Fording River to increase its competitiveness, however it is secondary to ensuring that the mine can produce. Service knowledge must be learned by the employees to ensure continued mine operation. With a third of the employees having low service number of years, their service knowledge is limited. It should be noted that not all new hires have come to Fording River with no skills, but the majority of new employees are new to mining and therefore do not bring mining experience to Fording River.

To increase the service knowledge of the employees, training is vital. Due to the change in demographics at Fording River and the large number of new hires, an increase in training staff was required. As a result, almost 20 new training positions were created to transfer the service knowledge to new employees. Because Fording River is a unionized workforce, there are certain jobs that are eligible only through the contractual bidding process. This means that although an employee may not be new to the Operation, he may be new to the position and requires training to increase his service knowledge.

For those employees hired before introducing role relationship knowledge, their exposure to role relationship knowledge can begin once they are competent in their role. This exposure will be outlined later in the paper, but unlike the new hire orientation, it will take longer than a couple of days to review the business operational processes.

The exposure to role relationship knowledge is somewhat reversed for new employees. New employees are not yet functional in their role. That is, they are not assigned to a crew or piece of equipment, and the status quo is not affected. Yes, they are needed in the operation, but the impact of not having them in their role is far less than removing a fully functional employee from their role that is already utilizing service knowledge. To this effect, instructing the new employees in role relationship knowledge at this time, can give them the top of the pyramid knowledge and set them up for training with a higher purpose other than service knowledge. They will embrace their service knowledge training with a greater ability to connect their new skills to the entire coal mining process.

In a perfect world, employees want to do the best they can at their job for pure personal satisfaction. However, many people only do the least amount of work as possible. Because most employees at Fording River are paid on an hourly rate, their income is less dependent on how much work is done in a period of time than someone that is paid on a per piece rate. To combat this, Fording River has a gain-sharing program that rewards employees through monetary bonuses for improved production, safety results, and lower costs. It can be argued that overtime is an easier way to increase an employee’s salary. While true, only some positions at the mine are eligible for overtime. The majority of employees are not, and the gain-sharing program is an attempt to give employees the chance to earn more money. In addition, when coal price is low, overtime is very limited and gain sharing is the only means to achieve higher earnings. To help achieve gain-sharing targets, all employees are encouraged to submit suggestions for management to consider and implement. Arthur and Huntley have shown that a suggestion based gain-sharing program can reduce operating costs (2005: 1167). Using employees as a source of information gives management more ‘sets of eyes’ to see what can be improved. Using employees can even be a more powerful source of information if role relationship knowledge is enhanced. The employee would be able to connect a perceived problem within the context of their job, to what it means to the operation, and suggest a solution that is a best fit for the company as a whole. An example of this is a haul truck driver reporting instances of ‘spill rock’ that is on the haul road. Spill rock is waste material that has dropped out of the haul truck. Spill rock is a major cause of damaged tires. If spill rock is not reported and removed, a damaged tire is very likely. Once damaged, the haul truck tire must be repaired and its usefulness is limited. From a service knowledge point of view, the employee can no longer do the job they are paid to do – drive a haul truck. From the role relationship knowledge point of view, not only is the employee not doing their role, but the adjoining processes of waste movement, coal cleaning, coal movement, and coal processing is impacted by a slower release of coal. There are fewer haul trucks available to move the waste to expose the coal that will feed the plant. This will lead to higher operating costs, less revenue and fewer profits. By imparting role relationship knowledge and listening to suggestions, employees will connect better to business operational success, employees’ actions will reduce cost, and employees can share in increased monetary rewards through gain sharing.

## Role of Senior Management

The basis for this paper is aimed at increasing the role relationship knowledge of the entire workforce to get the most out of employees. The next step is to show how this learning can be used. Many member of the Senior Management team at Teck Coal and Teck Resources have been working towards their Graduates Diploma in Business Administration or their MBA. This sponsored program was developed with the senior Human Resources group at Teck Resources. It has been determined additional education is vital for the future leaders in the company. This support for Senior Management is an acknowledgement that increased role relationship knowledge is important to Teck and confirms the need to expand similar concepts to all levels of employees.

## Next Steps

The current knowledge base of Fording River employees has been presented to show that Teck is not tapping into the most abundant source for a competitive advantage that exists. The intangible asset that stands to be exploited is enormous. In order to accomplish this, the teaching and knowledge transfer techniques must be changed. If the same methods are used, the risk of becoming a mediocre coal company increases. The employees at Fording River want to be better. This has been shown in maintenance initiatives and the different approaches taken towards improving safety. The following chapter outlines the path that must be taken to reap the benefits of increased role relationship knowledge and how it can make Fording River more competitive.

## Summary

To conclude and confirm the need for better role relationship knowledge, Table 2 summarizes the impact on current mine performance. It shows how current knowledge is leading to poor decisions, the use of poor practices and what this means to the product or financial performance.

Table 2: Ineffective role relationship knowledge and its impact on performance

|  |  |
| --- | --- |
| **Examples of ineffective role relationship knowledge**  | **Impact on the performance of the mine** |
| Haul truck driver drives on roads regardless of condition | Not lowering speeds increase damage to truck and increase downtime – lower productivity, higher costs |
| Loader Operator not following coal load counts | Decreased plant efficiency which leads to lower plant performance, and less coal produced |
| Processing group accepts marketing request without talking with Mine Engineering | Mine Engineering and Mine Operations have to change mine plan to accommodate and therefore release coals out of sequence – disrupts future coal release, quality, and therefore coal sales potential |
| Mechanic takes longer to repair truck because there are still ‘lots running’ | Keeping one truck down for longer than necessary prevents waste from being moved and coal being exposed. Without coal being exposed, there will be no feed to the Plant. |

# Proposed Changes to Fording River Operations

This paper has shown that the existing knowledge base at Fording River is leading to lost opportunities for productive gains. These gains are attainable if the employees’ knowledge of the consequences or connections between their roles is better understood. It has also shown that due to the demographics of the employees, different learning methods must be used. To increase the role relationship knowledge and benefit from this opportunity, changes in the way employees are educated are proposed. This chapter will outline both the changes and how the implementation should be carried out to new and existing employees.

## New Employees

As previously mentioned, two groups of employees exist: new employees and existing employees. New employees are most open to gain from role relationship knowledge. This is true because they carry no pre-conceived notions or attitudes towards their job or to Fording River. It is important to note that the attitudes of new employees are generally positive and this puts them in the perfect position to embrace new information. As stated previously, negatives attitudes are a challenge and can lead to improper decision-making motivation. The employees who have joined Fording River have done so for the opportunity and are in a positive state of mind. It will be important to maintain and build upon these positive attitudes. Education aimed at building role relationship knowledge will tend to support positive attitudes because it will help employees better understand the challenges and opportunities for the plan as a whole, and the advantages that accrue to all employees when the operation is run efficiently.

Teck can take advantage of this open-mindedness even before the on-boarding starts. Role relationship knowledge can be discussed during the interview process. This is a key step in the process of engaging the prospective new employee. In the current economic situation, the pool of talented personnel is limited and Teck needs to set themselves apart from the rest of the mining community. Considering that there are many parts of the country, and even other countries that are hurting from the economic crisis of 2008/2009, mining is doing relatively well. Because of this, new employees are getting harder to find. When people are looking for an employer, they are looking for stability, opportunity, and wage. By knowing this, we can highlight this in our interview process. The stability can be shown in the knowledge of the operation and explaining this to the potential new hires. A successful recruiter must know everything about the business so that they may sell it to the interviewee. People are choosing to apply with Teck Coal and we must bring our best face to the interview. This will mean bringing subject matter experts to the interview process. It could include bringing Engineers to an interview with a prospective new engineering employee or a Maintenance Foreman to a tradesperson interview. When the interviewee asks questions, the correct answers can be given on the spot and not have to be conjured up. People want to work for a knowledgeable company.

Once candidates have been successfully recruited, their first paid days at site are in new hire orientation. The existing orientation is similar to a shotgun strategy, hit as many people with as much information as possible.

Figure 7: Current Orientation Approach

It is proposed that the new hire orientation is changed to focus on Business Operations. Safety and SP&P’s will still be covered, as they are very important to ensuring the new hires understand the culture at Fording River.

### Safety

Safety is a core value at Teck. As a core value, safety resonates throughout the entire site and will not be compromised for anything. It cannot be shuffled about like cost, production, or profit. Because of its importance, safety must be included in the New Hire Orientation. It must be stressed that Fording River goes to great extremes to make any job as safe as possible. Safety equipment provided, and hazards addressed. It must be clear, that supervision and fellow employees are there to help and assist if necessary. It must also be stressed that the employee has a huge part to play in safety. It is expected that the employee will work safely and acting safely is a condition of their employment. Supervision is there to help, but it is the employee’s responsibility to be safe. If new hires do not relate to the importance of safety, then their employment must be reconsidered immediately, not when they have joined the general workforce. A focus on safe practices is an ideal way to introduce role relationship knowledge as it is easy for new employees to understand that failures to observe safe practices can affect others, not only the person deviating from them.

In addition to classroom training, specific safety related tours should be given. These tours will help new hires by adding a hands on approach enabling new hires to recognize hazards in the field. The tours would include light vehicle and haul truck interactions, conveyors, falling from heights and lockouts. Not only would these tours enhance safety learning, but they would also break up the day and make the environment more conducive to learning. The New Hire Orientation must also cover the safety basics at Fording River that include what to do in an emergency, how to use the radios, and where the First Aid office is located.

With safety basics being properly introduced to new hires, role relationship training can be more fully developed. This can start with safety related role relationship knowledge. A mechanic whose job it is to repair a haul truck must realize that the quality of his or her work directly relates to the safety of the operator and those around where the truck is operating. If the mechanic does not repair the brakes properly and they fail, there can be dire consequences. This holds true for the plant operators whose job it is to hose the floors. The operators are not hosing for themselves, but for the safety of others. Their role relates to the safety of others by ensure a clean and safe floor to walk and work on. A safer the operation has fewer injuries and incidents that can reduce productivity. When people are missing due an injury or a piece of equipment is down due to an incident, the associated role of this person or equipment is not being done. This leads to lower productivity, higher costs, and lower revenues. Lower revenues can lead to lower monetary rewards through profit and gain-sharing programs.

 Safety will always be the first part of the New Hire Orientation, the second part of the orientation will flow into the SP&P review.

### SP&P Review

Societies revolve around rules. Without rules, chaos and disorder arise. Fording River can be considered a mini city. To ensure the safe order of the Operation, there are basic rules that must be followed. These rules are set out in the SP&P’s. They outline how things must be done and who is to do them. They outline such things as the rules around drug and alcohol use, the discipline policy, what to do if one is late for work, and what to do is one is unable to come in because of sickness. Other SP&P’s outline how one must do Hot Work or how to enter a confined space. They also deal with contractors and their management and supervision.

Because new employees lack the understanding and experience, they need to be educated in the basic rules around working at Fording River. To make this easier and a better learning experience, Fording River has developed Computer Based Training Modules to teach some of the basic SP&P’s. It is widely accepted that different people learn in different ways. Fording River does not assess how their new employees learn best, but does have different ways to introduce knowledge to their new hires. This is done in an effort to educate in ways that reach all new hires, regardless of learning style. To assist in the retention of the policies, the interactive computer method was chosen. This method is proven and it reaches most individuals. Studies from ICOM, a computer software developer, have shown that this method allows the user to be more attentive and retain more information in the desired time (Harrington: 2010).

SP&P’s are also part of the role relationship training that new hires receive. Each orientation usually consists of different roles being hired. Because of this the SP&P’s that are reviewed, will have a different meaning to each role. A generic principle around light vehicle operation has a different meaning to someone who drives in the pit versus someone who only drives on the highway. By realizing that one procedure can apply to a variety of roles, the knowledge of role relationships and their benefits at Fording River can be enforced. Each role that uses the light vehicle procedure is related and by knowing this, the new employee can start to connect different roles through common procedures.

### Business Operation

The previous two sections do not reflect a major change from the existing new hire orientation but start to emphasise the role relationship knowledge between different jobs. They have been condensed so that the appropriate information is given, but the time is not wasted. The major change to the orientation is the Business Operation section. This section is where the most role relationship knowledge is given to the new employees. At this point, the safety related items have been covered, and the required SP&P’s reviewed. It is now time to introduce the new hires to what coal is all about.

The following table compares the existing orientation to the proposed section on Business Operations. As can be seen, the existing orientation has no specific role relationships presented. This left the new hires with a great deal of unconnected information.

Table 3: Relationship Interaction: Old Orientation vs. Proposed Business Operations.

|  |  |  |
| --- | --- | --- |
| **Existing Role Relationship Teaching** | **Proposed Business Operational Teachings** | **Role Relationship Interactions** |
| Safety Department helps all departments with safety issues | History of Fording River | Past knowledge to guide future decisions and learns from past mistakes. |
| Make coal within specification to help sales | Use of Coal in Steel Making | Why are we mining? What do we use as employees that require steel and therefore coal? |
| Every employee makes a difference at Fording River | Exploration | Affects the coal model that affects daily, weekly and LOM plans. Geologists routinely check found model accuracy against historical data. Good exploration required for financial decisions to proceed in a certain pit. |
| Use of Drugs and Alcohol are prohibited. If one is under the influence, they can harm themselves and others | Drill and Blasting | Need to know where the coal is located so that it is not blasted. Need to know the type of shovels to determine blast size. Need to know economics of blasting to blast enough for manageable digging, but not too much to warrant extra cost. |
| Tour of the Maintenance Shop, Pit and Plant | Mining and Hauling | Maintenance to keep equipment running. Capital expenditures for new equipment. Mine Engineering to keep up with Mine Plan. Processing to ensure proper specification of coal is being released and sent to plant. |
|  | Processing and Drying | How does the release of coal from the pit affect the plant? Consistent feed equals consistent product. Poor mining practices send more rock and less coal to the plant. More rock means higher processing costs. |
|  | Coal Storage | Finite room to store coal. Need to work with logistics to ensure train delivery. Need to work with Mine Engineering and Mine Ops to ensure proper quality of coal is released to meet marketing demands. |
|  | Logistics | Need to move the coal from site to port and do it at the right time. Need to realize that there are 3 mines on a single track of rail in the Elk Valley. Production rate determines train requirements. |
|  | Marketing / Sales | Need to produce what can be sold. Mine Engineering needs to work with Marketing and Sales to determine the amount of saleable coal. |
|  | Environment | All departments need to minimize the effect of the operation on the environment. We all need to put the land back to its original state and provide the proper areas for wildlife. |

Table 3 exposes the new employee to different interactions on the mine site. The presentation of this table is important also. It must be done using a cause and affect methodology. Interactions with new hires and getting their opinion how roles relate, start to build the connections between the roles. Questions should be asked to trigger their thinking and the potential role interactions. Questions similar to the following should be asked: How does the location of storing coal relate to hauling waste? Is it better to spend large amounts of money on explosives to blast the rock, or let the shovels dig through poorly blasted rock?

Because this information is so important to give to new hires, it cannot be done in just a classroom setting. Classroom learning alone will not impart information in a way that will be retained by the employees. To reinforce the learning of the Business Operations, specific tours of the entire site would be arranged. A pit tour would be used to show the location of the coal and the challenges of its removal. Without the recognition of the challenges the crews face in the pit, new hires will find it difficult to embrace the relationships that exist with the rest of the operation. A great deal of what happens in the pit affects the success of the entire mine. The following example highlights one of these relationships.

* When rock is not blasted properly, the shovels have to work harder to remove larger pieces of rock that have not been fractured. Not only will this lead to higher wear on the shovels, but it will also increase the haul truck loading time. This longer load time translates into less waste moved and coal exposed. If the coal is not release as per plan, the required coal for specific blends will be delayed and sales affected. Increasing the amount of explosives to blast and fracture the rock to what is called ‘popcorn’ is not necessarily better either. The more explosives used to fracture rock, the higher the operating costs. Blasting this way does translate into easier waste rock removal, but the potential to fracture the coal is greater, and the overall cost to the operation is higher. The appropriate amount of explosives must be used to limit cost, but fracturing the rock enough for reasonable digging is a necessity.

This type of an example highlights the relationships that exist between the shovel operators, the blasting crew, the haul truck drivers, maintenance personnel, engineering and accounting. The service knowledge must lie within the blasting crew and then the role relationship knowledge connects the other roles together.

The second tour would be of the maintenance shop. This tour would focus on the planning, scheduling and implementation of maintenance plans. This will enforce the need for maintenance within the organization and the role they play in keeping the operation running efficiently. Maintenance repair parts are one of the highest costs on site. Maintenance performed at the right time at the right cost and on the right equipment can assist in accurate forecasting. The following example shows the relationships between the Maintenance department and the need for accurate forecasting.

* The Maintenance department prepares an overhaul schedule for major pieces of equipment each year. This is prepared by looking at operating hours, cost of repairs, outstanding work-orders and reliability / predictive measures. This schedule is used to forecast the purchases required and therefore the cost to do these repairs. Depending on the cost, a replacement may be warranted. If so, this could change the spending from the operating budget to the capital budget. Regardless, either spending type will affect the cost to mine coal and potentially decisions from a mining and management side. If a proposed overhaul can be delayed by reassigning the equipment to a lower priority job, or an easier mining location, the associated costs are also delayed. If the replacement is pushed a year, the mine plan could be affected. The potential new piece of equipment may have higher productivities or be compatible with a larger fleet size.

These types of decisions cannot be made without the understanding and knowledge of relationships between Maintenance, Operations, Engineering and Corporate Accounting. Shareholders invest in companies to earn a return. Spending money efficiently on maintenance to ensure longevity can make Shareholder’s investment grow. If decisions are made that can negatively affect potential earnings, Shareholders will look elsewhere. Capital spending must be forecasted well so that the appropriate amount of money is allocated. If the forecast is inaccurate, operating expenditure will come in over budget and credibility of management is undermined.

To complete the business operations section, a third tour would expose new employees to the plant and the analytical lab. This tour will highlight the challenges of the process plant and the loading of unit trains. An example of the relationship knowledge in the Processing group is shown below.

* The amount of coal sold is determined on a yearly basis and it is updated periodically. Updates can result from a number of factors including potential spot sales that may occur throughout the year. These spot sales can be lucrative to the Operation if there is coal available, as prices can be greater than the quarterly contracted price. There are many times, Sales and Marketing makes requests that are outside of plan in an effort to capture high margin sales. If the Processing group agrees to this sale without having knowledge of the overall mine plan or the challenges that the Mine Operating group is facing, coal may not be available for the sales opportunity. Moving a mountain to expose coal is not a quick process and if any requests that are granted will change the process and have a long lasting ripple effect. Moving shovels to expose coal sooner than planned, results in not meeting the overall goal for the year. The annual committed sales under contract for the year may not be met and customers could find themselves without coal. In addition, mining costs are forecasted based on the annual mine plan. Changing this plan can have drastic effects that will in turn affect Teck Resources costs.

Although not common, the Processing group cannot accept requests out of ignorance. They must be knowledgeable in the mine plan, sales plan, and how the mine is operating. These types of relationships will be highlighted in the Processing tour.

To complete this part of the orientation, general discussion will be done to connect all operational areas and take questions from the new employees. These discussions will also introduce the profit and gain-sharing programs within Teck. The new employee, with their positive attitude and their new knowledge of the interactions between different roles will be primed for performance that will benefit the company and the employee.

## Existing Employees

The amount of information that the existing employees will require is less than a new hire. Existing employees are constantly reminded of safety related matters and on an annual basis, reviewing pertinent SP&P’s. The challenge with existing employees will be imparting the role relationship knowledge specifically to business operations. It is proposed that existing employees be taught the similar business operations material as new hires, but it should take place over a longer period. These topics will be covered in quarterly meetings, monthly reviews, and focused learning sessions.

Throughout each of these styles of meetings, the presenters must be wary of the attitudes of the employees. Existing employees have attitudes towards the learning, the company, and potentially the presenter that will affect the absorption of new knowledge regardless of the benefit. These attitudes must be tempered, or acknowledged, and refrained from impeding the delivery of new information to those willing to accept it.

### Quarterly Meetings

Quarterly meetings are already taking place. These meetings are an excellent opportunity for the General Manager to inform and update the workforce on important and timely issues. This is also the time when updates to the profit sharing and gain sharing programs are presented. As was noted, an increase in use of intangible assets can result in positive gains in monetary rewards. After the update on the rewards program, business operation topics relating to role relationship knowledge would be introduced. It would focus on the roles that each play in the mining process and how it affects the final product and the financial health of the company. Main topics would include Drill and Blasting, Mining and Hauling, Processing and Drying, Logistics and Marketing / Sales. Timing would coincide with the four quarterly meetings and relevant subject matter experts would convey the knowledge to the work force.

These meetings are meant to be informative and interesting. The delivery of role relationship knowledge must be to the point and have an impact of the audience. Many of those in the audience are used to operating machinery and not learning about the company’s financial health. Because of the hourly work force and the union affiliation, there is a concern about the amount of financial information that should be given out. More vetting would need to be performed prior to release.

### Monthly Reviews

The monthly reviews would be a chance for Sr. Management to introduce smaller topics that could be built into quarterly meetings. These topics would be 10 to 15 minutes in duration and could originate from outside sources such as customer or service provider (rail and port) presentations.

Because of the scheduling involved for over 1100 employees, these reviews would take place after safety meetings. This would allow the same information to reach the entire workforce and not take away from the message of safety. When knowledge is common, there is less chance for rumour and mistake. When being jointly discussed with safety, a sense of importance would be inherently attached to role relationship knowledge.

### Focussed Learning Sessions

The intent of focussed learning sessions is to increase the role relationship knowledge of key individuals in the Operation quickly. There are specific individuals that have an impact over many individuals or departments. In the case of Fording River, this would be the Engineering Group, Supervisors, and those that deal with outside services. The reason for this specific audience is to educate these groups and then have them use this information to make informed decisions that others can see. Those groups these Supervisors interact with will see how role relationship knowledge can be used to make smart decisions. From smart decisions come fewer operational disruptions and increases in productivity. These interactions will also re-enforce the individual employee’s role relationship knowledge that they have learned in quarterly meetings and monthly reviews.

The choice of the focus group is also important. Because of the networking potential, Supervisors are a group that would be taught first. As can be seen in the figure below, the Mine Operations group has a significant network that transcends different departments. Interaction is commonplace for this group.

Figure 8: Network of possible interactions for Mine Operations Supervisor

# Making the change

Change does not always lead to success. This chapter will evaluate ways to sustain change and make it successful. By analysing Kotter’s eight steps to change, the paper will relate the previously mentioned techniques and identify what still need to be done to ensure successful change to an employee base with high role relationship knowledge.

John Kotter, one of the foremost experts in change management, developed a process that is vital for change to succeed. His process is modelled around eight steps and is considered a guide to successful change. Each of these steps will be reviewed in relation to the change required for Fording River to achieve the necessary employee knowledge to increase competitiveness.

Figure 9: The Eight-Stage Process of Creating Major Change

(Kotter, 1996: 21)

## Establish a sense of Urgency

At this time, urgency is growing. The need for metallurgical coking coal is substantial and is predicted to stay high. Fording River must capitalize on being productive and competitive. Current demand will not last forever and Fording River must be prepared to last out the downturn. As this paper is being written, one of Teck Coal’s operations is in a labour dispute and not producing any coal. This has an effect on the market such that Teck Resources has reduced its coal sales guidance to the market. Urgency for coal is worldwide, and in Teck Coal, the need for improved processes to gain a competitive advantage is now.

Kotter suggests that for change to be successful, 75 percent of a company’s management needs to support the change. Fording River is getting there. Currently, about 50 percent of senior management are ready to support change. Senior management is only one piece of the urgency puzzle. While an important piece, buy in and a sense of urgency from the hourly employees is needed. To improve this sense of urgency, the planned focus meetings are an avenue to get the message of change to employees. This is not an attempt to skip steps in the change process, but a way to plant seeds of urgency throughout the mine and be prepared to accept the change.

The recently hired employees have been exposed to role relationship knowledge, and are beginning to understand the interactions between the different roles. They have also learned that this knowledge can also produce gains in their pockets through increased gain share payouts. They are going into the workforce full of energy and bringing that new energy to the existing employees. They are also bringing their new knowledge of role relationships and their part in a successful Fording River Operations.

## Form a guiding coalition

A guiding coalition happens through key players seeing the benefit of change. Department heads including Human Resources, Short Range Engineering, and Processing, along with the Mine and General Managers are ready for change. This group of personnel have the appropriate traits of leadership, expertise and creditability (Kotter, 1996). With the General Manager on the team and his direct line to corporate assistance, the coalition has a greater chance at success. If one looks at the personal traits of his group, all are driven individuals. None of the group however is looking for individual over team success. Each of the members of the coalition has either been promoted or hired into their positions based experience, success, and team working abilities. None of this core group is one to sit on the fence or be the bad apple in the group. All want to see Fording River improve and through change visions around knowledge, they feel it can succeed. This is a key step to making change happen. One person alone, even if they are the highest on the organizational structure cannot make change happen. The coalition departments and their respective leaders are the ones needed to work as a team, and to create momentum for increased urgency in relation to change.

## Develop a vision and strategy

Without a clear vision and strategy to convey how change will happen, it is destined to fail. This said, it must not be the first step in the change process. There have been many great visions for change and new ideas or directions that a company should go. Without the urgency and guiding team, the vision is lost and becomes a statement on the wall. Vision must be coherent and to the point. Kotter expands on how vision is important though certain characteristics of effective visions. In the case of increasing role relationship knowledge, the implementation of this leaning lets the employees see what the future can look like; an imaginable vision. The role relationship knowledge is desirable with the potential for increased monetary rewards and is feasible through the efforts that are in progress.

## Communicating the Vision

As previously stated, increased role relationship knowledge gives employees the focus to make better decisions, but also the flexibility to use their new knowledge when conditions are out of the ordinary. Above all else, the proposed implementation plan must easily communicate the vision. Let the employees know how their actions affect other departments and how this can lead them to better decisions and actions and potential monetary gains.

 The strategy for implanting the role relationship knowledge has looked at both new and existing employees as well as their availability for instructional sessions. It uses the key people with a better chance for networking to further show examples of how role relationship knowledge can be used for better decisions. The ongoing struggle with completing the change and having everyone on board with role relationship knowledge is getting the vision and buy in of all the hourly employees. Not everyone will agree or accept the change, but when a tipping point is reached, general acceptance will follow.

The key to making the change succeed in this case is getting the strategy in place to implement the teachings through quarterly and review meetings. This must be a focus of the guiding coalition.

## Empowering broad-based action

To change to a role relationship knowledge based culture, the guiding coalition must use the urgency and allow the employees to implement the vision. This can be accomplished, but needs assistance. The existing structures of Fording River will need to change. Make communication accessible to different levels of the company. It must be shown that the Superintendent does not always have to make the final decision. It must be clear that decisions are made with forethought and reason. If a decision is wrong, it must be accepted or momentum will be lost. No employee will want to make a decision if it leads to punishment for making a reasonable decision. The employee can be shown how a better decision could have been made so that the employee grows from the experience. This type of education enhances role relationship training. To help the employees, training may be required. Depending on the level of the employees, this training can be as simple as guidance, or as detailed as formal course on mining processes.

The final way to empower broad based action is to deal with any trouble supervisors that may thwart the change effort. If there is a possibility that the supervisor can change, then investment in that supervisor should be done. However, many supervisors are so entrenched in their ways that change is impossible. Removal and replacement of the supervisor may be required to continue the change process. Departmental silos were mentioned previously and how they are preventing interdepartmental knowledge from flowing. These silos need to be dismantled and the supervisor is the person to look at making this happen. If they are unwilling, this person’s role must be reviewed.

## Generating short term wins

Fording River has been and will continue to hire new employees into the near future. Because of this and the teaching of role relationship knowledge in the new hire orientation, this group will be the first to show the benefit of this knowledge. It is anticipated that better decisions are being made currently. These better decisions must be acknowledged and celebrated. Follow up is also important to see how this type of knowledge is delivered and if anything should be added.

Through follow up meetings with new hires, any decisions that were made based on role relationship knowledge shall be discussed. Was anything done differently because of this knowledge, and is there a different decision making process to those new hires orientated prior to the introduction of role relationship knowledge. These successes should be recognized taken to others on the crew in the department so that others can make similar decisions.

## Consolidating Gains and Producing More Change

Within one year, almost 10 percent of the employees at Fording River will have the basic knowledge of how their role relates to success and or failure for the Operation. This is not the end of the change. It will take much longer for the remaining 90 percent to understand this to relationship. They will require constant coaching on decisions made and how looking at the bigger picture may lead to a better decision. This will be most important for managers and supervision to show how the entire operation can be more successful from single choices.

As with many change initiatives, celebrating too early can lead to a stop in progress. Because the majority of employees will take a significant amount of time to learn all the areas of business operation at Fording Rive, the celebrations are still far off. Fording River should be impressed that their new hires are starting their careers with more role relationship knowledge than most of the veteran employees, but must stay vigilant in training the employees the consequences and connections that their roles have in relation to each other.

## Anchoring New Approaches in Culture

When changes made within the organization include new management personnel, it is important for those new people on the management team to be in line with a role relationship style of thinking. It should be included in the hiring process so that the short and long-term wins do not eroded with a change in management. These combinations will help Fording River be a more competitive company.

Fording River has seen a change in culture with respect to safety and needs to take the same approach with role relationship knowledge. Constant talking about the need for role relationship knowledge, looking at opportunities to relate consequences of different departments, and celebrating the wins is the way to anchor the changes into Fording River’s culture. This type of vigilance will lead Fording River to a state where the management of its knowledge will be at its maximum and its competitiveness will be stronger than ever.

# Conclusions

Coal mining is accomplished not by individuals, but by many people performing different tasks well. These tasks, while done in isolation, are connected, such that their impact to the entire operation can affect many other roles at the mine. Successful processes rely on the different departments working together and information flowing between them. To capitalize on the opportunity that exists, it is important for employees to have appropriate knowledge of the roles of other employees and their relationships with them. This paper defines this type of knowledge as role relationship knowledge.

Focusing on Fording River, the largest of the Coal Operations in Teck Resources, a number of examples are presented that illustrate the existing level of knowledge that employees possess and why this level of knowledge is not enough to increase competitiveness at the operation. Only knowing how to do ones role and not knowing the consequences or connections between roles is limiting the performance at the mine site. A number of recommendations have been made that include increased learning opportunities for new and existing employees. The key recommendations are to introduce business operations learning of the coal process at the new hire orientation and throughout specific sessions with existing employees. This exposure will start the process of linking roles of different employees to the improvement of the operation and the potential gains in monetary rewards that the employee can earn.

The time for change is now. The current demand for coal is high and the opportunity for Fording River to increase its competitive position has never been better. Knowledge is power, and employees that are knowledgeable in the relationships between their roles and the roles of other, will enable Fording River and Teck Resources to be a major competitor in the global coal business.

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