

4 DEFINING THE FUNCTIONALITY OF THE MINING OPERATIONAL MANAGEMENT MODEL

To be able to extract those elements from Total Quality Management, Just-in-Time and Theory of Constraints that will form the building blocks of the mining operational management model it is necessary to first define what the model should accomplish. It is therefore important to determine WHAT the model must accomplish, before the HOW is determined. This is accomplished by constructing an objective matrix that lists the specific functions that are required from the model. These functions are evaluated against each other to determine which aspects are the most applicable for use in the model and will add the most value to the first line supervisor of the mining production unit.

4.1 OBJECTIVE & PURPOSE OF THE OPERATIONAL MANAGEMENT MODEL

To develop an operational management model for an underground coal-mining environment that utilises the best and most applicable aspects from the selected management philosophies Total Quality Management, Just-in-Time and Theory of Constraints.

The operational management model needs to provide a first line supervisor with a proactive management tool that will assist him/her in quickly and easily adjusting the operations of the unit as well as to plan for the future in order to achieve the short and long term goals of the unit.

4.2 OBJECTIVE MATRIX

To define the functions of the operational management model an objective matrix (VM Services, 1992(v2): 8) is constructed. The objective matrix classifies different elements of the development of the operational management model in four quadrants:

- Results to achieve: the best possible results one would hope to achieve from the operational management model.
- Available resources: a list of all relevant resources that is available for the development of the operational management model.
- Results to prevent: all negative results that could be the result of the operational management model being used, and what needs to be out-designed from the start of the development.
- Constraints: all factors that could possibly hamper the achievement of the objective, i.e. those factors that could prevent the operational management model from being successfully used.

The objective matrix for the proposed operational management model is listed in table 3.

Table 3: Objective matrix

<p>RESULTS TO ACHIEVE</p> <ul style="list-style-type: none"> • Identifying problems • Improve problem solving activities • Breakdown silo's between functions • Assist unit leaders to become business orientated • Reduce downtime • Reduce cost • Streamline processes • Manage bottlenecks 	<p>RESULTS TO PREVENT</p> <ul style="list-style-type: none"> • Complicated calculations • More paperwork • Capital expenditure • Saving cost to the detriment of total production output • Time consuming activities • Un-flexible in use • Short term focus only
<p>AVAILABLE RESOURCES</p> <ul style="list-style-type: none"> • JIT, TQM, TOC information • Extensive maintenance & production information (downtimes, rates etc) • Financial information 	<p>CONSTRAINTS</p> <ul style="list-style-type: none"> • Resistance to change • Employees of production unit not trusting "another theoretical model" • Attitudes and perceptions of supervisors regarding "academic" sources

To confirm the content of the objective matrix the input of knowledgeable people in Sasol Mining was obtained. The people approached were a mine manager, the manager of the Work Study and Design department and one or two Industrial Engineers working on the mines. Their input and comments were used to complete the objective matrix, determine the functions and also determine the priorities of the functions.

4.3 FUNCTIONS

From the objective matrix the core functions of the operational management model are derived. A function is a description of the characteristics of the operational management model that will fulfill the user requirements as set out in the objective matrix.

The functions as derived from the objective matrix are:

- Identify root causes
 - o Provide a tool or process to highlight the problem areas within the unit and then identify the root causes. The first line supervisor is so busy with the day-to-day operations that he/she may find it difficult to obtain a bird's eye view of the operations in the production unit and identify where, and why, problem areas exist. The operational management model must provide the means or method to achieve this overview of the unit but with the ability to identify the problem areas (i.e. causing high downtime or high operational cost expenditure) as well as providing tools and techniques to identify the root causes.
- Provide solution frameworks
 - o The first line supervisor should be able to refer to a set of generic core principles regarding specific operational and managerial problems, i.e. how to reduce lead times.
- Manage cost expenditure
 - o The operational management model must assist the first line supervisor in managing the capital and operational cost of the production unit without it harming the production output or safety of the employees.

- Increase throughput
 - The production target of the production unit can be achieved by mining more coal (i.e. increasing the number of shifts or mining equipment) or by increasing the mining rate (i.e. more coal from the same number of equipment and shifts). The operational management model needs to assist the first line supervisor in determining what strategy to follow when, and also on how to achieve this.
- Improve business orientation
 - With the increased demands placed on the first line supervisor it is imperative that the production unit is run as a mini-business, using all the techniques, tools and practices that would be utilized in a business. The operational management model must assist the first line supervisor in long and short term planning and in decision-making based on sound business principles.
- Integrate sections
 - Traditionally the first line supervisor only looked at the production of the unit and the maintenance was the responsibility of the engineering team (roving maintenance team). For the production unit to be productive it must be managed as a whole, integrating all functions of the production unit. The first line supervisor needs a model to assist him/her in combining all activities of the unit and also convey this method of thinking to the employees of the production unit.
- Streamline processes
 - The operational management model need to provide a method for the first line supervisor to identify and eliminating unproductive actions in the operations of the unit that lead to long cycle times, high cost, duplicated and non-aligned efforts.
- Manage bottlenecks
 - The first line supervisor needs to identify and manage those processes or equipment that are limiting the output from the unit preventing it from achieving and exceeding the goals. The operational management model needs to provide a method for him / her to identify and manage these bottlenecks.

4.4 FUNCTION EVALUATION

In the previous paragraph eight functions were listed as being required from the mining operational management model. It would be difficult to use all eight functions in evaluating the different aspects of Total Quality Management, Just-in-Time and Theory of Constraints. Therefore an evaluation matrix (VM Services, 1992(v2): 24) is developed to determine which functions are the most important for the first line supervisor. The evaluation and subsequent ranking of the functions are done based on the researcher's understanding of and experience in the mining environment as well as discussions with various managers in the mining environment (refer to paragraph 4.2).

The evaluation matrix is shown in figure 1.

EVALUATION								ID	FUNCTION	SCORE	RANKING
A	A2	A3	A3	E1	A1	G2	H2	A	ID root causes	9	3
	B	B2	B2	E1	B1	G3	H2	B	Provide solution frameworks	5	4
		C	D1	E2	C1	G2	H2	C	Manage cost expenditure	1	6
			D	D1	F1	G2	H2	D	Increase throughput	2	5
				E	E1	G1	H1	E	Improve business orientation	5	4
					F	G2	H1	F	Integrate sections	1	6
						G	G1	G	Streamline processes	13	1
							H	H	Manage bottlenecks	10	2

Rating

- 1 - minor difference in importance
- 2 - medium difference in importance
- 3 - large difference in importance

Figure 1: Evaluation matrix

Explanation of the evaluation matrix

- All the functions as identified are listed in the column named **Function**.
- Starting with function A, it is evaluated against function B in terms of importance. If function A is more important for application in the model than function B, "A" is written in the relevant block in the columns named **Evaluation**.
- Using the rating provided, the level of difference in importance is determined. The rating is written next to the function letter.
- Moving systematically through the evaluation matrix all the functions are evaluated against each other in the described manner.
- Each function's score is calculated by counting the ratings where that function was the important one in relation to others. For example, when determining the score for function G, all the G1's, G2's and G3's are counted together, leading to a score of 13 for function G.
- Next the functions are ranked according to the scores they received. From the evaluation matrix it can be seen that function G has a ranking of 1 due to the highest score of 13. This result is shown graphically in figure 2.

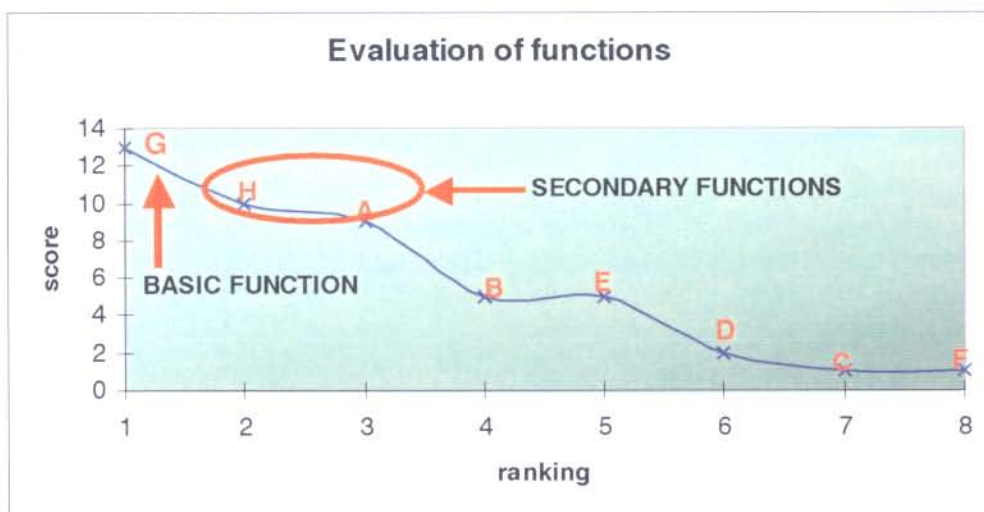


Figure 2: Evaluation of functions

In the graph two sets of functions clearly stand out from the rest. The one is the basic function, which represents the core function the model must fulfill (function G). The two functions called secondary functions (H & A) support the basic function in satisfying the

specification and requirements of the operational management model. Functions B, E, D, C and E are lower priority functions of the operational management model and will possibly still realise if the basic and secondary functions are attained in the model (VM Services, 1992(v2), p 26).

From the above analysis it is deduced that the functions to be used when investigating and evaluating the three management philosophies Theory of Constraints, Just-in-Time and Total Quality Management are:

Streamline processes

Manage bottlenecks

Identify root causes