



The development of a comprehensive, practical, and integrated management method for the South African mining industry

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Synopsis

This paper briefly reviews the adequacy of existing management theories and practices and the managerial proficiency or competency in the South African mining industry. The investigation revealed that existing management practices are totally inadequate to enable all employees on all the levels of the mining industry to achieve the results required from them, in all aspects, at all times. As a result, the South African mining industry is gradually losing its long standing reputation as a relative cheap, competitive, and reliable supplier of minerals to the local and global markets. According to some prominent management authors and theorists, an all-inclusive unified management theory does not exist at present. In this paper the authors summarize the main aspects of a newly developed comprehensive, practical, and integrated management method. It is believed that the application of this method would significantly improve the future performance and competitiveness of the South African mining industry

Keywords

Comprehensive integrated management, mine management, mine planning, Mine Managers Certificate of Competency.

Introduction

The South African mining industry¹ is the largest industry sector in the country and is widely recognized as a major employer, source of income to employees and the state, and leading supplier, producer and exporter of a great variety of minerals¹. It holds, in comparison to total world reserves, a dominant position in many mineral reserves. Its performance is lately being adversely affected by increasingly complex geological conditions, labour demands, local and global competition, and the fluctuation in the R/\$ exchange rate. In addition, skills shortages, increasing social commitments, rising input costs, new laws, and inadequate infrastructure, and unreliable energy and water supplies aggravate the situation. A survey indicated that mine management in general is of the opinion that existing management practices being utilized by the industry, are inadequate to enable it to manage in a comprehensive, practical, and integrated manner. It would appear that an all-inclusive management practice does not exist at present.

Haines² argued that for optimal results the management work for the whole organization needs to be performed comprehensively by all the responsible relevant stakeholders, on all the levels of the organization, at all times, in a coordinated and integrated manner. It was surmised that the inadequacy of existing management practices constituted one of the main reasons for the industry's deteriorating global competitiveness. The perceived management deficiency in the mining industry appears to be that existing management practices lack the necessary theory and relevant implementation procedures, which would enable all employees to manage in a comprehensive, practical, and integrated manner on all the levels of the organization. This is confirmed by several distinguished world-renowned management authors.

Drucker³ states that what it is to manage a business has so far been neglected. Allen⁴ points out that one could study management in an orderly and rational fashion only if one could develop the relevant taxonomy or principles of classification. Rue and Byars⁵ argue that a unified theory of management has not yet been realized. Callaway⁶ expresses the opinion that the quest for the one special management technique has led to the seemingly never ending supply of management theories.

In summary, it appears that most management theorists regard management as a process. Drucker⁷ emphasises that management must focus on the results and performance of the organization. Management is not the preserve or prerogative of managers and the man at the apex of the organization alone. It forms part of every employee's work. According to Daft⁸, the ultimate responsibility of managers is to achieve and maintain high performance standards.

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Survey of opinions of managers at mines

Perceptions and levels of proficiency of managers in the mining industry were tested by means of a questionnaire, supplemented by personal interviews, of 164 members of the South African Colliery Managers Association, the Association of Mine Managers of South Africa, and the Northern Cape Mine Managers Association.

The main emphasis of the revision was on the management practices and their applicability in the practical situation. It focused primarily on the area of management planning, more specifically the management planning processes and structures, as it is assumed that the planning function should form the basis for the development, utilization, coordination, and integration of the other management functions.

The perceptions and suggestions made by the respondents that participated in the empirical research and the conclusion of the researcher were that the main deficiencies of existing management practices are that:

- The administrative management approach is predominantly (96.34 per cent) being utilized in the mining industry. This approach is not based on a specific management logic. It is not complete and cannot enable the employee to manage comprehensively
- The management practices and programs being utilized in the industry are totally inadequate to enable the mining personnel to manage in a comprehensive, practical, and integrated manner on all the levels of the organization
- The planning processes being utilized are incomplete and cannot enable management to plan comprehensively, practically, and in an integrated manner
- The Mine Managers Certificate of Competency is largely outdated and should either be replaced with a comprehensive, practical, and integrated management method or be adequately updated
- The average overall management competency gap in the industry is 53.94 per cent
- A comprehensive, practical and integrated management method does not exist in the South African mining industry.

The following solutions were proposed by the respondents:

- Update the present Mine Managers Certificate of Competency
- Introduce a comprehensive, practical, and integrated management method that could be utilized by all employees in the organization.

Management competency is defined as the degree of proficiency of an employee in understanding and applying the perceived comprehensive, practical, and integrated management theory in his own practical situation. A management competency standard of 85 per cent was proposed since a general universal management competency standard could not be ascertained from the research work. The difference between the actual rated competency and the proposed management competency standard would constitute the management competency gap.

The most important conclusion arising from the questionnaire was that there exists a need for an improved management system on South African mines.

Development of a comprehensive, practical, and integrated management theory

The comprehensive, practical, and integrated management theory is developed from the need to achieve results. It is based on a specific logic. Needs are triggered by challenges, instincts, routine actions, opportunities, dissatisfactions, deviations or instructions, to mention only a few. A need can be satisfied only by the required results. In the comprehensive management logic, a need or objective and a result would be treated as synonymous. The only difference between an objective and a result is time. The moment when the objective is satisfactorily realized, it becomes the required result. Normally there would be more than one method with which to achieve the required results. The best method should be determined and applied. The comprehensive management logic reasoning is stated as follows:

- An unpreferred condition creates a need that can be satisfied only by the appropriate results required
- The required results create an objective
- The objective dictates that work should be performed
- The work (best method) produces the required results
- The results satisfy the objective and change the unpreferred condition to the preferred condition and
- When the results do not satisfy the objectives, timeous corrective action is taken.

The results required, need to be stated first; thereafter the objective should be formulated and then the work or the best method with which to achieve the results required should be determined and efficiently performed. The results required become the standards of performance and are used to measure, evaluate, and where necessary correct the work in progress or performed.

From Figure 1 it follows logically that the:

- Required results create the needs or objectives
- Needs or objectives dictate the work to be performed
- Work produces the required results and
- Required results satisfy or do not satisfy the needs or objectives.

The following terminology is proposed for the further development of the comprehensive management theory:

- Main tasks instead of management functions
- Supporting tasks instead of activities
- Controlling tasks instead of elements and
- Tasks further down the line where and when necessary.

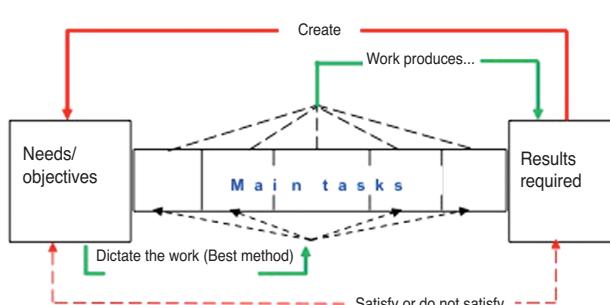


Figure 1—The comprehensive management logic development

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The main reason for the existence of any organization is that it has to produce optimal results. According to Daft⁸ the ultimate responsibility of managers is to achieve and maintain high performance standards. The manager must, when given the objectives and direction, initiate and develop the plans and processes to realize these objectives. The best method to satisfy this need therefore is to manage (Figure 2).

Therefore the best method to manage is broken up into main tasks. The following main tasks are identified:

- Plan
- Implement the plan and
- Control the progress with the plan.

In order to develop the best alternative down to the smallest tasks, the following procedure should be applied (Figure 3).

For each main task:

- Determine the results required
- Formulate the objective
- Develop alternative methods with which to achieve the results required
- Select the best alternative method and
- Develop each main task into supporting tasks.

For each supporting task:

- Determine the results required
- Formulate the objective



Figure 2—Development of the work flow of the best method

- Determine the best method with which to achieve the results required and
- Develop each supporting task into controlling tasks.

For each controlling task:

- Determine the results required
- Formulate the objective
- Determine the best method with which to achieve the results required and
- Develop the best method into main, supporting, and controlling tasks and where necessary develop these tasks further down to the most elementary and smallest tasks.

The sequence outlined above would ensure that:

- Starting with the results required, the work flow is developed systematically
- Work for each task supports a common objective
- Objectives ultimately culminate in the general objective and results of the supervisor, department, and the organization as a whole
- Objectives are optimally aligned
- Work is scientifically developed, integrated, coordinated, and delegated and
- Required resources are accurately determined.

For the supervisory positions it would be sufficient to develop their own work flow only down to the controlling tasks. The reasons for this are that the:

- Main tasks represent the selected perceived best method in order to achieve the required results most efficiently
- Supporting tasks are necessary to ensure that each main task is being performed efficiently
- Controlling tasks ensure that adequate control is exercised for the efficient execution of the supporting tasks and that the optimum results are achieved through the execution of the main task and



Figure 3—Development of the work flow

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- Supervisors could efficiently delegate work and accountabilities to the specific subordinates.

The extension of the work flow as indicated by the dotted lines in Figure 3 suggests that in the situation where required the work flow must be developed further. It must be developed until full control is established for that specific post or at the lowest levels to continue the work flow to the smallest task component necessary and to perform the task and resources analysis in the required detail. In order to analyse management work, the best method to achieve optimal results to manage will be further developed into main, supporting, and controlling tasks (Figure 8). From this

development it would be possible to classify management work and to develop a logical planning process. In the case of the nonsupervisory posts such as machine operators, artisans, clerks, sweepers, and others, the work flow development will have to be continued until the last and tiniest task and nuts and bolts, so to speak. This is necessary in order to determine the costs, probable hazards, and necessary procedures for control. This part may require detailed and time consuming work, which should be carried out by the incumbent and closely overseen by the immediate supervisor, at least in the beginning.

The development of the work to manage in Figures 2 to 7 proves that:

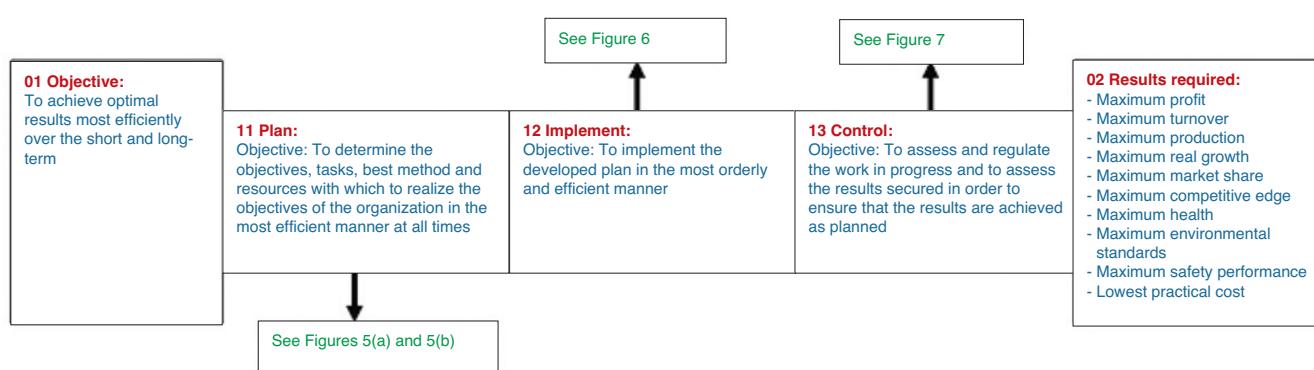


Figure 4—Detail work flow development of the alternative to manage with the comprehensive management logic

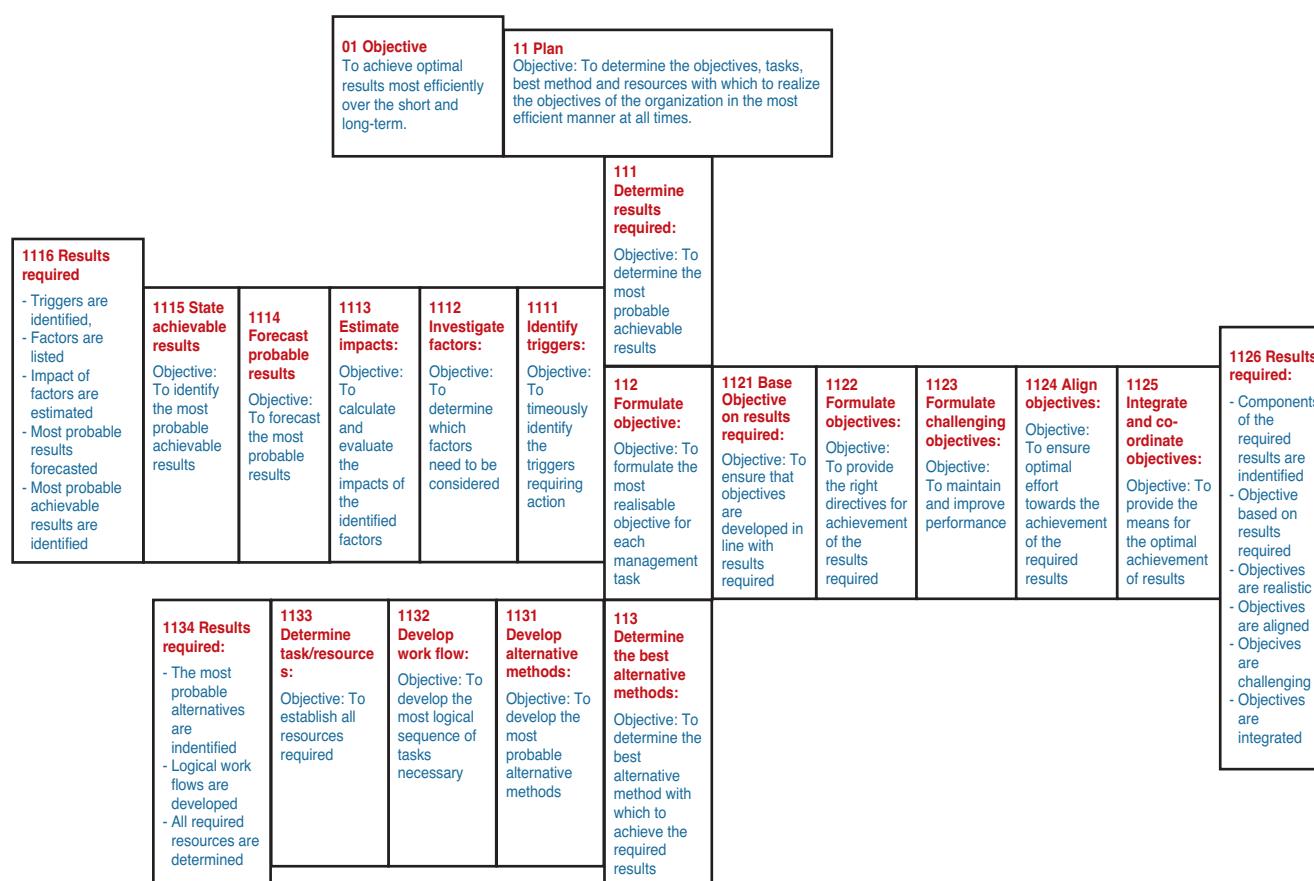


Figure 5(a)—Detail work flow development of the main task to plan with the comprehensive management logic

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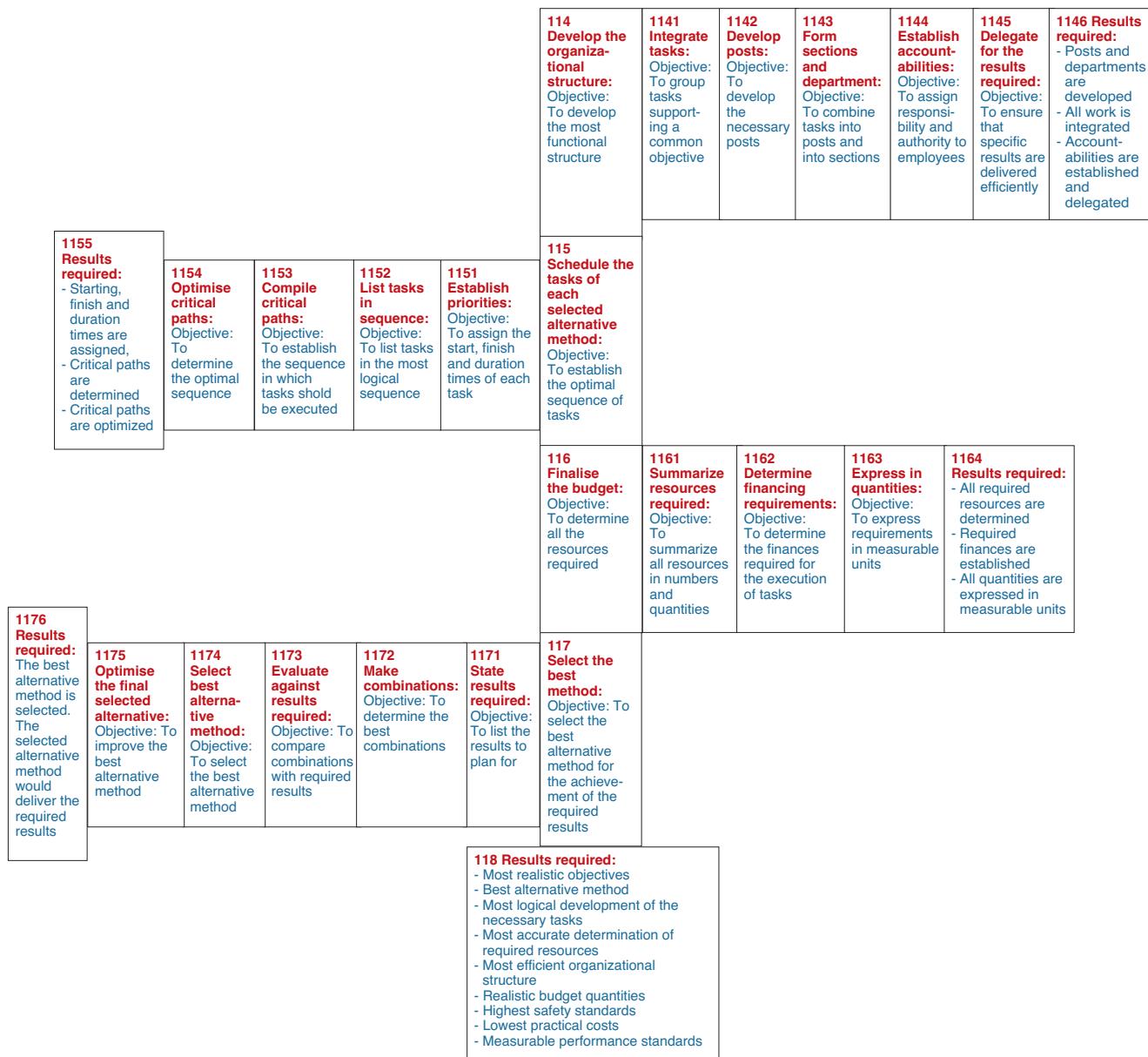


Figure 5(b)—Detail work flow development of the main task to plan with the comprehensive management logic

- The main results required satisfy the main objective,
- The results required for each main task satisfy the objective of each main task and become the standards of performance and
- The results of all the main tasks add up to the main results required for the general objective. It is the total of the results required from each main task.

The comprehensive management classification

Classification of management is necessary in order to develop and practically apply management work. It would follow logically from the development of the comprehensive management logic work. The work flow of management work is proposed as a general approach to develop and analyse management work.

The development of the work to manage in Table I proves that:

- All the activities of the organizing function of the administrative management approach are part of the main management task to plan. It is therefore more correct to perform this work during the planning stage. It would automatically result in the logical integration of the required management work,
- The activities of the leading function are utilized in management to maintain the tasks to plan, to implement, and to control. They should be seen as management skills that should be utilized from the start to the end and during management work, when and where required. It should not be seen as structural components or building blocks of the management structure but rather as the 'tools' to drive the management process, and
- The supporting task to develop performance standards is performed as part of the main task to plan.

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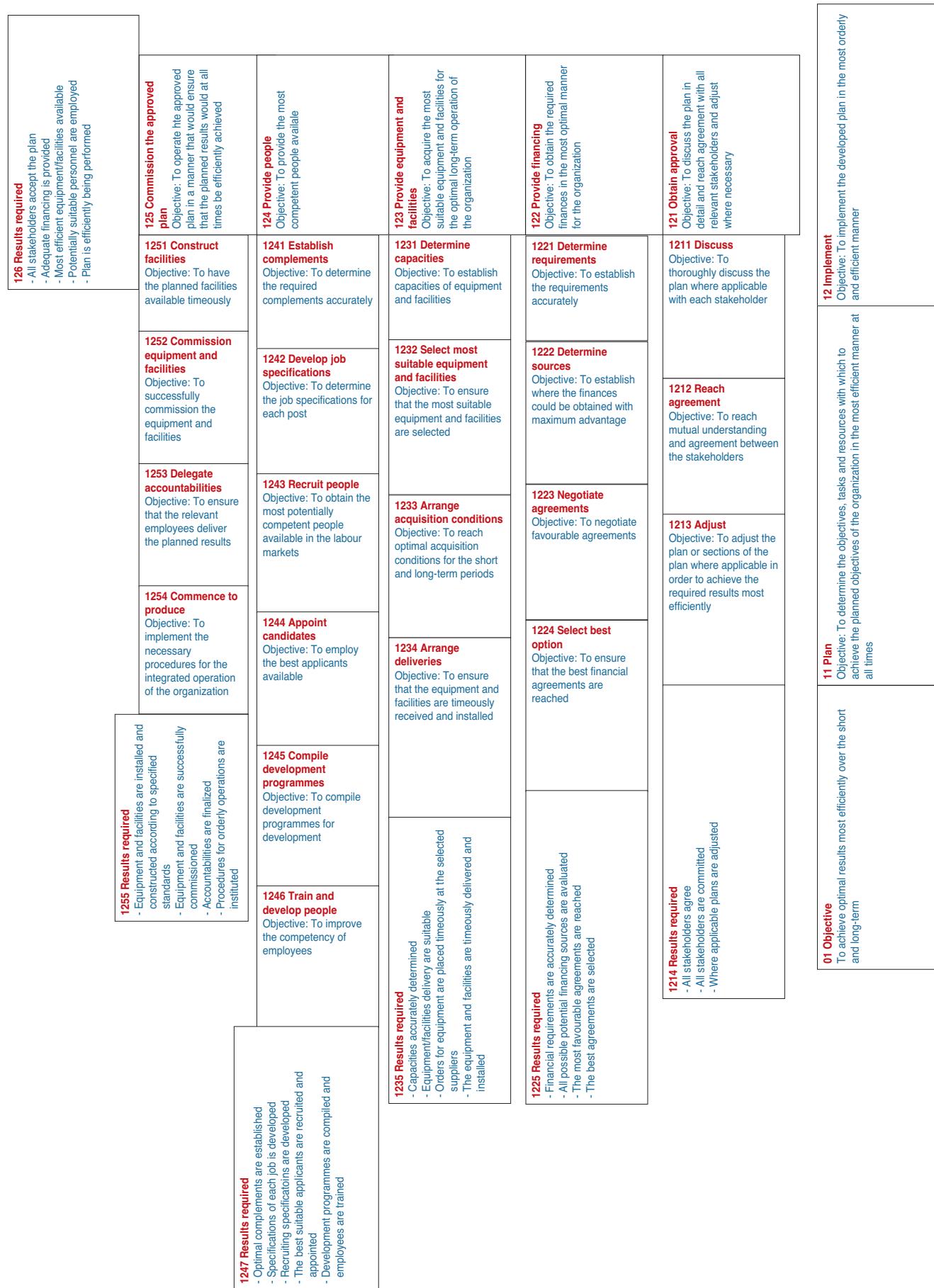


Figure 6—Detail work flow development of the main task to implement with the comprehensive management logic

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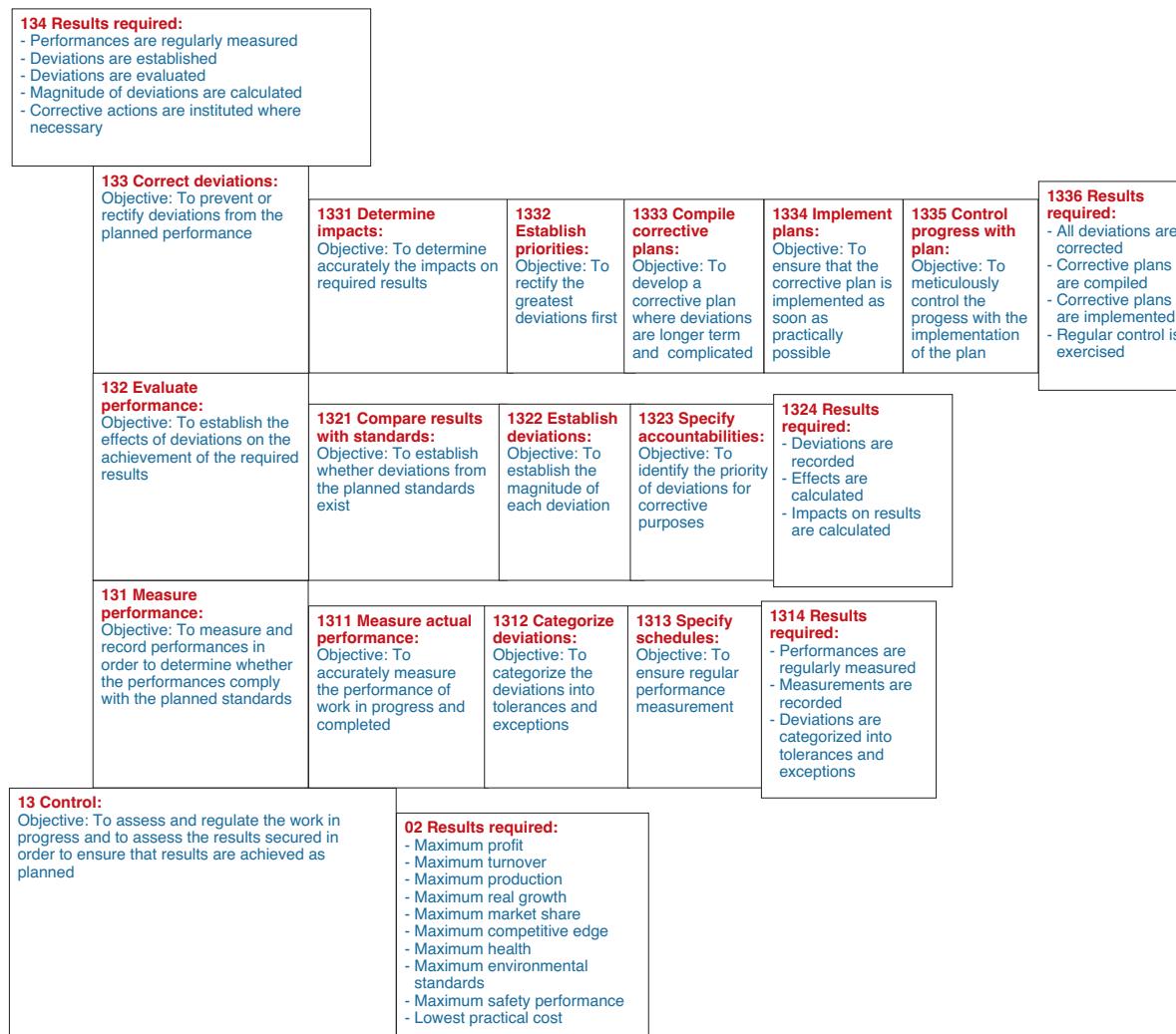


Figure 7—Detail work flow development of the main task to control with the comprehensive management logic

The planning process

The South African mining industry was from its inception extremely capital intensive. The lifespan of mining ventures stretches normally over long periods. Each venture has to justify the capital outlay. The planning process should therefore accommodate these needs and is derived from the development of the work to manage (Table I). The following process is proposed (Figure 8).

The planning process follows logically from the development and classification of the comprehensive management work. It closely follows the sequence of the development of the supporting and controlling tasks of the management main task to plan, to implement, and to control the plan. From Figure 12 it is clear that the development of each alternative, as indicated in red in the block, must be repeated in detail so that a more reasoned choice can be made as to which alternative method is the best.

The planning structure

In order to maintain its competitive edge, flexibility, and

ability to respond rapidly to changing factors, the industry should implement and utilize a logical comprehensive planning structure. It should consist of a series of plans capable of accommodating the demands of the industry's operations. It is imperative that each manager should compile his own plan, utilizing only functional or staff departments, where really justified.

The following practical and logical planning structure for the South African mining industry is proposed. Each mining house should decide whether to implement or reject it as proposed or to amend it for its own specific situation.

- A strategic plan
- A long-term plan
- A medium-term plan
- A short-term plan
- Operational plans
- Corrective action plans
- Contingency plans
- Supporting plans
- Project plans
- Fixed plans

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Table I Classification of the comprehensive management work		
Main tasks	Supporting tasks	Controlling tasks
Plan	Determine the results required	<ul style="list-style-type: none"> Identify the relevant deviations or triggers Investigate and analyse the factors involved Estimate the impact of these factors Determine and forecast the most probable results Discuss and state the most probable achievable results
	Formulate the objective	<ul style="list-style-type: none"> Base the objective on the results required Formulate objectives in futuristic terms (start with "To") Formulate challenging objectives Align objectives Integrate and coordinate objectives
	Determine the best alternative methods	<ul style="list-style-type: none"> Develop alternative methods Develop the work flow for each selected alternative method Develop the task and resources analysis for each selected alternative method
	Develop the organisational structure	<ul style="list-style-type: none"> Integrate the tasks supporting a single objective Develop the required posts Form sections and departments Establish accountabilities Delegate for the achievement of the required results
	Schedule the tasks of each selected alternative	<ul style="list-style-type: none"> Establish priorities List tasks in sequence Compile critical paths Optimize critical paths
	Finalise the budget	<ul style="list-style-type: none"> Summarize the resources required Determine financing requirements Express requirements in measurable quantities
	Select the best alternative method	<ul style="list-style-type: none"> State the results required Make combinations where applicable Evaluate each against the results required Select the best alternative method Optimize the selected alternative method
Implement	Obtain approval for the plan	<ul style="list-style-type: none"> Discuss plan with stakeholders Reach agreement Adjust plan where necessary
	Provide financing	<ul style="list-style-type: none"> Determine the requirements Determine potential financing sources Negotiate acquisition agreements Select the best option
	Provide equipment and facilities	<ul style="list-style-type: none"> Determine capacities Select the most suitable equipment and facilities Arrange acquisition conditions Arrange deliveries
	Provide people	<ul style="list-style-type: none"> Establish complements Develop job specifications Recruit people Appoint the most suitable applicants Compile development programmes Train and develop people
	Commission the approved plan	<ul style="list-style-type: none"> Construct facilities Commission the equipment and facilities Delegate accountabilities Start to produce the results planned
Control	Measure performance	<ul style="list-style-type: none"> Measure actual performance Categorize deviations Specify schedules
	Evaluate performance	<ul style="list-style-type: none"> Compare results with standards Establish magnitude of deviations Specify accountabilities
	Correct deviations	<ul style="list-style-type: none"> Determine impact of each deviation Establish priorities Compile corrective plans Implement the plans Control progress with plans

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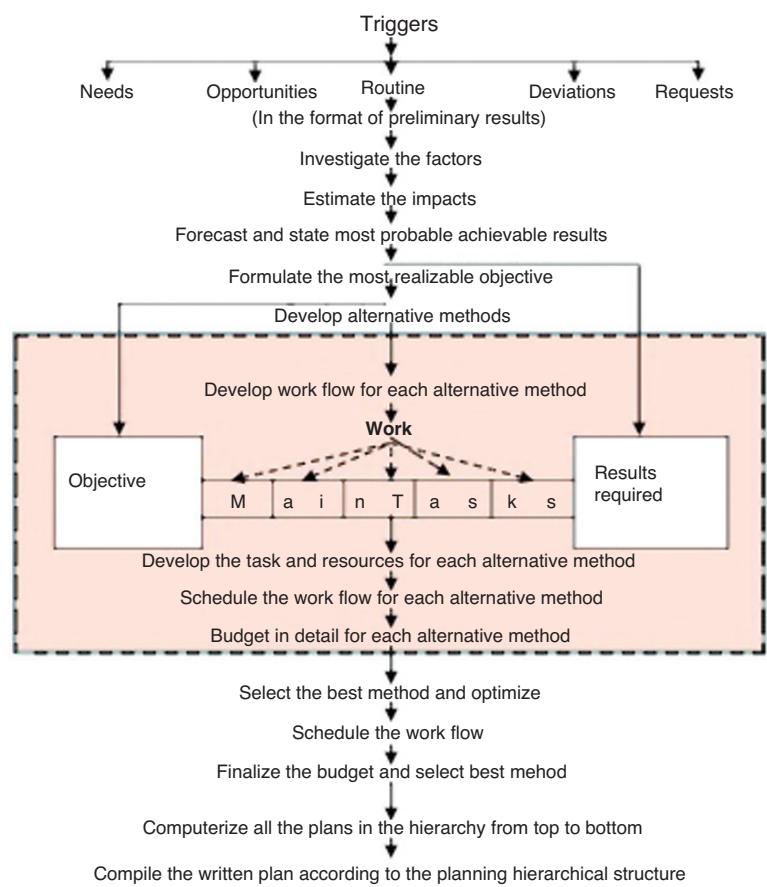


Figure 8—The comprehensive, practical, and integrated management planning process

- Policies
- Procedures
- Rules and instructions
- Emergency plans.

The advantages of the new theory are that:

- It is comprehensive, practical, and integrated
- It is possible to scientifically classify management work
- It facilitates the development of a logical integrated management planning process
- The planning process is applicable to each plan whether small or large or long or short-term
- A practical planning structure for the South African mining industry follows logically from it
- It can be applied on all the levels of the organization, and
- It recognizes the reality of and the need for every employee to plan for the results required from him.

Development of the task and resources analysis for each selected alternative method

From the work flow diagram each task must be analysed and fully developed as indicated in Table III (a) and III (b). The task and resources analysis must be developed in the required detail. The following procedure must be followed:

The budget for each alternative method would now follow logically from the task and resources analysis. It is important to remember that the total of the costs, capital, equipment,

manpower, and other resources must be calculated from the bottom upwards. The task and resources analysis form the basis for:

- The detailed determination of all resources required per task, post, section, department, and the organization as a whole
- The development of the organization structure
- Coordination
- Integration
- Delegation
- Development of job specifications
- Development of training and development programmes and schedules
- Complete control
- Compilation of the budget and
- Optimizing total operations.

Conclusion

The implementation of the comprehensive, practical, and integrated management method would mainly ensure that:

- Management work is completely integrated on all the levels by all employees under all circumstances, and every employee would be sufficiently empowered and competent
- The results of every employee and the organization would be those as planned
- The formulated objectives would support the main or general objective of the organization

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Table II	
Steps in developing the task and resources analysis	
1. Identify tasks (from the work flow diagram) <ul style="list-style-type: none"> 1.1 Assign an intrinsic code to each task 1.2 List each task 1.3 State: <ul style="list-style-type: none"> 1.3.1 The performance standards (from work flow diagram), company policies, and rules 1.3.2 Statutory regulations 1.3.3 Any other applicable laws, regulations, agreements, or restrictions 1.4 The objective for each task (from work flow diagram). 	4. Identify the most probable hazards <ul style="list-style-type: none"> 4.1 Establish what can go wrong, and 4.2 Establish what the possible consequences would be.
2. Determine the resources required <ul style="list-style-type: none"> 2.1 Labour <ul style="list-style-type: none"> 2.1.1 State the labour 2.1.2 State the number 2.1.3 State the unit cost. 2.2 Determine and state the equipment and facilities <ul style="list-style-type: none"> 2.2.1 Type, 2.2.2 Number 2.2.3 Required capacity of each 2.2.4 Capital required 2.2.5 Unit operating cost. 2.3 Determine and state the time <ul style="list-style-type: none"> 2.3.1 Starting time 2.3.2 Finishing time 2.3.3 Duration time. 	5. Assess all risks <ul style="list-style-type: none"> 5.1 Determine the probabilities 5.2 The possible severity 5.3 The severity rating 5.4 The type of risk.
3. List the performance <ul style="list-style-type: none"> 3.1 Identify possible deviations 3.2 Determine the possible resulting consequences. 	6. Develop the preventative measures <ul style="list-style-type: none"> 6.1 State the type and method 6.2 Establish the responsibility.
	7. Determine the control measures <ul style="list-style-type: none"> 7.1 Establish the inspections required; determine <ul style="list-style-type: none"> 7.1.1 The methods of inspections, 7.1.2 The frequency of inspections 7.1.3 The accountability. 7.2 Establish the supervision measures; determine <ul style="list-style-type: none"> 7.2.1 The accountability 7.2.2 The type of supervision.
	8. Establish the reporting procedures; determine <ul style="list-style-type: none"> 8.1 The accountability 8.2 The frequency 8.2 The type of report.

Legend								
P	Probability	S	Severity	R	Risk rating	T	Type of risk	

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Table III(b)

Example of the task and resources analysis breakdown sheet

Legend

Legend							
P	Probability	S	Severity	R	Risk rating	T	Type of risk

- Work is logically developed, integrated, and coordinated including the standards for control
 - All necessary risks, policies, procedures, and reporting systems are developed as part of the planning of the work, computerized, and resources continually optimized
 - The costs of management development practices in the mining industry would be optimized
 - The mining industry would be able to regain its global leading position
 - The following management work would be enhanced:
 - Efficient decision making, delegation, motivation and communication
 - Development of recruiting specifications and appointment of the most competent workers
 - Development of training and development procedures.

Acknowledgement

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References

1. CHAMBER OF MINES OF SOUTH AFRICA: Annual Report 2006– 2007. Produced by the Communications Services of the Chamber of Mines of South Africa. Marshalltown, Business Print Centre. pp. 12–18.
 2. HAINES, S.G. *Strategic and Business Planning: The Systems Thinking Approach*. Amherst Mass, HRD Press. 1999. pp. 10–14.
 3. DRUCKER, P.F. *The Practice of Management*. London, Pan Books. 1968. pp. 7–8.
 4. ALLEN, L.A. *Professional Management: new concepts and proven practices*. Maidenhead, McGraw-Hill. 1973. pp. 46–47.
 5. RUE, L.W. and BYARS, L. Management—Theory and Application. 5th ed. Homewood, Ill, Irwin. 1989. pp. 49.
 6. CALLAWAY, R.L. *The Realities of Management: A View from the Trenches*. Westport, CT, Quorum Books. 1999. pp. 21. Available from: <http://www.questia.com>.
 7. DRUCKER, P.F. *Management Challenges for the 21st Century*. Oxford, Butterworth Heinemann. 1999. pp. 39.
 8. DAFT, R.L. *Understanding Management*. New York, The Dryden Press. 1995. pp. 14–15.
 9. STONE, J.D. The Development Of a Comprehensive, Practical And Integrated Management Method With Specific Reference To The South African Mining Industry. PhD Thesis, University of Pretoria, 2009. ◆