

# Performance management—the total integration of a company's management systems\*

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## SYNOPSIS

The productivity indices of the Republic of South Africa compare poorly with those of its competitors in the rest of the world. The theory of productivity is relatively simple, and various models are available to demonstrate this. The problem is how to apply the theory in practice and to convert it into a practical management system that will guarantee results. The secret lies in a management approach that aims at a continuous improvement in achievement and that involves the entire work force down to the lowest level in the process. Good management systems ensuring the necessary attention to, among others, management by objectives, finance, personnel, maintenance, planning, and control are a prerequisite for continued improvement and staff involvement. The net result of such an approach is described by the term *performance management*, which encompasses the total integration of all a company's management systems.

## SAMEVATTING

Die produktiwiteitsindekse van die Republiek van Suid-Afrika vergelyk swak met sy mededingers in die res van die wêreld. Die teorie oor produktiwiteit is relatief eenvoudig en verskeie modelle is beskikbaar om dit voor te stel. Die probleem is egter om die teorie toe te pas in die praktyk en dit om te sit in 'n praktiese bestuurstelsel wat resultate sal waarborg. Die geheim lê in 'n bestuursbenadering wat daarop ingestel is om aanhoudend prestasie te verbeter en die hele werkerskorps tot op die laagste vlak betrokke te kry by die proses. Goeie bestuurstelsels wat die nodige aandag verseker aan onder andere: doelwitbestuur, finansies, personeel, instandhouding, beplanning en beheer, is egter 'n voorvereiste om aanhoudende verbetering en mensbetrokkenheid moontlik te maak. Die netto resultaat van so 'n benadering word goed omskryf deur die begrip *prestasiebestuur* wat die totale integrasie van al 'n maatskappy se bestuurstelsels behels.

## Introduction

It is well known that the productivity index, or gross domestic product per capita (GDP), of the Republic of South Africa (RSA) compares unfavourably with those of its competitors in the rest of the world, as indicated in Fig. 1. There, the graph for the RSA indicates a hypothetical and optimistic high growth rate of 4 per cent and shows that, if the index for the USA continued to grow at 1,44 per cent, it would be almost impossible for the RSA index to catch up with that of the USA. When one thinks in terms of productivity, it is important to realize that a better per capita production is the only way of increasing the living standard in a closed economy.

A few important factors tend to lower productivity in the RSA.

- (i) Its resources are declining, and the costs of exploitation are therefore increasing.
- (ii) The population growth rate is high.
- (iii) Too many people tend to be involved in the production process. (In the USA, on the other hand, only 30 per cent of the economically active population is involved in production.)
- (iv) Salary increases are outstripping improvements in productivity.

The seriousness of the problem in the RSA is further emphasized by the fact that, in real terms, the GDP was

the same in 1983 as in 1972, i.e. there has been no improvement in 11 years. This is borne out by Table I, which shows the rand per capita income in 1985 of some important industrialized countries that compete with South Africa on world markets.

From the above, it is clear that the South African businessman faces a tremendous challenge to improve productivity in the RSA. This paper attempts to address this problem by describing a management approach that offers a solution.

## Theories of Productivity

### Simple Model

One approach to the problem is to regard productivity simply as the way in which available resources are utilized. Mathematically, it is the ratio of output to input. Fig. 2 reflects the view of the National Productivity Institute (NPI), which regards the inputs of the production process as labour, material, and capital, and the output as goods or services. In the conversion of these to production, productivity is seen as the degree to which resources are utilized and the conversion process has been efficient. However, it is important that, irrespective of the efficiency of the process, the goods and services should be fit for the purpose, and a need for those goods and services has to exist in the market.

The NPI model does not indicate the important role that people play in the productivity. This role is portrayed by the following description (of unknown origin) given by Van Wyk<sup>1</sup>:

Productivity is an attitude of mind. It's the mentality of progress, of the constant improvement of that which exists. It's the certainty

\* Presented at the Colloquium 'Management Techniques in the Mining and Metallurgical Industry', which was organized by The South African Institute of Mining and Metallurgy and held in Pretoria from 15th to 17th June, 1988.

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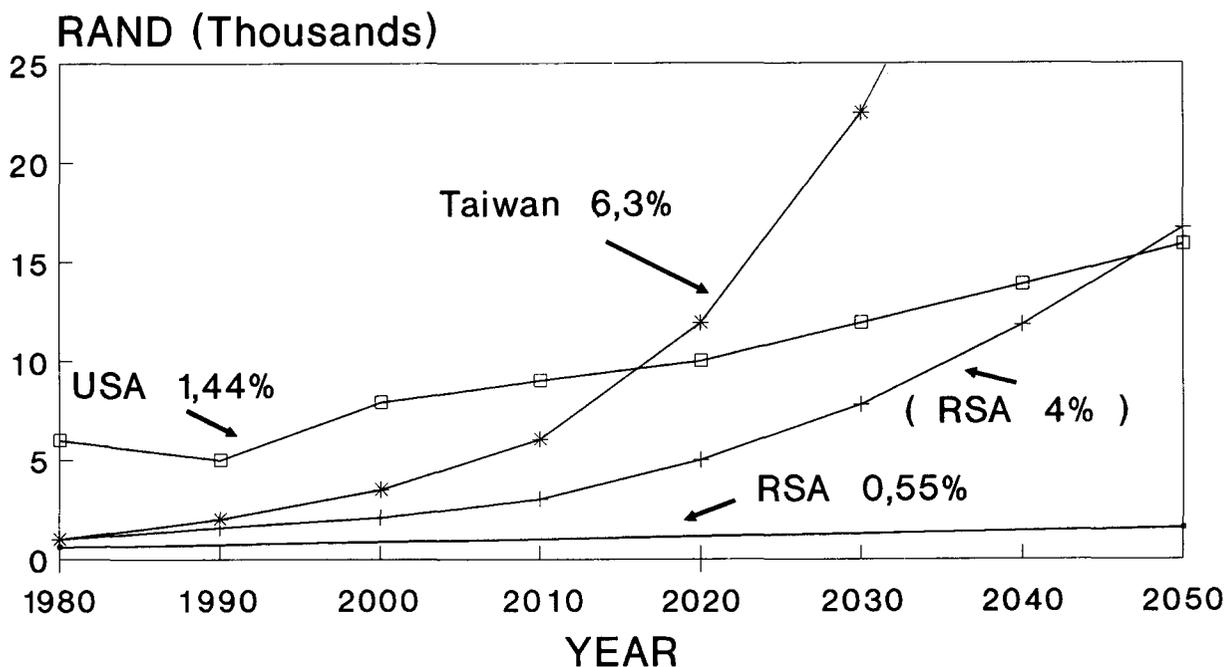


Fig. 1—Changes in the GDP per capita at 1975 prices (source: National Productivity Institute)

TABLE I  
PER CAPITA INCOME OF SOME INDUSTRIAL COUNTRIES: 1985

| Country                  | Income, R |
|--------------------------|-----------|
| Switzerland              | 12 500    |
| USA                      | 9 500     |
| England/Japan            | 8 000     |
| Israel                   | 4 000     |
| Republic of China        | 2 100     |
| Republic of South Africa | 1 800     |

addresses the two most important factors of productivity, namely technological and human factors, emphasizing that productivity is the main objective of an enterprise.

From Fig. 3 it is clear that productivity, or more correctly, improvement in productivity is seen as the key objective. Productivity is defined by Sutermeister as output per man-hour, with quality taken into account. This output is not the result of human effort alone, but the combined result of all the production factors, including labour, management, money, machines, raw materials, etc. The expression of productivity in terms of output per man-hour is only for convenience. Productivity can also be expressed in terms of output per R10 000 invested, or output per ton of raw material, or output in comparison with any other input factor.

An examination of Fig. 3 reveals the following interesting points.

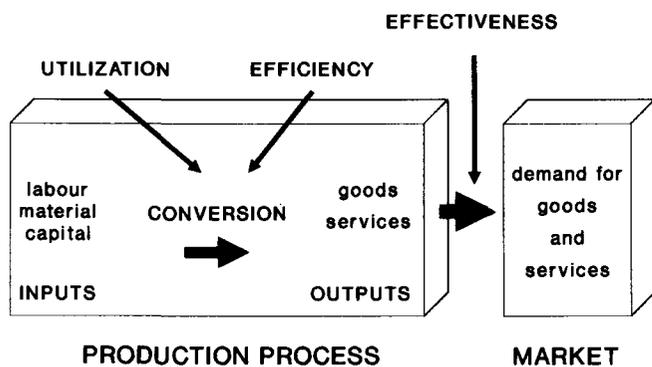


Fig. 2—Model for productivity (source: National Productivity Institute)

of doing better today than yesterday and less well than tomorrow. It is the will to improve on the present situation, no matter how good it may seem and no matter how good it may really be. It is the constant adaptation of economic and social life to changing conditions. It is the continuous effort to apply new techniques and new methods. It is the faith in progress!

#### Sutermeister's Productivity Circle

Sutermeister's model of productivity<sup>2</sup> (Fig. 3) is a good point of departure for a closer examination of important factors that influence productivity. Sutermeister

- (i) The diagram consists of a series of concentric circles, each divided into segments, and no attempt has been made to correlate the size of each segment to its relative importance. The importance of each segment would probably be different for each organization studied, for each department in an organization, and even for each individual employee with his/her own distinct needs.
- (ii) The factors in each segment of each circle are considered to affect or determine the factors in the corresponding segment of the next smaller circle. The factors in each segment of each circle frequently affect, and are affected by, factors in some of the other segments in the same circle.
- (iii) The factors in each segment of each circle may also affect factors in segments elsewhere in the diagram. All the factors in the diagram are subject to change with time. The special importance of time in affecting *Individuals' Needs and Formal Organization* is indicated.

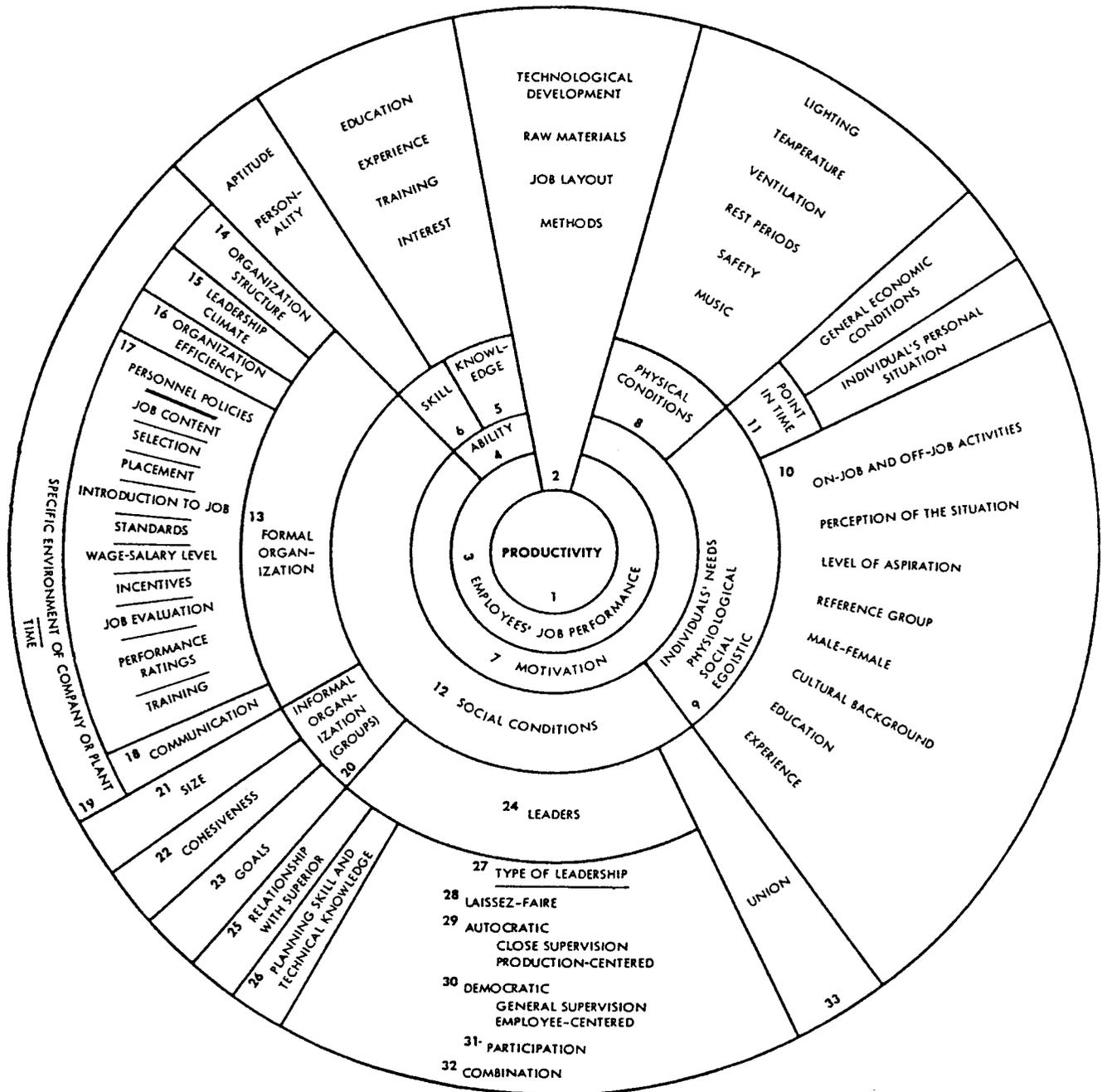


Fig. 3—Sutermeister's productivity circle<sup>2</sup>

(iv) In summary, the human factors are influenced by a great number of complex factors, each of which influences productivity improvement in its own unique manner.

**Practical Application of Productivity Theories**

The most important factor that must be realized right from the start is that any company that wants to improve its productivity has to have a sound organizational structure and must be well managed. Thus, the company's foundation must be right; otherwise, all efforts to improve its productivity will be fruitless.

The first question that immediately comes to mind is whether the average South African company is equipped to start with a productivity improvement programme, and

whether it has the ability to involve all its workers down to the lowest level in the process. There is no doubt that some companies will be capable of doing this, but others will have to take many preparatory steps. Some of the more important requirements are given below.

*Management System*

The company has to have a sound management system, such as management by objectives. This is a formal system in which the subordinate, together with his supervisor, sets objectives for himself and his unit on an annual basis. The main purpose of this procedure is one of integrated planning. Normally, a position charter, with critical performance areas and standards that have to be achieved, forms the nucleus of the system.

### Personnel System

The personnel system forms an important part of a formal organization. It is important that a company's appointment policy should ensure that the best person is selected for the vacant post, irrespective of race, colour, creed, or sex. One of the most serious problems in the RSA is the extensive specialization that is being encountered, in which every worker believes that he/she has only one specific task. The integrated handling of a number of tasks is a challenge that management has to face.

In the RSA, training in the principles of management and certain basic technical aspects of the job is normally undertaken by the employer. To this can be added in-house or on-the-job training, which ensures that personnel have all the knowledge to perform specific tasks in the organization for which they were appointed. The quality of this training contributes largely to the success or failure of a company.

### Maintenance Systems

A question that frequently arises is whether a company has a maintenance system that ensures a high availability of production equipment at optimal cost. The developments affecting equipment are so rapid that it is difficult for a company to remain aware of what is going on. However, it is important that it should establish the infrastructure that will enable it to keep up to date with the latest developments in the field of maintenance.

### Financial System

A company's financial system should give it early warning of trends and enable it to compile a sound sufficient budget. The division of a company into subdivisions should allow an individual to control costs in his/her own area. Finally, the company should be able to evaluate its results and measure its capital productivity.

### Mine Planning and Physical Standards

The importance of a life-of-mine plan to every mining company cannot be over-emphasized. The plan has to be worked through regularly so that it can be optimized step by step. With reference to mine production, the physical standards should be accurately measurable on a wide front so that management is in a position to effect on-going improvements.

### Process Control

The know-how required for the continuous optimization of metallurgical processes is of great importance, and a well-developed process-control system is indispensable. This is probably the technical area in which improvements (in yield, for example) can result in the greatest productivity improvement in the short term.

### Stock Control

A typical budget for the consumables of a large underground coal mine (materials and spare parts) should be in the region of 25 per cent of the mine's turnover. Well-trained manpower can fruitfully be employed in this area to optimize the stockholding and consumption.

### Marketing

Without a well-functioning marketing system, the benefits of a company's improvement in productivity cannot be fully realized.

### Strategy for Improved Performance

Productivity can be improved as shown in Fig. 4. Traditionally, management is geared to perform within an accustomed range. As soon as there is a sporadic deviation, management takes action to bring the process back to the original performance level. However, a company can frequently improve on its original performance level by adopting an open-minded attitude and utilizing suitable procedures, of which there are many.

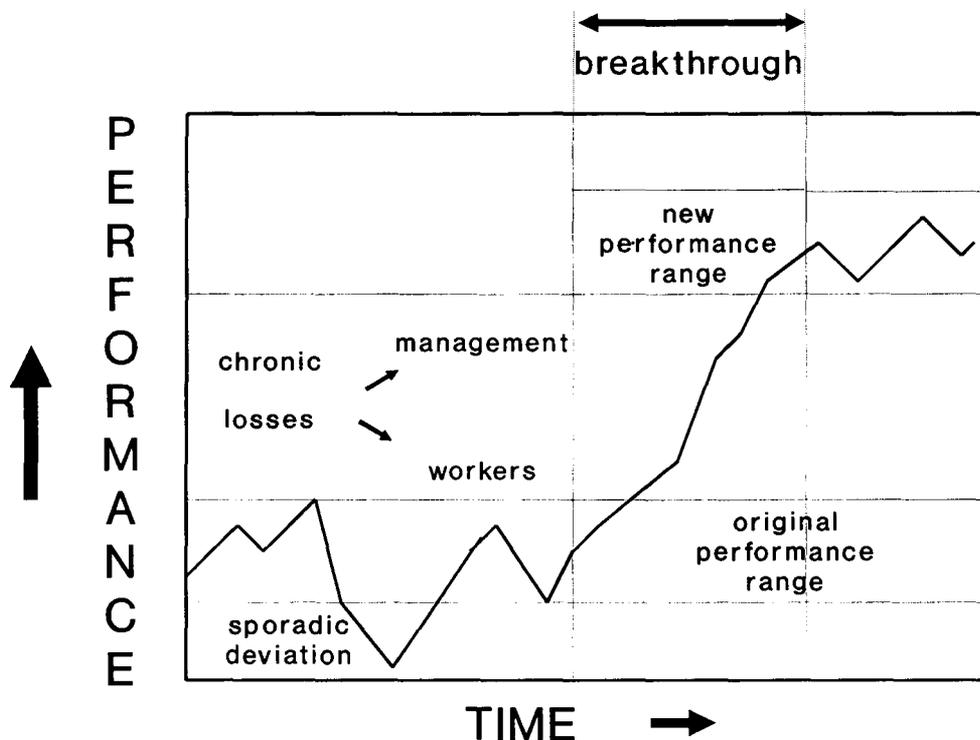


Fig. 4—Improvement of performance (after Juran<sup>2</sup>)

These procedures rely for their success on the very important principle that each employee has a great personal need to be fully informed about the company for which he works with regards to all aspects that influence his/her relationship with the company. Management must therefore take particular trouble to ensure that continuous high-level communication with employees is taking place.

Some of these management procedures are detailed below.

### *Future-oriented Approach*

It is important that every company should assess its position in respect of a large number of factors that can influence performance. The company must set itself targets that it wishes to achieve with these factors. A typical example of such an analysis is given in Table II.

TABLE II  
SEVERAL FACTORS THAT INFLUENCE THE PERFORMANCE OF A TYPICAL COMPANY

| Aspect      | Present situation  | Objective   |
|-------------|--|---|
| Management  | Honest and with integrity<br>Participative                                     | Honest and with integrity<br>More participative   |
| Climate     | Performance-orientated<br>Vague strategy<br>Management support                 | More performance-orientated<br>Clear strategy<br>Management commitment                        |
| Finance     | Insufficient capital<br>Low yield on capital                                   | Sufficient capital for necessities only<br>Improved yield on capital                          |
| Technology  | Buy in technology  | Buy in proven technology  |
| Markets     | National demand stagnant<br>Declining international market                     | National demand increasing<br>Retain international market share and improve upon it           |
| Systems     | Poor management systems  | Good management systems   |
| People      | Poor participation at the lower levels<br>Poorly trained<br>Average motivation | Participation at the lower levels higher than 80%<br>Well trained<br>Above-average motivation |
| Performance | Below objectives<br>Below average<br>Not measured continuously                 | Reach or improve upon objectives<br>Above average<br>Measured performance                     |
| Equipment   | Reserve capacity exists  | Utilize capacity fully  |

### *People Involvement*

The personnel needs of companies differ widely and depend on the personal circumstances of individuals at work, especially in their private lives. By applying the principles of Kenneth Blanchard<sup>4</sup>, one can reach the following conclusions:

- (i) most people want to perform
- (ii) persons who perform best should get the most attention

- (iii) people want to know how they perform
- (iv) people want good performance to be recognized.

Traditionally, managers were taught to manage by negative exception. The result was that only the non-performers received management attention, while persons performing well on a continuous basis received no attention. From this a few important applications can be deduced:

- (a) Management must see that only persons who wish to perform are taken into service. Training programmes must be geared to lead persons to performance and at the same time to get rid of dead wood. There are too many people who perform daily tasks that are not related to their remuneration level.
- (b) Management must ensure that performers get the most attention, i.e. that performance is rewarded by management's attention.
- (c) Performance can be properly recognized only after proper yardsticks have been established. This involves the following:
  - (1) Plan for improvement and set separate objectives for each individual.
  - (2) Control by setting simple but clear and measurable yardsticks for each individual, ensuring that the individual agrees to their use. As the level of posts moves downwards in a hierarchy, the yardsticks become simpler and fewer. Each subordinate should be given regular feedback on his/her performance and should receive recognition when this is merited.
  - (3) Improvements take place by positive reinforcement and success. Each objective that is reached leads to the setting of new objectives, and the process is repeated.

### **Factors Influencing People Involvement**

Of the factors that influence people involvement, the following are most important.

#### *Training*

Training is possibly one of the most important factors in improving productivity. This fact is unfortunately not always appreciated in the RSA. Many workers have no understanding of the free-enterprise system since they have no appreciation of the principles involved. A programme such as the 6M-programme, which teaches these principles, can be of great value to any company. In-house training can ensure that each new worker is conversant with the working practices at each specific mine.

Each manager and supervisor should be fully trained in the theory of management. This knowledge should not remain a matter of theory, but the management principles should become practical tools to assist the manager or supervisor in his daily work. Training in quality-circle activities will assist group leaders and group members in analysing and solving problems within their own work area.

A large variety of techniques are available to improve productivity within a company. The training programmes should be structured in such a way that every person involved receives training in these techniques.

### Motivation

Maslow<sup>5</sup> gives a theoretical basis for motivation, as depicted in Fig. 5. First, the physical needs of employees are satisfied at the lowest level, and then the need for social satisfaction comes into play. After these needs have been fulfilled, egoistical needs and, lastly, the needs of self-actualization arise. The last set of needs can be satisfied only when a person has the knowledge, achieves success in his work, and is capable of doing it properly. Self-actualization leads to self-respect.

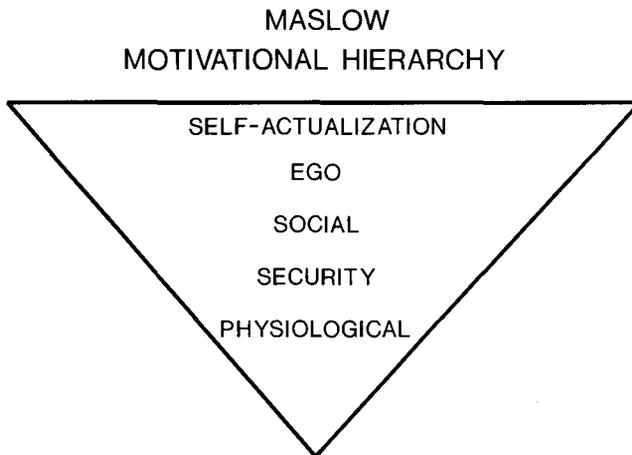


Fig. 5—Maslow's hierarchical theory of motivation<sup>5</sup>

### Participative Management

Because of the organizational structure within enterprises, a natural division exists between the work done by managers and that done by workers. The worker works within a system, whereas the manager (with other managers) is responsible for creating the system and improving on it. However, the person who best knows how to improve productivity on the shop floor is the worker himself. This is because he is in daily contact with his working environment and is often more creative than is realized by management.

A good example of participative management is the establishment of task groups to solve problems. Such groups are normally made up of members from a variety of disciplines and often from a number of departments.

Quality circles can be used by workers to solve problems within their working environment under the guidance of their first-line supervisors.

### Management Involvement

According to Deming<sup>6</sup>, it is basic Japanese philosophy that 80 per cent of a company's problems in regard to productivity and product quality must be solved through the action of top management. Quality circles can never replace the fundamental responsibility of management to spell out its own role and to build an organizational culture. As long as management is quick to take credit for the company's successes and in a hurry to blame workers for the failures, there is no chance of solving a company's low productivity.

However, the organization can function well only if management is fully committed to matters such as the improvement of systems, productivity, safety, tidiness,

the establishment of task groups, quality circles, and a number of other aspects. The control exercised by management is a key factor.

### Communication

As already mentioned, regular communication is of the utmost importance to ensure that all workers are fully informed of what is happening in the company for which they work.

The two most important methods that can be used are formal two-way communication by means of works councils, and a one-way communication system by which management communicates directly with workers through a group information system. The two-way system creates a communication forum between management and workers for solving problems on the shop floor. The group information system, as borne out by the experience of Edwardes<sup>7</sup> at British Leyland, is important in that it allows management to pass information directly to its workers without having to go through the trade unions.

### Restructuring of Work

The importance of employing specific technical specialists for development work within an organization cannot be over-emphasized. Line management is usually so preoccupied with the production process that there is little time for attention to technical development. The net result is that such work is largely neglected, and any improvement takes place sporadically and in an uncoordinated way.

### Ergonomics

In the past, many managers, misinterpreting the results of ergonomics studies, have concluded that ergonomics is not important. The Hawthorne study<sup>8</sup>, for instance, concluded that a deterioration in environmental factors (noise, lighting, ventilation, temperature, etc.) did not lower the performance of groups of workers. However, it was evident that other factors caused the groups to work better in spite of a poor working environment.

As an example of the importance of ergonomics, one can consider the case where a mine purchases a large bulldozer without a canopy, and expects the operator to be highly productive in a cold Highveld winter. It is becoming clear that the application of ergonomic principles can contribute considerably to higher productivity.

### Quality Management

It has been found that the quality trilogy of Juran<sup>9</sup> is a useful guide to management actions. It consists of three simple aspects that hold good for any situation, be it in an office, a medical company, a factory, or in services. These are planning, control, and improvement.

### Planning

Effective planning consists in the following 6 actions.

- (i) Identify internal and external clients.
- (ii) Determine the needs of the clients.
- (iii) Develop those characteristics of the products that coincide with the needs of the clients.
- (iv) Determine quality objectives that will satisfy the needs of the client and the supplier at a minimum combined cost.

- (v) Develop a process that will produce products with the required characteristics.
- (vi) Prove that the process can achieve the quality objectives under operational conditions.

#### *Control*

The second of the quality trilogy calls for the following activities.

- (i) Determine the factors that are to be controlled.
- (ii) Choose the units of measurement.
- (iii) Take the necessary measurements.
- (iv) Determine the standards and work performance.
- (v) Measure the true work performance.
- (vi) Investigate the difference between the achievement and the standard.
- (vii) Take action with regard to the difference between achievement and standard.

#### *Improvement*

The third quality requirement is more involved, requiring establishment of the need for improvement, identification of the most pressing need, organization of the project to fulfil the need, remedial action itself (or breakthrough), breakdown of resistance to change, and control at the new level.

*Establishment of the need.* Normally, it is relatively easy to determine a need or confirm the existence of a problem. The problem manifests itself in a symptom. It is important to distinguish between chronic and sporadic symptoms. By reference to Fig. 4, the difference can easily be seen. Normally, a process functions within a narrow band, but now and again the process goes out of control and a peak appears on the graph. This represents a sporadic deviation from the normal level or standard, and requires management action to rectify the problem. A sporadic symptom is, for example, the high cost of a relatively low-quality product. A chronic symptom is the continuous high cost of such a product.

*Identification of the project.* It is important that management should identify the most pressing problems, i.e. those whose solutions will potentially realize the greatest cost saving. It therefore becomes a process of setting priorities.

*Organization of the project.* The project has to be steered. Normally, an interdepartmental team will be established as the steering arm of the project. The advantages of an interdepartmental team is that unity is achieved and that emphasis is placed on organizational efficiency. Synergism is reached, the authority to diagnose is determined, and rectifying steps can be taken in time. The persons taking part in the diagnostic process should have time to conduct the diagnoses, diagnostic skills, and objectivity. The team that makes the diagnosis is referred to as the diagnostic arm of the project. During this process, all the symptoms are analysed and causes of the problems are determined. This identification of the problems is known as the diagnostic journey from cause to remedy. Theories regarding the causes are formulated, after which the theories are tested to determine the true cause of the problem.

*The breakthrough.* The next step in the process is known as the breakthrough. This is the remedial journey from cause to solution, which involves the finding of a solution and its implementation in spite of resistance to change. Solutions are developed, and the financial implication of each is determined, after which the steering arm makes a recommendation to the line department whose responsibility it will be to implement the solution.

*Removal of resistance.* Problems are often encountered in the implementation of a solution owing to the resistance of employees to change. The line managers concerned will have to make use of available techniques to break down the resistance and to deal positively with the change.

*Control at the new level.* The final step in the sequence is control at the new level, the aim being to maintain the gains after the breakthrough process. In cases where this is not possible in the beginning, the process can normally be brought under control by accurate process audits and financial control.

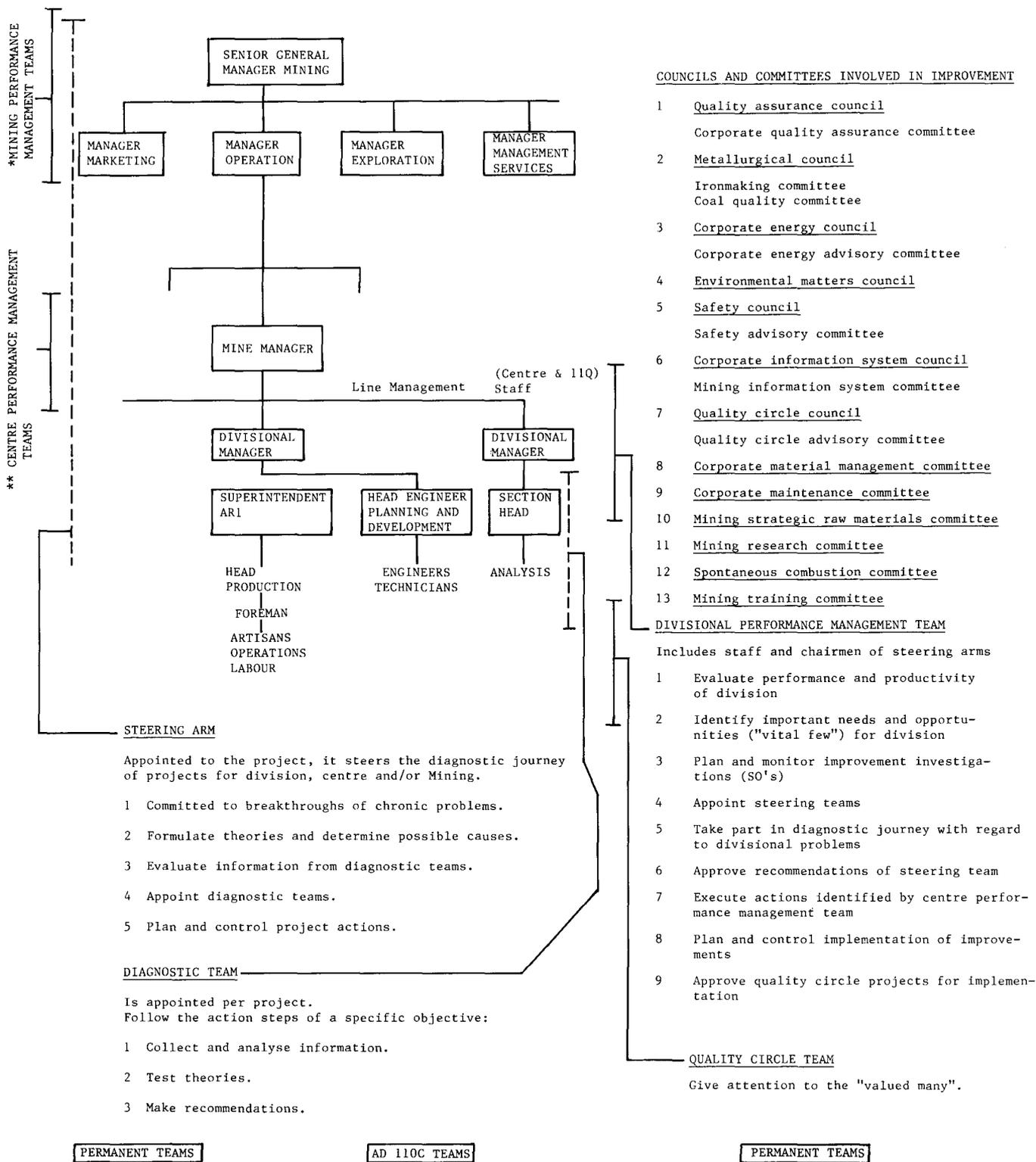
### **Performance Management**

As clearly demonstrated by the above discussion, ongoing improvements can be effected only if all the management systems within the company are fully integrated. The name that can be given to such an integrated management system is *performance management*. Fig. 6 illustrates the integration as applied in the Mining Division of Iscor Ltd.

The roles of the mining-performance management team and the centre-performance management teams are shown on the left of Fig. 6. The middle of the diagram clearly shows how the steering arm and the diagnostic arm are put together in order to make breakthroughs. On the right, all the councils and committees that are involved in the improvement are shown, as well as the roles of the divisional-performance management teams and the quality circles.

#### *Duties of the Mining Performance Management Team*

1. Evaluate the mining productivity and performance.
2. Identify opportunities and needs ('vital few') for mining.
3. Draw up an improvement plan for mining and determine strategies.
4. Monitor progress against the improvement plan.
5. Appoint steering arms for investigations in the Mining Division.
6. Take part in the diagnostic journey with regards to overall mining problems.
7. Monitor the progress of the overall mining investigations.
8. Approve the overall mining improvements.
9. Summarize the improvement plans for individual mines.
10. Compile communication plans for the mines.
11. Establish a working climate that will ensure management commitment.
12. Develop and maintain a performance management programme.
13. Take note of important matters to be handled by councils and committees.
14. Take note of successful improvement projects or mining centres.



**Fig. 6—Role and functions of the Mining Department's management team in the integrated management system used by Iscor**

**Duties of the Centre-Performance Management Team**

- Evaluate the productivity and performance of the centre.
- Identify the opportunities and needs ('vital few') for the centre and determine the priorities.
- Establish objectives for the centre arising from the mining objectives and abovementioned opportunities and needs.
- Draw up an improvement plan.

5. Monitor the improvement in terms of the improvement plan.
6. Monitor steering arms for centre projects.
7. Take part in diagnostic journeys of centre projects.
8. Approve recommendations by the steering arms.
9. Plan and control the implementation of centre projects.
10. Establish a working climate that will ensure management involvement.
11. Act on projects that have been identified by the mining-performance management team.
12. Take note of important matters handled by the councils and committees.
13. Monitor progress with the quality circles.

*Comments on Fig. 6*

1. The diagram shows the functions and relationships of the different teams.
2. The instruments that are used to measure performance (i.e. growth graphs, cost reports, objective matrices, etc.) are not shown.
3. Needs and opportunities at all levels are identified continuously by line management and staff, and are passed on to the teams involved.
4. Steering and diagnostic teams are made up for specific projects on an *ad hoc* basis of persons who are best qualified to solve the problems.
5. It may sometimes be necessary to second a person as a project leader on a full-time basis.
6. The functions of a steering arm at divisional level can be carried out by the divisional-performance management team, or by the centre-performance management team at smaller mines.
7. Meetings of these teams do not replace the specific objective meetings of divisions, centres, or mining.
8. Small mines have only the centre-performance management team, steering arms, diagnostic arms, and quality circles.
9. Representatives of the mining-management services may serve on the performance-management teams of smaller mines.
10. Headquarters is treated as a mining centre.

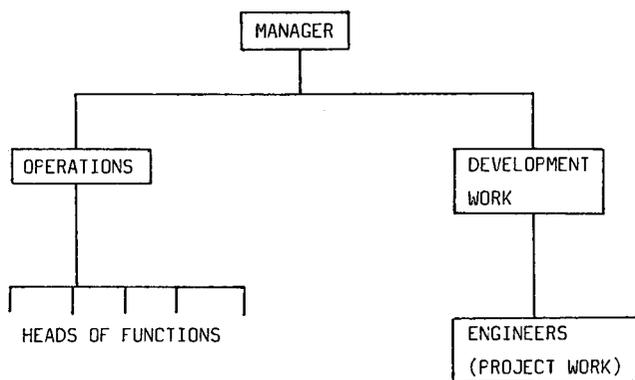
**Technology**

The importance of separating operating and development work is re-emphasized. At a mine, there are typically three development departments: mining, maintenance, and metallurgy. The structure can be represented as shown in Fig. 7. This separation is justified on the following grounds:

- (a) the quality of the professional engineering work is better because the engineers are employed within the development function and concentrate on technical work;
- (b) consequently, the scarce-category workers (engineers) can be employed optimally;
- (c) because of the separation, technicians can be employed in line functions;
- (d) someone with an NTD qualification or a Certificate of Competency can be promoted to a higher level;
- (e) the opportunity is created for each engineer to get the necessary experience in practical operating work by the rotation of posts, or by the making of an acting

appointment, or by promotion through the development or the operations leg of the organization;

(f) the development leg is the logical direct functional contact point with the specialists from Head office.



**Fig. 7—Structure for the operating and development work**

It is emphasized that only well-trained people who were also successful in line functions should be employed in these development departments. By such a divisional separation, full-time attention can be given to improvement and problem-solving. It is expected that such a department should be able to recover its costs four times a year.

*Monitoring of Performance*

The measurement of performance is of great importance in showing whether development work has been successful. The importance of a good management information system is obvious. The influence of all the actions taken to effect improvements should be measured to determine whether success has been achieved.

*Implementation of Development Projects*

Development projects can be launched in each separate department or interdepartmentally. In the latter case, it is recommended that a task group should be employed. As projects have to be coordinated at a high management level, the person with the highest line authority should serve as the chairman of such a coordinating committee.

**Iscor's Experience**

Iscor's top mining management decided to implement this new approach under the banner of performance management, and has now been practising it for two years. It is not a new system, but is, rather, the establishment of a change in attitude. The processes that have been explained in this paper are applied in every area in which managers have to manage for improvement. The process is illustrated in Fig. 8.

**Conclusion**

Against the background of poor productivity records in industry in the RSA, it is encouraging to know that techniques and management approaches are available that can be applied to change this situation. There is no doubt that, if the principles of performance management as described in this paper are applied on a large scale in the RSA, a great improvement in productivity will result in the years to come.

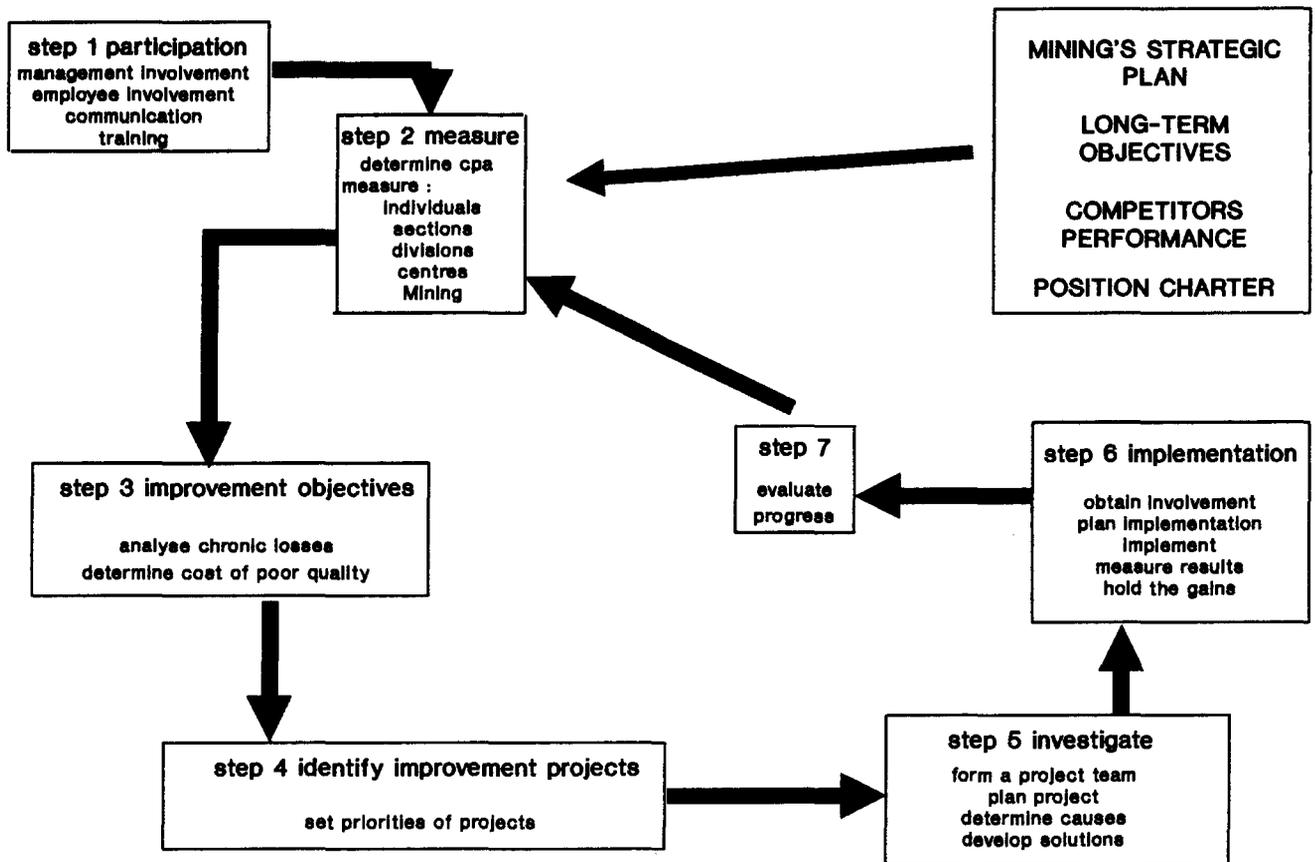


Fig. 8—Process for the improvement of performance

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## Filtration screens

Johnson Filtration Systems Inc. have issued the following 2 brochures, which are available free of charge from Ed Broeders, Johnson Filtration Systems, P.O. Box 64118, St. Paul, MN 55164, USA. Tel: (612) 636-3900. Fax: (612) 636-0889.

- *Johnson panels, baskets, and sieves*. 16 pp.

This full-colour brochure features screen panels, sieves, and baskets that are used for the processing of minerals,

pulp and paper, and food. It includes information on the construction, application, and design of screens.

- *Johnson support grids*. 12 pp.

This full-colour brochure features screen grids for use in hydrotreaters, desulphurizers, molecular sieves, sand-filters, gas sweeteners, and other adsorption systems. It also gives information on the construction, application, and design of screens.