CHAPTER 3

ANALYSING AND MANAGING HUMAN PERFORMANCE PROBLEMS

3.1 INTRODUCTION

This is the second of three literature review chapters that document the central concepts used in this study. Chapter 2 (the first literature review chapter) outlined several human performance models, as well as the sources of variance and trends that affect human performance. This chapter focuses on the analysis and management of human performance problems.

For the purposes of this study, a *performance problem* refers to any of the following (Ammerman, 1997:9):

- a difference between the actual performance and the performance requirement or performance expectation;
- an unwanted event, situation, or performance trend; and/or
- the main effect critical for a situation to occur.

This chapter is divided into the following sections:

- the goal of analysing and managing human performance problems;
- methods and tools used to analyse and manage human performance problems;
- managing performance problems pro-actively; and
- the role of human error in performance problems.

3.2 THE GOAL OF ANALYSING AND MANAGING HUMAN PERFORMANCE PROBLEMS

Allison Rossett (1992:103-105) has identified three types of initiating situation for investigating and analysing human performance problems: first, when the organisation is making changes and introduces new policies, programmes, initiatives and technologies; second, when employees are not doing what is expected from them (and as a result, performance problems occur); and third, when an investigation is mandated.

Another reason for analysing and managing human performance problems would be to minimize the costs that such problems create. When organisations calculate the total cost of performance problems, they should add the actual cost of the problem to the estimated cost of the potential consequences (Mager & Pipe, 1997:24). Mager and Pipe (1997:25-26) have identified the following sources of costs arising from performance problems:

- money lost directly, or as a result of lost goods or materials;
- time lost due to the deviation, or because of material shortages or lateness, slow service, or the need to re-work;
- an increase in waste, or the need to have waste hauled away or burned;
- equipment damage caused by the performance discrepancy;
- loss in production, or completed work;
- poor accuracy and poor quality of the completed work;
- increases in insurance policies caused by the discrepancy;
- an increase in the frequency of accidents;
- loss of business due to the discrepancy;
- duplicated efforts caused by the discrepancy;
- a need for more supervision, security, or more monitoring as a result of the discrepancy; and
- other sources, for instance, possible law suits or sexual harassment charges.

3.3 METHODS AND TOOLS USED TO ANALYSE AND MANAGE HUMAN PERFORMANCE PROBLEMS

In this section, some common methods and tools that can be used to help to analyse and manage human performance problems are discussed. These methods and tools provide organised and systematic ways of examining human performance problems and performance improvement opportunities (Rothwell *et al*., 2000:51).

3.3.1 Data presentation methods and tools

It is important to collect, track and monitor key performance data, so that performance problems and opportunities can be uncovered. The following four trending methods are discussed in this section:

- pie and bar charts;
- line or run charts;
- Pareto charts; and
- process behaviour charts.

3.3.1.1 Pie and bar charts

"Pie and bar charts are visual representations used to compare quantities, amounts, or proportions" (Rothwell et al., 2000:78). These types of chart make differences more evident and easier to identify. "Bar charts are generally used to compare groups or categories, while pie charts typically show the relative percentages making up the whole" (Rothwell et al., 2000:78-79).

3.3.1.2 Line or run charts

Line or run charts display a series of data points and are useful for showing trends over time. Looking at data such as volume, cost, or time on a line chart can help to detect important trends (Rothwell *et al*., 2000:80).

3.3.1.3 Pareto Charts

The 80/20 rule or Pareto Principle was discovered by an Italian economist, Vilfredo Pareto, in 1897, when he observed that 80% of the wealth in Italy and also in other countries was held by 20%

of the people. The Pareto Principle implies that 80% of the result can be obtained from 20% of the work (Paradies & Unger, 2000:149). Logically, therefore, identifying and fixing a few major problems can produce a huge return on investment for performance improvement.

Pareto Charts can be used for the following:

- If a large percentage of the cost (approximately 80%) is concentrated in a small percentage of performance problem categories, then these categories indicate opportunities that should be targeted for improvement. In this case, reasonably priced corrective actions should yield a significant cost reduction and a good return on investment.
- If, on the other hand, the cost is spread more evenly across the performance problem categories, then improvement efforts may have a less dramatic effect and the organisation can follow one of the following two alternative routes (Paradies & Unger, 2000:155):
    - the organisation can implement corrective action for each performance problem category and continue to use trending to identify future targeted improvement opportunities or to identify significant trends in the data over time; or
    - the organisation can decide that performance is, in general, good enough and stop implementing corrective action for each incident and instead monitor performance for significant trends over time.

In summary, Pareto charts can indicate whether there are great opportunities, or only limited opportunities, for rapid improvement by addressing a single performance issue or several performance issues. It must be noted that to achieve the highest return on investment it is essential that the Pareto chart be scaled by cost, not by count.

3.3.1.4 Process behaviour charts

A process behaviour chart is "a specialized chart of performance over time with limits calculated using statistical process control algorithms" (Paradies & Unger, 2000:156). As long as a system functions within these limits, the system is behaving normally and no significant problems are present. However, if the limits have been exceeded, then that indicates a significant change to the system, or a significant problem. This requires a root cause analysis (finding the cause of the significant problem).

Process behaviour charts can be used in the following ways (Paradies & Unger, 2000:169):

- to plot performance in important jobs – if a point is detected outside the limits, then the problem should be analysed for its root cause and be corrected;
- together with Pareto Charts, to identify the consistently worst performance problems and then target them for elimination using effective root cause analysis;
- to plot a trend for proactive performance indicators for key jobs – when a significant trend is detected, the root cause of the problem causing the trend can be found and fixed;
- to plot the trend of the root causes of performance problems to look for significant trends; and
- to track both proactive performance indicators and outcomes data to determine whether or not any improvement strategies that have been implemented have brought about significant improvements in performance – this can then be used to prove that the corrective actions have made a difference and what the real improvement in the average performance was. It will also help justify the improvement effort.

3.3.2 Troubleshooting methods and tools

Solving human performance problems requires a systematic approach that helps to identify the real performance gaps and root causes. However, the success of an approach often depends on the quality of the data that is used. Rothwell *et al*. (2000:52) provide the following list of types of data that would assist in analysing performance problems:

- sales, revenue;
- market share;
- profitability;
- cost, expenses;
- inventory levels;
- cycle time;
- throughput;
- lead time;
- quality;
- customer service/satisfaction;
- delivery performance;
- grievances;
- performance appraisal results;
- exit interview(s);
- employee satisfaction;
- absenteeism;
- accidents; and
- benchmarking results.

The above data requirements can be drawn from the following potential sources of data (Rothwell *et al*., 2000:52):

- the Sales Department;
- Finance/Accounting;
- Plant/Operations Management;
- the Production/Scheduling Department;
- the Quality Control/Assurance Department;

- the Human Resources Department; and/or
- the Safety Department.

As has already been mentioned in Chapter 1, the most common troubleshooting tools and techniques used to analyse human performance include brainstorming, the fishbone diagram and the five why's technique (Piskurich, 2002:57-58; Rothwell *et al*., 2000:67-71). The following three additional approaches and tools are discussed in this section:

- the basic five-step approach;
- Paradies and Unger's system; and
- Mager and Pipe's Performance Analysis.

3.3.2.1 Basic five-step *approach*

Rummler and Brache's (1992:42-45) Human Performance Technology approach consists of the following five basic steps:

Step 1: Problem definition

The objective of Step 1 is to identify and agree on the performance that is required by the client or organisation, how it is measured and the time frame in which it is measured.

Step 2: Analysis

In this step, the problem is diagnosed; the cause is established; and the treatment is specified or prescribed. A complete analysis requires an examination of each of the following three levels:

- *The organisation level*:

  The objectives of this step are to determine what changes are required in the variables of the organisation level to improve performance to the desired level and to identify the cross-functional process(es) that should be examined further. The sub-steps usually include developing a holistic picture of the organisation to show how the various functions and processes are related to the desired performance and how they affect it; and analysing performance data to identify gaps in performance and to name the critical processes.

- *The process level*:
  The objectives in this step are to determine the changes that are required at the process level to improve performance and to identify the jobs that should be examined further (Rummler and Brache, 1992:43). The sub-steps include (Rummler and Brache, 1992:43)
  - determining the performance of key processes (in terms of the desired performance goals);
  - identifying which process steps are not being performed properly and which ones are leading to the poor performance of those processes;
  - determining the action(s) required to improve the performance of those processes; and
  - identifying the jobs that are critical to the successful performance of the process(es), and that need to be analysed further for to improve performance.

- *The job/performer level:*
  The objectives of this step in the analysis are to determine what outputs of which critical jobs need to be improved in order for the key processes to work effectively and to produce the desired quality; and to identify the actions required to improve the job output (Rummler and Brache, 1992:43). This step consists primarily of identifying the gaps between the desired and the actual job outputs; and determining the cause(s) of poor job performance and the appropriate corrective action.

Step 3: Design and development

The objective of Step 3 is to design and develop those recommended changes that were specified as part of the analysis step (Rummler and Brache, 1992:44). The process that is to be used to evaluate the effectiveness of the treatment is also developed in this step.

Step 4: Implementation and maintenance

This step aims is to implement and maintain the various solutions successfully. The key to the success of Step 4 is planning the sequence needed to introduce the various treatments, while top management's support is critical to successful implementation (Rummler and Brache, 1992:44).

Step 5: Evaluation

The objective of Step 5 is to gather data on performance and to assess whether the implemented "treatments" are producing the desired results; and, if not, to ascertain how the "treatments" must be modified to achieve the desired outcome (Rummler and Brache, 1992:44).

3.3.2.2 Paradies and Unger's system

Paradies and Unger (2000:289) developed a system that helps to identify major human performance-related causes of problems. The system consists of the following 15 questions that identify the issues that are to be examined (Paradies & Unger, 2000:290, *verbatim*):

- Was a person excessively fatigued, impaired, upset, bored, distracted or overwhelmed?
- Should the person have had and used a written procedure but did not?
- Was a mistake made while using a procedure?
- Were alarms or displays to recognize or to respond to a condition unavailable or misunderstood?
- Were displays, alarms, controls, tools, or equipment identified or operated improperly?

- Did the person need more skill or knowledge to perform the job or to respond to conditions or to understand system response?
- Was work performed in an adverse environment (such as hot, humid, dark, cramped, or hazardous)?
- Did work involve repetitive motion, uncomfortable positions, vibration, or heavy lifting?
- Did verbal communications or shift change play a role in this problem?
- Did failure to agree about the who/what/when/where of performing the job play a role in this problem?
- Was communication needed across organisational boundaries or with other facilities?
- Was a task performed in a hurry or a shortcut used?
- Had management been warned of this problem or had it happened before?
- Were policies, admin, controls or procedures not used, missing, or in need of improvement?
- Should an independent quality control check have caught the problem?

Once all 15 questions have been answered, the following seven basic cause categories can be analysed, as indicated by the questions (Paradies & Unger, 2000):

- *procedures* – procedures were not used or followed, were wrong, or were followed incorrectly;
- *training* – no training was given or understanding needs improvement;
- *quality control* – no inspection was done or quality control needs improvement;
- *communication* – there was no communication; communication was not timely; turnover needs improvement; or verbal communication was misunderstood;

- *management system* – standards, policies or administrative controls need improvement; standards, policies or administrative controls were not used; the employee relations were poor; or corrective action was needed;
- *human engineering* – there were problems with the human-machine interface or work environment, there is a complex system, or a non-fault tolerant system; and
- *work direction* – there was a problem with the preparation, the selection of the worker, or supervision during work.

3.3.2.3 Mager and Pipe's Performance Analysis

Mager and Pipe (1997:5) developed a Performance Analysis Flow Diagram (see Figure 3.1, next page) to discover why people do not perform the way they should. The flow diagram also assists in matching solutions to the true performance problems.

3.4 MANAGING PERFORMANCE PROBLEMS PRO-ACTIVELY

Human performance problems can be managed pro-actively by safeguarding the performance against potential sources of performance problems. The concept of "safeguarding" originated from the philosophy that management should ensure that there are sufficient safeguards between the sources of damage and the things that are susceptible to damage (Paradies & Unger, 2000:334).

Safeguards can be used in two ways (Paradies & Unger, 2000:344-345), namely, first, to help identify causal factors, since most causal factors are related to the failure of some type of safeguard; and, second, to evaluate the proposed corrective actions which are intended to strengthen safeguards or introduce new safeguards.

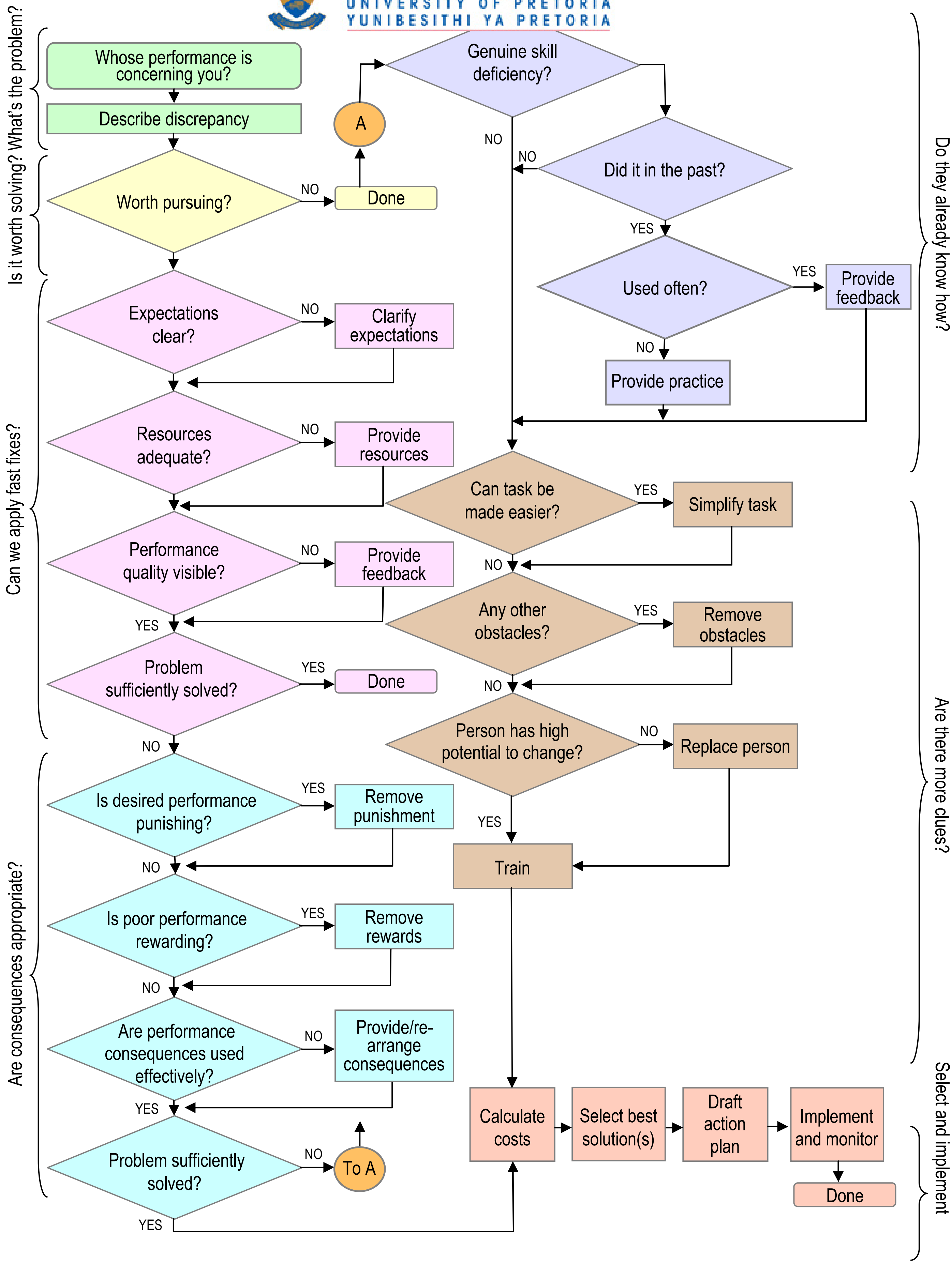

Figure 3.1 Performance analysis flow diagram

Source: Mager and Pipe (1997:5)

James Reason (Anon, 2004:2) has written extensively about how humans and organisations make errors and how such error incidents can be avoided once their causes are understood. He has also developed what he calls the "Swiss Cheese" model of incident occurrence (see Figure 3.2), which he explains as follows:

> In an ideal world each defensive layer would be intact. In reality, however, they are more like slices of Swiss cheese, having many holes – though unlike in the cheese, holes are continually opening, shutting, and shifting their location. The presence of holes in any one 'slice' does not normally cause a bad outcome. Usually, this can happen only when the holes in many layers momentarily line up to permit a trajectory of accident opportunity. (Reason, 2000:3)

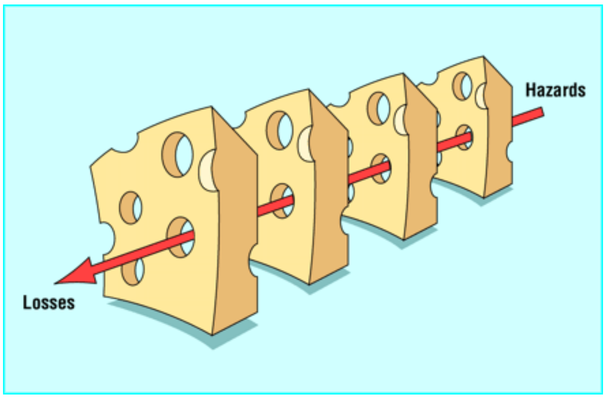

Figure 3.2 The Swiss cheese model

Source: Reason (2000:3)

According to Reason (2000:3), the holes in the defences arise either because of active failures or because of latent conditions:

- *Active failures* are unsafe deeds committed by people who are in direct contact with the system. Such acts take a variety of forms, which include slips, lapses, fumbles, mistakes, and procedural violations (Reason, 2000:3).
- *Latent conditions* are the unavoidable "resident pathogens" within the system. They arise from strategic decisions (made by designers, builders, procedure writers and top management) that have the potential of

introducing pathogens into the system. Latent conditions may lie dormant in the system for many years before any combine with active failures and local triggers to create performance problems (Reason, 2000:3). "Unlike active failures, latent conditions can be identified and remedied before an adverse event occurs" (Reason, 2000:3).

Experience has shown that no one type of defence is sufficient and therefore more multiple safeguards (defence in depth) are better than just one single strong safeguard, particularly when the negative consequences are severe (see Figure 3.3). Ideally, safeguards should possess both redundancy (there are multiple backups) and diversity (there is a variety of different safeguards) (Reason & Hobbs, 2003:13).

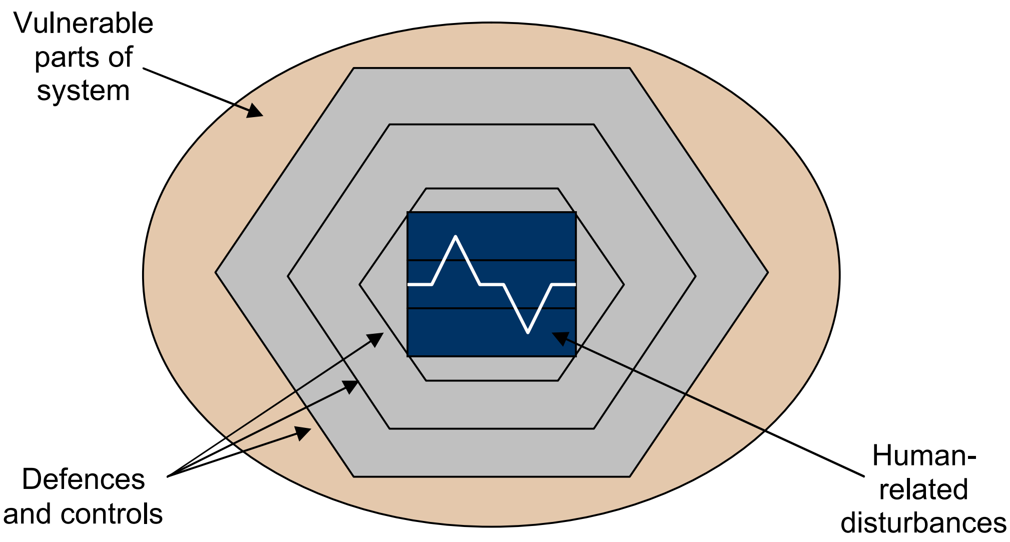

Figure 3.3 Defence in depth

Source: Reason and Hobbs (2003:13)

Although some safeguards are more effective in preventing negative consequences than others, safeguards are not infallible. Therefore, when putting safeguards in place, one should decide how many safeguards there should be and how effective the safeguards should be for the type of hazard they are protecting the performance against. The following types of safeguard are generally put in place (Paradies & Unger, 2000:337):

- *physical safeguards*, for example, insulation on a hot pipe and sunscreen;
- *natural safeguards*, for example, placing heavy objects on the bottom shelf, so that they cannot fall off and hurt someone;
- *human action safeguards*, for example, evacuating a building when the fire alarm sounds; or
- *administrative control safeguards*, for example, a poison sign on a bottle of poison, or a stop sign.

3.5 THE ROLE OF HUMAN ERROR IN PERFORMANCE PROBLEMS

3.5.1 The fundamentals of human error

Jim Reasons (in Latino & Latino, 2006:88) defines *human error* as "a generic term to encompass all those occasions in which a planned sequence of mental and physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to some chance agency".

It seems obvious that a human error must have human origins – the temptation is then to focus on the individual psychological factors immediately preceding the making of an error and to do whatever seems necessary to prevent their recurrence. However, in a study conducted by Alan Hobbs in 1997 (Reason & Hobbs, 2003:3-4), it was found that "there are certain situations and work pressures that lead people into the same kind of error regardless of who is doing the job". This statement is explained well by the following explanation and model developed by Reason and Hobbs (2003:89-91):

- The performance incident begins with the negative consequences of organisational processes, management decisions and the system's culture.
- The underlying conditions are transmitted along departmental and organisational pathways to the various workplaces where they show themselves as conditions that promote errors and violations.

- At the level of the performer, these underlying conditions combine with psychological error and violation tendencies to create unsafe acts. Many unsafe acts are committed, but only a few of them actually penetrate the defences and safeguards to produce bad outcomes.
- Defences are features of the system that have been put there, not to prevent, but to help the system cope with, unplanned and untoward events that have happened in the past, or that have been anticipated by the system designers.

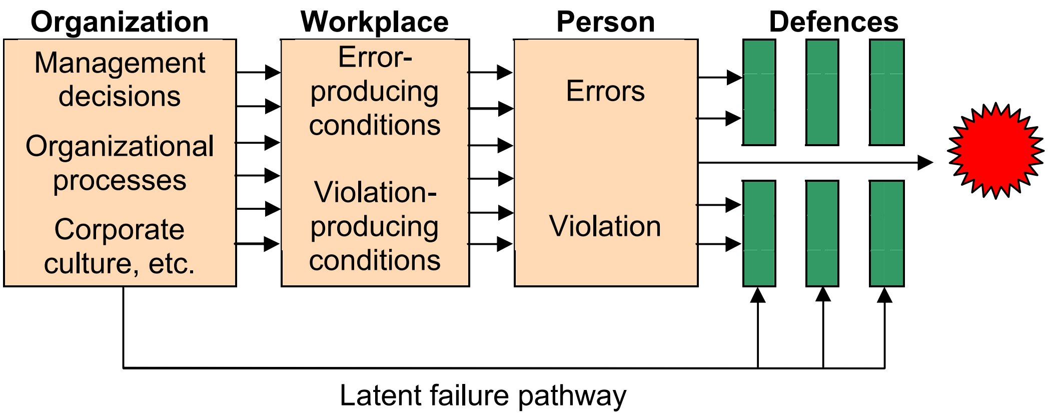

Figure 3.4 The stages involved in a performance incident

Source: Reason and Hobbs (2003:90)

Building on the above model developed by Reason and Hobbs, Balbir S. Dhillon (in Peterson, 2002:3) has identified the following common 14 reasons for human errors:

- inadequate lighting in the work area;
- inadequate training or skill;
- poor equipment design;
- high temperature in the work area;
- a high noise level;
- inadequate work layout;
- crowded work space;
- poor motivation;
- improper tools;

- poorly written equipment maintenance and operating procedures;
- inadequate handling of equipment;
- poor management;
- task complexity; and
- poor verbal communication.

This implies that one often has to deal with error-provoking tasks and error-inducing situations rather than with error-prone people. One should recognize that human actions are almost always constrained by factors beyond the person's immediate control, and that people find it difficult to avoid those actions that they never intended to commit in the first place (Reason & Hobbs, 2003:15). Many of these factors were mentioned among the research findings listed in Chapter 2.

Reason and Hobbs (2003:10) emphasize two important points about human error:

- *Errors are inevitable*. No one intends for them to happen, but everyone makes them.
- *Errors are consequences, not just causes*. They are shaped by local circumstances, such as the task, tools, equipment, and the workplace in general.

There are two ways in which people can go wrong – they can either do something they should not have done, or fail to do something they should have done (Reason & Hobbs, 2003:6). However, if one understands the above two factors, then, instead of focusing on what went wrong in the performer's head, one should rather focus on the nature of the system as a whole. The character of the system as a whole, the surrounding circumstances, and what was being done at the time all play a role in human error (Reason & Hobbs, 2003:12). According to Latino and Latino (2006:89), human beings have the ability, through their senses, to be more aware of their environments. If their senses are sharp, they can detect changes and take action to prevent errors from occurring.

Human error is often treated as a standard set of unwanted acts. In reality, errors fall into distinct types that require different kinds of remedial action and that occur at different levels in the organisation (Reason & Hobbs, 2003:19). Reason and Hobbs (2003:39-40) outline three ways in which planned actions may fail to achieve their current goals, namely skill-based errors, mistakes and violations.

3.5.1.1 Skill-based errors

Skill-based errors occur when the plan of action is entirely appropriate, but the actions themselves do not go as planned (Reason & Hobbs, 2003:40). Skill-based errors are identified with the following three related aspects of human information processing (Reason & Hobbs, 2003:40-48):

- *recognition failures*, which fall into two main groups, namely the misidentification of objects, messages, or signals; and the non-detection of problems;
- *memory failures*, which can occur during encoding (or input), storage, and/or retrieval (or output); and
- *attention failures*, which are caused internally by distractions and externally by distractions.

3.5.1.2 Mistakes

Mistakes occur when actions go entirely as planned, but the plan is inadequate to achieve the desired goal. Mistakes can be split into the following two classes (Reason & Hobbs, 2003:49-53):

- *rule-based mistakes*, which occur when a good rule is applied in a situation for which it is not appropriate, or when a (bad) rule is applied that would get the job done, but with unwanted consequences; and

- *knowledge-based mistakes*, which occur due to either failed problem-solving, and/or a lack of knowledge.

3.5.1.3 Violations

Violations occur when actions deviate intentionally from the safe method of working, in other words, people fail to apply good rules. Violations may be a contravention of formal rules and procedures, unwritten norms or standard practice. There are three main violation categories (Reason & Hobbs, 2003:55-58):

- *routine violations*, which are committed to avoid unnecessary effort, get the job done quickly, demonstrate skill, or circumvent what seem to be unnecessarily laborious procedures;
- *thrill-seeking or optimizing violations*, which are committed to appear macho, to avoid boredom, or simply for the thrill; and
- *situational violations*, which occur due to a mismatch between work situations and procedures, for example, when it is impossible to get the job done by sticking rigidly to the procedures.

Different errors lead to different consequences and, therefore, it is important to understand the different types of error. An Australian maintenance study (Reason & Hobbs, 2003:59) compared errors that led to quality incidents to errors that led to worker safety incidents (see Figure 3.5 on next page). The study showed that the three most common errors that led to quality incidents were memory lapses, violations and knowledge-based mistakes. Slips were the most frequent error type that led to worker safety incidents. The study showed, in summary, that the errors that cause injury may be different to the errors that affect the quality of work. Both these problems need to be addressed, but they may require different interventions.

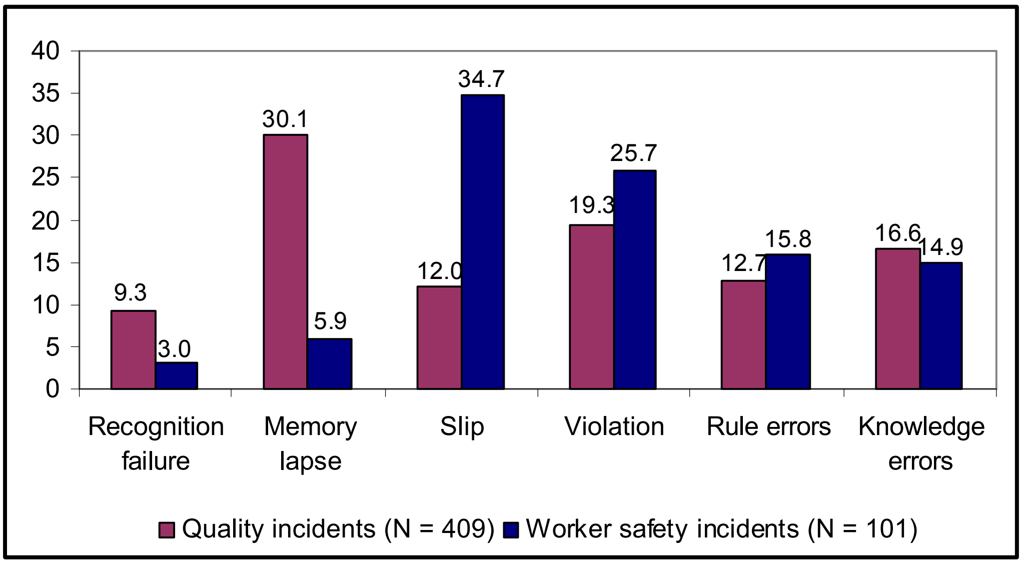

Figure 3.5 A comparison between error types

Source: Reason and Hobbs (2003:59)

Another study indicated that particular factors tend to lead to specific types of error (see Figure 3.6).

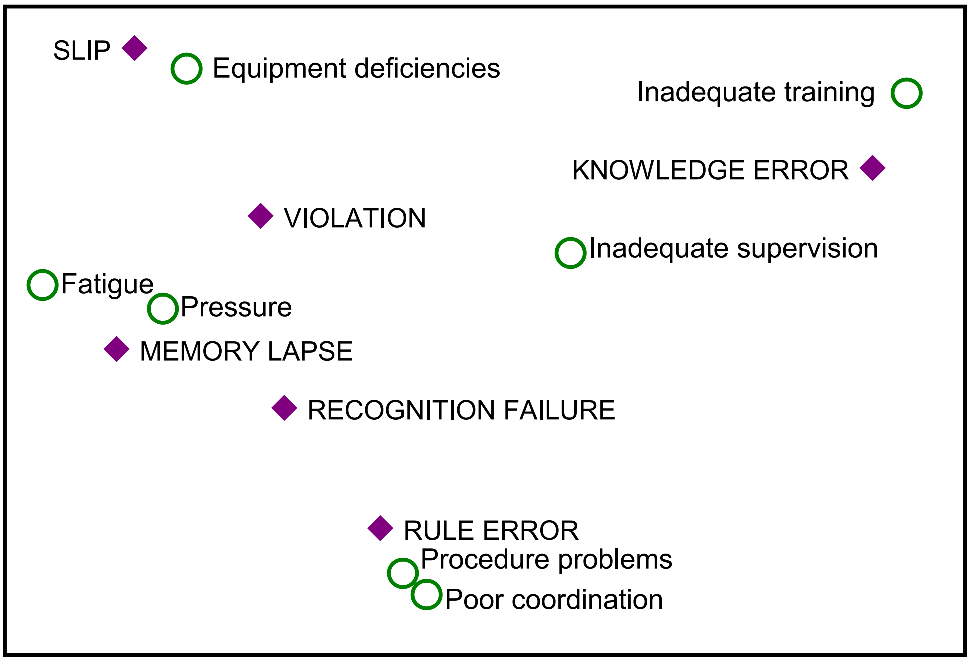

Figure 3.6 Links between types of error and performance factors

Source: Reason and Hobbs (2003:74)

The above study by Reason and Hobbs (2003:74) has, more specifically, indicated that, first, memory lapses are closely associated with time pressure and fatigue; and, second, rule-based errors are linked to inadequate procedures and coordination.

While the risk of human error can never be eliminated entirely, it should be managed effectively. People in the organisation should understand why human error occurs and how the risk of human error can be controlled. According to Reason and Hobbs (2003:17), removing error-promoting situations and improving defences are the two most important aspects of effective error management.

3.5.2 Managing human error

Managing human error has two components (Reason, 2000:4) – first, limiting the incidence of dangerous errors; and, second, creating systems that are better able to tolerate the occurrence of errors and contain their damaging effects.

Without a set of guiding principles, efforts to manage human error have little chance of being successful. Reason and Hobbs (2003:96-100) list the following guiding principles for human error management:

- "Human error is both universal and inevitable" (Reason and Hobbs, 2003:96). Such errors are rarely malicious acts and can never be eliminated.
- Errors are not intrinsically bad; without them, people can neither learn nor acquire the skills that are essential for safe and efficient work.
- One cannot change the human condition, but one can change the conditions in which humans work. Identifying the characteristics of situations that provoke unwanted actions is essential to effective error management.
- "The best people can make the worst mistakes" (Reason and Hobbs, 2003:97). Errors can strike anywhere, at any time; and no one is immune. The best people often occupy the most responsible

positions; and, therefore, their errors can have the greatest impact upon the system as a whole.

- People cannot easily avoid errors they do not intend to commit. If the intention is to remedy errors, it is useless to blame people for their errors, but everyone should at least be accountable for his/her errors and strive to avoid their recurrence.
- “Errors are consequences rather than causes” (Reason and Hobbs, 2003:97). An error is the product of a chain of events that involves people, teams, tasks, workplaces and organisational factors. Therefore, discovering an error is the beginning of the search for a cause, not the end of the process.
- “Many errors fall into recurrent patterns” (Reason and Hobbs, 2003:98). Systematic or recurrent errors occur in work situations that recur many times in the course of activities.
- Errors can occur at all levels of the system. A general rule of thumb is that the higher up the organisation an individual is, the more dangerous his/her errors potentially are. Therefore, human error management techniques need to be applied across the whole system.
- Human error management is about managing the manageable. One of the most common errors in human error management is trying to change those aspects of human nature that are virtually unchangeable. An important step in effective human error management is to recognize the existence of a tendency to blame individual persons and to fight against such a tendency.
- Human error management is about making good people excellent. The principal aim of human error management is to make well-trained and highly motivated people excellent. People need to be informed about the ways in which human performance problems can arise and they should be trained to plan how they might detect and recover errors before the errors cause harm.
- There is no single best way. Different types of performance problem occur at different levels of the organisation and each requires

different management techniques. Different organisational cultures also require the “mixing and matching” of different combinations of techniques. Each organisation has to choose or develop the methods that work best for that organisation.

- Effective human error management aims at continuous reform rather than at local fixes. Instead of trying to prevent the recurrence of individual errors, what is required is reforming the conditions under which people work, as well as strengthening the system and reducing the system’s deficiencies. Reforming the whole system should be a continuous process that aims at reducing and containing whole groups of errors rather than single blunders.

Human error management has three components, namely error reduction, error containment and managing activities so that the system continues to work effectively. Managing human error is the most challenging and difficult part of this process. For human error management to have a lasting effect, it needs to be continuously monitored and adjusted to changing conditions.

Effective or comprehensive human error management involves targeting different counter-measures at different parts of the company – counter-measures can be targeted at the person, the work team, the workplace and the task, and the organisation as a whole.

3.5.2.1 Counter-measures targeted at the person

Such counter-measures involve coming to grips with a number of people-related issues:

- understanding error-provoking factors, such as the following (Reason & Hobbs, 2003:104-105):
    - excessive reliance on memory;
    - interruptions;
    - pressure;
    - tiredness;

- inadequate coordination;
- unfamiliar jobs;
- ambiguity; and
- highly routine procedures;

- understanding why people violate good procedures – there are two techniques that are generally used for reducing violations (Reason & Hobbs, 2003:106-107), first, efforts to scare people into compliance (for instance, by using graphic posters and videos that highlight the consequences of unsafe behaviour); and, second, social controls (this is related to the extent to which other people whose opinions matter to the individual would approve or disapprove of the violating behaviour); and
- achieving the right degree of mental readiness for a task before it begins, which can greatly enhance the quality and reliability of human performance (Reason & Hobbs, 2003:110) – mental rehearsal improves the quality of the mental model and helps in activating the correct task steps, rather than the wrong ones, towards the intended goal.

3.5.2.2 Counter-measures targeted at the work team

Training programmes that deal with team issues generally include the following (Reason & Hobbs, 2003:114, *verbatim*):

- teaching team members how to pool their intellectual resources;
- learning to acquire a collective situational awareness that admits challenges from junior team members;
- emphasizing the importance of teamwork;
- establishing a common terminology to minimize communication problems;
- training for leadership and team membership skills;
- identifying organisational norms and their effects on safety;

- understanding organisational culture and recognition of shared values;
- improving communication skills; and
- understanding and managing stress.

3.5.2.3 Counter-measures targeted at the workplace and task

Making good people better will only have limited effect if the work environment and task continue to elicit errors. Some of the most powerful interventions to reduce errors are those directed at removing task-related challenges to work quality (Reason & Hobbs, 2003:119). The following are key aspects of the task and environment that can have a powerful impact on error reduction (Reason & Hobbs, 2003:119-126):

- *Fatigue management*

  Fatigue can increase the likelihood of error in the same way that alcohol does. If work is carried out outside standard hours, then fatigue management is one of the most important issues facing the organisation.
- *Task frequency*

  The error rate for tasks that are performed infrequently is likely to be high, because inexperienced workers tend to perform at the error-prone knowledge-base level. Once they have gained experience, there is a smaller likelihood of knowledge-based errors, but the probability of skill-based slips and lapses increases. Both unusual and routine tasks create their own kind of errors and therefore intelligent task assignment can help to reduce risks.
- *Design*

  Many errors have their origins in inadequate system design. It is not possible to design systems that eliminate the possibility of errors altogether, but both designers and users of systems should do everything possible to reduce the occurrence.

Potential users of the system should establish at the outset that the information received is clear and unambiguous and that the system is distinctively marked and easy to interpret.

- *Housekeeping*

  On the one hand, housekeeping should avoid an excessive concern with cleanliness, tidiness and outward form, but, on the other hand, it should also avoid neglecting dangerous slovenliness. It is important to find a standard of housekeeping that meets the needs of safe, swift and effective operations, but that does not go too far beyond these aims.

- *Spares, tools and equipment*

  An important part of managing error is getting the task environment right. Practical issues such as a lack of availability of spares and equipment can lead to errors, as employees struggle to perform their tasks in the face of obstacles and frustrations.

- *Omissions*

  It is important, first, to know in advance where an omission is likely to happen; and, second, to draw people's attention to the possibility of omission so that they might avoid it. Reason and Hobbs (2003:127) have developed a 20-item task step checklist as practical error management tool that can be applied to a specific task procedure to identify omission-provoking steps or items.

3.5.2.4 Counter-measures targeted at the organisation as a whole

Managing error requires action not only at the level of the individual or the workplace, but at all levels of the organisation. Activities often share a number of common factors that have a profound effect upon the success of the system as a whole. "At the organisational level, these factors include organisational structure, training and selection, people management, the provision of tools and equipment, commercial and operational pressures, planning and scheduling, communication and the maintenance of buildings and equipment" (Reason & Hobbs, 2003:134). Local conditions within a particular workplace that have a direct influence upon the reliability and efficiency of employees include factors such as knowledge, skills and the ability of the workforce, the quality of tools and equipment, the availability of parts, paperwork, manuals and procedures, ease of access to the job, and computer support (Reason & Hobbs, 2003:134).

The following are techniques for managing organisational factors that exert a powerful upstream influence on errors (Reason & Hobbs, 2003:135-142):

- *Reactive outcome measures*

  This involves learning the right lessons from past events. If an organisation is serious about reducing and containing human factor problems, it first needs to understand the nature and varieties of the errors that occur within its own system. It should analyse human errors according to the factors that may be associated with their occurrence. If there are recurrent error patterns, this indicates that there are conditions within the workplace or system that keep producing the same kinds or error, regardless of who is doing the job.
- *Proactive process measures*

  This involves the deployment of targeted remedial actions to increase the resistance to hazards. Proactive process assessment tools are used to identify and prioritize the workplace and organisational factors that have an adverse effect on human performance. They do not depend on the prior occurrence of errors – they are workplace and organisational factors that may cause errors later, so that remedial efforts can be directed at the problems that are most in need of attention. Reason and Hobbs (2003:140-141) have identified the following generic organisational factors in different locations: organisational structure, people management, provision and quality tools and equipment, training and selection, commercial and operational pressures, planning and scheduling, maintenance of building and equipment, and communication.

- *Putting appropriate defences in place*

  Even if organisations do their best to prevent human errors, errors are likely to still occur and when they do, they often have adverse consequences beyond the task at hand. Therefore, organisations need to ensure that their systems are as error-tolerant as possible. To achieve this, they need two types of defences, namely defences designed to detect human errors, and defences intended to contain the consequences of undetected human errors. Nobody can ever guarantee total immunity from human errors, accidents, or human performance problems, but organisations can increase the system's intrinsic resistance by identifying weaknesses in the error detection defences and strengthening these defences by identifying and eliminating the known causal ingredients that are latent in the system. The aim should be to be as resistant as reasonably practical to the organisation.

3.6 CONCLUSION

Human performance has a direct impact on organisational performance. Thus, for organisations to achieve their goals, employees need to meet or exceed performance expectations. Human performance problems occur when there is a good reason to assume that employees have the capacity to do what is expected of them, but do not do so.

The following conclusions can be drawn from the literature discussion in this chapter:

- Tracking and monitoring performance can help organisations to ensure that good quality data are collected from the most reliable sources. If these data are fed into a systematic troubleshooting approach, they would help organisations identify the performance gaps and root causes of the performance problem(s).
- Human performance can be managed pro-actively by identifying potential causes of performance problems and then implementing multiple safeguards against these causes.
- Although human error is often treated as the cause of performance problems, it is frequently merely a consequence of error-provoking tasks and error-inducing situations. Human error can be controlled by implementing the correct counter-measures that target the person, the work team, the workplace, the task and the organisation as a whole.

The purpose of this study is to develop a root cause analysis process for uncontrolled variations in human performance. Root cause analysis is all about making order out of chaos and finding out “what is going on”. The next chapter focuses on root cause analysis as a problem-solving tool that can assist organisations in finding and disseminating information that would help in the quest to find the answers to human performance problems.