CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Over the centuries, many have contributed to our understanding of the concept of performance excellence. Three leaders in the field of performance excellence are W.E. Deming, J.M. Juran, and P.B. Crosby (Vanderbilt University, n.d.). Historically, the lessons that these three "gurus" have learned and the methodologies that they investigated have, to a large extent, shaped the way in which performance as a concept is applied in organisations.

During the late 1920s, while working as a summer employee at the Western Electrical Company in Chicago, Dr W. Edwards Deming found that worker motivation systems were undignified and economically unproductive. In the 1930s Deming partnered with Walter A. Shewhart, a Bell Telephone Company statistician whose work persuaded Deming that statistical control techniques could be used to replace conventional management methods. Using Shewhart's theories, Deming developed a statistically controlled management process that provided managers with a way to determine when to intervene in an industrial process and when to leave it alone (*Encyclopedia of Small Business*, n.d.). Deming put Shewhart's statistical quality-control techniques and his own viewpoints of management to the test during World War II. Government managers found that these techniques could easily be taught to engineers and workers and quickly implemented them in over-burdened war production plants (*Encyclopedia of Small Business*, n.d.).

After World War II, Japan's economy suffered from the post-war economic depression. In 1950, Dr Deming was invited to visit Japan by the Japanese Union of Scientists and Engineers. Deming gave a series of lectures on quality control to Japan's top engineers and managers. Japan adopted Deming's principles and this strategy began to show positive results eighteen months

after his first lecture. In the mid-1950s, Japan began to display remarkable improvements in the quality of their products (Neave in Williams, 2001:38) and began to capture an increasingly large part of the international market share in the automotive and electronic industries – all this within four years of Deming's first visit (Aguavo, Deming & Walton in Williams, 2001:39).

Although Deming's former definition of quality concentrated on its statistical component, his later works considered quality from both a statistical and a management perspective. He argued that it was essential to transform management practices so that quality can be looked at from a systems perspective. Deming argued strongly that quality should be an organisation-wide effort and that it is everyone's duty, with management playing a primary role (CHI Publishers, n.d.:4). It is not surprising, then, that W. Edwards Deming is considered the father of Total Quality Management (TQM) (CHI Publishers, n.d.:4), which was the phrase applied to the quality initiatives offered by Deming and other management gurus, such as Joseph M. Juran and Philip B. Crosby, who were also major contributors to the TQM movement (*Encyclopedia of Small Business*, n.d.:5; CHI Publishers, n.d.:2).

"TQM is a holistic concept that considers the improvement in all organisational activities and processes" (CHI Publishers, n.d.:5). According to Andersen and Fagerhaug (2006:12), "TQM developed in different directions more or less simultaneously. One of these directions is the development of a number of problem analysis, problem-solving and improvement tools". Today, TQM possesses a large toolbox of such techniques, which are all overarching theories with the aim of continuous improvement in quality. Root cause analysis is part of this toolbox; and it plays an integral part in the continuous improvement process (Andersen & Fagerhaug, 2006:12; Neal *et al.*, 2004:75).

It can thus be said that the origins of root cause analysis can be traced to the broader field of TQM (Andersen & Fagerhaug, 2006:12).

To gain a better understanding of the origin and concepts of root cause analysis, it is necessary to describe it briefly. *Root cause analysis* has been

defined as “a structured investigation that aims to identify the true cause of a problem and the actions necessary to eliminate it” (Neal *et al*. 2004:75). According to Mary A. Bowling (2003), root cause analysis focuses primarily on processes and systems, and not on individual performance.

Significant industries using root cause analysis include the manufacturing, construction, healthcare, transportation, chemical, petroleum and power generation industries (Wilson, n.d.). According to Wilson (n.d.), the possible fields of application include operations, project management, quality control, health and safety, business process improvement and change management. In a root cause analysis survey conducted by the Plant Maintenance Resource Center (2001), 59% of the respondents indicated that they use some form of root cause analysis and that the following people usually participate in the root cause analysis process:

- reliability/plant/maintenance engineers;
- maintenance managers/superintendents;
- maintenance foremen/supervisors/coordinators;
- maintenance planners/schedulers;
- maintenance trades people/craftspeople;
- production managers/superintendents;
- production foremen/supervisors/coordinators;
- production operators;
- safety officers; and
- environmental officers.

It is evident from the above list that the field of human resources management has not been a general area of application. It is from this gap that the focus of this study emerged.

The greatest challenge of this study was therefore to adapt the data fields that are commonly used in root cause analysis – for example, manufacturer, model number, failed component, maintenance start date/time, equipment type

(Latino & Latino, 2006:75) – to human performance factors in order to identify the latent conditions that underlie variations in human performance.

The aim of this study is to integrate root cause analysis in and apply it to the field of human performance management – more specifically, to apply a root cause analysis process to uncover the root cause(s) of uncontrolled variation(s) in human performance.

An explanation of the types of variation in performance implied here is set out below to clarify the concept.

1.2 VARIATIONS IN PERFORMANCE

Deming, Juran and Crosby all noted more than two decades ago that variability on critical performance metrics is evidence that a business is not being managed effectively (Adsit, n.d.). Variation in measures such as performance, quality and throughput poses a threat to the vitality of an organisation. The greater the range of variation, the more costly the business is to operate.

Motley's (2005) definition of a variation is most apt for the purposes of this study – variation is any unwanted condition, or is the difference between a current and a desired end state.

It can be accepted that there will always be variation between people, in output, in service and in product(s). However, it is a key element of performance excellence to manage and reduce variation, and when variation does occur, to identify the sources of that variation and then to earmark them for further scrutiny. However, this does not imply that we need to measure and investigate every possible source of variation – we only need to investigate the possible sources that probably contribute most significantly to the variation in the output.

All causes of performance variation fall into two categories, namely chronic or controlled variation and sporadic or uncontrolled variation, and any situation may display both these types of variation from time to time (4GM Consulting, n.d.).

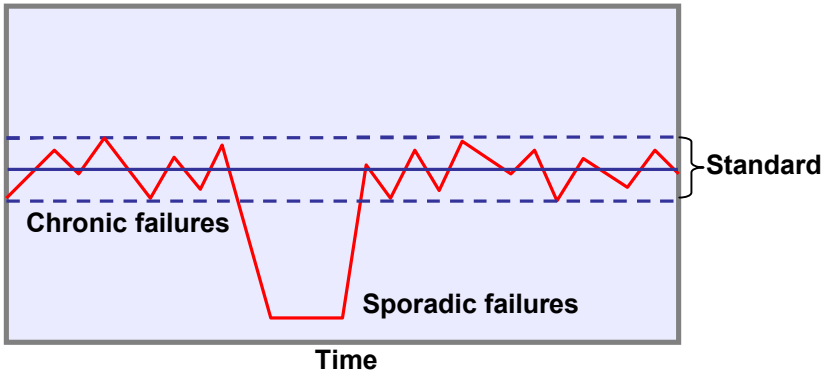

Figure 1.1 Types of variation

Source: Adapted from Latino and Latino (2006:46)

Small, individual causes of problems are inherent in all the possible sources of variation and they combine to produce a predictable degree of variation that remains reasonably constant over time, provided nothing arbitrarily changes in the process or job. These causes of variation are referred to as *controlled variation*, *common cause*, or *chronic failures/events* (4GM Consulting, n.d.; Latino & Latino, 2006:46). These variations happen so often that they become part of the *status quo*. If they can be eliminated, that would lead to an improvement.

Significant, assignable causes of variation are referred to as *uncontrolled variation*, *special cause*, or *sporadic failures/events* (4GM Consulting, n.d.; Latino & Latino, 2006:46). These are unnatural, inconsistent, unpredicted and unplanned, and they cause a significant shift or variation when they occur. Their occurrence can usually be ascribed to something special or specific that occurs. When they do occur, they cost a lot of money and require urgent and immediate attention.

According to Deming (quoted by Halliday, n.d.), confusion between controlled and uncontrolled variation could lead to frustration, greater variability and higher costs – the exact opposite of what an organisation needs. It is therefore important to distinguish between controlled and uncontrolled variation, as well as between performance management and performance improvement, because performance management and performance improvement as strategies generally follow different approaches. For the purposes of this study,

- *performance management* refers to actions taken to solve uncontrolled variation by eliminating the root causes and preventing a recurrence of the event that is causing the variation; and
- *performance improvement* refers to long-term strategies used to identify, understand and reduce or solve controlled variation, as well as to raise the level of performance by means of on-going management and improvement.

1.3 RATIONALE FOR THE STUDY AND ITS SIGNIFICANCE

1.3.1 The lack of shared understanding

When a variation in human performance occurs, it is usually the supervisor's responsibility to identify the deficiency and to respond to it promptly and consistently. However, if the manager/supervisor and the person who performs the task do not see the problem the same way, each will try to resolve a different issue and that will get them nowhere (Kepner & Iikubo, 1996:72). Tools are required that would allow organisations to create a common view or understanding of the problem (Gano, 1999:34). According to Gano (1999:34), sharing a common understanding made up of different people's perspectives would enable the organisation to escape from the illusion of "common sense" and thus avoid the usual type of disagreements.

1.3.2 The lack of proper analysis

In addition to a lack of shared understanding, ineffective problem-solving is often caused by people's tendency to focus on solutions

before clearly defining the problem and its causes (Gano, 1999:32). Jumping into a debate about possible solutions to a variation in human performance – for instance, job aids, coaching/mentoring, teaming, training or work group alignment (Rothwell, Hohne & King, 2000:99-100) – would focus only on the symptoms. As a result, the problem will recur again and again. According to the Center for Industrial Research and Services (n.d.), most organisations try to fix problems quickly, without ever finding out what caused the problems in the first place, making the problems reappear. "Only when the root cause is identified and eliminated can the problem be solved" (Center for Industrial Research and Services, n.d.).

1.3.3 Shortcomings of existing techniques and methodologies

According to Ammerman (1998:65), the most common root cause analysis techniques are Event and Causal Factor Charting, Control Barrier Analysis, and Fault Tree Analysis:

- *Event and Causal Factor Charting*

  The principles of using sequence diagrams was first adopted by the U.S. Atomic Energy Commission (Livingston, Jackson & Priestley, 2001:7). "Subsequently, many other root cause analysis programmes have included Events and Causal Factor diagrams in their armoury of methods" (Livingston *et al*., 2001:7). The purpose of Events and Causal Factors Charting is to identify and document the sequence of events from the beginning to the end of the incident, and to identify the factors, conditions, failed barriers, and energy flows that contributed to the incident (Livingston *et al*., 2001:7).

- *Control Barrier Analysis*

  The concepts used in barrier analysis were originally developed in Hienrich's domino theory in the 1930s (Livingston *et al*., 2001:13). Haddon and Gibson (in Livingston *et al*., 2001:13) developed the concept of an accident as an abnormal or unexpected release of energy. "Barrier analysis uses this idea in its approach to accident

prevention by suggesting that, in order to prevent an accident, a barrier must be erected between the energy source and the item or person that is to be protected" (Livingston *et al*., 2001:13).

- *Fault Tree Analysis*

  The theory of Fault Tree Analysis has been around at least since 1961 (Livingston *et al*., 2001:16). It is a deductive methodology – "it involves reasoning from the general to the specific, working backwards through time to examine preceding events leading to failure" (Livingston *et al*., 2001:16). Fault Tree Analysis is used to determine the potential causes of incidents or of system failures more generally (Livingston *et al*., 2001:16).

The principles and concepts that the above techniques employ have provided the foundation for almost every root cause analysis technique (Livingston *et al*., 2001:13) to date. According to Piskurich (2002:57-58) and Rothwell *et al*. (2000:67-71), the most common cause analysis tools used when analysing human performance are brainstorming, cause-and-effect analysis (also known as the fishbone or Ishikawa diagram), and the five why's technique.

Although techniques such as brainstorming, the fishbone diagram, and the five why's have proved to be robust and useful, it may be argued that, for the following reasons, they are not necessarily geared for and apposite in analysing uncontrolled variations in human performance and would therefore have only limited success in identifying the root causes of human performance problems:

- There is no evidence of an objective, finite data point or base performance from which to proceed or against which a comparison can be made, or a logical structure by which to be guided (Kepner, 2006b:1).
- According to Latino and Latino (2006:21), techniques such as these allow ignorance and assumptions (hearsay) to be treated as fact and then not enough time is spent on collecting data or evidence to

support the hearsay hypothesis. As a result, objective analysis is not possible. The only conclusions that can be reached are judgements based on partial and superficial experience, intuition and opinion. In such circumstances, the root cause that is selected is the one that feels good and seems to explain the performance variation, but it may have no analytic veracity (Kepner, 2006b:1).

The author's own experience in root cause analysis over the past 13 years concurs with Dr Kepner's (2006b:2) findings, namely that the methods and tools currently used to identify the root cause(s) of uncontrolled variations in human performance

- lack a precise, agreed-upon definition of the required or desired performance;
- lack a means of identifying what information is relevant;
- cannot identify sources of relevant, needed information, or those who can best judge the degree to which the conclusion explains the variation; and
- does not give enough guidance as to the remedial or corrective action that should be taken, which leads to much insecurity and trial-and-error adaptation of the action. The result is confusion, mistrust, resentment, and erosion of loyalty to the manager.

1.3.4 The need for a tool that fits the means

If attention is not paid to the uncontrolled variation in human performance and its root causes, it may have a damaging effect on performance and could ultimately have a negative and unfair impact on employees' careers and organisations' missions. What is needed to analyse uncontrolled variations in human performance is a logical and verifiable process that will establish a data point about which relevant information can be recognized and gathered, and against which the conclusion can be evaluated, to have confirmed knowledge of the root

cause of the uncontrolled variation from the data point. *The lack of such a root cause analysis process necessitates this research*.

A proper root cause analysis process for uncontrolled variations in human performance will

- provide a precise definition of the required or desired performance;
- provide a blueprint of the relevant information, as well as of who has the required information and knows enough about the situation to be able to help to identify an adequate explanation for the observed uncontrolled variation in human performance;
- demonstrate how well the explanation fits the uncontrolled variation in human performance; and
- identify and avoid the consequences of an action – this will lead to stability, acceptance of the action taken, loyalty to the manager and organisation, and trust in the humanity and justice of the entire system.

A root cause analysis process for uncontrolled variations in human performance should make successful corrective action a real possibility, whereas a superficial analysis which leads to an incorrect or inadequate understanding of the cause can only create chaos, waste and confusion (Kepner, 2006a:1). Knowing the root cause of an uncontrolled variation in human performance would be a huge step forward for all stakeholders.

In summary, a root cause analysis process would assist managers and supervisors because it could

- provide them with a strategy and a set of guidelines that would help them make sense of all the information coming their way regarding the uncontrolled variation in human performance;
- make them proactive by helping them to call for, and seek out, the specific information that they need in order to address the source of uncontrolled variation in human performance;

- assist them in determining the root cause of the uncontrolled variation in human performance, by providing them with a process for diagnosing, analysing and assessing the variation in the performance;
- help them in their efforts to determine what could be done to solve or prevent the source(s) of uncontrolled variation in human performance;
- assist them in making appropriate referrals, which would in turn enable them to enhance overall performance and, in some instances, even salvage careers; and
- give them added credibility for fairness, increase loyalty and commitment to both manager and company, and lead to positive future collaboration.

The study contributes to the body of knowledge on human performance management by presenting a systematic root cause analysis process that uncovers the root causes of human performance problems effectively and consistently; and controls these causes in a way that prevents the problems from recurring. The process will also facilitate the sharing of information between the manager/supervisor and performer – they become partners in formulating ideas and conclusions based on the facts and their combined knowledge and experience. To solve performance problems today, it is vital that managers/supervisors and performers pool their best knowledge and ideas to find the causes and develop the best solutions.

1.4 RESEARCH OBJECTIVES

The main objective of this study is to *develop a root cause analysis process that will uncover the root cause(s) of uncontrolled variation in human performance and prevent the recurrence of events causing the variation*.

In addition to the main objective, the study aims to use the root cause analysis process to *develop a Human Performance Management Model*. The purpose

of this model is to expand the boundaries of traditional performance management also to include

- actions that will sustain the new, improved performance;
- actions that will prevent the same or a similar performance problem in other areas of the organisation; and
- a process that will ultimately create an environment and culture of continuous performance improvement.

1.5 SCOPE OF THE STUDY

This study's main focus is the management of human performance by uncovering and preventing the root causes of uncontrolled variation by means of the application of a root cause analysis process. A secondary component of this study illustrates how the root cause analysis process can be incorporated into a larger performance management model as a cause analysis tool.

For the purposes of this study, as already mentioned earlier in this chapter, *performance management* refers to actions taken to keep the performance at the expected level of performance and to eliminate any event that causes unwanted variations from the performance norm, or uncontrolled variation.

Human performance management originated in the behavioural sciences, while quality improvement originated in engineering and statistics. Despite these differences, there are significant similarities between human performance management and quality improvement (JHPIEGO Corporation, 2003, *verbatim*)[1] – both

- are cyclical problem-solving processes;
- advocate the establishment of standards and the continual quest to meet those standards;
- seek to establish the root causes of identified problems; and

[1].Throughout this thesis, on a few occasions, items in a bulleted list are cited *verbatim* because that is the simplest and most concise way of making those points. Wherever this has been done, such citations are indicated as *verbatim* citations in the brackets after the page number.

- identify and select appropriate actions that are intended to address performance problems.

Notwithstanding these similarities, this study does not include an investigation of quality or performance improvement, or performance improvement methods, such as Six Sigma and innovation. For the purposes of this study, as mentioned previously in this chapter, *performance improvement* refers to actions taken, first, to obtain consistency and precision by minimizing or eliminating controlled variation, and/or, second, to raise the expected level of performance to a new standard.

1.6 OVERVIEW OF THE RESEARCH DESIGN AND METHODOLOGY

The objectives of this study could best be achieved by means of a qualitative research approach, applying action research as the research method. According to Hopkins (quoted by Gabel, 1995), the action research framework is most appropriate for recognizing the existence of shortcomings and for adopting some initial stance with regard to the problem, formulating a plan, carrying out an investigation, evaluating the outcomes and developing further strategies in an iterative fashion. The basic action research cycle, as displayed in Figure 1.2 (O'Brien, 1998:1), was used in this study. It is explained in greater detail in Chapters 5 and 6.

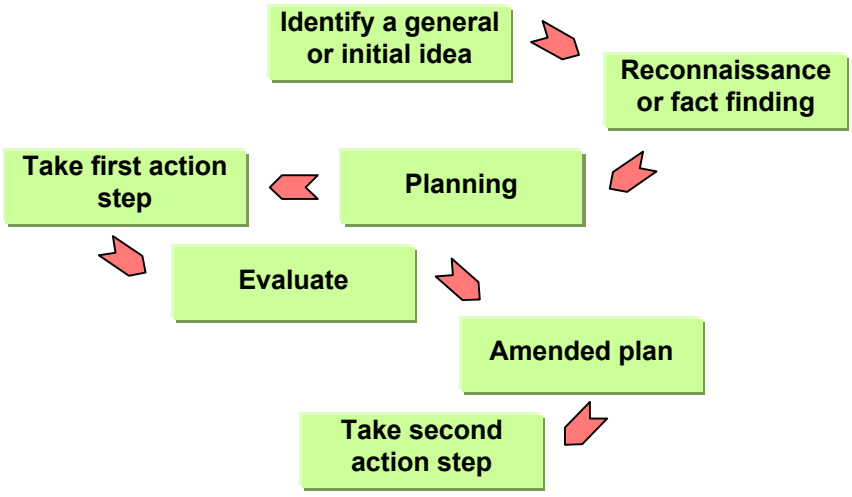

Figure 1.2 Basic action research cycle

Source: O'Brien (1998:1)

This study primarily involves the analysis of data in the form of words (more specifically literature studies) and gathering feedback after a practical application of the root cause analysis process. Most of the data analysis was carried out alongside data collection.

The study was conducted in three phases and nine steps (see Figure 1.3 – Research methodology overview):

Phase 1: Development of the root cause analysis process

- Step 1: Conduct a literature review
- Step 2: Develop a root cause analysis process for uncontrolled variations in human performance

Phase 2: Testing and refinement of the root cause analysis process

- Step 3: Design a feedback guide to gather opinions and suggestions
- Step 4: Apply the root cause analysis process to real life human performance variations
- Step 5: Gather, interpret and incorporate feedback data into process
- Step 6: Develop a case study
- Step 7: Apply the root cause analysis process to the case study
- Step 8: Interpret feedback data and refine the process

Phase 3: Development of a Human Performance Management Model

- Step 9: Develop a model for human performance management

The research process and steps are described in more detail in Chapters 5 and 6, which also explain the purpose of the process and its application to this study.

1.7 OUTLINE OF THE STUDY

This thesis consists of eight chapters.

Chapter 1 has highlighted the following:

- Current tools and methodologies used in root cause analysis have been developed with safety, quality, risk and reliability in mind. They are therefore not necessarily geared or appropriate to analysing uncontrolled variations in human performance.
- The lack of an appropriate tool increases the likelihood that people would fall into the trap of jumping ahead to solutions, instead of analysing the problem properly.
- There is a need for an appropriate tool that can be used to analyse and uncover the root causes of uncontrolled variations in human performance – it needs to establish a data point about which relevant information can be recognized, gathered, and against which the conclusion can be evaluated.
- The objective of this study is to develop a root cause analysis process that can uncover the root causes of uncontrolled variations in human performance, as well as to use the newly developed root cause analysis process to develop a human performance management model.
- The newly developed root cause analysis process and human performance management model will benefit any manager or supervisor who faces uncontrolled variations in human performance and who wishes to find the root cause of the variation, to improve performance, and to prevent any recurrence of the events that caused the variation.

Chapter 2 describes the fundamentals of human performance and the variables and trends that influence the level of work performance. **Chapter 3** describes methods and tools that could help manage human performance, as well as the role that human error plays as a potential cause of variation in human performance. The concept of root cause analysis is discussed in detail in **Chapter 4**. The research approach, methodology and methods used in this study are discussed in **Chapters 5 and 6**. The details of the research results and findings are outlined and discussed in **Chapter 7**. **Chapter 8** concludes this thesis by discussing the conclusions and recommendations.

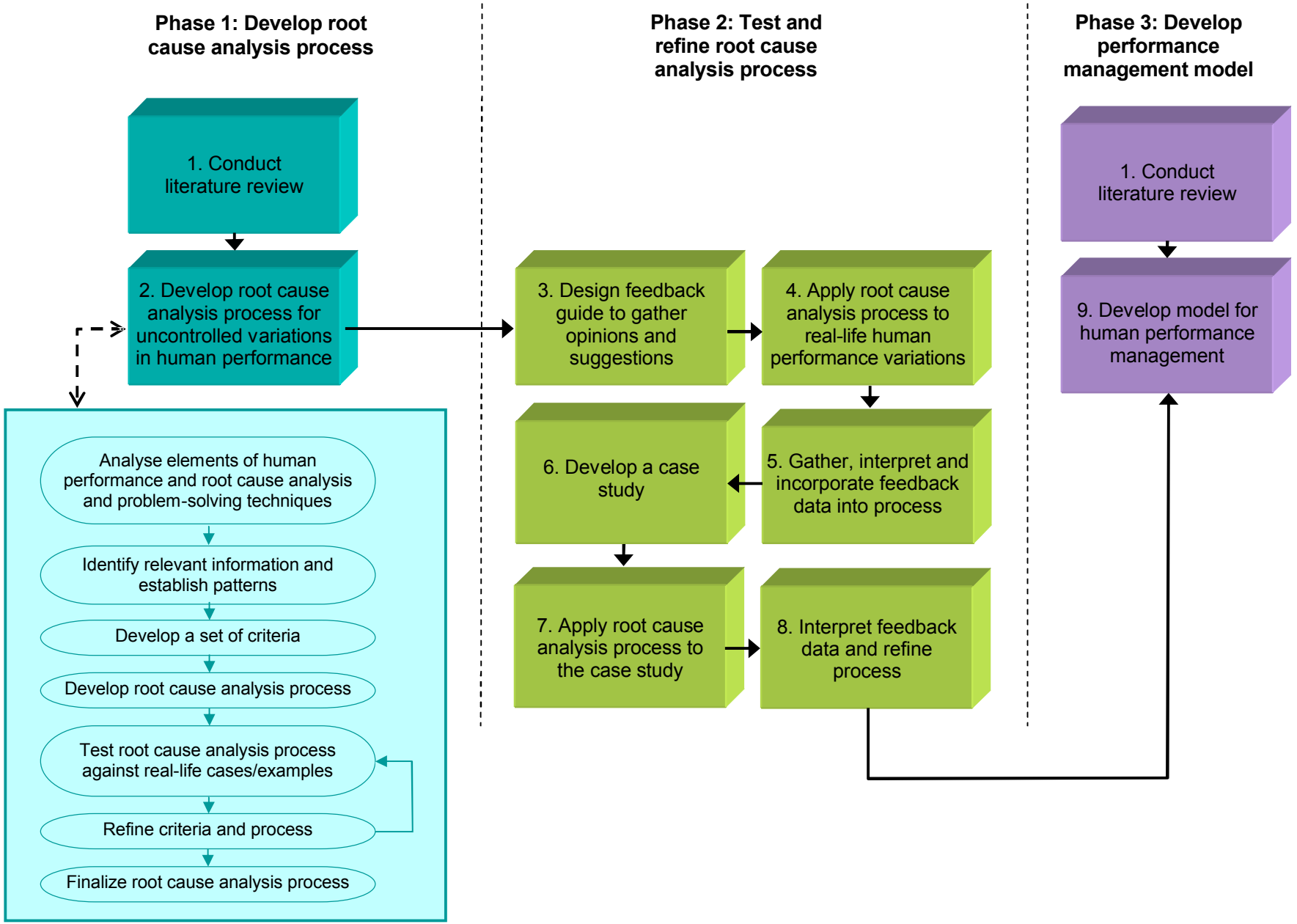

Figure 1.3 Research methodology overview