

The development, implementation and transformation of the Disaster Management Cycle

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"Trust in the Lord with all your heart, And lean not on your own understanding; In all your ways acknowledge Him, And he shall direct your paths."

Proverbs 3:5

Summary

During the early 1970s increase in disaster events lead to the emergence of a “new concept” within the field of disaster management. This concept was called the Disaster Management Cycle. The cycle was designed to illustrate the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. The Disaster Management Cycle concept has not remained static over the past 40 years and some changes and variations have occurred in how the cycle is illustrated, and how it is applied in different organisations. Furthermore, it is also not clear how the concept of managing disasters and their impacts in a cyclical fashion originated. Consequently it was the purpose of the research study to determine how the cycle originated, what changes occurred in the cycle concept, and how Disaster Management Cycles were applied in different contexts.

To answer the research questions posed for the study two tools were used. A review of literature was undertaken in order to provide a base from which further analysis could be conducted. In this regard, a wide spectrum of literature was reviewed which included training material, policies, international organisation documentation, peer reviewed articles, research reports and case studies. Semi-structured interviews with knowledgeable individuals in the field of disaster and risk management were also used to triangulate the finding of the literature review. The data gathered from the literature review process was then analysed by the application of general systems theory concepts such as ecquifinality, open systems, feedback arrangements an isomorphism. Through the application of these general systems theory concepts the interaction between the Disaster Management Cycle and the environment in which it was created or applied was explored, which in turn provided insight into the origins and differing applications of the cycle.

The study found that although Disaster Management Cycles only appeared in illustrative format in the 1970s, the origins of the Disaster Management Cycle can be traced back to early disaster phase research. In this regard studies into linear disaster phases conducted by Prince (1920), Carr (1932), Powell (1954), Chapman (1962) and Stoddard (1968), established phase ideas like emergency, relief, recovery and rehabilitation. All of which could be observed in subsequent Disaster Management Cycles. Consequently it is argued that the origins of the Disaster Management Cycle can be traced back as far back as the 1920 study conducted by Prince. It was found that much of the changes that occurred in the Disaster Management Cycle concept, over several decades, could be ascribed to the specific context in which the cycle was created as well as the open system nature of Disaster Management Cycles. In this regard it was established that the context in which a Disaster Management Cycle was created and applied greatly affected the composition of the specific cycle. Furthermore, it was found that the open system nature of Disaster Management Cycles allowed many context specific changes to occur and as consequence many different variations of the Disaster Management Cycle appeared.

OPSOMMING

Die verhoogde aantal rampgevalle gedurende die vroeë 1970s het gelei tot die ontwikkeling van 'n "nuwe" konsep in die veld van ramp- en risikobestuur. Hierdie konsep heet die rampbestuursiklus. Die siklus is ontwerp om die voortdurende proses uit te beeld wat regerings, besighede en die algemene publiek moes volg om beter te vaar die vermindering van die impak van 'n ramp, om die reaksie tydens en na ramp insidente te verbeter en om die samelewing te herstel na so 'n ramp insident. Alhoewel die konsep van die rampbestuursiklus reeds 40 jaar bestaan, het die konsep nie staties gebly nie en het die siklus opsigself baie veranderings ondergaan, asook die toepassing daarvan deur verskeie organisasies. Geen duidelikheid bestaan oor die oorsprong van die konsep van 'n rampbestuursiklus nie. Dit is daarom die doel van die studie om vas te stel, hoe die konsep ontstaan het, watter veranderinge plaasgevind het en hoe die siklus in verskillende kontekste toegepas word.

Om die navorsingsvrae ten opsigte van die studie te beantwoord is twee navorsingsmeganismes toegepas. Die eerste van die meganismes was 'n indiepte literatuurstudie. 'n Wye spektrum literatuur is bestudeer, insluitend opleidingsmateriaal, beleidsdokumente, dokumentasie van internasionale organisasies, geakkrediteerde joernaal artikels, navorsingsverslae en gevalle studies. Semi-gestruktureerde onderhoude met academici en praktisyns in die veld van rampriskobestuur is gevoer om triangulasie met die bevindinge van die literatuurstudie te bewerkstellig. Die ingesamelde data vanuit die literatuurstudie is geanaliseer aan die hand van die Algemene Sisteemteorie se konsepte soos oop-sisteme, terugvoer rangskikkings en isomorfisme. Die interaksie tussen die rampbestuursiklus en die omgewing waarin dit funksioneer is bestudeer deur die konsepte van die Algemene Sisteemteorie toe te pas. Die resultate van die studie het antwoorde verskaf ten opsigte van

die ontstaan van die siklus sowel as die wyse waarop die siklus binne verskillende organisasies toegepas word.

Die studie het bevind dat alhoewel die rampbestuursiklus vir die eerste keer in die 1970s verskyn het, dat die oorsprong van die siklus sover terug dateer as vroeë studies wat gefokus het op liniere ramp fases. In die opsig het studies deur Prince (1920), Carr (1932), Powell (1954), Chapman (1962) en Stoddard (1968) 'n kardinale rol in die formulering van basiese beginsels soos herstel, rehabilitasie, noodgeval en respons gespeel. Die genoemde fase beginsels kan duidelik opgemerk word in die formulering van rampbestuursiklusse. Gevolglik kan daar redeneer word dat die ontstaan van die rampbestuursiklus sover terug dateer as die studie van Prince (1920). Daar is ook bevind dat die veranderings wat in die rampbestuursiklus opgemerk word, deur die konteks waarin die siklus ontwerp is asook die oop sisteem aard van die konsep veroorsaak is. Daar is spesifiek vasgestel dat die konteks waarin die siklus ontwerp is, 'n groot invloed op die samestelling van 'n spesifieke siklus het. Verder is bevind dat die oop sisteem aard van die rampbestuursiklus verskeie konteks-spesifieke veranderinge toegelaat het. Gevolglik is daar vandag verskeie variasies van die rampbestuursiklus te vind.

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CHAPTER 1

ORIENTATION AND PROBLEM STATEMENT

1.1 INTRODUCTION

During the early 1970s increase in disaster events lead to the emergence of a “new concept” within the field of disaster management. This concept was called the Disaster Management Cycle. The cycle was designed to illustrate the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. The concept of a Disaster Management Cycle has not remained static over the past 40 years. Some changes and variations have occurred in how the cycle is illustrated and how it is applied in different organisations. Furthermore, it is also not clear how the concept of managing disasters and their impacts in a cyclical way, originated. Consequently, it was the purpose of the research study to determine how the cycle originated, what changes occurred in the cycle concept and how Disaster Management Cycles were applied in different contexts.

Through the in-depth review of literature and analysis by means of the General System Theory, it will be illustrated that the Disaster Management Cycles only appeared in illustrative format in the 1970s. However, the origins of the cycle can be traced back to early disaster phase research, which established phase ideas like emergency, relief, recovery and rehabilitation. All these phase ideas were observed in subsequent Disaster Management Cycles. From this, the argument is made that the origins of the Disaster Management Cycle can be traced back as far back as the 1920 study conducted by Prince.

The influence of the specific context and the open systems, in changes that have occurred in the Disaster Management cycle, is extensively explored. In this regard it will be established that the context in which a Disaster Management Cycle is created and applied greatly affects the composition of the specific cycle. Furthermore, the relation between the open system nature of Disaster Management Cycles and the many context specific changes and consequent variations of the Disaster Management Cycle was explored.

1.2 PROBLEM STATEMENT

Each year thousands of people lose either their lives or livelihoods due to the adverse impact of both natural and human-made disasters. Alarming, disaster frequency has increased dramatically over the past 50 years. From the 1970s to the 1990s, the number of people affected globally tripled while the decadal economic cost increased by a factor of \$5 billion to more than \$600 billion.

During the early 1970s, at the same time as the increase in disaster events were taking place, a “new concept” started to emerge within the field of disaster management. This concept was called the Disaster Management Cycle. The cycle was designed to illustrate the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster and take steps to recover after a disaster has occurred. Baird, O’Keefe, Westgate and Wisner (1975) present an early example of different disaster phases in a cyclical manner (*Figure 1.1*).

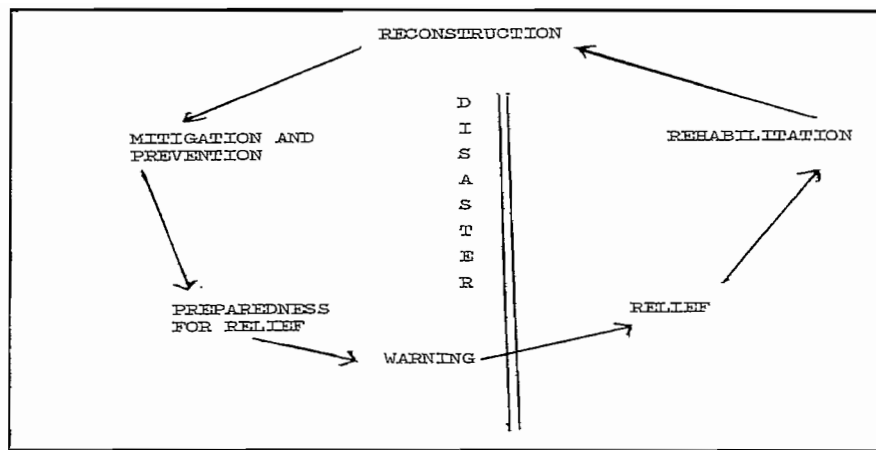


Figure 1.1 Early Disaster Management Cycle

Since this early six-phased example of a Disaster Management Cycle, many adaptations and changes have occurred in the composition of the disaster cycle as well as its application. A cycle proposed by the UNDP and the now defunct UNDRO (1992), for instance, comprised of five phases. Later cycles proposed by Alexander (2002) and the United Nations University (2008) comprises of four and three distinct phases respectively. These are only some examples of the many possible variations of the Disaster Management Cycle currently in use within the field of disaster management. Furthermore, governments and organisations working within the field of Disaster and Risk Management implement the original cycle or adaptations of the original cycle differently. For instance, the cycle promoted by the UNDP and UNDRO (1992) differs from the cycle promoted by DFID, which in turn differs from the cycle promoted by FEMA. To remove some of the clutter caused by decades of reinterpretation of the Disaster Management Cycle, this study will aim to evaluate both how the Disaster Management Cycle has transformed since its earliest forms in the 1970s as well as changes in its application by various institutions over the last four decades.

1.3 KEY RESEARCH QUESTIONS

The study focused on answering the following key research questions:

- How was the Disaster Management Cycle developed?
- How is/was the cycle applied in different contexts?
- How has the cycle changed since its inception?

1.4 RESEARCH OBJECTIVES

The research objectives for the study are as follows:

- To Investigate and determine the historical development of the Disaster Management Cycle.
- Determine how the cycle is/was applied in different context around the globe.
- Evaluate how the cycle has changed from its inception until 2005.

1.5 LITERATURE REVIEW

Studies and debates on the various phases of disasters go back as far as the 1930s (Neal, 1997:240). Since these early times, both scholars and practitioners within the field of disaster management has used these categories relating to the various phases of disaster to better understand their field of study as well as improve their response to disaster events (Neal, 1997:240). Approaches differed greatly from the four phased approach proposed by Carr in 1932 to eight, seven and five phased approaches

proposed by Powel (1954), Stoddard (1968) and Barton (1970) respectively. United Nations documentation from the early 1970's also describes four distinct phases associated with disaster and risk management. These are disaster prevention and prediction (phase1), preparedness and pre-disaster planning (phase 2) actions during the emergency (phase 3) and post-disaster rehabilitation and reconstruction (phase 4) (UN, 1971). It is still unclear whether this thinking was carried over to United Nations agencies dealing with disaster and risk management like UNDRO and the UNDP, but is addressed further in this study.

Though, in spite of much theorising about possible disaster management phases, the practical approach to disaster management still remained mainly focused on response and relief efforts following disaster events (Lewis *et al.*, 1976:2, Twigg, 2004:14, UNISDR, 2004:7). This traditional approach to disaster management only started to change during the 1970s. The seventies saw a dramatic increase in disaster events that caused increased deaths and greater economic losses than in previous decades. With the recurrent and increasing human and capital costs of disaster, came the realisation that there must be a more efficient way of utilising capital than merely providing relief. Pre-disaster planning seemed like a practical and necessary component to compliment traditional thinking (Lewis *et al.*, 1976:2). During this time, the first Disaster Management Cycles appeared and illustrated the "new" pre-disaster planning approach to disasters. This cycle incorporated much of the early thinking about disaster phases described by Carr (1932), Powell (1954), Stoddard (1968) and Barton (1970).

Some typical Disaster Management Cycles (refer to figure 2) comprise of two over arching phases and these can be described as the pre-disaster and the post-disaster phases respectively (Holloway, 2003:7; Raheja, 2003:8; UNDP/UNDRO, 1992:12). Disaster prevention, disaster mitigation and disaster preparedness constitute the pre-disaster phase, while response,

recovery and mitigation (development) the post-disaster phase (Raheja, 2003:8).

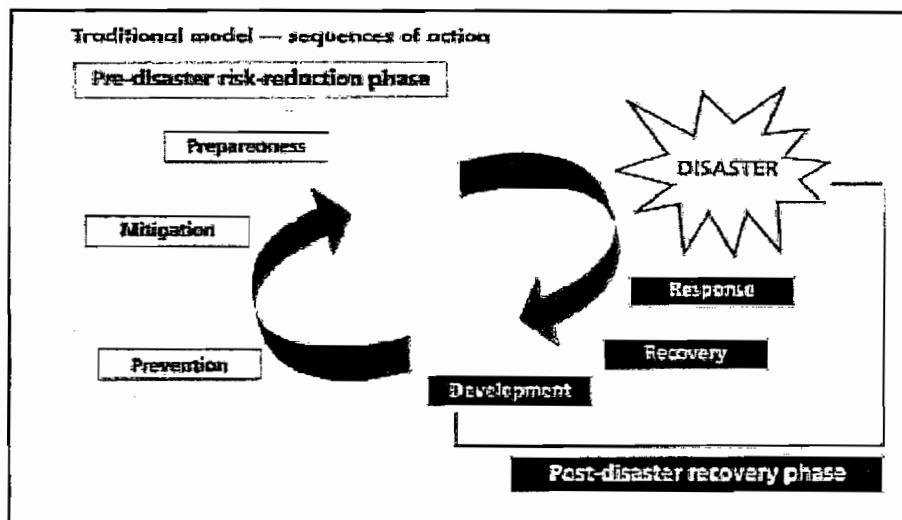


Figure 1.2: Two phased Disaster Management Cycle

(Source: South Africa, 1998)

Some other cycles differ from this typical view and divide the cycle into three broad (figure 1.3) categories, which can be divided into a post-disaster response phase, post-disaster recovery phase and a pre-disaster mitigation and preparedness phase (Khan & Khan, 2008:47).

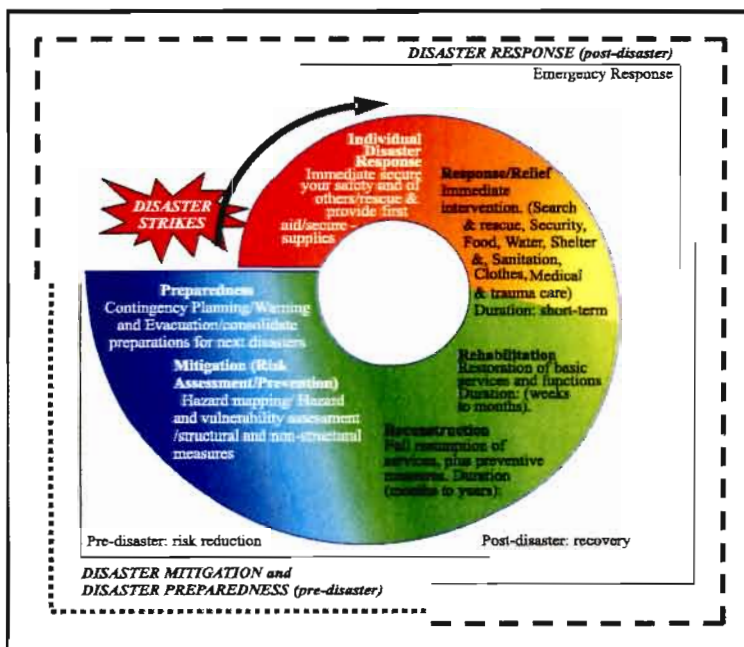


Figure 1.3: Three phased Disaster Management Cycle

(Source: Khan& Khan, 2008:47)

Even though this approach differs from the two-phased approach by addressing the disaster occurrence phase (response phase) as a unique phase in itself, both cycles still function on the basic premise of the Disaster Management Cycle, which is to take appropriate actions at all stages in the cycle. Therefore, greater preparedness, improved warnings, reduced vulnerability or the prevention of disasters during the next iteration of the cycle can be attained (Khan & Khan, 2008:48; Wisner, 2001:13).

Apart from differences amongst cycles themselves, both countries and organisations working within the field of Disaster and Risk Management apply these cycles in a manner, which is most appropriate to their needs (Carter, 1991:59). The tailoring of the Disaster Management Cycle to a country or organisations needs might explain why certain phases receive greater primacy in some cycles and not in others. However, this point would need to

be explored further before it can be substantiated. This study will help to clarify the aforementioned point as well as other issues regarding the Disaster Management Cycle.

1.6 REASEARCH DESIGN

A dual research approach of both quantitative and qualitative research was followed within the research study. The quantitative approach helped to determine the relationship between the independent and dependent variables within the population (Singh, 2007:63). Specifically, the study utilised an exploratory research approach. This exploratory approach was used in order to create a broad understanding of issues relating the Disaster Management Cycle (Bless *et al.*, 2006:47; Singh, 2007:64; Neuman, 2006:35; Babbie & Mouton, 2008:79). The exploratory research was conducted in a deductive manner.

The qualitative component of the study comprised of an in-depth review of literature regarding the Disaster Management Cycle (Fouche & Delport, 2005:123). A wide spectrum of literature was reviewed for the purposes of the study. These included training material, policies, international organisation documentation, peer reviewed articles, research reports and case studies. To assure greater validity through triangulation, the study also utilised semi-structured interviews with knowledgeable individuals in the field of Disaster and Risk Management.

Both scholars and practitioners within the field of Disaster and Risk Management were consulted. Purposive sampling was applied specifically to individuals that work within universities, NGOs and the public sector. These individuals were targeted because of both their theoretical and practical knowledge on issues pertaining to the Disaster Management Cycle. The

knowledge provided by these individuals ensured that objectives of this study could be achieved. The ideal amount of participants to inform the study was determined by means of the snowball sampling methodology. This methodology was utilised to ensure that data saturation was achieved.

To answer the research questions relating to how the cycle is applied in different contexts and how cycle has changed since its inception the general systems theory was applied. The general systems theory allowed for a holistic perspective on the different interacting units that form part of the integrated whole, which was found to be the case with the Disaster Management Cycle (Du Toit *et al.* 2002:21; Skyttner, 2005: 57; Van der Waladt & Du Toit, 1997:95). The general systems theory was utilised because of its recognition that through the constant interaction between systems and environment, that the environment affects systems and systems in turn affect the environment (Skyttner, 2005:64; Van der Waladt & Du Toit, 1997:94). By viewing Disaster Management Cycle as a system, it was illustrated how the concept was affected by its environment as well as how the concept affected its environment. Attention was also given to explaining why various cycles differ so dramatically from each other and also why they were applied differently by different organisations.

1.7 CHAPTER DELINEATION

The first chapter of the research study provides the framework by which the rest of the study was conducted. It constitutes a brief overview with regards to the problems associated with the Disaster Management Cycle concept. From the problem statement, relevant research questions and research objectives were formulated. A literature review was conducted to give a brief contextual understanding of the problems relating to the Disaster Management Cycle. The research design to be followed in the study was also delineated in this chapter. Chapter 2 discusses the General Systems Theory as the main

analytical tool for the study. The development of the General System Theory and its key concepts discussed as well as how the key concepts identified are relevant to the study of the Disaster Management Cycle. Chapter 3 elaborates on other aspects relating to the methodology that was adopted in the process of exploring the origins and development of the Disaster Management Cycle. In this regard issues relating to the qualitative research process, data collection method, reliability and validity and ethical research are discussed. Chapter 4 aims to clarify the confusion surrounding the origins and development of the Disaster Management Cycle by conveying a broad overview of the historical development of both linear disaster phases as well as Disaster Management Cycles. The information gathered from this historical overview is then analysed in chapter 5 through the application of the General System Theory concepts identified in chapter 2. The aim of the analysis was to illuminate the general systems properties of both linear phases and cycles, thereby providing greater insight into both terms as well as providing answers to the research questions posed for the thesis. The study concludes with a more in-depth look at the conclusions and recommendations of the research in chapter 6. These conclusions were discussed according to the research questions posed for the study and included a brief recommendation for future research.

1.8 CONCLUSIONS

The first chapter of the research study provided the framework by which the rest of the study was conducted. A brief overview was given with regards to the problems associated with the disaster management cycle concept. In this regard problems relating to the origins, development and implementation were identified as significant problems that need to be addressed through further research. The identified problems were reformulated into relevant research questions as well as research objectives. A literature review was also conducted to give a brief contextual understanding of the problems relating to the Disaster Management Cycle. The research design and tools to be used in

the study was also briefly discussed, and will be discussed in greater detail in chapters 2 and 3 respectively. The chapter concluded with a delineation of the main focus of each of the chapters that follow.

The following chapter will discuss the General System Theory as the main analytical tool that was used in the study. The development of the General System Theory and its key concepts will be discussed as well as how the key concepts identified are relevant to the study of the Disaster Management Cycle.

CHAPTER 2

GENERAL SYSTEMS THEORY

2.1 INTRODUCTION

Describing the management of a disaster is a difficult task. The main reason is that just like a disaster itself, disaster management and management tools like the Disaster Management Cycle, emerge out of a complex system of interrelated and interdependent conditions and events that effect its development (Becker, 2009:3). The Disaster Management Cycle has through its history been influenced by many disciplines such a sociology, geography, psychology, civil defence, public administration and development studies (Quarantelli, 1986:11; Tierney, 1998:2; Quarantelli, 1997:2). The varied inputs from these disciplines have made the Disaster Management Cycle a complex system which, just like disaster events themselves, are often difficult to comprehend and explain (Cebulla, 2004:87). Much like other concepts such as society, organisms, the brain and climate in other areas of scientific inquiry one should view the Disaster Management Cycle not as an independent unit a whole but rather as a compilation of a multitude of parts and processes (Becker, 2009:13). To decipher these complexities scientists often look upon the entity or concept under study as a system (Boulding, 1956; Ashby, 1960; Buckley, 1968; Becker, 2009:14; Skyttner, 2005:49-108; Richardson, 2005). By applying system approaches to the study of the Disaster Management Cycle, one will be able to focus on the individual components as well as the relationship between the elements, which will contribute greatly to understanding the system as a whole (Checkland, 1999; Skyttner, 2005; Becker, 2009:4). It should be noted that it is virtually impossible to understand such systems completely but the goal still remains to obtain as holistic a

picture as possible, which in turn will enable the researcher to answer the research questions (Skyttner, 2005:100; McEntire, 2002).

For the purpose of the research, General Systems Theory has been selected as an analytical tool. As a *metatheory* within science, the General Systems Theory serves as a common language, whereby the common underlying principles of widely separated phenomena can be explained (Laszlo, 1972a: 5; Rapoport, 1986:1; Checkland, 1999:3; Skyttner, 2005:56; Ingelstam, 2002:9-28; Whitchurch and Constantine, 1993:325; Laszlo, 1972b:10). This characteristic of the General System Theory makes it ideally suited to studying a multi-faceted concept like disaster management and related concepts such as the Disaster Management Cycle (Ingelstam, 2002:9-28). The following aspects of the Disaster Management Cycle will be discussed in this chapter.

Firstly the historical development of systems thinking will be addressed. The development of key systems concepts will be discussed according to the specific scientific time period in which it was developed. The purpose of this discussion is to illustrate that systems thinking or components thereof have been used in scientific thinking in some shape or form for many millennia. The contributions made by various scientific developments have greatly contributed to what is known by system scientists as general systems theory.

The second section of this chapter will describe central concepts relating to General Systems Theory. The concepts that have been selected explain both the basic principles of general systems theory as well as provide mechanisms relevant to the analysis of the Disaster Management Cycle.

The chapter concludes by highlighting the relevance of General Systems Theory to the particular study. Special attention will be given to the

applicability of the following concepts: isomorphisms, open systems, feedback arrangements, system adaption and design/ re-design.

2.2 HISTORICAL DEVELOPMENT OF SYSTEMS THINKING

Systems science approaches the chosen field of study from the point of view of understanding humans and their environment as part of interacting systems (Skyttner, 2005:3; Von Bertalanffy, 1972:417; Whitchurch and Constantine, 1993:325). The main aim of this form of social science is to understand systems as whole entities by analysing the interaction between the various components of the system, be they people, cells, molecules or concepts (Von Bertalanffy, 1972:415). It also aims to understand the subsequent behaviours or patterns that emerge because of these interactions between the components over time (Skyttner, 2005:3; Meadows, 2008:2; Boulding, 1956:197). The views and basic assumptions of systems science as described above, as well as its basic concepts are the product of many millennia of scientific development (Skyttner, 2005:3; Haimen, 1998:13). Although much of the early scientific works did not often use the actual term "system", it did establish basic concepts that would form integral part of what is known today as systems theory (Skyttner, 2005:3; Haimen, 1998:13; Von Bertalanffy, 1972:407). With this in mind a good departure point for this chapter would be to briefly discuss the development of system science from its early roots in the classic scientific thought (4th Century B.C. -17th Century A.D.) until the emergence of the systems age in the 1950s.

2.2.1 The influence of classical thought

Some of the earliest forms of systems thinking can be traced back to a time when the scholastic paradigm was in ascendance within the world of science (4th Century B.C. -17th Century A.D.) (Weinert, 2004:22). Within this

Scholastic paradigm, the meta-physical world (such as the spiritual realm) and physical world (human world) were viewed as inseparable entities that interacted with each other on a constant basis (O' Boyle, 2006:112; Weinert, 2004:11-12; Whitchurch and Constantine, 1993:326; Bausch, 2002:417). An especially important concept within scholastic paradigm was teleology or goal seeking (Weinert, 2004:11; Von Bertalanffy, 1972:407; Whitchurch and Constantine, 1993:326). Some of the earliest examples of teleological thoughts can be found in the work of the Greek philosopher Aristotle (384-322 B.C.) on biological systematics in which he presented a metaphysical vision of hierarchic order of nature (Skyttner, 2005:49; Haimes, 1998:14; Losee, 2001:11). Aristotle's teleological thoughts on natural philosophy together with Plato's (428-348 B.C.) theory of forms represented some of the first advanced forms of systems thinking (Skyttner, 2005:49; Haimes, 1998:14; Weinert, 2004:11; Losee, 2001:11-19; Von Bertalanffy, 1972:407). In fact it is Aristotle who first stated, "*that the whole is more than the sum of its parts*", a concept, which still remains crucial to the understanding of systems today (Von Bertalanffy, 1972:407). Other scholastic paradigms that contributed to early systems thinking were the geocentric worldview put forward by Ptolemy (200 AD) and Galenos' (131-201 A.D.) classification of human beings according to their body fluids (Skyttner, 2005:6). Although these explanations of systems by their proprietors might today be considered pre-scientific, the basis that these thoughts laid for the development of systems science still remains invaluable (Skyttner, 2005:6-8; Haimes, 1998:13; Klir and Elias, 2003:6). In fact the concept of teleology as identified by early scholars, is still evident in the field of Disaster Risk Management where disasters are seen to be caused by the complex interplay and interaction between risk, hazards and societal vulnerability.

2.2.2 Renaissance paradigm

With the dawn of the Renaissance in the 16th and 17th centuries the scholastic paradigm is gradually replaced by one in which science is acknowledged as

capable of describing phenomena, as a route to knowledge (Von Bertalanffy, 1972:408; Skyttner, 2005:8; Bausch, 2002:417). The teleological explanations of which served as the norm for explaining observed regularities in the human environment for a long time, was replaced by the more scientifically calculated and observed concept known as the *Laws of Nature* (Von Bertalanffy, 1972:408; Skyttner, 2005:9; Whitchurch and Constantine, 1993:326). The geocentric worldview was also abandoned during this time for a more heliocentric theory about the earth and its place in the solar system. This was mostly due to astronomical discoveries by Copernicus (1473-1543), Bruno (1548-1600), Brahe (1546-1601), Kepler (1571-1630) and Galileo (1564-1642) (Weitner, 2004:11; Skyttner, 2005:9). These discoveries in the field of astronomy were the starting point for radical changes in human society as a whole (Weitner, 2004:11; Skyttner, 2005:11). Significantly old meta-physical explanations of certain phenomena began to be replaced by more mechanistic, scientific explanations (Weitner, 2004:11; Skyttner, 2005:10; Von Bertalanffy, 1972:408; Whitchurch and Constantine, 1993:326; Klir and Elias, 2003:6).

2.2.3 Mechanistic world and determinism

By the 18th century, the scientific worldview presented that the world and phenomena within it can be explained through the application of rational and empirical thought, was firmly established in Europe (Skyttner, 2005:12). Humans had therefore moved away from old ways of understanding natural phenomena, such as tradition and speculation, and adopted rationalism and empiricism to investigate and explain these phenomena in a scientific manner (Von Bertalanffy, 1972:408; Whitchurch and Constantine, 1993:325; Klir and Elias, 2003:6; Bausch, 2002:418). During this time the physical world was thought to be part of a machine wherein every sub-function could be calculated and events in one part of the universe have consequences for all other parts (Skyttner, 2005:12; Bausch, 2002:417). This type of thinking was a

classic form of determinism, which was the dominant doctrine during the time period (Skyttner, 2005:12-14).

Deterministic thinking was also found in some of the “systems thinking” of the time, most notably in the works of Isaac Newton (Skyttner, 2005:13; Haimes, 1998:14; Laszlo, 1972(a): 5). In fact, Newton’s four rules of reasoning philosophy, contained in *Book Three: Systems of the world (in Mathematical Treatment)* is still regarded as one of the foundations of systems thinking (Haimes, 1998:14). Another influential work to be produced in this time period was by George Hegel (1770-1831). Hegel’s *Encyclopedia of the Philosophical Science* (1817) contributed greatly to the formation of the concept of holism, which is crucial to the overall understanding of systems theory (Haimes, 1998:15, Skyttner, 2005:49; Kast and Rosenzweig, 1972:448).

2.2.4 Age of relativity and quantum mechanics

The age of determinism was effectively derailed by theories such as the relativity theory (both general and special), quantum theory and Heisenberg and Bohr’s uncertainty and complementary principle’s respectively (Skyttner, 2005:24-25; Whitchurch and Constantine, 1993:326). These theories and principles laid the foundations for what is today known as quantum mechanics (Skyttner, 2005:25). In this system of quantum mechanics, determinism was replaced with indeterminism that was less rigid in the sense that it allowed theories to be formulated to explain certain phenomena even though in essence those theories were only made up of scientific probabilities or uncertainties rather than outright facts (Skyttner, 2005:25; Whitchurch and Constantine, 1993:326; Bausch, 2002:419). In earlier times of determinism, using uncertainties as knowledge would be considered ignorance, but in the era of quantum mechanics uncertainty is seen as crucial to the body of knowledge of certain theories (Skyttner, 2005:25).

Modern Science based on quantum mechanics, has come to release that it is impossible to conclusively describe and understand the structure of the natural world (Skyttner, 2005:28). Instead quantum theory has provided man with a means to explain the function of a system as a whole by means of synthesis (Skyttner, 2005:34). Synthesis can be regarded as a prerequisite for modern systems thinking (Skyttner, 2005:34). One of the most influential works to be produced because of the application of synthesis was that of "*Gestalt Philosophy*" by German psychologists Max Wertheimer, Kurt Koffka and Wolfgang Kohler (Haimes, 1998:15). One of the most important findings of this philosophy was that the whole is more important than the sum of its parts, thereby reiterating Aristotle's earlier findings (Haimes, 1998:15; Skyttner, 2005:50; Von Bertalanffy, 1972:407).

2.2.5 The Systems Age

Systems Theory surfaced and received public support after the terrible destruction caused by the two World Wars (1914-1918,1939-1945) and "*The Great*" economic depression (1929-1940) that plagued the early 20th century (Mulej *et al*, 2003:76). The increased complexity of problems such as environmental disasters, economic collapses, traffic-system breakdowns and nuclear threat, exposed classical sciences inability to provide solutions to problems of a complex nature (Skyttner, 2005:36-37; de Zeeuw, 2006:434; Lynn and Ovsenik, 2004:48; Mulej *et al*, 2003:76). The biggest reasons for the failure of classical science to handle complex problems can be found in its inability to understand that the whole is greater then the sum of its parts (Lynn and Ovsenik, 2004:48; Von Bertalanffy, 1972:10; Mulej *et al*, 2003:76). A new approach was needed to explain social and biological phenomena, and systems theory with its holistic orientation, provided a possible solution (Skyttner, 2005:37; Laszlo, 1972:6; de Zeeuw, 2006:434; Lynn and Ovsenik,

2004:48; Kast and Rosenzweig, 1972:448, Whitchurch and Constantine, 1993:329-330; Klir and Elias, 2003:2; Mulej *et al*, 2003:76-77).

One of the first contributors to modern systems theory was Norbet Wiener. In his seminal book on “*Cybernetics*”, Wiener (1948) established concepts relevant to systems theory such as information theory, self-regulating machines and feedback control (Haimes, 1998:15; Skyttner, 2005:45; Vallee, 2003:854; Whitchurch and Constantine, 1993:332). In 1950, Ludwig von Bertalanffy first used the term General Systems Theory (Haimes, 1998:15, Von Bertalanffy, 1950:134; Von Bertalanffy, 1973:32; Kast and Rosenzweig, 1972:452; Mulej *et al*, 2003:76; Gaines and Shaw, 1984:1).

General systems theory was born as an attempt to converge in a world where the unity of science had been lost and different disciplines had drifted apart (Skyttner, 2005:38; Kast and Rosenzweig, 1972:447; Whitchurch and Constantine, 1993:327; Mulej *et al*, 2003:76). By the establishment of general systems theory it was gradually accepted that systems should be treated as wholes, and can only be fully understood by understanding the interaction of their parts (Skyttner, 2005:38; Kast and Rosenzweig, 1972:450; Von Bertalanffy, 1972:415). The influence of general systems theory was expanded in 1954 by the establishment of the “*Society for General Systems Research*” (Later changed to *International Society for System Science*) by prominent systems thinkers such as von Bertalanffy and Kenneth Boulding (Haimes, 1998:15; Skyttner, 2005:39; Von Bertalanffy, 1972:413; Whitchurch and Constantine, 1993:327; Salmon, 1978:175). The aim of this interdisciplinary scientific organisation was to link together the many splintered disciplines of science with a law of laws applicable to them all (Haimes, 1998:15; Skyttner, 2005:39; Laszlo, 1972(a): 7; Whitchurch and Constantine, 1993:328; Salmon, 1978:175; Laszlo, 1972(b): 10). The further development and enhancement of General systems theory was seen as necessary to provide just such a law of laws.

2.3 CENTRAL CONCEPTS OF GENERAL SYSTEMS THEORY

The unity of science (as mentioned above) was lost mostly due to the increasing levels of specialisation required by each individual discipline. Therefore a situation had occurred where basic scientific disciplines like physics, biology, psychology and sociology functioned completely independent from each other, encapsulated in their own separate universes with no manner of knowledge exchange occurring between the fields (von Bertalanffy, 1973:30). Yet during this period of mutual independence of scientific disciplines, parallel cognitive principles started to emerge within the different branches of science (Von Bertalanffy, 1973:31). This tendency was observed by the originator of the term of General Systems Theory. Von Bertalanffy came to the conclusion that *"there exist models, principles and laws that apply to generalised systems or their subclasses, irrespective of their particular kind, nature of their component elements, and the relations or forces between them"*. From the above observation, von Bertalanffy coined the phrase "General System Theory" (Von Bertalanffy, 1950:134; Von Bertalanffy, 1973:32; Vallee, 2003:853; Whitchurch and Constantine, 1993:326). At the heart of this new theory was the objective to discover the formulations, derivations and principles that are valid to systems in general, irrespective of whether they are of physical, biological or sociological nature (von Bertalanffy, 1973:33; Salmon, 1978:175). Some of the central concepts of General Systems Theory will now be discussed in greater detail.

2.3.1 Isomorphism and general system properties

In his seminal work on general systems theory Ludwig von Bertalanffy observed that on general level, similar fundamental conceptions of "holism" appear to present in all branches of science at time (Von Bertalanffy,

1950:136). In other words many scientific disciplines, irrespective of whether the object of their study is represented by inanimate objects, living organisms or social phenomena, recognised the need to look at phenomena as a whole and not merely as the sum of its parts (Von Bertalanffy, 1950:136). It is from this basis that Von Bertalanffy discusses isomorphisms.

Von Bertalanffy postulates that not only do different scientific fields share certain general viewpoints and aspects but they also share formally identical or isomorphic laws (Von Bertalanffy, 1950:136; von Bertalanffy, 1973:33; Laszlo, 1972(a): 6, Davidson, 1983; Whitchurch and Constantine, 1993:328; Klir and Elias, 2003:3). Skyttner (2005:39) elaborates on the concept of isomorphic laws by describing them as *“formally identical laws governing the functioning of materially different phenomena”*. Thus on a basic theoretical level isomorphisms relate to the description of those laws within different systems (or fields of study), that share common or similar traits in explaining phenomena being studied.

Von Bertalanffy illustrates the presence of isomorphic laws through various examples, one of which focuses on the presence of exponential laws of growth within different scientific fields such as physics, biology and research (Von Bertalanffy, 1950:136; Von Bertalanffy, 1973:33). Von Bertalanffy observes that although the entities (in this case bacteria, animals, humans and books) and causal mechanisms being studied by their respective scientific fields may differ completely from each other, the mathematical law that guides the functioning of growth patterns within each of these fields remains the same (Von Bertalanffy, 1950:136). Von Bertalanffy puts this correspondence down to the fact that as systems, the entities involved are in a state of constant interaction with each other (Von Bertalanffy, 1973:33). This constant interaction leads to the similarities in general and sometimes even special laws within different scientific fields (Von Bertalanffy, 1973:33).

It is the presence of isomorphism in widely differing fields, which proves that a general system law could exist. Such a law could be applied to any system irrespective of the particular properties of the system and the elements involved (von Bertalanffy, 1973:37; Von Bertalanffy, 1972:415). The concept of isomorphism forms one of the basic building blocks on which general systems theory was founded and provides one with the opportunity to consider diverse fields of science as part of organised wholes (Von Bertalanffy, 1973:37; 38; Whitchurch and Constantine, 1993:328).

2.3.2 Open systems and general systems theory

Traditional physics, as practiced from a mechanistic point of view has the innate characteristic of only focusing on *closed systems* (von Bertalanffy, 1973:39; Whitchurch and Constantine, 1993:333). For example physical chemistry tells us about chemical reactions, their rates, and the chemical equilibrium eventually established in a closed vessel where a number of reactions takes place (von Bertalanffy, 1973:39). Yet one finds other types of systems that by their very nature and definition are not closed systems (von Bertalanffy, 1973:39). Open systems are systems that try to achieve what is called a “*steady state*” through maintaining themselves in a continuous inflow and outflow and building up and breaking up of components (von Bertalanffy, 1973:39; Boardman and Sauser, 2008:31; Kast and Rosenzweig, 1972:450; Whitchurch and Constantine, 1993:333). This continuous inflow and outflow and building up and breaking up of components can also be seen with the development of the Disaster Management Cycle. In this regard components of the cycle have been continuously changed or in some cases removed due to changes in inflow and outflow of information.

Open systems can be said to be the traditional terrain in which general system theory functions and therefore, a clear understanding of the concept of

Open Systems is crucial to the understanding of systems theory (von Bertalanffy, 1973:39-40; Von Bertalanffy, 1972:412).

A key principle related to the understanding of open systems is that of *equifinality* (Von Bertalanffy, 1950:40; Whitchurch and Constantine, 1993:333). Equifinality is based on the basic assumption that within an open system the same final state can be reached from different initial conditions and in different ways (Von Bertalanffy, 1950:40; Kast and Rosenzweig, 1972:450; Whitchurch and Constantine, 1993:333). This state of equifinality is impossible to achieve within a **closed system** because the final state is unequivocally determined by the initial condition, thus for example in a chemistry experiment, the final concentrations of the reactants naturally depend on the initial concentrations (Von Bertalanffy, 1950:40)

As stated earlier in this section, open systems try to achieve a “*steady state*” through maintaining themselves in a continuous inflow and outflow of information (Von Bertalanffy, 1973:39; Boardman and Sauser, 2008:31; Kast and Rosenzweig, 1972:450). Without this continued information inflow and outflow an open system would cease to exist. Therefore a mechanism is required to ensure that a “*steady state*” is achieved. In open systems this maintenance mechanism is provided by feedback arrangements within the system (Kast and Rosenzweig, 1972:450). Feedback arrangement will be discussed in greater detail in the following section.

2.3.3 Feedback arrangements and its importance to general systems theory

Another development that has a bearing on systems theory is that of the communication and control theory (Von Bertalanffy, 1973:41-42). Especially relevant is the concept of *feedback*.

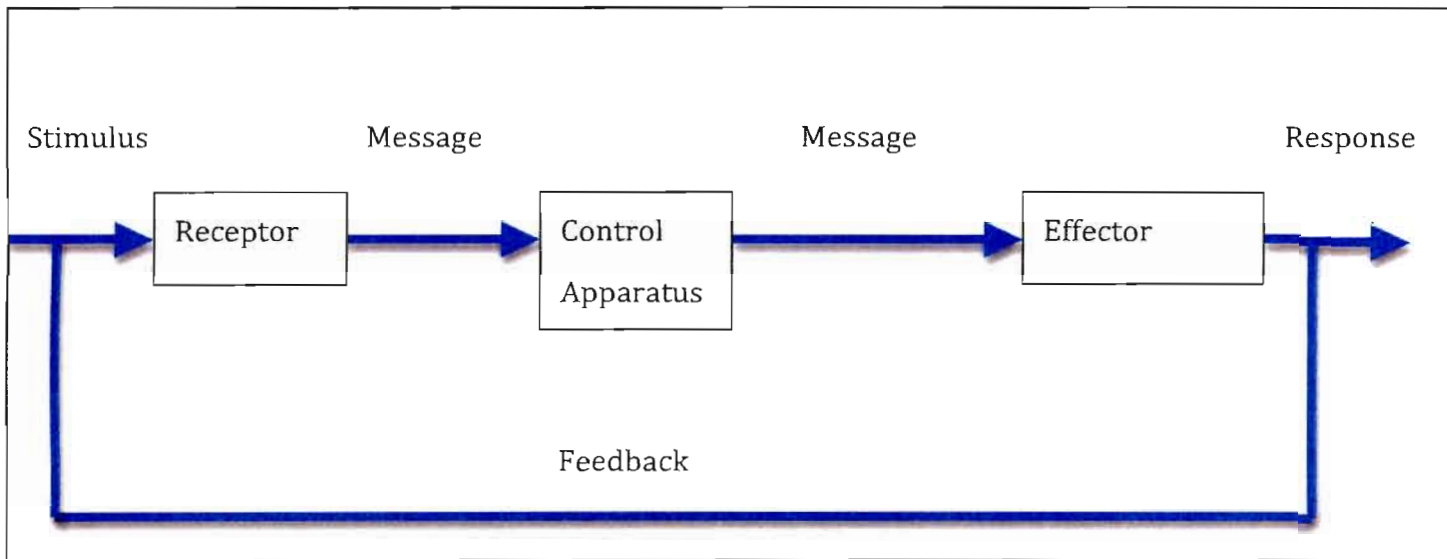


Figure 2.1: Simple Feedback arrangement (adapted from Von Bertalanffy, 1973:43)

Figure 2.1 illustrates the first basic explanation of feedback. In this specific instance, the feedback arrangement described comprises of a receptor, a message, a control apparatus, an effector and a feedback loop (Von Bertalanffy, 1973:42). Within this specific feedback arrangement, inputs (stimuli) into the system are conveyed via a receptor and control apparatus to an effector. In reaction to the input received, the effector produces a certain response (output). In turn the response (output) from the effector is monitored back to the receptor via a feedback loop that allows the system to self regulate and direct its actions (Von Bertalanffy, 1973:43; Whitchurch and Constantine, 1993:334). The application of feedback arrangement is especially useful when trying to correct deviations from a system's goal because deviations are continuously fed back until the goal or target is reached (Von Bertalanffy, 1973:43).

Since the basic conception of the feedback arrangement (*Figure 2.1*) 60 years ago, many variations of the concept have emerged. The extrinsic feedback model proposed in Figure 2.2 proves a useful analytical tool when describing the impact of interaction between an "individual" and it's environment. This was first discussed by one of the founders of general systems theory,

Kenneth Boulding (Boulding, 1956: 201; Skyttner, 2005:87). This specific variation of the original feedback model aims to explain the process whereby outputs from a system cross the system boundary and become modified through their interaction with the environment before re-entering the system (Skyttner, 2005:87). This extrinsic feedback model links to the general systems concepts proposed by Boulding, that all discipline have some form of individual, (such as atoms in physics and cells in biology) and that these individuals exhibit behaviour, action or change related to the environment to which it is exposed (Boulding, 1956: 201; Whitchurch and Constantine, 1993:333)

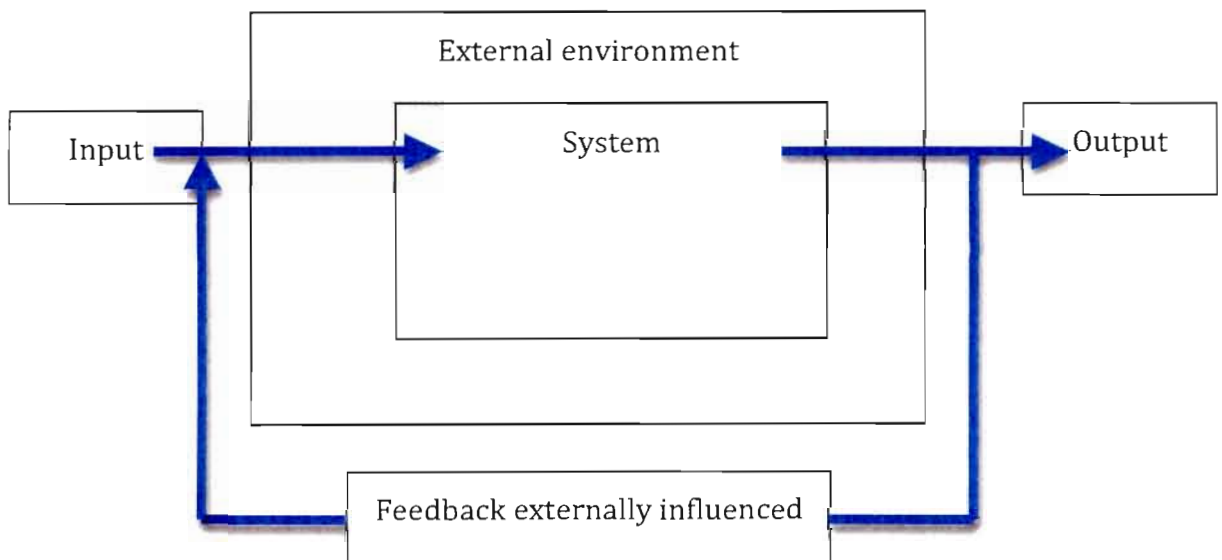


Figure 2.2: Extrinsic feedback (adapted from Skyttner, 2005:88)

2.3.4 Teleology and its importance to general systems thinking

The concept of teleology forms yet another crucial aspect for the understanding of general systems. Before the introduction of modern scientific method, discussions on teleology were considered taboo by classical science

because it did not adhere to the laws of causality that governed science at that time (Von Bertalanffy, 1973:45; Von Bertalanffy, 1972:415). Yet in modern science, the classical scientific practice of isolating units and explaining their one-way causation has been found to be insufficient (von Bertalanffy, 1973:45; Laszlo, 1972:4; Von Bertalanffy, 1972:410). Due to classical science's inability to explain certain phenomena, modern science allows notions such as teleology to be taken into account. Teleology is based on the premise that it is impossible to understand nature or human society in full without taking into account its adaptive, purposeful and goal-seeking nature (Von Bertalanffy, 1973:45; Von Bertalanffy, 1972:407). This type of thinking is therefore crucial to understanding systems in a holistic manner, as proposed by general systems theory (Von Bertalanffy, 1973:37; Klir and Elias, 2003:6).

Teleological thinking can be attained in several ways, 2 of which have been discussed in previous sections that dealt with open systems and *equifinality* as well as the section on *feedback arrangement*. The third and final model for stimulating teleological views on systems was proposed by Ashby (1957).

This model relates to the adaptive nature of systems (Von Bertalanffy, 1973:46). Although system adaptiveness will not form a crucial part in the analysis of the Disaster Management Cycles contained in this particular thesis, it does provide yet another tool whereby which the teleological or goal-orientated nature of the Cycle can be illustrated in future studies.

In the proposed model system, adaptiveness is explained by *step functions*. These step functions are reformulated into a different set of differential equations after a certain critical value is passed. Thus, by means of step functions, the system shows adaptive behaviour (Ashby, 1957; Von Bertalanffy, 1973:46). Put in simpler terms, Ashby 's work indicates that systems adapt themselves to their environment through trial and error. Through trial and error, a system tries different ways and means and

eventually settles down in a field where it no longer comes into conflict with critical values of the environment (Von Bertalanffy, 1973:46). Illustrating the adaptiveness of a system can prove particularly useful if it is used to point out which trial and error-processes were applied by various disciplines such as development studies and engineering to adapt the Disaster Management Cycle to suit their specific needs and purposes.

Apart from describing how teleological thinking is promoted by systems theory, *equifinality*, *feedback arrangement* and *adaptiveness*, also help to illustrate how systems are designed and redesigned on a constant basis. The next section will focus in more detail on the concept behind system design and redesign.

2.3.5 Design and Redesign concepts

Concepts associated with general system theory like *design and redesign* also provide possible avenues of exploration whereby a greater understanding of systems and system changes can be attained.

Design and redesign is based on the conviction that humans can be the creator or manager of their reality and not merely passive victims of it (Skyttner, 2005:43). Since the future has become too complex to be foretold or planned, humans have to create a future (Skyttner, 2005:43). Through the application of *design and redesign* concepts humans can take pragmatic steps towards creating new or improved systems, which improve the world they live in (Skyttner, 2005:43). System design or system synthesis is the formal process where human resources, artifacts, techniques, information and work procedures are integrated into a system in order to facilitate its performance (Skyttner, 2005: 43-44; Mulej *et al*, 2003:76).

The aspects discussed in the above section can by no means be considered as an exhaustive discussion on general systems theory because many new principles and associated theories have been linked to the theories basic *corpus* of knowledge since its establishment in the 1950s. Yet those aspects that have been addressed reveal greater details about the core aspects of General Systems Theory. This has particular relevance to the Disaster Management Cycle. The following section will elaborate on the relevance of the general systems concepts already discussed to the study.

2.4 RELEVANCE OF GENERAL SYSTEMS THEORY TO THE STUDY

On a basic level, general systems theory aims to formulate generalised system theories including theories of system dynamics, goal-oriented behaviour, historical development, hierarchical structure, and control process (Skyttner, 2005:40). Due to the nature of this particular study, the general systems theory is thus ideally suited to provide a greater insight into the development of the Disaster Management Cycle.

The Disaster Management Cycle has through its history been influenced by many fields such as sociology, geography, psychology, civil defence, public administration and development studies (Quarantelli, 1986:11; Tierney, 1998:2; Quarantelli, 1997:2). The cross-cutting nature of the Systems Theory provides will allow for the classification of general system properties in various fields mentioned above through the identification of isomorphisms (Von Bertalanffy, 1973:33; Skyttner, 2005:40). By identifying the isomorphisms contained within these various fields, it will be possible to explore the possible influence that the central concepts could have had on the development of the Disaster Management Cycle.

The concept of the Disaster Management Cycle can be regarded as an open system. The main reason for this being that if one was to look at the history of the concept (*in chapter 3 and 4*), one will quickly observe that throughout its history it has been characterised by an inflow and outflow of information as well as building up and breaking down of components, a point reinforced by the presence of so many variants of the Disaster Management Cycle today. As a consequence of being an open system, the concept of *equifinality* will also be applicable to the discussion of the disaster management cycle. This concept could prove especially useful in explaining why different organisations, with varying theoretical orientations have formulated disaster management cycles that are especially adapted to their specific needs.

The concept of feedback arrangements also provides useful analytical tools for describing the origins of the Disaster Management Cycles. Of these, the concept of extrinsic feedback (*illustrated in figure 2.2*) is particularly relevant to the study because it provides a mechanism whereby one can illustrate the influence of the external environment on a system, such as the Disaster Management Cycle. In other words, this mechanism allows one to illustrate how external factors contributed to the initial creation of the cycle as well as how external factors contributed to later adaptations of cycles.

At the core of the concept of Design and redesign is the pragmatic view that humans can take control of an ever changing and complex future by designing, or re-designing, systems in order to ensure an improved and safer world for humanity (Skytner, 2005:43). The presence of features of design and re-design could shed light on how, and why, the Disaster Management Cycle was first developed as well as on the various changes that have occurred within the cycle.

2.5 CONCLUSION

The views and basic assumptions of systems science as well as its basic concepts are the product of many millennia of scientific development. In this regard early studies conducted by Aristotle and Plato during the Classical age, Copernicus and Galileo during the Renaissance, Newton and Hegel during the Mechanistic age and Wertheimer, Koffka and Kohler during the age of Quantum Mechanics played a crucial role in establishing system concepts such as teleology and holism. Yet all though these basic concepts had been around for many millennia, the need for a formalised systems approach to address ever increasing and complex problems such as wars, environmental disasters and economic collapses, only emerged during the mid 20th century. One of the systems approaches that emerged during this period was General Systems Theory. This General Systems theory accepted that systems should be treated as wholes and can only be fully understood by understanding the interaction of their parts. As such by the application of general systems theory it was hoped that a better understanding of and possible solutions to the complex problems humanity faces in modern times could be produced.

General Systems Theory comprises of various concepts such as isomorphisms, open systems, feedback arrangements, equifinality and design and re-design. These central concepts are particularly useful tools due to the fact that they help to focus on the individual components as well as the relationship between components that form part of the Disaster Management Cycle concept as a whole. As a consequence of the holistic vision provided by these concepts the complex origins and developments that have occurred with regards to the Disaster Management Cycle can be deciphered.

Each of the central concepts related to General System Theory have certain specific advantages that would help to answer the research questions posed in this study. In this regard the concept of isomorphisms, provides a tool whereby, it will be possible to explore if common or similar traits exist between early linear disaster phase research and Disaster Management Cycles. If similar traits can be identified, it can be postulated that the Disaster Management Cycle developed from linear phase models.

In the case of the concepts of open systems and equifinality it will be possible to analyse the various information inflows and outflows that have over time lead to the building up and breaking down of components that comprise both linear disaster phases as well as Disaster Management Cycles. As a consequence it will be possible to explaining why different organisation, with varying theoretical orientations have formulated Disaster Management Cycles that are especially adapted to their specific needs.

The concept of feedback arrangements also provides useful analytical tools for describing the origins of the Disaster Management Cycles. Of these, the concept of extrinsic feedback (*illustrated in figure 2.2*) is particularly relevant to the study because it will provide a mechanism whereby one can illustrate the influence of the external environment on a system, such as the Disaster Management Cycle. In other words, this mechanism will allow one to illustrate how external factors contributed to the initial creation of the cycle as well as how external factors contributed to later adaptations of cycles.

It should be clear that by applying the General System Theory approach and its related concept to the study of the Disaster Management Cycle, it would be possible to provide answers relating to both the origin as well as development of the Disaster Management Cycle.

This chapter has firmly established the core aspects relating to General System Theory, which will serve as the main analysis tool within the study.

Chapter 3 will elaborate on other aspects relating to the methodology that was adopted in the process of exploring the origins and development of the Disaster Management Cycle. In this regard issues relating to the qualitative research process, data collection method, reliability and validity and ethical research will be discussed.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The following section will describe various aspects of the methodology that was adopted in the process of exploring the origins and development of the Disaster Management Cycle (DMC).

Firstly, the qualitative research method used in the research study will be discussed. The applicability of the qualitative research method in the context of the specific study will also be addressed by focusing on issues relating to the role of participant and researcher perspectives, contextualism, process and research flexibility.

The second issue to be addressed in this chapter relates to General System Theory as an analyses tool for the research study. The section reinforces the use of General System Theory as analytical tool and gives a brief overview of how central concepts were applied to the analysis of the literature review conducted in chapter 5.

The data collection method used in the research study will also be discussed. In this regard describing the acquisition and use of secondary data sources during the literature review process receives prominent attention.

Failure to address reliability and validity issues can result in project findings being worthless and inaccurate. Therefore, the process of proofing the reliability and validity of the research study will be discussed in section 3.5.

The chapter closes with a description of the ethical consideration that influenced the study.

3.2 QUALITATIVE RESEARCH DESIGN

Qualitative research does not describe a single research method, as there are many research methods associated with qualitative research (Struwig and Stead, 2001:11; Pugsley and Welland, 2002:1). Even though quantitative and qualitative research methods sometimes intertwine, it is still possible to distinguish qualitative research methods from quantitative research methods. The greatest differences between these two paradigms can be found in the research methods that are used, which include participant observation, archival source analysis, interviews and content analysis, as well as the type of soft data the aforementioned methods are applied to (Bless and Higson-Smith, 1995:100; Neuman, 2006:151; Wisker, 2001:164; Blaikie, 2000:243). The soft data qualitative research methods include impressions, words, sentences, photos and symbols and can be discerned from hard data in that it is not quantifiable and often more applicable to understanding complex social contexts (Bless *et al*, 2006:44-45; Neuman, 2006:151; Blaikie, 2000:243). As various applications, methods, and types of data are involved in qualitative research, it is often described as interdisciplinary, multi-paradigmatic and multi-methodological, which makes it ideally suited to studying the complex history of the Disaster Management Cycle (Struwig and Stead, 2001:11).

Due to its complex nature, it is necessary to reflect and describe how qualitative methods were applied in the study of the origins and development of the Disaster Management Cycle. Therefore, the following sections will focus on describing the applicability of certain key aspects related to the

qualitative research method, as well as how they were applied in the specific study.

3.2.1 Applicability of Qualitative Research Method

Some forms of information cannot be expressed and analysed by means of quantification, as is the case in quantitative studies (Bless *et al*, 2006:44-45; Willis, 2007:6; Blaikie, 2000:243). Such a case is presented by the information gathered for the study of the origins and development of the Disaster Management Cycle where the quantification of the data gathered will not lead to a clearer understanding of the origins and development of the cycle concept. Therefore, a qualitative approach was followed to ensure that a holistic picture of the origins and development of the Disaster Management Cycle was attained. The applicability of the qualitative research method in the context of the specific study will be discussed by focusing on issues relating to the role of the participant and researcher perspectives, contextualism, process and research flexibility.

3.2.2 Participant and researcher perspectives

Qualitative research intends to understand the research phenomena from the perspective of the research respondents (Bless and Higson-Smith, 1995:100). This is achieved by gathering information directly from research respondents. The information gathered from these respondents provides in-depth information, which can contribute to a holistic and clearer understanding of the issue being studied (Bless and Higson-Smith, 1995:100; Neuman, 2006:152; Strydom, 2005:275). Even though an issue, which is investigated from the respondents' point of view can provide in-depth information, steps should be taken to avoid that a study become an anecdotal report with no in-depth

analysis or commentary on the expressed views (Struwig and Stead, 2001:12).

Great attempts were taken in this study to gather information on the views of different respondents. Information on the views of the different respondents were gathered from various sources such as the review of literature from academic, government and NGO sources. These were complemented with data gathered from interviews with DMC specialists in the academia as well as in practice. The views that were gathered was then analysed by means of the General Systems Theory (GST) (see chapter 5), thereby avoiding the chance of the study becoming an anecdotal report.

3.2.3 Contextualism

All human behaviour occurs in a certain context and often the behaviours of individuals or the concepts they create are inextricably linked to the environments in which they are situated (Wisker, 2001:164; Neuman, 2006:158; Willis, 2007:159). Due to the constant interaction between humans and their environment, it is necessary to provide a comprehensive description and analysis of the environment or social context of the research respondent (Neuman, 2006:158; De Vos, 2005:346). In this regard then, contextualism emphasises various macro and micro contexts of the individual and how these context dramatically interact with one another (Struwig and Stead, 2001:12; Neuman, 2006:158). Contextualism is closely aligned to holism, which examines social environments in their totality (Struwig and Stead, 2001:12).

Throughout the study contextualism plays a major role. Being such a complex concept, influenced by many fields of study and policy changes, the Disaster Management Cycle cannot be understood without understanding both the environment in which it has functioned as well as the historical development

of key concepts associated with it. Thus, for the purpose of understanding the whole, and not just parts of the concept of the Disaster Management Cycle, General Systems Theory (as discussed in chapter 2) has been selected as a research tool. The concepts of feedback arrangements within the General Systems Theory is particularly relevant to illuminating issues of context by illustrating how the concept of the DMC interacts with its external environment, and how the environment in turn effects the DMC.

3.2.4 Process

Social events are not static, in fact they are dynamic events characterised by continual change (Neuman, 2006:159). Understanding changes and process involved in these changes is critically important in any social research (Struwig and Stead, 2001:12). The qualitative research method provides an ideal mechanism, in the form of process research, whereby it is possible to understand how prior events play a role in the individual's thoughts or behaviour (Struwig and Stead, 2001:12; Neuman, 2006:159). Process research examines interrelated events along a temporal or developmental continuum (Struwig and Stead, 2001:12; Neuman, 2006:159).

The concept of process as in qualitative research is not only perfectly suited to thesis study but also forms a crucial part of the study. For instance, great attempts were made to understand the development of certain key concepts related to the Disaster Management Cycle from the early 1920's to the early 1970's when the cycle first appeared. It is the opinion of the researcher that these earlier conceptual developments were the precursor to later terms and processes used in the Disaster Management Cycle. The exploration of the possible relations between earlier conceptual developments and later terms and processes used in the Disaster Management Cycle, shows how earlier research influenced later thinking and application of the Disaster Management Cycle.

3.2.5 Flexibility and the use of theories

As opposed to quantitative research methods, the qualitative research method often begins in a relatively open and unstructured manner, with a reluctance to follow a step by a step theoretical research framework of what to investigate (Fouche, 2005:269; Struwig and Stead, 2001:13). By following this unstructured approach, qualitative studies are more flexible and sensitive to unexpected events and place less emphasis on theory, which in turn may influence the understanding and interpretation of events (Neuman, 2006:157-158; Fouche, 2005:268-269; Struwig and Stead, 2001:13).

In this thesis study, flexibility is provided by the General Systems Theory, which serves as analysis tool within the study. The main reason for selecting General Systems Theory as analysis tool was that it takes into account the environment and its effect on the central concept, which is the Disaster Management Cycle. The holistic vision of the General System Theory gives a point of departure whereby one can identify a vast amount of factors that have influenced the Disaster Management Cycle concept over the past 80 years. Consequently, it is not too rigid in saying that only one or two concepts or events have influenced the Disaster Management Cycle, but it is open to illustrate that several factors and combinations thereof could have influenced the development of the Disaster Management Cycle.

3.3 GENERAL SYSTEMS THEORY AS ANALYSIS TOOL

Through history, many disciplines like sociology, geography, psychology, civil defence, public administration and development studies have influenced the Disaster Management Cycle (Quarantelli, 1986:11; Tierney, 1998:2;

Quarantelli, 1997:2). The various inputs from these diverse disciplines have made the Disaster Management Cycle a complex system, which just like disaster events themselves, are often difficult to comprehend and explain (Cebulla, 2004:87). In order to better understand the complexities associated with the origins of the Disaster Management Cycle, General Systems Theory was selected as a suitable analytical tool.

Chapter 2 addressed various aspects relating to the General Systems Theory, including issues relating to the origins of this theory. Important key concepts of the General System Theory, such as isomorphisms, open systems, equifinality and feedback arrangements were delineated and subsequently utilised in the analysis (see chapter 5) of the information gathered in the literature review conducted in Chapter 4.

3.4 DATA COLLECTION METHODS

The collected research data can be classified into two broad categories. These two categories include data, which is collected from primary data sources and those data collected from secondary data sources (Struwig and Stead, 2001:80; Bless *et al*, 2006:112). Primary data consist of original written material of the author's own experience and observations, while secondary data sources are available data from sources other than the current research project (Bless *et al*, 2006:112; Struwig and Stead, 2001:80; Neuman, 2006:44; Hakim, 2000:24). The data collection method, for the most part, comprised of an in-depth review of literature in which secondary data sources are used as the main sources of information. The following section will discuss the use of secondary data sources in the research in greater detail.

3.4.1 Secondary data collection methods

According to Struwig and Stead (2001:81), secondary data can be classified into three broad categories, namely raw data already collected, summaries of numbers, and written treatises (e.g. books, articles and thesis). Of these three identified categories, written treatises was utilised in the study. The main reason for using written treatises can be ascribed to the review of the historical nature of the phenomena (May, 1998:157). To gain a holistic picture of the history of the Disaster Management Cycle, some secondary data sources had to be consulted that were written before the 1970s, most notably the works of Prince (1920), Carr (1932) and Powell (1954).

Secondary literature sources were collected from a wide range of resources such as personal communication with leading figures in DMC research via email; official documents in the form of annual reports of organisations like FEMA, UNDP, and the Asian Development Bank; mass media sources such as accredited journals and archival material from specialist research centres around the world (Marshall and Rossman, 2006:107-108; May, 1998:159). These information sources were consulted as they could provide a holistic body of knowledge relating to the origin and history of the Disaster Management Cycle.

The literary sources consulted in the study also comprised of a combination of introductory and advanced text relating to subjects such as General System Theory, linear disaster phases and Disaster Management Cycles (Struwig and Stead, 2001:81). Both introductory and advanced sources that were consulted comprised of a mix of older documents, some of which originated as far back as the 1920s and newer documents that were produced as recently as 2007. This mixture of old and new documents was mostly used due to the historical and comparative nature of the research. Both types of introductory research sources, old and new, proved useful in providing sufficient knowledge on the

origins and development of the Disaster Management Cycle, and therefore provided a platform from which the research questions relating to the subject could be addressed.

Great care was taken to consult relevant content and chapters in each of the literary resources used for this research. Many techniques were applied to reduce the time consumed by the intense literature review, some of which include the reading of chapters relating to findings and/or recommendations and the consultation of text indexes (Struwig and Stead, 2001:81).

Research notes were compiled with the aim to synthesize the main ideas of the researcher into understandable formats, to identify unusual or exceptional formulations of the problem or solution proposed by the researcher relating to the Disaster Management Cycle (Struwig and Stead, 2001:81; Neuman, 2006:464). The notes made during the study served as a foundation on which many of the arguments in the study were built and founded.

Secondary data was also collected by consultation Internet sources. Firstly, email interviews were conducted with learned scholars specialising in matters relating to the Disaster Management Cycle and the origins thereof. These learned scholars were approached because of the informed opinions that they could convey with regards to the subject matter of the thesis. Web pages of organisations specialising in the field of disaster management was also consulted, in this regard the websites of the UN/ISDR, Prevention Consortium, and the University of Colorado: Natural Hazard Centre provided excellent links to materials that could be applied in the study. Academic subject directories were also widely used during the study. These academic directories such as EBSCO-host, JSTOR and Hazlit hazard library provided relevant information by linking the researcher to Internet resources and articles that addresses the subject matter of the thesis.

A crucial necessity of any study is to report whether the instruments used in the study are reliable and whether the research design is valid (Bless and Higson-Smith, 1995:129-139; Neuman, 2006:188; Fouche, 2005:118, Bless *et al*, 2006:150). In this regard issues relating to reliability and validity should be discussed.

3.5 MEASURES TO ENSURE RELIABILITY AND VALIDITY WITHIN STUDY

Reliability relates to whether a particular technique, applied repeatedly to the same object, would yield the same result each time under comparable conditions (Neuman, 2006:196; Bless and Higson-Smith, 1995:130; Bless *et al*, 2005:150). Validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration (Bless *et al*, 2005:156; Neuman, 2006:196; Struwig and Stead, 2001:143). Failure to address reliability and validity issues can result in project findings being worthless and inaccurate. The issue of reliability will be discussed first, followed by a discussion on validity.

3.5.1 Reliability in research study

As is the case with quantitative studies, qualitative researchers want to be consistent in how observations are made over time (Neuman, 2006:196). In spite of this desire to produce consistent results, qualitative studies, such as the review of the origins and development of the Disaster Management Cycle, face the problem of producing constant results from concepts which often do not remain stable or are in a process of constant change (Neuman, 2006:196; May, 1998:68). The nature of this particular study's literature review further

complicated the process of producing constant and reliable results. According to Strydom and Delport (2005:314), authors of documents often harbor ulterior motives such as money and prestige, which in turn influences the quality and reliability of the work they conduct. Furthermore there is often a time lag between the occurrence of the event and the writing of a document. This delay might lead to lapses of memory or inaccuracies (Bailey, 1994:317). To overcome issues relating to reliability of literary sources, the following steps were followed within this research project.

Firstly, to ensure reliability of the literary sources, sources were compared with external data in the form of interviews conducted with knowledgeable experts within the field of disaster studies as well as General System Theory (Babbie and Mouton, 2001:285-286). Many of the experts that were interviewed have also been working in the field of disaster studies for decades, and could therefore indicate which sources could be most relevant towards the completion of the study.

According to Bailey (1994:318), the reliability of documents can be checked either by means of instrument reliability or by analyst reliability. Instrument reliability relates to comparing similar documents at two or more points in time. Analyst reliability relates to comparing the results of two or more researchers at the same points in time (Bailey, 1994:318). With regards to this research project, instrument reliability was used to a greater extent than analyst reliability. Documents from different time periods were used not only to track the development of crucial components of the Disaster Management Cycle, but also to reveal which sources are consistently referred to as crucial documents for the understanding of key concepts. One example of such a document is the work by Prince (1920) on the societal response to the explosion in Halifax harbor, where authors constantly referred back to the specific source as the pioneering work from which the entire disaster research tradition evolved (Dynes & Quarantelli, 1992:1; Chapman, 1962:4).

3.5.2 Validity in Qualitative Research

Validity can be defined as the degree to which one can rely that the concept, methods, and inferences of the study, or tradition of inquiry form the basis for theorising and empirical research (Neuman, 2006:196; Bless and Higson-Smith, 1995:135; Rees, 2002:84). The validity of a qualitative study is often more difficult to prove than that of quantitative study, mostly because there are no widely accepted guidelines for testing validity in qualitative research (Struwig and Stead, 2001:18). Yet some methods such as triangulation exist whereby the validity of a study can be proved. In this study, validity of data sources was ensured through triangulation of the sources.

3.6 ETHICAL CONSIDERATIONS OF STUDY

Conducting social research is an ethical enterprise and research ethics provide researchers with a code of moral guidelines on how to conduct research in a morally acceptable way (Bless et al, 2006:140; Struwig and Stead, 2001:67; Wisker, 2001:168; Willis, 2007:311-316). Ethical guidelines have therefore been established to prevent researchers from engaging in scientific misconduct such as distorting and inventing data, plagiarising the work of others and republishing their data as original contribution without proper acknowledgement (Wisker, 2001:168; Bless and Higson-Smith, 1995:102; Neuman, 2006:129). The researcher took great care in ensuring that the research conduct was ethical at all times and achieved informed consent during the course of data collecting.

3.7 CONCLUSION

It has been illustrated that some forms of information exist, that cannot be expressed and analysed by means of quantification, as is the case in quantitative studies (Bless *et al*, 2006:44-45; Willis, 2007:6; Blaikie, 2000:243). Such a case is presented by the information gathered for the study of the origins and development of the Disaster Management Cycle where the quantification of the data gathered would not lead to a clearer understanding of the origins and development of the cycle concept. Therefore a qualitative approach was followed to ensure that a holistic picture of the origins and development of the Disaster Management Cycle was attained.

Within this qualitative study the review of literature from academic, government and NGO source served as the primary source for data collection, which was then complimented with data gathered from interviews with disaster management cycle specialists in the academia as well as in practice. These two sources of data were consulted in order to gain a holistic picture of the history of the Disaster Management Cycle. The collected data was then analysed by means of general systems theory concepts such as isomorphism, open system, equifinality and feedback arrangements in order to better understand the complexities associated with the origins of the Disaster Management Cycle.

It has also been established that the research study has produced both reliable and valid results. Reliability within the study was ensured through instrument reliability. In this regard source were highlighted which were continuously referred to as crucial documents. With regards to the validity of the data sources collected, validity was ensured through the triangulation of data sources.

It has also been affirmed that the research was conducted in ethical manner during all phases of the research process.

CHAPTER 4

THE HISTORICAL DEVELOPMENT OF THE DISASTER MANAGEMENT CYCLE

4.1 INTRODUCTION

The Disaster Management Cycle has been a crucial instrument for the management of disaster events and their affects for at least 30 years (Neal, 1997:260; Baird *et al*, 1975:42; Kelman, 2009; Lewis, 2007). Yet, many scholars and practitioners within the field still debate its origins, leading to much confusion within the field of disaster management research. It is the aim of this chapter to clear up some of the confusion surrounding the origins of the cycle by addressing some relevant subjects relating to it.

The first of these subjects relates to the possible role of early disaster phase research by sociologists like Prince (1920), Carr (1932) and Powell (1954) in the formation of concepts like response, mitigation and preparedness, which is currently used in the Disaster Management Cycle. Just as the case with Disaster Management Cycles, these sociologists created phase models in order to assign order and rationality to the complex reality of natural and technological disasters, and human responses to them (Richardson, 2005:27). The works of the authors, and that of others will be discussed in the section on **early disaster phase research** (figure 4.2).

Some confusion surrounding the Disaster Management Cycle has also arisen because of the differing formats in which it is often illustrated. From its inception as a tool for the management of disaster events in the early 1970s,

various countries and organisations adapted the Disaster Management Cycle to suite their individual needs (Carter, 1991:59). To illustrate the various adaptations that have occurred, the section on **the varied applications of the Disaster Management Cycle** (figure 4.3) will examine some examples of Disaster Management Cycles ascribed to by some NGOs, international organisations, academic institutions and individual states around the globe.

4.2 EARLY DISASTER PHASE RESEARCH

The origins of the disaster management phases can be traced back to early research on human behaviour following disaster events (Chapman, 1962:4; Quarantelli, 1986:14; Dombrowsky, 1981:2; Tierney, 1995:2). Much of this early research was based in the field of Sociology although some studies into phases of disaster was also conducted within the fields of Geography, Anthropology and Psychology (Quarantelli, 1986:11; Quarantelli, 1994:25;31;32). The studies based in the field of Sociology were the most prominent during the early years of disaster phase research and also received most of the funding assigned to the research field following the end of World War II (Quarantelli, 1986:11; Tierney, 1998:2; Quarantelli, 1997:2). Military institutions provided most of the early funding for research into disaster phases and therefore lead to a greater focus on the emergency response phase of disasters (Quarantelli, 1986:11; Chapman, 1962:4; Dombrowsky, 1981:2; Tierney, 1998:2; Quarantelli, 1994:1). Therefore, the theoretical grounding of disaster phase research compared favourably with the practical orientation of disaster management at the time, which was greatly orientated towards reaction to disasters, rather than prevention and recovery (Quarantelli, 1986:11).

Phase models were developed to assign order and rationality to the complex reality of natural and technological disasters, and human responses to them (Richardson, 2005:27). These early studies described the phases of human

response to disaster events in a linear way. Both the earliest and the most influential example of such a study is the 1920 study of Prince on the societal response and changes in Halifax, Canada after a massive explosion following the collision of two ships in Halifax harbour (Drabek, 2005:2; Drabek & McEntire, 2003:98; Kreps, 1984:310; Dynes & Drabek, 1992:3; Dynes & Quarantelli, 1992:1; Chapman, 1962:4; Dombrowsky, 1981:1). Prince's work was so influential that it served as the basis of the disaster research tradition that evolved following the publication of his pioneering work (Dynes & Quarantelli, 1992:1; Chapman, 1962:4). Therefore, this section of the thesis will track the development of phase research from Prince's pioneering work in 1920, as well as examining other influential works regarding phase research such as Carr (1932), White (1946), Powell (1954), Fritz and Mathewson (1957), Chapman (1962) and Stoddard (1968).

4.2.1 A study of social reactions in disaster events: Princes pioneering work

In his study, Prince views disaster events as an extra-social or stimuli factor that precipitates social change (Prince, 1920:16). He supports this viewpoint by quoting earlier works by Thomas (1909) and Giddens (1920). According to Thomas, when human habits are running smoothly their attention is relaxed; it is not at work. Yet, when something happens to disturb habits, the attention is called into play, and devises a new mode of behaviour, which in turn will meet the crisis. That is, "the attention establishes new and adequate habits, or it is its function to do so" (Thomas, 1909:17). Giddens (1920:401) states that crises break down both traditions and habits. The impact of a crises event causes reflexes and higher processes in a society to detach from old stimuli and associate with new ones (Giddens, 1920:401). Out of this, Prince theoretically argues that both minor and major disasters lead to social change (Prince, 1920:20). To document his claim further, Prince provides an analysis of the Halifax disaster. The outcome of this analysis is proof that in Halifax, the shock of the disaster resulted in disintegration of social institutions,

dislocation of the usual methods of social control and dissolution of the customary (Prince, 1920:34). The catastrophe threw the community into the state of flux, which is the logical and natural prerequisite for social change (Prince, 1920: 34).

Prince continues to describe various periods of social response and change following the disaster event. These periods, as Prince calls them, bear a striking resemblance to descriptions of disaster management phases (Prince, 1920:85).

4.2.1.1 Prince's Emergency Period

The first of these phases is what Prince calls the **emergency period** (Prince, 1920:85). This phase was greatly characterised by the confusion and flight impulse illustrated by the inhabitants of Halifax following the initial explosion (Prince, 1920:42). According to Prince, as first confusion reigned, some individuals ran to the cellars, some ran to the streets, some ran to their shops, those in the shops ran home and automobiles sped over broken glass and splintered boards toward the unknown (Prince, 1920:42). This initial instance of the stun phenomena and subsequent flight impulse was further augmented by reports that a secondary explosion was immanent (Prince, 1920:42). This view is being questioned in modern times though, especially with regard to the 9/11 terrorist attacks. In studies conducted by Mawson (2005) and DiGiovanni (2003) it was found that persons in mass emergency situation, such as the 9/11 terror attacks, behave without panic and with a sense of compliance and orderliness. Furthermore, it was found that individuals often remained or even approached the situation of danger in order to seek the proximity of familiar persons (Mawson, 2005:96; DiGiovanni, 2003:254).

4.2.1.2 Prince's transition period

The next period or phase Prince writes about is the **transition period** (Prince, 1920:85). In this period social organisation plays a key role. Social organisation is associated with the organisation of relief, which was the first social activity following the disaster (Prince, 1920:59). Following the disaster, social groups like the army and fire fighters largely remained organised (Prince, 1920:60). These groups quickly responded to the general alarm soon after the explosion and proved to be the most effective and promptly reacting units in the emergency (Prince, 1920:60). The main reason these groups (fire-fighters and army) could organise themselves to respond to the disaster so quickly and effectively before any other social institutions, is ascribed to the fact that even in normal times these groups were closely organised and disciplined (Prince, 1920:60). These tightly organised and well-disciplined groups, especially the army, took up the leading role in the coordination of rescue and relief efforts within Halifax (Prince, 1920:61; Carr, 1932:212). Only after the army took control, did rescue and relief efforts start to illustrate signs of cooperative action (Prince, 1920:61). Previously, such rescue and relief work was undertaken in a rapid and random fashion with a single ruin being dug through a second or even a third time (Prince, 1920:61).

4.2.1.3 Prince's rehabilitation period

Rehabilitation is the final period Prince addresses (Prince, 1920:85). According to Prince, the drive towards rehabilitation occurs with the realisation that relief efforts only serve as a temporary cure for social and economical losses and therefore, social reorganisation should be implemented to restore the habits and customs of everyday life (Prince, 1920:69). In the case of Halifax, the community moved into this rehabilitation period by delegating the relief task to special social groups, thereby leaving public men and public thought free to turn their energies to the restoration of a normal society

(Prince, 1920: 70). These public figures passed their ideas of rehabilitation on to various grassroots organisations and peoples like volunteers, schools, churches and social clubs; this greatly improved the rehabilitation efforts in Halifax (Prince, 1920: 85).

4.2.2 Carr and the sequence pattern of social change in disasters

Through comparative studies of catastrophic changes, Carr found that all social changes follow a definite sequence pattern, beginning with a precipitating or initiating event or condition and moving through a phase of dislocated adjustment into a phase of readjustment and eventually renewed equilibrium (Carr, 1932:207). Applying this thinking to disaster, Carr describes a general disaster stage model consisting of one informal period and four formal periods (Carr, 1932; Neal, 1997:241; Dombrowsky, 1981:1).

The informal period Carr addresses is called the period of preparation (Carr, 1932:210; Neal, 1997:241). This informal period is a forerunner for the sequence pattern that follows (Carr, 1932:210). Carr (1932:211) describes this period by referring to various catastrophic events like the Halifax explosion, the San Francisco earthquake (in 1906) and the Galveston storm (of 1900). In all these instances Carr (1932:211) refers to various conditions that had already existed, which contributed significantly to the occurrence of the disaster event. For instance, in the case of the Halifax explosion, there was a period of about twenty-three minutes during which the Belgian relief ship "Imo" and the French munitions ship "Mont Blanc," with her 2300 tons of picric acid and 450 000 pounds of trinitrotoluol, were colliding and the "Mont Blanc", afire and deserted, was drifting toward the docks (Carr, 1932:211).

As mentioned above, this period of preparation only serves as a forerunner sequence pattern that follows and therefore was not the main focus of Carr 's

study (Carr, 1932:210). The following section will pay greater attention to those formal periods that Carr considered as crucial to his general disaster stage model.

4.2.2.1 Formal phase one: The preliminary or prodromal phase

The first formal period Carr describes is called the **preliminary or prodromal phase** (Carr, 1932:211). Carr only vaguely describes this period as a preliminary period during which the forces that would cause the ultimate collapse, start mobilising (Carr, 1932:211). Carr does not continue to describe this period in any more detail, and therefore it leaves one to ponder how the first formal period differs from the informal period he describes.

4.2.2.2 Dislocation and disorganisation phase: The onset of catastrophe

Carr (1932:211) describes the second phase as **dislocation and disorganisation**. This phase begins with the actual onset of the catastrophic forces (Carr, 1932:211). In this phase, Carr addresses an issue that stands at the heart of the field of disaster management, which is the fact that a disaster can only be seen as a disaster once it affects people or leads to a collapse of the social protections of a society (Carr, 1932:211). The deaths, injuries, and other losses induced by a disaster event are described as the essential consequences of a disaster that leads to dislocation and disorganisation within a society (Carr, 1932:211).

4.2.2.3 Readjustment and reorganisation phase: a community's informal response

The third phase flows directly out of the dislocation and disorganisation phase. Carr (1932:212) calls this phase the **readjustment and reorganisation phase**. This period reflects a community's attempt to respond initially, and is determined by a community's culture, morale and leadership as well as the speed, scope, complexity and violence of the catastrophe itself (Carr, 1932:211-212; Neal, 1997:241). Also, citing the Halifax explosion as an example, Carr (1932:212) states even though the community was badly shaken, some part of the community still remained in tact and could therefore start to take action.

4.2.2.4 Confusion delay phase: a formalised response to disaster impact

The final period is the **confusion delay phase** (Carr, 1932:212). This phase occurs from the time of the catastrophe until emergency plans start to operate (Carr, 1932:212; Neal, 1997:241). According to Carr (1932:212), initially no community has any plan or prearranged organisation to deal with the disorganisation of community services caused by a disaster event. Only after a few hours or even days following a disaster event, do some plans get formulated and implemented to deal with the consequences of that event (Carr, 1932:212). Carr uses the Halifax explosion as an example, and indicates that only after five hours a make shift plan for rescue work started to appear and only a day later did a hastily formed citizens committee formulate an effective plan to guide rescue and relief work (Carr, 1932:212).

4.2.3 White: A study of structural adjustment to flood impacts

In his study, White (1946:130-202) addresses human adjustment to floods in the United States of America. White (1946:128) describes eight structural and non-structural forms of adjustment that was prevalent in the United States when he wrote his book. The forms of adjustment he describes were the

following: **Land elevation, flood abatement, flood protection, emergency measures, structural adjustment, land use, relief and insurance** (White, 1946:128). According to White (1946:128), these adjustments could be used individually, or as in the case of disaster phases, these adjustments could be used in combination and thereby increasing its advantages.

Although not part of his identified adjustment measures, White also addresses a phase that usually forms part of most discussions of disaster management phases and of later Disaster Management Cycles. This phase is the rehabilitation phase. White (1946:174) views rehabilitation as a measure that can be conducted both before and after flood events, although he states that rehabilitation would probably be a much more valuable exercise if it forms part of the relief efforts following the flooding, than as part of education efforts beforehand. This is in sharp contrast with modern thinking in disaster risk management where great emphasis is placed on educating communities to reduce their risk and lessen their vulnerability before a disaster strikes (Mileti, 1999:14; King, 2002:223-228).

Interestingly, White also raises a contemporary problem relating to the relief phase of a disaster event. He critiques the relief policy of the time by stating that he found that relief policy often reinforces risk filled behaviour (White, 1946:199). He found that relief policy at the time encouraged and even augmented the problem of people living on flood plains. This is due to the fact that people living on the flood plains knew that they would receive some form of remuneration for their losses (White, 1946:199). According to White (1946:200), public relief has relieved public suffering from floods in such a way as to promote or at least, fail to check the growth of causes for even greater suffering in future.

White's study on human adjustments to floods in the USA was unique in the sense that it focused on a specific hazard facing communities and how those

communities can adjust to that hazard. Yet, in spite of this specific focus his study still produced information that could be applied to disasters and their phases in general. The general overview of disasters and their phases continues in the following sections by focussing on studies conducted by Powell, Chapman, Fritz and Mathewson as well as Stoddard.

4.2.4 Powell disaster – time stage model

Building on an earlier study by Powell and Rayner (1952), Powell identifies eight different disaster-time stages (Powell, 1954; Powell and Rayner, 1952; Neal, 1997:241). Powell (1954) describes the first stage as the **pre-disaster conditions stage**. This stage refers to a community's familiarity with and attitude towards a specific hazard that threatens them (Powell, 1954; Neal, 1997:241). After the pre-disaster conditions stage follows the **warning stage** (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). This stage refers to the precautionary activities that a community engages in before a disaster event occurs (Powell and Rayner, 1952; Powell, 1954). The next stage, namely **Threat**, is when a community focuses on actions related to surviving an impact of a specific disaster event (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). The fourth stage is **Impact** (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). This stage represents the phase during which the disaster strikes and causes deaths, injuries and destruction (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). The **inventory stage** occurs after the impact of a disaster. Throughout this stage the community or individual fully realises the degree of the destruction caused. People also start to realise that steps need to be taken to deal with the impact of the disaster (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). The **rescue phase** follows the inventory stage (Powell and Rayner, 1952; Powell, 1954). During this stage, ad hoc efforts emerge to help victims of the disaster. Usually, the community self conduct these initial efforts at search and rescue (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). The **remedy stage** occurs when trained, professional-emergency responders like fire-fighters arrive at

the site of the disaster (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241). Finally, the **recovery phase** emerges when attempts are made to resume normal operations following a disaster (Powell and Rayner, 1952; Powell, 1954; Neal, 1997:241).

According to Neal (1997), Powell's efforts signalled an important attempt to sensitise and define disaster phases, and subsequently served as an important source for efforts at defining various disaster phases (Neal, 1997:241). Chapman's (1962) work illustrates the latter point best.

4.2.5 Fritz and Mathewson: A study of convergence behaviour in disasters

Fritz and Mathewson also mention various disaster phases in their 1957 study relating to convergence behaviour in disasters. Although their description of disaster phases puts greater emphasis on the profiteering behaviour such as the selling of emergency supplies and looting often found during various phases, rather than the phases themselves, it does prove that thinking on disaster phases was well established at the time of the writing of their study. Fritz and Mathewson (1957:57) define three clear phases, namely the **emergency phase, post emergency phase and the rehabilitation phase**. Of these three phases Fritz and Mathewson only clearly define the rehabilitation phase as the phase during which disaster-struck communities are trying to rebuild and restore their losses (Fritz and Mathewson, 1957:57). About the emergency phase and post emergency phase, Fritz and Mathewson only write that both these phases are characterised by the availability of a plethora of emergency goods and services. If one was to look at these two phases from a literary point of view, it would be plausible to speculate that the emergency phase alludes to the moment of impact of a specific disaster event until the end of that specific event, and that post disaster refers to the start of relief efforts immediately following the disaster.

4.2.6 Chapman: Building on the foundations set by Powell

Chapman's work expands on the earlier work by Powell by updating the main findings regarding six of the eight disaster phases described by Powell in 1954 (Chapman, 1962:8).

Concerning the **warning phase** of the disaster response sequence, it was found that minor changes in the stimulus situation can produce great differences in reaction, and these different reactions can in turn alter or reinforce interpretations of information that is available (Chapman, 1962:10). Therefore, Chapman concluded that the prevailing activity within the warning phase of a disaster is concerned with the human search for certainty in the absence of reliable information (Chapman, 1962:10). Thus, providing sufficient training in detecting and combating dangers, persons would be better prepared and equipped to deal with warnings during the warning phase (Chapman, 1962:10).

In the **threat phase** human beings face the problem of perceptual ambiguity more directly than that they did in the warning phase (Chapman. 1962:11). For this reason it was found that during this phase, disaster agencies should provide information that is accurate, not only to ensure that the belief is established that a disaster is about to occur, but also that necessary actions will be taken in order to survive the impact of a specific disaster event (Chapman. 1962:11). To be effective, warnings provided during this phase should combine enough threatening information to arouse the involvement of the community as well as the assurance that specified preventative action will be effective (Chapman. 1962:11).

Although the **impact period** represents the phase during which the disaster strikes and causes deaths, injuries and destruction much can be done to better manage the deaths, injuries and loss experienced in the phase by means of pre-disaster training and indoctrination with regards to roles in protective and rescue functions (Chapman, 1962:14). With roles clearly defined prior to a disaster, leadership capacities already exist within a community to ensure that leaders emerge within the community when a disaster event occurs (Chapman, 1962:14). The clear presence of community leaders allows a community to deal with the impact of disasters with greater efficiency (Chapman, 1962:14).

The **inventory phase** starts after the impact period. Efforts of survivors during this phase are aimed at understanding the catastrophe that has just taken place (Chapman, 1962:15). This phase is characterised by two contrasting responses. Initially, the social scene is fragmented into isolated individuals overwhelmed by the event and each believing that they are the only ones affected by the disaster (Chapman, 1962:15). This response is soon replaced by one of greater social cohesion when individuals begin to grasp the degree of mass destruction that had occurred (Chapman, 1962:15). Those who are alive or lightly injured soon become active, rescuing victims who are trapped or badly injured, searching for loved ones and comprehending the extent of the tragedy (Chapman, 1962:15).

Chapman (1962:17) separates the **rescue phase** from the immediately preceding impact by naturally indistinct boundaries. Generally the rescue phase starts when those persons not suffering from what Chapman calls “disaster syndrome”, recover their mobility and start to assess their situation and take steps to cope with their situation (Chapman, 1962:17). During the rescue phase, convergence behaviour brings both official rescue agencies and civilian volunteers that are concerned about friends and relatives into the disaster area (Chapman, 1962:17). If this influx of people into the disaster

area is not managed effectively it can greatly hamper rescue efforts (Chapman, 1962:17).

During the **remedy period** relief starts to flow into the community, thereby starting the healing process of the disaster stricken community (Chapman, 1962:19). For the most part this phase consist of the formulation of long-term plans and measures to ensure that recuperation of the affected community occurs (Chapman, 1962:19). The remedy period can last for many years, especially if one includes in it such slow recovery as the rebuilding of critical infrastructure, or on a social level adjustment to the loss of family members (Chapman, 1962:19). Initially the remedy period is characterised by great social cohesion within an affected community due to the collective loss induced by the disaster event. However, this social cohesion starts to dissipate the further the remedy period advances, thereby causing a return to the status quo that existed before the disaster event occurred (Chapman, 1962:21).

4.2.7 Stoddard: A peak at the future

Stoddard describe some relevant phases including pre-emergency, emergency and post-emergency phases (Stoddard, 1968; Neal, 1997:241). Of the three phases Stoddard identifies, both the pre-emergency and post emergency contains sub-phases or activities. During the pre-emergency phase Stoddard describes the following activities: warning, threat and evacuation, dislocation and relocation. The post-emergency phase should initiate short and long-term rehabilitation (Stoddard, 1968; Neal, 1997:241). The way that Stoddard subdivides various main disaster phases is rather similar to what can be seen in many Disaster Management Cycles at later time periods.

The above description is some examples of the earliest and most crucial thinking on disasters and its possible phases. This early research established phase ideas like emergency, relief, recovery and rehabilitation, all of which can be seen in more recent Disaster Management Cycles. Scholars widely debate whether one of the early works on disaster phases was translated directly into the Disaster Management Cycle that is known today and therefore it needs much further exploration (Lewis, 2007; Kellman, 2007; Wisner, 2007). The study on the preceding subject will be contained in chapter 5 of the dissertation.

The above discussions on early disaster phases clearly show that the idea of disaster phases is certainly not a new conceptual creation. These concepts have been around in some shape or form since the early 1920s. What remain difficult questions to answer is when exactly the disaster phases became illustrated in a cyclical manner and who first illustrated it in such a way. These questions are difficult to answer because there is no agreement between scholars and practitioners within the field of disaster management on when the cycle first appeared (Lewis, 2007; Kellman, 2007; Wisner, 2007). This primary problem further compounds the problem of identifying who first used the cyclical format. For all the problems faced, some vague information is available that illustrates when persons or organisations started to move away from just using disaster phases in a linear fashion, and also using in a cyclical manner. According to Neal (1997), models in the 1970s started to move away from showing that disaster phases can only be illustrated in linear fashion. It started to appear that phases could also be illustrated in cyclical fashion (Neal, 1997:262). The work of Baird *et al* (1975:41-42) supports Neal's argument in that two diagrams are presented, one of these contains phases that are illustrated in a linear fashion and the other (presented in *Figure 4.1*) contains phases illustrated in a cyclical manner. In spite of their different forms of illustration, Baird *et al* (1975:40) come to the conclusion that both aim to illustrate linear causation.

The following section will focus on describing the various cyclical formats in which linear disaster phases were illustrated from the 1970's onwards. Various countries and organisations adopted and reformulated these Disaster Management Cycles to suite their individual needs over a time period of about 30 years.

4.3 VARIED APPLICATION OF DISASTER MANAGEMENT CYCLES

From its inception as a tool for the management of disaster events in the early 1970s, various countries and organisations adapted the Disaster Management Cycle to suite their individual needs (Carter, 1991:59). To illustrate the various adaptations that have occurred, this section will examine some examples of Disaster Management Cycles ascribed to by some NGOs, international organisations, academic institutions and individual states around the globe. The examples selected in this section will be analysed by means of the general systems theory that was explained in chapter 2. This analysis will ascertain as to why each example differs from the other as well as determine which factors induced the variation in the specific cycle. Common and unique variables in each cycle will also be identified.

4.3.1 University of Bradford: Disaster Research Unit

Before this cycle appeared, the University of Bradford Disaster Research Unit had produced some works, notably during 1973 and 1975, which focused on pre-disaster planning issues such as indigenous resource coordination as part of larger pre-disaster planning (Baird *et al*, 1975:40). In the study, two models were conveyed that could be associated with pre-disaster planning: one expressing disaster phases in a linear manner and the other expressing the same phases in a cyclical manner (Baird *et al*, 1975:41-42). The cycle (*Figure*

4.1), even though not necessarily the intention of the researchers at the University of Bradford (to produce a Disaster Management Cycle), aims to illustrate disaster occurrence within an activity system over time, therefore bearing a resemblance to the aims of any Disaster Management Cycle (Baird *et al*, 1975:42).

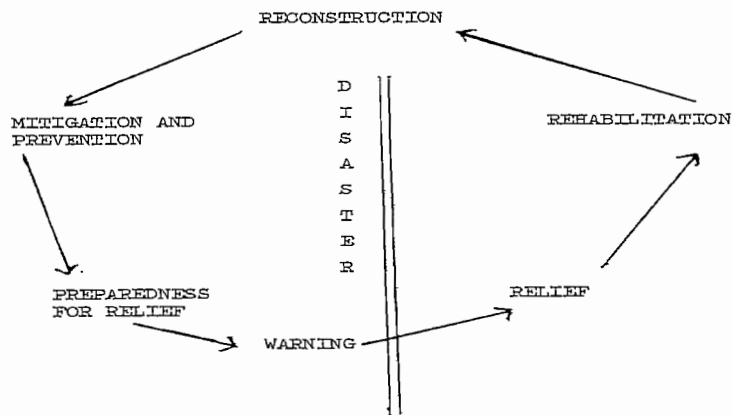


Figure 4.1:1975 Disaster Management Cycle (Baird, O'Keefe, Westgate and Wisner, 1975)

Disasters must be seen as occurring within a system of activity, which takes place before and after a disaster event (Baird *et al*, 1975:40; Lewis *et al*, 1976:14). At the time of the cycle's formulation, all activities or phases that form part of the proposed disaster cycle should be viewed in the context of the philosophy of pre-planning that permeated the University of Bradford: Disaster Research Unit (Baird *et al*, 1975; Lewis *et al*, 1976). Accordingly, most of the phases, except the disaster and relief phases, are oriented towards pre-disaster planning, even such phases like reconstruction and rehabilitation take on a pre-planning nature (Baird *et al*, 1975; Lewis *et al*, 1976:14).

The cycle proposed by the University of Bradford: Disaster Research Unit is made up of the following phases: prevention, mitigation, warning, relief, rehabilitation and reconstruction (Baird *et al*, 1975:40). In a broader sense, prevention, mitigation and warning constitute activities that occur pre-disaster,

while relief, rehabilitation and reconstruction are activities initiated after a disaster event has occurred (Baird *et al*, 1975:40).

In the above cycle, **mitigation and prevention** are bracketed together as one distinct phase. During this phase both physical precautions and contingency plans are put in place to lessen or prevent the impact of a disaster event (Lewis, 1976:13:15). Physical precaution includes land use zoning, formulation of building construction codes and implementation of civil engineering programmes (Lewis, 1976:13). Contingency planning should be conducted by making use of indigenous resources, emergency organisation and sectoral plans (Lewis, 1976:13).

4.3.2 FEMA Model

The Disaster Management Cycle proposed by FEMA (Federal Emergency Management Agency of the United States of America) (*Figure 4.2 below*) was greatly influenced by the 1979 National Governors Association Report on emergency preparedness (Donahue & Joyce, 2001:730)



Figure 4.2: FEMA Disaster Management Cycle (FEMA, 2009)

During the **mitigation phase** all activities aim to reduce the loss of life and property from natural and/or human-made disasters. This is done through avoiding or lessening the impact of a disaster. Also, value is given to the public by creating safer communities. Mitigation seeks to fix the cycle of disaster damage, reconstruction, and repeated damage (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009). These activities or actions, in most cases, will have a long-term sustained effect (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009).

According to FEMA, the **preparedness phase** of the Disaster Management Cycle should be viewed as a continuous cycle of planning, organising, training, equipping, exercising, evaluating and taking corrective action to ensure effective coordination during incident response (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009). Within America's National Incident Management System, preparedness focuses on the following elements: planning; procedures and protocols; training and exercises;

personnel qualification and certification and equipment certification (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009).

During the response phase of the Disaster Management Cycle activities are initiated to address the short-term, direct effects of an incident (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009). Response includes immediate actions to save lives, protect property, and meet basic human needs (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009). Response also includes the execution of emergency operation plans and of mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavourable outcomes (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009).

The **recovery phase**, as proposed by FEMA, includes both short and long-term activities to ensure that a society returns to its pre-disaster level of functioning (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009). Some key activities during this phase include the development, coordination and execution of service- and site-restoration plans; the reconstitution of government operations and services; individual, private-sector, non-governmental and public assistance programmes to provide housing and to promote restoration; long-term care and treatment of affected persons; additional measures for social, political, environmental, and economic restoration; evaluation of the incident to identify lessons learned; post-incident reporting; and development of initiatives to mitigate the effects of future incidents (Wallace & De Balogh, 1985:135; Comfort, 1985:160; FEMA, 2009).

Multi-national organisations like UNDRO (United Nations Disaster Relief Organisation) also developed cycles to serve as an educational mechanism in countries, which did not have the capacities to develop their own disaster

management tools. Both the rapid and slow onset cycles developed by UNDRO in the 1990s will be discussed in the following section.

4.3.3 UNDRO (United Nations Disaster Relief Organisation)

UNDRO was established in the 1970s to coordinate disaster relief within the United Nations (UN) system (United Nations Library, 2009; Lewis, 1991:131). UNDRO conducted several technical studies in the field of disaster management, prepared guidelines for development planning for areas vulnerable to disasters and collaborate with other UN agencies like the United Nations Development Programme (UNDP) in joint research projects (United Nations Library, 2009; United Nations, 1986). UNDRO also developed two separate Disaster Management Cycles, one for rapid onset events (Figure 4.3 above) and one for slow onset disaster events (*Figure 4.4 below*) (UNDP/UNDRO, 1992:12-13).

The rapid onset Disaster Management Cycle comprised of five clear phases, which were the relief, rehabilitation, reconstruction, mitigation and preparedness phases (UNDP/UNDRO, 1992:12). Of these five phases the relief, rehabilitation and reconstruction phases were divided into an overarching category known as the post-disaster recovery phase whilst the mitigation and preparedness phases slotted into what was known as the pre-disaster risk reduction phase (UNDP/UNDRO, 1992:12).

During the post-disaster recovery phase, the **relief phase** was defined as the period immediately following the occurrence of a sudden disaster when exceptional measures have to be taken to search and find survivors as well as meet their basic needs for shelter, water, food and medical care (UNDP/UNDRO, 1992:13). During the **rehabilitation phase** decisions are taken and operations initiated that aim to restore a disaster struck community

to its former living conditions, while encouraging and facilitating the necessary adjustments to the changes caused by the disaster (UNDP/UNDRO, 1992:13). The **reconstruction phase** of post-disaster recovery efforts, build on the work done during the rehabilitation phase. Actions during this phase are especially focused towards the rebuilding of damaged infrastructure and restoration of all services like electricity and water supply, in order to completely restore a community to their pre-disaster state (UNDP/UNDRO, 1992:13).

During the pre-disaster risk reduction phase, the **mitigation phase** comprised of various actions taken prior to the occurrence of a disaster event, including preparedness and long-term risk reduction measures (UNDP/UNDRO, 1992:13). The final phase in UNDRO's rapid onset Disaster Management Cycle is the **preparedness phase** (UNDP/UNDRO, 1992:13). The preparedness phase consist of activities designed to minimise loss of life and damage, organise the temporary removal of people and property from a threatened location and facilitate timely and effective rescue, relief and rehabilitation (UNDP/UNDRO, 1992:13).

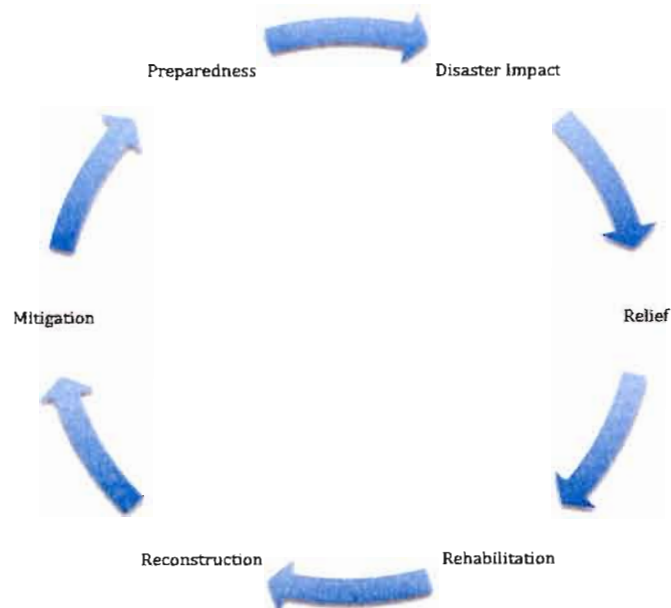


Figure 4.3: UNDRO rapid-onset disaster, Disaster Management Cycle (UNDP/UNDRO, 1992:12)

The phases described in the slow-onset Disaster Management Cycle (Figure 4.4) is similar to the phases described in the rapid-onset cycle but there are some crucial differences (UNDP/UNDRO, 1992:13). One of the most significant differences is that the early warning, emergency and relief phases are all conducted whilst the slow-onset event is still occurring (UNDP/UNDRO, 1992:14). The early warning and emergency phases are also two new phases that were not included in the rapid-onset cycle. During the **early warning phase**, situations are monitored in communities or areas known to be vulnerable to slow onset hazards. The purpose of the early warning phase is to enable remedial measures to be initiated and to provide more timely and effective relief including through disaster preparedness actions (UNDP/UNDRO, 1992:14). The **emergency phase** is the period during which extraordinary steps are taken to support human needs, sustain livelihoods and to avoid the onset of disaster. This phase can encompass pre-disaster, disaster alert, disaster relief and recovery periods. The rehabilitation phase in the slow-onset cycle also differs a bit from the same phase in the rapid-onset cycle (UNDP/UNDRO, 1992:14). During the **rehabilitation phase** in the slow-onset cycle, steps are taken to ensure that issues like resettlement and returnee programmes are initiated after the slow-onset disaster has occurred (UNDP/UNDRO, 1992:14).

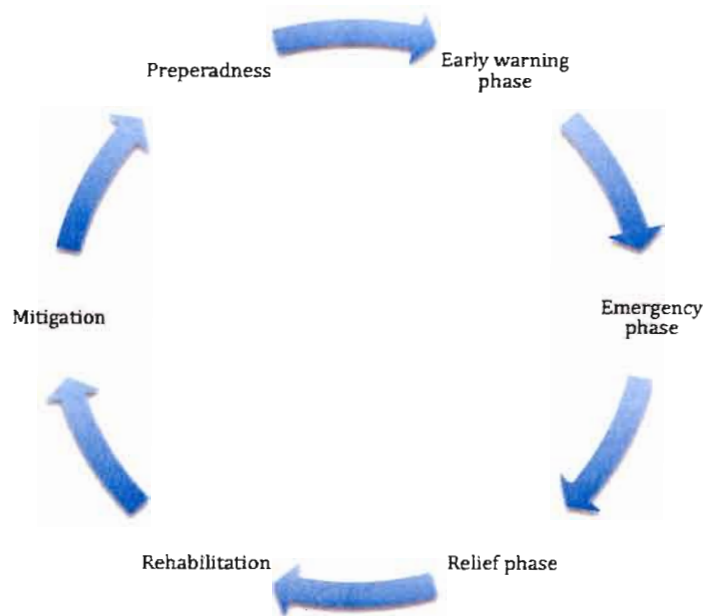


Figure 4.4: UNDRO slow-onset disaster, Disaster Management Cycle (UNDP/UNDRO, 1992:13)

By the 1990's, organisations involved in international development practices also started to produce Disaster Management Cycles. These cycles were unique in the sense that they incorporated distinct development phases, which aimed to reduce social vulnerability to disasters through developmental programs. In the next section two examples of development-orientated cycles will be discussed, namely that of the Asian Development Bank and the Foundation of Development Cooperation.

4.3.4 Asian Development Bank

The Asian Development Bank utilised the Disaster Management Cycle as their chosen format to educate disaster management practitioners on the various phases of a disaster event (Carter, 1991:51; Asian Development Bank, 2007:3). The cycle (*Figure 4.5*) is used to illustrate that both a disaster event as well as the management thereof should be viewed as a continuum of interlinked activity and not just a series of events that start and end with each disaster occurrence (Carter, 1991:51). The cycle comprises of the following phases: impact, response, recovery, development, prevention, mitigation and preparedness.

The disaster **impact phase** is rather self explanatory as the phase in which the disaster event strikes (Carter, 1991:57). The impact phase can be sudden as is the case with an earthquake or protracted, in the case with a tropical cyclone. The impact phase is characterised by injuries, loss of life and destruction of infrastructure (Carter, 1991:57).

Following the impact phase is the **response phase** (Carter, 1991:57). Response measures are usually those which are taken immediately prior to and following disaster impacts and include activities like evacuation measures, activation of a counter-disaster systems and the distribution of emergency food, shelter and medical supplies (Carter, 1991:57). This phase is a fairly brief period (two to three weeks after impact) when emergency measures are necessary to deal with the immediate effects of a disaster (Carter, 1991:57).

During the **recovery phase** both communities and nations are assisted in returning to their proper level of functioning following a disaster (Carter, 1991:58). The recovery process can be a protracted process taking five to ten years, or even more depending on the magnitude of destruction experienced by a community (Carter, 1991:58). The recovery phase comprises of three parts which are restoration, rehabilitation and reconstruction and includes activities like restoration of essential services, provision of temporary housing and long-term measures of reconstruction such as the replacement of buildings and infrastructure affected by the disaster (Carter, 1991:58).

The **development phase** provides a link between disaster-related activities and national development (Carter, 1991:58). The inclusion of a development phase in the Disaster Management Cycle is necessary to ensure that the results of a disaster are effectively reflected in future policies in the interest of

national progress (Carter, 1991:58). The phase also ensures that national policy does not create further disaster problems, nor exacerbate existing ones (Carter, 1991:58).

During the **prevention phase**, actions are taken to impede the occurrence of a disaster event and/or prevent such an occurrence having harmful effects on communities or key institutions (Carter, 1991:54). Preventative activities include the building of preventative infrastructure like dams, controlled burning of bushfire prone areas or the formulation of legislation that serve a preventative purpose like land use regulations (Carter, 1991:54).

The **mitigation phase** implies that whilst it may be possible to prevent some disaster effects, other effects will persist but can be modified or reduced provided that appropriate actions are taken (Carter, 1991:54). Therefore, actions in this phase take the form of specific programmes intended to reduce the effects of a disaster on a nation or community (Carter, 1991:54). Mitigation activities include enforcement of building codes and agricultural programmes that aim to reduce the effect of hazards on crops and the development of safety regulations relating to high-rise buildings (Carter, 1991:54).

The **preparedness phase** comprises of measures, which enable governments, organisations, communities and individuals to respond rapidly and effectively to disaster situations (Carter, 1991:55). Preparedness measures include the provision of warning systems, emergency communications and public education and awareness (Carter, 1991:55). In his formulation of the preparedness phase, Carter points out that some organisations divide the preparedness segment into sub-segments like warning, threat and precaution in order to provide some indication of the possible sequence of events that lead up to a disaster impact (Carter, 1991:55).



Figure 4.5: Asian Development Bank Disaster Management Cycle (adapted from Carter, W.N. 1991. Disaster Management: A disaster manager's handbook. Asian Development Bank.)

4.3.5 Foundation of Development Cooperation Cycle

The Foundation of Development Cooperation (FDC) also produced a similar cycle to that of the Asian Development Bank (*Figure 4.6*). Only a slight difference exists in its repetition of the Disaster Management Cycle. Instead of a single recovery phase, the normal recovery phase is divided into separate phases of rehabilitation and reconstruction (FDC, 2003:7). A mitigation phase is also omitted but the activities conducted during the mitigation phase are divided into the prevention and preparedness phases (FDC, 2003:7).

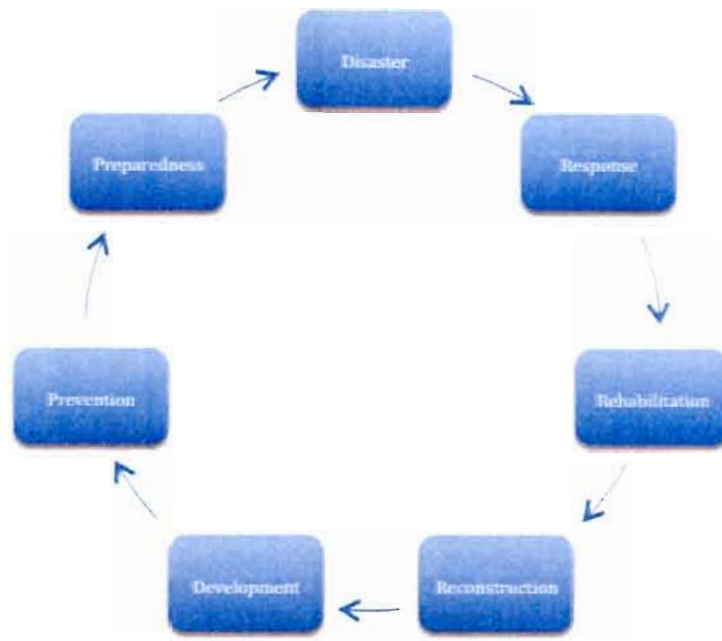


Figure 4.6: Foundation of Development Cooperation (FDC, 2003:7)

4.3.6 Munich Personal RePEc/Government of India

The Disaster Management Cycle described by Khan and Khan (*Figure 4.7*) is similar to many of the cycles that have already been discussed previously (Khan& Khan, 2008:47; Arya *et al*, s.a.:8). It is made up of three overarching phases that are known as the **emergency response phase**, the **post-disaster recovery phase** and the **pre-disaster risk reduction phase** (Khan& Khan, 2008:47; Arya *et al*, s.a.:8). The cycle also contains the standard sub-phases seen in previous cycles such as response and relief, reconstruction, rehabilitation, mitigation and preparedness phases respectively (Khan& Khan, 2008:47; Arya *et al*, s.a.:8). This cycle differs slightly from the previous cycles discussed with regards to the emergency response phase. During the emergency response phase the cycle contains an additional **individual disaster response phase** (Khan& Khan, 2008:47; Arya *et al*, s.a.:8). This phase occurs immediately after the disaster event has occurred and before any formal response or relief efforts are initiated by emergency services such as fire or police departments (Khan & Khan, 2008:47; Arya *et al*, s.a.:8). This phase comprises of activities whereby

survivors should secure their personal safety as well as the safety of others, the provision of first aid to other survivors and the salvaging of supplies for survival purposes (Khan& Khan, 2008:47; Arya *et al*, s.a.:8).

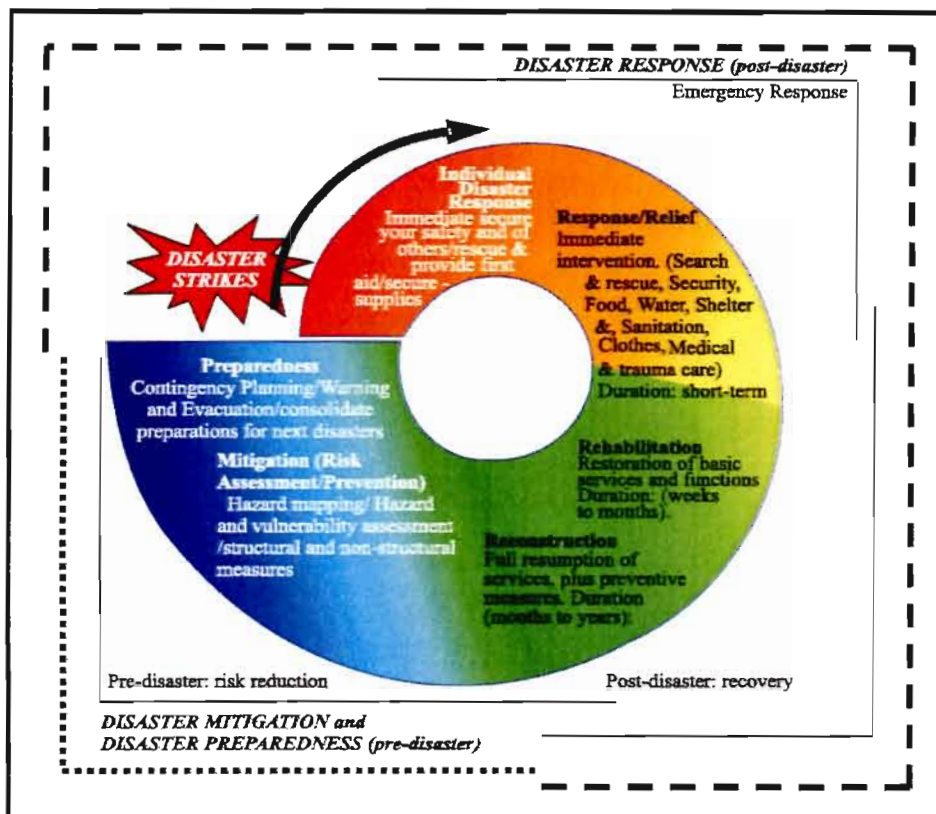


Figure 4.7: Munich Personal RePEc/Government of India Disaster Management Cycle (Khan & Khan, 2008:47; Arya *et al*, s.a.:8)

4.3.7 Department of Civil Engineering: North Carolina State University

The Disaster Management Cycle proposed by Pradhan (*Figure 4.8*) consist of six steps taken before, during and after a disaster to effectively manage the disaster (Harris, 2005:3). According to Pradhan these steps are not set in stone, and the amount of steps used to manage a disaster will often depend on the type of disaster (Harris, 2005:3). For the most part though, a Disaster Management Cycle can comprise of the steps contained in the cycle in Figure

4.8, which are identification, prediction, mitigation, preparation, response, and recovery (Harris, 2005:3).

Pradhan's disaster cycle begins with the **identification phase** that identifies physical infrastructure like roads, buildings and bridges and human infrastructure like hospitals and fire stations as being in most danger (Harris, 2005:3). Once the most vulnerable human and physical infrastructural entities have been identified, the level of possible damage to those identified entities is determined in the **prediction phase** (Harris, 2005:5).

Pradhan's cycle's phase which includes phases such as **mitigation, preparedness, response and recovery** bares a great resemblance to the corresponding phases of cycles previously described in this section and thus do not need much further description. The only significant difference in Pradhan's description of the aforementioned phases is the civil engineering perspective in which these phases are discussed. The effect of this civil engineering perspective is that all activities in any of these phases have a civil engineering nature with the same aim of protecting or restoring both physical and human infrastructure before or following a disaster event (Harris, 2005:5). Some examples of this civil engineering orientation are the elevation of houses above a flood plain during the mitigation phase, sandbagging of certain areas during the preparation phase, the protection of affected physical and human infrastructure during the response phase and the restoration of buildings and utilities during the recovery phase (Harris, 2005:5).

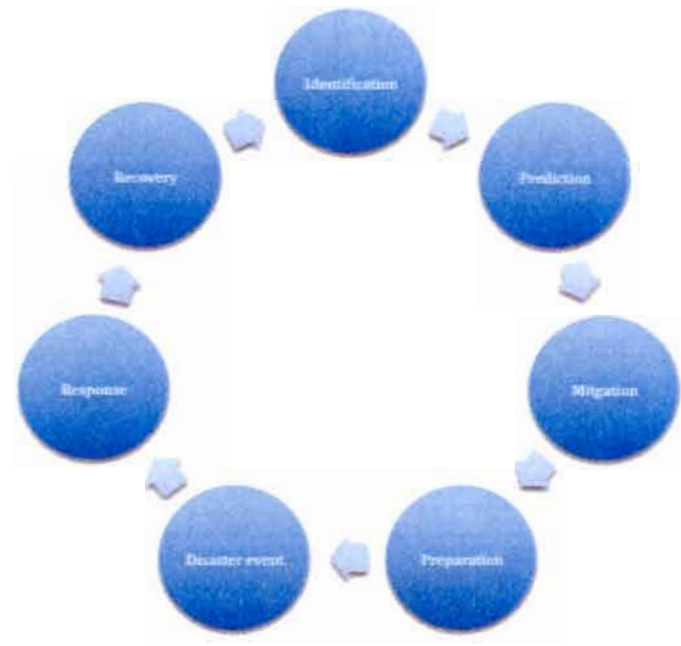


Figure 4.8: Department of Civil Engineering: North Carolina State University Disaster Management Cycle (*adapted from Pradhan, 2003*)

All the cycles discussed in this section have been placed on a timeline (*Figure 4.9*) to indicate when the cycle originated and how it has been adopted as a tool by various organisations to manage disasters and their impacts in subsequent decades. The cycles discussed in this section are not an exhaustive collection of all Disaster Management Cycles currently in issue globally. However, they do represent a wide spectrum of thought generated by varying public, private and academic instructions relating to the Disaster Management Cycle. The literature review provided during this section of the paper will serve as a useful foundation for answering the key research question relating to how the cycle is/was applied in different contexts and how the cycle has changed since its inception?



Figure 4.9: Historical timeline of Disaster Management Cycles

A description of the various cycles that have developed over the past few decades is not sufficient for an in-depth study that would provide answers to the research question posed for this study. Therefore, to prevent this study from becoming an anecdotal report on Disaster Management Cycles over time, an in-depth analysis of the cycles that were presented must be conducted by using an adequate analysis tool. The General Systems Theory (as discussed in chapter 2) provides such an analysis tool.

The following chapter aims to apply some of the basic concepts relating to General Systems Theory such as feedback, isomorphism and system synthesis to the linear disaster phases and Disaster Management Cycles.

By applying General Systems Theory to the study of the Disaster Management Cycle, one will be enabled to focus on the individual components as well as the relationship between the elements, which will contribute greatly to deciphering the complexities of the concept of the Disaster Management Cycle (Checkland, 1999; Skyttner, 2005:49-108; Becker, 2009:4; Boulding, 1956; Ashby, 1960; Buckley, 1968; Richardson, 2005). It should be noted that it is virtually impossible to understand such systems completely. Still, the goal remains to obtain a holistic picture, which in turn will enable the researcher to answer the research questions (Skyttner, 2005:100; McEntire, 2002).

4.4 CONCLUSION

This chapter has established that although Disaster Management Cycles only appeared in physical format in the 1970s, that the origins of the phases that comprise the Disaster Management Cycle could be traced back to early disaster phase research, which focused on human behaviour following disaster events. Much of this early research was based in the field of Sociology although some studies were also conducted within the fields of Geography, Anthropology and Psychology. The studies based in the field of Sociology were the most prominent during the early years of disaster phase research and also received most of the funding assigned to the research field following the end of World War II.

These phase models were developed to assign order and rationality to the complex reality of natural and technological disasters and the human responses to them. These early studies described the phases of human response to disaster events in a linear fashion. Both the earliest and the most influential example of such a study is the 1920 study of Prince on the societal response and changes in Halifax, Canada after a massive explosion following the collision of two ships in the Halifax harbour. Prince's work was so

influential that it served as the basis of the disaster research tradition that evolved following the publication of his pioneering work. Subsequent studies conducted by Carr (1932), Powell (1954), Chapman (1962) and Stoddard (1968) built and expanded on the conceptual base that was set by Prince through establishing phase ideas like emergency, relief, recovery and rehabilitation, all of which could be observed in later Disaster Management Cycles. Coinciding with an increase in the occurrence in disaster events in the 1970's, these linear disaster phases began to be illustrated in a cyclical form. These cycles were adopted by a wide array of institutions such as academic departments, national and international governance institutions and international development organisation. The cycles served as a mechanism whereby disaster events could be managed more effectively. It was found that each one of these institutions incorporated different phases and activities into their interpretation of the Disaster Management Cycle in order to suite their specific contextual needs. Consequently, various variations of the Disaster Management Cycle appeared from the 1970s onward.

CHAPTER 5

AN ANALYSIS OF LINEAR PHASES AND CYCLE CONCEPTS BY MEANS OF GENERAL SYSTEMS THEORY

5.1 INTRODUCTION

General systems theory serves as a metatheory within science and therefore provides a common language whereby widely separated phenomena can be explained (Laszlo, 1972(a):5; Rapoport, 1986:1; Checkland, 1999:3; Skyttner, 2005:56; Ingelstam, 2002:9-28; Whitchurch and Constantine, 1993:325; Laszlo, 1972(b):10). This characteristic of General Systems Theory makes it ideally suited to studying a multi-faceted idea such as the Disaster Management Cycle, which has been illustrated in previous sections to have been influenced by many different disciplines over a time period of at least 90 years (Ingelstam, 2002:9-28; Quarantelli; 1986:11; Tierney, 1998:2; Quarantelli; 1997:2). The following section will apply the relevant general systems concepts discussed in chapter 2 of the research study to analyse both the linear disaster phases and Disaster Management Cycles presented earlier in this chapter. The aim of the analysis is to illuminate the general systems properties of both linear phases and cycles, thereby providing greater insight into both terms as well as providing answers to the research questions posed for the research study.

5.2 THE ISOMORPHIC CHARACTER OF LINEAR PHASES AND DISASTER MANAGEMENT CYCLES

The following section will aim to describe the presence of isomorphic characteristics both within linear disaster phase concepts and Disaster Management Cycles. By proving the presence of isomorphism both within and between linear phases and Disaster Management Cycles, it is hoped to establish a possible illustration of how Disaster Management Cycles have developed and the role that early phase research played in the development of the Disaster Management Cycles. To aid the specific analysis a concise summary of phases and key characteristics of the phases being used in both the linear phases (Table 5.1) and Disaster Management Cycles (Table 5.2) discussed during chapter 4 has been provided. Both these summaries provide a visual indication of structural similarities both within and between linear phases and Disaster Management Cycles.

5.2.1 Isomorphisms within linear disaster phases

Isomorphisms represent those laws within different systems that share common or similar traits in explaining the phenomena being studied. As such by identifying isomorphisms that are present throughout the development of linear disaster phases it will be possible to indicate the mutual influence these different linear conceptions of disasters had on each other, and on the subsequent idea of the Disaster Management Cycle.

In his pioneering work on General Systems Theory, Ludwig von Bertalanffy stated that because different scientific fields are in a state of constant interaction with each other, it often leads to similarities in general laws and sometimes even special laws within the interacting scientific fields (Von Bertalanffy, 1973:33). This statement serves as a departure point for the analysis of linear disaster phases.

In the case of linear disaster phases much of the work that has already been presented in the thesis and summarised in Table 5.1, come from different

scientific fields. Whilst the works of Prince (1920) and Carr (1932) were produced within the field of sociology, the work of White (1946) emerged out of Geography and the works of Powell (1954), Chapman (1962), Fritz and Mathewson (1957) and Stoddard (1968) have strong inclinations towards the field of psychology. Even though the linear phases discussed, emerged out of different scientific fields they can be said to share both general and special laws.

Using the pioneering work of Prince (1920), regarded as the base document on which the disaster research tradition was founded, it is possible to establish the presence of general and special isomorphic laws within linear disaster phase research from the 1920s until Stoddard 's work in 1968 (Dynes & Quarantelli, 1992:1; Chapman, 1962:4). Prince identified 3 distinct phases, which are the emergency, transition and rehabilitation phases' respectively. In general, all three of these original phase, as identified by Prince, can be said to be present in some shape or form throughout the historical development of linear disaster phases. Importantly within this analysis it should be kept in mind that objective searching for isomorphisms is not necessarily to point out obvious. For example similarities such as the use similar terminology to describe the various phases, but rather the focus is on illustrating that underlying laws that are present within the concept of linear disaster phases as a whole.

The first phase Prince (1920) identified was the emergency phase. In essence this phase was described as the period when the disaster strikes causing negative consequences for society as a whole. In the case of Prince's work, the death and destruction brought on by the explosion of the ships in the harbour induced panic and a general attempt for self-preservation within society (Prince, 1920:42). Subsequent studies such as the studies by White (1946), Fritz and Mathewson (1957) and Stoddard (1968) use the exact term, of "emergency" as used by Prince to describe the period when a disaster impacts on a community. Other studies such as those conducted by Powell

(1954) and Chapman (1968) used the term “impact” to describe the moment a disaster impacts a society and Carr (1932) uses the terms “dislocation and disorganisation” to describe the same phase.

Although the different linear phases use different terms to refer to the initial impact of a disaster, all share an underlying similarity with the work of Prince in that they all identify a period when a disaster strikes. This disaster strike causes death, injury and property damage which induces a certain level of disorganisation within society. The initial disorganisation caused by the disaster impact lasts until the point when societal responses to the impact start to emerge.

Prince discusses the societal response to the disaster in the transition phase. The phase is characterised by the emergence and organisation of relief efforts. Survivors usually conduct the initial relief efforts, but these efforts are mostly carried out as Prince puts it in a “rapid and random” fashion. Only after formal relief agencies such as the army take control, do relief efforts become more organised and start to illustrate signs of cooperative action (Prince, 1920:61). Thus on a basic level, Prince's transition phase aims to illustrate that following a disaster, relief efforts emerge which are initially conducted by survivors in an ad hoc fashion, followed by more organised and formal relief efforts conducted by relief organisations. In the works of Fritz and Matewson (1957) and Stoddard (1968) both formal and informal relief efforts also form part of a single, post-emergency phase.

Some subsequent studies seem to build on Prince's concept that informal and formal relief operations exist following a disaster by actually dividing informal and formal relief efforts into separate distinct phases. Carr (1932) does this by dividing informal relief efforts into the readjustment and reorganisation phase and formal more organised relief efforts are conducted during the confusion delay phase. Powell (1954) and Chapman (1962) also follow this trend by

dividing informal and formal relief efforts into rescue and remedy phases' respectively.

In his work Prince also identifies a rehabilitation phase. During this phase activities are conducted that aim to restore the disaster-affected community to its previous level of functioning. This basic concept of rehabilitation as proposed by Prince is visible throughout the history of linear disaster phases, although sometimes in different forms or under different names. Whilst both White (1946) and Fritz and Mathewson (1957) use the exact term and description of rehabilitation as used by Prince, other studies such as those conducted by Powell (1954) and Chapman (1962) use the term recovery to describe the rehabilitation efforts of a community following a disaster. Interestingly, Chapman's work positions the recovery phases as more of a long-term activity, wherein long-term plans and measures are formulated to ensure the recuperation of the effected (Chapman, 1962:19). The division of the rehabilitation phase into long-term and short-term activities had not pertinently existed in the studies conducted before that of Chapman. Subsequent work conducted by Stoddard (1968) also divides the rehabilitation phase, which he calls the post-emergency phase, into smaller parts. Stoddard identifies the post emergency phase as the phase wherein both short-term and long-term rehabilitation activities should be conducted in order to restore a community to its previous level of functioning.

Another governing principle that can be observed in all the linear disaster phases discussed thus far pertains to the descriptive nature of linear disaster phases. These linear phases presented can be regarded as having a descriptive nature due to the fact that all the studies presented in Table 5.1 and indeed previous sections of this chapter, merely observed and described how disaster, impacted on societies, and how these societies dealt with. At no stage from Prince's work in 1920 until the work by Stoddard in 1968 did the descriptive nature of the linear disaster phase studies change. In fact, only during the 1970s did a shift occur away from the purely descriptive ways of

describing disaster phases, and did disaster phases become incorporated into normative models such as the Disaster Management Cycle.

One possible explanation for the constant presence of this descriptive orientation could be put down to the nature of the institutions that provided funding for early studies into disaster phases. As pointed out earlier in this chapter, early funding in disaster phases was provided by military institutions, which wanted to observe how societies react within mass emergency situations (Quarantelli, 1987). The possibility exists that within the military institutions this descriptive information was used to aid in the formulation of normative phase models that would govern how the military institution handled certain phases of a disaster situation. Although normative disaster phase models might have existed within military institutions from as early as the 1950s, the main stream scientific disaster phase research presented in the study only started to demonstrate normative characteristics with the emergence of Disaster Management Cycles in the 1970s (Quarantelli, 1987).

From the above discussions it should be clear that all the linear phases discussed share certain general isomorphic or structural similarities with the pioneering work conducted by Prince. Although different terminology and different methods, like dividing relief efforts into formal and informal relief efforts are used at certain times, it does not detract from the fact that the underlying laws governing the functioning of each phase are similar from the work of Prince in 1920 through to the work of Stoddard in 1968. The presence of the identified isomorphism verifies the claim of scholars such as Dynes and Quarantelli (1992:1) and Chapman (1964:4) that Prince's work was so influential that it formed the basis of the disaster research traditions that developed after the publishing of his pioneering work. Importantly the presence of isomorphisms derived from Prince's work in other fields apart from the field of Sociology in which it originally emerged, establishes that there must have been a degree of interaction between the various scientific

fields, hence the similarity in general and special laws with regard to linear disaster phases.

The table (5.1) that follows gives a brief overview of the linear disaster phases discussed in the research study. The table presents the creator as well as the specific phases that form part of linear disaster phase concept. The basic characteristics or outcomes of each phases is also conveyed. The purpose of the summary is to simplify the analysis process as well as to visually illustrate isomorphic similarities between various linear disaster phase studies over a period of time.

Scholar (Date)	Phase	Characteristics of the phase
Prince (1920)	Emergency	Disaster impact, panic within society
	Transition	Relief efforts emerge, rescue efforts are coordinated
	Rehabilitation	Activities are engaged to restore society to previous level of functioning
Carr (1932)	Preliminary	Mobilisation of catastrophic forces
	Dislocation and disorganisation	Disaster onset. Causes loss of life, injuries and damage to infrastructure
	Readjustment or reorganisation	Initial community response to disaster. Community based rescue efforts
	Confusion delay	Formal plans formulated and implemented to guide relief work.
White (1946)	Land elevation, flood abatement, flood protection, emergency, structural adjustment, land use, relief, rehabilitation, insurance	All adjustment described by White, in essence try to mitigate the impact of flood events and aim to aid recovery from flood events

Powell (1954)	Pre-disaster conditions	Societies familiarity and attitude towards disaster events
	Warning	Precautionary activities engaged in before disaster strike
	Threat	Community focuses on activities to survive impact
	Impact	Disaster strikes, causing casualties and damage
	Inventory	Society realise degree of destruction and also realises that steps need to be taken
	Rescue	Ad hoc rescue efforts initiated by community
	Remedy	Professional emergency response efforts
	Recovery	Attempts made to resume normal operations following a disaster
Chapman (1962)	Warning	Search for certainty that disaster is going to occur
	Threat	Established that disaster is going to occur and action need to be taken
	Impact	Disaster strikes
	Inventory	Initial shock at impact of disaster, informal rescue efforts engaged
	Rescue	Convergence of formal and informal rescue efforts
	Remedy	Formulate long-term plans for recuperation of normal society
Fritz and Mathewson (1957)	Emergency and Post-emergency phase	All emergency goods and services are brought together to address disaster impact
	Rehabilitation	Communities try to rebuild en restore their losses

Stoddard (1968)	Pre-emergency	Activities such as warning, threat, evacuation, dislocation and relocation occur before the disaster impact
	Emergency	Disaster impact
	Post-emergency	Short and long term rehabilitation plans are formulated and initiated

Table 5.1: Summary of Linear Disaster Phases

The preceding section has demonstrated that there is indeed a similarity in general and special laws with regard to linear disaster phases even though they have emerged within differing scientific fields. The following section will explore whether any of the identified isomorphic characteristics had been incorporated into the Disaster Management Cycle.

5.2.2 The continued presence of isomorphic characteristics in Disaster Management Cycles

The previous section indicates that a continuous isomorphic character with regards to disaster phases was presented in early linear disaster phase research. Some of the basic concepts relating to disaster phases established by earlier linear disaster phase research, continued to be present in the formulation of Disaster Management Cycles. The following section aims to illustrate some of the isomorphic characteristics between linear disaster phases and Disaster Management Cycles as presented in Table 5.2. This will be done by dividing disaster events into the sub-phases of pre-emergency, emergency and post emergency as defined by Stoddard (1968). By using Stoddard's work to guide the analysis, a bridge is provided between the concept of linear disaster phases and Disaster Management Cycles.

The first phase Stoddard describes is the pre-disaster phase. This phase comprises of activities such as warning, threat, evacuation and dislocation and relocation. Some of the activities described by Stoddard in this phase originated from earlier works by Powell (1952) and Chapman (1962) (see Table 5.1) and describe activities that a society engages in before a disaster event occurs in order to lessen the eventual impact of a disaster. The type and amount of pre-disaster activities differs from cycle to cycle. Cycles such as those presented by the University of Bradford: Disaster Research Unit (1975) and the UNDRO slow-onset Disaster Management Cycle (1992), identify 3 pre-disaster phases, which are mitigation, preparedness and relief. Other cycles proposed by FEMA (1979), UNDRO rapid-onset cycle (1992) and Munich Personal RePEc and the Government of India (2008) consist of 2 pre-disaster phases, which are the *mitigation* and *preparedness* phases. Some cycles comprise of pre-disaster phases, which are of particular relevance to the field or organisation in which the cycle is developed. In this regard, cycles developed in organisations concerned with social development such as the Asian Development Bank and Foundation for Development Cooperation, incorporate development and prevention phases into the larger pre-disaster phase. This presence of organisation specific pre-disaster phases is not an isolated occurrence as can be seen from the cycle presented by North Carolina State University's Department of Civil Engineering. The phases of identification, prediction, mitigation and preparation that form this specific cycle's "pre-disaster phase" all aim to ensure that civil engineering mechanism are checked and in place before disaster impact.

Stoddard also identifies an emergency phase. This phase is described as the period in which a disaster occurs causing loss of life and infrastructure damage. This basic phase of disaster impact can be observed in almost all the cycles described in the thesis (Table 5.2). There are some exceptions to the rule as seen in the slow-onset disaster cycle presented by UNDRO (1992) and the Disaster Management Cycle proposed by FEMA (1979). In the case of the UNDRO slow-onset Disaster Management Cycle a distinct impact phase is not included. This is mostly due to the protracted nature of slow

onset events such as droughts. It is unclear why the FEMA cycle does not include a distinct impact phase, but the answer could lie in the fact that the FEMA cycle puts a greater emphasis on those phases and activities that would facilitate better response and lessen the impact of a disaster rather than the disaster impact itself, which is a given in any disaster situation.

The final phase Stoddard defined was the post-emergency phase. Stoddard describes this phase as the phase where a society formulates and implements its short and long-term rehabilitation following a disaster. This post-disaster phase includes all short and long-term activities or phases a community engages in to restore itself to its former level of functioning. With regards to what specific phases the post-disaster phase should comprise of Baird *et al* (1975:40) states that relief, rehabilitation and reconstruction, should form part of post-disaster activities. In that case relief, response and related activities such as the restoration of basic human needs, would represent short-term rehabilitation activities, and rehabilitation and reconstruction would represent long-term rehabilitation interventions. This assumption is supported throughout the various Disaster Management Cycles presented (see Table 5.2). Notable examples include the cycles proposed by The University of Bradford: Disaster Research Unit (1975), UNDRO rapid-onset Disaster Management Cycle (1992), Foundation for Development Cooperation (2003) and the finally the Disaster Management Cycle proposed by Munich Personal RePEc and the Government of India (2008). It is important to mention that the Disaster Management Cycle, proposed by Munich Personal RePEc and the Government of India, indicate that the response or relief phase can form part of both the larger emergency response phase as well as the larger post disaster recovery phase, which includes the longer term rehabilitation phases of rehabilitation and reconstruction.

Although both pre-disaster and post-disaster phases comprise of different activities within the Cycles described, these Cycles can be said to be isomorphically similar because they all share the basic concept of engaging in

a wide set of activities before and after a disaster impact in order to lessen its eventual impact as well as deal with the effects of disaster impact. Thus although the entities (different activities within the various cycles) and causal mechanisms (those factors that cause a cycle to adopt development or engineering specific activities) being studied differ from each other, they still all share the basic principle that disasters and the management thereof comprises of a cycle of activities conducted before during and after a disaster impact.

Organisation	Phase	Characteristics of specific phase
University of Bradford: Disaster Research Unit (1975)	Warning	Warning issued to community before possible impact
	Disaster	Disaster occurs
	Relief	Activities that occur after disaster impact which aim to help community to regain its former level of functioning
	Rehabilitation	
	Reconstruction	
	Mitigation and prevention	Physical precautions and contingency plans formulated to lessen impact of disasters
	Preparedness for relief	Stockpile supplies for future relief efforts
FEMA (1979)	Mitigation	Activities to lessen loss of life and property during disasters

	Preparedness	Activities to ensure effective incident response, such as training, planning and organising are undertaken
	Response	Response, constitutes immediate actions to save lives, protect human property and meet basic human needs
	Recovery	Recovery includes both short and long-term activities to ensure that a society returns to its pre-disaster level of functioning
UNDRO (1992) Rapid onset cycle	Pre-disaster phases: Mitigation and Preparedness	Mitigation: actions taken prior to the occurrence of a disaster event including long-term risk reduction measures Preparedness: activities designed to minimize loss of life and damage and facilitation timely and effective rescue, relief and rehabilitation
	Disaster impact	Disaster strikes causing loss of life and property and infrastructure damage
	Post disaster phase: Relief, Rehabilitation and Reconstruction	Relief: Search for and save survivors, assure that basic human needs are met Rehabilitation: operations initiated that aim to restore a disaster struck community to its former living conditions Reconstruction: rebuilding of damaged infrastructure and restoration of all services like electricity and water supply, in order to completely restore a community to their pre-disaster state

UNDRO (1992) Slow onset cycle	Early warning Emergency Relief, mitigation and preparedness phases are the same as in rapid onset event an will not be discussed Rehabilitation	Early warning, emergency and relief phases conducted whilst slow onset event is occurring. Early warning: Monitoring of slow onset disaster event within a community Emergency: extraordinary steps are taken to support human needs, sustain livelihoods, and to avoid the onset of disaster Rehabilitation: step are taken to ensure that issues like resettlement and returnee programs are initiated
	Impact	Disaster event strikes
	Response	Measures taken prior to and following a disaster impact. Measures include evacuation and distribution of basic emergency supplies such as water.
	Recovery	Communities and nations are assisted in returning to their proper level of functioning following a disaster. Comprises of sub phases such as restoration, rehabilitation and reconstruction
	Development	Serves as a link between disaster-related activities and national development. Phase aims to ensure that disaster prevention forms part of larger national development policies
Asian Development Bank (1991)	Prevention	Actions are taken to impede the occurrence of a disaster event and/or prevent such an occurrence having harmful effects on communities or key institutions. Action can be of a social or physical nature

	Mitigation	Actions in this phase take the form of specific programs intended to reduce the effects of disaster on a nation or community
	Preparedness	Preparedness includes measures such as early warning systems, which enable governments, organisations, communities and individuals to respond rapidly and effectively to disaster situation
Foundation for Development Cooperation (2003)	Disaster, Response, Development, Prevention and preparedness phases similar to Asian Development Bank Cycle Separate Rehabilitation and Reconstruction phases	Rehabilitation: Aims to reestablish normal level of functioning within society following disaster. Reconstruction: Focuses on the reconstruction of crucial infrastructure following a disaster
Munich Personal RePEc/Government of India (2008/ s.a)	Emergency Response phase	Individual disaster response: Survivors of disaster impact secure personal safety and safety of others, provide first aid to other survivors and salvage survival supplies Response/Relief phase: Short term intervention which include activities such as search and rescue and providing for basic human needs following a disaster
	Post-disaster recovery phase	Rehabilitation: Medium term intervention, including the restoration of basic services and functions Reconstruction phase: Long term intervention include activities to ensure the full resumption of services, plus preventative measures

	Pre-disaster risk reduction	Mitigation: Risk assessments conducted and preventative measures are put in place to decrease impact of future disasters Preparedness: Activities initiated to ensure that community are better prepared for future disaster. Activities include contingency planning and improvement of early warning and evacuation systems
Department of Civil Engineering: North Carolina State University (2005)	Identification	Physical (roads, bridges) and Human infrastructure (Hospitals, fire stations) which are most vulnerable to disaster impacts are identified
	Prediction	Level of possible damage to identified, physical and human infrastructure is determined
	Mitigation, Preparation, Disaster event, Response and Recovery	All phases take on civil engineering orientation for example the elevation of houses above the flood plain during mitigation or sandbagging of certain areas during preparation phase

Table 5.2: Summary of Disaster Management Cycles

5.3 THE CONCEPT OF OPEN SYSTEMS AND CHANGES IN DISASTER MANAGEMENT CYCLES

In one of his pioneering works on General Systems Theory, Ludwig Von Bertalanffy (1973:39) identifies 2 types of systems, those that can be described as closed systems and those that can be described as open

systems. The most relevant of these 2 types of systems in the context of a discussion of Disaster Management Cycles, is the open system. Von Bertalanffy (1973:39) defines an open system as system that aims to achieve a "steady state" through maintaining itself in a continuous inflow and outflow of information, and building up and breaking down of components. This open system characteristic of building up and breaking down of components to reach a "steady state", can be observed throughout the history Disaster Management Cycles. It has led to the emergence of many different variations of the Disaster Management Cycle. The most prominent examples of the open system nature of Disaster Management Cycles are exemplified by the cycles presented by FEMA, UNDRO, The Asian Development Bank and Foundation of Development Cooperation and the University of North Carolina's Department of Civil Engineering.

In the case of the Disaster Management Cycle presented by FEMA, the inflow and outflow of information from the National Governors Association report played a major role in determining how FEMA's Disaster Management Cycle would be compiled (Donahue and Joyce, 2001:730). The report found that disaster management activities such as response, mitigation and preparedness, were often conducted as separate activities which often lead to ineffective response to disasters (National Governors Association, 1979:3). The report stresses the need for mitigation, response and preparedness measures to be conducted in a coordinated fashion and it also states FEMA should develop long-term recovery coordination programs (National Governors Association, 1979:3). If one takes a look at the Disaster Management Cycle presented by FEMA, those phases recommended by the National Governors Report (mitigation, preparedness, response and recovery) form its key components. Thus it is clear, that the inflow of information from the National Governors Report broke down the original disjointed conception and approach to the management of disaster. Therefore a new, more integrated approach was proposed which in turn influenced how FEMA would develop their Disaster Management Cycle.

If one was to compare the Disaster Management Cycles proposed by UNDRO with that of FEMA, it is already possible to observe a deviation caused by a different information inflow and outflow. With regards to the rapid-onset Disaster Management Cycle proposed by UNDRO, the cycle identifies 3 distinct phases directly involved with long and short-term recovery of a society following a rapid-onset disaster. Whilst the FEMA cycle is similar with regards to 2 of these phases, which are response (relief) and recovery (rehabilitation), the FEMA cycle does not dedicate a separate phase only focusing on reconstruction efforts, such as the case with the UNDRO rapid-onset cycle. The dedication of a single phase to reconstruction could have much to do with the type of hazard involved, which in this case are rapid-onset disaster events such as hurricanes and tsunamis. Rapid-onset events generally cause significantly more damage to infrastructure than slow-onset events, and therefore UNDRO had to ensure that reconstruction efforts receive necessary attention (UN Chronicle, 1991). What should be clear is that the UNDRO rapid-onset disaster cycle breaks up the concept of recovery (rehabilitation) into a smaller, but more specific and relevant conception of recovery for the specific type of disaster (rapid-onset disaster) involved.

The trend of adapting the Disaster Management Cycle to the type of hazard involved is continued in the slow-onset Disaster Management Cycle proposed by UNDRO. In this UNDRO cycle, an early warning and emergency phase is added and a reconstruction phase is removed. The phases of warning and emergency were specifically added because they allow for the constant monitoring (early warning phase) and provision for basic human needs (emergency phase) as the disaster occurs. The reconstruction phase was also removed from this cycle because slow-onset disasters such as droughts do not effect infrastructure to the degree that rapid-onset disasters would.

The Cycles presented by the two Social Development based organisations (The Asian Development Bank and Foundation for Development Cooperation) show signs of building up and breaking down of components in their respective cycles. Importantly, both also have an added development phase included in their illustration of the Disaster Management Cycle. This development phase is probably added due to the developmental context in which both these organisations conduct their activities or even the developmental goals of the specific organisation involved. Yet both cycles also have a unique adaptation because of information inflows and outflows, relating to the specific developmental needs of the society in which it is implemented. Consequently these information inflows and outflow influence the adaptations of the Disaster Management Cycle. In the case the Asian Development Bank Disaster Management Cycle, separate phases are described for the activities of mitigation and prevention. In the earliest cycle described by the University of Bradford (1975), these 2 phases were bracketed as one distinct phase and the cycles that follow (FEMA and UNDRO cycles) incorporate prevention activities into the mitigation phase. In the case of the cycle presented by the Foundation for Development Cooperation the recovery (or rehabilitation phase) is divided into 2 distinct phases, which are rehabilitation (which focuses on the community) and reconstruction (which focuses on the rebuilding of infrastructure). It could be that by dividing the recovery phase in this manner the organisation involved can ensure that both forms of rehabilitation, societal and physical, receive equal attention following a disaster.

In the cycle presented by Munich Personal RePEc and the Government of India, the Disaster Management Cycle is broken up into overarching phases and sub-phases. The first of these overarching phases is the post disaster phase, which includes the traditional phase of relief but also the additional phase of individual disaster response. The post-disaster recovery phase is divided into distinct phases for short-term and long-term recovery of society, the former being represented by the rehabilitation phase and the later by the reconstruction phase. In the final pre-disaster mitigation and preparedness

phase, preventative actions are assimilated into the mitigation phase and preparedness continues to be a distinct phase.

The final cycle produced by the Department of Civil Engineering at North Carolina State University also illustrates the open system nature of the concept of the Disaster Management Cycle. In the specific cycle 2 unique phases, identification and prediction get added to the Disaster Management Cycle. These phases get added because of the civil engineering orientation of the academic department involved. In this cycle the reconstruction of buildings and utilities are also not divided into a separate reconstruction phase, but rather the form part of a single recovery phase. Importantly in this cycle, an additional civil engineering orientation is added to all the phases presented, consequently all the phases take on a civil engineering characteristic.

5.4 THE PRESENCE OF EQUIFINALITY IN DISASTER MANAGEMENT CYCLES

Apart from illustrating that the concept of the Disaster Management Cycle can be regarded as an open system that is subject to change due to the inflow and outflow of information from the environment in which it functions, the previous section also contains examples of the concept of equifinality. This concept forms part of the theory of open systems as presented by Von Bertalanffy (1950:157-159). According to Von Bertalanffy, equifinality relates to the assumption that within an open system the same final state can be reached from different initial conditions and in different ways (Von Bertalanffy, 1950:157-159; Kast and Rosenzweig, 1972:450; Whitchurch and Constantine, 1993:333).

In the case of Disaster Management Cycles, the final state to be reached can be regarded as the concept of presenting models to manage disasters and

their impacts in an effective manner. This final state can be reached from different initial conditions and in different ways. In the context of the research already conducted the different initial conditions is represented by the field of specialisation that the organisation or institution is involved. Examples such as pre-planning for disasters (The University of Bradford: Disaster Research Unit), social development (Asian Development Bank and Foundation of Development Cooperation) or civil engineering (Department of Civil Engineering: North Carolina State University) illustrates this point. From these initial conditions, interaction with the environment occurs, where these initial conditions interact with established concepts relating to disaster phases such as those presented by linear disaster phases. Interaction also occurs with prerogatives calling for the need for normative models to manage disasters in the form of Disaster Management Cycles. The effect of this interaction leads to the creation of normative Disaster Management Cycles that incorporate isomorphically similar phases as those found in linear disaster phases, but with variations that are specific to the organisation or institution involved. Thus from different initial conditions and in different ways all institutions such as The University of Bradford: Disaster Research Unit, Asian Development Bank and Foundation of Development Cooperation and the Department of Civil Engineering: North Carolina State University all reach the same final state of presenting a cyclical model to manage disasters and their impacts. This process also demonstrates the General Systems Theory concept of system synthesis because information from the organisation and information from environment are integrated into a system in the form of a Disaster Management Cycle, in order to facilitate its performance.

5.5 FEEDBACK ARRANGEMENTS IN EXPLAINING ORIGINS AND VARIATIONS IN DISASTER MANAGEMENT CYCLES

Feedback arrangements, especially extrinsic feedback (*Figure 2.2*) serves as particularly relevant analysis mechanism within the study of Disaster Management Cycles. It illustrates how external factors contributed to the

creation of cycles as well as how external factors contributed to the creation of various adaptations of the Disaster Management Cycle. In this regard extrinsic feedback models explain the process whereby outputs from a system crosses the system boundary, becomes modified through its interaction with the environment before re-entering the system. The effects of the interaction between system outputs and the external environment will be explained as it relates to cycle origins and adaptations.

The feedback model can be applied to Disaster Management Cycles in the following manner. Inputs into the system is represented by the various descriptive studies (from differing scientific fields) conducted from Prince (1920) to Stoddard (1968) on disasters and their related phases. The system can be represented as the accumulated body of knowledge on linear disaster phases. This body of knowledge is characterised by its descriptive nature. This is due to the fact that all studies conducted from the work of Prince in 1920 untill the work of Stoddard, only describe the various phases associated with a disaster and do not describe how a disaster should be handled as is the case in normative, Disaster Management Cycles. These linear, descriptive conceptions of disasters and the particular phases involved interacted with the external environments. In the early 1970s this external environment was especially filled with the need for normative models that could assist in the effective management of disasters and their consequences. This need for normative models could have been brought about by the frequency in instances as well as damage caused by disasters from the 1970s onwards. Due to its exposure to the changing needs of the external environment, descriptive linear models about disaster phases evolved into normative models for the management of disasters, which is the case with Disaster Management Cycles. The necessity to use normative Disaster Management Cycles as a tool to manage disasters and their consequences are re-laid to create new inputs with a normative inclination.

In the case of explaining different variations of Disaster Management Cycles that have appeared since the 1970s, the feedback model can be illustrated in the following fashion. Input into the system can be represented by the need to use normative Disaster Management Cycles to address the increased instances of and damages caused by disaster events. The system itself is represented by the organisation itself, whether academic institutions (University of Bradford: Disaster Research Unit or North Carolina State University 's Department of Civil Engineering), development organisations (like the Asian Development Bank and the Foundation for Development Cooperation) or institutions of local or international governance (such as FEMA, UNDRO and the Government of India).

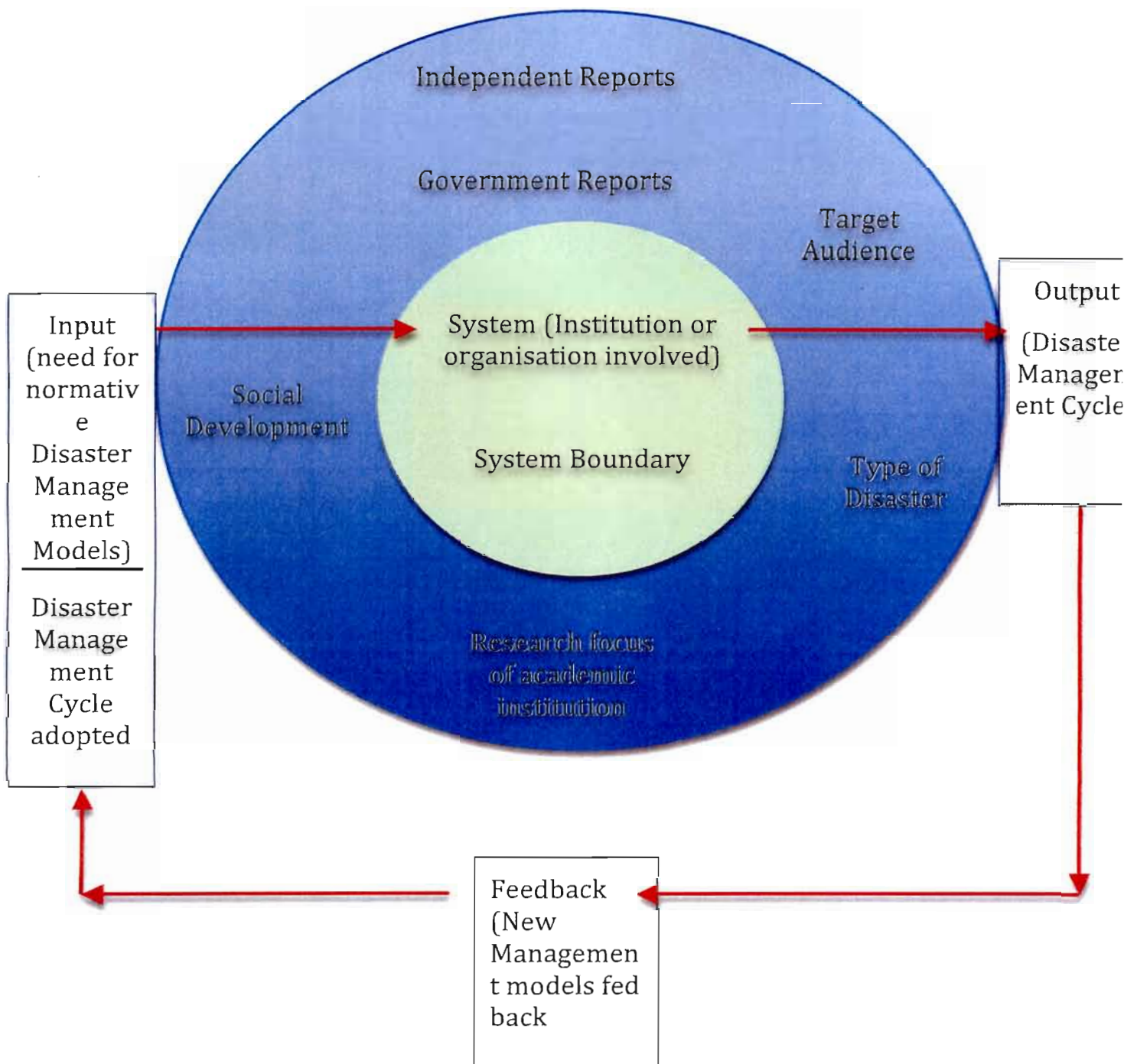


Figure 5.1: Intrinsic Feedback model of Disaster Management Cycle origins

All of these organisations function in certain specific contexts, which represent the external environment. Within the external environment many factors exist which shape the way the Disaster Management Cycle is implemented within the specific organisation. Some examples of such external factors found in the

literature include, independent reports (FEMA cycle), the type of disaster involved (UNDRO cycles) the focus of the academic department involved (University of Bradford Disaster Cycle and North Carolina State University) or the developmental requirements of the environment in which the organisation function (Asian Development Bank and the Foundation of Development Cooperation). The final external factor that can be identified is the target audience for whom the cycle is intended. In the case of the cycle adopted by the Government of India and Munich Personal RePEc, the specific cycle was adopted as to inform parliamentarians and insurance brokers respectively on how disasters should be handled. Both of these groups might not be familiar with disaster phases and when these phases should be conducted, as such the specific cycle delineates Disaster cycles into 3 main phases and specific sub-phases. All the inputs from the external environment change the original input into the system, thereby creating cycles that are organisation specific. The organisation specific cycle gets fed-back to form the new input into the system as the chosen cycle whereby the organisation will manage disasters.

5.6 CONCLUSION

This chapter has established that the origins of the Disaster Management Cycle concept can be traced back to earlier research into linear disaster phases conducted by researchers such as Prince (1920), Carr (1932) and Powell (1954). These earlier studies established key terms such as relief, rehabilitation and emergency. Through the application of the General System Theory concept of isomorphisms it was established that some of these basic concepts with regard to disaster phases established by earlier linear disaster phase research, continued to be present in the formulation of Disaster Management Cycles. The presence of isomorphically similar concepts indicates an interaction between the concepts of linear disaster phases and Disaster Management Cycles, which reiterates the influence of linear disaster phase research on the origins and development of the Disaster Management Cycle.

The influence of the earlier linear disaster phase studies on the origins of the Disaster Management Cycle was visually illustrated by means of feedback arrangements. Inputs into the system was represented by the various descriptive studies (from differing scientific fields) conducted from Prince (1920) to Stoddard (1968) on disasters and their related phases of human response. The system was represented as the accumulated body of knowledge on linear disaster phases. This body of knowledge was characterised by its descriptive nature. These linear, descriptive conceptions of disasters and the particular phases involved interacted with the external environments, which in the early 1970s was especially filled with the need for normative models that could assist in the effective management of disasters and their consequences. Due to its exposure to the changing needs of the external environment, descriptive linear models about disaster phases got changed into normative models for the management of disasters, which is the case with Disaster Management Cycles. The necessity to use normative Disaster Management Cycles as a tool to manage disasters and their consequences got fed back to create new inputs with a normative inclination.

It has also been established that Disaster Management Cycle has since its inception 1970s been exposed to various context specific changes. These context specific changes can be ascribed to the open systems nature of the Disaster Management Cycle concept. This open systems characteristic of building up and breaking down of components to reach a “steady state” can be observed throughout the history Disaster Management Cycles and has led to the emergence of many different variations of the Disaster Management Cycle. The most prominent examples of the open system nature of Disaster Management Cycles are exemplified by the cycles presented by FEMA, UNDRO, The Asian Development Bank and Foundation of Development Cooperation and the University of North Carolina 's Department of Civil Engineering. In all of the instances mentioned the cycle phases were adjusted (or in some instances new phases added) in order to meet the contextual

requirements of the organisation involved. Thus for example an organisation like the Asian Development Bank included a distinct development phase into their adaptation of the cycle because it is a relevant to the context in which they function, such a development phase is not added in other cycles (FEMA, UNDRO) because it is not relevant to their specific context.

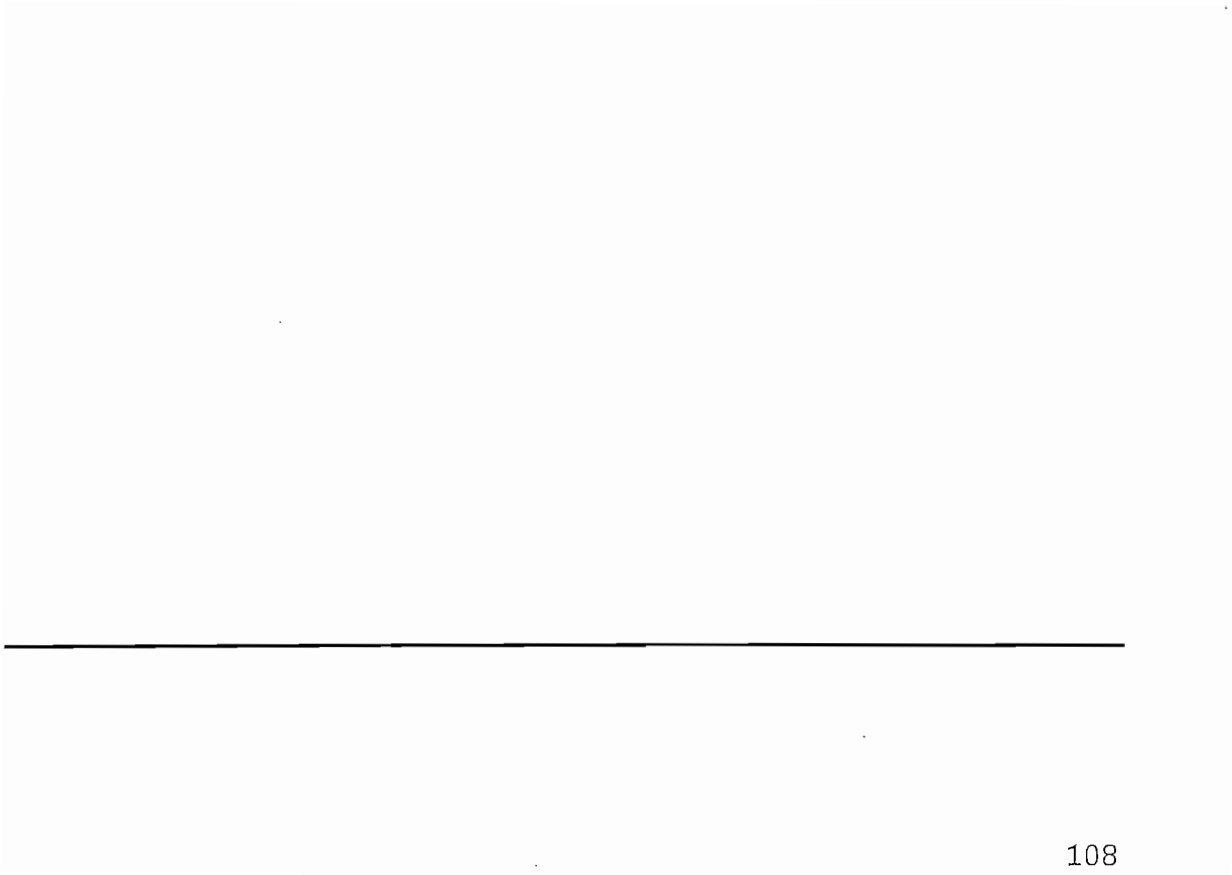
Feedback models were also used to illustrate the different variations of Disaster Management Cycles that have appeared since the 1970s, the feedback model was illustrated in the following fashion. The input into the system can was represented by the need to use normative Disaster Management Cycles to address the increased instances of and damages caused by disaster events. The system itself was represented by the organisation itself, be it academic institutions such as the University of Bradford: Disaster Research Unit or North Carolina State University 's Department of Civil Engineering, development organisations like the Asian Development Bank and the Foundation for Development Cooperation or institutions of local or international governance such as FEMA, UNDRO and the Government of India. All these organisations function in certain specific contexts, which represent the external environment. Within the external environment many factors exist which shape the way the Disaster Management Cycle is implemented within the specific organisation. Some examples of such external factors included independent reports, government reports, social development, type of disaster and research focus of the academic institution. All the inputs from the external environment changed the original input into the system, thereby creating cycles that were organisation specific. The organisation specific cycle gets fed-back to form the new input into the system as the chosen cycle whereby the organisation will manage disasters.

It was found that much of the changes that have occurred in the Disaster Management Cycle concept over several decades could be ascribed to the specific contexts in which the cycle was created as well as the open system

nature of Disaster Management Cycles. With regards to the open system nature of Disaster Management Cycles it was found that the continuous inflow and outflow of information, and building up and breaking down of components has led to many context specific changes and consequently the emergence of many different variations of the Disaster Management Cycle. The changes brought about by the open system nature of Disaster Management Cycles is most clearly visible in the cases of cycles presented by development organisation and academic institutions. Phases such as development (in the case of development organisations) and identification and prediction (in the case of the cycle presented by the Department of Civil Engineering at North Carolina State University) got added to the Disaster Management Cycle, which did not traditionally form part of phase terminology.

In some cases it was found that the presentation of cycles was changed without incorporating newly created disaster phases. Thus existing phase terminology was still being used but was presented in differing ways to suite the specific context. In this regard the cycle presented by FEMA only utilised four traditional phases (response, mitigation, preparedness and recovery) to serve as the optimal combination of phases to address increased instances of disaster as well as rising personnel and equipment costs and in the case of the cycles presented by UNDRO traditional phases was arranged in such a manner as to create two unique cycle, of which one could be applied in the case of rapid onset event and the other in slow-onset events.

This chapter has established that through the application of general system theory concepts that it is possible to provide answers to how the Disaster Management Cycle was developed, how it is applied in different contexts and how it has changed since it inception in the early 1970's. The following chapter provides a more in-depth look at the conclusions and recommendations of the research conducted. These conclusions will be discussed according to the research questions posed for the study and will include a brief summary of the findings relating to the research objectives.



CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The Disaster Management Cycle has been a crucial instrument for the management of disaster events and their affects for at least 30 years (Neal, 1997:260; Baird *et al*, 1975:42; Kelman, 2009; Lewis, 2007). Yet many scholars and practitioners within the field still debate it's origins, leading to much confusion within the field of disaster management research. This confusion is further augmented by die numerous variations that have appeared since the cycle's inception as disaster management tool.

The following chapter provides conclusions and recommendations of the research conducted. The conclusions are discussed according to the research questions posed for the study, and will include a brief summary of the findings relating to the research objectives.

6.2 CONCLUSIONS

Although Disaster Management Cycles only appeared in physical format in the 1970s the study has found that the origins of the Disaster Management Cycle can be traced back to early disaster phase research, which focused on human behaviour following disaster events. Much of this early research was based in the field of Sociology although some studies into phases of disaster was also conducted within the fields of Geography, Anthropology and Psychology. The studies based in the field of Sociology were the most prominent during the early years of disaster phase research and also received most of the funding assigned to the research field following the end of World War II.

These phase models were developed to assign order and rationality to the complex reality of natural and technological disasters, and human responses to them. These early studies described the phases of human response to disaster events in a linear fashion. Both the earliest and the most influential example of such a study is the 1920 study of Prince on the societal response and changes in Halifax, Canada after a massive explosion following the collision of two ships in Halifax harbour. Prince's work was so influential that it served as the basis of the disaster research tradition that evolved following the publication of his pioneering work and subsequent studies conducted by Carr (1932), Powell (1954), Chapman (1962) and Stoddard (1968), built and expanded on the conceptual base that was laid down by Prince by establishing phase ideas like emergency, relief, recovery and rehabilitation, all of which could be observed in later Disaster Management Cycles.

This link between linear disaster phase concepts and Disaster Management Cycles was explored by using General System Theory. In this regard by applying the General System concept of isomorphisms it was found that some of the basic concepts with regard to disaster phases established by earlier linear disaster phase research, continued to be present in the formulation of Disaster Management Cycles. As a consequence of this relation it can be argued that the Disaster Management Cycle has its origins in the work of researchers such as Prince (1920), Carr (1932) and Stoddard (1968).

This relation between linear disaster phase research and Disaster Management Cycles was illustrated by means of the General System Theory concept of Feedback arrangements. Inputs into the system is represented by the various descriptive studies (from differing scientific fields) conducted from Prince (1920) to Stoddard (1968) on disasters and their related phases of human response. The system can be represented as the accumulated body of knowledge on linear disaster phases. This body of knowledge is characterised by its descriptive nature, which is due to the fact that all studies conducted from the work of Prince in 1920 up and till the work of Stoddard only describe the various phases associated with a disaster and do not describe how a

disaster should be handled as is the case in normative, Disaster Management Cycles. These linear, descriptive conceptions of disasters and the particular phases involved interacted with the external environments. In the early 1970 this external environment was especially filled with the need for normative models that could assist in the effective management of disasters and their consequences. This need for normative models could have been brought about by the increase in instances as well as damages caused by disasters from the 1970s onwards. Due to its exposure to the changing needs of the external environment, descriptive linear models about disaster phases got changed into normative models for the management of disasters, which is the case with Disaster Management Cycles. The necessity to use normative Disaster Management Cycles as a tool to manage disasters and their consequences was used as feedback to create new inputs with a normative inclination.

From its inception as a tool for the management of disaster events in the early 1970s, the Disaster Management Cycle has been adapted by various countries and organisations to suite their individual needs (Carter, 1991:59). This was found to be especially applicable to the cases involving academic institutions and development organisations.

In the case of cycles presented by academic institution such the University of Bradford: Disaster Research Unit and that Department of Civil Engineering: North Carolina State University, the academic focus of the department involved played a major role in determining which phases and activities would comprise their individual cycles. Consequently the University of Bradford cycle incorporates phases and activities that advanced the philosophy of pre-planning that permeated the Disaster Research Unit at the time of the cycle's creation and North Carolina State University cycle incorporates civil engineering phases and activities due to the fact that it was created by the Universities Department of Civil Engineering.

By the 1990s organisation involved in international development practices such as the Asian Development Bank and the Foundation of Development Cooperation Cycle also started to produce Disaster Management Cycles. These cycles were unique in the sense that they incorporated distinct development phases, which aimed to reduce social vulnerability to disasters through developmental programs. These development phases provided a link between disaster-related activities and national development. In the case of the Asian Development Bank cycle was seen as necessary to ensure that the results of disaster are effectively reflected in future policies in the interest of national progress. The phase is also included to ensure that national policy does not create further disaster problems, nor exacerbate existing ones.

Context also played a significant role in the other cycles presented. The Disaster Management Cycle proposed by FEMA was greatly influenced by the 1979 National Governors Association Report on emergency preparedness. The report identified preparedness, response, mitigation and recovery as the optimal combination of phases to address increased instances of disaster as well as rising personnel and equipment costs. Thus by using these four identified phases it was felt resources (human and material) would be optimally utilised to improve response and planning with regards to disasters in the United States. It was also found that the type of disaster, be it a slow-onset disaster or rapid-onset disaster influences the composition of a Disaster Management Cycle. In this regard UNDRP developed two separate Disaster Management Cycles, one for rapid onset events (Figure 4.3) and one for slow onset disaster events (Figure 4.4).

How cycles are applied in different contexts was explored by the application of the General Systems Theory concept of equifinality. Equifinality relates to the assumption that within an open system the same final state can be reached from different initial conditions and in different ways. In the case of Disaster Management Cycles, it was found that the final state to be reached can be regarded as the concept of presenting models to manage disasters and their

impacts in an effective manner. This final state can be reached from different initial conditions and in different ways. In the context of the research already conducted the different initial conditions is represented by the field of specialisation the organisation or institution is involved in such a pre-planning for disasters (The University of Bradford: Disaster Research Unit), social development (Asian Development Bank and Foundation of Development Cooperation) or civil engineering (Department of Civil Engineering: North Carolina State University). From these initial conditions, interaction with the environment occurs, where these initial conditions interact with established concepts relating to disaster phases such as those presented by linear disaster phases, interaction also occurs with prerogatives calling for the need for normative models to manage disasters in the form of Disaster Management Cycles. The effect of this interaction leads to the creation of normative Disaster Management Cycles that incorporate isomorphically similar phases as those found in linear disaster phases, but with variations that are specific to the organisation or institution involved. Thus from different initial conditions and in different ways all institutions such as The University of Bradford: Disaster Research Unit, Asian Development Bank and Foundation of Development Cooperation and the Department of Civil Engineering: North Carolina State University all reach the same final state of presenting a cyclical model to manage disasters and their impacts.

It was found that much of the changes that have occurred in the Disaster Management Cycle concept over several decades could be ascribed to the specific contexts in which the cycle was created (see point 6.3) as well as the open system nature of Disaster Management Cycles.

With regards to the open system nature of Disaster Management Cycles it was found that the continuous inflow and outflow of information, and building up and breaking down of components has led to many context specific changes and consequently the emergence of many different variations of the Disaster Management Cycle. The changes brought about by the open system nature of Disaster Management Cycles is most clearly visible in the cases of

cycles presented by development organisation and academic institutions. Phases such as development (in the case of development organisations) and identification and prediction (in the case of the cycle presented by the Department of Civil Engineering at North Carolina State University) got added to the Disaster Management Cycle, which did not traditionally form part of phase terminology.

In some cases it was found that the presentation of cycles was changed without incorporating newly created disaster phases. Thus existing phase terminology was still being used but was presented in differing ways to suite the specific context. In this regard the cycle presented by FEMA only utilised four traditional phases (response, mitigation, preparedness and recovery) to serve as the optimal combination of phases to address increased instances of disaster as well as rising personnel and equipment costs and in the case of the cycles presented by UNDRO traditional phases was arranged in such a manner as to create two unique cycle, of which one could be applied in the case of rapid onset event and the other in slow-onset events.

Finally through the use of an extrinsic feedback model it was illustrated how external factors such independent reports (FEMA cycle), type of disaster (UNDRO), focus of the academic department (University of Bradford Disaster Cycle or North Carolina State University) the developmental environment (Asian Development Bank and the Foundation for Development Cooperation) and the indented target audience (Government of India and Munich RePEc) shaped the way the Disaster Management Cycle is implemented within the specific organisational context.

6.3 RECOMMENDATIONS

Many fields such as sociology, geography, psychology, civil defence, public administration and development studies have over time influenced the development of the field of Disaster Risk Management. As a consequence management tools such as Disaster Management Cycles as well as conceptual terminology related to the field are often complex to understand, and even harder to apply in practice. To solve the problems faced by scholars and practitioners in deciphering and applying the concepts and tools of the field it is recommended that systems approaches are applied more often, especially in the research context. By applying these systems approaches to the study of Disaster Risk Management issues, it will enable researchers to focus on the individual components as well as the relationship between the components that comprise a certain terminology or tool, which will in turn contribute greatly to understanding of those tools and terms that form the core of the field of Disaster Risk Management.

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