

A QUALITATIVE APPROACH TO FINANCIAL RISK

by

Jason Patrick Shedden

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Study leader: Prof. D G Gouws

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Abstract

Research indicates that the dynamics and complexities driving and challenging business organisations in the current era have increased exponentially in the recent past. As a result more complex demands are being placed on organisations to adapt to an ever-changing environment. This adaptation to change is demanding more flexible structures capable of enduring the dynamics of current market risks.

This research proposed that such endurance is possible by reconsidering the current paradigm that governs an understanding of risk. It is proposed that risk to date has been focused on a quantitative perception. In the light of this a comprehension from a qualitative perspective is proposed.

This comprehension will then permit concepts from a number of diverse disciplines to be incorporated into an alternative paradigm on risk. As such a more creative approach to understanding risk can be presented.

This dissertation will focus on introducing creativity into the current understanding of risk in a bid to produce a qualitative risk model capable of not only defining an alternative definition of risk but also providing solutions to managing risk. In this manner, it is proposed that a trend toward a more flexible organisational structure will arise and a comprehension of risk that is more in keeping with current economic trends will result.

CHAPTER 1

INTRODUCTION

Thus the task is not so much to see what no one yet has seen, but to think what nobody yet has thought about that which everybody sees (Schopenhauer in Wheatley)

1.1 Introduction

“We live in a moment of history where change is so speeded up that we begin to see the present only when it is already disappearing (Laing in Olson & Eoyang 2001:xiii). This is a harsh reality depicting a truth about an era in time in which the only key to survival lies within the ability of an organisation to adapt to change. Despite this awareness, “when we look around our natural environment, we see continuous change...and yet our business organisations seem to be incapable of dealing with change” (Capra 2002:87). This is because organisations are emerging from an era dominated by Newtonian paradigm (Wheatley 1994) in which the business models proposed in the past no longer possess the flexibility to cater for the present. This inflexibility is largely a result of old risk management styles. Pike (2001:xi) states that “risk management has undergone an evolution over the years. The old style of risk management was a reactive-type by way of minimizing risks to assets by insuring as much as possible...” In the current era it is no longer feasible to insure all things possible as the business environment has become too complex. For this reason, the approach of bracing companies to withstand any type of risk event is no longer feasible. Instead, “we will need much greater flexibility of ideas, because economic patterns keep changing and evolving and hence cannot be described adequately except in a conceptual framework that itself is capable of change and evolution” (Capra 1983:435). For this framework to be achieved, a move away from a reactive, defensive approach toward risk is needed and instead a proactive approach in which risk is embraced is required. This implies that organisations should no longer have rigid structures but rather evanescent boundaries.

It is proposed that the first step toward a change in risk paradigm begins by abandoning the old. Specific to this is the notion of risk being a largely quantitative construct. Organisations and people forget that numbers are only tools and have no soul (Bernstein 1996). A focus toward the qualitative aspects of risk should be considered. As will be shown, in this way organisations will be better equipped to cope with the dynamics of change, the consequence of which is a greater flexibility and freedom to embrace the characteristics that are proposed to define present-day risk and a heightened ability to survive.

A second approach toward a change in risk paradigm can be achieved through understanding. For this to take place, it is necessary to propose a degree of detail in terms of the characteristics that constitute qualitative risk. As this dissertation progresses, such detail will be provided and will take the form of insight into the mechanics that define the characteristics of qualitative risk being put forward. The purpose of this is to present a level of comprehension that will allow for a better knowledge of the subject matter at hand. The intention of such knowledge is to stimulate new ways of thinking and to reveal features of risk not commonly considered. Such features include:

- The fact that risk exists only because humans exist
- That risk is a totally mental construct and as such attains significance only in the presence of the human mind
- That risk is largely correlated to uncertainty within the human being
- That risk is not a static property, but rather an evolving structure that takes on new shape and form depending on the manner and context in which information is perceived
- That information is the key to managing risk
- That risk is a necessary catalyst within natural and organisational structures in order to survive
- That risk is not a rival of organisational success, but rather an ally.

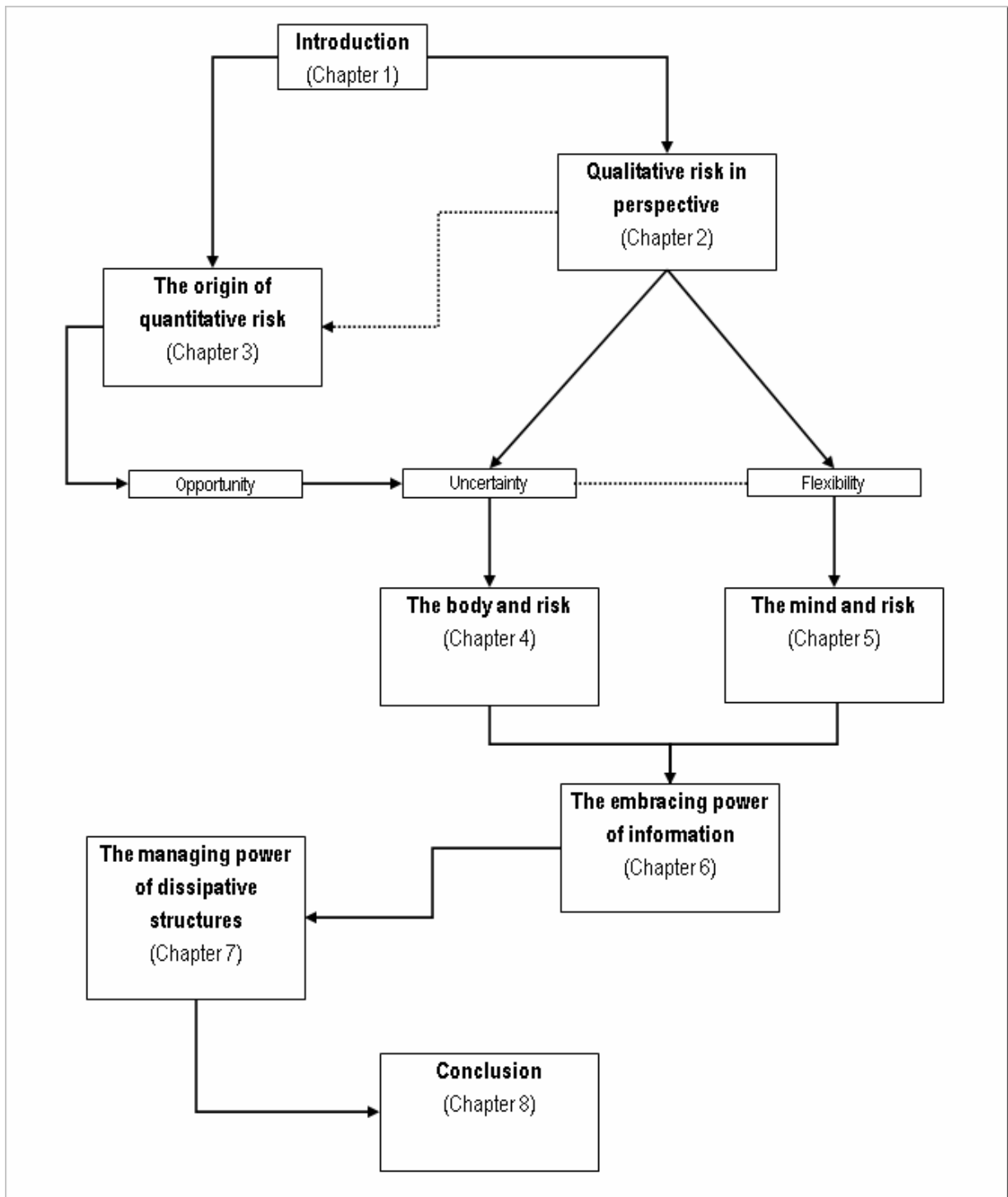
The end result of this dissertation will be a broad overview of qualitative risk and will place into perspective the importance of qualitative risk in relation to the human being. Such a broad

overview will incorporate a multidisciplinary approach and as such will consider literature from a number of academic fields. A brief look into the mechanics of ecology, the origin of risk, the physiology of the human body, the structure of the human mind, the science of information and the principles of dissipative structures will constitute the foundation for this multidisciplinary approach.

The approach to this dissertation is based fundamentally on natural principles as can be found in everyday existence. The first reason for this is that many natural structures exude the characteristics of life which provide the best examples about change (Wheatley & Kellner-Rogers 1998). As survival in today's business environment is so closely correlated to the ability an organisation has to adapt to change, understanding the mechanisms and processes capable of achieving this, is fundamental. The second reason is that nature provides endless insight into the qualitative characteristics of risk. Such insight contains an array of examples, properties and qualities that define and contribute toward an alternative paradigm of risk.

The philosophy of this dissertation is "not so much to see what no one yet has seen, but to think what nobody yet has thought about that which everybody sees" (Schopenhauer in Wheatley & Kellner-Rogers 1996: front page). For this to be achieved, a call is made for all previous perceptions of risk to be abandoned and a new, creative approach to the understanding risk be embraced.

Figure 1.1 - A conceptual understanding of the dissertation



Source: Own observation

Figure 1.1 provides a conceptual understanding of this dissertation. Chapter 1 serves to introduce the dissertation by providing a background into the nature and reasons behind the study. Chapter 2 introduces the concept of qualitative risk using ecological systems as a basis to work from. In Chapter 3 the origins of quantitative risk are provided and the notion of how it engendered opportunity within the human race is put forth. This notion of opportunity ties in with the fundamental principles of risk alluded to in Chapter 2 to form the basis of discussion for Chapter 4. Chapter 4 considers the implications of opportunity for humans and relates these implications through consideration of the physiology of the human body in order to substantiate the first fundamental qualitative principle of risk, namely uncertainty. Chapter 5 in turn serves to substantiate the second fundamental principle of qualitative risk, namely flexibility. Upon completion of an understanding of these two principles, Chapter 6 links and relates them to risk through the use of information. The end result of Chapter 6 is a comprehensive and contextual understanding of qualitative risk. Chapter 7 then proposes a natural principle capable of managing such qualitative principles which in turn form the basis of a model for qualitative risk. Chapter 8 concludes the dissertation by summarising using this model.

1.2 The problem statement

1.2.1 The management dilemma

The current methods of risk analysis employed in organisations have served a valuable purpose. Given the dynamics inherent in business environments at present, an additional need has arisen to identify and describe further risk models capable of adapting to rapid change. In this regard the following challenges are proposed:

- i. A large majority of risk models developed to date depend on quantitative analysis, which in itself is incapable of the kind of adaptation dynamics required by organisations today. "It is one thing to set up a mathematical model that appears to explain everything. But when we face the struggle of daily life, of constant trial and error, the ambiguity of the facts as well as

the power of the human heartbeat can obliterate the model in short order” (Bernstein 1996:6). From this a clear management dilemma can be identified, namely that the old quantitative paradigm of risk lies vulnerable and exposed to the more qualitative aspects inherent in people. “... People are as much prone to risks which can impact adversely on a business as are the hard assets owned by the business. What is more, whilst hard assets and people assets are both prone to physical risk, people assets are also subject to the additional dimension of non-physical risks” (Pike 2001:x). A need is therefore identified to deal with the aspect of people and non-physical risk within a risk model so as to circumvent the shortfalls associated with a purely quantitative risk focus. This implies an inclination toward a greater consideration of the more qualitative (non-physical) characteristics that constitute risk.

- ii. In relation to the above, a second theme relating to the management dilemma is identified, namely that of managing change. The reality shaping organisations today is that as pressures related to competition intensify, “South African companies will be obliged to make rapid organisational and cultural changes, and these can only be affected through the agency of people” (Carrell, Elbert, Grobler, Hatfield, Marx & Van der Schyf 1997:4). This once again relates the importance of people and a need to understand qualitative risk, however, it does so in context of a need to adapt to change. “Organisations must be able to recognise environmental changes, re-engineer themselves on the spot, and respond...” (Olson & Eoyang 2001:xxxii). In the light of this, as well as that which is proposed in i. above, a risk model is called for that is not only capable of accommodating the qualitative (non-physical) aspects of risk, but also of accommodating the demands associated with change such as embracing uncertainty and engendering flexibility.
- iii. It has been identified that the construct of risk needs to be placed into perspective. By this it is intended to shown that risk is in essence a human construct. Pike (2001:x) says of qualitative risks that “the bad news is that about 90 per cent of them are caused by people’ minds. The good news is also that about 90 per cent of them are caused by people’s

minds.” It is necessary to qualify this statement in more detail so as to bring about a new understanding of risk. The intention of this is to show that risk is in essence a human construct and exists only because the human mind exists. By showing this to be true, it is possible to expose an aspect of risk that will form the foundation stone for further academic debate. Such debate will be guided toward a more qualitative focus of risk and as such will stimulate an area of thought needed in order to advance further understanding. Such guided thought will bring about a better balance in the current approach to risk in that it will permit the notion of risk to be considered as having two fundamental halves, namely a quantitative and qualitative half.

- iv. In proposing risk to be a human creation, understanding the role of information becomes paramount. The importance of it relative to its contribution into both the formation as well as management of risk needs to be considered. It is proposed that not enough emphasis has been placed on the importance of information and the bridge it forms between risk and reality. Fundamental characteristics of information need to be considered and placed into perspective relative to qualitative risk so as to expose this suggested importance.

1.2.2 The consequence of the management dilemma

The consequence of the management dilemma can be summarised in the context of paragraph 1.2.1 above, namely “... Unless businesses continue to have a soul, most will eventually founder” (Pike 2001:xii). An attempt to understand risk from a qualitative perspective can be regarded as an attempt to reintroduce soul back into organisations. By focusing on the softer aspects that define currentday risk, a trend is put into place that strives to perpetuate organisations toward a path of continued existence.

A second consequence of the management dilemma relates to failure to adapt to change. An inability to adapt to change within an organisation can result in its overall demise. This is evident by the fact that change is a fundamental characteristic of today’s market conditions (see paragraph

1.1). If organisations cannot develop risk strategies capable of evolving accordingly, then organisations cannot achieve the flexibility required to survive. For this to be done, it is imperative to start recognising the human aspect associated with risk.

The benefit of recognising the human aspect associated with risk lies in the following: “Any realistic discussion of changing the game must begin with the recognition that... the current form of economic globalization has been consciously designed and can be reshaped” (Capra 2002:185). By placing qualitative risk into the context of it being a human creation, it is possible to achieve recognition and understanding of the fact that risk is a conscious construction of the mind. This form of recognition permits a change in paradigm allowing for openness and consideration toward solutions directed at “changing the game”.

The last consequence of the management dilemma relates to information. It is proposed that failure to understand the notion of information results in failure to survive. This is simply because ignorance toward the very dynamic property capable of determining organisational failure or success, exists and that within this ignorance lays an organisation’s demise.

1.2.3 The benefits of researching the management dilemma

A number of benefits have been identified relative to researching the management dilemmas. Such benefits can be summarised as follows:

- i. The most important benefit of researching the management dilemma is that it plants a seed. By this it is implied that once the notion of qualitative risk is put forward a possibility exists for further academic debate. Such debate opens the pathway for new creative ways of thinking which in itself possesses the potential to engender a significant contribution to science.
- ii. Understanding risk from a qualitative perspective will permit the softer, more people-related issues to be factored into models defining organisational risk. In a market of change it is

proposed that the flexibility to adapt lies not with the inanimate assets available as resource, but rather with the animate assets such as people.

- iii. Researching the management dilemmas will bring about a change in current risk perception. Such a change will shift focus away from the fact that risk is a quantitative construct and will bring about a more balanced perspective. Balance in this sense is the sum of both quantitative and qualitative aspects. In addition by focusing on the importance of the qualitative aspects of risk and by bringing about a change in perception, it is possible to provide solutions to it. This holds true on the basis that a solution begins with recognition.
- iv. The outcome of the research focused on the management dilemmas will be a qualitative risk model. Such a model will incorporate all aspects of qualitative risk proposed in this dissertation and will provide for the flexibility required to evolve an organisation toward a structure capable of change. In addition, such a model will be based on principles of living systems taken from nature. Living systems have survived within nature over long periods of time and as such modelling risk on living structures is a step toward creating continuity within organisations. Continuity equates to survival which in terms of business organisations is critical.
- v. Researching the management dilemmas will not only provide a holistic understanding of risk, but also substantiate such an understanding. By this it is implied that a deeper contextual meaning will be provided. Such meaning will give insight into the reasons upon which risk being a qualitative construct is proposed. In this manner further areas of research can be identified that could possibly offer additional benefits to science.
- vi. Finally, the line of research to be conducted in this dissertation will be in keeping with current market trends. This is critical for any contribution to science in that the outcomes

concluded can be employed into organisations' models and remain applicable to current times.

1.2.4 Restrictions inherent in the dilemma of management analysis

The restrictions associated with the approach adopted for this dissertation are identified as follows:

- i. It is not possible to consider all opinions relating to areas of research conducted within this dissertation. As such a limit has been placed on the number of texts consulted and via a process of active filtering only those texts considered to be most valuable have been utilised.
- ii. Certain areas of research have been of such a specialised nature that limited subject material has been available. In such an instance few texts were consulted and therefore the possibility exists of perceiving the research provided as being skewed toward a limited opinion.
- iii. A great degree of creativity has been applied through out this dissertation. This has been identified as a fundamental strategy in terms of trying to propose new principles in science (Bohm 1998). However, creativity in terms of research is often met with resistance and as such an inherent restriction relative to this dissertation lies not within the study itself but rather within external paradigms.
- iv. In certain parts of this dissertation difficult subject material has been approached in order to relate concepts applicable to qualitative risk. Where possible such subject content has been described and put forward in the simplest manner possible, however, a minimum level of understanding has been assumed. Should this assumption be overstated then certain constructs and notions might not present well in relation to the objectives of this dissertation. As such, a potential limitation exists in terms of being able to comprehend the intended meaning of this dissertation.

1.3 Prior work done in this field

An abundant source of literature is available regarding the individual disciplines within the areas of science considered for this dissertation. Such individual disciplines are extensively researched and it is noted that a vast array of work has been done on each of the given topics in relation to risk. However, a multidisciplinary study, aimed at merging each of the individual disciplines so as to provide a holistic perspective on risk, is far less common. For this reason, it is proposed that in terms of prior work done in this field a relatively small contribution toward an understanding of risk from a multidisciplinary approach has been made. A perception is therefore drawn that the approach adopted in this dissertation could possibly contribute toward science.

1.4 Research methodology

1.4.1 Multidisciplinary literature study

The primary research method adopted in this dissertation has been a literature study. In this a number of texts have been consulted so as to gain insight and understanding into the relative disciplines incorporated in this dissertation. However, it must be noted that that a multidisciplinary approach has been adopted. By this it is implied that literature studies from an array of various scientific disciplines have been considered. The information and understanding attained from an individual literature study of each respective discipline have been combined in order to present one holistic and united idea. This approach is modelled on the idea that "To limit our world views... tends to prevent the consideration of fundamentally different notions that may be needed to fit new observations and experience" (Bohm 1998:72). Furthermore, this approach is in keeping with the notion of systems science, which is a science whereby all disciplines are put together so as to study a phenomenon as whole and from all points of view (Ackoff 1972). By adopting a systems view in the form of a multidisciplinary approach to risk, the novelty of this dissertation is proposed. It is possible, in a broad manner of speaking, to categorise the individual disciplines contemplated for

purposes of this dissertation into studies associated to the fields of history, ecology, biology, psychology and science.

1.4.2 Personal experience of the author

The author is employed in the financial sector and as such is subject to the demands of risk management. A vast majority of what is proposed in this dissertation has been tried and tested in reality. In addition, the concepts, ideas and proposals put forward are inspired not only by literature, but also by real-life observations and incidences evident in the financial industry.

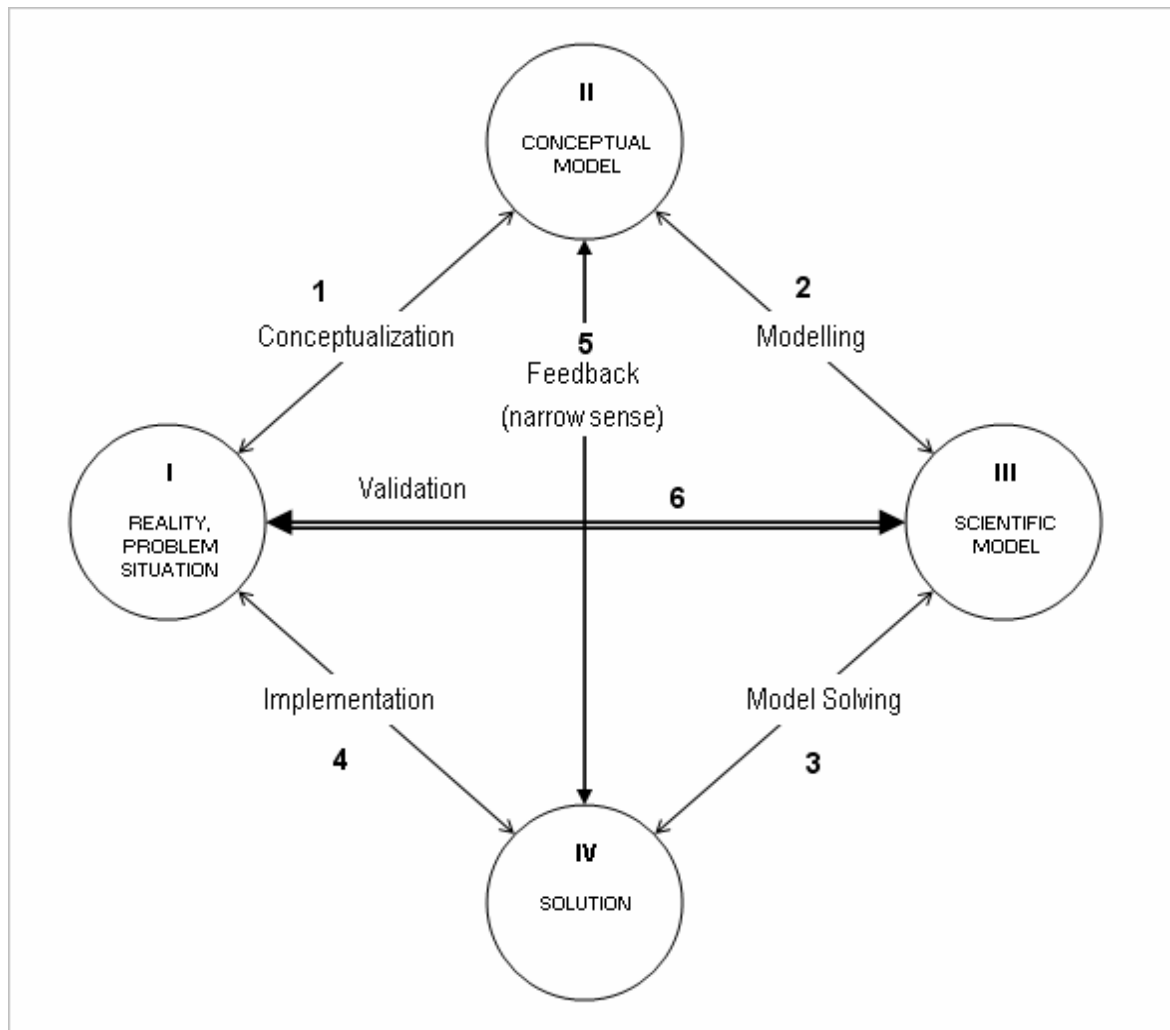
This is a fundamental necessity in terms of maintaining a realistic and practical focus for the dissertation. Subjected to the practicality of risk in everyday organisational activity, the realities of a working environment can assist in curbing the creative aspect of the research, thereby offering a well balanced presentation of risk tending away from the extremes of either too little, or too much leeway in a new understanding of risk.

1.4.3 A systems approach to research

A fundamental intention of this dissertation is not so much to conclude an accurate scientific model of qualitative risk, but rather to propose a new perception of risk so as to stimulate further scientific debate. This is often regarded as non-conventional in that it steers toward a more non-formal and interpretive method of research, which is a method encouraged in Tomkins and Groves (1983). In addition, according to Morgan (1983), alternative research strategies often generate new types of knowledge.

The Mitroff model is a systems-based model designed to assist academics engaged in a more informal approach to research (Koornhof 2001).

Figure 1.2 - Mitroff model – a systems view of problem-solving



Source: Mitroff et al. (1974:48)

Figure 1.2 depicts the Mitroff model to be used in the systems approach to research. The essence of the model is a circular dependency between its components, alluding to the fact that systems research has no predefined start or end. This presents a great degree of flexibility in research and supports a more informal approach in that a research project could begin at any one of the given stages presented in the diagram above. That is to say that research could begin in circle II whereby a conceptual model is arrived at relative to a topic of research. Once such a model is conceptualised it is possible to migrate to the next phase of research by performing the activity

linking the circles. In this instance the activity would be modelling, the end result of which will be a more formal scientific model (circle III) of the one previously conceptualised. From here the process of model solving can be approached, thereby generating a solution (circle IV) which in turn can be implemented into practice again generating new realities (circle I) which in turn could lead to new areas of research or conceptualisation (back to circle II).

From this model it is clear that research can begin at any one of the phases identified by the circles in Figure 1.2 above. On this basis the authors have identified a total of 3 555 sub systems that can be researched by considering all possible ways of combining two, three and four elements (Mitroff et al., 1974).

For the purposes of this dissertation only circles I and II will be used. Research will begin at circle I by identifying the problems present in reality. This exercise has been completed in paragraph 1.2.1 in which the management dilemmas associated with the topic of this dissertation were identified. The activity of conceptualisation will then be conducted in which instance consideration of the problems identified in circle I will permit a natural migration to circle II. The end result of such an activity will be a conceptual model of risk.

It is not the intention of this dissertation to expand upon this conceptual model of risk and as such the dissertation will end in circle II. In accordance with Mitroff et al. (1974) this is permissible. The effect of this is an open-ended invitation for criticism of the conceptual model proposed. This allows room for further scientific research to be conducted in which such a conceptual model could then be taken to further levels as indicated by circles III and IV of Figure 1.2. This migration could possibly be the subject of a doctoral study.

1.5 Overview of chapters

1.5.1 Chapter 1

Chapter 1 serves the purpose of introducing the research material that is to form the subject matter of this dissertation. Included in this function is an introduction into the current business environment and an indication of the dynamics governing risk in present-day reality. The notion of qualitative risk is touched upon and explained sufficiently enough to justify the need to have it researched.

The key areas that are to form the basis of study in all other chapters are alluded to in the form of an identification of a number of management dilemmas. These management dilemmas are briefly discussed and the consequences of not resolving them are proposed.

Lastly, Chapter 1 presents the research approach to be adopted throughout this dissertation.

1.5.2 Chapter 2

Chapter 2 serves primarily to introduce the notion of qualitative risk and to show that it is in essence a human creation. This is achieved by taking natural concepts from the discipline of ecology and showing the destructive effect that human interaction with nature has had on such a discipline. Using this as a basis to work from, this effect is integrated into a qualitative understanding of risk. The end result of this activity is a conceptual model, incorporating principles of nature, that is capable of providing a holistic and natural perspective of reality. Such a holistic and natural perspective of reality places into context the role of man and the relation of this role in the creation of risk thereby highlighting the grounds upon which risk is proposed to attain its qualitative human property.

In addition, Chapter 2 touches on the notion of human opportunity as the primary driver of qualitative risk thereby setting the foundation for Chapter 3.

1.5.3 Chapter 3

Chapter 3 can be seen as an extension of Chapter 2 in that it ratifies the notion of risk being a human creation, however, it considers this notion from a quantitative and not a qualitative perspective. This is done by contemplating a new discipline which focuses on the historical origins of quantitative risk from around 3500 BC onwards. Such a historical consideration touches upon key moments in time that can be regarded as having shaped the drive toward a quantitative understanding of risk.

Through a comprehension of the above an interesting observation can be made, thereby completing the theme of risk as proposed in Chapter 2. This observation relates to the notion of human opportunity.

A discussion of this topic completes the conceptual understanding of risk as proposed in the previous chapter thereby rounding off the intended theme of qualitative risk.

Chapter 2 and 3 should be regarded as one theme which strives toward a balance between the two fundamental halves that constitute risk namely, the quantitative and qualitative halves. The end result of these two chapters is a subtle hint of the characteristics that constitute the more qualitative properties of risk, namely uncertainty and flexibility.

1.5.4 Chapter 4

Chapter 4 serves the purpose of introducing the first of the fundamental characteristics of risk, namely uncertainty. Such a characteristic of risk was shown to be the by-product of human opportunity which was the theme of Chapter 3. The concept of uncertainty is introduced using the

discipline of biology. This is done by considering the physiological effects that uncertainty has on the human body. The intention of this is to create a practical awareness of uncertainty and the almost genetic role it plays in shaping human reality. By understanding this it is possible to support the previously proposed notion that risk is an entirely human construct.

A by-product of the discussion of uncertainty is the engenderment of the notion flexibility. This sets the theme for the Chapter 5 to follow.

1.5.5 Chapter 5

Chapter 5 deals with the notion of flexibility as one of the qualitative characteristics of risk. This is done using principles of Freudian psychology. The structures and functioning of anxiety within the human mind are presented in a bid to bring about an awareness of how risk attains its dynamic nature and so-called characteristic of being flexible.

Specific to the task of Chapter 5 is the understanding of cognitive perception and how this can vary from person to person depending on a number of personal factors. Such factors, amongst others, include the effect of past experiences and the role that this plays in the dynamic variance associated with risk perception. It is through this process that risk attains its qualitative property of flexibility.

1.5.6 Chapter 6

Chapter 6 deals with the concept of information in detail. In so doing, it is shown what information is (in the context of qualitative risk) and how information bridges the gap between the human mind and risk in reality.

The role that information plays in the formation of risk is discussed and the manner in which it effects risk perception is presented. In addition to this, Chapter 6 facilitates an understanding of

key fundamental characteristics of information specific to qualitative risk. These key characteristics are extracted from notions naturally engendered from discussions relating to previous chapters.

Chapter 6 can also be seen as consolidating everything that has been proposed in previous chapters and sets the foundation for Chapter 7.

1.5.7 Chapter 7

Chapter 7 considers the discipline of science by delving into the principles of dissipative structures. The intention of this is two-fold. First it provides natural physical evidence that substantiating the qualitative principles of both risk and information as alluded to in previous chapters. Secondly, it provides an example of a real-life solution to qualitative risk. This is evident in the scientific laws that govern dissipative structures.

Given this, a large focus of Chapter 7 will be on understanding the mechanics of dissipative structures. This will provide closure to the theme of qualitative risk and allow for a basis upon which to present a final conceptual model. Such a model will represent the outcome of the conceptualisation process as required by Mitroff et al. in order to facilitate a systems approach to research.

1.5.8 Chapter 8

Chapter 8 represents the conclusion of this dissertation. The conclusion will take the form of summarising the outcome of the process of conceptualisation and place such a summary into a visual model capable of inviting further academic debate.

Chapter 8 will also present further areas of research that have been identified during the course of this dissertation.

1.5.9 Closing Remarks

Finally, the outcome of this dissertation will be placed into context by providing a practical account of the application of the conceptual model in reality. Such an example will be based on personal business experience.

CHAPTER 2

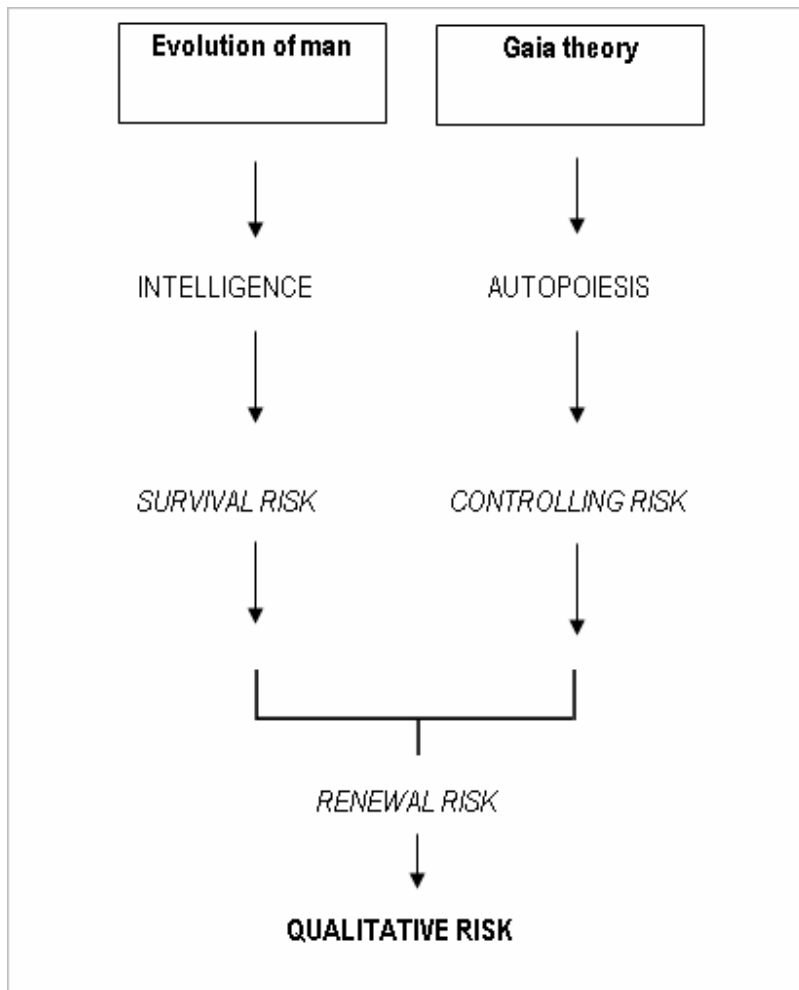
THE ROOTS OF QUALITATIVE RISK

2.1 Introduction to Chapter 2

This chapter focuses on a qualitative approach to understanding risk. This is necessary if consideration is given to the current perception from which risk is drawn. "Currently the modern concept of risk is rooted in the Hindu-Arabic numbering system that reached the West seven to eight hundred years ago" (Bernstein 1996:3). Present-day perception is firmly focused on numbers and as such the current understanding can be considered biased when contemplated in terms of a greater risk perspective. A qualitative approach to research can therefore be beneficial, given that historically research in large has been inclined to adopt a pure scientific approach (Koornhof 1998). "If one has a new way of thinking, why not apply it to wherever one's thought leads to ... it is often very illuminating and capable of leading to new and deep insights" (Cole 1985:2). A qualitative approach embraces this philosophy.

The theme of this chapter, in the light of the approach described, will be the qualitative mechanics of nature as well as the qualities of human intelligence that have allowed for a superior ability to survive within this mechanistic order. To facilitate this consideration, particular attention will be given to the evolutionary process of man as well as Gaia theory, a theory that focuses on the ecological balance of nature. In both cases, underlying constructs such as intellectual evolvment and autopoiesis (the balance of nature) contain certain fundamental principles that can be used to propose alternative risk concepts relative to a qualitative understanding of risk. Examples of such new concepts are controlling risk, survival risk, sacrificial risk, and opportunity risk. Essentially these concepts will be used in the compilation of a qualitative risk model, the purpose of which will be to derive and explain a new risk order. The diagram below summarises the above.

Figure 2.1 - Chapter 2 as seen from a visual perspective



Source: Own observation

The approach to be adopted in Chapter 2 is to consider two particular theories. The first theory is the theory of evolution, the second is Gaia theory. In relation to evolution, particular focus will be placed on the evolution of human intelligence. Through this consideration it will be possible to propose an alternative perspective of risk, namely survival risk. In a similar approach using Gaia theory, particular focus will be on the subject of autopoiesis. Using this principle it will be possible to once again propose another alternative perspective of risk, namely controlling risk. Finally, these two concepts will be brought together by proposing renewal risk. Each form of risk, namely survival, controlling and renewal risk is proposed to be novel and serves the purpose of presenting qualitative risk from a natural perspective.

2.2 A natural approach to man-made risk

2.2.1 Brief overview of man-made risk

A natural approach to man-made risk is simply an approach based on a study of man and the natural environment. An acute global awareness regarding this type of study is growing in the 21st century (McNeill 2003). More specifically, an acute awareness of the impact man is having on the natural environment is taking place. Within this awareness lie certain qualitative principles which can be used in order to better understand the nature of risk. One such principle is the physical effect that man's heightened survival ability (evident through economical progress) is having on the sustainability of the natural environment. It is increasingly more apparent that man's organisational and technological structures are the primary catalysts behind global environmental destruction and more specifically the principal threat to the long-term survival of humanity (Capra 2002). This particular view is shared by Wilson (2003:22): "While preoccupied with all this tumult, humanity managed collaterally to decimate the natural environment ... We thereby accelerated the erasure of entire ecosystems and the extinction of thousands of million-year-old species". A definite pattern of human destruction is emerging and such a pattern is increasing almost exponentially at present.

The views of Capra and Wilson are the basis for paragraph 2.2.2 to follow. Their focus is on a present-day fact, namely that through the very progress of man an inadvertent threat has been placed at the foot of existence, namely the threat of extinction. For this reason an opportunity exists to consider the relationship between man and extinction and the possible risk association within. The purpose of this is to extract an understanding of qualitative risk principles that can be used to arrive at a new risk order.

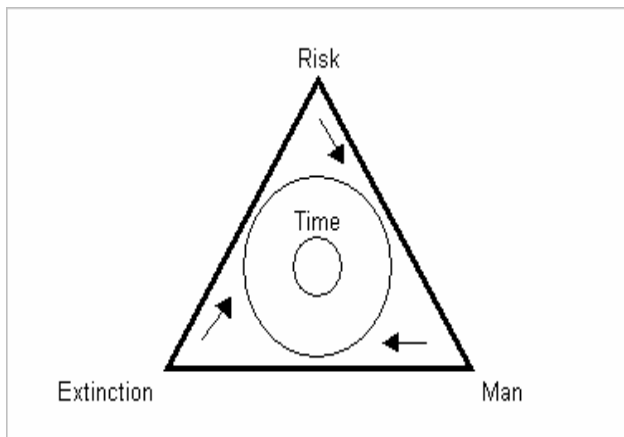
2.2.2 The relationship between risk, extinction and man

To determine the relationship between risk, extinction and man it is first necessary to show that they are correlated. This correlation is best explained by understanding the common element that relates them, namely time. It can be shown that neither risk nor extinction nor man can bare any physical significance in the absence of time. Consider the following:

The term extinction is defined as “a coming to an end or dying out” (Oxford 1944:661). Within this definition there exists a finite element of time, for the simple reason that the term extinction, by definition, implies a finality of the present. Any living species, which becomes extinct, will reach a finite point that prevents it from occupying a quantum of time or space in the future. Extinction is a tangible moment that once attained effectively implies no tomorrow.

With regard to risk it can be said that “Risk and time are opposite sides of the same coin, for if there were no tomorrow there would be no risk” (Bernstein 1996:15). From this a correlation between risk, extinction and man can be made. The term extinction, by definition, implies no tomorrow. No tomorrow equates to no risk. This results in extinction equating to risk through the element of time. It is evident therefore that in both instances of extinction and risk the element of time must be present before either of the constructs can bear physical significance. In the case of man, or any living species for that matter, physical significance depends on the state of the other two constructs. An organism, once extinct, bares no physical significance. This is true based on the fact that it no longer exists. The triangle representing this association is given below.

Figure 2.2 - The association between risk, extinction and man



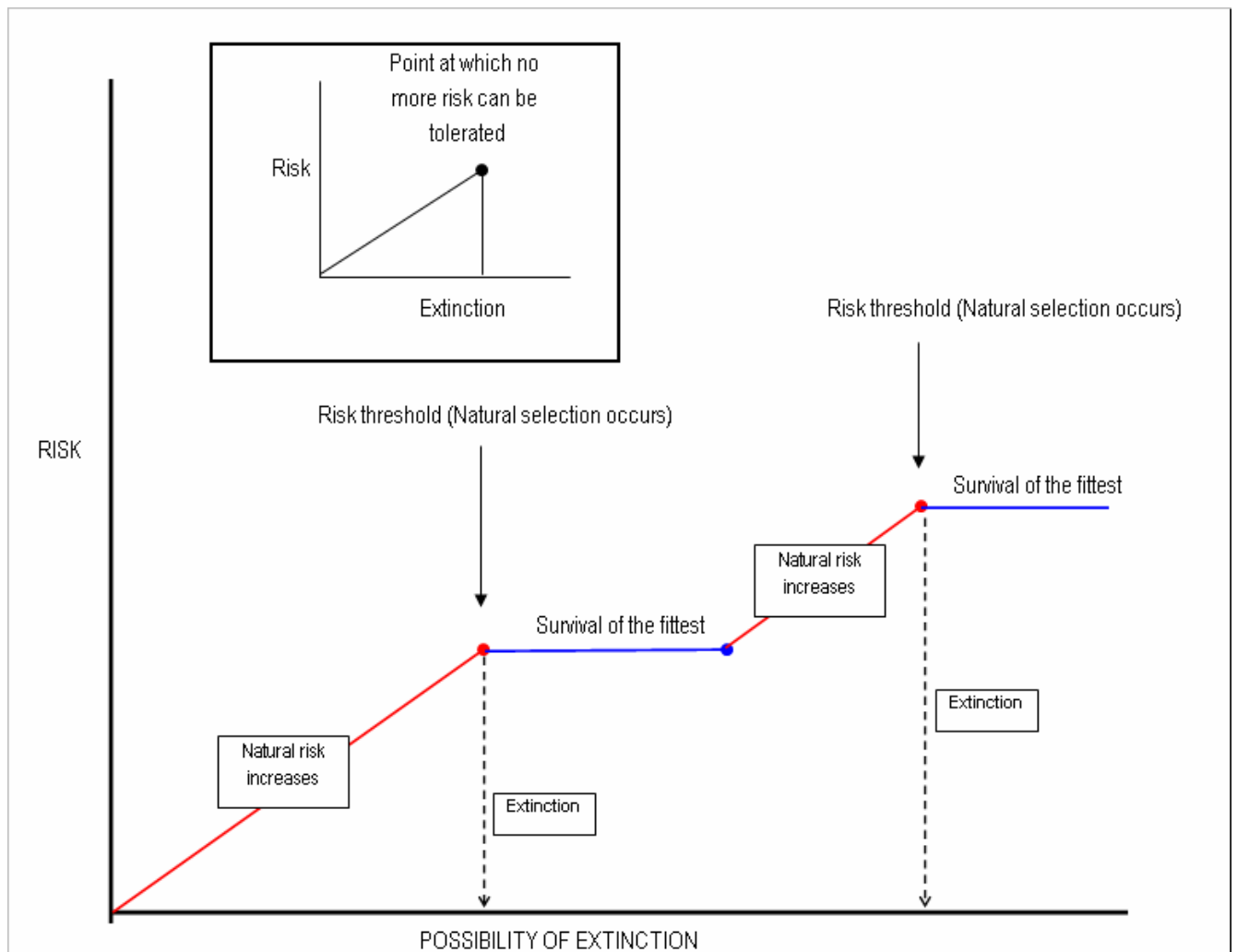
Source: Own observation

The common elements that give meaning to the association between risk, extinction and man are depicted in Figure 2.2 above. Without the element of time none of the three constructs can bear any physical significance. That is to say that an environment without any risk results from extinction. At this point in time all significance associated to living species is inconsequential simply because that species will no longer exist.

The significance of this association is as follows: “In looking at Nature, it is most necessary to keep the foregoing considerations always in mind – never to forget that every single organic being around us may be said to be striving to the utmost to increase in numbers...” (Darwin 1998: 53). Within the context of the discussion of this quotation, it is clearly put forth by Darwin that the strongest natural intention for any living organism in nature is simply to propagate its kind in order to survive. For this reason, extinction can be regarded as the least of its intentions. In addition to this, it was concluded that extinction equates to a situation of no risk. By correlating these two concepts, it is possible to conclude a fundamental qualitative risk principle. All instances that increase a species’ possibility of extinction must consequently increase the risk associated with that species. This association will continue to remain true until such time that a critical threshold is reached whereby the increase in risk, associated with that

species, becomes so great that the result is extinction. Due to the fact that the instance just prior to extinction is finite in nature, it must represent the greatest possible risk that can be associated with that species. Any additional risk beyond this point would result in risk, extinction and the specie relinquishing all physical significance. Figure 2.3 summarises these views

Figure 2.3 - Illustration of the proposed relationship between risk and extinction



Source: Own observation

Figure 2.3 details the relationship between risk and extinction. Assuming the whole of nature is represented in the diagram above, the graph depicts the normal course of nature in terms of managing risk. As natural risk increases in nature so it tends toward extinction. A critical point

is reached whereby the natural risk will force nature to survive or become extinct. If nature survives it will re-align and start the process again (Darwin 1998). If, however, nature cannot realign, then the instance just prior to this will represent the greatest possible natural risk.

The reasoning behind this understanding can be qualified. “How much extinction is occurring today? Researchers generally agree that it is catastrophically high, somewhere between one thousand and ten thousand times the rate before human beings began to exert a significant pressure on the environment” (Wilson 2003:98-99). This clearly points out that man is tending nature toward extinction. For this reason, it is possible to suppose that within the context of nature, man must represent the greatest possible risk to any living species (see paragraph 2.2.2). For this reason man is risk.

This supposition is important. It approaches an understanding of risk from a totally different perspective. Instead of a Newtonian approach to risk, an approach in which understanding is achieved by breaking risk down into individual components and then studying these parts so as to understand the whole, it is now possible to rather apply a holistic qualitative approach. Key to this approach is the fact that risk needs no longer be the subject of understanding, but rather man. This is because of the proposition concluded in the paragraph above that man is risk. An approach based on understanding the qualities in man that could engender extinction is simple and can be understood by considering the evolution of man’s intellect. Through this understanding, enough evidence exists to show that the consequence of man’s intellectual evolution is the ability to tend nature toward “extinction”.

2.3 The evolution of man – tracing risk back to its roots

2.3.1 An overview of the origin of qualitative risk

The purpose of describing the evolutionary phases of man is purely to raise an awareness of how the growth in structure, relative to the brain, gave rise to an intellectual ability far superior

to that of any other living species. It is also to show how this ability allowed man a survival capacity (greater than that of any other organism) which resulted in an inadvertent ability to engender "extinction." By showing this to be true, the proposition can be qualified stated in paragraph 2.2.2 above, namely that man is representative of the greatest form of risk and that man is therefore risk.

2.3.2 Evolution – man's intellectual evolvement

It is important to compare each stage of intellectual evolvement to the ability an organism has to survive. The purpose for this is simply because the basis of qualitative risk is a heightened ability to survive. That is to say that as man's ability to survive increased so too the tendency to engender extinction, thereby resulting in true natural risk. This forms the basis for the following view.

Intellectual evolvement begins with the fish brain whereby fish developed a tube that could carry nerves from distant parts of the body to a central control point (Carter 2000). Over a period of time this arrangement of nerves evolved to form a more complicated structure known as the reptilian brain.

During the mammalian phase of evolution, however, the reptilian brain developed more modules, namely the thalamus, amygdala and hippocampus. Each respective module gave rise to a more superior ability such as allowing sight, smell and hearing to be used together; a crude memory system and ability for an organism to react to more stimuli (Carter 2000). In addition a thin matrix of cells formed a skin around the brain known as the cortex (Carter 2000). This was a significant contribution to intellectual evolvement and resulted in the next era of evolution.

Over time, the more advanced the organism became the greater the size of the cortex (Goleman 1996). "The areas of the brain that expanded most were concerned with functions like thinking, planning, organizing and communicating" (Carter 2000:35). Within the context of

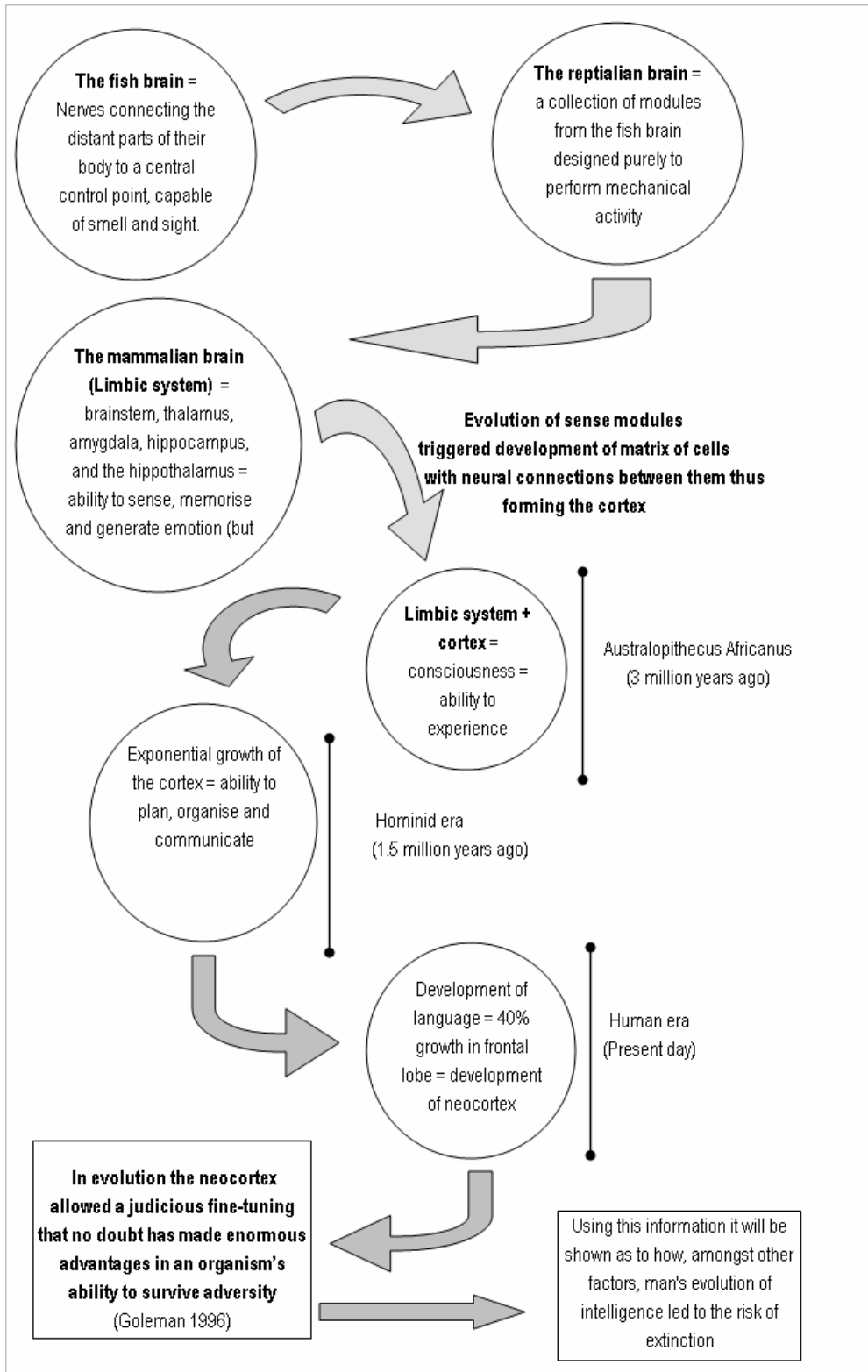
this the correlation between structure and ability is evident. The more physically intricate the brain became, the more complex the ability of the organism (Lewin 1993). This increase was most evident in the final stage of intellectual evolution.

The last known era of intellectual evolution was the human era. This era gave rise to the development of language. The complexity of language required much more brain tissue and consequently the frontal lobes of the brain expanded by some 40 percent (Carter 2000). This expansion within the brain formed what is known as the neocortex. This formation is of fundamental importance in terms of the discussion on structural evolution in man versus intellectual ability because the neocortex allowed a judicious fine-tuning that had an enormous advantage on an organism's ability to survive (Goleman 1996). The implications of this form the basis of the proposal for the creation of risk.

2.3.3 The result of intellectual evolvement

If nothing else, all that needs to be comprehended is that each phase of intellectual evolution attested to an increase in structural complexity within the organism. This increase in complexity, led to an enhanced intellect, which ultimately resulted in man's superior ability to survive. In this, the fundamental dynamics of nature were altered. Darwin (1998:50) clearly states that "Every being... must suffer destruction during some period of its life...otherwise, on principle of geometrical increase, its numbers would quickly become so inordinately great that no country could support the product" (Darwin 1998:50). On the basis that man has the ability to increase in numbers without suffering the necessary destruction the concept of engendering extinction is based. This concept leads to the creation of true risk and will be qualified using Gaia theory and the principle of autopoiesis. Figure 2.4 summarises this discussion.

Figure 2.4 - A visual summary of intellectual evolution in man



Source: Own observation

The evolutionary phases of man in terms of intellectual evolution are summarised in Figure 2.4. It describes in more detail the major structural developments that occurred during evolution as well as the particular phases in which these developments took place in. It also provides a visual overview of how human intellectual evolution gradually increases an organism's ability to survive. It is on the basis of heightened survival ability that man engendered extinction which in turn is the foundation argument upon which the creation of risk will be based. Gaia theory and the principle of autopoiesis will conclude this concept.

2.4 Gaia theory and the principle of autopoiesis

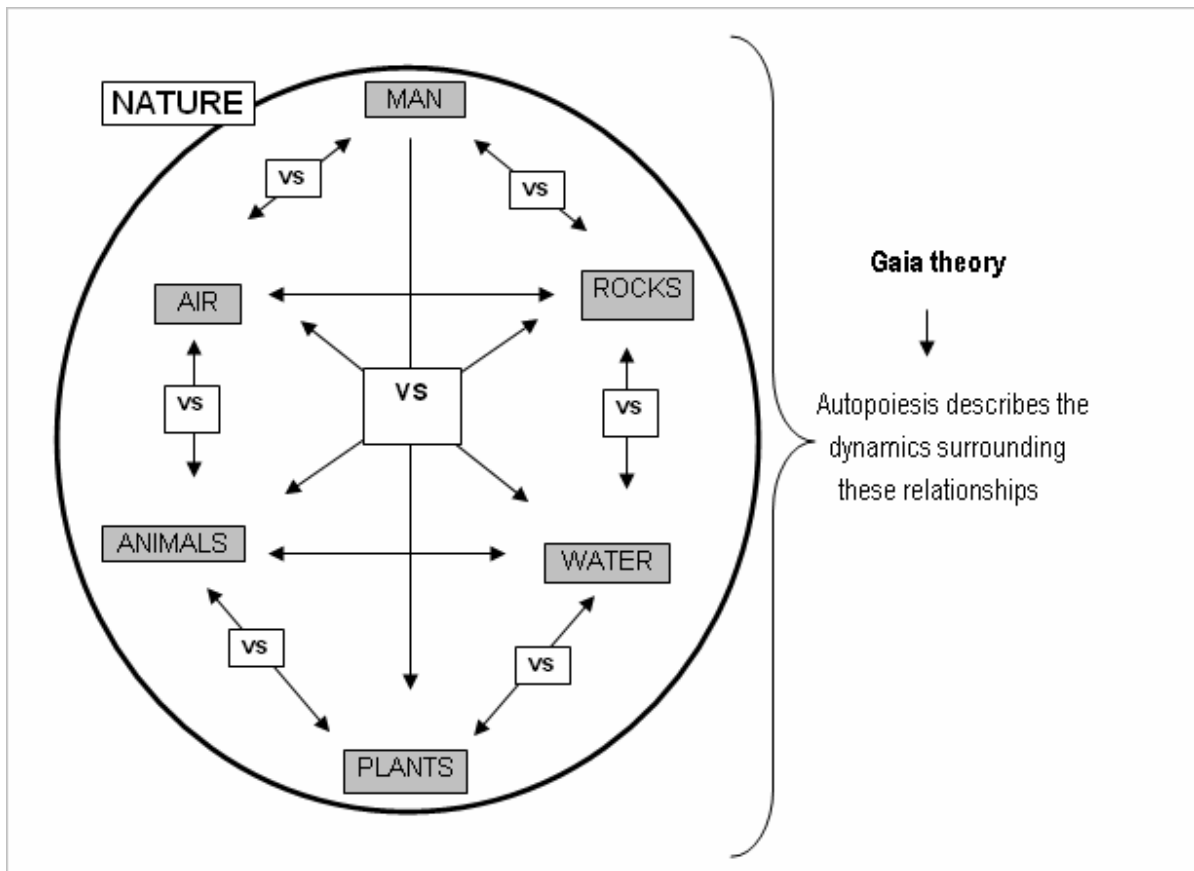
2.4.1 Gaia theory and the application to risk

The description of the evolutionary phases above has led to an understanding in which human intellectual ability is clearly segregated from that of any other living species. The consequence of this is what is proposed to partly give rise to man's ability to engender extinction. The reason why this holds true has not yet been discussed in this research. In order to ratify this proposition, consideration must be given to Gaia theory and the principles of autopoiesis. This will reveal why a struggle for life is necessary in order to ensure continued existence. It will also show why any living organism capable of defying this struggle would jeopardise the very balance that keeps nature alive.

2.4.2 An introduction to Gaia theory

Gaia theory was established by James Lovelock and Lynn Margulis and in essence is a theory that describes the earth as a self-regulating structure (Capra 1997). It provides scientific evidence that proves how components (both living and non-living) interact together in order to create the conditions that sustain life (Wheatley 1994).

Figure 2.5 - The interdependency between elements in nature



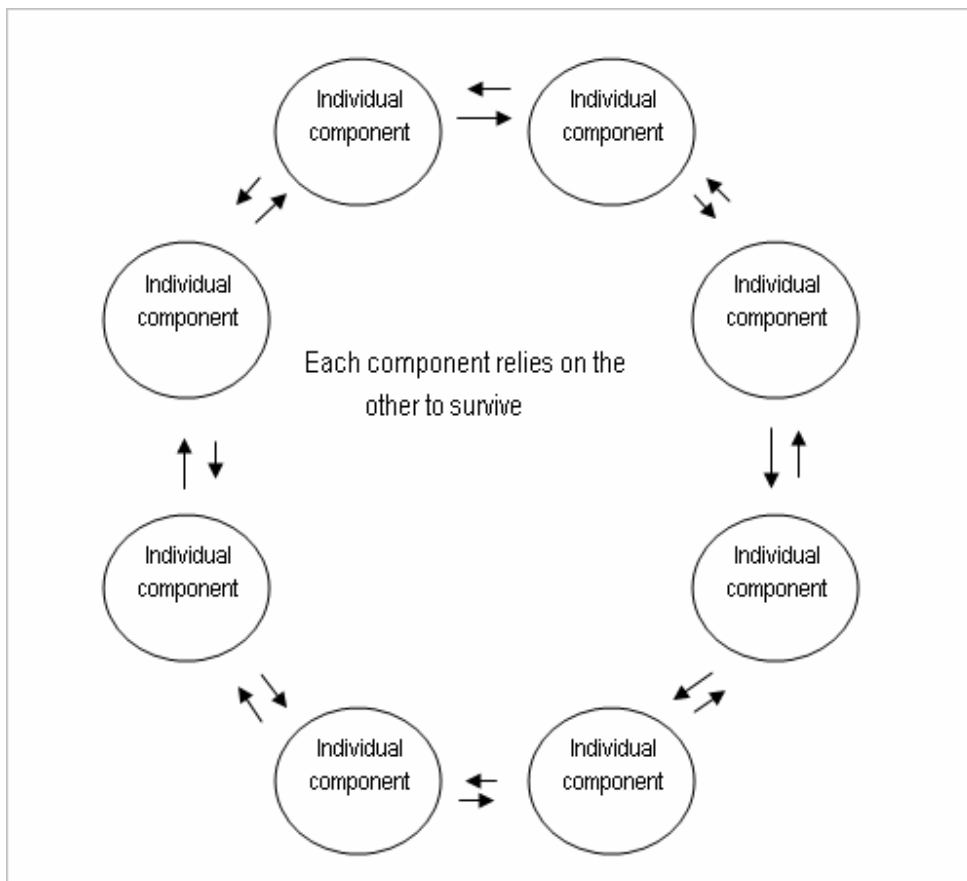
Source: Own observation

A number of major components exist within nature of which a few are depicted visually in Figure 2.5. Gaia theory serves to explain the dynamics that govern these relationships through a process dubbed autopoiesis or rather self-regulation. This is a process in which each of the respective components in nature co-exists in natural harmony by regulating their existence in relation to one another. This results in a circular dependency in which each component is dependent on the others in order to exist. This dependency is illustrated by the arrows connecting the components in Figure 2.5 above.

2.4.3 The principle of autopoiesis

Autopoiesis or rather self-regulation is “a network of production processes, in which the function of each component is to participate in the production or transformation of other components in the network” (Capra 1997:98). It has also been described as “... the characteristic of living systems to continuously renew themselves and to regulate this process in such a way that the integrity of their structure is maintained” (Jantsch 1980:7). Figure 2.6 serves to illustrate this concept visually.

Figure 2.6 - **The basic principle of autopoiesis**



Source: Own observation

Figure 2.6 portrays the basic principle of autopoiesis which relates to the circular dependency between each of the individual components in nature. In this relationship it can be seen that should one of the components be removed, then a situation arises in which the possible existence of all other components is jeopardised. This therefore alludes to the fact that in order to maintain an autopoietic structure all components must be present so as to contribute toward the successful functioning of the system as a whole. No individual component can exist outside this circular dependency.

A further fundamental characteristic of an autopoietic system is its need to maintain a balance between each of these components. According to Capra (2002:202): "No single variable is maximised; all variables fluctuate around their optimal values". This insight is fundamental as it corroborates the purpose behind explaining autopoiesis. In paragraph 2.4.1 it was stated that man's intellect allowed for the ability to bypass the natural struggle for life. By reconsidering this statement in the context of Gaia theory and autopoiesis, the following can be put forth as an explanation of the reason why the consequences of human intellectual ability have engendered the possibility of extinction.

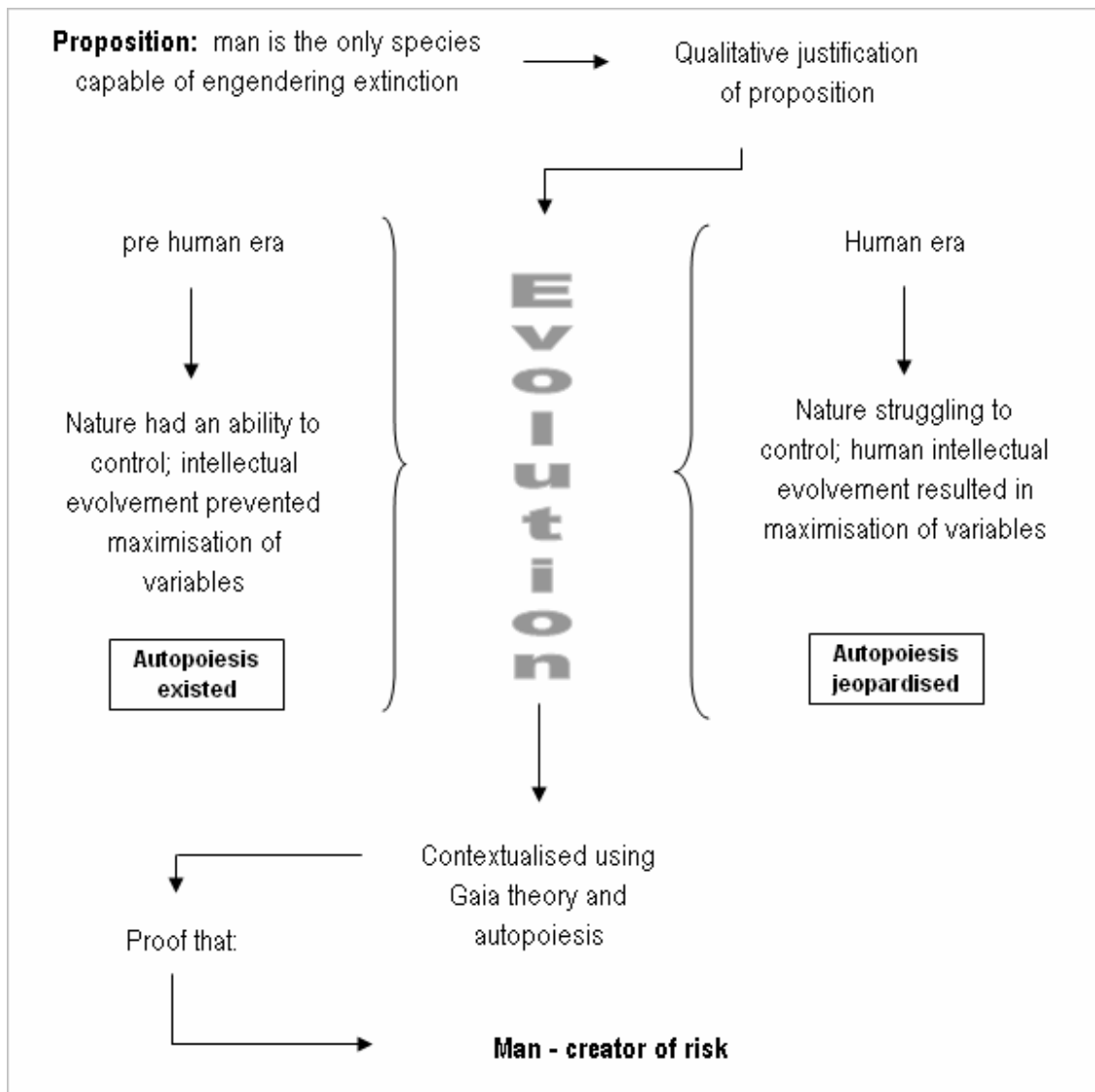
It was previously established that no single variable is maximised within an autopoietic system (Capra 2002). It was also established that at some stage all organic beings have to struggle with life and suffer destruction (Darwin 1988). Autopoiesis unifies these views by placing them into context. Man, through a superior ability to survive, has the potential to exist as a maximised variable, thus overcoming the rule of destruction that Darwin alludes to. Wilson (2003:25) reflects the same view when he says: "Human ingenuity has always found a way to accommodate rising populations and allow most to prosper". In so doing the very balance that preserves existence as a whole is jeopardised. This maximisation of human variable and the consequence thereof are understood in an everyday context when considered against the crisis of over population within the human race. "Some signs of these defects are the widespread occurrence of pollution and destruction of the balance of nature, in a context of growing

overpopulation...,” according to Benthall (1973:97) Furthermore, this state of maximisation places a resource burden on nature to meet the energy demands required to sustain human life. This increase in demand upon nature results in certain sacrifices having to be made simply because resources within nature are limited. “The habitat of an animal population offers only finite resources for its use,” reflects Crook (1980:38). This fact coupled with the continual maximisation of variable amongst humans’ presents a very compelling argument that justifies mans position as being capable of engendering extinction.

2.4.4 Conclusion

The purpose behind struggle in life is to interject a mechanism in which the balance of variables is maintained so as to benefit an ecosystem on the whole according to Darwin (1980). Without this balance, the trend toward extinction is inevitable. As has now been shown, man is the only variable causing this trend. “Homo sapiens has become a geophysical force, the first species in the history of the planet to attain that dubious distinction” (Wilson 2003:22). For this reason the proposition that man is risk is qualified. By extrapolating on this it is also possible to propose that man is solely the creator of risk because of the fact that no other species is capable of engendering extinction. Figure 2.7 summarises this view visually.

Figure 2.7 - Overview of the qualitative creation of risk



Source: Own observation

The proposition that qualitative risk arises from the possibility of extinction set the theme for all discussion thus far. Figure 2.7 illustrates this proposition and proceeds to visually summarise the approach used to qualify this proposition. Using the concept of intellectual evolution it can be seen that prior to human existence intellect presented no real threat to nature. This was as a direct result of the fact that no organism possessed any significant ability to survive. During this phase nature was regarded as being in autopoietic balance. Contrary to this was the

introduction of humans. During this era the ability to survive within was heightened and the tendency it had on natural control were qualified using Gaia theory. This tendency was toward an increase in the probability of extinction which now forms the basis upon which qualitative risk is proposed.

2.5 Qualitative risk modelling – an approach toward a new concept

2.5.1 An overview of a qualitative approach

The chapter thus far has focused on a qualitative approach to risk, in that the qualities of man have been considered and applied to models that were capable of explaining how these qualities gave rise to the creation of risk. Gaia theory has been touched upon as well as the principles of autopoiesis. In order to attain any significant academic advancement it is necessary to place all that has been discussed and concluded into a framework that could possibly contribute to a better understanding of risk within an organisational context. For this reason, all of the above has served as a platform upon which the remainder of Chapter 2 will be built.

The fundamental understanding of Gaia theory, autopoiesis and the consequences of intellectual evolvment played the role of bringing about a new mindset from which to understand risk. This mindset was simply to show that man is the creator of risk. This is proposed as it has possibly not often been considered in quantitative risk models to date and hence the shift in paradigm. The advantage of approaching risk from this perspective is the following: By acknowledging man as the creator of risk it is possible to conceive of man as the solution to risk. “Any realistic discussion of changing the game must begin with the recognition...” (Capra 2002:185). The solution, however, no longer has to take the form of a quantitative risk model, but rather a qualitative one.

This new approach has been made possible simply by altering the old paradigm that governed risk from that of an externalised approach that defends against it, toward an internalised approach that embraces it. “We believe that in order to maintain ourselves and protect our individual freedom, we must defend ourselves from external forces. We tend to think that isolation, secrecy, and strong boundaries are the best way to preserve individuality. But this self-organizing world teaches that boundaries not only create distinctions; they are also places for communication and exchange” (Wheatley 1999:84-85). In addition to this new approach, a systems philosophy to research allows for the development of a conceptual model to be proposed without the need to prove it (see paragraph 1.4.3). This concludes the grounds upon which a qualitative risk model can be proposed and justifies the proposed course of action.

The way forward therefore rests in qualitative modelling. In order to achieve this, principles of autopoiesis and Gaia theory again need to be looked at from a more holistic perspective in order to raise the right qualitative questions, the answers to which will explain the novel risk concepts presented in Figure 2.1, namely survival risk, controlling risk and sacrificial risk. Such concepts are specific to this dissertation and will be the basis for discussion in paragraph 2.5.2 and other paragraphs to follow.

2.5.2 Qualitative risk modelling in perspective

It is proposed that four types of risk result from the principles of Gaia theory, autopoiesis, and Darwin’s theories of survival. The concepts upon which these constructs are based are not new in terms of academic contribution, however, the manner in which they are proposed are specific to this dissertation.

The risk constructs being proposed are:

1. Controlling risk
2. Survival risk

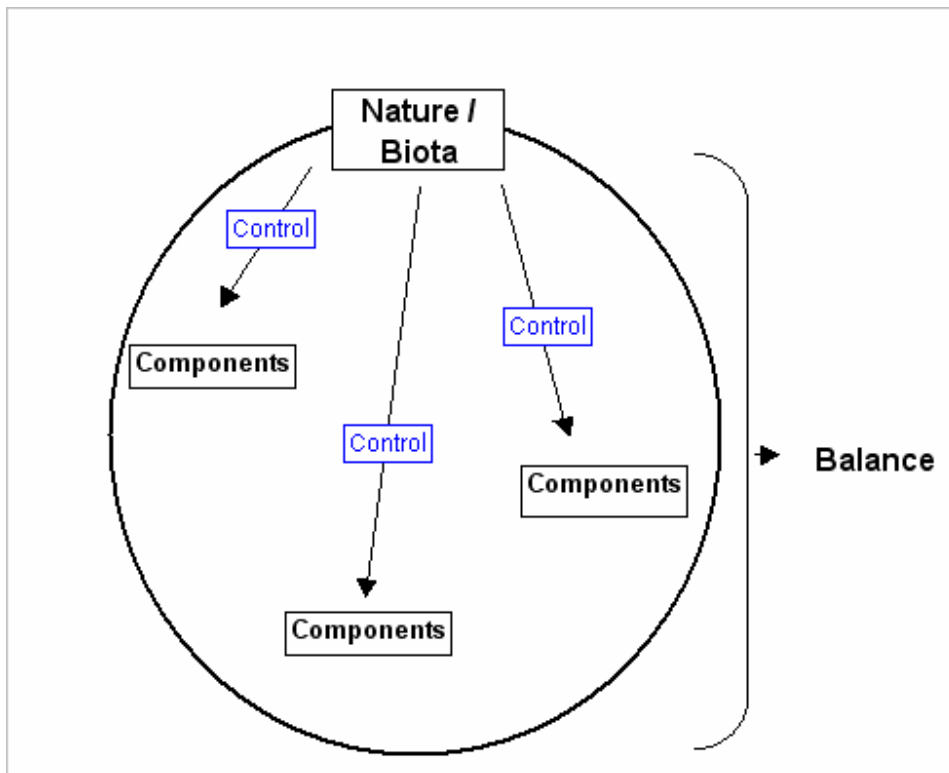
3. Sacrificial risk
4. Opportunity risk

Three of the risk principles will be discussed in Chapter 2. Once an understanding of each is attained, only then will they be applied to a qualitative risk model. The fourth principle forms the theme for Chapter 3 and will complete the qualitative risk model proposed.

2.5.2.1 Controlling risk

The process of autopoiesis demands a balance to be maintained amongst the components that constitute its makeup (Capra 2002). This balance was said to be the function of nature. Gaia hypothesis shows that homeostasis within nature is maintained by active feedback processes operated automatically and unconsciously by the biota (Lovelock 1989). "She can act on every internal organ, on every shade of constitutional difference, on the whole machinery of life" (Darwin 1998:65). As such an inherent function of control within nature is implied. This is the first of the fundamental principles that Gaia theory puts forth and it sets the basis upon which a new qualitative risk model is to be built. Consider Figure 2.8 in which this principle of natural control is illustrated visually.

Figure 2.8 - A visual understanding of controlling risk



Source: Own observation

The concept of controlling risk stems from the principle of autopoiesis in which each individual component functions in consideration of all other components. This is needed for overall existence. In this process of acting for the greater community, a natural element of control must exist in that free radicals cannot be tolerated. This natural element of control is proposed to be the force of nature and is represented by the circular ring around the internal components. This natural force of nature is coined as controlling risk.

2.5.2.2 Survival risk

Evolution is a well-recognised theory. It was shown that the more complicated the physical structure of the brain the greater an organism's complex ability, thus the greater its competence to survive. This, however, raises a question, the answer to which gives rise to the second

fundamental principle of qualitative risk. If an ecosystem is capable of indefinite existence through the process of self-regulation, why are all species born with a natural instinct to survive? Surely this goes against the grain of self-regulation ... or does it?

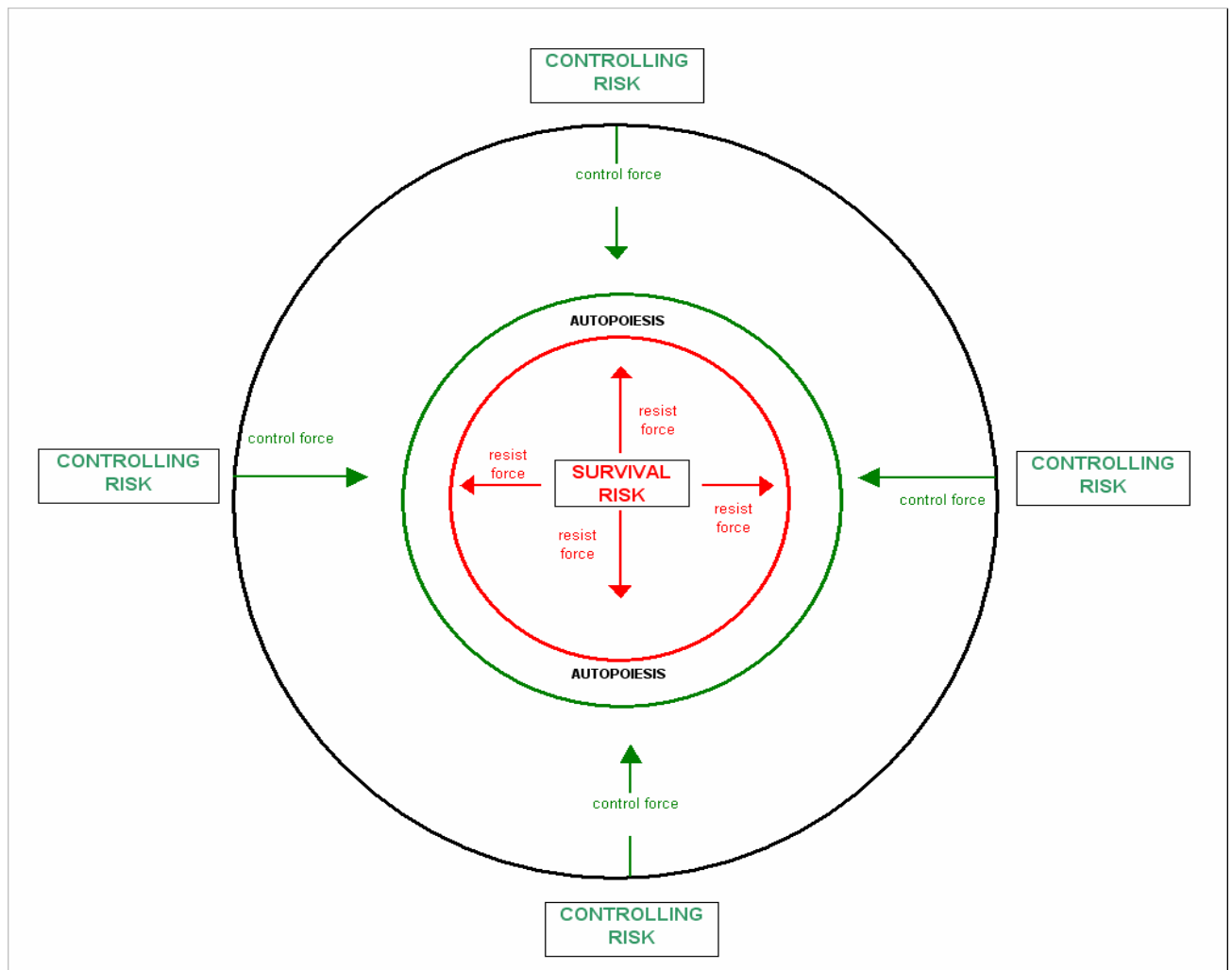
Survival is inherent in all aspects of life and the concept of survival risk is not new. Natural selection within nature has been around since inception and is inevitable within a living network (Darwin 1998). If this concept is considered from a holistic perspective and in the light of the principle of controlling risk, survival can be seen as having an additional aspect to it. This aspect pertains to a function of opposing controlling risk.

The opposition of controlling risk is needed in order to maintain and create structure and form within a living network. If an opposing force were not present, controlling risk would simply implode upon all variables within that system. Survival risk, in a figurative sense, creates a barrier or boundary that counters the force of control. "An important characteristic of living systems is that their autopoietic organisation includes the creation of a boundary that specifies the domain of the network's operations and defines the system as a unit" (Capra 1997:98.) This concept of a boundary is critical and completes the understanding of a need for survival risk. This is evident if the concept of survival risk is attested against the notion of autopoietic balance. Autopoietic balance was previously implied (paragraph 2.4.3) as being the point at which all variables within a network fluctuate around their optimal values (Capra 2002). A different perspective of this notion of autopoietic balance would be to regard it as the point at which two opposing forces (controlling risk and survival risk) are equal and opposite in nature. This point of balance by default will define the optimal value of variables that can be maintained in a natural state and therefore represents the equilibrium position between survival and control.

This alternative understanding of autopoietic balance holds merit in that not only does it consider autopoietic balance from a totally different perspective, but it also creates a new opportunity from which to derive a qualitative risk solution applicable to organisational structure.

This will be discussed briefly in paragraph 2.6 to follow. Consider Figure 2.9 in which the concept of survival risk is summarised visually.

Figure 2.9 - Survival risk as an autopoietic necessity



Source: Own observation

Figure 2.9 highlights the purpose of survival risk. Survival risk offers an opposing force toward a tendency of control and as such prevents controlling risk from imploding upon its internal components. The point at which both opposing forces are equal and opposite can be seen as the point which defines the state of dynamic balance or rather autopoiesis. This state is represented by the area between the red circle (survival force) and the green circle (controlling

force). This understanding also qualifies the question as to why all living species are born with a natural ability to survive.

2.5.2.3 Sacrificial risk

The concept of sacrificial risk was derived from a question relating to fundamental principles housed within Gaia theory and natural selection respectively. The question posed was what the purpose of reproduction or regeneration within an ecosystem is. This question was induced from the current understanding of autopoiesis, namely that if one organism's waste is another organism's fuel then why should reproduction take place? The obvious answer is renewal of life (Capra 1983), however, if considered in the light of the previous two principles concluded (controlling risk and survival risk), then a very distinct and alternative approach to answering this question can be achieved.

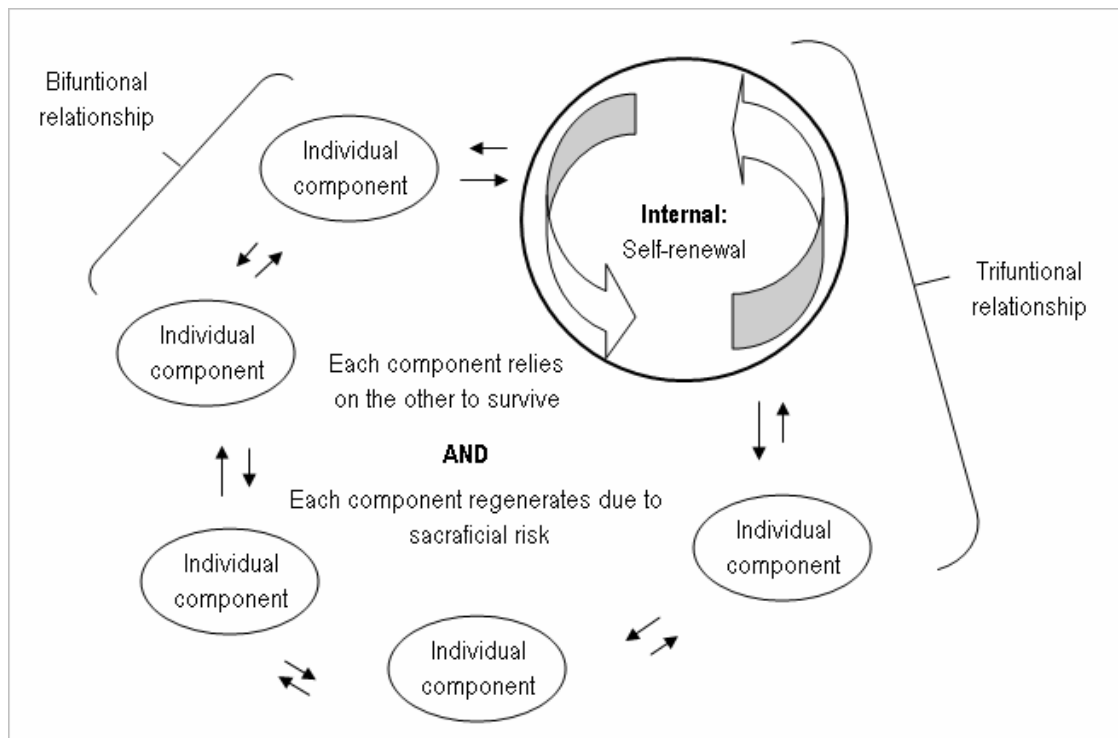
"The habitat of an animal population offers only finite resources for its use. As individuals reproduce these resources are necessarily depleted and the relation between the speed of their renewal and the rate of population growth governs the numbers of individuals that can live there" (Crook 1980:38-39). In this statement Crook makes reference to a key concept, namely that reproduction takes place in order to renew a resource that is continually being depleted. It is this process of renewing resources that highlights another distinct characteristic of survival risk.

Controlling risk, as applied by nature, demands of its variables a natural resistance in order to maintain its state and form (see paragraph 2.5.2.2). The moment control risk is greater than what a living organism (in its current state) is capable of sustaining it must call upon an external energy reserve. This is in order to overcome the control risk imposed so as to survive. This process induces the concept of sacrificial risk as each time survival risk is applied in nature a resource element is sacrificed. This element attracts a risk status due to the fact that it is finite

in nature. Should the resource be depleted faster than it can be regenerated, an inherent supply risk is present, according to Hugo, Van Rooyen, and Badenhorst (1997).

Sacrificial risk has a fundamental implication. The balance within a truly autopoietic ecosystem must be viewed as trifunctional and not bifunctional implying that organisms cannot rely exclusively on other organisms present within a living structure in order to survive. They must in addition rely upon themselves to regenerate in order to prevent extinction resulting from sacrificial risk. In this way a trifunctional relationship is established. This concept is termed self-renewal. "All these processes are regulated in such a way that the overall pattern of the organism is preserved, and this remarkable ability of self-maintenance persists under a variety of circumstances, including changing environmental conditions and many kinds of interference," Capra (1983:293). If consideration is given once again to Figure 2.6 then an additional modification is needed to better explain autopoiesis. Figure 2.10 details the change.

Figure 2.10 - A trifunctional approach to autopoiesis



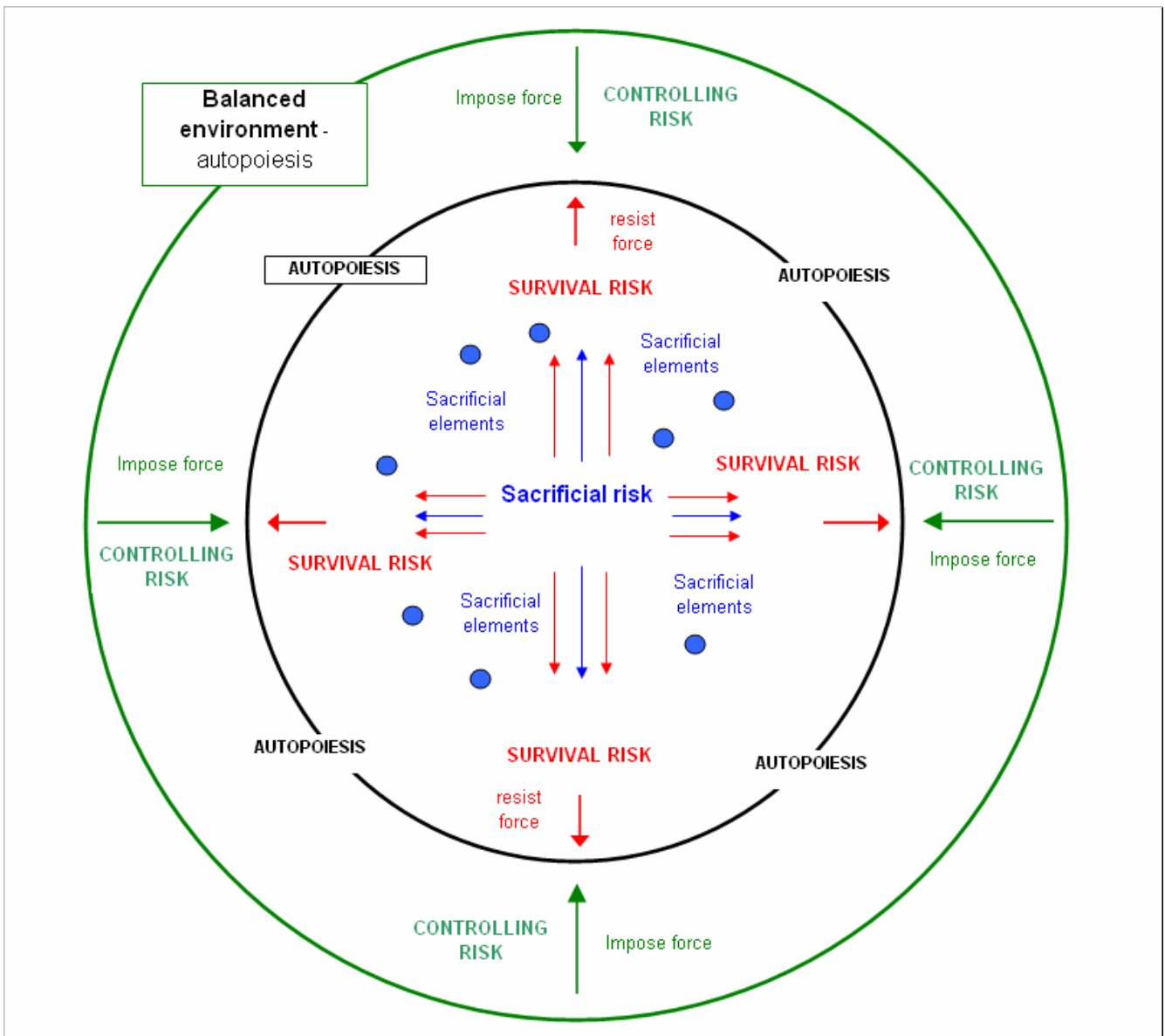
Source: Own observation

A proposed trifunctional understanding of autopoiesis is depicted in Figure 2.10 above. In such an approach a three-way relationship exists between components within a system. Where a common understanding of autopoietic balance recognises a dual directional relationship between two components, a third aspect is now introduced. This aspect relates to an internal relationship within each of the individual components themselves. In this way autopoietic balance is dependent not only on a mutually beneficial relationship between components within a network, but also within each internal structure respectively. This third element of understanding is modelled on the basis that all components self-renew for the sake of continuity. Thus continuity in turn is necessary in order to contribute toward the sustainability of a network.

2.6 Conclusion

Three of the four new risk concepts put forth in paragraph 2.1 have been described, namely controlling risk, survival risk and sacrificial risk. The fourth concept of opportunity risk is to form the basis of Chapter 3. It presents a host of qualitative implications that are to be considered throughout the remainder of the dissertation, however, from the concepts deduced so far a risk model can be partly extracted that encompasses the overall qualitative principles of risk. Figure 2.11 provides a qualitative risk model that can possibly be implemented at an organisational level. It is not the purpose of this chapter to discuss the implementation of this model, however a brief overview is required in order to ascertain a holistic understanding of the opportunity this model presents.

Figure 2.11 - A qualitative risk model detailing three of the four new risk concepts



Source: Own observation

The purpose of Figure 2.11 is to provide a conceptual model depicting three of the four proposed forms of qualitative risk, namely controlling risk, survival risk and sacrificial risk. In the model, sacrificial risk is seen as residing in the centre of the model. The basis for this is that self-renewal is the primary requirement for the existence of a species. As the demands of survival risk increase so the number of sacrificial elements called upon in order to sustain this survival drive increases.

This concept is coined sacrificial risk and completes a three-way relational understanding of autopoiesis. It is evident from the diagram, within the circle depicting survival risk lies the critical element of sacrificial risk. Together these two factors (survival and sacrificial risk) contribute toward maintaining an autopoietic balance as defined by the separating line between control risk. This boundary line was previously depicted as being established by a two-way relationship between survival risk and control risk only. For a detailed explanation of this concept refer to paragraph 2.5.2.3

Assume the theory behind a trifunctional understanding of qualitative risk can be applied at an organisational level. If the philosophy constituting the model is implemented into organisations, then essentially it proposes that organisations should never attempt to deal with risk through a process of eradication but rather through a process of invitation. Comparative to nature, organisations fulfil a role of control. That is to say that, organisations can also be viewed as a natural system that relies upon individual components (employees) within that system in order to achieve indefinite existence (going concern). This function of organisational control is likened to controlling risk. For an organisation to maintain its structure it has to have a counterforce apposing this Control risk (see paragraph 2.5.2.2). This is the function of the individual components within the system, namely the employees. This function can be likened to survival risk.

In applying this to a physical example, if an organisation wanted to increase profit potential or achieve any corporate objective, it would simply have to increase controlling risk. Unlike nature, an organisation has the benefit of being able to manage the consequences arising from an increase in control risk. This management process takes the form of counter-stimulating survival risk amongst its employees so as to arrive at a new autopoietic state. By a matter of default this new boundary (dynamic balance) will be positioned in accordance with the corporate objectives being pursued. This is a discussion for chapters to follow. The only additional consideration the organisation would have to ensure is that sacrificial risk (a natural by-product arising from an increase in survival risk) is taken into consideration. This, in organisational terms, is also fully manageable.

This qualitative modelling of risk clearly indicates the need to invite risk into organisations. In so doing survival risk is stimulated and a greater degree of control can be implemented in order to achieve organisational objectives. The consequences resulting from this action are manageable and will form the content of discussion in the chapters to come.

CHAPTER 3

HISTORY OF QUANTITATIVE RISK – the gateway to human opportunity

3.1 Introduction

An understanding of risk has been formulated in terms of a qualitative approach. The focal point has been the role of man within nature and the consequent relationship that resulted in the creation of risk. A further consideration of the more quantitative nature of risk is now necessary. It will strengthen the current proposition that man is the creator of risk and also support this understanding by allowing the final concept of opportunity risk to be deduced. This will be achieved by considering the history of risk from as far back as 3500 BC to the present day. Considering this period it is possible to attain a holistic understanding of the events that influenced not only the development of risk, but also the development of Western civilization and the realisation of opportunity that a quantitative risk understanding brought forth. It will further be shown how opportunity in fact is the true catalyst that gives meaning to the current human perception of risk. This will be done by considering the consequences associated with human opportunity and benchmarking these consequences against the principles inherent in autopoiesis. By doing this it will help to understand risk better, thus providing a deeper insight into the nature of risk. Once this is achieved, opportunity risk will be integrated into the qualitative risk model derived in Chapter 2, thus completing the final dimension of it. The model will then represent an internal framework from which all remaining quantum disciplines can be considered.

3.2 The history of quantitative risk

3.2.1 Introduction

Bernstein (1996) has been referenced in large in order to describe the historical development of risk. This is due to the fact that alternative literature, providing a consolidated view of the history of risk, is scarce. External references have been consulted and included where possible, however, the nature of these references has provided only snapshots of the history of risk and as such could not be relied upon in isolation to sketch an overall understanding.

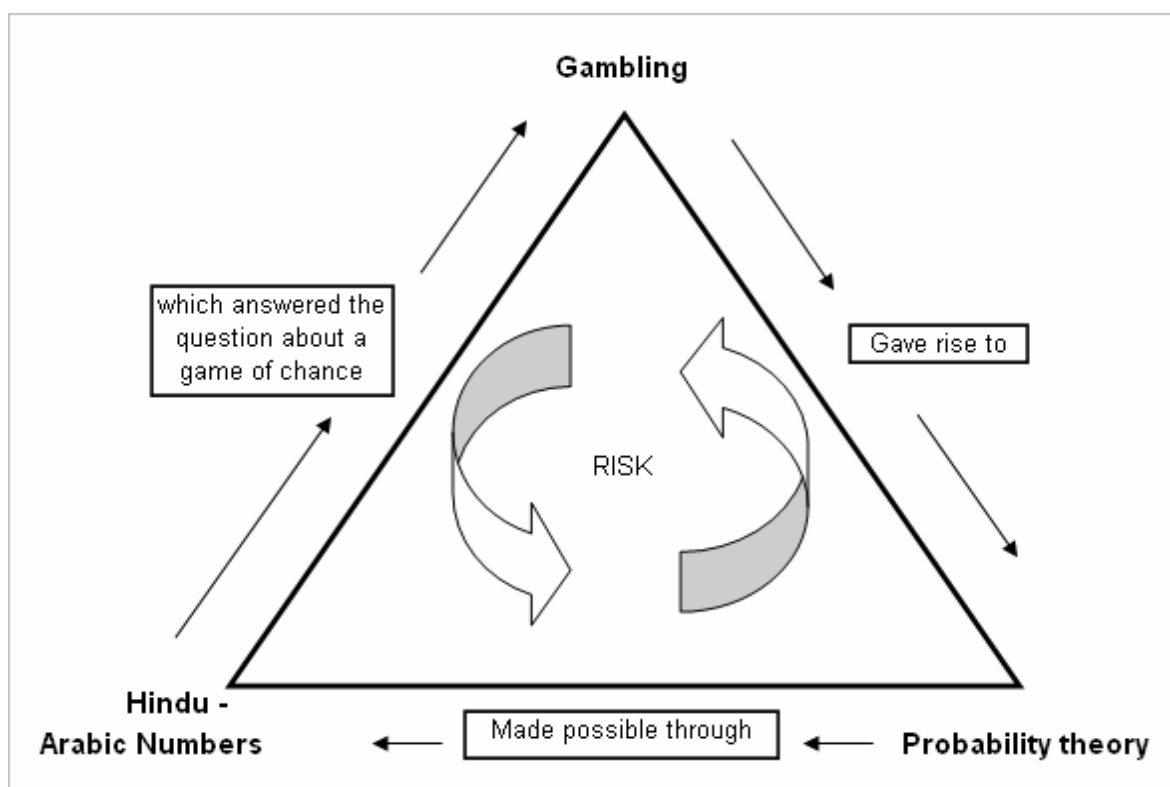
In coming to understand the nature of opportunity, it is important to comprehend the history of numbers. The reason for this lies in the need to be able to examine the concept of human possibility, which is only possible if an understanding of periods of time prior to and after the introduction of numbers is attained. For this to be achieved, a deviation from the central theme of this chapter is required and a brief historical consideration, starting from 3500BC, is required.

The history of risk began with gambling of which the earliest known form dates back to around 3500 BC. Archeological diggings confirmed this through the discovery of dice made from the ankle bones of sheep or deer according to Bernstein (1996). These dice had four faces and were known as astragali. The purpose of the game, in which the dice were used, was to achieve a Venus roll. This was attained by rolling the four dice and getting them to stop in such a way that the faces of each of the dice revealed a different number (Hastie & Dawes 2001). This was gambling in its earliest known form and comprised a starting point for risk. It occupies an important space within the history of risk as it effectively gave rise to another element of risk, namely probability theory. This was achieved through a question related to gambling. A French noble man (Chevalier de Mere) questioned as to how the stakes of an unfinished game of chance between two players could be divided equally when one of them was ahead (Bernstein 1996). The final and possibly most significant contributor to the origin of risk was the Hindu-Arabic numbering system. As a result of

the technology made possible by this system, probability theory could be developed (Hastie & Dawes 2001).

From this brief explanation it can be deduced that risk originated from three elements, namely gambling, numbers and probability. The diagram below summarises this view.

Figure 3.1 - The risk triangle

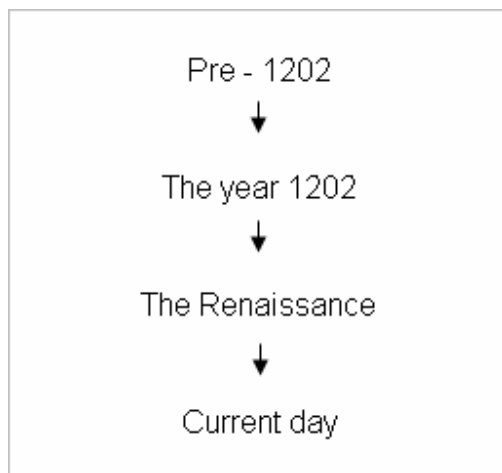


Source: Own observation

Figure 3.1 depicts the three essential components associated with the creation of risk, namely gambling, the Hindu-Arabic numbering system and probability theory. A historical account of the periods of time from which these three components occurred will contribute toward a better understanding of the true nature of quantitative risk as well as how opportunity, the true creator of risk, came to the fore.

A proposed starting point, upon which to build this chapter, is with an understanding of these three elements. This understanding is tangible by nature and as such puts forth a convincing rationale that man is the creator of risk. In addition to this, particular historical events exist within this understanding requiring consideration for the reason that they assist in shaping the characteristics that have come to define opportunity. Insight into these characteristics is necessary before an appreciation of opportunity risk can be attained. In order to deal with these historical events effectively a methodical approach, in terms of a timeline, has been applied.

Figure 3.2 - The timeline applicable to the history of risk



Source: Own observation

Figure 3.2 details the timeline associated with the history of risk. Adherence to this timeline will result in an understanding of key principles necessary to meet the objectives set out for this chapter.

3.2.2 Pre-1202

The focus for this era will be the most significant element pertaining to the origin of risk, namely the Hindu-Arabic numbering system. It was one of the most important technological discoveries that

brought about change in the history of the Western world (Kiyosak in County, B (2000) MSC). Within the context of trying to comprehend this change, Bernstein (1996:18) writes that “Up to the time of the Renaissance, people perceived the future as little more than a matter of luck or the result of random variations and, most of their decisions were driven by instinct. When the conditions of life are so closely linked to nature, not much is left to human control.” This qualitative mentality, that future outcome was beyond human ability, was one of the key factors that the Hindu-Arabic numbering system served to transform. Without this transformation, opportunity risk could not exist. To best understand this, it is necessary to benchmark the possibilities inherent in the Hindu-Arabic numbering system against alternative numbering systems prior to 1202 AD.

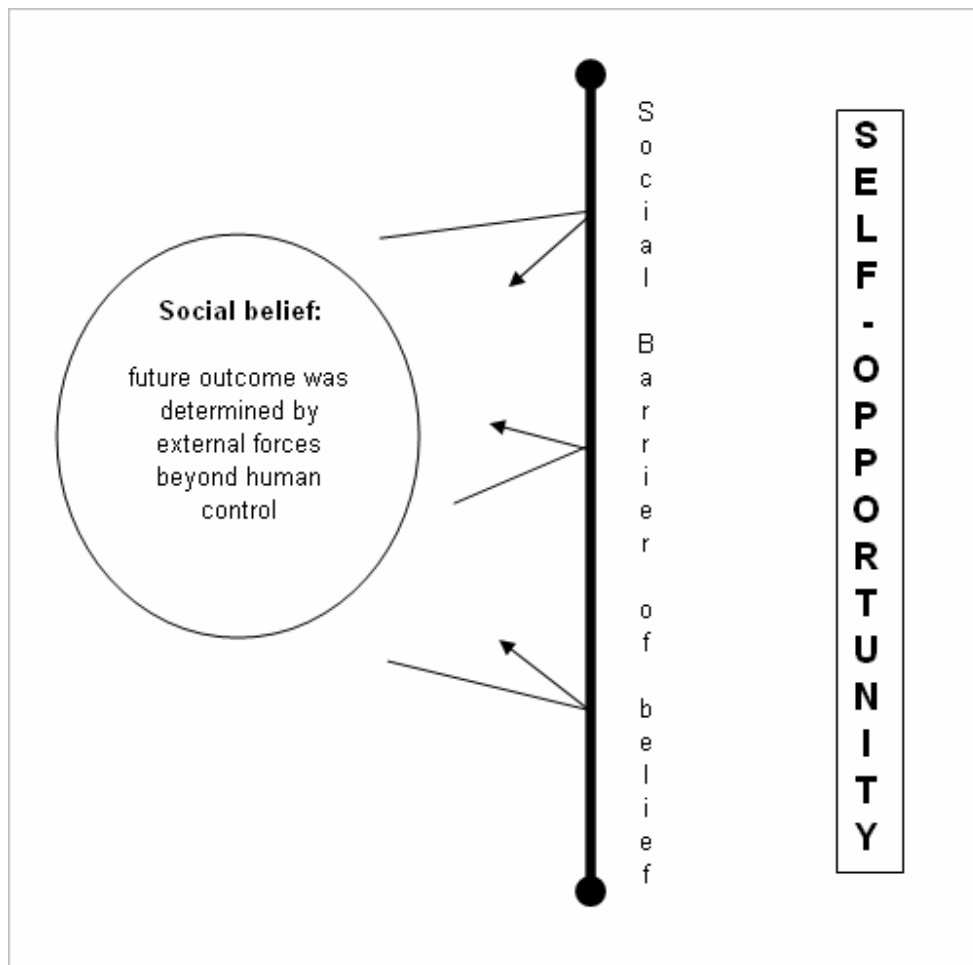
3.2.2.1 Other numbering systems

A number of civilisations utilised form of numbering system prior to the year 1202. These numbering systems varied in terms of complexity and ability. The simplest of all was used by the Neanderthals who relied on markings made on stones or trees in order to count. The Greeks had in turn devised something more complex, namely an alphabetic numbering system that relied on the 24 letters of the Greek alphabet and the Hebrews and Romans used a kind of ‘cipher–alphabet’ system (Bernstein 1996). The details of each numbering system are irrelevant to the theme of this chapter. What is relevant, however, is the fact that throughout each of these civilisations, ranging from the Neanderthals through to the Greeks, Hebrews and Romans, a common shortfall existed. Neither of the respective systems could calculate. They were merely substitutes for numbers that provided nothing more than mechanisms that could be used to record results (Bernstein 1996). This was a fundamental shortfall as without an inherent ability to calculate, there existed no chance for Western society to understand the possibility of creating self-opportunity.

The definition of opportunity is “a condition of things favorable to an end or purpose” (Oxford 1944: 1377). This condition of favourability was believed to be a function of luck, random events (see paragraph 3.2.2,) or religious forces (Barrow 1991). Greek and Roman societies firmly believed that three goddesses, namely Clotho, Lachesis and Atropos, were responsible for controlling the

outcome of human life (Oxford 1944). For as long as this mentality remained, self-opportunity was not something humans accepted as possible and until such time that a technology existed that could allow people to correlate future outcome with human endeavor, there existed no basis upon which the transformation from current belief into opportunity risk could take place. Figure 3.3 summarises this concept visually.

Figure 3.3 - Summary of the social belief that prevented the understanding of opportunity



Source: Own observation

Figure 3.3 serves to represent the implication of social mentality that prevailed prior to the Renaissance era (1500 AD). During this era society believed that human fate or outcome was determined by an external godly force. This persistent belief acted as a barrier by preventing any possible consideration of the fact that fate was possibly a human control. As a result of this barrier

of belief, no cognitive recognition existed that would engender the notion of being able to create opportunity for the self.

3.2.3 The year 1202

In the year 1202 the Hindu-Arabic numbering system was introduced into Western civilisation and as such the very first possibility of altering this social perception was presented. Leonardo Pisano introduced the Hindu-Arabic numbering system into Western civilization (WSJ 1996:A18). The notion of human opportunity was now presented through the practical implications of mathematics. Leonardo Pisano in his book titled *Liber Abaci*, gave physical mathematical examples. These examples were made possible only through the use of the new Hindu-Arabic numbering system, were given that could be applied practically in everyday life (Bernstein 1996). For the first time since the inception of risk (around 3500 BC) the possibility of human control was implied.

3.2.4 Opportunity risk

This notion of human control represents a fundamental point in this chapter in that it concludes the missing factor needed to transform social mentality into opportunity risk. This process of transformation is best understood by benchmarking the consequences of human control against the principles of autopoiesis extracted from Chapter 2. In this manner the approach remains within the ambit of a qualitative analysis.

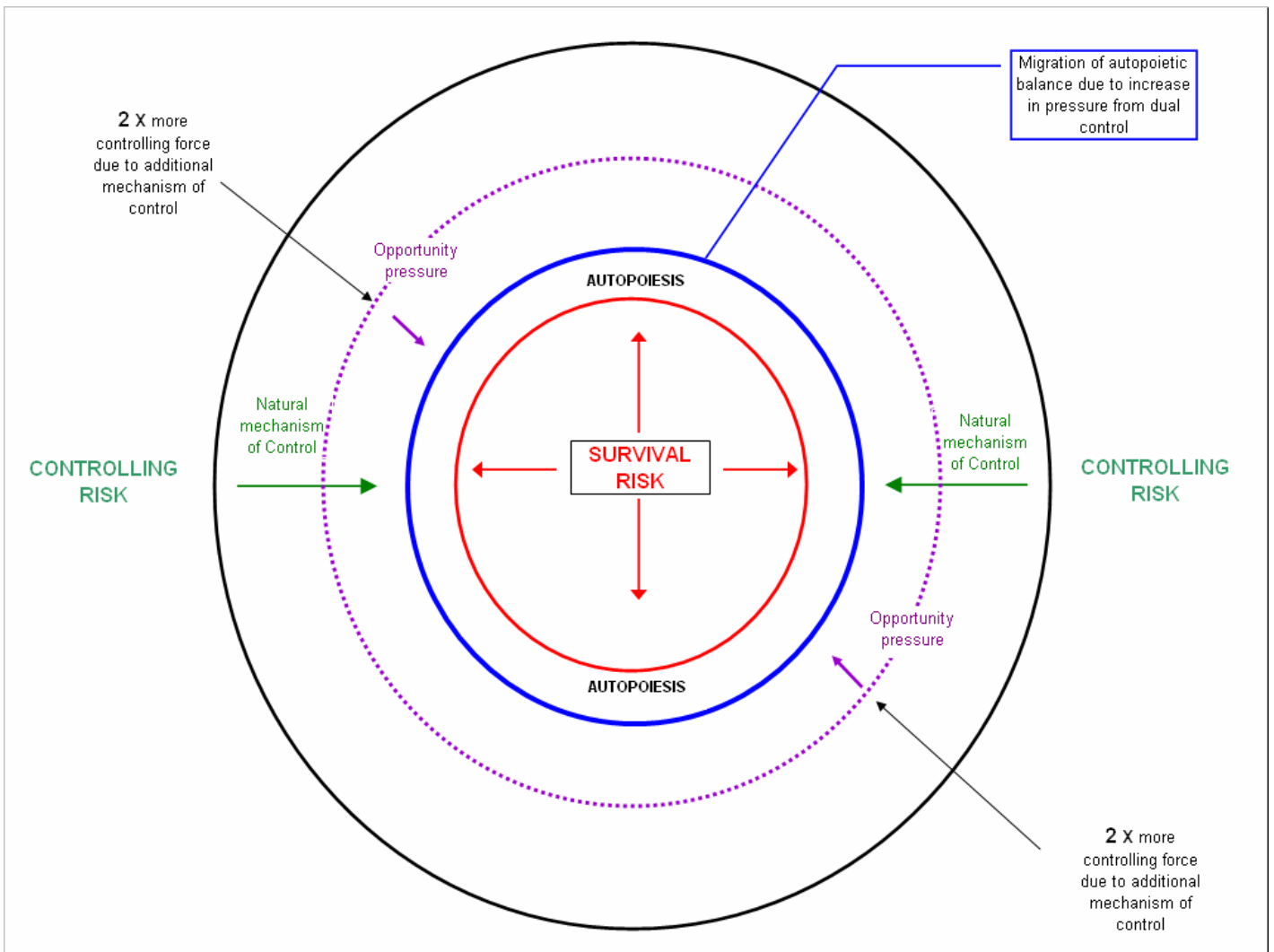
In Chapter 2, autopoiesis was said to be a state of dynamic balance in which continued existence is possible. From this understanding, three principle elements of risk were identified and derived namely controlling risk, survival risk and sacrificial risk. These three elements were incorporated into a qualitative risk model, the mechanics of which represented a state of autopoiesis. This state of autopoiesis was a function of the fact that each of the three risk elements existed without either of their functions (namely to control, survive or renew) posing a threat or interfering with one

another. That is to say that controlling risk functioned only in a capacity to control, survival risk functioned only in a capacity to counter control (i.e. survive) and sacrificial risk served only in a capacity to renew those sacrificial elements called upon as a result of this process. As a result of this the relationships that evolved amongst these three risk elements were always within the ambit of an autopoietic state. Using this understanding as the benchmark, against which to compare the notion of control, allows for opportunity risk to be arrived at.

It was proposed in paragraph 3.2.2 that opportunity risk was reliant on the fact that the social paradigm dominating Western perception be altered before any form of transformation, relative to opportunity risk, could take place. In comparing this statement against the benchmark proposed, an interesting qualitative property emerges. If society's core belief remains focused on the fact that external forces determine future outcome, then in terms of autopoiesis, society can be seen to be acting within the ambit of an autopoietic state. This is based on the fact that a belief system which accepts that human outcome is a function of external control will always remain passive before nature and as such only ever fulfil a function of countering this control in a bid to survive. This is typical of the relationship within an autopoietic state. However, the moment perception alters and society accepts the notion that they can control, then in terms of autopoiesis a natural threat evolves. This is because of the fact that social perception no longer complies with acts associated with passive survival. Instead, a more active approach is adopted. People no longer remain complacent in the hands of fate or rather controlling risk and as such approach the future by also trying to impose an element of control. This concept of dual control places additional pressure on an autopoietic system which naturally threatens the concept of continued existence. For this reason opportunity is regarded as risk within an autopoietic state and hence the term Opportunity risk.

Figure 3.4 visually summarises the above view however, before building upon this concept it is necessary to understand why the notion of human control is regarded as opportunity. Once this is achieved, the holistic understanding needed to conclude opportunity risk can be attained. For this reason, further consideration is given to historical events pertaining to the Renaissance era.

Figure 3.4 - The effect of opportunity risk within an autopoietic system



Source: Own observation

Figure 3.4 depicts the implication of opportunity risk. It is important to understand that self-opportunity is synonymous with self control in that any person creating opportunity for themselves is in effect controlling their own fate. The implication of this is simple to understand in that prior to the realisation of opportunity the only form of control that resided on nature was the natural form of control coined Control risk. The instance opportunity was understood by humans a tendency to want to perform a personal function of control was engendered. In so doing two elements of control were now imposed on a natural system. The first being natural control and the second being

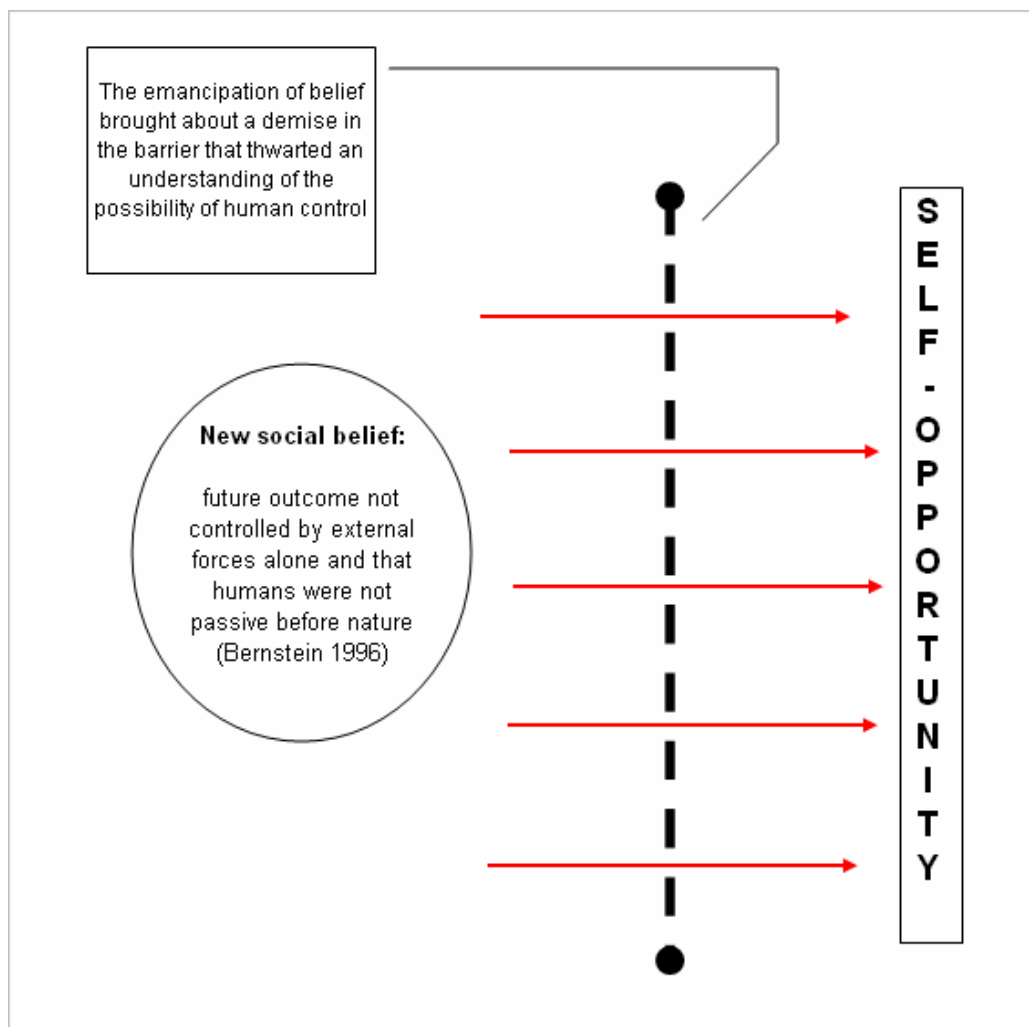
human control. The effect of this is a migration in autopoietic balance. By imposing an extra level of control within a system, an increase in directional pressure on its internal elements is imminent. This has the effect of diluting the resisting strength imposed by survival risk, thereby altering and possibly threatening the state of autopoietic balance. This threat of autopoietic balance is what relates opportunity to risk and hence the term opportunity risk.

3.2.5 The Renaissance era

The purpose of considering the Renaissance era is to extract those events or circumstances that contributed to the process of understanding opportunity risk. The most important of these events or circumstances relates to the fact that the Renaissance era was a time of emancipation in which Western civilization, through the Protestant reformation, managed to break through the dominance of the Catholic Churches (Knight & Lomas 1997) that had controlled social belief for so long. Such emancipation contributed toward “completing” the human being as it permitted the development of all aspects of education ranging from natural sciences, to art, philosophy, trade, medicine and exploration. This emancipation of belief was fundamental to the understanding of opportunity for the following reason. “A number system without a moral value system is insufficient to promote discovery. It was the moral code of integrity and belief in a world of design that gave rise to the incredible science of discovery we enjoy today” (Leadership Training Institute of America (479) 443-0510). It is within this liberation that opportunity came to fruition. If the definition of opportunity is reconsidered as being “a condition of things favorable to an end or purpose” (Oxford 1944: 1377), then the Renaissance can be seen as being the provider of the right conditions in which people could freely exercise control in an attempt to achieve favourable end or purpose. This atmosphere prompted the understanding of human opportunity through the opening up of choices and decisions in people’s lives (Bernstein 1996). As a result of this the full potential of the Hindu-Arabic numbering system could be realised and as such resulted in an exponential rise in a tangible comprehension of human possibility. “The Hindu-Arabic system of numbers allowed people to sail farther out to sea with greater accuracy; architecture could be more ambitious; time keeping could be more accurate; the human mind sharpened; and people thought more accurately, abstractly, and

critically" (County, B (2000) MSC). This tangible comprehension of possibility was momentous in that it had been preceded by centuries of suppression. For this reason when the final element pertaining to the origin of risk, namely probability theory was derived, the impact it had on human understanding was enough to explain why risk is currently perceived as quantitative in nature. Figure 3.5 summarises this view

Figure 3.5 - The effect of emancipated belief on an understanding of human opportunity



Source: Own observation

Figure 3.5 illustrates the effect that the Renaissance era had on social mentality. It broke through the belief system, imposed by the Catholic Church, that future outcome was determined by factors

beyond human control. With this emancipation of belief came a new-found possibility for human society. As a result of this, Western civilization came to understand the concept of self-opportunity.

3.2.6 Probability theory

In 1654 Pascal and Fermat managed to derive an answer to a question posed by Chevalier de Mere as to how the stakes should be divided equitably in a game of chance, considering one of the players was ahead (Bernstein 1996). This solution formed the basis of probability theory. The importance of knowing this lies in one single fact and is implied by Hastie & Dawes (2001:169) as follows: "Modern probability theory got its start when wealthy nobles hired mathematicians to advise them on how to win games of chance ..." Effectively what has been alluded to in this statement is the first real attempt to quantify the notion of opportunity through the use of mathematics. This action is what has given rise to current perception of the best approach to understanding risk as being quantitative in nature. Bernstein (1996:22) implies this when stating that "Modern methods of dealing with the unknown start with measurement, with odds and probabilities. The numbers come first". During the Renaissance era it became more evident that humans perceived the future as an unknown and that the best way to approach it was to quantify it by understanding the probabilities of outcome.

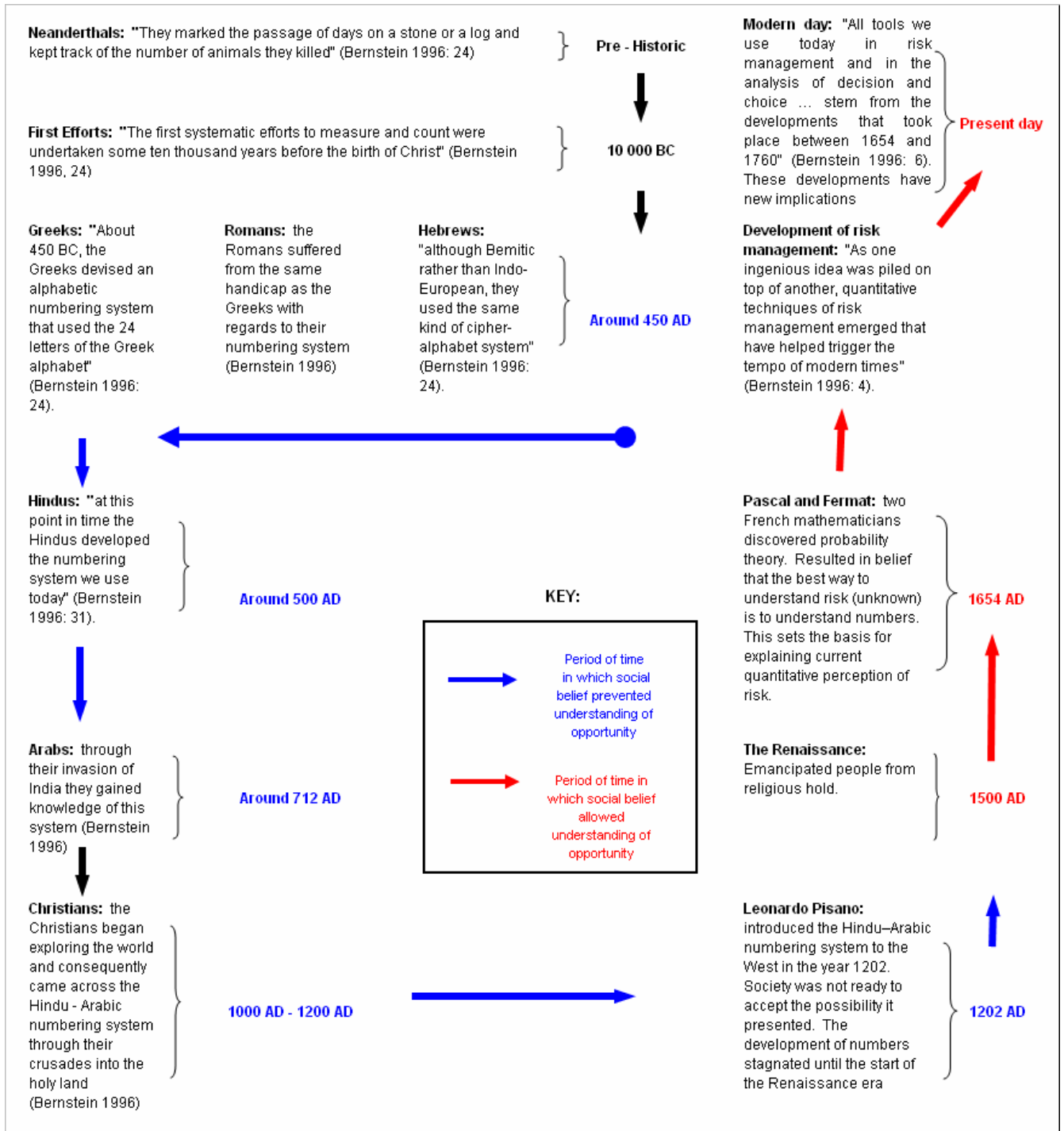
This factor is proposed to be the logic that justifies why the currentday perception of risk is quantitative in nature.

3.2.7 Current day

The reason why the notion of human control can be perceived as opportunity has been explained in this chapter. It has further been explained why opportunity within an autopoietic system can be regarded as risk. The three elements pertaining to the origin of risk have also been disclosed. This laid the foundation for opportunity risk and the consequences thereof can now be integrated into the

qualitative risk model. However, before this can be done Figure 3.6 summarises the origin of risk from the introduction of the first numbering system to the present day for the sake of clarity.

Figure 3.6 - Historical summary of quantitative risk

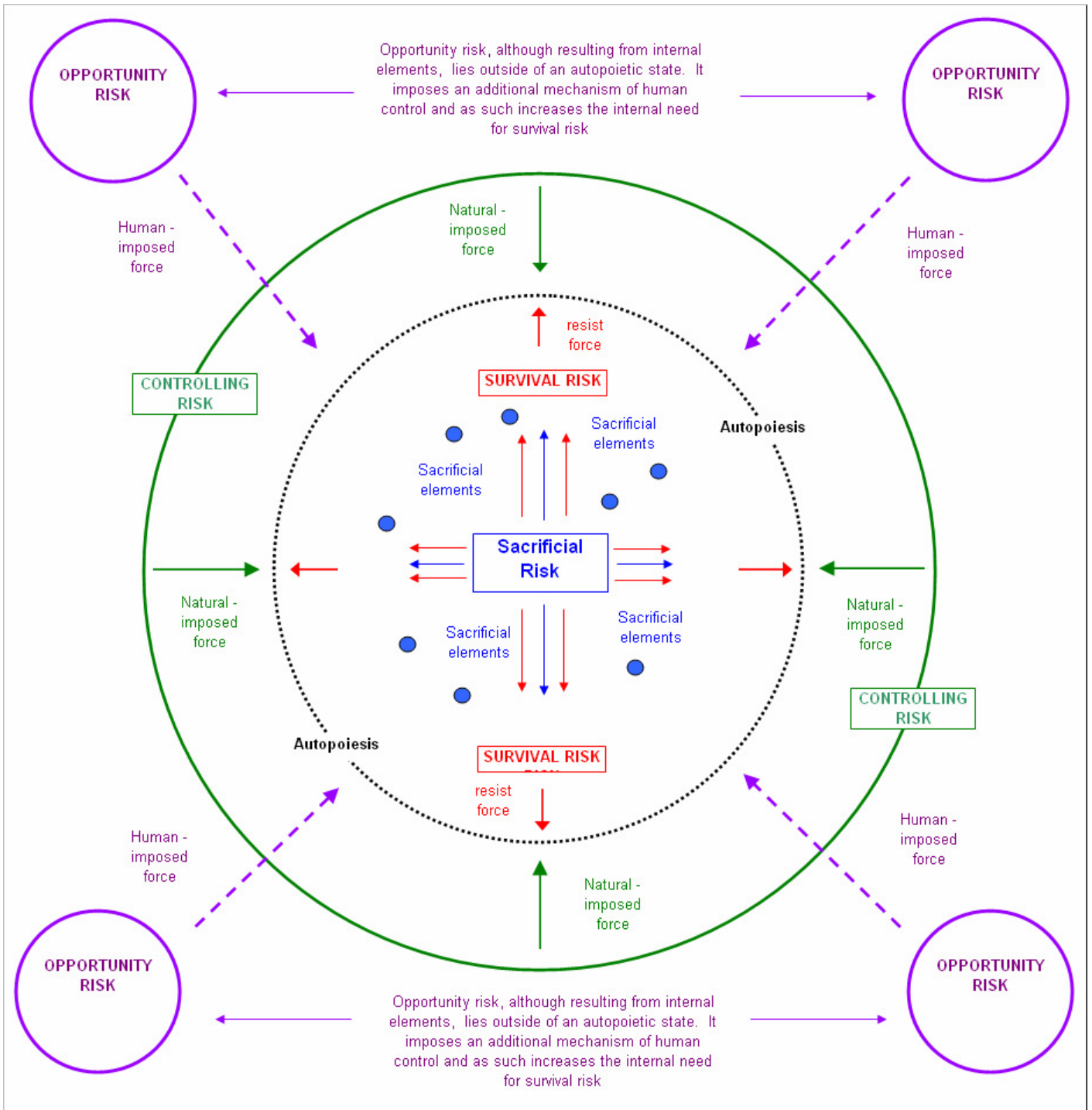


Source: Own observation

Figure 3.6 visually summarises the history of risk from the Neanderthal era to the present day. It also depicts the timeline associated with the understanding of opportunity and places the discussion of opportunity risk into a holistic perspective.

In the light of the current day, the opportunity being presented by a quantitative risk understanding has presented carries with it some definite qualitative implications, however, this discussion now allows for the final element of risk, namely Opportunity risk to be incorporated into the qualitative risk model. Figure 3.7 provides a visual depiction of this final incorporation.

Figure 3.7 - Final presentation of qualitative model for risk analysis



Source: Own observation

Figure 3.7 represents the final conceptual model of qualitative risk and incorporates all four proposed aspects of qualitative risk, namely control risk, survival risk, sacrificial risk and opportunity risk. Positioning of each form of risk is important in the diagram. Opportunity risk is positioned outside of the natural system for the reason that it was not engendered by nature but rather by man and as such cannot be seen to form part of the natural mechanism of autopoiesis. Survival risk and sacrificial risk are positioned together in the centre of the system. Survival risk serves the purpose of opposing control and opportunity risk. Sacrificial risk serves the purpose of sustaining resources so as to ensure continuity of elements. Autopoiesis is now the balance attained between forces imposed through opportunity and control risk as well as counterforces opposed by survival risk. This qualitative risk model is indicative of a risk model that incorporates the concept of how humans have engendered risk.

3.3 Summary

This chapter served the purpose of introducing, explaining and integrating the final concept applicable to a qualitative understanding of risk, namely opportunity risk. The historical development of risk was provided. From the timeline associated with this historical development, fundamental events or circumstances were extracted which were necessary to provide a better understanding of the true nature that constitutes risk. The notion of humans being able to control their own future was explained and provided a key comprehension as to why this notion leads to the concept of opportunity. In addition to this opportunity was benchmarked against the qualitative implications of an autopoietic state and it was further deduced as to why opportunity can be regarded as risk. From this the term Opportunity risk was put into perspective and incorporated into the qualitative risk model arrived at in Chapter 2 thus completing it.

The qualitative risk model has provided an infrastructure on which the remainder of this dissertation can build. Additional quantum disciplines will be called upon to further provide insight into the qualitative nature of risk. The first of these disciplines will be physiology. Chapter touched on the history of risk in order to bring forth an understanding of the reason why so many years of

suppression of belief gave rise to an exponential pursuit of opportunity. It also touched on the manner in which quantitative methods of risk management (probability theory) were adopted in an attempt to quantify opportunity. A host of implications arose from this that providing invaluable evidence into the nature of risk. In order to capitalise on these implications, additional quantum disciplines will be considered, the intention of which is to complement the overall concept applicable to this dissertation, namely understanding risk.

CHAPTER 4

MAN – DESIGNED FOR RISK

4.1 Introduction

Chapter 3 served to introduce opportunity risk into the qualitative risk model. It provided a broad overview into the manner in which opportunity was introduced into Western society. In the summary of Chapter 3 (paragraph 3.3) it was mentioned that certain implications arose as a result of the realisation of opportunity. The intention of this chapter is to consider one of those implications in a bid to provide a more holistic understanding of the nature of qualitative risk. This implication can be highlighted as follows.

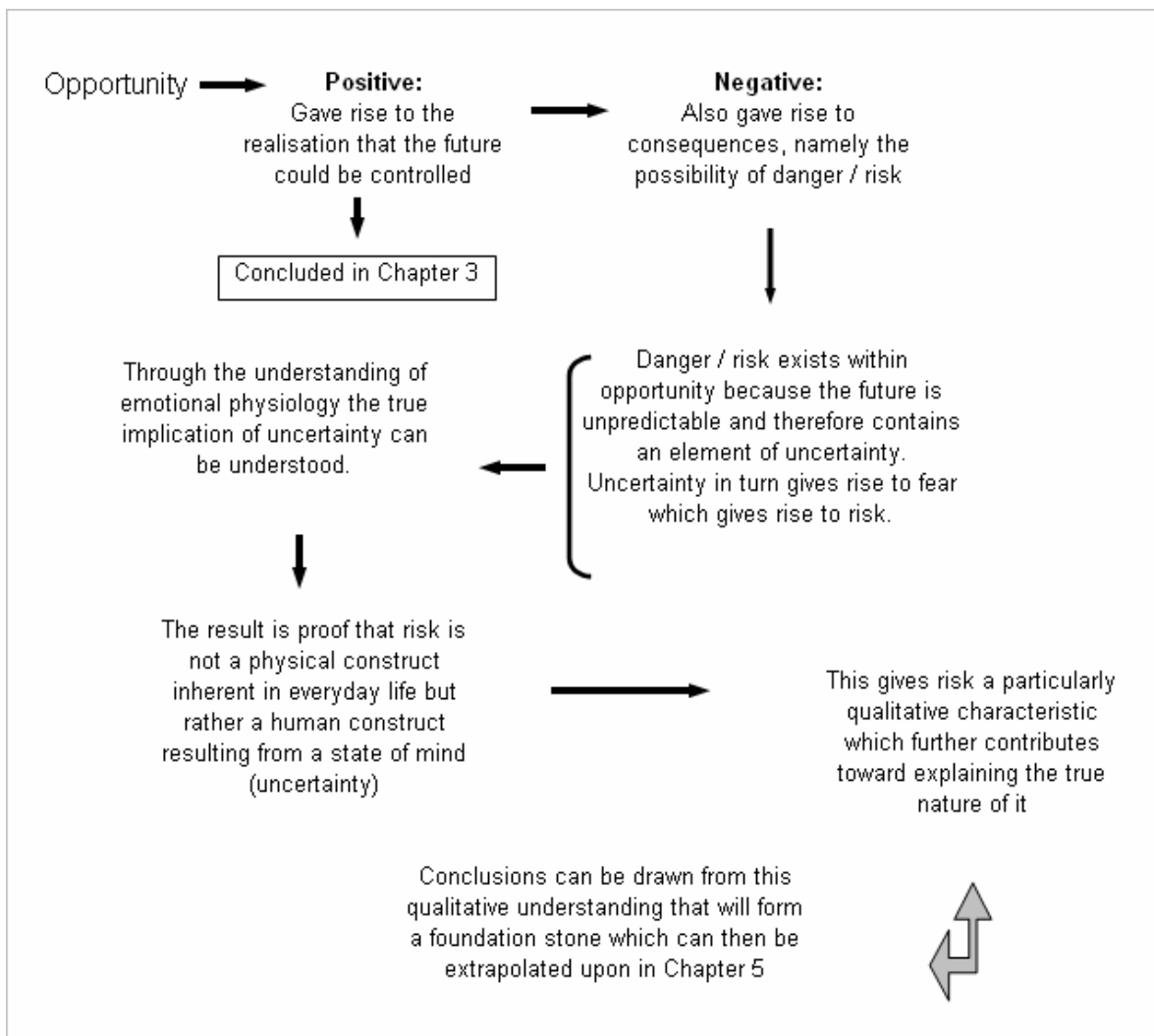
Thus far opportunity has only been presented in a positive light in that it has been shown, how the emancipation of belief brought about a realisation of endless possibility for humans, and how opportunity gave rise to an intellectual understanding that directed Western society toward an acceptance of the fact that controlling future outcome was now in the hands of mankind. However for every cause in life, there is an effect (Capra 1997) and for this reason the pursuit of opportunity, as a cause, could be regarded as having engendered consequences as an effect. One such consequence that opportunity engendered was the possibility of danger (Bernstein 1996). It is the intention of this chapter to discuss and highlight this relationship in an attempt to show how the possibility of danger is but one factor that results in a human perception of risk.

The purpose of showing this is to prove that risk is not a tangible construct that simply exists within the universe, but rather a construct that originates as a result of human existence. This manifestation will be shown to be the result of biological mechanisms, evident in human physiology that has been relied upon to perceive danger in instances of uncertainty. By understanding this, it is possible to highlight the fact that risk is a human construct and in so doing, ascribing to it yet

another qualitative characteristic which provides additional evidence further contributing toward the theme of this dissertation, namely understanding qualitative risk.

In order to achieve the objectives set out, this chapter will resume with a brief discussion on the physiology of man and the role of fear as an emotion. This will provide a level of understanding needed to place into perspective uncertainty as a key characteristic of risk. Once this is achieved, a conclusion will be drawn relative to understanding risk from a qualitative perspective. Figure 4.1 summarises this view.

Figure 4.1 - Overview of Chapter 4



Source: Own observation

The approach to be adopted in Chapter 4 is summarised in Figure 4.1 above. The positive aspects of opportunity were discussed and raised in Chapter 3. Building on this understanding, the negative aspects of opportunity will now be discussed. The introduction of the concept uncertainty gives rise to certain human implications. Such implications will be considered using the physiology of man as a benchmark. In so doing, the true nature of uncertainty will be revealed and the notion that man is the creator of qualitative risk will further be clarified. This understanding will also set the foundation stone for Chapter 5.

4.2 A physiological approach to opportunity risk

In Chapter 3 it was proposed that the emancipation of belief was one of the reasons why humans came to understand opportunity. This notion accounted for the positive aspect that opportunity brought forth (see paragraph 3.2.5), however, a second factor associated with opportunity was not fully considered. As long as the future offered opportunity it also offered danger (Bernstein 1996). The reason for this revolves around one single, detail namely that the future will always refer to what is to come (Benthall 1973) and can therefore never be predicted. It was, and still is, not possible for people to guarantee that opportunity, defined as a condition favourable to an end or purpose (Oxford 1944), will indeed result in a favourable outcome. For this reason opportunity contains an element of uncertainty which is proposed to be one of the characteristics that give rise to human qualitative risk. Understanding this relationship of uncertainty = risk can be achieved by considering the physiology of emotions within the human body. It can be shown how humans instinctually adapt, through the use of emotions, to associate instances of uncertainty with risk.

4.2.1 Acknowledgement

It is not the intention of this chapter to provide a comprehensive scientific explanation of the entire manner in which the brain responds and reacts to uncertainty, but rather to provide only the detail needed to understand the function of fear as an emotion and the perception of risk it

gives rise to in situations of uncertainty. As such numerous texts have not been consulted and within Goleman (1996) and Carter (2000) enough literature is provided in order to achieve the required objective. It is further acknowledged that the physiological processes presented in this chapter are not entirely complete in that a full biological explanation of the physiology of emotions has not been considered.

4.2.2 Introducing fear as an emotion

In the context of understanding risk, particular consideration is given to the one emotion responsible for inclining humans to associate instances of uncertainty to risk, namely fear. In accordance with Barlow and Durand (1995:709) fear is described as “an emotion of an immediate alarm reaction to present danger...” Due to the fact that danger is nothing more than “...exposure to risk” (Oxford 1944), it is possible to conclude that fear is an emotion of an immediate alarm reaction to present risk.

From this the assumption that fear equates to risk is made. What remains in terms of objectives is to correlate how instances of uncertainty in turn give rise to fear. This then will conclude the notion that uncertainty equates to fear which in turn equates to risk.

In order to proceed, an understanding of human emotional physiology is first required. This is needed in order to put into place a required foundation of knowledge upon which later conclusions can be drawn.

4.2.3 The ‘physiology of risk’

Humans interact with the environment on a daily basis. In order to facilitate this interaction people go through a very specific process of taking in data, interpreting it and reacting to it in an appropriate manner (Goleman 1996). This is the process of perception and is very detailed expanding across many aspects of human physiology, however, specific to the theme of risk is

the effect of uncertainty resulting from perception as uncertainty is what gives rise to the emotion of fear and the ultimate acuity of risk. Understanding this relationship is all that is required for the sake of this chapter as it will provide the required level of comprehension from which final conclusions applicable to achieving the objective set out for Chapter 4 can be made.

A starting point therefore, in terms of the above, is a simple understanding of the manner in which perception takes place and the circumstances that give rise to uncertainty.

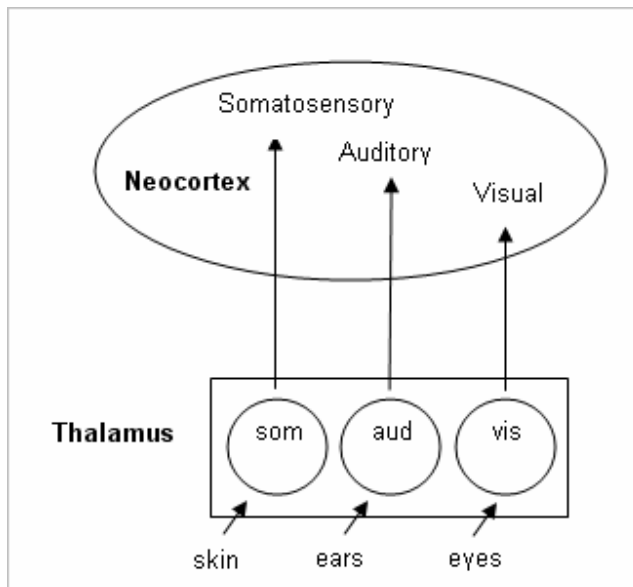
4.2.3.1 Perception and uncertainty

The process of perception can be seen to be logical by nature. It is proposed that in order to best understand this process it should be discussed methodically. For this reason bulleting the process of perception in the following way is most appropriate:

- In any normal situation where the human brain is sensing the environment, the data received by the senses enters the brain and travels directly to a part of the brain known as the thalamus (Carter 2000).
- It is here that the data is sorted and sent on to the rationale part of the brain known as the neocortex (Goleman 1996).
- In accordance to LeDoux (1999), a second path in which data travels has also been identified, however, for the sake of simplicity only one avenue will be considered.
- Once received, the data is channelled to the appropriate sensory processing areas of the neocortex where it gets interpreted.

Figure 4.2 summarises this information.

Figure 4.2 - Visual summary of data path



Source: Joseph LeDoux (1999:83)

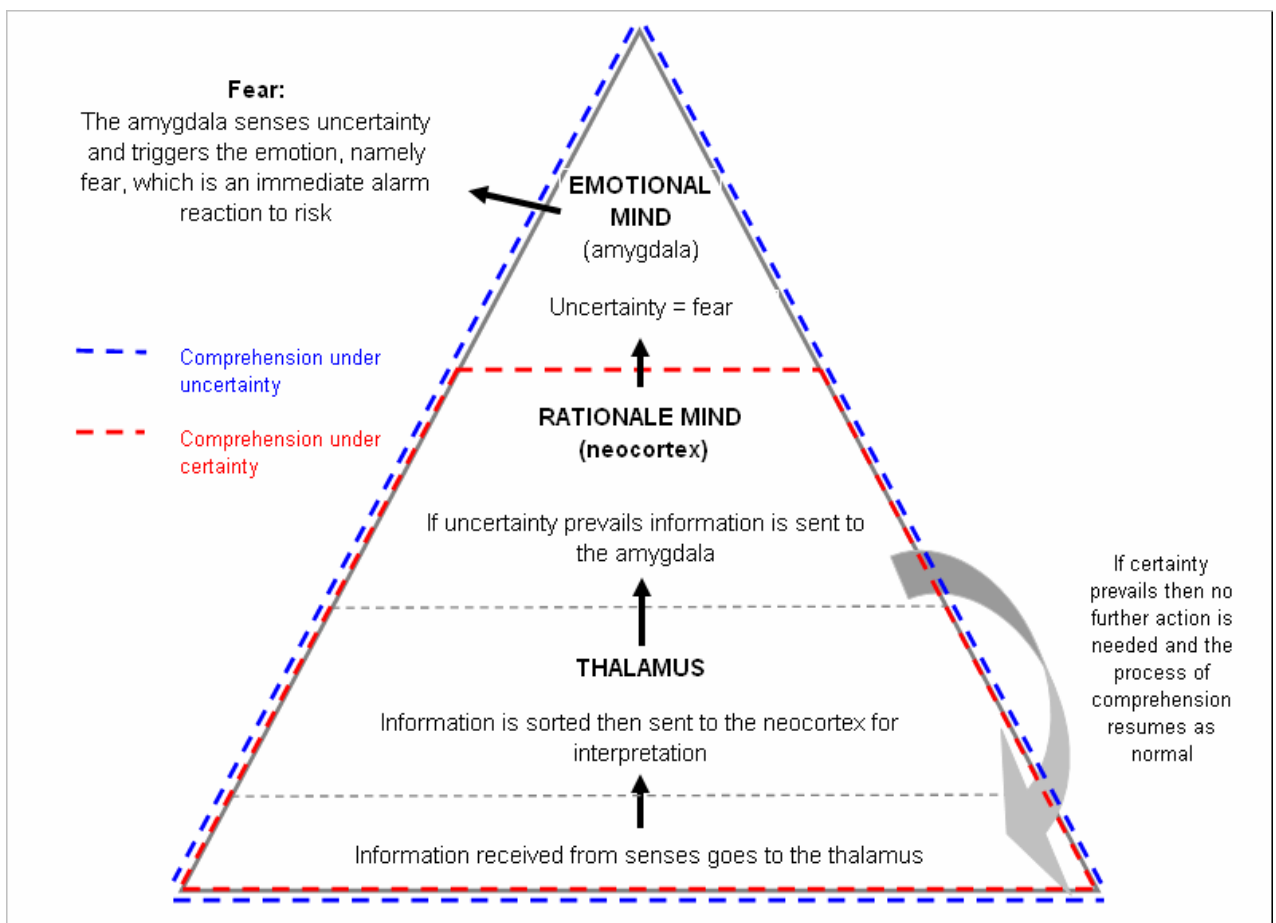
Figure 4.2 provides a visual understanding of the manner in which data is received, through the senses. In this example the skin, ears, and eyes are receiving incoming signals and sending it to the thalamus. From here the thalamus routes the signals to the Neocortex which houses the appropriate sensory areas of the brain. These areas of the neocortex, namely the somatosensory, auditory, and visual interpret the incoming signals respectively.

- Interpretation takes place by means of pairing data off against memories and stored past experiences (Goleman 1996).
- Once a match is attained a sense of understanding prevails and the brain is then capable of concluding the meaning of the data sensed and placing it into context.
- If the conclusion drawn is reassuring then no uncertainty prevails and the process as described ends and no further action, other than simple comprehension, is taken (Goleman 1996).

- In instances, however, where the conclusion drawn is unsatisfactory or inconclusive, uncertainty prevails in which case the amygdala, which is the alarm centre of the brain (Carter 2000), takes further action.

For the sake of consolidation, Figure 4.3 provides an overall summary of the process described thus far.

Figure 4.3 - **Physiological consequence of uncertainty**



Source: Own observation

Figure 4.3 provides a basic understanding of the physiology of the brain relative to the process of understanding and interpreting the environment. It details the manner in which the normal mode of rationalisation takes place. It can be seen how information enters the brain via the sense organs and into the thalamus. From here information is sorted and sent to the neocortex for interpreting. If any uncertainty exists in terms of interpreting the information, then a sense of fear is triggered and the body is prepared to take on risk. If no uncertainty exists then the body continues to function as normal. On this basis it is possible to see how the human body creates a perception of risk in instances of uncertainty using the emotion of fear.

4.2.3.2 Uncertainty and fear

From the brief description of the process of perception as discussed in paragraph 4.2.3 above, it can be seen that uncertainty is engendered the instance unsatisfactory or inconclusive conclusion is drawn from to data assimilated through the senses. It is at this stage of perception that the emotion of fear is introduced and the function of it can be understood. For this to be revealed, uncertainty is considered in finer detail.

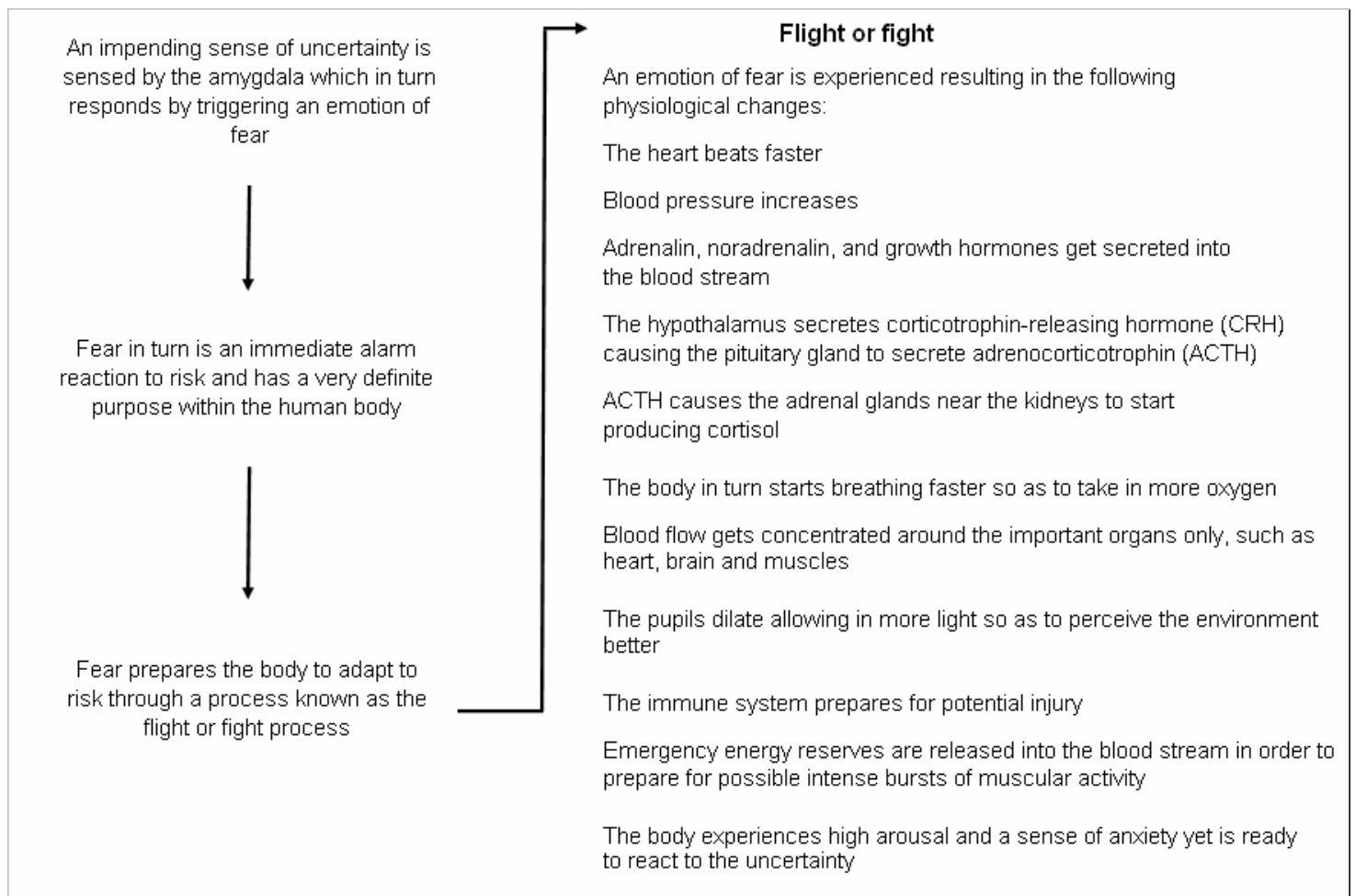
Uncertainty, amongst other accounts, has been identified as being the result of two general instances:

1. Either uncertainty arises as a result of the concluded information conflicting with past experience (Goleman 1996) or,
2. Uncertainty arises in instances whereby not enough data can be assimilated from the surroundings in order to bring about proper comprehension (Goleman 1996).

In both instances of uncertainty a part of the brain known as the amygdala triggers an emotion of fear which in turn serves to alert and prepare the body for possible danger (Carter 2000).

The result of this is that the body adapts to the perceived uncertainty by going through a set of physiological changes that is experienced as high arousal and unpleasant anxiety (The Psychology of Risk Taking Behavior – Introduction). These physiological changes are detailed in Figure 4.4 for the sake of a more thorough comprehension, however, the important aspect to note from all of this is that the physiological reaction to instances of uncertainty engenders the perception of risk thus implying that risk is nothing more than an inherent product of human functionality. This concept is to be discussed in more detail in paragraph 4.2.4 to follow.

Figure 4.4 - **The physiological change the body goes through when alerted to risk**



Source: Summarised from www.risktaking.co.uk/Introduction.htm

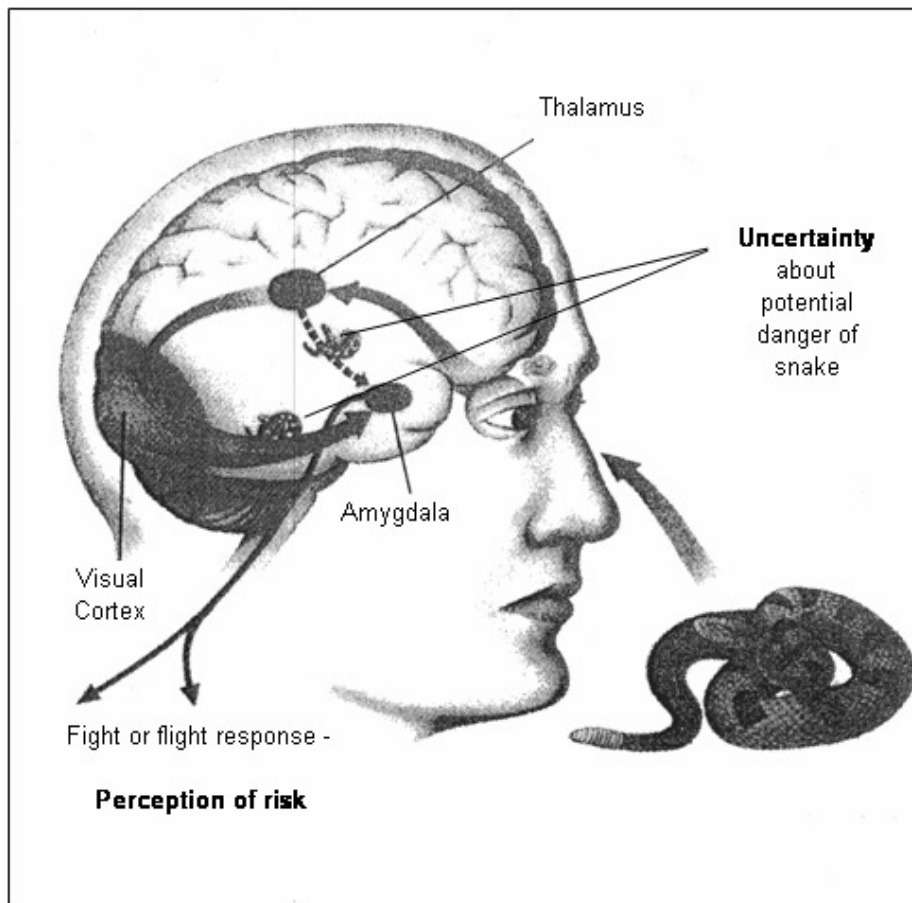
Figure 4.4 depicts the physiological process the human body undergoes when faced with an impending sense of uncertainty. It is included simply to provide an understanding of the autonomous process the body undergoes in order to adapt so as to take on risk. It is because of this autonomous adaptation in instances of uncertainty that humans are proposed to be the creators of qualitative risk.

4.2.4 The applicability to qualitative risk

The processes of perception as described above were provided in order to establish a factual foundation upon which to show that risk is not a tangible phenomenon that exists independently within the universe, but rather a phenomenon autonomically engendered by humans as a result of the physiological response to instances of uncertainty. This can be placed into context through the use of examples.

Using the process of perception as presented in paragraph 4.2.3 above, consider Figure 4.5, in which a visual example is provided showing how the human brain has received data from the outside environment and responded to it by triggering an emotion of fear. In this example not enough information is known about the snake and as such fear is triggered due to a sense of uncertainty. This response is in exact accordance with the functioning of human physiology as discussed in paragraph 4.2.2 above whereby the amygdala is alerted to the possibility of danger and then reacts by preparing the body to take on risk.

Figure 4.5 - Effect of uncertainty of information on risk



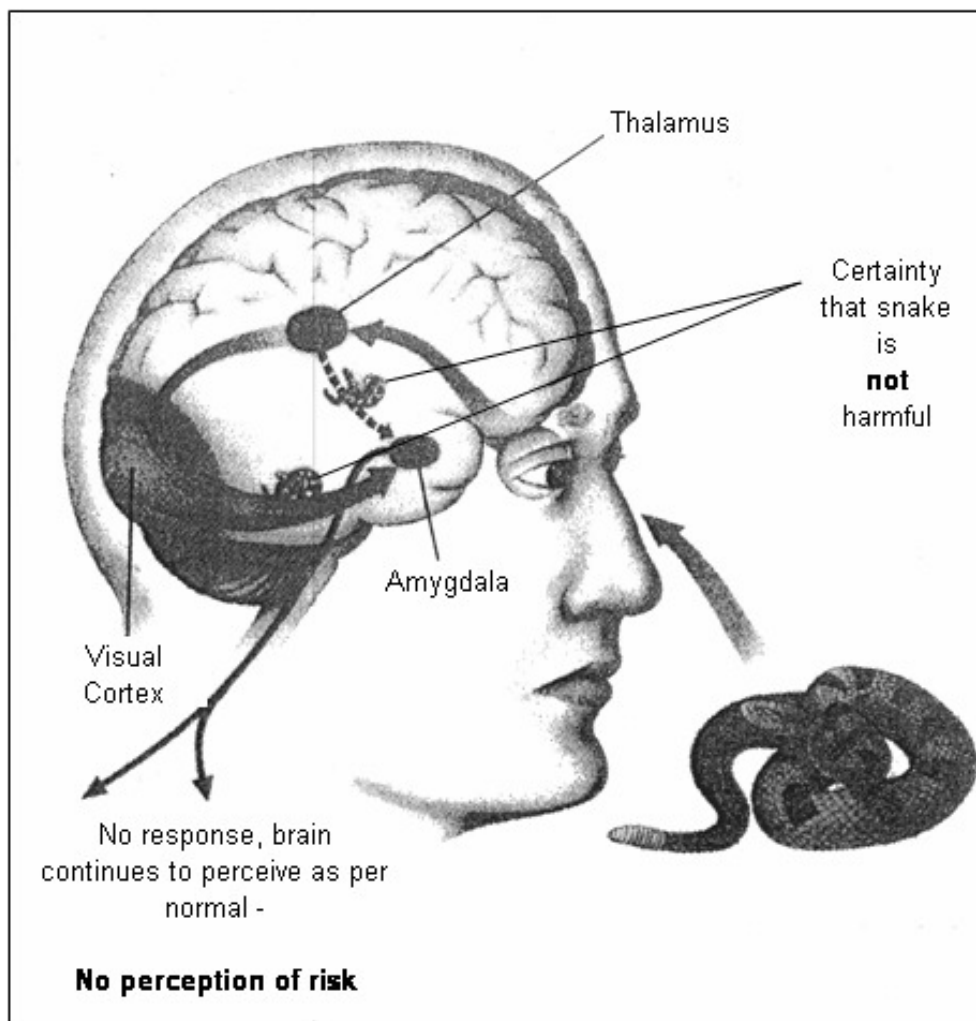
Source: Adapted from Goleman (1996:19)

Figure 4.5 provides a visual example of how the human brain has received data from the outside environment and responded to it accordingly. The assumption made in this instance is that insufficient information was assimilated thus causing a sense of uncertainty resulting in an emotional response of fear thereby triggering a perception of risk resulting from an autonomic biological reaction to uncertainty.

Consider further an alternative scenario in which the context of the situation remains consistent with the one depicted in Figure 4.5, yet an alternative response is evoked. In Figure 4.6 it is shown how

the same data is assimilated by the human brain, however, no risk reaction is solicited. This is due to a sense of certainty attained during the process of perception whereby the neocortex could refer back to a stored past experience which recognised the snake as harmless thus providing a sense of comfort through certainty. As a result there was no cause for alarm and thus the amygdala did not trigger an emotion of fear which would have resulted in a definite perception of risk.

Figure 4.6 - The effect of certainty of information on risk



Source: Adapted from Goleman (1996:19)

Figure 4.6 provides a visual example of how the human brain has received data from the outside environment, yet this time not responded to it at all. The assumption made in this instance is that

as a result of past experience the brain recognised the object being perceived and as such was certain about the fact that it was not harmless. The result of this is that certainty prevailed and as such no autonomic reaction was triggered which would have resulted in a perception of risk.

4.2.5 Conclusion

In both examples provided, the object being perceived in reality remained the same, yet two different responses evolved. In the instance of uncertainty where it was not known if the snake could present a possible threat, an immediate emotional reaction of fear was triggered. This resulted in an instant perception of risk followed by an autonomic biological reaction designed to prepare the body for the possibility of danger. Where, however, it was known (due to the availability of information resulting from stored past experience) that the snake was not harmful, a sense of certainty prevailed. In this instance no emotional reaction was triggered and as such no perception of risk was engendered.

From this a significant conclusion is drawn. Considering that the only variable to have changed in either of the two scenarios was a distinctly human sense of certainty or uncertainty, it can be surmised that risk must have evolved as a result of qualities inherent in human physiology rather than existed as an isolated instance within the environment. That is to say that humans, through an inability to know, autonomically created a perception of risk which was not there prior to human interaction.

Zukav (1979:79) alludes to this concept of creating risk perception by writing that "Without perception, the universe continues ... to generate an endless profusion of possibilities. The effect of perception is immediate and dramatic. All of the wave functioning representing the observed system collapses, except the one part, which actualizes into reality." In simple terms it is suggested that reality (in this case the snake) manifests itself only in the form of which it is perceived. Prior to being perceived it bears no significance and represents only the potential of alternative possibilities.

As perception is a human process the potential for risk, or no risk, as represented by the snake, had no significance outside the human mind, thus causing risk to be a human construct. The Oxford (1944:2286), in its definition of uncertainty, concurs to this notion by defining uncertainty as “the state or character of being uncertain in mind.” The reference to mind within the dictionary definition of uncertainty is what holds significance and as a result of the discussions provided in this chapter thus far, it is possible to rationalise and understand the true significance behind this, thereby comprehending the true meaning of what has been said.

Lastly, it can be concluded that uncertainty is therefore an essential catalyst in the creation and formation of risk. It is qualitative by nature and as has been shown to bears significance only in the presence of human perception. For this reason it can be regarded as a human quality and as such attains the characteristic of qualitative risk.

CHAPTER 5

RISK – A PROCESS OF THE MIND

Men believe themselves to be free, simply because they are conscious of their actions, and unconscious of the causes whereby those actions are determined. (Baruch Spinoza, Ethics)

5.1 Introduction

Chapter 5 can be considered as an extension of Chapter 4 in which a qualitative attribute applicable to risk was put forth, namely uncertainty. The manner in which uncertainty is dealt with, in accordance with human physiology, was discussed and from this it was pointed out that risk evolves into a state of being rather than merely existing.

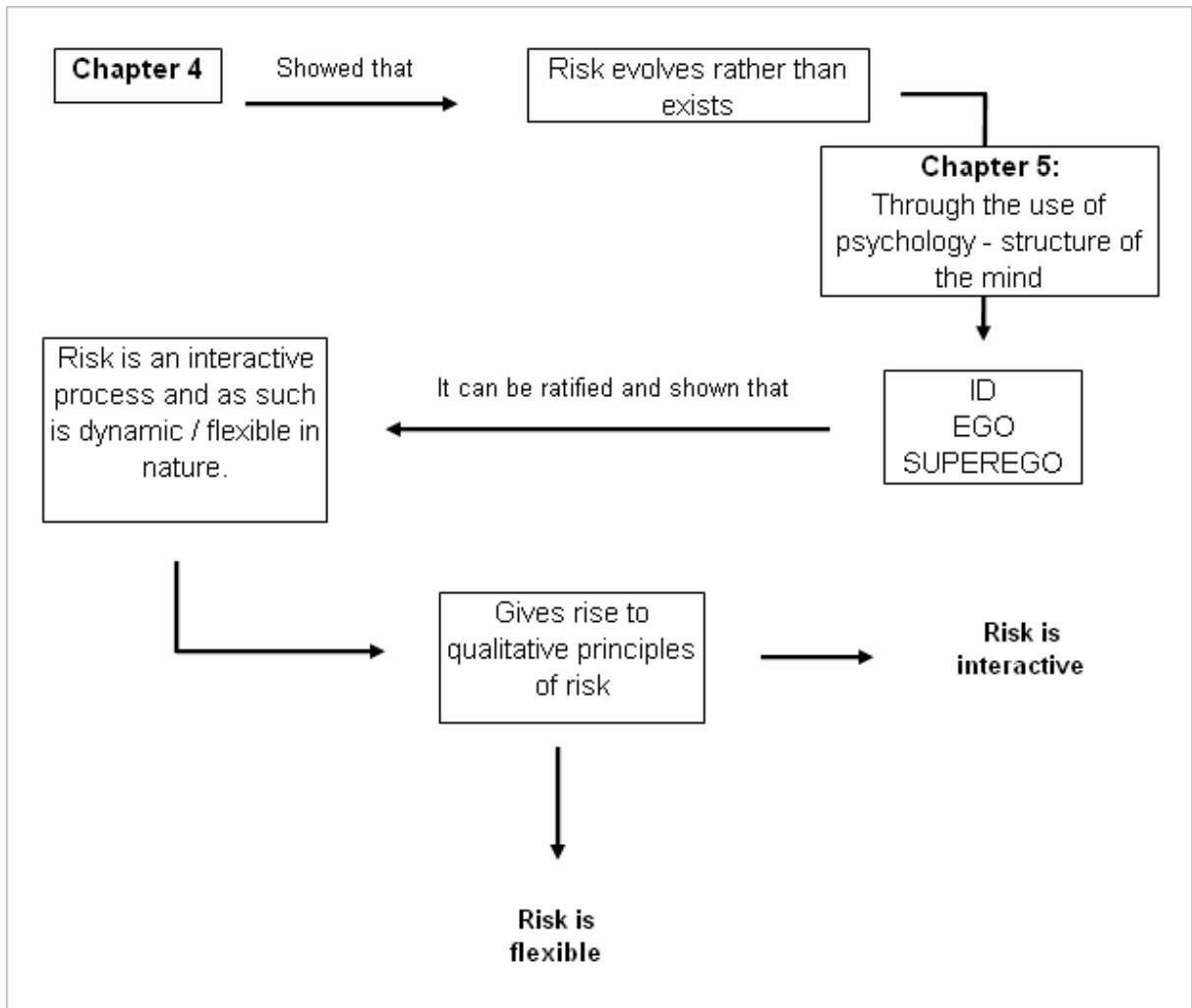
In addition to this theme, Chapter 5 will continue along the lines of considering the psychological process of perception and how the human mind assimilates and associates information. Particular to this process is a feeling of a state of anxiety which like fear is a mechanism used to alert the body to danger. The subtle difference, however, is that fear is regarded as an alarm reaction to risk arising from circumstances in the outside world (LeDoux 1999) where as anxiety is more the anticipation of risk generated from within us (LeDoux 1999).

As with Chapter 4, by understanding the dynamics of anxiety, it will be possible to extract principles applicable to attaining a better comprehension of qualitative risk. Such principles include the proof that risk, as a result of the process of perception, alters in form as perception changes. This results in risk being an interactive construct which not only validates what has been discussed in Chapter 4, namely that risk evolves through human effort rather than exists but also alludes to the fact that risk is dynamic in state and as such retains the qualitative characteristic of being flexible. This proof provides an opportunity to challenge the conventional methods of risk management which

typically rely on quantitative methodology (which is inflexible by nature) to hedge against it. This theme, however, is not the purpose of this chapter and will be dealt with later.

It is the intention of this chapter to therefore consider risk from a psychological perspective and to provide an understanding of how the structures of the mind interact with one another and how, amongst this process of interaction, a state of anxiety arises. Once this is understood, it will be possible to conclude why risk is regarded as dynamic in nature, implying that the boundaries which define it are ever-changing, thereby attributing yet another fundamental qualitative characteristic to risk. Combined with the characteristic of uncertainty as well as the discussion of risk from previous chapters, a stable foundation of comprehension will have been put into place, thereby allowing a platform on which the remaining chapters can be proposed. Figure 5.1 summarises the approach to be adopted in Chapter 5 from a visual perspective.

Figure 5.1 - Visual summary of Chapter 5



Source: Own observation

Figure 5.1 provides a visual summary of Chapter 5. It is the intention of this chapter to arrive at additional qualitative characteristics of risk. In order to achieve this, Chapter 5 will consider cognitive psychology as a broad-level discipline. More specifically, the id, ego and superego will be discussed and through an understanding of these structures and how they interact, it will be possible to understand the qualitative characteristics of risk, namely that it is interactive and dynamic (flexible) in nature.

5.2 A psychological approach to risk

Considering risk from a psychological perspective, reveals an interesting characteristic, namely that the perception and assessment of risk is essentially phenomenologically based and that the nature of risk is fundamentally interactive (Anon 2003. *The Psychology of Risk Taking Behaviour – Conceptual issues.*) This implies that risk is a mental construct made up of perception attained from psychological observations concluded whilst interacting with the environment. In simpler terms, “our acts of observation are part of the process that brings forth the manifestation of what we are observing” (Wheatley 1994:36). Having said that, risk from a psychological perspective is nothing more than human perception and as such gives rise to a number of implications that can be used to better understand it. One such implication is that as risk is a perception it would allude to the fact that at any given stage the perceived state of risk will alter in characteristic each time perception alters. It is this concept that ascribes to risk its dynamic property.

Secondly, as will be shown from a psychological perspective, perception is a process that takes place between objects found in reality and the mind. This alludes therefore to the fact that perception is an interactive process. As risk is the product of perception, it stands to reason that by nature risk must also be interactive, implying that it derives its existence only from the process of the human mind interacting with the environment.

In order to proceed with the themes proposed, it is needed to put certain fundamental building blocks into place. For this reason, a brief discussion of the psychological structure of the mind first needs to be presented. From here the core characteristics of risk, namely that it is flexible and interactive by nature, will be deduced.

5.2.1 Introduction to the human mind

It was not Freud’s intention to utilise the structure of the mind from which to extrapolate an understanding of risk; however, Freud did utilise the structure of the mind to explain the

concept of anxiety. Due to this a common element exists between the structure of the mind and risk. This is evident in the following manner. Anxiety is regarded as a state of feeling present in the mind that is relied upon to alert it to danger (Freud 1969). Risk in turn is the possibility of danger (Oxford 1944). As such it can be seen that danger forms the common element between mind and risk. It is on this basis that understanding anxiety within the structure of the mind will provide a link toward understanding risk.

The intention of this discussion is therefore to utilise Freud in order to establish an internal framework from which the true nature of risk can be extrapolated.

5.2.1.1 The structure of the mind in more detail

In accordance with Freudian psychology, the human mind can be divided into three essential parts, namely the conscious, preconscious as well as the unconscious mind.

Although these parts bear no direct relevance to the theme of risk, they are required to be understood as they form an integral part of the internal framework being established and will be referred to in discussion.

The conscious mind refers to the “range of experiences of which a person is aware at any given moment” (Brooke 1991:14). This implies the conscious mind to be a current state of perception or rather the current state of mind in which things being observed in the present are understood.

The unconscious mind in turn refers to “...the personal thoughts, experiences, memories, and so on that have been forgotten or repressed” (Brooke 1991:15) and as such implies a state of ‘non-perception’ in that it represents all those things the conscious mind is not aware of in the present. However, through effort on behalf of the person the unconscious

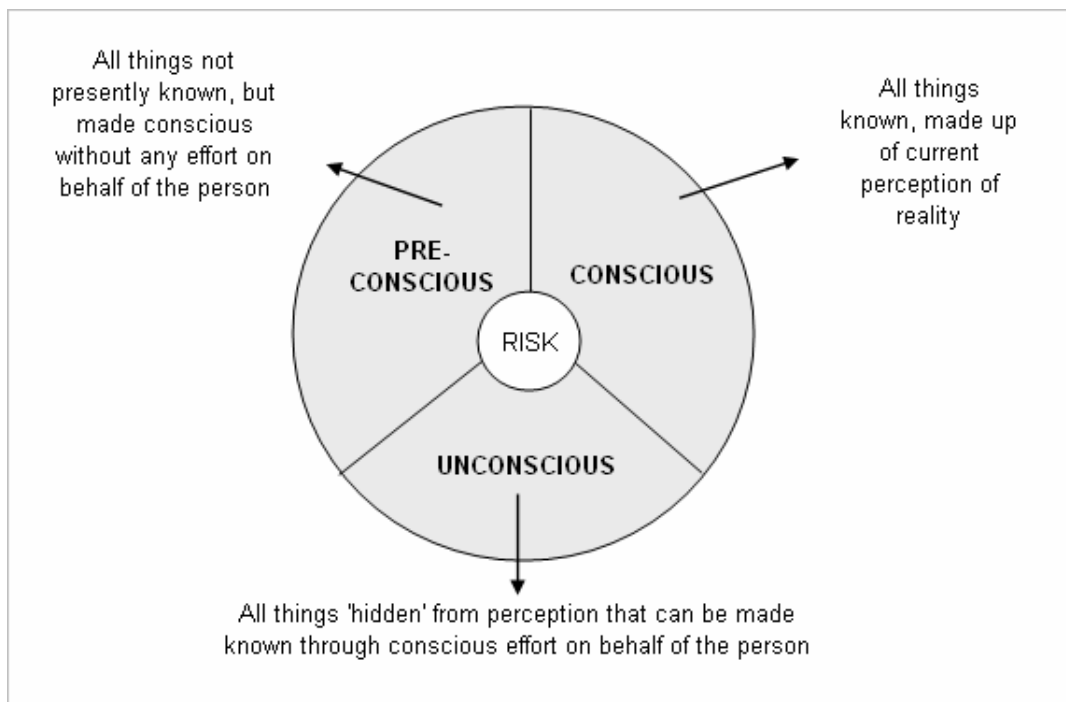
could be made conscious (Roberts 2005. Sigmund Freud's Final Outline of Psychoanalysis).

Lastly, the preconscious mind is that part of thought that is made conscious without any effort on behalf of the person (Roberts 2005. Sigmund Freud's Final Outline of Psychoanalysis).

It represents those parts of thought that are capable of becoming conscious at any given point in time (Freud 1969).

Between these three layers of the mind exist those factors that give rise to cognitive perception, or rather thought, which is applicable to the discussion on anxiety. An understanding of these three layers is achieved by comprehending what Freud terms the id, ego and superego. Figure 5.2 summarises this.

Figure 5.2 - **The basic structure of the human mind**



Source: Own observation

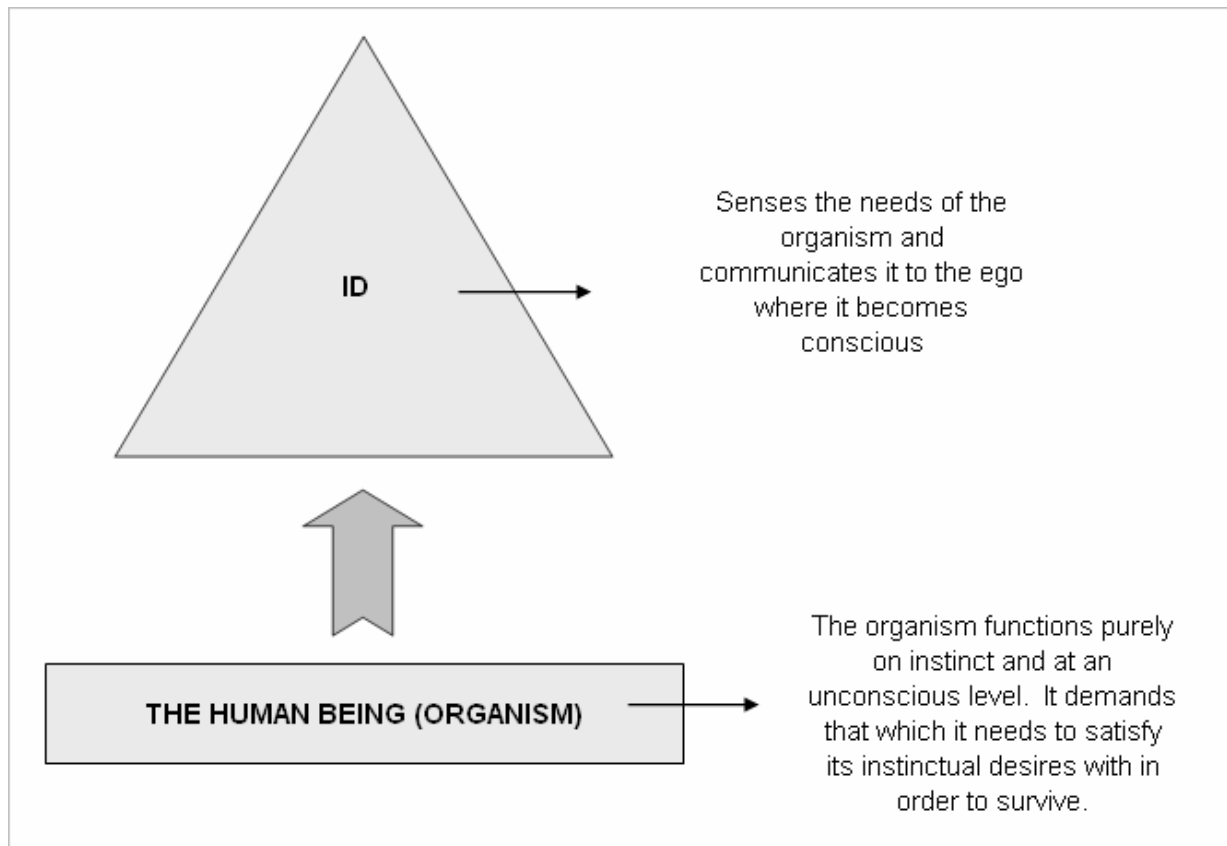
Figure 5.2 details the basic structure of the human mind, namely the conscious, pre-conscious and the unconscious. These structures represent the highest level of the mind and between them exists the ability of cognitive perception. Freud uses these structures to describe the mechanics of the mind and in so doing reveals the very dynamics that engender further characteristics of qualitative risk.

5.2.1.2 The id

A brief explanation of each of the three structures, namely the id, ego and superego, will be provided before being placed into context.

In Freudian theory, the human being is referred to as the organism. The organism exists of a nervous system which is responsible for regulating and achieving basic somatic or instinctual needs (Freud 1969), such as safety, warmth and food amongst others. The function of the id is to communicate these basic needs, which are present in the unconscious, into conscious desires so that the mind can come to know of them and therefore physically act upon them, thus fulfilling the need of the organism so as to ensure its survival (Roberts 2005-Sigmund Freud's Final Outline of Psychoanalysis). In simple terms the id can be seen as making known the primitive needs of the body. This concept is visually summarised in Figure 5.3.

Figure 5.3 - The structure of the mind (id)



Source: Own observation

Figure 5.3 represents the basic function of the id, which is to sense physiological needs arising from the organism and communicate them to the ego where they can become conscious. This interaction ensures the organism's survival.

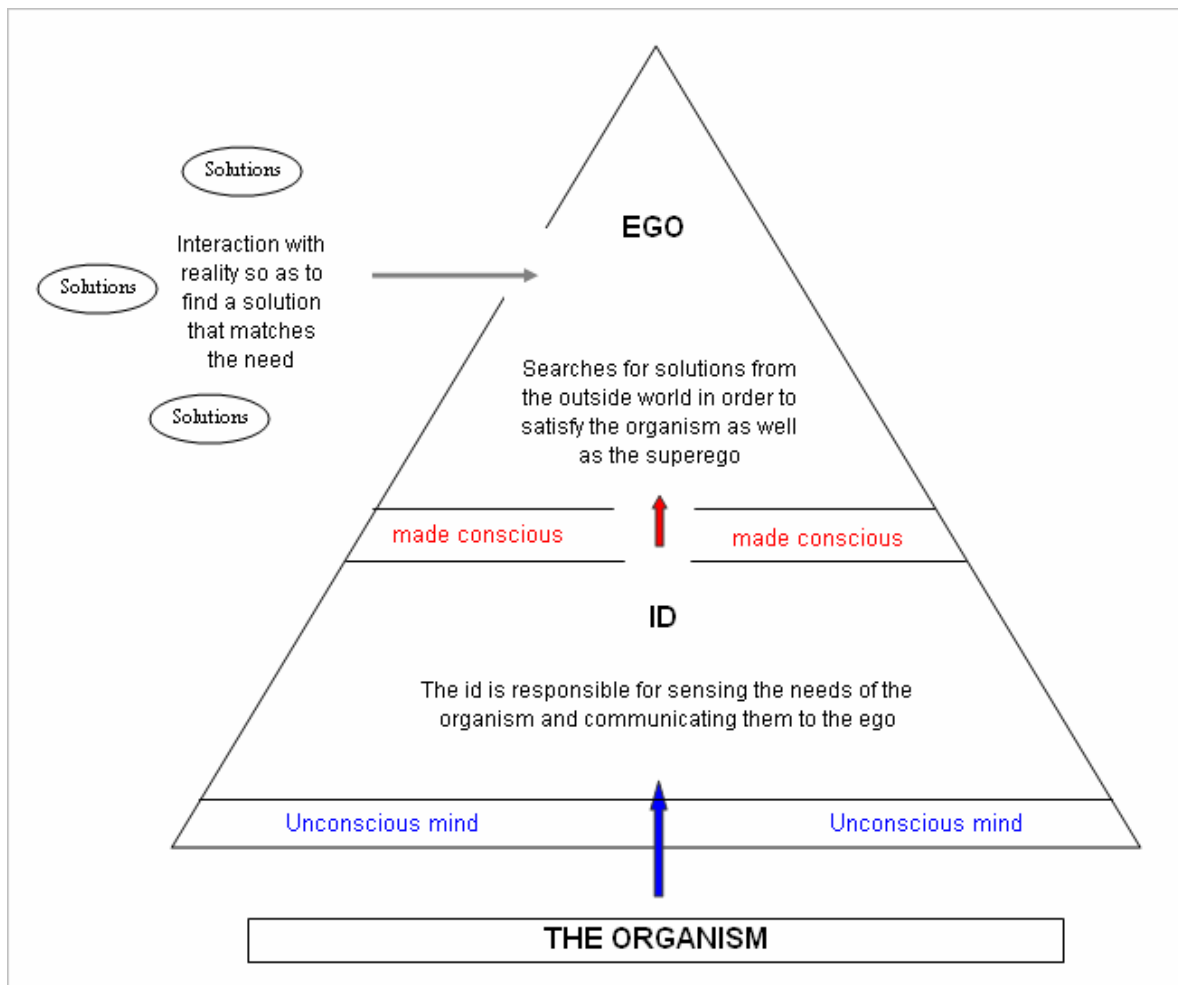
5.2.1.3 The ego

The ego is the conscious level of the mind that interacts with the outside world through the use of the five senses (Freud 1969). In terms of its role in relation to the id, it has the task of "...gaining control over the demands of the instincts, deciding whether they are to be allowed satisfaction, postponing that satisfaction to times and circumstances favourable in

the external world or suppressing their excitations entirely” (Mackay 1989: 73). This implies that the Ego has to perform the function of regulating and ensuring that the needs of the id are met, it was concluded that these needs are the primitive instinctual needs of the body, such as safety, warmth, etc. In addition to this it also has to regulate and ensure the needs of the superego (to be discussed in paragraph 4.2.1.4).

Finally, the ego acts as the controlling body of the mind and one of its most important tasks is that of ensuring the safety of the organism (Freud 1969). This will be extrapolated upon in paragraph 5.2.2. For now Figure 5.4 summarises the above discussion.

Figure 5.4 - **The structure of the mind (id and ego)**



Source: Own observation

Figure 5.4 depicts the basic function of the ego relative to the structure of the mind which is to search for solutions from the outside world that can satisfy the needs of the organism as communicated through the id.

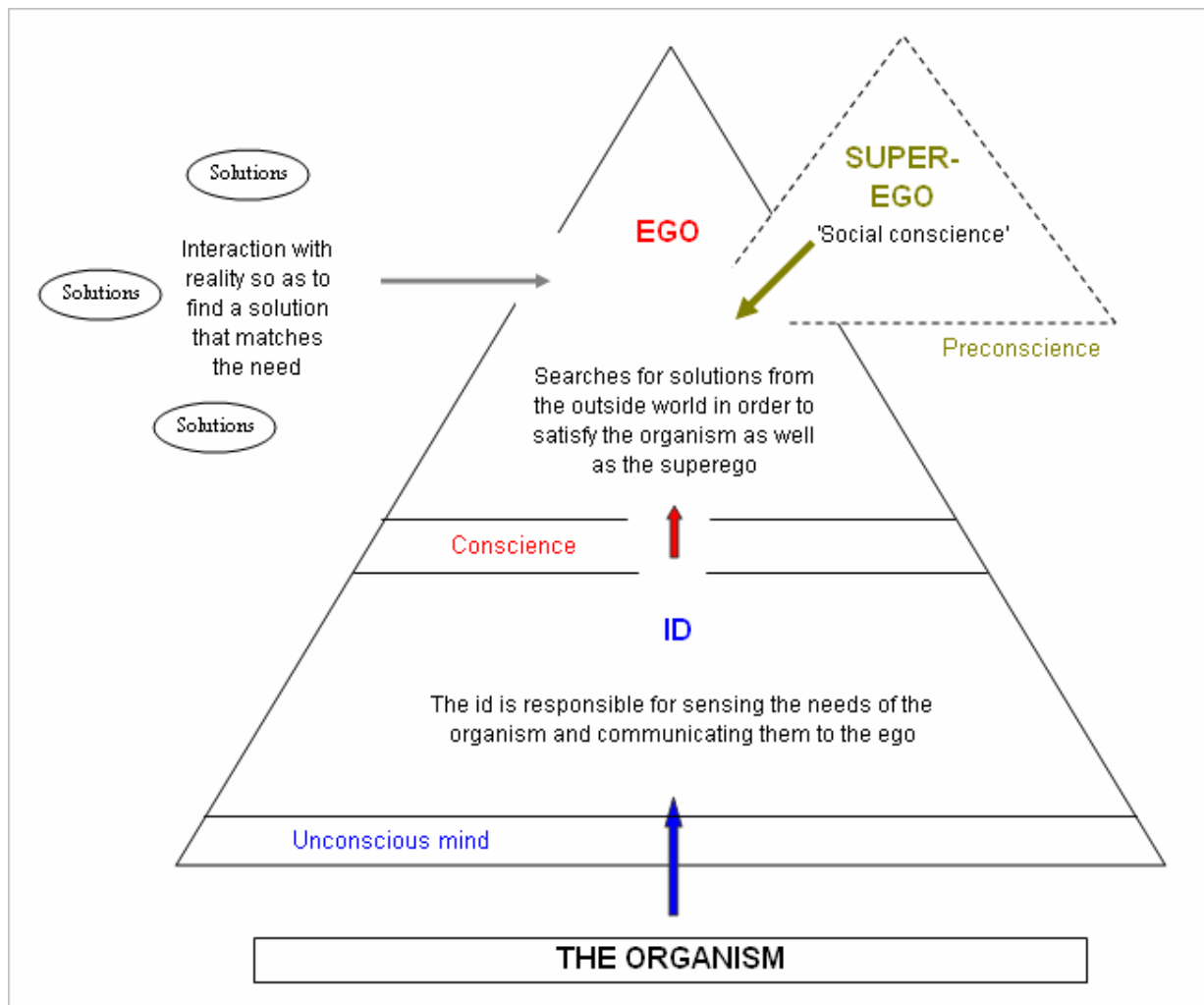
5.2.1.4 The superego

The superego is referred to by Freud as a new physical agency and is in essence an extension of the ego. "This new psychological agency continues to carry on the functions which have hitherto been performed by the people (the abandoned objects) in the external world: It observes the ego, gives it orders, judges it and threatens it with punishment...." (Freud 1969:62). Where the ego is made up of daily experiences attained from searching for solutions in reality, the superego is made up of experiences and convictions passed on from people, parents and society (Freud 1969).

The superego can really be seen as representing social conscience. Social conscience can be seen as that part of the mind that differentiates right from wrong in society. The superego places natural pressure on the ego to conform to this understanding of right and wrong within society. The superego is almost the direct opposite of the id. This is true on the basis that the id functions on what is termed the pleasure principle which is a principle of self satisfaction (Barlow & Durand 1995). This implies that the id only pursues those demands that will bring it pleasure and avoid all demands that will bring it displeasure (Barlow & Durand 1995), such as social restraints inflicted by the superego. The superego in turn is unlike the id in that it functions in a far more reserved manner in which an acute awareness of social conviction is present. The superego also tends to counter the instinctual demands of the id through the use of feelings such as guilt, shame, pride etc. upon the ego (Freud 1969). This counterprocess is regulated by the ego in that the ego performs the vital role of 'mediator' between the id and superego.

It functions on what is termed the reality principle (Barlow & Durand 1995), implying that it takes reality into account and decides on how to appropriately meet the demands of both the id and superego in a rational, realistic and socially acceptable manner. Figure 5.5 summarises this view.

Figure 5.5 - The structure of the mind (id, ego and superego)



Source: Own observation

Figure 5.5 represents a conceptual model of the final structure of the mind. It takes into account all aspects described by Freud. For the sake of revision, the id and the superego can be seen as the unconscious and preconscious parts of the brain, the function of which

respectively is to impose biological and social pressure upon the ego. The ego in turn plays the role of mediator between these two pressures. It represents the conscious sector of the mind and is responsible for ensuring that the needs of both the id and superego are met in a rational, realistic and socially acceptable manner.

5.2.2 Applicability to risk

It was not the intention of this chapter to provide a detailed description of Freudian psychology, but rather to put a basic framework of understanding into place that is sufficient enough to relate to the theme. As such enough has been presented regarding the structure of the mind in order to proceed with drawing a conclusion.

In returning to the point put forward in paragraph 5.2.1.3, the most significant intention to understand in relation to risk, as well as the framework presented, is that the ego serves the purpose of preserving the organism and is governed by considerations of safety (Freud 1969). For the ego to achieve this role a very specific function is performed. Before this function could be understood, it was needed to explain the individual structures of the mind. This has been done and as such the function of safety, as performed by the ego, can now be explained.

5.2.2.1 The function of the ego relative to risk

Within the ego, the function of safety involves “interpolating, between the demand made by an instinct and the action that satisfies it, the activity of thought which, after taking its bearings in the present and assessing earlier experiences, endeavours by means of experimental actions to calculate the consequences of the course of action proposed” (Freud 1969: 56). Simply put the ego takes in data in a bid to find a solution to the demands of the id, matches it to past experience and decides whether the consequences

associated with the course of action proposed are threatening in any manner. In this sense it regulates, in a safe and socially acceptable manner, behaviour relative to the instinctual demands of the organism thus allowing for the effective interaction with reality.

The relation to risk in this entire process lies in the fact that in order for the ego to achieve its goal of safety and preservation of the organism it has to be able to identify danger amongst the perceived information, within this process. For this, the ego relies on a sensation termed anxiety (Freud 1969).

5.2.2.2 Forms of anxiety

Anxiety, as defined by Barlow and Durand (1995: 704), is a “mood state characterized by marked negative affect and bodily symptoms of tension in which a person apprehensively anticipates future danger or misfortune.” Freud identified three types of anxiety that can manifest within the ego. It is not the intention to discuss these forms of anxiety in detail, but rather to mention them simply to assist in attaining a better understanding of the types of warnings the ego relies on in order to identify danger and risk. For this reason the three forms of anxiety are mentioned in brief.

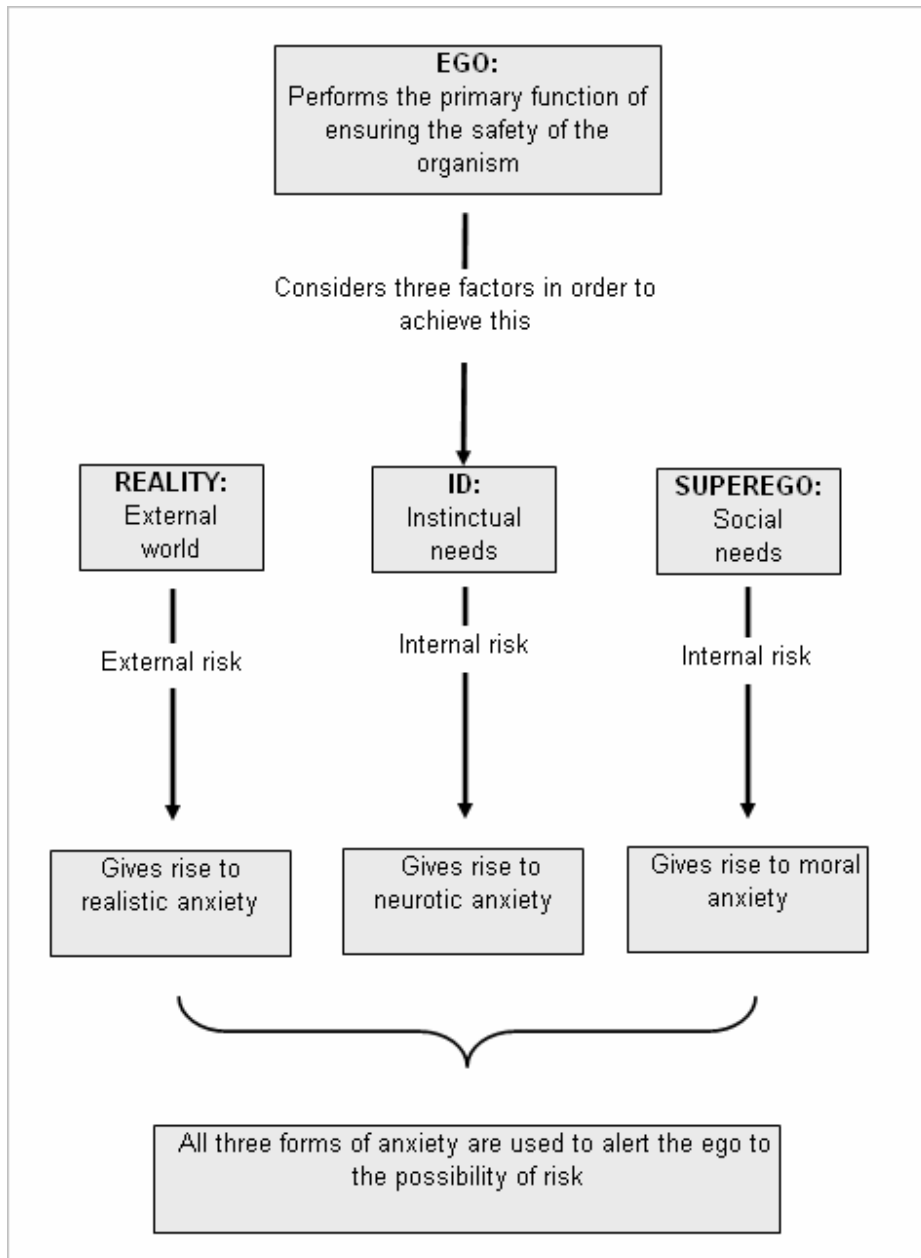
First, anxiety can arise in instances when perceived information is matched off against past experience known to present a threat. This Freud termed realistic anxiety (Roberts 2005. Sigmund Freud’s Final Outline of Psychoanalysis).

Secondly, anxiety can also arise within the ego as a result of the superego. This takes place when the solution attained to satisfy the demands of the id is not socially acceptable and the superego then inflicts its demands on the ego through feelings of guilt, shame, pride, etc. (Freud 1969). This Freud termed moral anxiety (Roberts 2005. Sigmund Freud’s Final Outline of Psychoanalysis).

Lastly, anxiety can also arise within the ego as a result of the id. This occurs in instances in which the demands of the id become so overwhelming that the organism begins to experience a sensation of nervousness or irrationality (Roberts 2005. Sigmund Freud's Final Outline of Psychoanalysis). This Freud termed neurotic anxiety

From this understanding it is possible to apply what has been put forth into a context that draws relevance to the objective this chapter serves to achieve. For the sake of clarity, Figure 5.6 summarises the concepts, relative to the mind, proposed thus far.

Figure 5.6 - The role of the ego and the forms of anxiety the ego relies upon in order to alert it to risk



Source: Own observation

Figure 5.6 visually summarises one of the primary roles of the ego, namely to ensure the safety of the organism. For this to be achieved, the ego has to identify circumstances that would place the organism in potential danger or risk. This ability is made possible through

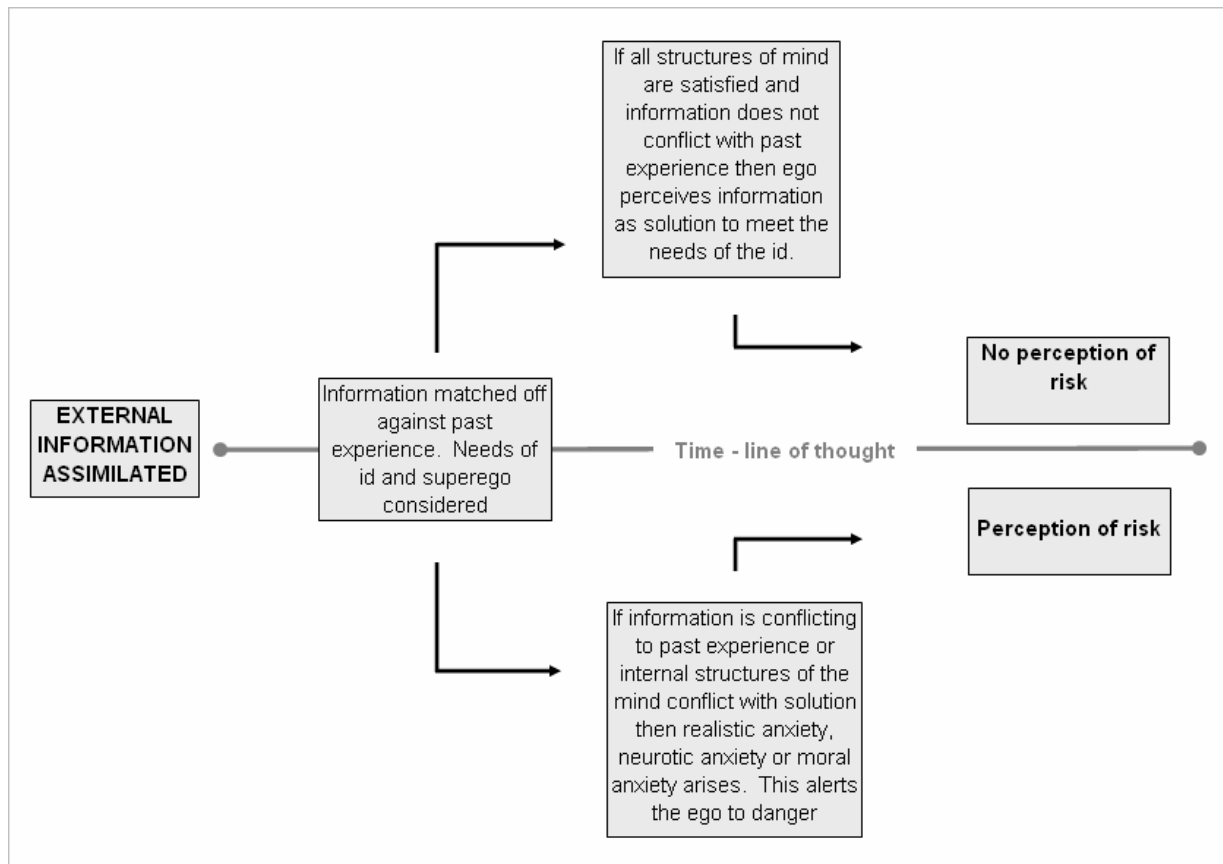
the sensation of anxiety. Specific to this are three forms of anxiety, namely realistic, neurotic and moral anxiety. It can be seen that realistic anxiety manifests itself as a result of interaction with the external world whilst neurotic and moral anxiety manifests itself as a result of tension created within the internal mind. In this, as is evident in Figure 5.6 above, all areas of the mind that the ego interacts with, get considered during the mental process of identify risk.

5.3 Risk as a process of interaction

From the framework put into place regarding the structure of the mind as well as the manner in which anxiety is used and arises within this structure, it is possible to see that the perception of risk results from a very definite process that requires a form of interaction between the mind and the external world to function. Bohm (1998:VII) writes that “the human being is thus in the unique position of perceiving the dynamism and movement of the world around him, while at the same time realizing that the means by which this perception takes place – one’s own mind – is of an equivalent order of creativity, participating intimately with the world which it observes.” By drawing conclusions, a number of additional qualitative properties of risk such as flexibility emerge. However, the quality of risk as being interactive needs to be understood before further properties are explored.

In order to depict the process of risk perception as being interactive, consider it to be a function that can be represented on a timeline. Such a function is visually illustrated in Figure 5.7 below.

Figure 5.7 - Timeline depicting the process of thought



Source: Own observation

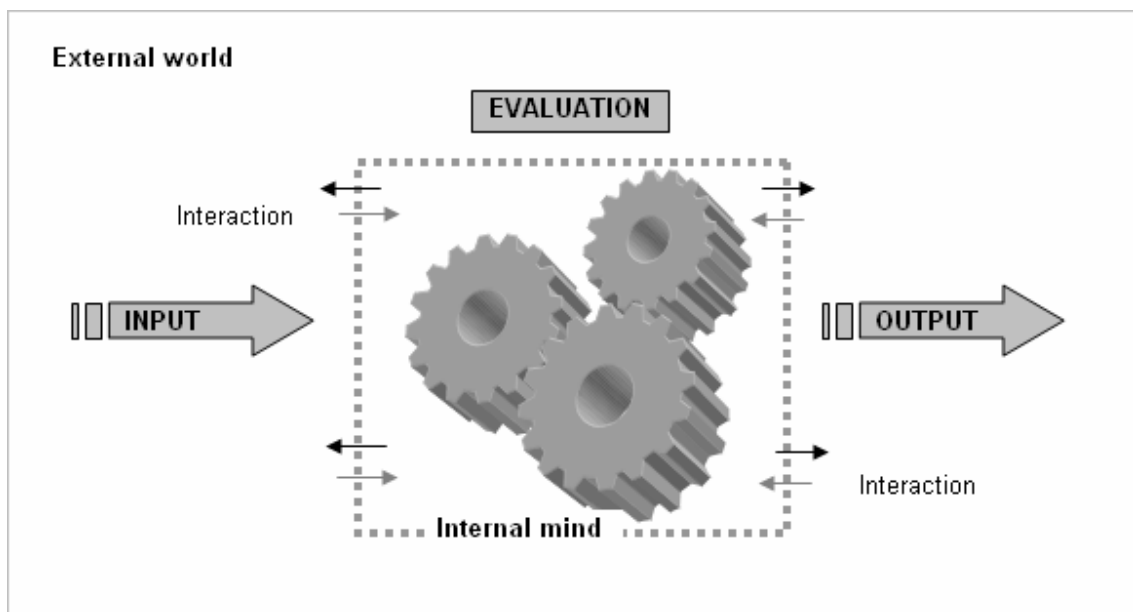
Figure 5.7 depicts a timeline associated with the process of thought as described using the structure of the mind. It serves to provide a visual understanding of how a perception of risk is arrived at using psychology as a basis to work from. Anxiety is the catalyst for engendering risk perception (see paragraph 5.2.2).

5.3.1 Simplification of the process

It is evident from Figure 5.7 how a perception of risk is arrived at. This process can be summarised for the sake of simplicity into three functions, namely input, evaluation, and

output. At the input level data is assimilated from the external environment. It is then evaluated against past experience within the mind, as well as the demands of the superego and an output in the form of an action or no action is provided. This is an oversimplified version of what has been described in paragraph 5.3 above, but it serves to highlight a specific point. Figure 5.8 summarises this visually.

Figure 5.8 - **Oversimplification of the process of perception**



Source: Own observation

Figure 5.8 depicts an oversimplification of the process described in Figure 5.7. It also depicts the manner in which risk perception acts as an interactive process. It is evident from the diagram above that a linear dependency exists amongst the three structures (input, evaluation, output) and as such should any one of them be removed the process as a whole would not exist.

5.3.2 Summary

The purpose of providing an oversimplified view of the process of perception is to show that all three components (input, evaluation and output) need to be present in order for the process to function. It is logical to conclude from Figure 5.8 that without any one of the components being present, the process of perceiving risk simply cannot function in any meaningful way. That is to say the ego could not call upon anxiety as a means of determining risk if there were no input criteria to evaluate. Similarly, if there were no action associated with the data evaluated, then there would be no need for evaluation in the first place.

It is on this basis that risk perception can be regarded as interactive and in summary it simply implies that an inherent interaction between the environment and the internal structures of the mind is required in order for the identification of risk to take place.

5.4 Flexibility

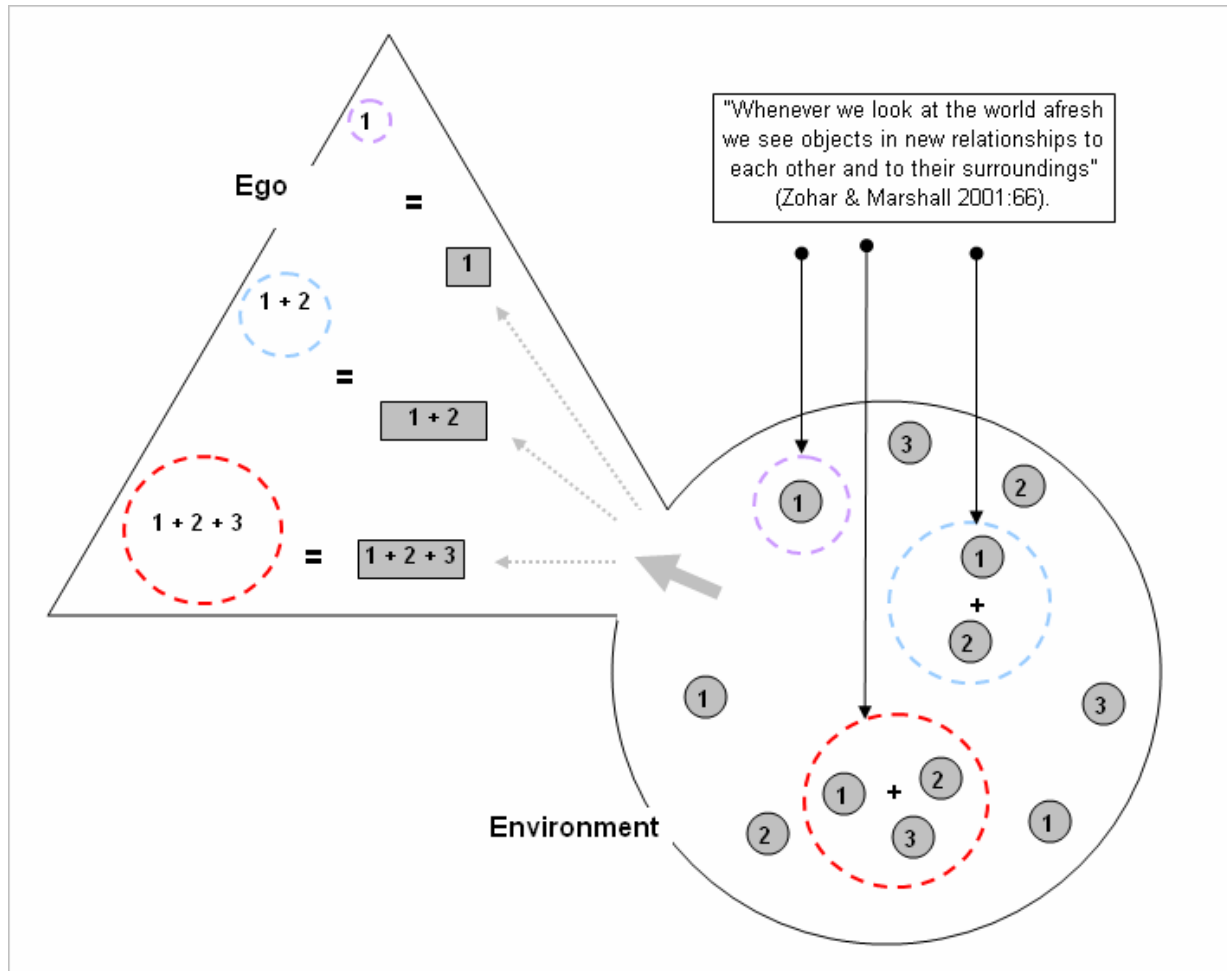
The use of psychology as a discipline to arrive at a discussion on flexibility was needed in order to provide a deeper insight into the true nature of risk. It is only when considering the principle of flexibility that this can be fully appreciated. In arriving at a conclusion in terms of how risk is perceived, through the use of anxiety, two essential mediums were identified, namely the external world and the internal mind (see Figure 5.8). In relation to the external world it will be shown how flexibility in risk results from the dynamics of interacting with an ever-changing environment. In relation to the internal mind, it will be shown how the degree of risk association changes in accordance with the strength of conviction imposed by the superego and stored past experiences.

5.4.1 External flexibility

The external flexibility of risk can easily be identified and is founded on the basis that risk must be a dynamic perception because of the fact that it is arrived at through a process of interaction with the external environment (see paragraph 5.3). Consider the following. Benthall (1973:101) writes that

“one thought succeeds another through association or through response to new perceptions, and in this way what seemed to be an eternal truth is seen later to be limited, or even false...” What Benthall implies in this statement is the fact that perception changes on a continual basis as a result of the data attained from the external world being perceived in a different manner. “Whenever we look at the world afresh we see objects in new relationships to each other and to their surroundings,” according to (Zohar and Marshall 2001:66). Thus, an ever changing perspective on reality is a result of new data being perceived in relation to old information already assimilated. This has the effect of placing reality into a different context each time additional external data gets assimilated. Because constant change in perception takes place as a result of new associations made between data attained from the outside world, this form of flexibility is regarded as being external. Figure 5.9 depicts this visually.

Figure 5.9 - External flexibility



Source: Own observation

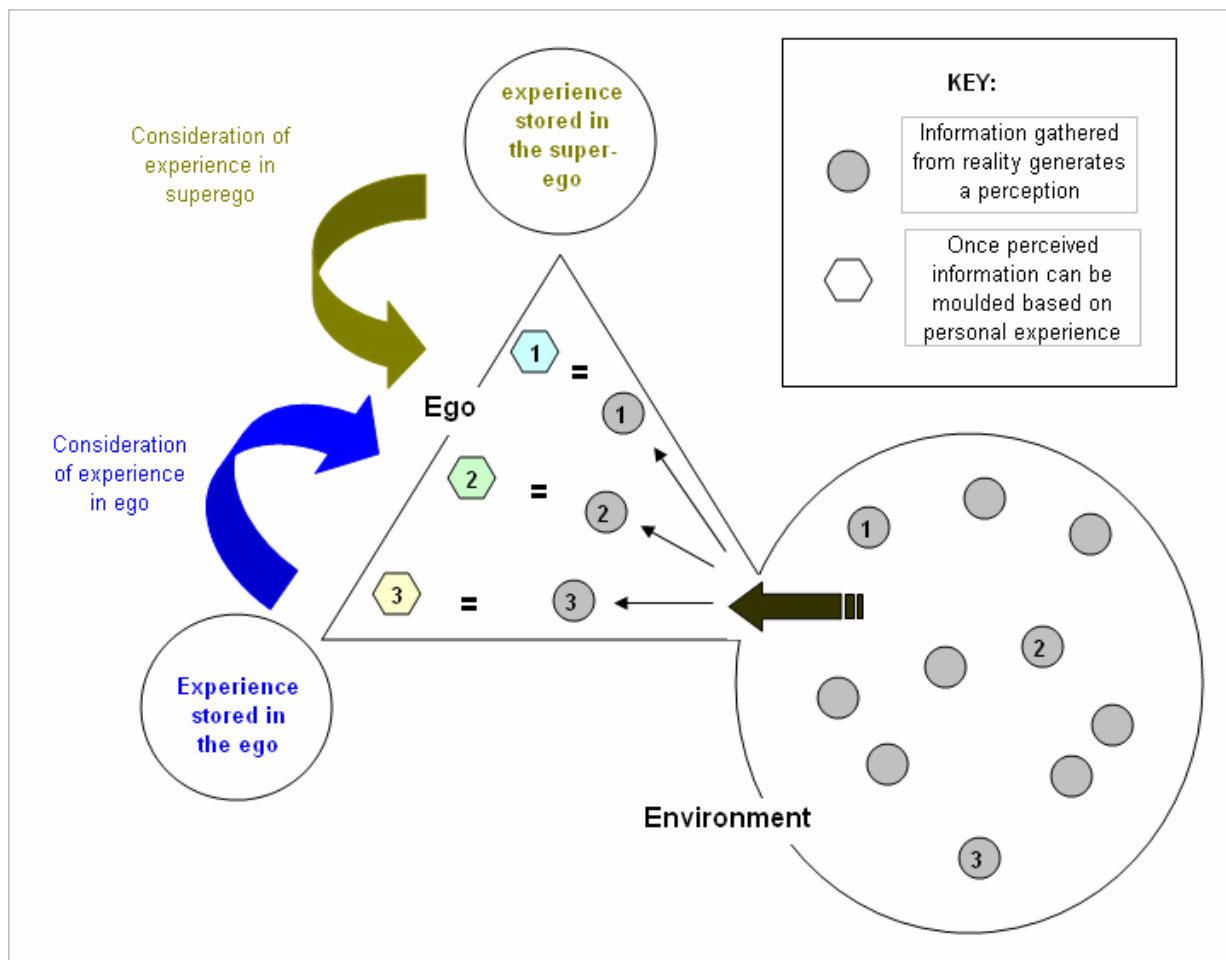
Figure 5.9 serves to depict how risk is assigned the characteristic of external flexibility. The grey circles represent pockets of data. The coloured circles represent alternative ways these pockets of data can be grouped so as to create different perceptions. The outcome of grouping data in different orders is what causes a constant change in risk perception. As the data being perceived lies outside the mind initially it is attributed the characteristic of external flexibility.

5.4.2 Internal flexibility

Internal flexibility is proposed to arise as a result of the experiences that govern the ego within the internal mind, as well as the manner in which these experiences contribute toward moulding and forming the perceptions attained through the process of thought. In this regard Jantsch (1980:163) writes that “the self-reflexive mind ... designs actively a model of the environment in which the original system itself is represented. Thus ... it becomes involved in the creative interpretation and evolution of the image. The relationships with the environment become totally plastic, subject to creative design.” What Jantsch alludes to in this statement is the fact that a perceived image (as seen in relation to data attained from the external environment) generates a perception that once internalised has no physical boundaries. That is to say that once what has been perceived is understood, nothing exists to prevent that same perception from being moulded and transformed into a new form or meaning. In everyday terms this would be regarded as mental manipulation, which in turn is a distinct trait of internal flexibility. Interestingly enough, the Oxford (1944:1470) provides a philosophical definition of perception and describes it as being “the action of the mind by which it refers its sensations to an external object...” This concurs directly with the notion of internal flexibility as proposed in that perception, in this instance is defined as being the result of what the internal mind chooses to see.

Enough has been presented in order to understand the notion of internal flexibility. Where external flexibility resulted from a constant change in perception because of objects and relationships observed from the external world, internal flexibility arises from a change in perception due to the influence of internal structures of the mind. Figure 5.10 summarises this visually.

Figure 5.10 - Internal flexibility



Source: Own observation

Figure 5.10 serves to depict internal flexibility. This diagram assumes that the same set of external data is perceived within the ego. In this instance a change in perception is shown to be the function of the internal structures of the mind rather than a change in external data grouping. The interpretation of data within the internal structures of the mind can vary depending on stored past experiences. On this basis the notion of internal flexibility is engendered. This process is depicted using colours whereby the grey circles represent the same external data, however, depending on the internal experiences of the mind these grey circles are perceived in a different manner. In the case of the blue hexagon it can be reasoned that stored past experience is more weighted around matters concerning the superego and therefore a tendency to interpret information from a socially

conscious perspective is more probable. The same concept applies to the yellow hexagon in which such stored past experience would centre on a more balanced perspective.

5.5 Conclusion

The intention of Chapter 5 was to identify two additional characteristics of risk through the use of psychology as a discipline to work from. This has been achieved and from the exercise conducted the notions of risk being interactive and flexible can now be understood. In addition to this it was shown how each of these characteristics was engendered from a distinctly human process. This has the effect of making them qualitative by nature in that it was only as a result of specific human qualities that each of these characteristics of risk was arrived at. This concludes yet again that risk is a distinctly human phenomenon.

CHAPTER 6

INFORMATION AND KNOWLEDGE – the laws of nature as a guide to risk

It is information that gives order, that prompts growth, that defines what is alive. It is both the underlying structure and the dynamic process that ensures life. (MJ Wheatley)

6.1 Introduction

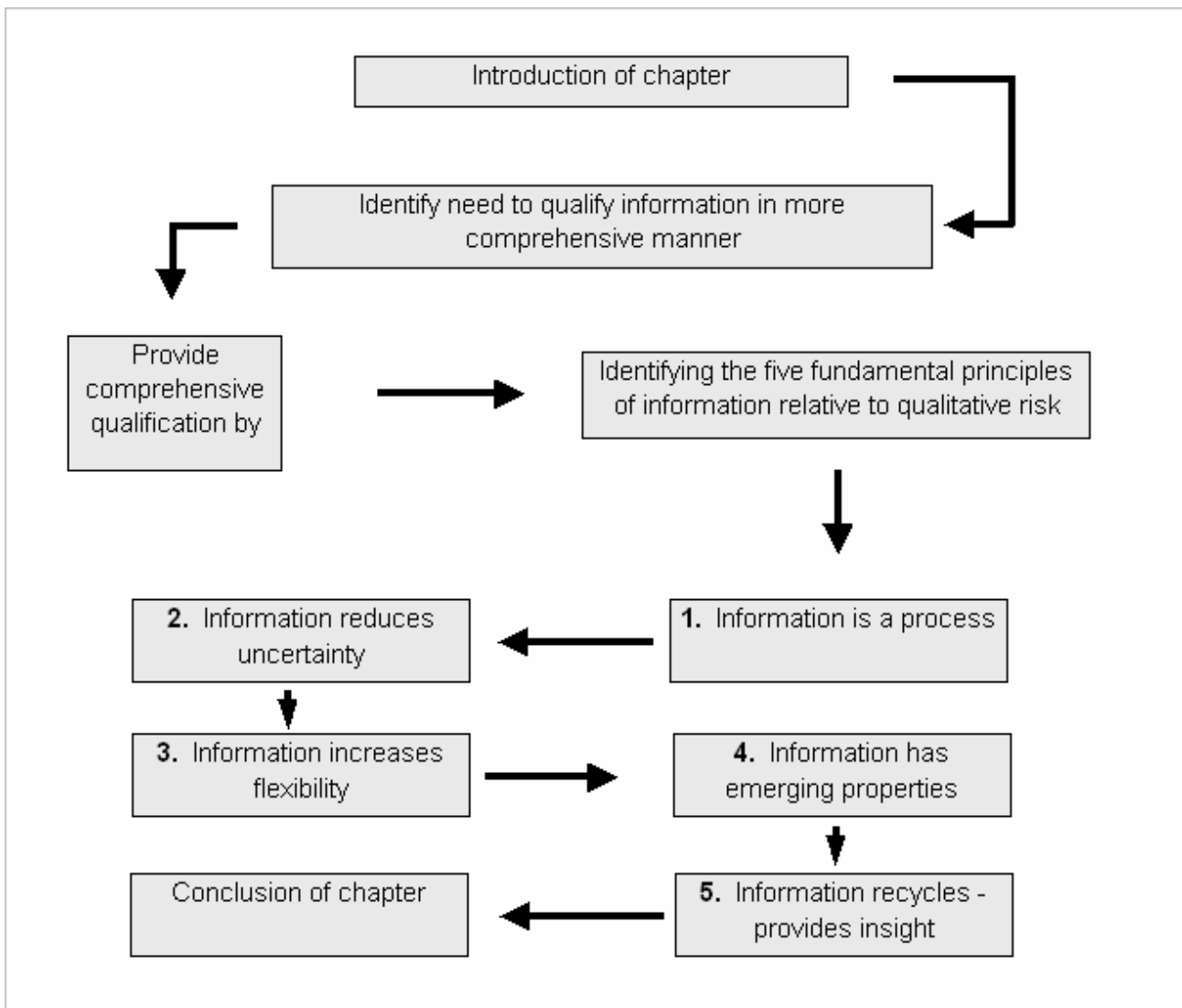
This dissertation has reached a pivotal point in which alternative literature has been presented concerning qualitative risk and some fundamental characteristics. In order to bring about consolidation it is necessary to start employing what has been learnt. To achieve this it is necessary to put into perspective the notion of information. The intention of this is simply to provide a contextual understanding of where information fits in, in terms of qualitative risk and to reveal the vital role that it plays in terms of finding a solution regarding the managing of qualitative risk.

In addition to this primary objective, information has formed a critical component in Chapter 4 and Chapter 5 respectively in that the process of perception from both a physiological (Chapter 4) and psychological (Chapter 5) perspective relied heavily on the assimilation of information. It was shown how the process of mentally gathering information (perception) gave rise to the qualities that now define qualitative risk. Such qualities were uncertainty and dynamic flexibility. For this reason and others, a detailed qualification of the notion of information is required. Qualification, however, will extend beyond the point of simply defining information from an academic perspective. It will extend to a point in which an internal framework will be established so as to provide not only a holistic perspective on information and the purpose it has in terms of the solution to qualitative risk; but also to provide a conceptual framework against which the concept of dissipative structures, the topic for Chapter 7, can be applied.

The intention of Chapter 7 is to show that dissipative structures hold the key to managing qualitative risk and that many lessons can be learnt in understanding them. However, in order to fully appreciate the value that dissipative structures can add to the organisational management of qualitative risk, it is first needed to understand the role of information in the context of all that has been proposed thus far.

As such this chapter serves to build upon the concepts of uncertainty and flexibility as proposed in Chapters 4 and 5 respectively, as well as add additional knowledge, by considering the purpose and role of information relative to qualitative risk in far more detail. Figure 6.1 provides a visual summary of the approach to be adopted in Chapter 6.

Figure 6.1 - Overview of Chapter 6



Source: Own observation

Figure 6.1 provides a visual overview of the approach to be adopted in Chapter 6. In such an approach the importance of understanding the concept of information will be revealed by identifying and explaining five key components of information, namely information is a process, it reduces uncertainty, it increases flexibility, it displays emergence and provides insight. Each of these components is considered in context of the topic applicable to this dissertation, namely qualitative

risk and serves the purpose of creating a platform from which to address dissipative structures in Chapter 7.

6.2 Understanding information

The approach to be followed in terms of better understanding information will commence by assuming five characteristics, identified as being fundamental in terms of understanding information on qualitative risk. These five characteristics are:

1. Information is a process
2. Information reduces uncertainty
3. Information increases flexibility
4. Information exhibits emergent properties
5. Information recycles – provides insight

Each one of these characteristics will then be explored in detail, in which instance the factual basis upon which they are grounded will be revealed. After a discussion of each of these characteristics, a framework of knowledge will exist that not only qualifies the true nature of information by placing it into the correct perspective, but also provides a backdrop against which principles inherent in dissipative structures (the topic of Chapter 7) can be proposed.

It is noted that the five key characteristics proposed are by no means the only characteristics that constitute the notion of information. These characteristics are put forward in context of the objectives established for this dissertation as well as the conclusions drawn thus far regarding qualitative risk.

6.3 The first characteristic of information

6.3.1 Information as a process

The key objective for this paragraph is to establish a framework depicting the manner in which information is derived. In so doing, it can be shown that information is the result of a process (Haken 1999). For this to be achieved, the discussion begins by clarifying a simple misperception relative to information.

A common misconception of information is that it is often used as a value-free term (Gleick 1998) implying that the notion of information is associated with a concept that actually has no meaning. As will be shown, information relies on the context and knowledge of a recipient before it can attain any form of significance (Zwass 1992). Without the presence of a recipient, knowledge and context are not possible, in which instance information remains value-free and as such cannot be regarded as information. Instead, it must be referred to as data.

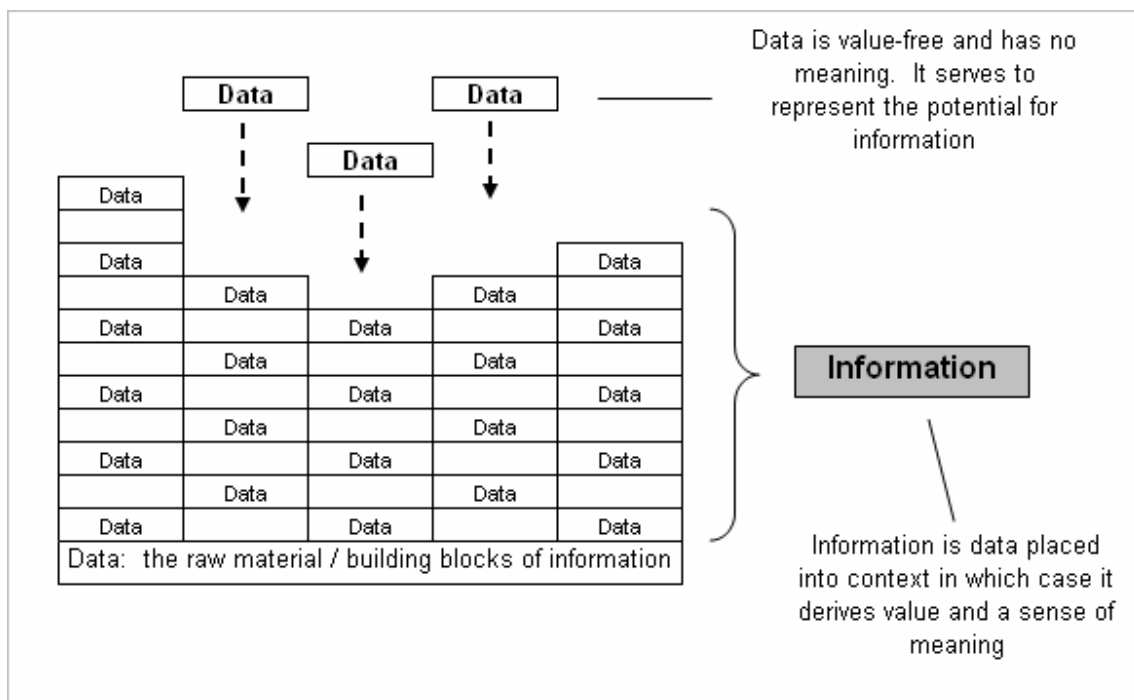
Data in contrast is the raw material or building blocks used to arrive at information (Zwass 1992). It has no value and as will be shown, simply represents the potential for information. Before this concept is expanded upon, Figure 6.2 visually concludes the subtle difference between data and information as alluded to in paragraph 6.3.1 above.

6.3.2 The implication thereof

In establishing the subtle difference between data and information, one of the characteristics that constitute it can be revealed, namely that information is not a construct that exists in isolation within the universe. Rather, information is the by-product of a process in which data is contextualised and given meaning. The mechanism of contextualising data in order to give it meaning is that of perception. This was discussed in detail in paragraph 4.2.3.1. It is therefore

not necessary to re-iterate this process of perception. Rather, the understanding put forward in Chapter 5 can simply now be relied upon so as to further the objectives of this paragraph.

Figure 6.2 - **Data versus information**



Source: Own observation

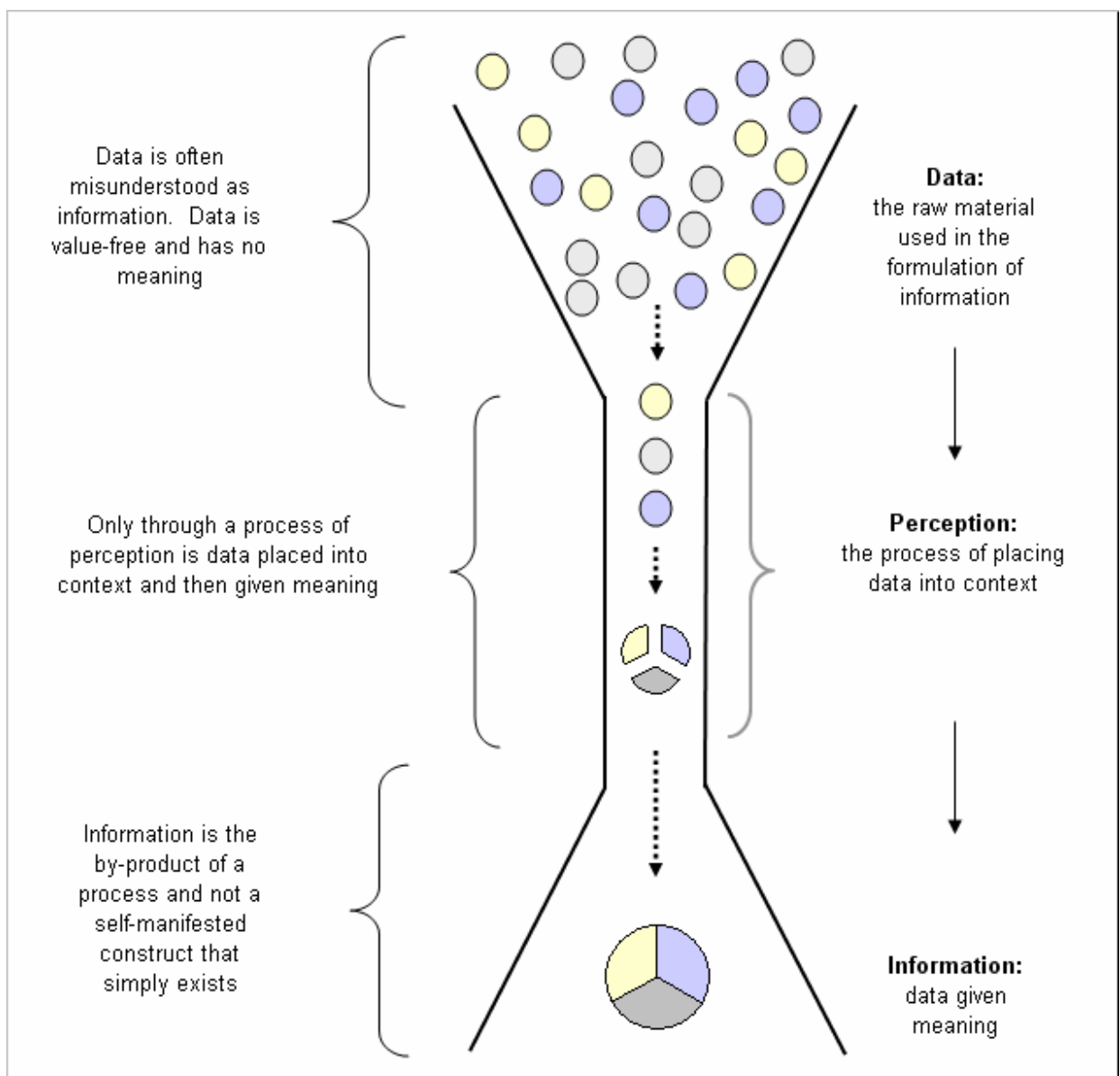
Figure 6.2 illustrates the difference between data and information. It can be seen that data forms the building blocks from which information is derived. Data has no meaning until such time that it is placed into context, only then is it regarded as information.

In so doing, it can be assumed that the mechanism by which data is converted into information (perception) is understood, thus allowing for the three fundamental components, regarded as constituting the information process, to be identified. These components are:

1. Data (the raw material of information)
2. Perception (the mechanism of converting data into information)
3. Information (the by-product of a process)

Using these three components a basic understanding of the information process can be concluded and this is done in Figure 6.3 below.

Figure 6.3 - **The basic outline of information as a process**



Source: Own observation

Figure 6.3 illustrates the basic outline of the information process. It incorporates the three key elements identified to have formed this process, namely data, perception and information. The concept of perception is illustrated using the different coloured circles. As these circles are perceived from the outside world, so they come together in a specific manner ultimately forming a larger circle representative of a piece of information. From this process it is possible to understand the difference between information and data, namely that data is used to create information.

6.3.3 Conclusion

From Figure 6.3 above, the first of the characteristics that constitute information has been established. It may seem somewhat elementary, however, the true value of understanding this particular characteristic of information will be revealed in the paragraphs to follow. The basis upon which the remaining traits such as reducing uncertainty, increasing flexibility and emerging properties are founded, relies on the foundation of knowledge pertaining to this information process.

6.4 The second characteristic of information

6.4.1 Information reduces uncertainty

The notion of uncertainty was discussed in Chapter 4, in which case it was shown that qualitative risk is the by-product of a human emotional response to fear which is nothing more than an alarm reaction to uncertainty. During this discussion the role of information was alluded to however not focused on. This was for the simple reason that the objective of Chapter 4 was concentrated on understanding the physiology of the emotion of fear and the role it played in the creation of qualitative risk, rather than on understanding information.

For this reason the notion of uncertainty will now be considered from the perspective of information. In so doing, the second fundamental characteristic of information, namely that information reduces uncertainty, will be revealed.

6.4.2 Relevance of this characteristic

Understanding that information reduces uncertainty has relevance for the following reason. It has already been identified that uncertainty is a fundamental characteristic of qualitative risk. Knowing therefore how to reduce uncertainty is in essence the same as knowing how to reduce risk. Given this, the objective of this paragraph begins by considering Koornhof (1998:33) who maintains that information "... serves to reduce the uncertainty inherent in the business environment ...". This statement holds true, however, it requires to be placed into context before the full value of it can be appreciated and understood. By utilising a simple example, the full implications of the second characteristic of information can be understood.

6.4.3 An example of how information reduces uncertainty

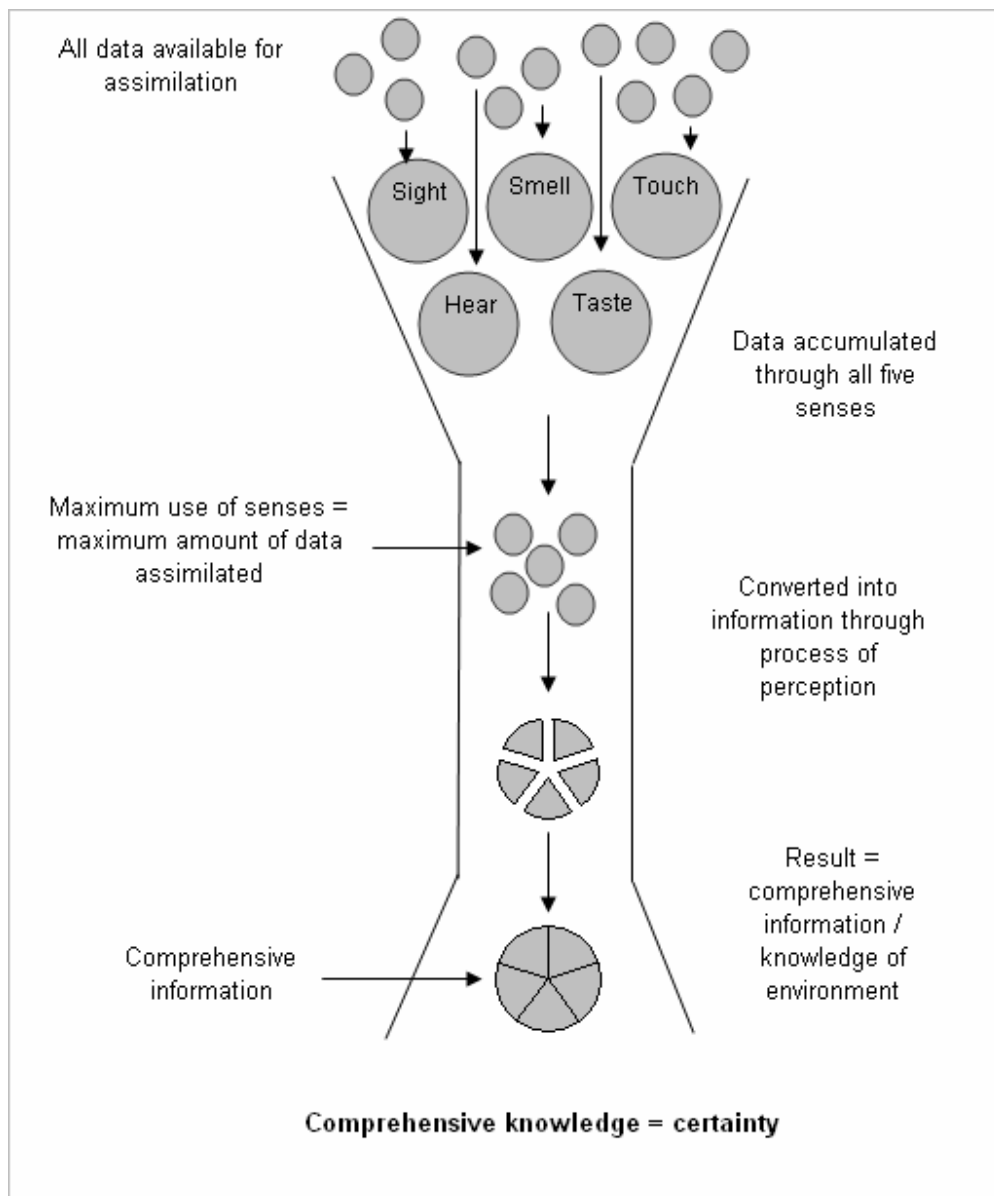
Human beings rely upon their senses in order to attain knowledge of the environment (Tubbs & Moss 1983). Given that, certainty by definition is a sense of knowing (Oxford 1983,) and a sense of knowing simply is knowledge (Oxford 1983), it can be concluded that human beings rely on their senses in order to attain certainty about their environment.

Using this understanding as well as the framework representative of the information process as proposed in Figure 6.3 above, it is possible to understand the relationship between information (knowledge) and certainty. This can be done by an example in which the effect of a reduction in the number of senses used to attain certainty is shown.

Assume an instance in which all five human senses are being used to assimilate data from the surroundings in order to attain a better knowledge of the environment. Applying such an instance

into the framework relating to the information process provides a visual understanding of the implication and is concluded in Figure 6.4 below.

Figure 6.4 - First example of the effect of information on uncertainty



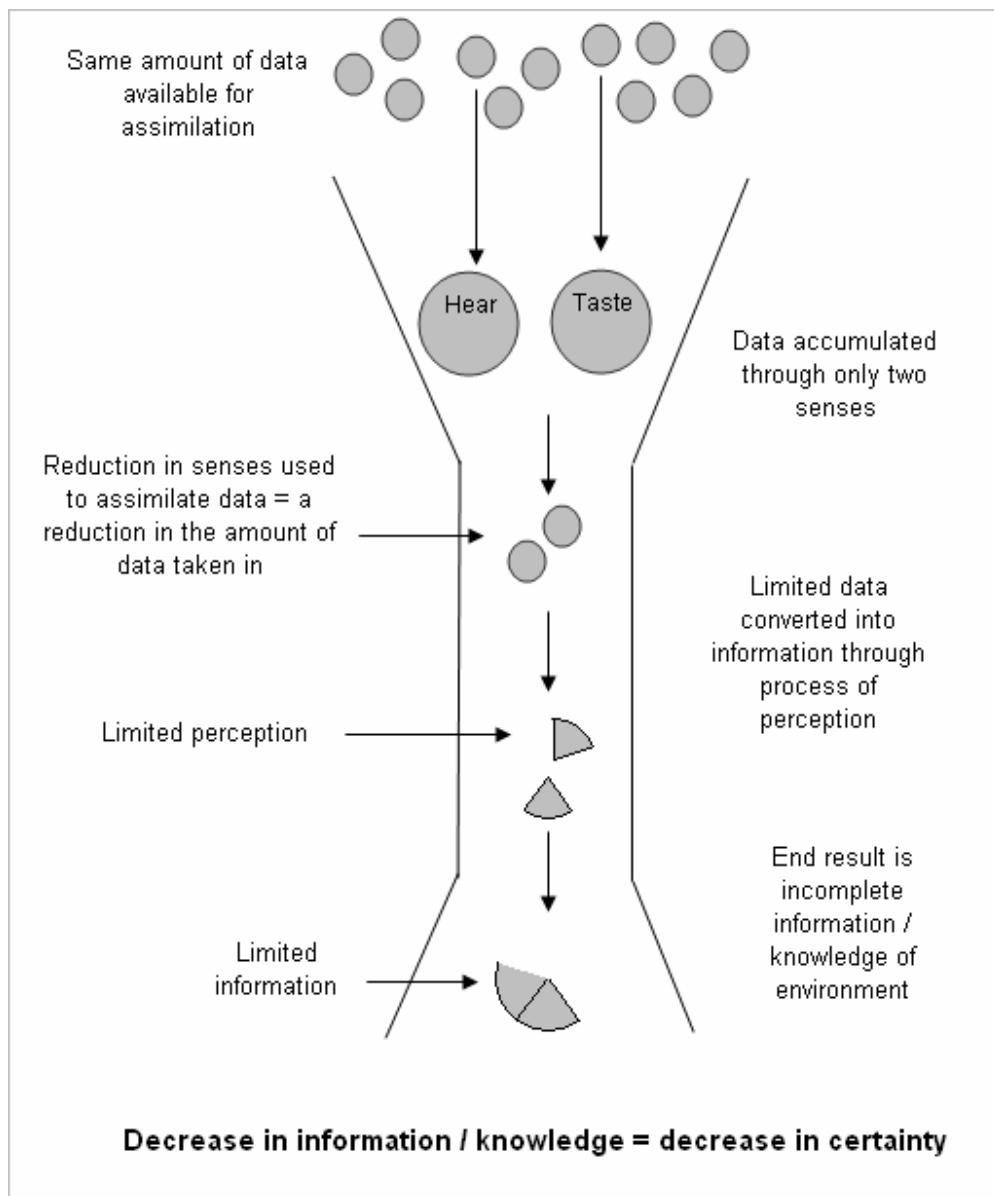
Source: Own observation

Figure 6.4 serves to illustrate the effect that information has on uncertainty. In this instance comprehensive data is being accumulated by virtue of the fact that all five senses, represented by

the five grey circles, are being used to assimilate data. Each bit of data gathered from these senses is then channelled down the information funnel, through the process of perception. This results in a complete circle of information made up of five slices, each slice representing a bit of data attained from one of the respective senses. By completing the circle a full array of information has emerged thereby resulting in a comprehensive understanding. A comprehensive understanding results in a sense of certainty.

In keeping with the concept depicted in Figure 6.4 above, it is possible to illustrate the effect on information and uncertainty if only a portion of the senses is used to gather data. Figure 6.5 illustrates this visually.

Figure 6.5 - Second example of the effect of information on uncertainty



Source: Own observation

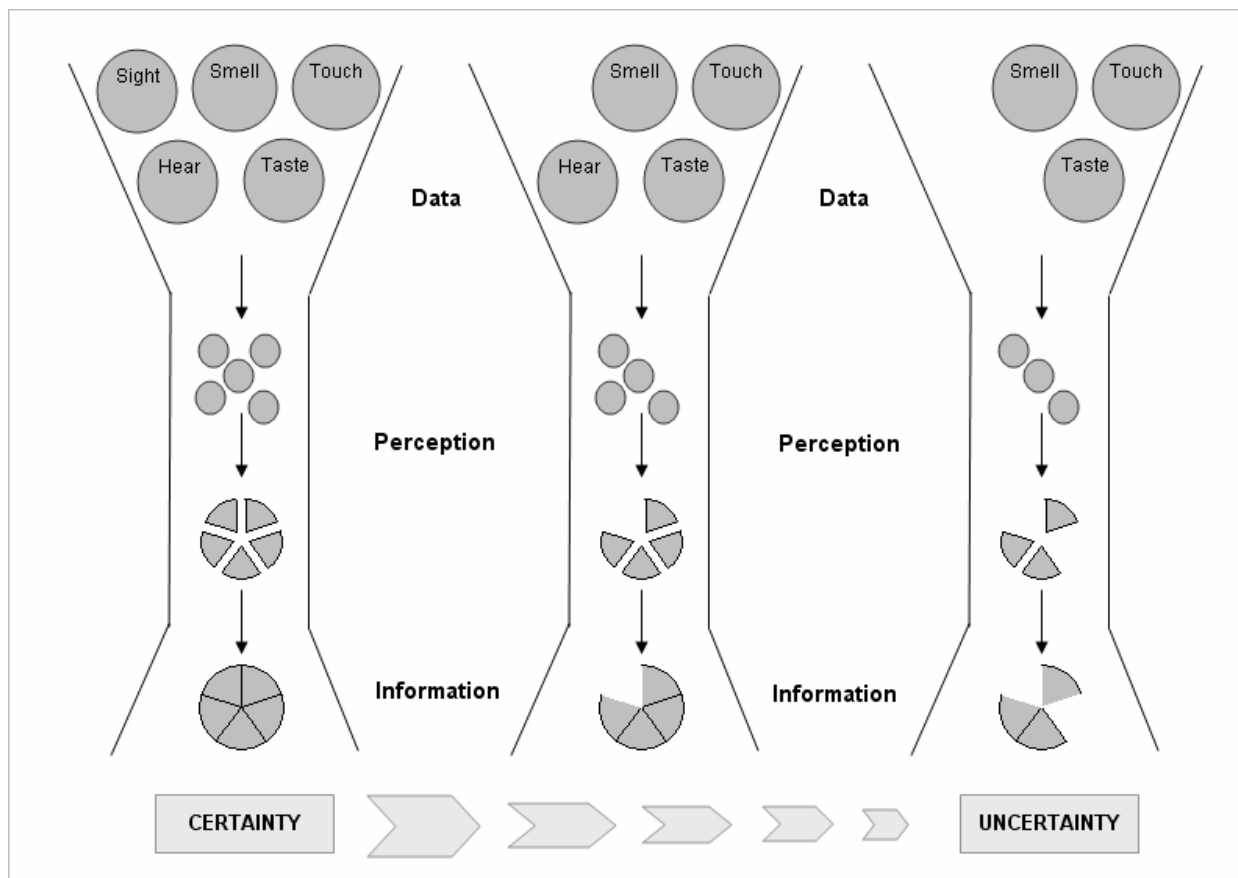
Figure 6.5 serves to illustrate the effect that information has on uncertainty. In this instance limited data is being accumulated by virtue of the fact that only two of the five senses, represented by the five grey circles, are being used to assimilate data. Each bit of data gathered from these senses is then channelled down the information funnel, through the process of perception. This results in an incomplete circle of information made up of two slices, each slice representing a bit of the data

attained from only two respective senses. As the circle is incomplete, only a limited array of information has emerged thereby resulting in a limited understanding. This limited understanding in turn results in a decrease in certainty.

6.4.4 Summary

It is clear from the example provided in paragraph 6.4.3 above that as the amount of data assimilated decreases (due to a reduction in the number of senses used to gather data) so too does the degree of certainty. This then concludes the second characteristic of information namely that it reduces uncertainty. This concept is summarised visually in Figure 6.6 below.

Figure 6.6 - A visual summary of the second characteristic of information



Source: Own observation

Figure 6.6 serves to summarise the second characteristic of information, namely that information reduces the effect of uncertainty. As the quantity of data assimilated reduces due to fewer senses being used, the perception process becomes less effective thus resulting in a lack of information and a trend toward uncertainty.

6.5 The third characteristic of information

6.5.1 Information increases flexibility

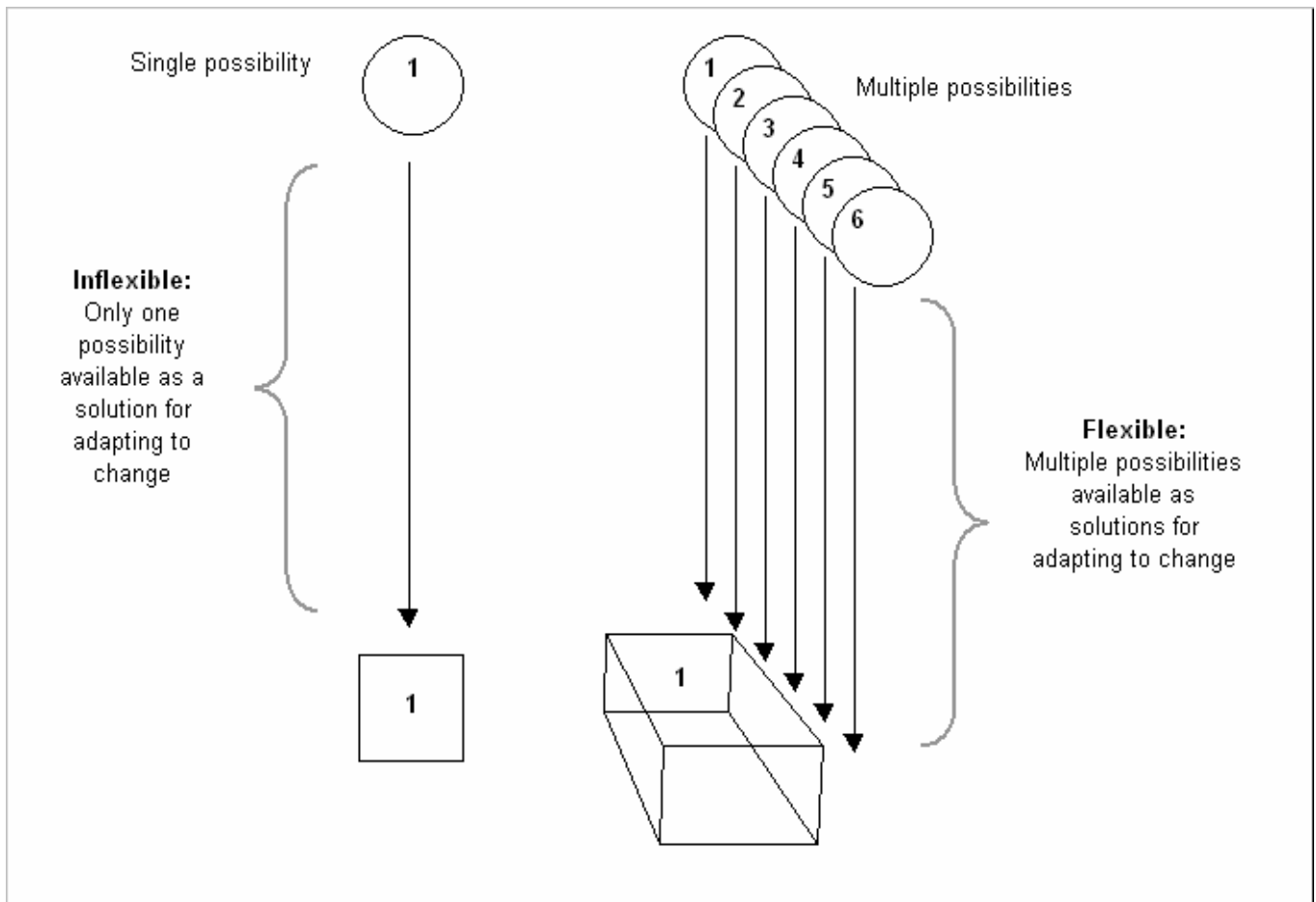
The approach to be adopted in terms of the third characteristic of information will focus not so much on the notion of flexibility itself, but rather on the circumstances required in order to achieve it. Due to the fact that flexibility is a fundamental characteristic demanded of most modern-day organisations in order to survive (Olson & Eoyang 2001), simply dealing with the concept of flexibility in itself is insufficient to ensure survival; instead it needs to be understood as to how organisations can create flexibility. This creation of flexibility is once again the task of information and can be demonstrated using the conceptual model of the information process arrived at in Figure 6.3 above. This will be done in Figures 6.8 and 6.9 respectively, however, before this is done it is necessary to correlate flexibility to possibility and highlight the relationship between the two.

6.5.2 Flexibility – a product of possibility

The term flexibility refers to the ability to be changed so as to suit circumstances (Oxford 1983). The keywords in this definition are ability to be changed and as such the task at hand is to understand the construct capable of this function. For this to be achieved, consideration of the following statement is given. “The more present and aware we are as individuals and as organisations, the more choices we create. As awareness increases, we can engage with more possibilities” (Wheatley & Kellner–Rogers 1996:26). This statement is fundamental to the objective

of this paragraph as it forms the correlation between flexibility and possibility. That is to say that an individual or organisation wishing to create flexibility can do so by increasing awareness in a bid to open up choices and engender a greater number of possibilities that can be used as solutions for adaptation to change. The correlation therefore is simple, the more options available to a system the more flexible the system becomes (Capra 1983). An organisation faced with only one possibility as a solution to facilitating change, can be considered far less flexible, or rather capable, of adapting to circumstance than an organisation with multiple possibilities at its disposal. This holds true on the basis that an organisation with multiple solutions at its disposal by default has a greater degree of discretion in terms of deciding upon the best approach to be adopted in order to facilitate change most effectively. In contrast to this an organisation with only one solution has no flexibility in the sense that there are no alternative possibilities that can be explored as solutions for adaptation. This concept is not a complicated one but needs to be understood. Figure 6.7 provides a visual understanding of the above.

Figure 6.7 - Visual depiction of the association between flexibility and possibility



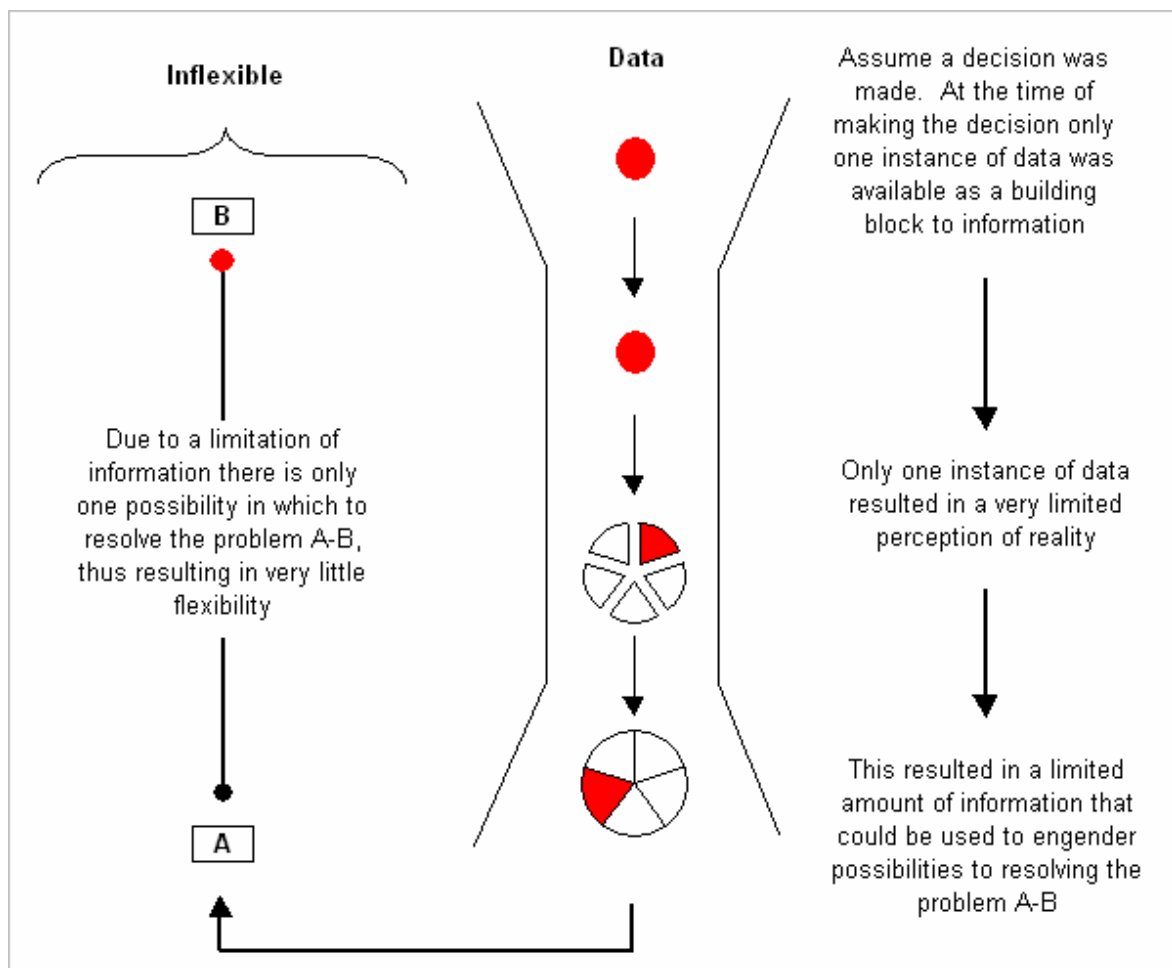
Source: Own observation

Figure 6.7 details the association between flexibility and possibility. The boxes labelled 1 in the diagram represent the ideal outcome to a problem requiring organisational change. The circles and the arrows linking the boxes, represent the possible solutions and paths that can be followed in order to achieve this ideal. Given this, it is possible to attain an understanding of the proposal that the more possibilities which exist at the disposal of an organisation, the more paths (options) an organisation has to explore, the greater the probability of achieving the desired outcome. This process allows for a more probable ability to adapt to change. Herein lies the concept of flexibility.

6.5.3 Information as the gateway to possibility

Now that the association between flexibility and possibility is understood, what remains is to provide insight into the manner in which possibility can be created. For this, the following statement is considered key: "To limit our world views... tends to prevent the consideration of fundamentally different notions that may be needed to fit new observations and experience" (Bohm 1998:72). Effectively what is alluded to in this statement is a call to maximise the information process. That is, to ensure the maximum amount of data is perceived and processed so as to prevent limiting perceptual views. A perfect example in which perceptual views are limited relates simply to decision-making. Effectively what takes place when making a decision is that the process of observation (gathering data) is brought to an end as the data available at the time of making the decision is now decided upon. At this instance the ability to generate new information and therefore possibility is thwarted by virtue of the fact that the mind no longer permits further observation. A lack of observation results in a reduction of information. This in turn reduces the number of new possibilities that can be generated out of a given situation and as such a trend toward a reduction in flexibility is established. Wheatley and Kellner-Rogers (1996:26) concur with this statement by claiming that "whatever we decide to notice blinds us to other possibilities. In directing our attention to certain things, we lose awareness of everything else. We collapse the world of possibilities into a narrow band of observation". On this basis it can be stated that the limiting of perceptual views, regardless of the manner in which this limitation is enforced, is synonymous with a reduction in information and therefore possibility. As possibility decreases, so too does flexibility. This was depicted in Figure 6.7. Furthermore, Figure 6.8 illustrates the effect of limiting information on possibility.

Figure 6.8 - The effect of limiting information on possibility

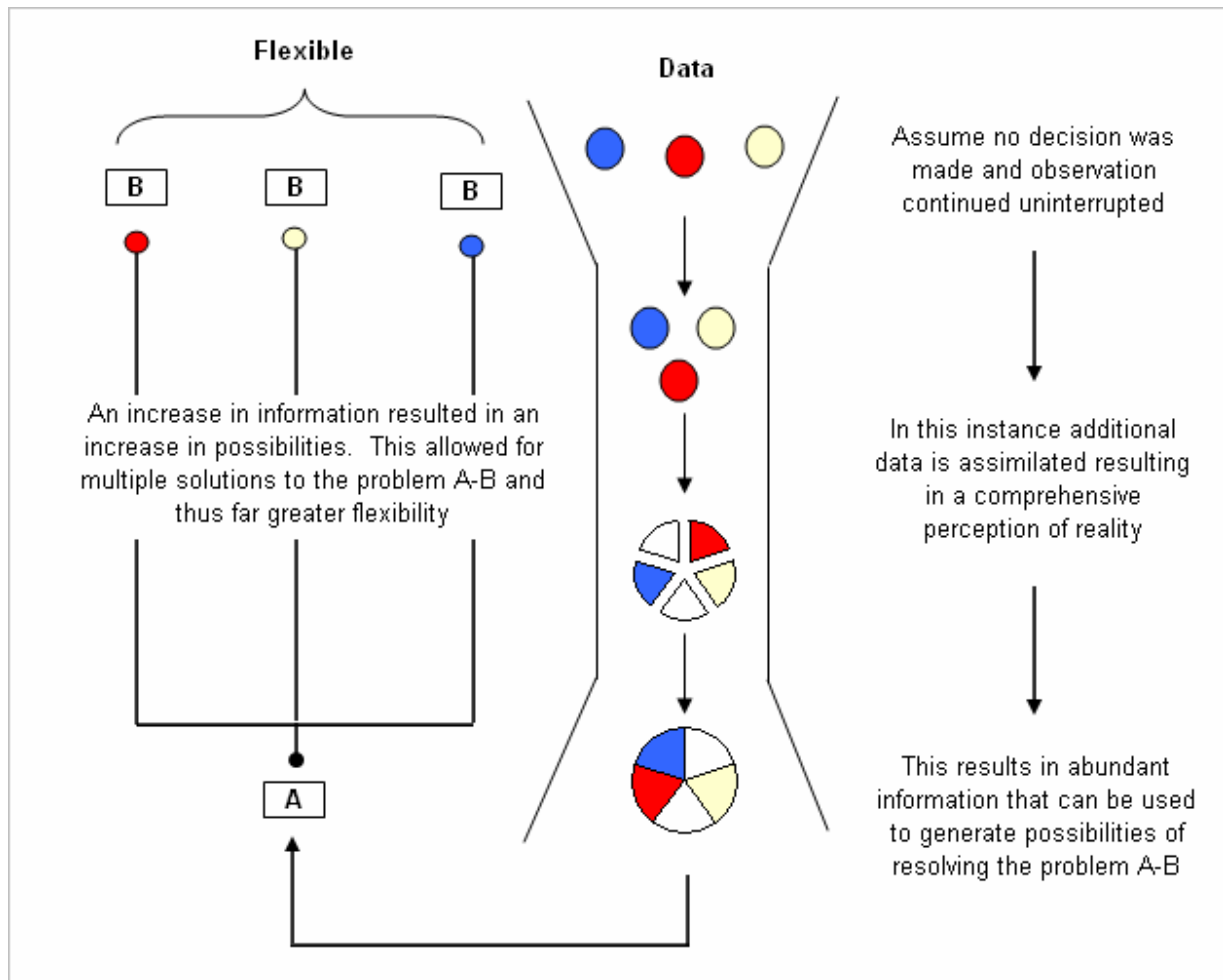


Source: Own observation

Figure 6.8 depicts the association between information, possibility and flexibility. By limiting available information, a limit is placed on the ability to generate multiple possibilities and as such a reduction in flexibility takes place. This association is depicted using an extreme example in which a decision is made based on only one bit of data represented by the small red circle. Using only limited data, a reduced ability to perceive information results. This is represented by the information circle being made up of only one slice. Consequently only one possibility is engendered as a solution to the problem A-B. As previously concluded (Figure 6.7) one solution represents complete inflexibility.

In building upon the example put forward in the diagram above, consider Figure 6.9. In this example the assumption is made that decision-making is delayed so as to gather more data. The effect of this delay is illustrated accordingly.

Figure 6.9 - The effect of increasing information on flexibility



Source: Own observation

Figure 6.9 depicts the association between information, possibility and flexibility. By prolonging the act of observation and not limiting the process of perception an increase in the amount of data used in perception occurs. This has the effect of increasing information, thereby increasing the number of possible solutions to the problem A-B that can be engendered. As previously concluded (Figure 6.7) an increase in possibility increases flexibility.

6.5.4 Concluding remarks

Figures 6.8 and 6.9 above conclude the effect of information on flexibility. It has been shown that by increasing the effectiveness of the information process it is possible to increase possibility and therefore flexibility. This concludes therefore that information increases flexibility.

This concept, although simple, holds fundamental implications in terms of managing qualitative risk. As flexibility was shown to be a distinct characteristic of qualitative risk (paragraph 5.4) it is now possible to place into context the role and implication of information in terms of this characteristic. It can be concluded that in order to remain effective in terms of managing flexibility it is needed to increase the effectiveness of information. In so doing a natural tendency toward a flexible structure evolves and as such a more effective environment is engendered in which to manage flexibility of qualitative risk.

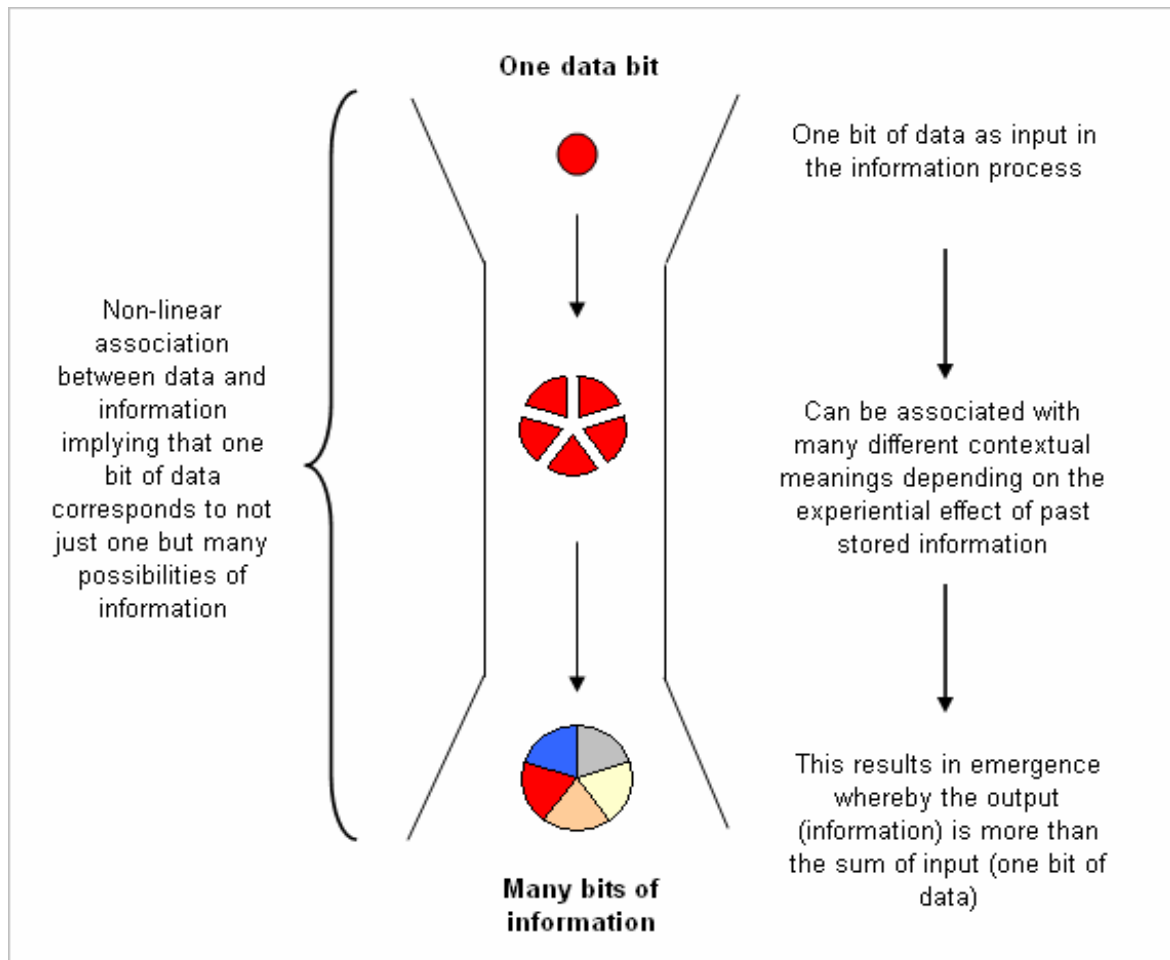
6.6 The fourth characteristic of information

6.6.1 Information exhibits emergent properties

The final characteristic in terms of information is the fact that it exhibits emergent properties. Emergence in the context of this paragraph refers to “a process by which a system of interacting subunits acquires qualitatively new properties that cannot be understood as the simple addition of their individual contributions” (Bonabeau, Camazine, Deneuborug, Franks, Sneyd & Theraulaz 2001:31). In simple terms, new information is considered to reconfirm and strengthen existing information (Shannon & Weaver 1949) and the result therefore is greater than the sum of its parts. The result of this is the emergence of new information of which the relational meanings have a non-linear association between data, as input into the information process, and information as output of the information process. Stated differently, one bit of data used as a raw material into the

information process does not equate to only one bit of information being produced as an output from the information process. Figure 6.10 depicts this simple factor visually.

Figure 6.10 - **Visual depiction of the concept of emergence**



Source: Own observation

Figure 6.10 serves to depict the basic principle constituting the characteristic of information, namely that it has emergent properties. In the diagram it is possible to understand that a non-linear association between data and information exists implying that one bit of data does not result in only one bit of information but rather many. This is illustrated in the way that one bit of data (represented by the small red circle) can be associated to many different perceptions at any given moment (represented by the single-coloured fragmented circle). The result of this is a number of

different comprehensions of information resulting from the same bit of data. The multiple-coloured slices of the information circle represent the notion emergence.

This concept is critical and as such requires further understanding. This can be achieved by means of a simple illustration using graphs. However, before this concept is explained it is first necessary to comprehend the basis upon which information attains the characteristic of being emergent.

6.6.2 The basis upon which information obtains the characteristic of emergence

Up to now the information process has assumed a linear relationship between data and information meaning one bit of data equated to one output of information. This has been done for the sake of simplicity so as to remain effective in terms of explaining the previous three characteristics of information. However, this relationship is not a true reflection of the information process. Emergence in information displays a non-linear association between data as an input and information as an output. This non-linear association can be understood by considering the concept of human learning.

Learning is a process of, amongst others, attaining knowledge by experience (Oxford 1944). There are many different forms of learning, some of which have been identified in Laszlo (1972) as habituation learning, conditioning, trial and error learning, latent learning and insight learning. It is not the intention of this dissertation to delve into detail regarding each form of learning. However, trial and error learning, which is learning attained through experience, will be briefly discussed. A comprehension of this will provide enough insight in order to relay the basis of understanding upon which the fourth characteristic of information, namely emergence is based.

6.6.3 Associative learning – trial and error

Experience is largely the result of associative (trial and error) learning and is best understood by means of an example. “When a rat learns to run a maze it doesn’t follow rules, it practices. If a trial run fails, no neural connection is wired in; if it succeeds, the brain strengthens that connection” (Zohar and Marshall 2001:53). The important point being alluded to in this extract is simple. The brain stores information and uses it to test all newly assimilated data against. Through repetition of this process a number of outcomes are generated which in turn gets stored in the form of experience. In effect every action of perception in life results in an association being stored thus creating a ‘database’ of information within the brain. It is interesting to note that Gombrich in Calvin (1998:44) describes the act of perception as being “...an active process, conditioned by our expectations and adapted to situations.” This implies therefore that through perception, the data being assimilated is placed into context by virtue of an expectation resulting from previously stored experiences or information within the brain. Once all possible contexts have been considered, only then is the data given meaning by adapting it to the context most appropriate to the given situation.

This concept of placing data into context is a complex one and will not be discussed in this chapter. Enough has been presented in order to understand that one bit of data can now take on many different contextual meanings. The number of alternative possible meanings is largely related to the number of stored experiences within the brain. Haken (1999:28) summarises the concept of emergence by stating that “the interaction of the system with its environment... leads to the formation of new information. Through the continuous testing of the new information stored and created in the brain by the environment, new contexts are established and thus a new kind of semantics occurs.” The old linear notion depicted by the information process that one bit of data being perceived equates to only one bit of information no longer exists. Instead a new non-linear association is made in which one bit of data being perceived can potentially equate to a host of different meanings. It is this concept that drives emergence.

6.6.4 Conclusion

A brief reconsideration of the meaning of emergence as proposed in paragraph 6.6.1 is required, as enough has now been presented in order to make this definition more meaningful. Emergence was defined as “a process by which a system of interacting subunits acquires qualitatively new properties that cannot be understood as the simple addition of their individual contributions.” (Bonabeau *et al* 2001:31). In respect of the comprehension put forward in paragraph 6.6.3, it can clearly be seen why information exhibits a characteristic of emergence. As human experience continues to grow, so the gap between data as input into the information process widens, relative to output (possible contextual meanings of data).

6.6.5 A graphic example of the concept of emergence within information

For the sake of completeness, a simple visual example utilising graphs is provided. In order to remain effective in terms of illustrating the concept of emergence as proposed in paragraph 6.6.3 above, a comparison will be done illustrating the graphical outcome of the ‘old’ linear paradigm associated with the information process, namely that each input of data results in a corresponding output of information and hence no sign of emergence to the new non-linear paradigm associated with the information process, namely that one input of data can result in multiple output of information. Such a comparison will be conducted using mathematical algorithms. In the first instance, a normal linear equation will be presented. In this equation, no notion of emergence is present. In the second instance, a non-linear equation will be presented. In this equation, the concept of emergence will be shown to be present. The comparison between the two equations will be illustrated on a spiral graph. This will neatly illustrate the concept of emergence within information.

Consider the following algorithm $D = 2i$. This algorithm expresses a linear association between data and information in that for each input of variable D (data) a direct correlation of twice the output in i (information) exists. Table 6.1 illustrates examples of this relationship. It shows that as

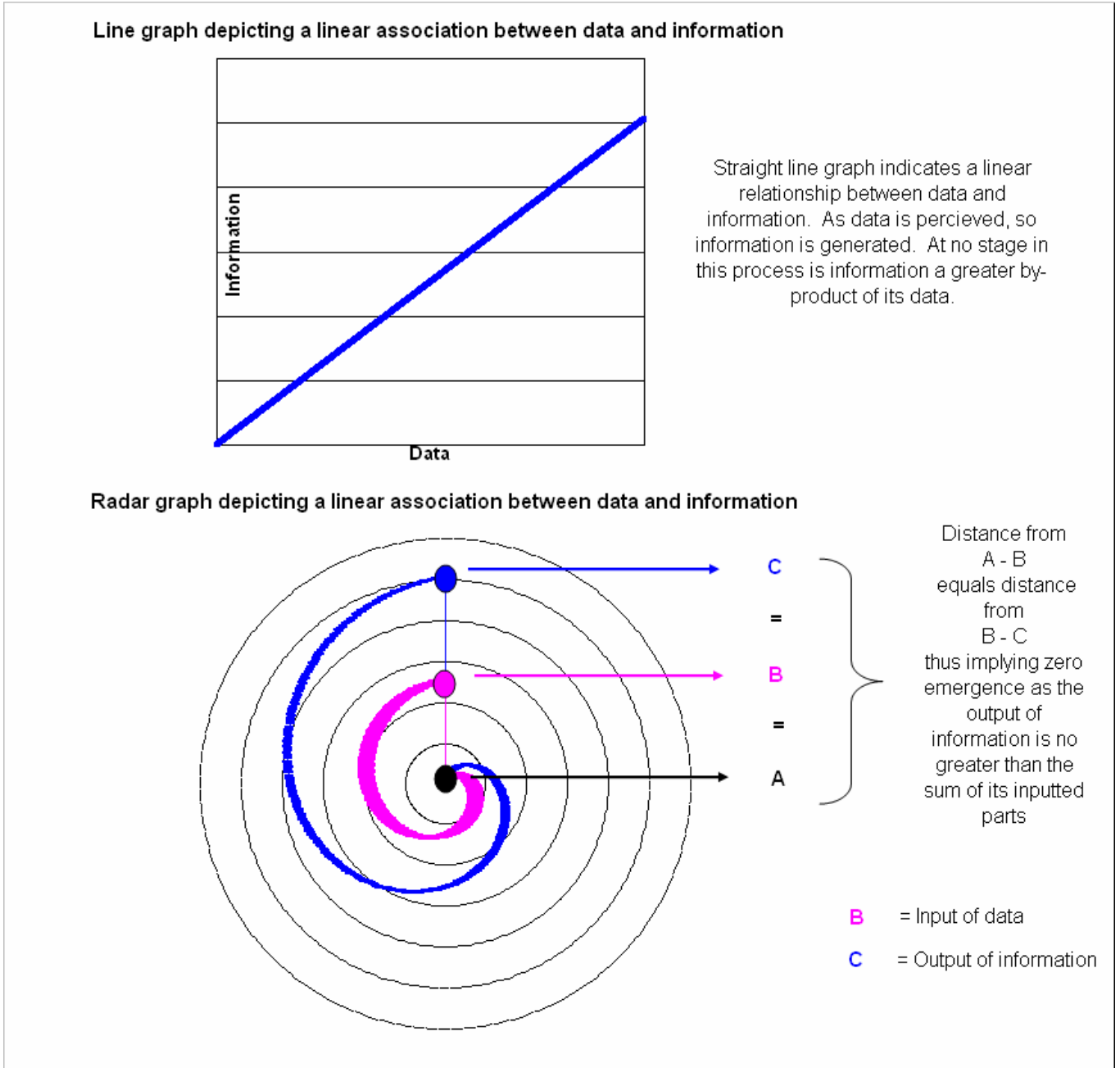
more bits of data are used in the process of perception so a linear outcome of exactly twice the amount of information results. Graphing this visually results in a graphical understanding of why the old paradigm of information does not include the notion of emergence. Table 6.1 and Figure 6.11 illustrates accordingly.

Table 6.1 - Data table representing the 'old' linear paradigm of the information process

The number of bits of data used in the process of perception (D)	Linear relationship relating data to information (old paradigm)	The resultant in output of information (i)
1	$D = 2i$	2
2	$D = 2i$	4
3	$D = 2i$	6
4	$D = 2i$	8
5	$D = 2i$	10
6	$D = 2i$	12

Figure 6.11 - Graphic depiction of a linear relationship between data and information as per

Table 6.1



Source: Own observation

Figure 6.11 illustrates a linear association between data and information. This is done by graphing the data set in Table 6.1 on a spiral graph. In the spiral graph, the pink spiral indicates the input of data and the blue spiral indicates the output of information. It can be seen that as the number of bits of data used in the perception process increases, so too does the resultant output of information. Important to note is that the two spiral lines always remain equidistant from each other. The interpretation of this is that the resultant output of information at no given stage is greater than the input of data used. The concept of synergy ($1 + 1 = 3$) therefore never applies. As a result of this continual equidistant relationship between data and information, emergence is shown to be missing in the old information paradigm.

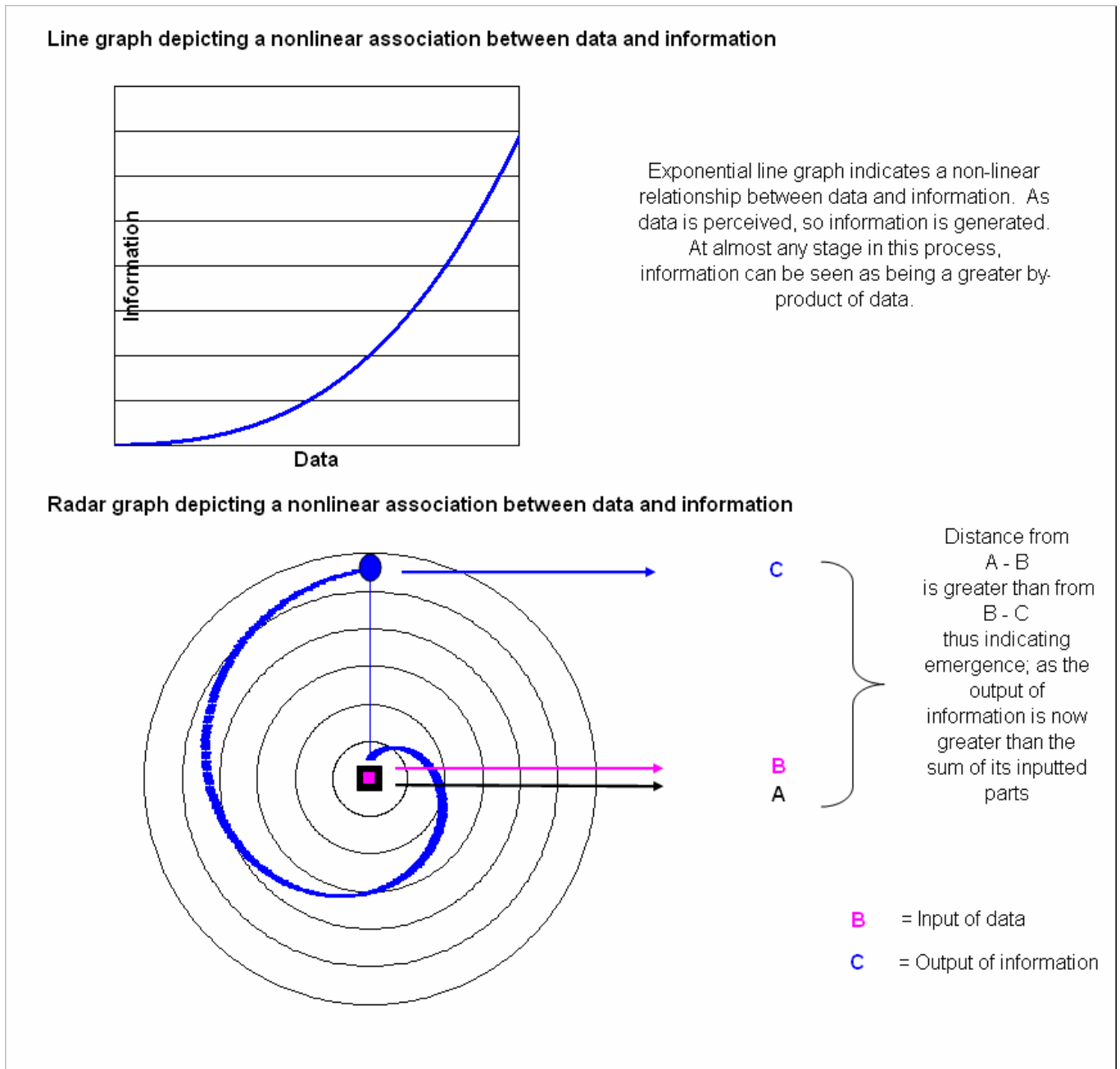
In contrast to the example above, consider a second example depicting a new paradigm of the information process, namely that due to the concept of associative learning (experience) a non-linear association between data and information results, thereby displaying the characteristic of emergence. This example follows the same approach adopted above, however, uses a non-linear algorithm to illustrate the concept of emergence. Table 6.2 and Figure 6.12 illustrate this accordingly.

Table 6.2 - Data table representing the new nonlinear paradigm of the information process

The number of bits of data used in the process of perception (D)	Linear relationship relating data to information (old paradigm)	The resultant in output of information (i)
1	* $D = I^3$	1
2	* $D = I^3$	8
3	* $D = I^3$	27
4	* $D = I^3$	64
5	* $D = I^3$	125
6	* $D = I^3$	216

* It must be noted that the cube root function used in this algorithm is not necessarily indicative of the relationship between data and information. The cube root function is utilised simply for the purpose of illustrating the concept of emergence.

Figure 6.12 - Graphic depiction of nonlinear association between data and information as per Table 6.2



Source: Own observation

Figure 6.12 illustrates a non-linear association between data and information. This is done by graphing the data set in Table 6.2 on a spiral graph. In the spiral graph, the pink spiral indicates the input of data and the blue spiral indicates the output of information. It can be seen that as the number of bits of data used in the perception process increases so too does the resultant output of information. Important to note is that the two spiral lines gradually move away from each other. The interpretation of this is that the resultant output of information is greater than the input of data and continues to be so on an exponential basis as the input of data increases. This trend illustrates the concept of synergy ($1 + 1 = 3$) in that over time a small increase in data results in a large output of information, implying that the output of information during the process of perception is greater than the sum of the individual parts used as input. This notion is in line with the concept of emergence.

6.6.6 Emergence – closing remarks

The fourth characteristic of information has been discussed and graphically illustrated. The concept of emergence has been put forward and illustrated using graphs. On the basis of this characteristic, the final trait of information can now be proposed, namely that information is recycled thereby providing insight.

6.7 The fifth characteristic of information

6.7.1 Information provides insight through recycling

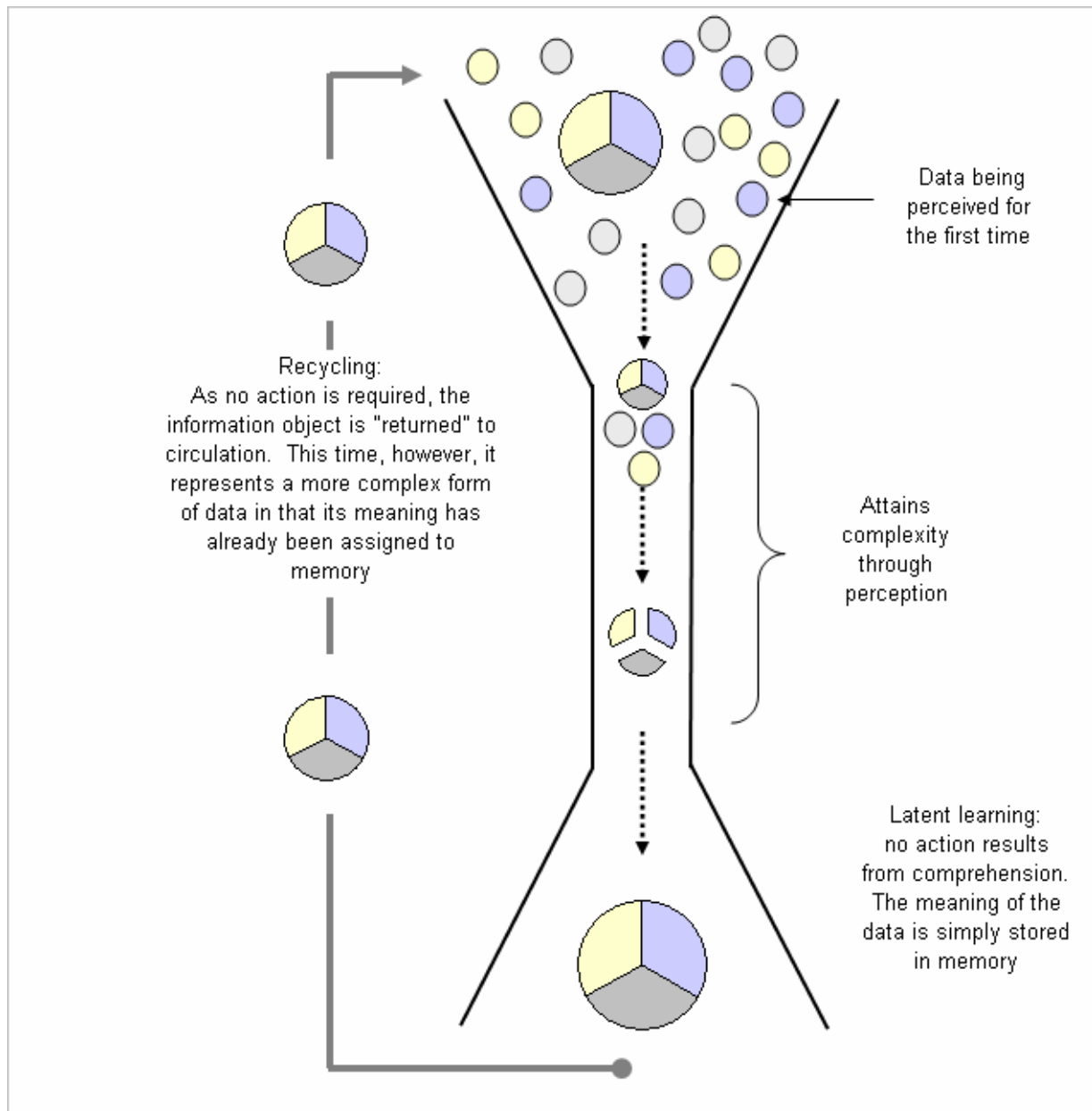
This characteristic of information can be considered an extension of paragraph 6.2.4 above and is based upon the principle of latent learning. This characteristic is proposed for the purpose of concluding the framework of the information process so as to be able to adapt it to the final chapter involving a discussion of dissipative structures.

Latent learning is a form of learning which does not need to be reinforced by confirmation (Laszlo 1972). In the context of the information process, this implies that the resultant output of information does not necessarily have to be correlated to an action or outcome. It is possible simply to attain knowledge of the surroundings by exploring and understanding the relationships represented by certain objects. Consider latent learning as a form of familiarization or exploration in which data is assimilated, converted into information and then dismissed leaving only a memory of the meanings thereof. The continual repetition of this is what engenders the notion of insight, however, before this is discussed the fundamentals need to be established.

6.7.2 The fundamentals

Consider the following statement as a starting point for relaying the fundamentals: “All of the wave functioning representing the observed system collapses, except the one part, which actualizes into reality.” (Zukav 1979:79). In the context of the discussion from which this statement is drawn, Zukav primarily discusses the effect of observation and how observation results in the creation of reality. In addition to this discussion is a second and more relevant theme, namely that of recycling. Zukav alludes to this theme when inferring that all data which does not contribute to the actualisation of reality collapses. This implies that information not used in the final process of contextualisation is “returned” in a manner of speaking and placed back into circulation where it once again represents new potentials. What is interesting to note, however, is that the information being “returned” to circulation represents a far more complex structure than data alone. Due to the mechanism of latent learning, the meaning associated with data the instance it is observed, is stored within the brain as perceived information in which case it represents a greater complexity than data alone. Thus a more complex structure is returned to circulation. Figure 6.13 illustrates this concept and sets the framework of reference in place for the discussion to follow.

Figure 6.13 - The concept of recycling within information



Source: Own observation

Figure 6.13 represents the concept of recycling. Even though all data is used during the process of perception, the information which is not used in the final context of understanding is discarded, thereby effectively returning to the external environment where it remains until perceived once again. At this stage of re-perception the data perceived has evolved in complexity in that it is

perceived not as an individual bit of data that has no significance, but rather as an individual bit of information, the significance of which has previously been determined. Thus, the principle of recycling is facilitated through memory and results in new dynamics within the information process such as insight.

6.7.3 How this leads to insight

In accordance with Laszlo (1972:85), insight is described as an "...apprehension of the relations between objects in the environment in function of their relation to the environmental needs of the organism." In the context of this statement, insight implies an ability to understand the relationship between current circumstance and objects within the environment, without necessarily having experienced the situation before. For lack of a better description, it is an educated form of "predicting" outcome.

This ability is made possible by virtue of recycling within the information process. Through repetition of the process of latent learning, data attains a level of complexity that over time permits a far more superior understanding of objects and the contexts that can possibly relate them to reality. This superior understanding of the potential relational value of objects to reality is what makes it possible for newly perceived circumstances to be contextualised and assigned meaning without necessarily having to experience it.

6.7.4 The relevance to risk

This theme holds a particular relevance to qualitative risk in that it permits an ability to enhance flexibility and reduce uncertainty. Insight by definition is "the ability to perceive and understand the true nature of something" (Oxford 1983:338). Paragraphs 6.4 and 6.5 dealt with the notion that by increasing the effectiveness of the information process it is possible to increase flexibility and reduce uncertainty. On this basis insight can be considered as the "cherry on top" of these two

characteristics in the sense that it refines the effectiveness of the information process by adding true clarity to that which is being perceived. It is like contributing a third dimension to the information process. Where certainty and flexibility represent the first two dimensions, insight can be seen as the third.

Insight is a fundamental requirement in terms of managing qualitative risk. This is due to the fact that "life's most challenging existential problems exist outside the expected and the familiar, outside the given rules, beyond past experience, beyond what we know how to handle" (Zohar & Marshall 2001:13). Insight is an information tool that assists in understanding that which has not yet been experienced, which cannot always be perceived and therefore often remains unknown. It allows for the ability to generate information where data is a scarce commodity.

6.8 Conclusion

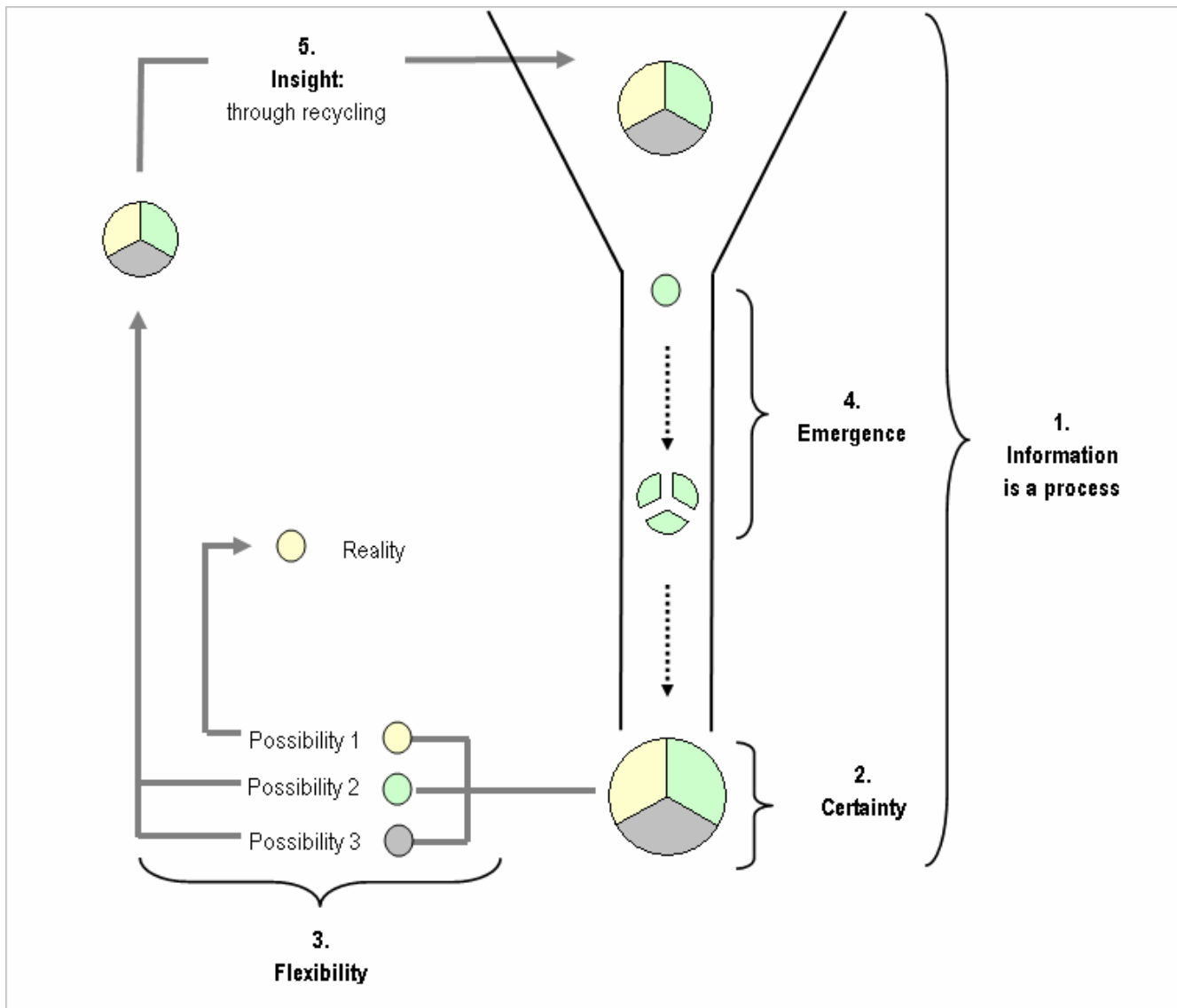
The importance of information to risk has been discussed and highlighted in the paragraphs above. It has been shown that information is a process which, if managed effectively, can reduce uncertainty and increase flexibility thereby increasing the probability of effectively managing qualitative risk. It has also been shown how the information process results in a compounding effect in which perceived data takes on an exponential rise in meaning as associative learning in humans takes place. In addition, through the recycling of information latent learning permits an ability to extract information from circumstances in which data is scarce or experience is lacking.

From this understanding, the importance of information and the role that it constitutes relative to qualitative risk can be comprehended and concluded. Information is the key link between man's creation of qualitative risk, as well as man's ability to manage it. It constitutes the bridge between the principles that define qualitative risk (uncertainty, flexibility and interaction, within the human mind – Chapters 4 and 5) and the means by which to control it. In addition to this information underlie all processes that define life itself (Wheatley 1994), thereby concluding the importance of trying to better understand it.

In closing, what has become more and more apparent as this dissertation has evolved is the concept that qualitative risk is a totally mental construct that exists somewhere between the act of observation and perception of reality. Given that this association differs from person to person (Capra 1983), the notion of risk has adopted an evanescent quality which renders it borderless in effect. "The most significant characteristic of the reflexive mind is apperception, the capability of forming alternative models of reality," according to Jantsch (1980:163). The implication of this is that rigid inflexible models of risk can no longer be imposed as the only solutions to it. Instead an identification of the need to adapt in a similar evanescent structure in which alternative concepts of risk and reality can be accommodated is required. As has now been shown, such a structure is possible simply through the medium of information. This allows for uncertainty to be embraced with the knowledge that the ability to adapt (flexibility) is an inherent by-product of the process of information. In the light of this, an opportunity exists to identify such a structure, capable of maximising the effectiveness of the information process in a bid to survive relative to the demands of qualitative risk. This topic will form the discussion point of to Chapter 7.

Figure 6.14 concludes and summarises the principle characteristics of information as put forth in this chapter. It serves to depict the final framework of the information process that will be used and called upon in Chapter 7 to follow.

Figure 6.14 - A concluding model of the information process as proposed in Chapter 6



Source: Own observation

Figure 6.14 consolidates, in one united model, all the characteristics of information as proposed in Chapter 6. Each of these characteristics can be understood by referencing them to the applicable sections and diagrams within this chapter. The purpose of this diagram is simply to consolidate the five fundamental principles of information in one united format. Using these characteristics as a framework to work from, the final chapter relating to dissipative structures can be proposed.

CHAPTER 7

DISSIPATIVE STRUCTURES

True strength lies not with he who stands strong alone, but rather
with he who stands weak but amongst others (*own source*)

7.1 Introduction

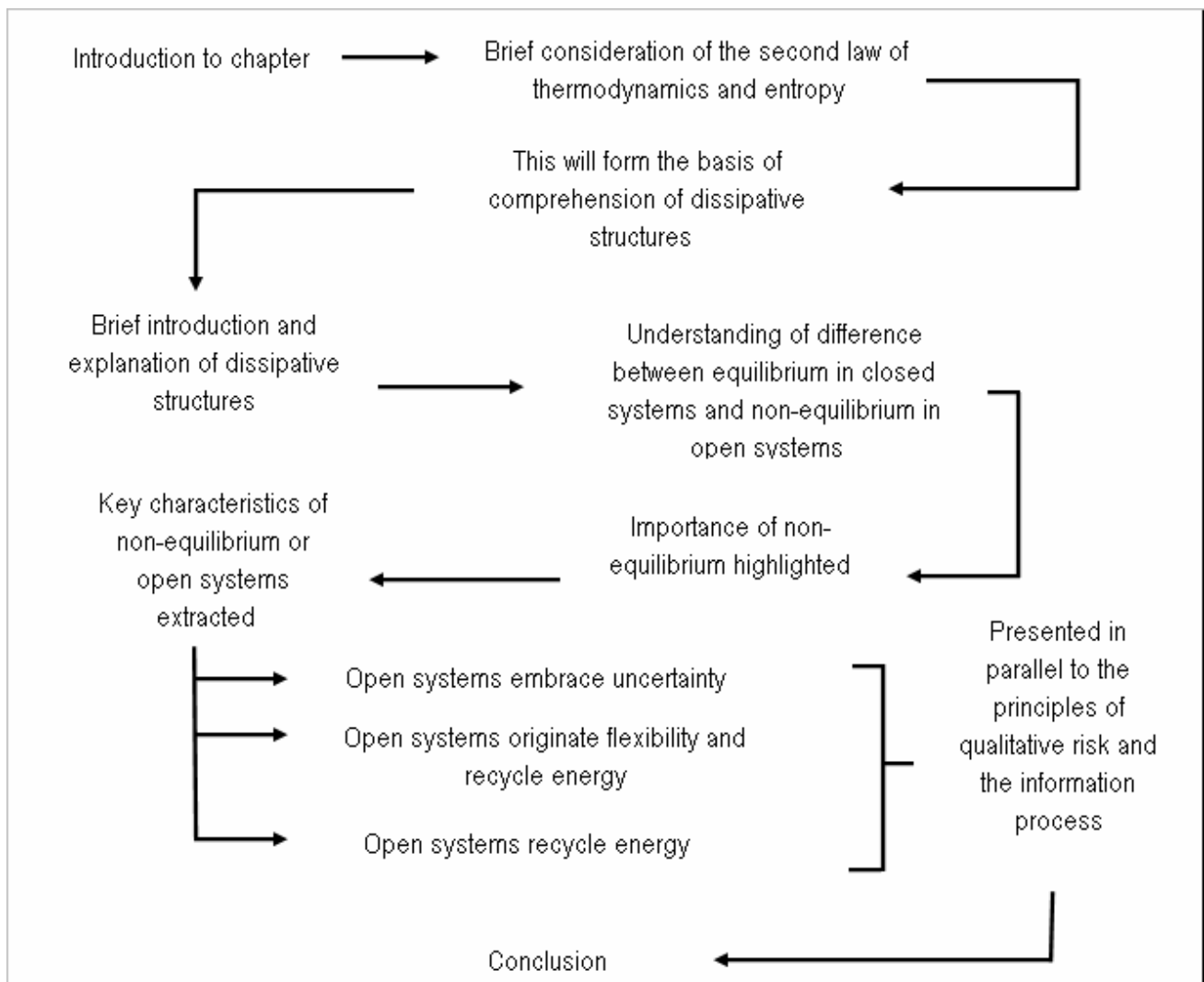
Chapter 7 is the final chapter prior to conclusion and therefore serves the purpose of bringing together all that has been discussed relative to qualitative risk thus far. In order to achieve this, the qualitative characteristics of risk, as well as the implication of information on these characteristics, have to be considered. Consideration, however, will take the form of a model or structure that can be used in a practical manner within organisational structures. Such a structure must not only embrace the key characteristics of qualitative risk and information, but also provide an example into the manner in which these characteristics can be incorporated, so as to manage qualitative risk effectively.

It is proposed that a starting point for such a model lies within the bounds of nature in the form of dissipative structures. In this regard it is noted that “we must understand which properties of complex living systems confer on the systems their capacities to adapt” (Kaufmann 1993:xiv). By doing this (understanding adaptation in complex dissipative structures) the solutions to managing qualitative risk can be revealed.

The focus of Chapter 7 therefore will be on dissipative structures. In order to remain practical it will be necessary to begin first by considering the basics of entropy, and then more specifically dissipative structures. Once the basics have been proposed, it will be possible to build upon them until such time that the full complexities surrounding the final concept of dissipative structures can be understood with relative ease. Thereafter, the principles applicable to the information process

can be incorporated so as to arrive at a model for achieving the objective of this chapter. Figure 7.1 summarises the approach relative to Chapter 7.

Figure 7.1 - A logical approach to finding solutions for qualitative risk



Source: Own observation

Figure 7.1 serves to provide a visual summary of the approach to be adopted in achieving the objective set out for this chapter, namely to search for solutions to ways in which qualitative risk can be managed more effectively. Such a solution will embrace the characteristics of qualitative risk already proposed, as well as the principles put forward in the framework applicable to the

information process. This will be achieved by introducing dissipative structures and the concept of equilibrium in closed and open systems and then drawing a parallel between such concepts and that which has already been presented on qualitative risk and the information process.

7.2 The basics of entropy and dissipative structures

7.2.1 The second law of thermodynamics and entropy

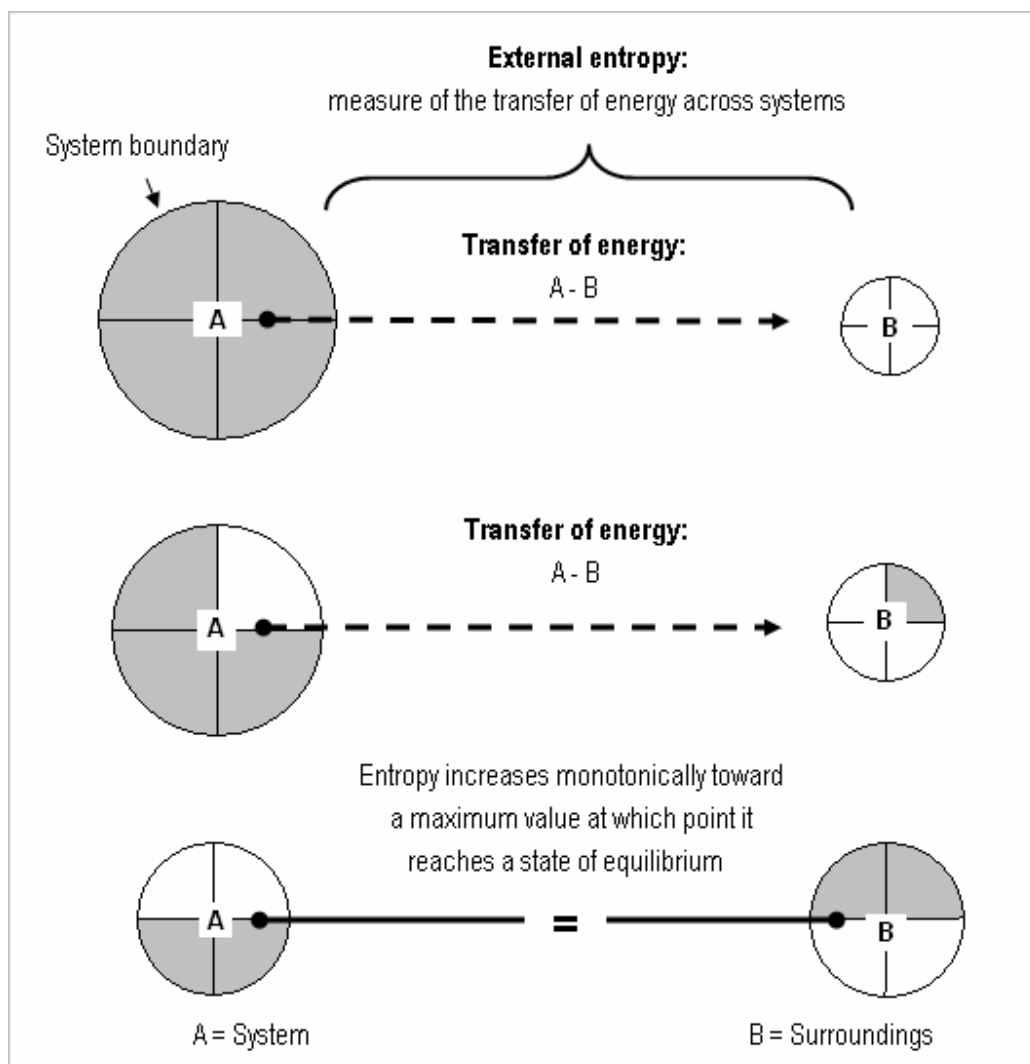
This chapter begins with a discussion aimed at attaining an understanding of thermodynamics and the notion of external and internal entropy. These two principles, although a minor deviation from the central theme of this chapter, form the basis for dissipative structures and as such hold relevance.

In short, thermodynamics relates to the “study of the transformations of energy” (Atkins 2004:109). Within this transformation process lies a specific scientific law applicable to the theme of this chapter. This law is known as the second law of thermodynamics and proposes that “all kinds of energy spontaneously spread out from where they are concentrated to where they are more dispersed” (Entropy and the second law of Thermodynamics). In simple terms, energy will automatically move from a high concentration to a low concentration. The manner in which energy moves is via the transformation of energy.

It is not the intention to go into detail on the transformation of energy as it falls beyond the scope of this dissertation. However the concept associated with the second law of thermodynamics, namely that energy moves from a high concentration to a low concentration, is important as it holds relevance to non-equilibrium states in open systems (paragraph 7.3.1), which is to be discussed later. For now, however, it is only necessary to know that the movement of energy as described in the paragraph above is what relates to the concept of entropy.

External entropy is regarded as the measure of the spread of energy (Entropy and the second law of Thermodynamics). More specifically, external entropy refers to the transfer of energy across a system's boundary (Prigogine 1980), thereby indicating a 'loss' or transfer of energy out of a system. This transfer of energy, according to the second law, continues to take place until such time that the system reaches an equilibrium state in terms of its surroundings (Prigogine 1980). For the sake of clarity, the concept of external entropy is visually depicted in Figure 7.2 below.

Figure 7.2 - A visual depiction of the notion of external entropy



Source: Own observation

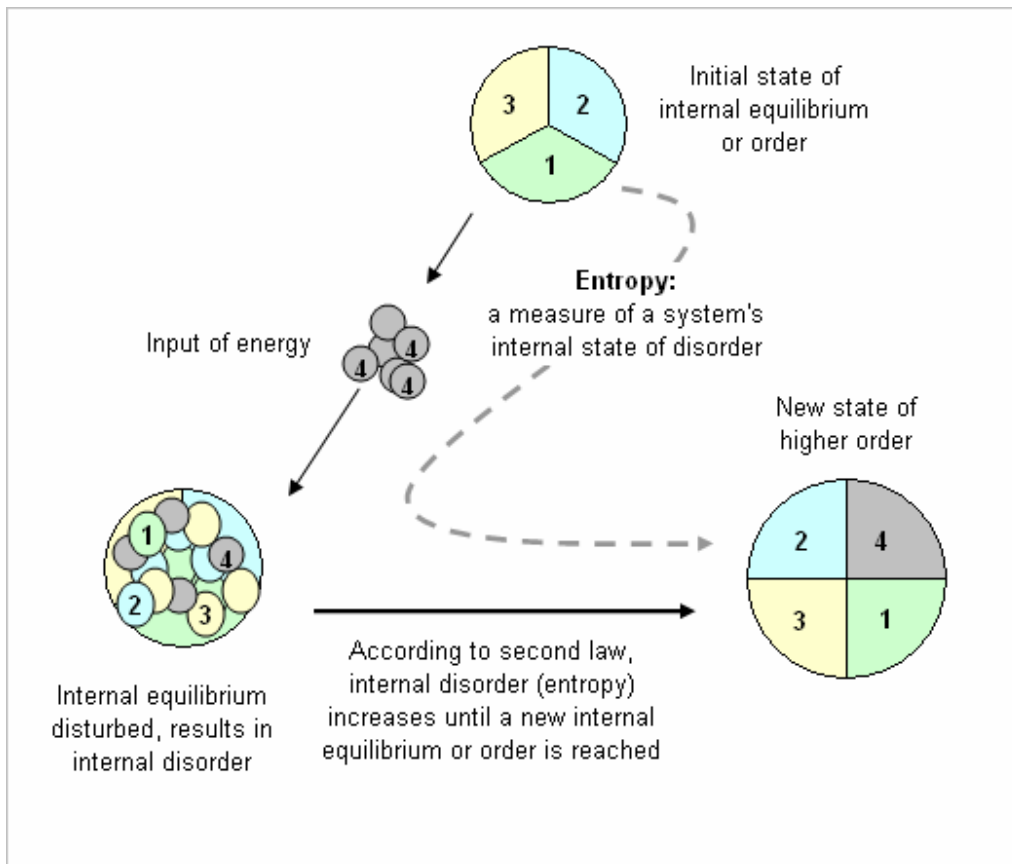
Figure 7.2 serves to illustrate the second law of thermodynamics and the concept of entropy that it engenders. From the diagram, it is possible to ascertain an understanding of how energy will always move from a point in which it is highly concentrated (point A) to a point in which it is less concentrated (point B). This movement will take place until such time that equilibrium is reached ($A = B$). At this point the state of energy between the two systems will be equal and external entropy will have been achieved.

7.2.2 Internal entropy

In building upon the level of understanding, as proposed in paragraph 7.2.1 above, the second aspect of entropy can now be proposed, namely that of internal entropy. Where external entropy referred to the transfer of energy across a system's boundary, internal entropy refers to the movement of energy within a system's boundary. In accordance to Schroedinger (1957), internal entropy increases within a system's boundary and goes from an initial state of order to an increasing state of disorder. This requires clarification and is best understood by way of a simple explanation.

Assume an isolated or closed system in which the internal state of the system is in equilibrium or an internal state of order. Consider the effect if external energy is transferred into such an isolated system. At first, the system will experience an internal imbalance or rather state of disorder resulting from the inclusion of new energy. This new state of internal disorder will in accordance with second law of thermodynamics continue to increase to a maximum threshold. At this threshold level, the system will have evolved into a higher state of equilibrium or order. Figure 7.3 illustrates this concept visually.

Figure 7.3 - A visual depiction of the notion of internal Entropy



Source: Own observation

Figure 7.3 depicts the concept of internal entropy as a notion of disorder. In this diagram internal disorder and disturbance is taking place within the system as a result of an additional input of energy from the outside. This additional energy will create an initial state of disorder which will continue to increase until such time that a whole new equilibrium state or higher order is achieved. At this state of higher order the system will be in a new equilibrium state. Entropy in this regard can also be defined as the measure of a system's internal state of disorder.

From Figure 7.3 it is possible to understand the concept of internal entropy within a closed system. Where external entropy was originally considered to be a measure of the spread of energy across a system's boundary, internal entropy can now be regarded as the state of a system's internal disorder (Schroedinger 1957) or rather spread of energy within a system's boundary.

7.2.3 Internal entropy – closing remarks

A basic understanding of the notion of entropy has been provided in 7.2 above. It is noted that the explanations offered are by no means comprehensive and serve only the purpose of introducing the principle of entropy. By understanding such a principle, it becomes possible to continue with a more detailed discussion of more complex characteristics evident in dissipative structures. It is within this discussion that the main objective of this chapter can be achieved.

7.3 Dissipative structures

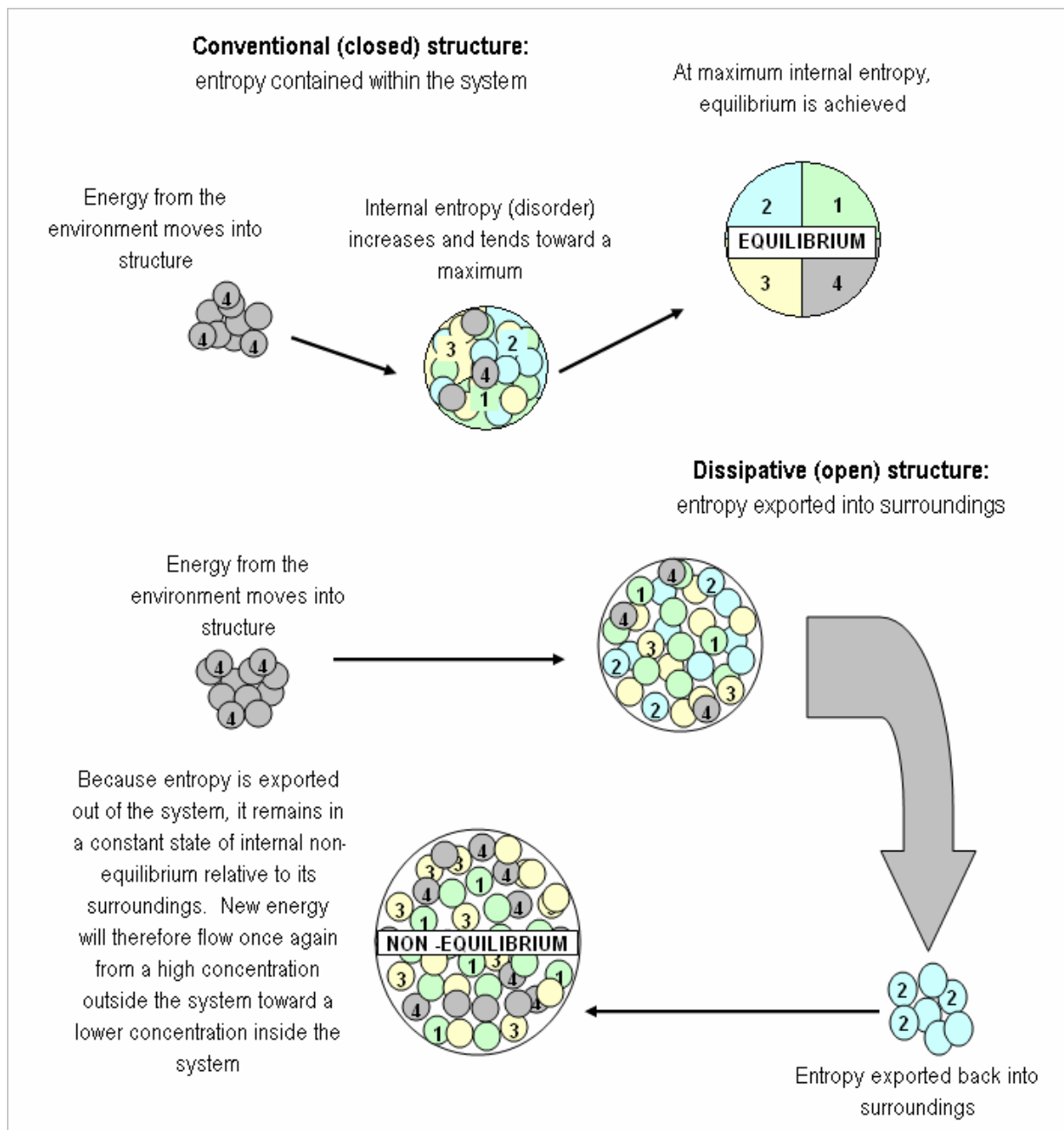
Dissipative structures are so called because they dissipate their energy (Wheatley 1994). This concept might seem simple, however, it contains within it far deeper implications applicable to qualitative risk. The notion of dissipation itself is easily comprehensible given the explanation of entropy provided in 7.2 above. However, unlike the conventional rules governing entropy in isolated systems, dissipative structures retain a single characteristic that separates them from the norm in that dissipative structures place emphasis on internal non-equilibrium states (Prigogine et al. in Holte 1993). That is to say that where closed systems tend toward internal equilibrium as a rule (see Figure 7.3), dissipative structures do not. Instead they tend toward internal non-equilibrium (Capra 2002). The manner in which this is made possible is fundamental as it contains within it the concept for achieving the objectives set out for this chapter. An elaboration on the importance of non-equilibrium is therefore required.

7.3.1 The importance of non-equilibrium within dissipative structures

The importance of non-equilibrium within dissipative structures can be understood by understanding the mechanics of an open structure. In this regard, “open systems have the possibility of continuously importing free energy from the environment and to export entropy. This means that entropy, in contrast to isolated systems, does not have to accumulate in the system and increase there,” according to Jantsch (1980:26). This statement implies that unlike closed systems, entropy within an open system is not contained within but rather exported out of the structure.

The principle behind this is that by exporting entropy, the internal state of the system always remains in non-equilibrium thereby ensuring a lower energy concentration in terms of its surroundings. This in accordance with the second law of thermodynamics will result in a new flow of energy into the structure. The importance of this can be understood if consideration is given to Gribbin (2005:104) who states that “equilibrium itself is of no intrinsic interest because nothing happens there”. This implies that if energy levels within a structure equate to the surroundings, no new energy can flow. The implication of this is death and is evident in the statement claiming that “the nearest a living thing ever gets to equilibrium is when it dies” (Gribbin 2005:104). The importance of non-equilibrium can now be understood in that any system, which by design tends toward an equilibrium state, can be seen as inclining itself toward a state of perpetual demise. Such a state cannot teach principles relative to any form of ordered behaviour like adaptation, survival, or change. By default, however, the opposite applies in that “as long as the system stays open to the environment, and matter and energy continue to be exchanged, the system will avoid equilibrium and remain, instead, in these ‘evanescent structures’ that exhibit exquisitely ordered behaviour” (Coveney & Highfield 1990:164). For this reason, open systems as a characteristic of dissipative structures, requires further exploration. Before this takes place Figure 7.4 summarises the views discussed thus far.

Figure 7.4 - Dissipative structures versus conventional structures



Source: Own observation

Figure 7.4 depicts the fundamental difference between a closed and an open system. It portrays both systems in the diagram for the sake of reference and makes comprehending the disparities much easier. It is evident from the illustration that unlike a closed system, in which entropy is

contained within the system's boundaries, an open system exports its entropy. Internal entropy is therefore in continual state of disorder relative to the surroundings. This state of disorder is an imperative characteristic of an open system which ultimately ensures its continued existence. This is achieved by virtue of the fact that by maintaining an internal state of disorder, according to the laws of thermodynamics, new energy will continue to flow through the system.

7.3.2 Open systems as a characteristic of dissipative structure

The purpose of this paragraph is not to delve too deeply into the full complexity of openness within dissipative structures, but rather to search for solutions to managing qualitative risk. As such the discussion applicable to open systems will focus on that which is relevant.

Open systems result in a number of characteristics that are regarded as key in terms of the objective proposed. These characteristics will be justified and are very similar to those put forward in the information process. As such an opportunity exists to present both dissipative structures and the information process in parallel. In so doing, it can be shown how dissipative structures, by design, incorporate the characteristics of qualitative risk as well as information into a structure capable of evolving, adapting and most importantly surviving. Such a structure, by default, must ultimately represent that which this dissertation strives to achieve, namely a model indicating an effective way to manage qualitative risk.

On this basis the following characteristics of an open system are proposed:

- i. Open systems embrace uncertainty
- ii. Open systems originate flexibility and recycle energy
- iii. Open systems display emerging properties

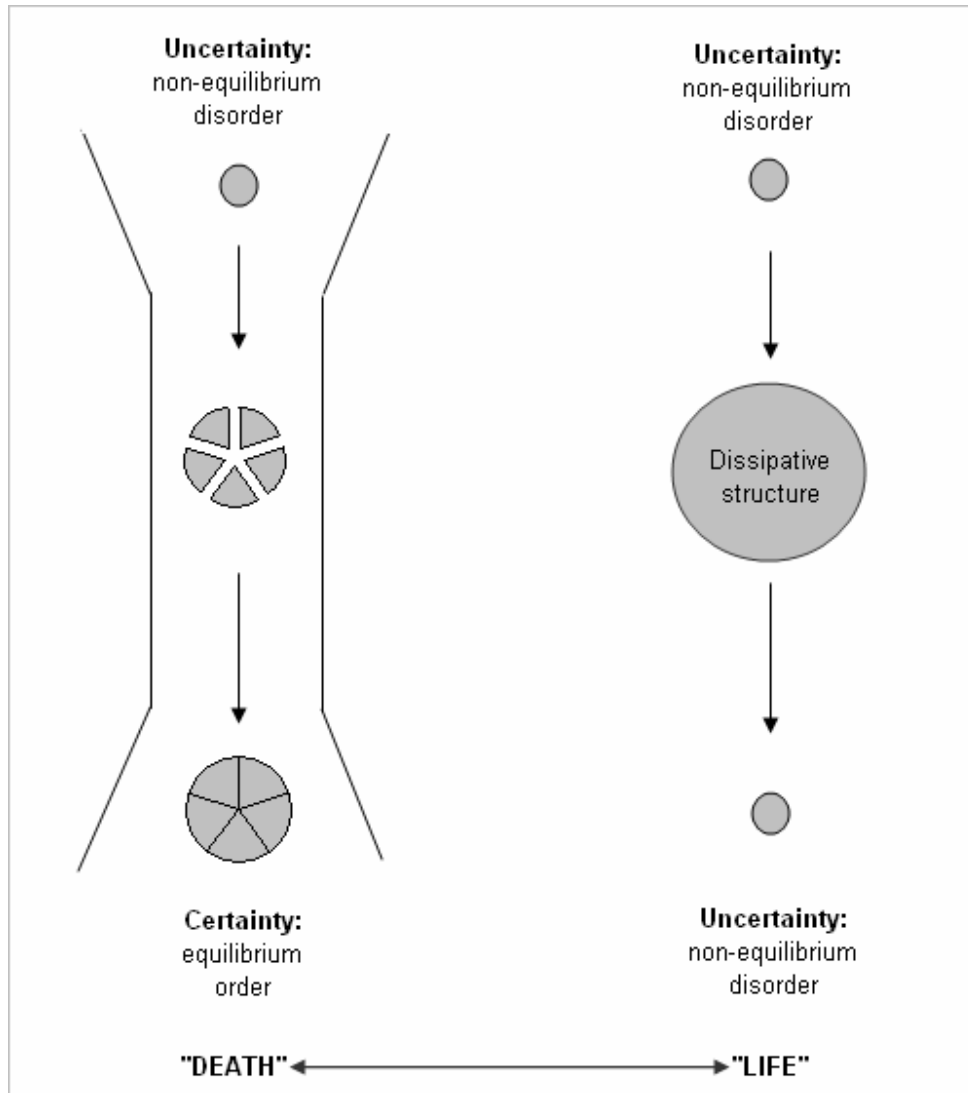
7.4 Open systems embracing uncertainty

This principle is a simple principle based on the notion that open systems continually import energy from the surroundings in order to function. This is synonymous with the information process that also continually imports energy (in the form of data) from the surroundings in order to function. A subtle difference exists, however, between these two functions and this difference provides the first lesson in terms of qualitative risk.

Where the principle within the information process is to import energy in order to reduce uncertainty (see paragraph 6.4.1), dissipative structures import their energy in order to increase uncertainty. This is a distinct characteristic of dissipative structures and it is vital in terms of survival, for as discussed in paragraph 7.3.1 above an equilibrium state in any structure equates to 'death'.

For this reason, the information process which relies on importing energy so as to reduce uncertainty, can be seen as trying to equate outcome toward an absolute state of certainty. This state of certainty is a trend toward order or equilibrium and as such presents a conflict when considered in relation to dissipative structures. This conflict needs to be placed into a deeper context, however, before this is done, Figure 7.5 visually summarises the discussion thus far.

Figure 7.5 - Information process versus dissipative structures



Source: Own observation

Figure 7.5 depicts the subtle difference between the information process and dissipative structures. The information process in effect imports energy (data) in order to bring about certainty, whereas dissipative structures import energy in order to increase uncertainty. Certainty and uncertainty are terms synonymous with order and disorder respectively. The subtle difference between the two structures provides the first lesson relative to qualitative risk. For this lesson to be understood, it is necessary to place the information process into a deeper context.

7.4.1 The information process in a deeper context

The contradiction in terms of the information process relative to dissipative structures can be removed by altering the preconditions of the information process and uncertainty. By this the following is implied.

The information process is called upon in instances of uncertainty so as to bring about understanding. This function is purposeful as understanding permits, amongst other things, informed decision-making which in terms of organisational success is vital. For this reason, the information process itself should not be changed, however, in trying to equate the information to dissipative structures, it is proposed that the preconditions preceding the use of the information process should change. By stimulating uncertainty in any structured environment, such as an organisation, a greater dependency is placed on the information process. This is due to the fact that the information process, by default, is designed to reduce this uncertainty via the creation of information.

This thereby concludes the point to be extracted. Like dissipative structures, new energy in the form of information can be continually imported into an organisation simply by stimulating uncertainty within. In this manner a continual reliance on the information process prevails in which case a continual flow of knowledge and understanding is eminent. This flow of knowledge and understanding is in a sense the entropy (movement of energy) within an organisation, which as in dissipative structures, permits a heightened ability to survive.

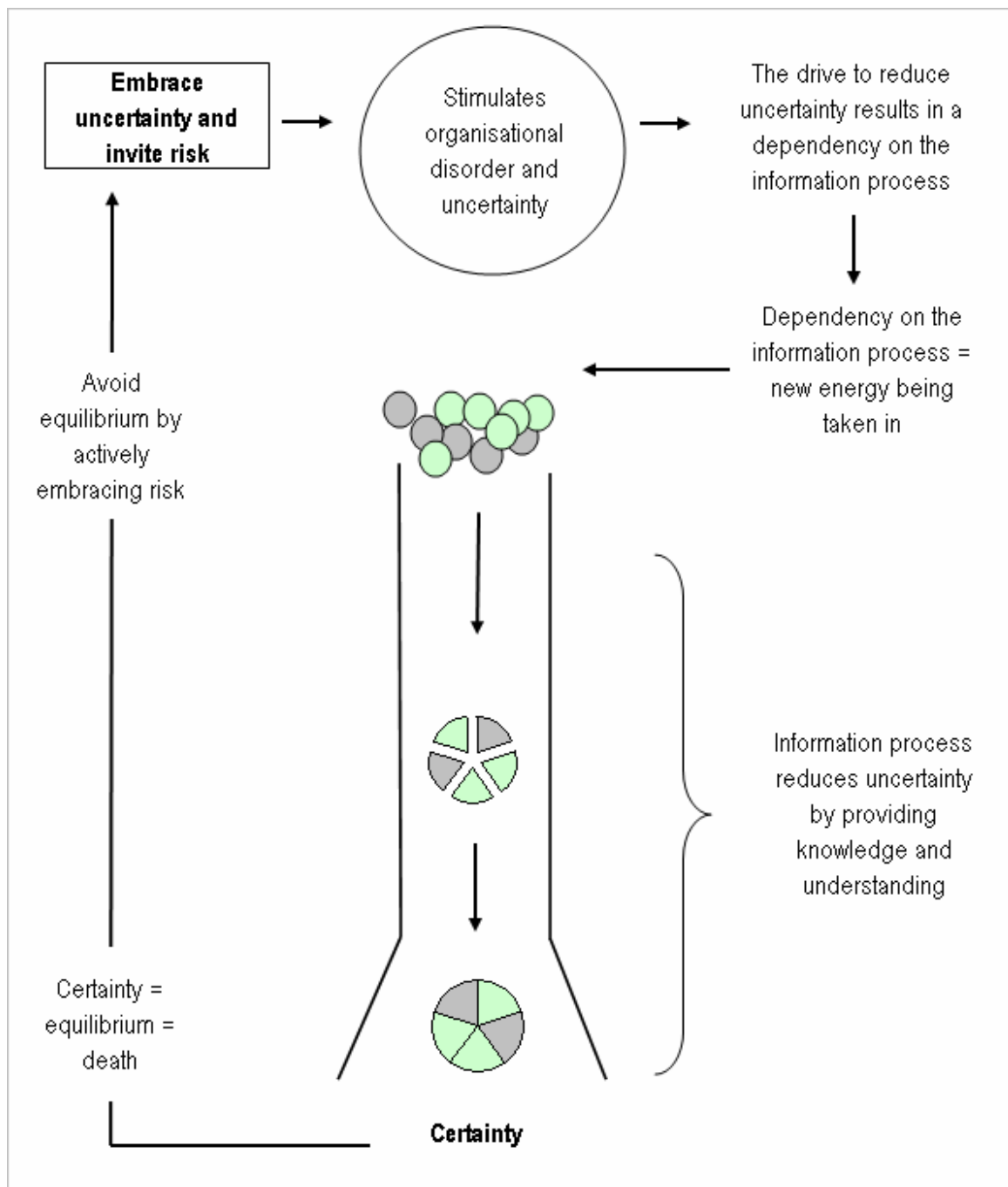
7.4.2 Embracing uncertainty

From this, the first lesson relative to dissipative structures has been extracted. As uncertainty is a direct characteristic of qualitative risk (paragraph 4.2.5), the concept of embracing uncertainty can be achieved by inviting risk into organisations.

By inviting risk into an organisation a continual state of non-equilibrium is achieved. This organisational state of non-equilibrium forces a reliance on the information process which serves the purpose of reducing uncertainty. For as long as a process of reducing uncertainty is taking place then energy within an organisation is being exchanged. This energy exchange takes the form of data being taken in and information being given out.

This concept mimics the fundamental notion of entropic energy movement evident in dissipative structures. Such movement of energy has the effect of increasing survival. Similarly, within the information process by increasing the exchange of energy a greater knowledge and understanding begins to emerge. Such increase in comprehension by default reduces uncertainty and dilutes the effect of risk. Figure 7.6 illustrates this principle accordingly.

Figure 7.6 - Embracing uncertainties by inviting risk



Source: Own observation

Figure 7.6 depicts an adaptation of the concept of openness as taken from dissipative structures. This concept alludes to the fact that in order to ensure a heightened ability to survive and dilute the

effect of risk it is necessary to embrace uncertainty. The proposed motive for such action is taken from the fundamental characteristic associated with dissipative structures. Such a characteristic dictates that in order for a dissipative structure to survive it must remain in a state of internal disorder. By stimulating risk within an organisation a state of disorder arises. Such a state requires new external energy to be imported into the organisation in order to reduce the uncertainty associated with the new disorder. In so doing new forms of information and understanding emerge, the consequence of which is a reduction in uncertainty and a dilution of risk.

7.5 Open systems originating flexibility and recycling energy

The notion of flexibility was shown to be a by-product of possibility and was based on the concept that “locking-in to a single mode can be enslavement, preventing a system from adapting to change” (Gleick 1998:293). This implied that the more options available to a system the more possible ways of adapting, therefore the more flexible the system. In addition to this, lies a second factor of flexibility evident in open systems. This factor equates the achievement of flexibility to feedback of information within an open system. In this regard Capra (2002:202) states that “... flexibility is a consequence of multiple feedback loops that keep the system in a state of dynamic balance”. The concept of maintaining dynamic balance is strategic to flexibility and as will be shown is the inherent by-product of feedback loops.

It is proposed that the success of an open system in terms of originating flexibility lies in its ability to maintain dynamic balance. Autopoiesis (an example of an open system) was discussed in detail in Chapter 2 (paragraph 2.4.3) and in this discussion it was noted that a fundamental characteristic of an autopoietic system was the need for it to maintain a balance between each of its components. This was achieved by ensuring that no single variable within such a system was maximised, but rather that each variable fluctuated around an optimal value. The ability of a system to ensure this optimal value of variables will be shown to be the function of feedback mechanics. It is within this

function that the concept of flexibility is engendered and the term dynamic balance, can be understood.

7.5.1 Dynamic balance through feedback

Two types of feedback mechanisms are relied upon in order to maintain dynamic balance namely positive and negative feedback. These mechanisms are most easily explained by relating the concept of cause and effect. As such it can be said that “each cause is the effect of its own effect” (Ibn’ Arabi in Jantsch 1980:185), implying that every action in life elicits a particular outcome. This outcome in turn leads to a new action which in turn elicits a new outcome. This process takes place continually and results in a circular dependency between the cause of an action and the effect it elicits.

In the context of dissipative structures, as well as the information process respectively, cause results from the entropic movement of energy or attainment of knowledge and effect is the by-product of such movement. As this effect is ‘recycled’ through feedback loops into the system, new information arises thereby resulting in a new cause. This new cause, understood to be the entropic movement of energy or knowledge, gives rise once again to a new effect.

7.5.2 Positive feedback

Taking this into consideration, positive feedback can be seen as an instance in which the circular dependency between cause and effect is reinforced in the same direction (Capra 1997). An example of this would be in population growth and the birth rate of babies (Bonabeau *et al* 2001). In a growing population, new babies are born. The effect of this action is that over time these babies themselves possess the ability to produce more babies. This ability to produce babies perpetuates with each new baby born. The effect of this is an exponential increase in the production rate of babies thereby resulting in the growth of a population. Due to the fact that the circular dependency between cause and effect in this example is reinforced in a united direction

(namely toward population growth), the feedback mechanism is regarded as positive. Figure 7.7 depicts this visually.

7.5.3 Negative feedback

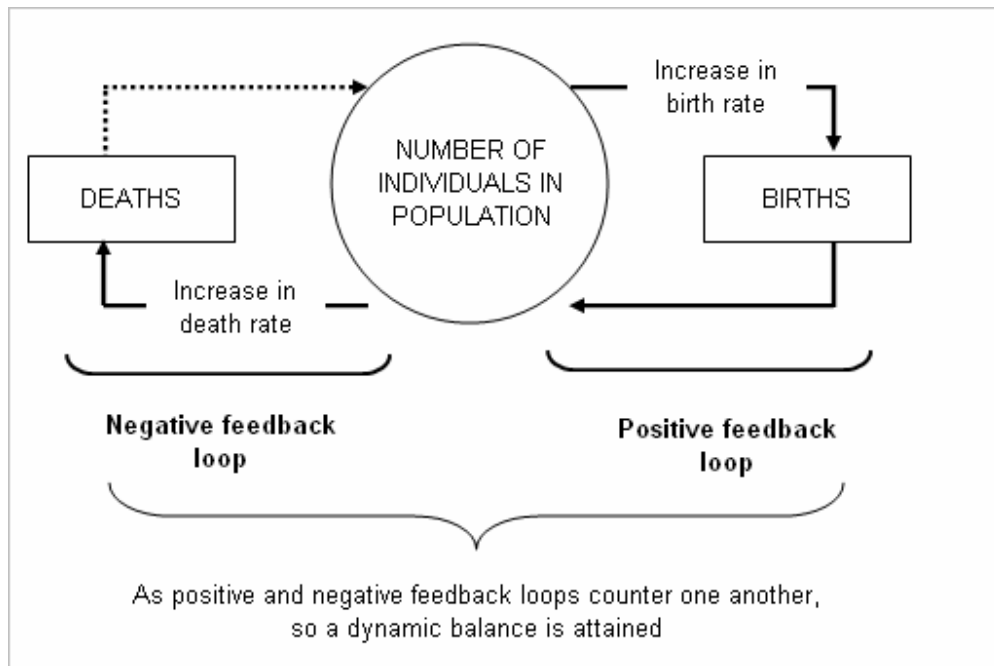
A negative feedback loop in contrast to that which has been described above can be regarded as an instance in which the circular dependency resulting from cause and effect is in an opposing direction to the current course of action (Capra 1997). Using the same example of population growth, negative feedback can be understood as follows.

It is given that the growth rate of a population will continue to grow due to the effect of positive feedback. However, over time this growth rate will begin to stabilise as a result of an increase in death rate. Unlike positive feedback which results in population growth, negative feedback results in population death. As more people are born, so more people exist that will die. For this reason, the circular dependency between cause and effect in negative feedback loops resists a given trend and as such is seen to oppose reinforcement in a unified direction.

In this manner the relationship between positive and negative feedback loops continually takes place in opposing directions implying that where positive feedback reinforces a trend in a given direction, negative feedback opposes this trend in the opposite direction.

Figure 7.7 depicts this visually.

Figure 7.7 - An example of positive and negative feedback loops in population growth



Source: Adapted from Bonabeau, Camazine, Deneuborug, Franks, Sneyd & Theraulaz (2001:17)

Figure 7.7 serves to illustrate the concept of positive and negative feedback using a simple example of population growth. In this diagram positive feedback represents increased births and negative feedback represents increased deaths. As more people are born into the population, so more people die. The two feedback mechanisms oppose each other, thereby resulting in a dynamic balance in the total number of people in the population.

7.5.4 How feedback contributes to flexibility

The contribution to flexibility lies in the system's ability to survive in any given circumstance. As an open system embraces uncertainty it cannot guarantee the outcome of such an action. If the cause associated with the embracing of uncertainty leads to an extreme effect, in which survival of the system as a whole is jeopardised, then the value of feedback can be seen. Feedback serves two

purposes in this regard. It reinforces all effects that have a positive implication on a system (Capra 1997), thereby promoting a system's growth, yet at the same time it will curtail all negative effects on a system thereby reducing any trends that could result in the system's demise (Capra 1997). In this manner a system gains flexibility by virtue of the fact that it has a heightened capacity to adapt to suite circumstance.

7.5.5 Flexibility – closing remarks

The lesson to be extracted from this paragraph goes back to the concept of dynamic balance, which, given the contents of paragraph 7.5.2, can now be understood. The reason as to why dynamic balance is so named, is because of the fact that the benchmark that sets the boundary, indicative of this point of balance, is in itself not fixed. Rather, it fluctuates depending on circumstance. Open systems, through feedback mechanisms, have a truly effective means of tracking and achieving dynamic balance. Lazslo (1972:103) states that "... within the threshold of the system's control-resources negative feedback mechanisms maintain its existing pattern, beyond it, positive feedback takes over and evolves the system in new directions". As is shown open systems achieve dynamic balance through a process of active evolvment.

An ability to achieve dynamic balance is imperative to the health of an organisation as "all life lives off balance in a world that is open to change" (Wheatley 1998:89). Given this, a call is made for organisations to structure themselves in such a manner so as to benefit from the principle of feedback. This can be done simply by adhering to the framework applicable to the information process. By ensuring that information is recycled into the environment, not only can insight be gained (paragraph 6.7.1), but an awareness of the effects of information relating to the cause can be created. In this manner positive or negative steps can be taken to direct an organisation toward a state of dynamic balance (balance appropriate to circumstance). Such action will provide additional flexibility which ultimately equates to a heightened ability to survive.

7.6 Open systems displaying emerging properties

This property of an open system is included in this chapter not so much to present a more effective means to manage qualitative risk, but rather to provide evidence of the fact that dissipative structures incorporate all the principles inherent in the information process, as well as highlight the benefits of such action. As such it is necessary to highlight the concept of emergence within dissipative structures and provide a similarity to the information process.

7.6.1 The concept of emergence

The concept of emergence arises due to the notion of entropy and the second law of thermodynamics that govern it. A detailed discussion of this topic is not required here and as such it is enough to know that with open systems all processes that produce entropy are irreversible (Jantsch 1980). This concludes that because the entropic processes in open systems cannot be reversed, they can only move forward in time, thereby implying a continual state of evolution. "In a microscopic view, the system gains the experience of innumerable encounters and exchanges between system components..." (Jantsch 1980:26). By virtue of the fact that each entropic movement contributes something new toward the overall experience of the system and that in open systems entropy is irreversible, it is possible for such a system to be seen as having a 'memory' in which new experiences are continually added yet cannot be erased. This provides an open system with the ability to constantly evolve toward a higher order. In this sense emergence can be defined as "a process by which a system of interacting subunits acquires qualitatively new properties that cannot be understood as the simple addition of their individual contributions" (Bonabeau *et al* 2001:31).

7.6.2 The value of knowing relative to risk

The contribution that knowing this has toward qualitative risk is simple. In the first instance, it can be shown to be that same as the characteristic of emergence within the information process (see paragraph 6.6.1), however, more importantly is the reinforcement it provides toward the concept of embracing uncertainty. If consideration is given to the fact that despite an open system continually taking in risk (embracing uncertainty): it still manages through entropic means to emerge to a higher order. This in itself is a testament toward the success of open structures and reinforces the call for organisations to embrace uncertainty. If the management principles within organisations are modelled on the notions applicable to dissipative structures then evidence exists that the consequence of such a management style is the emergence toward a higher organisational order.

7.7 Conclusion

The three fundamental characteristics of dissipative structures have been discussed, namely:

1. Open systems embrace uncertainty.
2. Open systems originate flexibility and recycle energy.
3. Open systems display emerging properties.

In the discussions on each of these characteristics their benefits have been proposed and the similarities they share with the information process have been included. Where applicable the information process has been adapted so as to align it with principles inherent in dissipative structures (see Figure 7.6), however, in general it is possible to conclude the importance of information and the value that it plays in not only the formation of risk, but also the effective management of it.

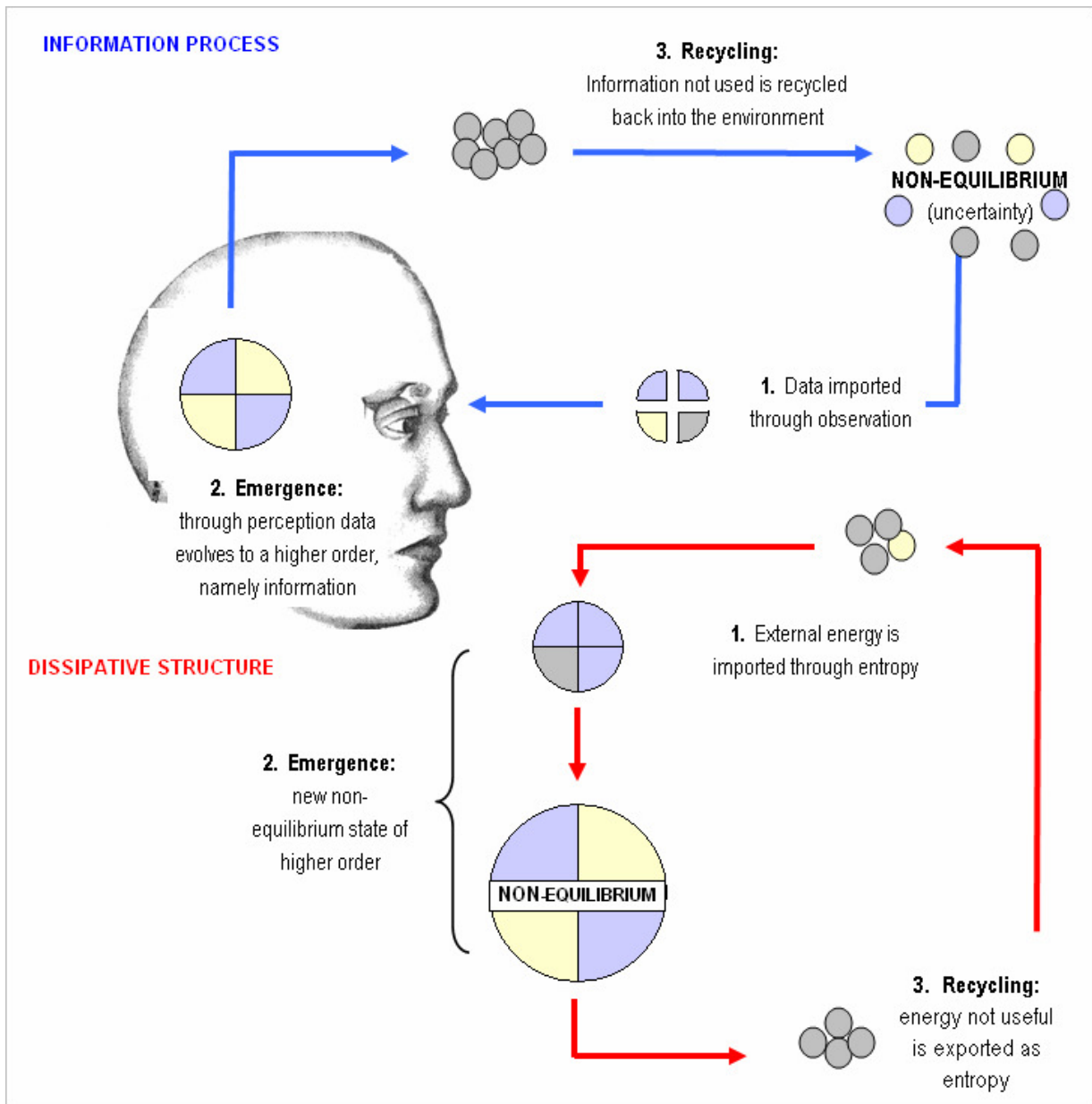
Dissipative structures are living examples of how information can be employed so as to better manage risk. This can be achieved by embracing uncertainty, creating flexibility and emerging complexity. Table 7.1 depicts the similarities between the information process and dissipative structures for the sake of final conclusion, while Figure 7.8 illustrates this visually.

Table 7.1 - **Similarities identified between the information process and dissipative structures**

Information process	Dissipative structures
'Imports' data through the act of observation	'Imports' energy through entropic movement
Converts data into information during perception	Converts energy during dissipation
Exports information not used in final perception	Exports entropy not used in final state of internal non-equilibrium
Recycles information through associative learning	Recycles energy by ensuring internal non-equilibrium
Information provides experience	Irreversibility of entropic state provides 'experience'
Information provides flexibility	Feedback loops provide flexibility
Information process is most effective in times of uncertainty (disorder / non-equilibrium)	Dissipative structures function only in instances of uncertainty (disorder / non-equilibrium)
Data evolves into a higher order of information	Dissipative structures evolve continually toward a higher order
Information displays emerging properties	Open systems display emerging properties
Information manages risk	Dissipative structures manage risk

Source: Own observation

Figure 7.8 - Illustration of similarities between the information process and dissipative structures



Source: Own observation

Figure 7.8 depicts the information process, the act of perception, as well as the mechanics of a dissipative structure. The purpose of this depiction is to provide a visual comparison of the basic similarities between the information process and dissipative structures alike. In so doing a conceptual appreciation of the notion that the mechanics of the information process and dissipative structures respectively are

synonymous to one another, is depicted. This then allows for an idea to be engendered proposing that the mechanics of dissipative structures can be implemented and adapted into the information process as a solution to qualitative risk. Such implementation and adaptation form the concluding theme for Chapter 8.

CHAPTER 8

CONCLUSION TO RISK

... every significant breakthrough in the field of scientific endeavor is first a break with tradition, with old ways of thinking, with old paradigms (S Covey)

8.1 Introduction

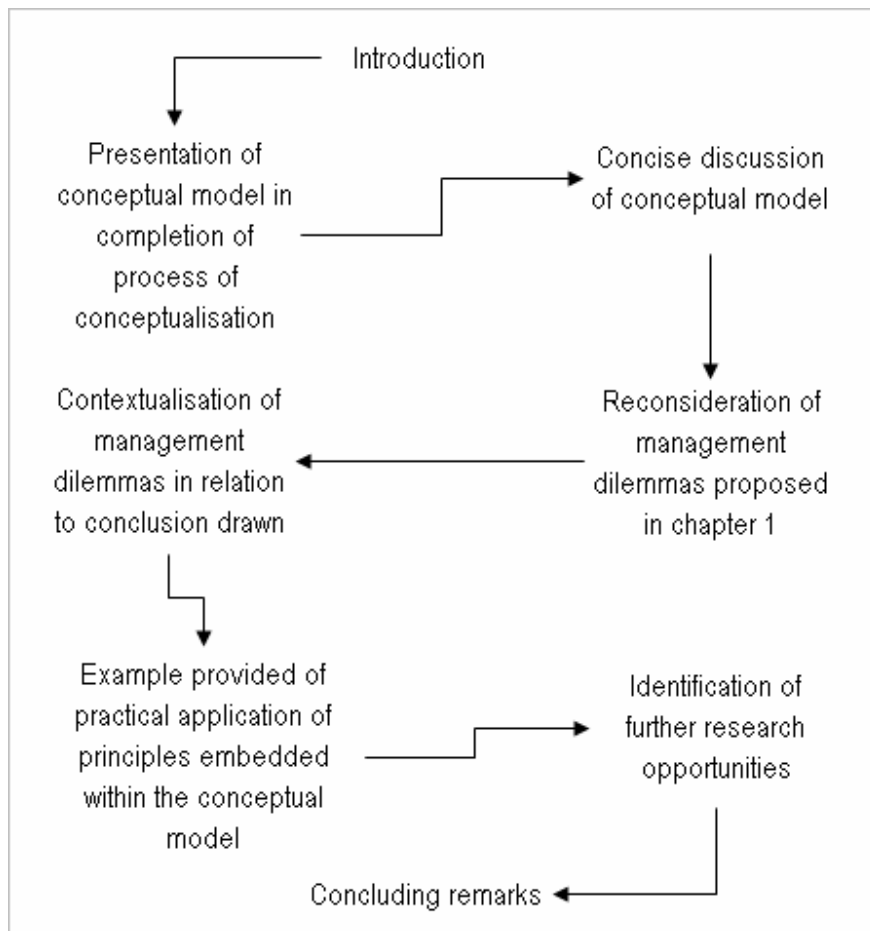
The manner in which a conclusion is to be drawn will follow two fundamental approaches. First, the conclusion will take the form of a conceptual model that is in keeping with the basic requirements of a systems approach to research. The philosophy of such an approach was discussed in detail in paragraph 1.4.3 and as such no further explanation is needed. It is sufficient to know that the conceptual model to be proposed will complement the outcome of the activity of conceptualisation. By this it is implied that a model encapsulating the essence of what this dissertation has put forward will be provided.

The second approach focuses on ensuring that the conclusion to this dissertation remains effective. For this to be achieved all concluding remarks will be precise and limited to a specific objective only. It is not the intention to draw the concluding chapter out, but rather to present the final conceptual model together with a concise explanation of what this model represents. In this manner the concluding concepts relating to qualitative risk can be presented without unnecessarily deviating from the intended objective.

After the presentation and explanation of the proposed conceptual model, this chapter will close by restating the management dilemmas put forward in Chapter 1 and explaining how they were dealt with by placing them into the context of the conclusion drawn. A brief discussion, based on personal experience, of where the principles inherent in the proposed conceptual model have been applied in reality, will be provided. Lastly, further research opportunities will be identified and

concluding remarks will be made. Figure 8.1 presents a visual summary of the approach to be adopted in this chapter.

Figure 8.1 - Approach to be adopted in Chapter 8



Source: Own observation

Figure 8.1 details the approach to be adopted in Chapter 8. Such an approach is designed to remain concise and focus only on providing an effective conclusion. The main theme of this approach revolves around presenting a conceptual model in line with a systems approach to research (see paragraph 1.4.3). Such a model will be discussed and presented in the context of the literature study conducted in this dissertation. Secondary themes will be to again discuss the management dilemmas presented in Chapter 1, present a practical example of the application of such models, identify alternative research opportunities and provide concluding remarks.

8.2 The golden thread that binds qualitative risk

“As piece after dark piece was put into place and the picture emerged, I was astounded. I had not known there would be a picture. It was quite beautiful...” Remen (1997:170). The intention of this chapter is illustrated by this, namely to unite the central themes of each individual chapter in a bid to present a final holistic perspective on qualitative risk. In this manner a concise overall conclusion can be carried across without having to get involved in the finer details of each section accordingly. The proposed golden thread that therefore binds qualitative risk begins by taking cognisance of the following.

Chapter 2 through 5 discussed the concept of qualitative risk using principles extracted from a number of alternative disciplines. Throughout this process a common theme existed, namely that risk is a man-made concept.

This concept was shown to hold true by means of literature studies relating principles taken from generally defined subject areas such as ecology, history, human physiology and human psychology.

In Chapter 2, using principles inherent in ecology, it was shown how man’s desire to control outcome threatened ecological balance and consequently engendered the concept of risk.

Chapter 3 relied on a study of the historical development of numbers, the outcome of which was an understanding of the origin of quantitative human opportunity. Housed within this notion it was shown how human opportunity also engendered the concept of risk.

Chapters 4 and 5 relied on specific principles extracted from subject areas such as physiology and psychology to ratify the notion that risk is a human construct. It also served the purpose of providing further comprehension into the physical properties of qualitative risk such as uncertainty and flexibility.

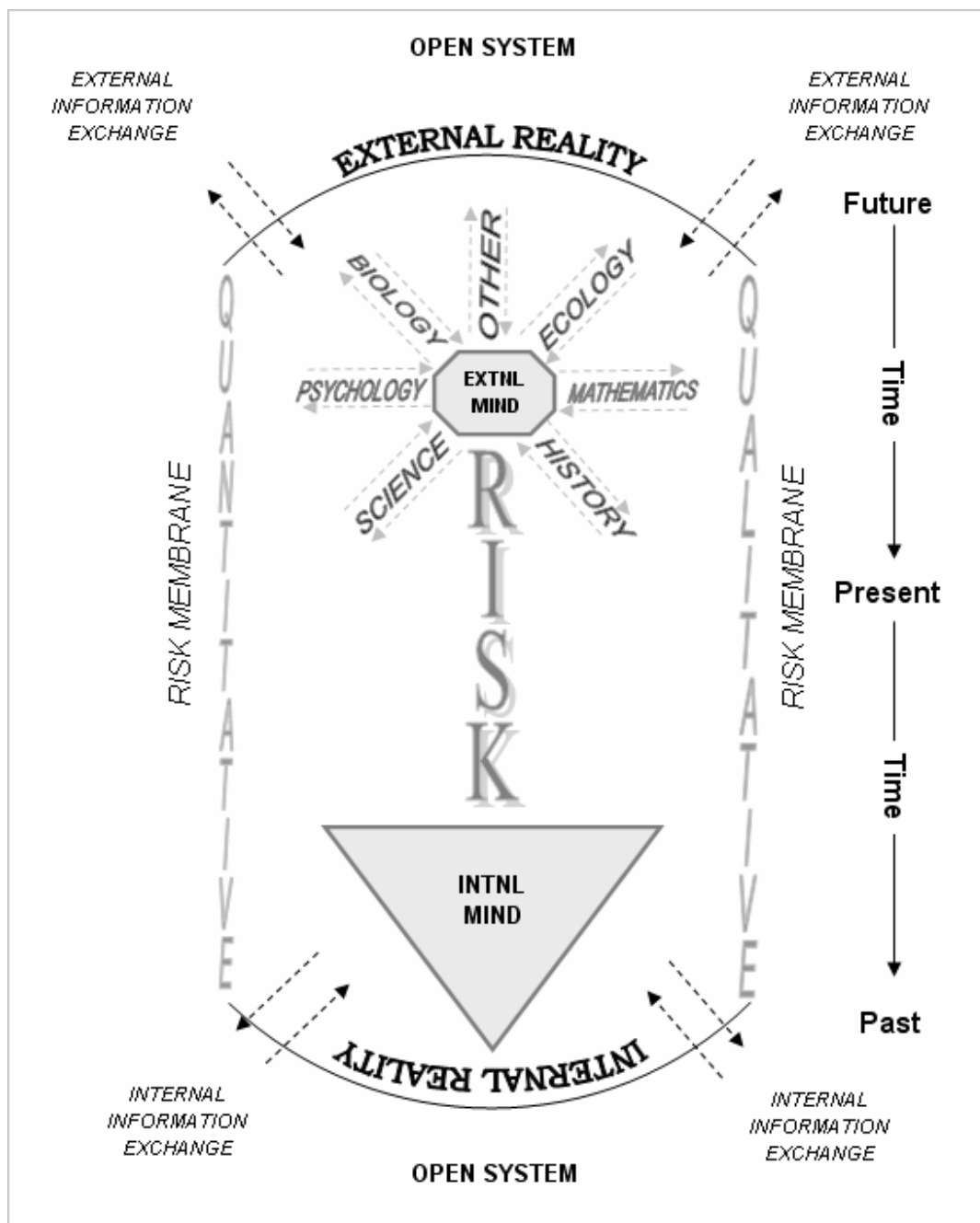
Chapter 6 combined all the concepts provided in previous chapters and introduced the function and importance of information into qualitative risk. It also provided a fundamental understanding of what information is and how it plays a role within the human mind so as to derive the concept of risk and its properties. In addition to this, Chapter 6 provided a foundation stone upon which to compare the information process against dissipative structures. The purpose of such a comparison was to find examples of solutions to the effective management of qualitative risk.

Finally Chapter 7 considered principles extracted from subject matter relating to science in a bid to find an example of how qualitative risk is currently managed inside nature. Such example was provided within the mechanics of dissipative structures. A valuable lesson, such as open system logic, was extracted from this and an opportunity presented itself to possibly apply such a lesson into an organisational context.

8.2.1 A holistic and conceptual understanding of qualitative risk

By combining the holistic concepts achieved in each of the chapters briefly summarised in paragraph 8.2 above, a holistic understanding of risk can be presented. Such a holistic understanding is encapsulated in the first of the conceptual models required for a systems approach to research. Such a model represents the essence of what qualitative risk is proposed to be and serves as a visual definition of it. Figure 8.2 below depicts this summary accordingly.

Figure 8.2 - Holistic conceptual model of risk



Source: Own observation

Figure 8.2 puts forward a basic conceptual model of what qualitative risk is proposed to be by visually defining it. It is modelled on the information presented in each respective chapter of this

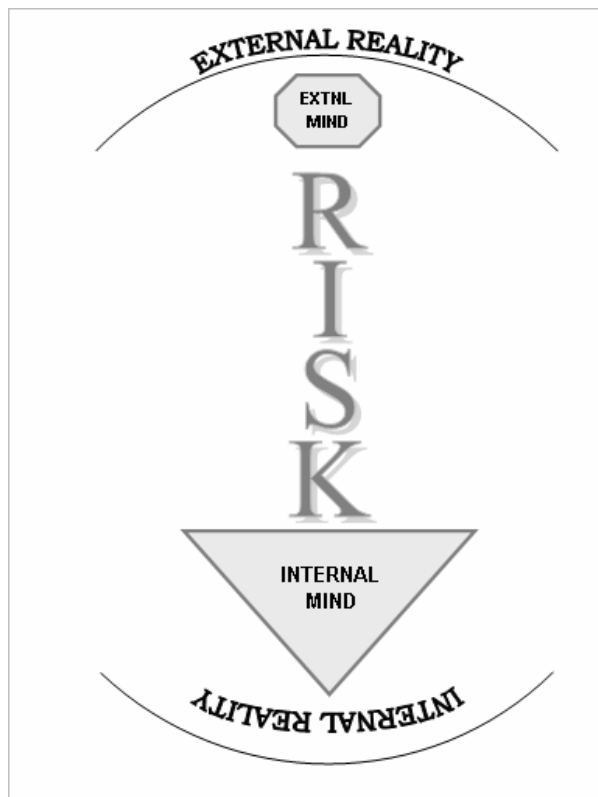
dissertation and depicts a holistic understanding of risk. In order to better comprehend the model it will be broken down and explained in a concise and detailed manner in paragraph 8.3 to follow.

8.3 A breakdown of the first conceptual model of risk

8.3.1 Risk – concept of mind

The first important aspect of qualitative risk that the model proposes is that risk is a function of both the internal and external human mind. This is represented in the diagram by placing the concept of risk between two arched boundary lines labelled internal and external reality. Figure 8.3 summarises this view.

Figure 8.3 - Risk as function of the internal and external mind



Source: Own observation

Figure 8.3 depicts the first fundamental characteristic of qualitative risk, namely that it is a function of the human mind. The fact that risk is shown to fall inside the two arched boundaries labelled internal and external reality is significant. This symbolises that risk does not exist outside the threshold of human thought.

From Figure 8.3 above, a proposed definition of qualitative risk, in line with the visual depiction, is further proposed.

Qualitative risk is proposed to be: the difference between a human perception of the outside world and a human ideology of the outside world as formulated by the internal mind.

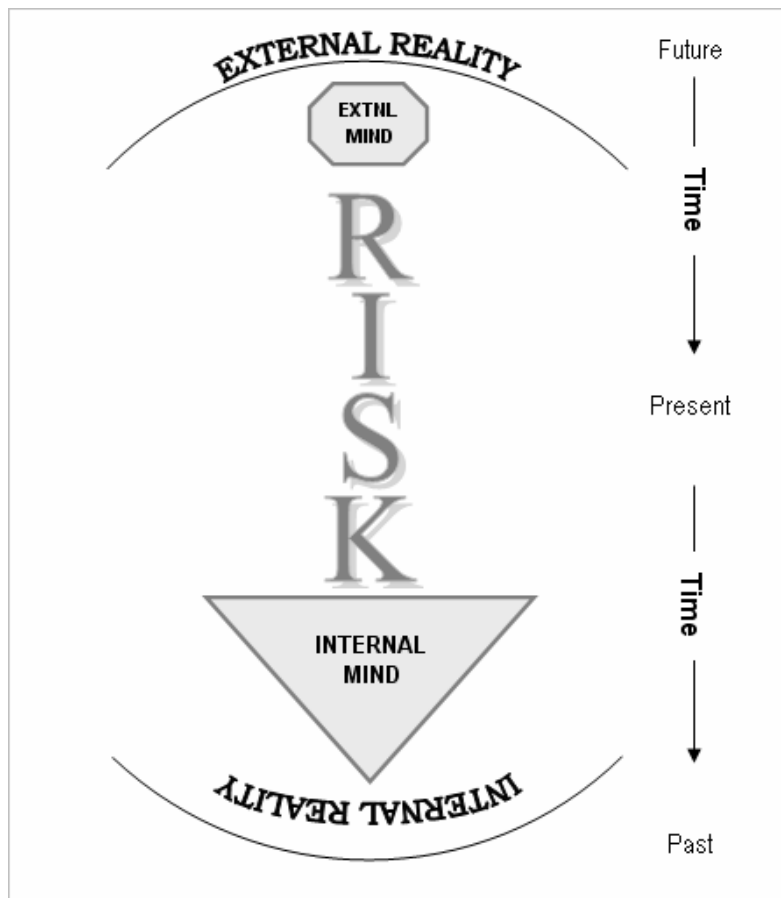
By this definition it is implied that qualitative risk is simply the difference, measured in terms of information, between the internal and external perceptions of the mind. If, for example, past experience (internal mind) anticipates a particular outcome relative to a given circumstance and the external mind, through observation, perceives information that is in keeping with the expectation set by the internal mind, then the difference between the two states of mind is zero and the concept of risk can be regarded as minimal. If, however, anticipation set by the internal mind deviates from the information attained through perception of the external mind, then proportionally the greater the degree of qualitative risk. The difference between these two states of mind is a function of nothing other than information.

8.3.2 Risk – a construct of the present

The second important characteristic of risk presented in the model is the notion that qualitative risk is a function of the present only. The future is shown to be a function of the external mind for the simple reason that "... the expected future is always known only in thought, operating the present, but referring to what is to come and does not yet exist..." (Benthall 1973:100). This implies that

what the external mind perceives in reality is merely anticipation of the future adapted to the present. The instance such anticipation is confirmed through a passing of time it becomes a function of the past in which instance it is represented as a stored experience within the internal mind. This transition of events from future perception through to stored past experience is proposed to define the threshold of risk. This concept is represented in the model as follows:

Figure 8.4 - Risk as function of the present



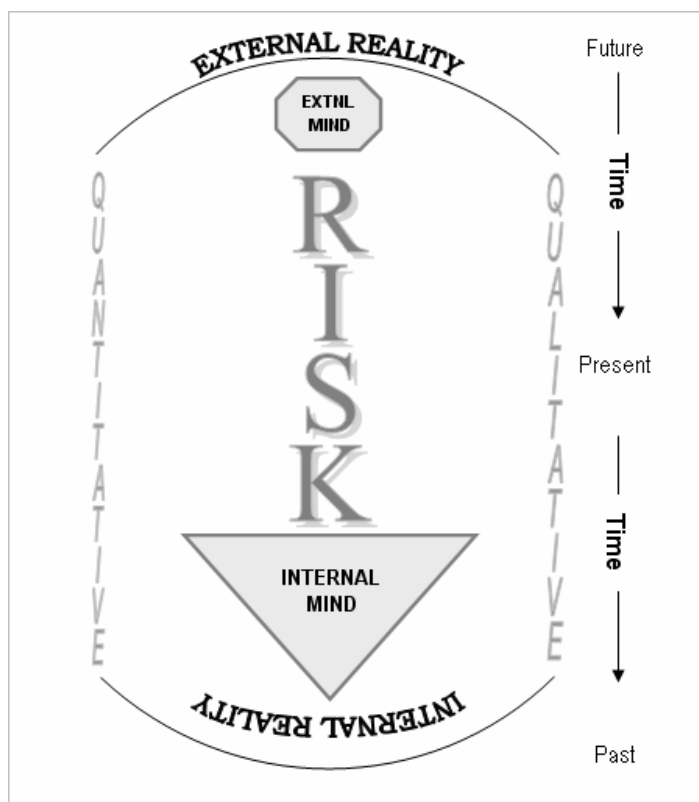
Source: Own observation

Figure 8.4 depicts the second characteristic of risk, namely that it is a function of the present. The transition of events from a present tense perception of the future (external mind) through to a stored past experience of the past (internal mind) defines the boundaries between which qualitative risk takes place.

8.3.3 Risk – a balanced and multidisciplinary concept

In keeping with the central theme of this dissertation, namely autopoietic balance, it is imperative to ensure that any proposed definition of risk is balanced. In this regard the conceptual model of risk is shown to be a function of both quantitative as well as qualitative properties. This is indicated in the model in the following manner:

Figure 8.5 - The balance of risk



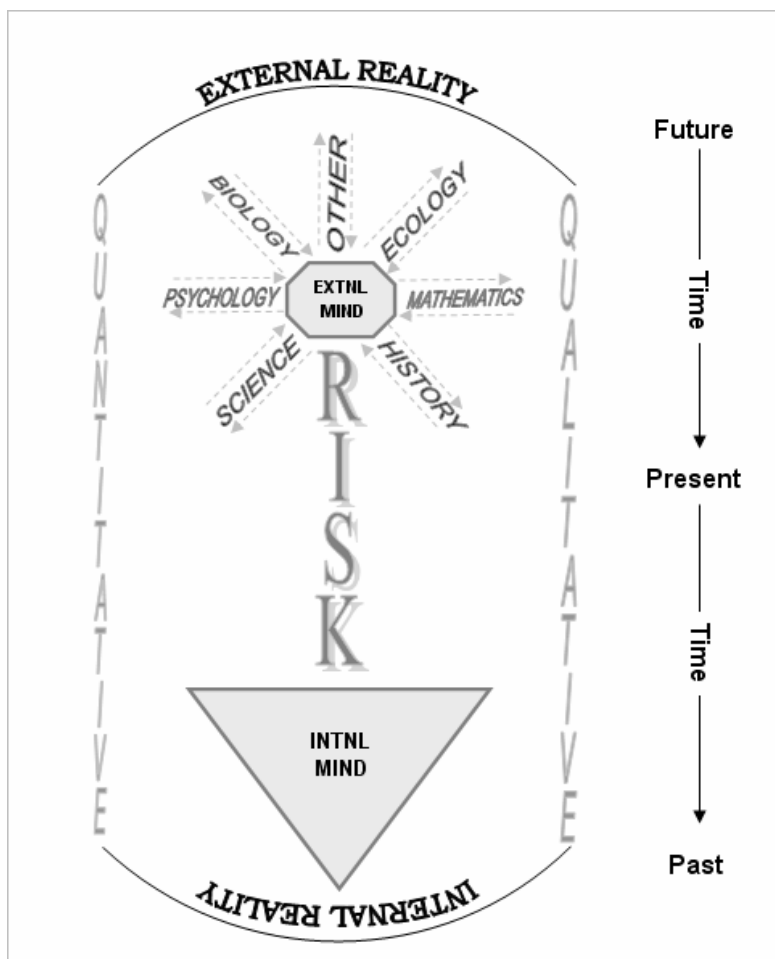
Source: Own observation

Figure 8.5 introduces balance into the visual definition of risk. This is achieved by showing risk to be a function of both quantitative and qualitative principles.

8.3.4 Risk as a multidisciplinary construct

The initial intention of this dissertation was to conduct a study of qualitative risk by incorporating a multiple number of disciplines. This intention is in keeping with a strive toward balance and serves the purpose of not limiting a view on risk to only one perspective. Capra (1983: 435) writes that “The task of mapping the economy will require a multidisciplinary approach. It can no longer be left to economists alone, but must be supplemented by insights from ecology, sociology, political science, anthropology, psychology, and other disciplines.” This philosophy is carried through into the model as follows:

Figure 8.6 - Risk: a multidisciplinary approach



Source: Own observation

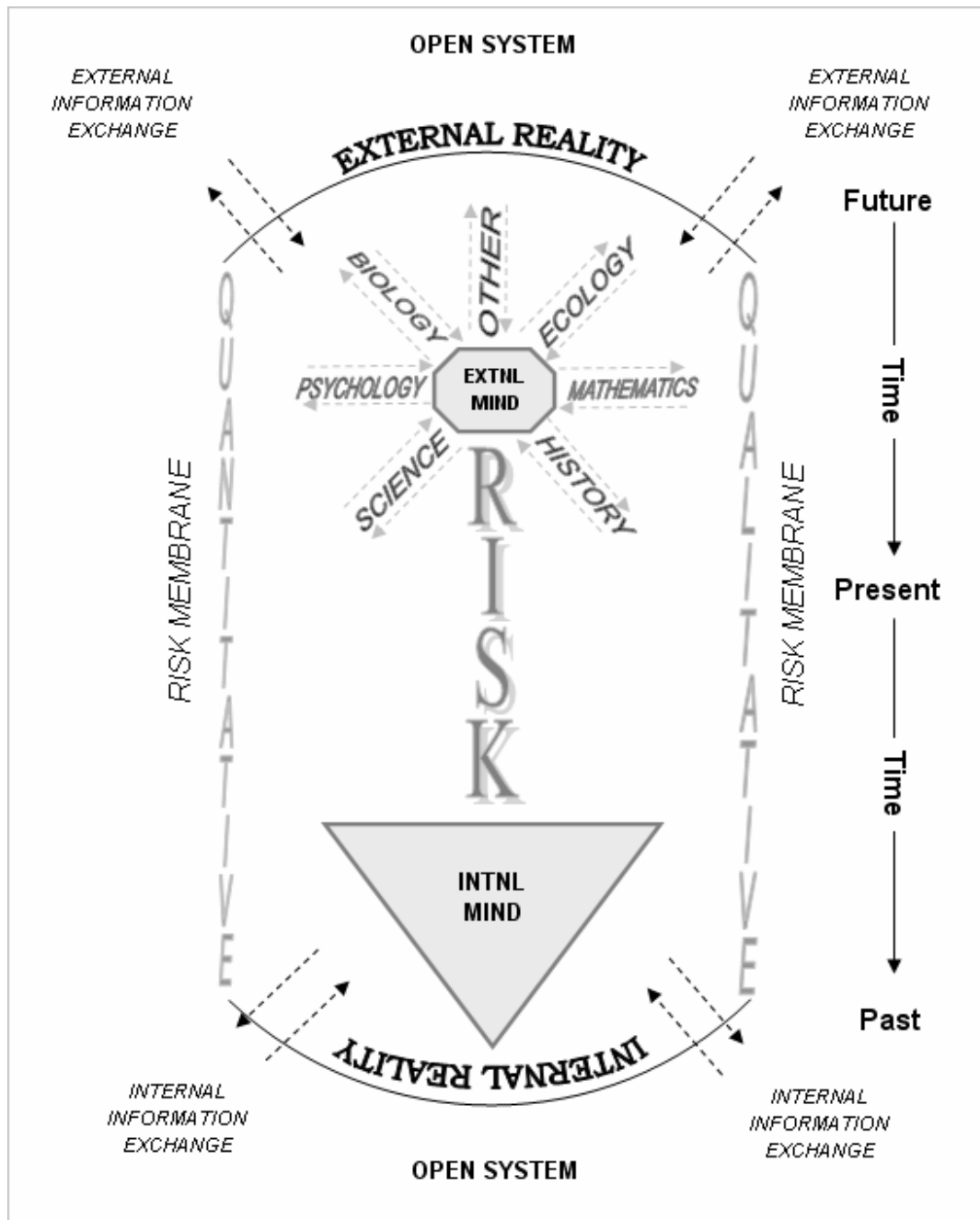
Figure 8.6 incorporates into the visual definition of risk the concept that it is a multidisciplinary construct. The five disciplines within this dissertation from which principles were extracted in order to better understand risk are visually depicted as biology, psychology, physiology, science and history. The perfect reality in relation to understanding risk would, however, be if all disciplines of life could be applied to an understanding of risk. For this reason the concept of other is included as one of the six disciplines depicted in Figure 8.6 above.

8.3.5 Risk – an open system

The final touches introduced to the conceptual model of qualitative risk relate to the principles of an open system which was derived from an understanding of dissipative structures. This philosophy is represented by the 'flower' which has emerged as a result of all the other concepts of risk being brought into play. The conceptual risk flower is synonymous with the manner in which normal flowers function in nature in that like normal flowers which function on a basis of continual energy exchange, so too risk functions on a basis of continual information exchange. This information exchange takes place through a mental membrane represented in the model by the arched curves on top of the flower and the principles of balance on the sides. Such exchange ensures an internal state of disorder which in turn ensures continued existence. This concept was dealt with in detail in Chapter 7.

By incorporating the final touches, as described above, into the conceptual model of risk, a final picture emerges. Such a picture is the outcome of the philosophies proposed in each respective chapter and is indicative of a holistic interpretation of qualitative risk. Figure 8.7 concludes.

Figure 8.7 - A holistic perspective of qualitative risk



Source: Own observation

Figure 8.7 represents visually the final perspective of qualitative risk. It incorporates all the philosophies proposed in each respective chapter of this dissertation and was explained in a step-by-step basis in paragraph 8.3 above.

8.4 Reconsideration of the management dilemmas

A brief discussion in terms of how this dissertation has dealt with the concerns of the management dilemmas is required.

8.4.1 Adaptation to change – dilemmas i and ii

Two management dilemmas relative to change were proposed in Chapter 1. The first dilemma related to the inability of quantitative risk models to adapt to change due to them being inflexible by nature. It called upon a model that could introduce the human element or rather non-physical aspects of risk (paragraph 1.2.1). The second management dilemma proposed related to the need for organisations to be able to adapt to rapid change. It was identified that the business environment of the present era is continually changing and that an inability to adapt to such change most likely equates to failure.

In relation to both these dilemmas proposed a qualitative understanding of risk, as represented by Figure 8.7 can be seen to deal with each respective concern. The essence of qualitative risk was shown to be a human construct. By definition this implies that an understanding of risk is modelled off the qualities that define human behaviour and by default therefore includes the human at the centre of the risk philosophy. In so doing the concerns raised in the first management dilemma are automatically dealt with.

Secondly, using principles inherent in both ecology (autopoiesis) and dissipative structures, it was shown how adaptation to change is facilitated by ensuring a continual state of internal organisation disorder. This philosophy was proposed in paragraph 2.6 as well as 7.4.2. At a high level it put forward that the only way to ensure an organisation remains capable of adapting to change was to stimulate risk. In this way continual organisational learning took place by way of information exchange and no possibility of stagnation or internal equilibrium could arise.

8.4.2 Risk in perspective – dilemma iii

The third management dilemma called for risk to be placed into perspective. This involved showing risk to be a human construct in order to bring about a fresh understanding of risk that could be used as a platform for further academic research (paragraph 1.2.1).

This dissertation dealt with the above dilemma throughout all chapters. It was shown on a continual basis that risk is a construct of the human mind and that humans formed the centre of risk creation. In so doing, further research opportunities have been identified and will be discussed in paragraph 8.6 to follow.

8.4.3 Information and risk – dilemma iv

The final management dilemma relates a need to understand the role of information is its contribution to both the formation and management of risk (paragraph 1.2.1).

In relation to this Chapter 7 served the purpose of discussing this concern. The importance of information in terms of risk was highlighted and a conceptual model of the information process was proposed (see Figure 6.14). Chapter 8 presented this model and went on to propose the manner in which information can be used in order to better manage risk.

8.5 Practical application of the model

It is not the intention of this dissertation to provide a detailed case study of the practical application of the model in reality, but rather to allude only to the fact that the model has been hypothetically tested in a financial environment. Such testing was the function of observation.

Currently the author is employed in the financial sector of the economy and over the last year has been through the process of a corporate buyout. During such time it was observed that a change in

human temperament, in the light of the stresses imposed by such corporate action, resulted in a degree of risk that threatened not only the viability of the corporate deal, but also the sustainability of business operation. This degree of risk pertained purely to the non-physical aspects of the business environment, namely staff and was observed to have taken priority over all other quantitative areas of risk identified in the corporate transaction.

In a bid to salvage the deal and continue with the buyout transaction, the purchasing company launched a comprehensive staff wellness campaign so as to deal with the issue of staff retention and employee motivation. It was only once such staffing issues had been solved and the qualitative risks within the environment managed, that the further roll-out of the corporate buyout could proceed.

During this phase a hierarchy of organisational risk was observed in which the qualitative aspects of risk took precedence over all other aspects. The original buyout transaction was quantitatively modelled and designed to take only three months. The reality of human dynamics, however, not only potentially jeopardised the viability of the transaction, but resulted in the original three-month time frame taking well over a year.

The value that the conceptual model of qualitative risk presented in this given scenario concerned itself with the issues of managing change. By understanding risk to be a human perception from the onset of the transaction, it would have been possible to manage risk simply by committing resources toward altering human perception. Secondly, by ensuring the correct initial perception and increasing staff motivation, it would have been possible to impose greater organisational stresses on the environment over a short period of time in order to drive the buyout initiative. It would also have ensured that the most important resource needed to facilitate the transaction, namely staff, would have been in place. A qualitative perspective of the initial transaction would also have presented a view on the benefits of introducing uncertainty into the environment and allowed for the transaction to absorb the increase in risk. All this would have been possible through the correct application and management of people. This philosophy was discussed in detail in

Chapters 2 and 3 respectively and was incorporated in a previously concluded model (see Figure 3.7).

8.6 Further research opportunities

During this dissertation a number of areas requiring further research were identified:

Two remaining activities of the Mitroff model were not completed namely activity III, "Scientific Model" and IV, "Solution." In the light of this, further study is required thereby completing a systems approach to research.

A second fundamental area of research that could be conducted relates to one of the conceptual models of qualitative risk presented in Chapter 3 (Figure 3.7). Such a model put forward four risk concepts, namely controlling risk, survival risk, sacrificial risk and renewal risk. Within the philosophy presented in the model, opportunity exists to test it within an organisational environment. The concept of stimulating survival risk and managing renewal risk (in a bid to increase controlling risk so as to achieve greater organisational delivery) is proposed to present a valuable contribution and further research opportunity.

In addition further areas of research that could possibly benefit this science are identified as follows:

- Exploring the arrow of time relating to the second law of thermodynamics and relating this principle to the understanding of risk as a present-day construct.
- Introducing more disciplines into the overall holistic understanding of risk in a bid to engender a more balanced comprehension. One such possible discipline is mathematics and the application of fractal geometry. Such a form of mathematics is concerned with chaos theory which ties in neatly with the principles of emergence.

- Further consideration of Gaia theory and the use of non-linear dynamic biomathematics as a means to develop a scientific qualitative risk model. This concept was originally alluded to in the 'daisy world' model developed by James Lovelock.
- The validation of the final conceptual risk model proposed and its usefulness in organisations.
- An observation of the effect of embracing uncertainty and stimulating risk within an organisation.
- A comparison between the contributions that a quantitative versus a qualitative approach to risk management has on the sustainability of organisations.
- A more detailed consideration of the number of quantitative risk models developed to date relative to qualitative risk models.
- A study into the holistic cost to company of implementing a qualitative risk management philosophy versus a quantitative risk management philosophy.
- A possible extrapolation of the concept of qualitative risk into other sectors of business and the economy.

8.7 Concluding remarks

The primary purpose of this dissertation has been to introduce an alternative perspective on risk in a bid to stimulate further academic debate. It has been designed to invite constructive criticism and to plant a seed of possibility that hopefully will develop into something capable of contributing to science.

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