A STUDY OF STRATEGIES FOR TRANSFORMING ZESA ENTERPRISES (ZENT) INTO A COMPLEX ADAPTIVE SYSTEM FOR ACHIEVING SUSTAINABLE GROWTH FROM 2009 TO 2013

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GRADUATE SCHOOL OF MANAGEMENT

UNIVERSITY OF ZIMBABWE

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DECLARATION

STUDENT’S DECLARATION

I, Farai Chinhengo, do hereby declare that this dissertation is a result of my own investigation and research, except to the indicated in the acknowledgements, references and by comments included in the body of the report, and that it has not been submitted in part or in full for any other degree to any other university.

Student’s signature…………………………… Date……………..

Supervisor’s signature…………………………… Date……………..
DEDICATION

This research is dedicated to my parents, Mr and Mrs O. K. K. Chinhengo and my family, without whom I never would have imagined this possible. Thank you especially to my parents who throughout my life have given me the latitude to explore my ambitions without rigid boundaries, providing subtle guidance, unwavering support and love.
I would like to acknowledge this research to Dr S. Ruturi my supervisor for assisting and guiding me to produce a quality and unique research in the study of complexity theory in Zimbabwe. Not forgetting the late Dr M Mutowo for introducing me to the world of chaos and complexity.

Great appreciations to my wife, Sharon, for always being available for me and to my daughter, Tanyaradzwa, for making me laugh during the research period.

Lastly, but not least, to my parents once again, for raising and guiding me to become what I am today in this chaordic environment. My knowledge is a resemblance of yours though with a little advancement. Thanks to Uncle David Maruta for source of inspiration.

Mrs C. Chinhengo, Dr S. Gondo and Eng. S. Mudehwe your editing was greatly appreciated, without you this document was going to be meaningless.

Thank you all, my work mates at ZESA Enterprises, fellow students, lecturers and staff at the Graduate School of Management for your unwavering support.
ABSTRACT

The purpose of this research is to examine how a public organisation can be transformed into complex adaptive systems (CAS) to achieve sustainable growth for the benefit of all stakeholders.

This research reviews the strategies and provides a conceptual framework of transforming a public organisation into complex adaptive systems and a conceptual framework is provided. The purpose of this dissertation is to apply organisational transformation through CAS in an organisation especially in the field of project management (construction) and manufacturing. The research explores and identifies the best approaches that the organisation can implement to achieve sustainable growth. The research was based on a case study and two divisions were under study although research information was collected from the organisation’s four divisions including the head office.

The benefits of CAS application in the organisation give management an alternative for adapting and managing, in the current turbulent environment. The findings show that the application of CAS in organisations is not a popular concept in the organisation under study. The CAS approach looks at the relationship between management, employees and the processes to achieve sustainable growth.

The research recommends that transformation strategy through complex adaptive systems will encourage continuous innovation, restructuring, application of advanced technology, improvement in communication, employee involvement, review of the organisation, application of CAS characteristics and approaches, reward teams based performance for sustainable growth.

The case study contributes to the empirical body of knowledge of organisational transformation strategies through complex adaptive systems. This paper will introduce a new way of thinking to the manager on current and future issues in the field of project management and manufacturing, and move away from out-dated management model e.g. Taylor’s management model.
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<tr>
<th>ABB</th>
<th>ASEA Brown and Boveri</th>
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<tr>
<td>CAS</td>
<td>Complex Adaptive Systems</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
</tr>
<tr>
<td>E-commerce</td>
<td>Electronic commerce</td>
</tr>
<tr>
<td>GJIMT</td>
<td>Gian Jyoti Institute of Management and Technology</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standards Organisation</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolts</td>
</tr>
<tr>
<td>kVA</td>
<td>Kilovolts ampere</td>
</tr>
<tr>
<td>Ltd</td>
<td>Limited</td>
</tr>
<tr>
<td>MODeST</td>
<td>Mission, Organisation, Delivery, Stakeholders and Team</td>
</tr>
<tr>
<td>MVA</td>
<td>Megavolts ampere</td>
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<tr>
<td>OT</td>
<td>Organisational Transformation</td>
</tr>
<tr>
<td>PESTEL</td>
<td>Political, Economic, Sociocultural, Technological, Ecological and Legal</td>
</tr>
<tr>
<td>PM</td>
<td>Project management</td>
</tr>
<tr>
<td>Pvt</td>
<td>Private</td>
</tr>
<tr>
<td>QFD</td>
<td>Quality Function Deployment</td>
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<tr>
<td>R &amp; D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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</tr>
<tr>
<td>REA</td>
<td>Rural Electrification Agency</td>
</tr>
<tr>
<td>ROI</td>
<td>Return on Investment</td>
</tr>
<tr>
<td>SABS</td>
<td>South African Bureau of Standards</td>
</tr>
<tr>
<td>SADC</td>
<td>Southern Africa Development Community</td>
</tr>
<tr>
<td>SAP</td>
<td><em>Systeme, Anwendungen und Produkte in der Datenverarbeitung</em> (Systems, Applications and Products in Data Processing)</td>
</tr>
<tr>
<td>SAZ</td>
<td>Standards Association of Zimbabwe</td>
</tr>
<tr>
<td>SPSS</td>
<td>Statistical Product and Service Solutions</td>
</tr>
<tr>
<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities and Threats</td>
</tr>
<tr>
<td>TQM</td>
<td>Total Quality Management</td>
</tr>
<tr>
<td>ZEDC</td>
<td>Zimbabwe Electricity Distribution Company</td>
</tr>
<tr>
<td>ZENT</td>
<td>ZESA Enterprises (Pvt) Ltd</td>
</tr>
<tr>
<td>ZESA</td>
<td>Zimbabwe Electricity Supply Authority</td>
</tr>
<tr>
<td>ZETCO</td>
<td>Zimbabwe Electricity Transmission Company</td>
</tr>
<tr>
<td>ZETDC</td>
<td>Zimbabwe Electricity Transmission and Distribution Company</td>
</tr>
<tr>
<td>ZPC</td>
<td>Zimbabwe Power Company</td>
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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

At the turn of the millennium numerous, large and multinational companies have been struggling and others have even collapsed. This has led many management practitioners and management gurus to question whether the old management techniques are still applicable in the modern business environment. The current turbulent economic environment that is witnessed in the modern business field has initiated management scientists to try and use different techniques that can elucidate and conquer this global tsunami. One of the new management systems that practitioners are trying to explore is the use of complex adaptive systems (CAS) as a model to demystify the present problems that are facing firms in every part of the world.

This branch of management was coined “new science” by Houston and Rothschild (2001) that is also known in various names such as chaos, complexity, complexity theory, dynamic systems and non-linear systems. Putnik (2012) elaborated that lean organisation is the oldest and in turn it is followed by agile organisation and learning organisation in that order of historical trajectory of development and formulations of business, organisational and theoretical approaches and these three approaches are now succeeded by chaordic organisations. The new science moves away from the Newtonian model characterised by materialism and reductionism which focuses on things rather than relationships (Wheatley, 1994). The new science seeks to explain organisational behaviour, change management and organisational transformation (OT) in a new dimension which is non-linear, evolutionary and adaptive; that is vital to management practitioners and academia. Recent applications of the theory of CAS to organisations have opened up major theoretical questions about the role of strategic management and governance (Bovaird, 2008). O’Reilly III, Harreld, & Tushman (2009 p.75) concluded that it is
not the strongest of the species that survive, nor the most intelligent, but the one that is most responsive to change.

This research seeks to investigate strategies that can transform ZESA Enterprises’ (ZENT) two divisions Manufacturing and Projects, into a complex adaptive system that will be able to offer customer satisfaction and value for money to other stakeholders by continuously adapt, adjust and apply, in this complex business environment. The industrial revolution, the quality revolution, the lean movement and the agile age are representative of such adaptive changes (McCarthy, Rakotobe-Joel, & Frizelle, 2000). This research will look at the CAS that has a top down view and more recent works that combine top-down and bottom-up views.

1.2 BACKGROUND

The electricity industry is broad and has several players with various specialities ranging from mechanical, civil, electrical and telecommunications; that are either manufacturers or contractors. ZENT is one such big player in electrical related equipment manufacturing, electrical infrastructure construction and civil works in Zimbabwe, and has been in the business for over two decades although the company was incorporated in 1994. The ZENT divisions were technical departments in the original ZESA formed in 1987.

1.2.1 Background of the Study

The application of complex adaptive system as a transformation strategy has not been widely used or popularised in this part of the world among management practitioners and academia. Companies in Zimbabwe have used popular transformation strategies like restructuring and adopting new technology to transform their organisations. Little has been done on the use of CAS or published; even in the rest of the world empirical data on CAS is not much, available literature is based on views and opinion of the authors. Introduction of new transformation strategies generates low morale, uncertainty, fear, resistance, reducing focus and performance (Alder & Koehn, no date). The organisation under research is a parastatal, and is wholly owned by government of Zimbabwe. Public institutions are very difficult to transform, especially by using current strategies and many
authors have proved that it is really difficult to transform these institutions (Christensen, Laegreid, Roness, & Rovik, 2007). CAS can be used in these types of organisations to change the processes and promote team work among employees, hence increasing productivity and profitability. Once this research is completed the data can also be used to transform similar organisations in Zimbabwe and the rest of the world by practitioners. Academia can also use it as a case study in researching CAS.

1.2.2 Background of the Organisation

The electricity industry is one of the most essential businesses in the world and it is the obligation of every government to ensure that electricity is available to major sectors of the economy including citizens of that particular country. Before the eighties, these gigantic entities were mainly public companies and towards the turn of the millennium, the majority of industrialised nations, transformed these entities into smaller and efficiently private owned companies. Under-industrialised countries were not to lag behind from their industrialised counterparts as they followed suit and Zimbabwe was one of them. Although Zimbabwe did not unbundle the sector into private sector they just created smaller public entities which specialised in generation (Zimbabwe Power Company-ZPC), transmission (Zimbabwe Electricity Transmission Company-ZETCO), distribution (Zimbabwe Electricity Distribution Company-ZEDC), rural electrification (Rural Electricity Agency-REA), telecommunication (Powertel) and an enterprising company that supports the industry in construction of electrical infrastructure and manufacturing of electrical equipment (ZESA Enterprises-ZENT). These entities were originally under one holding company ZESA Holdings. However, ZETCO and ZEDC have since merged to form Zimbabwe Electricity Transmission and Distribution Company (ZETDC) while REA is no longer a subsidiary of ZESA Holdings.

ZESA Enterprises (Private) Limited was incorporated in Zimbabwe in 1994 as an unregulated investment arm of ZESA Holdings (Private) Limited (ZESA Enterprises, 2010a), and began to operate after the Electricity Act of 2001. ZENT currently has four divisions namely:
Projects Division – involved in the design and construction of power lines and substations up to 330kV. The division has been ISO certified since January 2002 and in 2010 it was recertified to ISO 9001:2008 (ZESA, 2010).

Manufacturing Division – manufacturing of electrical equipment (transformers and switchgear) and related structures and transformers ranging from 10kVA to 75MVA, with voltage classes ranging from 11kV to 132kV. The division works in partnership with PME Power Solutions of India in the manufacturing of transformers and technological transfer since 2006. In 2011 the division signed a switchgear technology transfer, manufacturing and repair agreement with Techpro (Pvt) Ltd of South Korea (ZESA, 2012). This division is ISO certified since year 2000 and currently recertified to ISO 9001:2008 (ZESA, 2012).

Transport Division – transportation of specialised equipment (huge transformers and lifting equipment), heavy duty rigging team, and vehicle repair and maintenance.

Retail Division – retail outlets for the sale of electrical related equipment and conductors.

This research dwells more on the first two departments, Projects and Manufacturing divisions.

1.2.2.1 Vision and Mission: ZENT’s vision is “to become a world class business, in support of the electricity industry” (ZESA Enterprises, 2010a).

The mission of the company is “to provide diversity products and services that meet customer needs at competitive prices in support of the electricity industry and to enhance shareholder value” (ZESA Enterprises, 2010a).

The importance of a mission statement to effective strategic management is well supported in the management literature (Staples & Black, 1984). A mission statement may be the most visible and public part of a strategic plan. As such, steps should be taken to ensure that the statement includes all the essential components and attributes. In addition, a company mission should be evaluated
to ensure that it communicates clearly the desired feelings that will guide and motivate employees to action.

Pearce (1982) identified eight key components of mission statements: customers, products or services, markets, technology, concern for survival, growth, and profitability, philosophy, self-concept, and concern for public image.

The researcher proposes a mission statement that reads:

To provide a wide range of tailor made value for money world class low and high voltage products and services to corporate and individual customers in the world.

1.2.2.2 ZESA Enterprises Business Performance: ZENT has been in the business for more than a decade although its employees have experience ranging from few years to more than two to three decades in the business of manufacturing and installation of electrical related equipment. The years from 2002 to 2008 were marked by increasing hyperinflation that also affected the business and to use the figures in this period will provide a false picture of the performance of the business. The highest rate of brain-drain was also experienced during this period, as majority of technical expertise went abroad in search for greener pastures and ZENT was not spared.

After dollarization in 2009 the true performance of the organisation started to prevail and the business’ sales and revenue started to increase steadily until in 2012, when a decrease of 23.2% was experienced. There was a steady loss reduction between 2009 and 2012 from US$6.2m to US$1.9m. There was however a phenomenal increase of 197.4% in losses from 1.9m to US$5.6m as shown in Table 1.1 below. The witnessed loss in 2009 was due to recapitalisation and heavy losses that were contributed by one of its former division Agro which was disbanded in 2009.
### Table 1.1: ZENT Financial Performance

<table>
<thead>
<tr>
<th>YEAR</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>7,448,289</td>
<td>23,668,574</td>
<td>46,615,046</td>
<td>35,802,435</td>
</tr>
<tr>
<td>Expenses</td>
<td>13,642,674</td>
<td>26,119,991</td>
<td>48,499,027</td>
<td>41,404,961</td>
</tr>
<tr>
<td>Profit/Loss BT</td>
<td>(6,194,385)</td>
<td>(2,451,417)</td>
<td>(1,883,981)</td>
<td>(5,602,526)</td>
</tr>
</tbody>
</table>

All figures in United States dollars (US$)

Source: (ZESA Enterprises, 2010 and ZESA Enterprises, 2013)

### 1.2.3 SWOT Analysis

#### 1.2.3.1 Strengths:
ZENT as a parastatal has strengths such as superior reputation in the manufacturing of transformers and construction of substations. Government institutions have low risk of not completing projects and becoming insolvent. Most of the projects and transformers are being executed and supplied respectively without down payments, indicating that ZENT has a strong financial base. ZENT is efficient when it comes to execution of jobs and the supply of its products.

ZENT has a wide customer base that ranges from individual customers to large corporates such as Econet and mining companies. The company has the capacity to expand its customer base into other Southern Africa Development Community (SADC) region countries as Zimbabwe has strong access to the rest of the region as it is geographically central. The company has a wide range of skilled manpower whose experience ranges from few years of service up to more than twenty years. Its labour force is diverse and it also varies from permanent, flexible short and long term contracts that give the company an added advantage.

ZESA is the custodian of the national grid excluding a few networks that are owned mostly by mining companies and other big corporations. The transformers and equipment supplied; and the projects executed, are all done to high quality and are of national and international standards (ISO, SAZ and SABS).

#### 1.2.3.2 Weaknesses:
Most of ZENT’s machinery has now out-lived its economic life; workshop plant and equipment, and light and heavy motor vehicles. The production facilities layout are decades behind the modern robotic operated
factories. The organisation relies on labour intensive manufacturing which is prone to many labour disputes and strikes. This is a disadvantage compared to similar leading manufacturing firms in the world which rely on robot manned manufacturing and contract staff. Although the company is in the manufacturing of electrical related equipment and construction of substations, and its products and projects have always changed over the years in terms of technologies used, its research and development (R & D) has been inadequate or not being done at all, as a way of introducing new products or improving the old system.

ZENT’s management needs to move from the stable management style to that of the world’s leading company of learning, improving and adapting strategy, and quick to respond to external environmental changes. Government institutions have a disadvantage in that management sometimes cannot have long term strategies of more than five years as the regulations normally change as the governments change. This can be witnessed in the bundling and unbundling of ZESA that took place since 1987 and they are now more than five processes in the same institution with different Ministers. Procurement procedures have not improved in public institutions as most of projects that ZENT execute, require rapid procurement processes as a competitive advantage, as most project delays emanate from this crucial activity.

1.2.3.3 Opportunities: ZENT has many opportunities which arose after the introduction of dollarization, increased internet connectivity and networking with the rest of the world (new suppliers and new customers). This allowed improvement in the procurement processes across country borders and some speciality services can be sourced very cheap on the internet from draughting and designing companies.

Most of the company’s products and projects involve specialised skills that are scarce in many sub-Sahara countries. The shortage of these specialised skills gives ZENT an opportunity to venture into new territories like Lesotho, Malawi, Mozambique and Democratic Republic of Congo (DRC). Although ZENT has entered the Botswana and Zambia markets, there is need for the organisation to increase its market share in these countries and beyond African countries.
1.2.3.4. Threats: The biggest threat that ZENT has is that many former employees have formed almost similar entities that have fast response time to customer needs and delivery time on projects. Above all, these owners have inside information of the company. ZENT has not changed much in terms of project execution and differentiating its product line to cope with ever changing market tastes. The new competitors are also providing substitute products to the ones that ZENT is manufacturing like transformers. The presence of Alstom and ABB is an indication that the future competition will be intense from the two manufacturers of transformers and switch gear as well as substation construction. The current changes in the Holding company can introduce uncertainty among employees if it is not communicated to them well.

1.2.4 ZENT Industry Analysis

Porter (2008) stated that to understand industry competition and profitability in different organisations and markets, one must analyse the industry’s underlying structure in terms of the fives forces. The author represented the five forces in a diagramatic form as illustrated in Figure 1.1.
To better understand ZENT’s rival firms, we will use Michael Porter’s five forces model.

1.2.4.1 Threat of entry: ZENT through its Manufacturing Division has an advantage of economies of scale over its competitors Nical Transformer Manufacturing (Pvt) Ltd and South Wales Electric in that it is the major supplier of transformers to its sister company ZETDC and many other individual customers in Zimbabwe. This also reduces the price of transformers to various destinations in the country and nearby countries.

Projects Division is one of the few civil contractors that specialises in the design and construction of electrical substations and most major projects come from ZETDC and few from mining entities. However the indigenisation policy will retard
new entry from outside the country as the laws now require foreign companies to have 49% ownership and 51% of local ownership.

1.2.4.2 **The power of suppliers:** Projects Division has acquired many contracts because it executes projects on credit and its clients can settle their debts after their projects have been completed. This is the same with Manufacturing Division which also supplies transformers to big customers on credit. This gives ZENT an edge over other suppliers as they can increase their prices while retaining their customers. Manufacturing division has an edge over its competitors on the testing and approval of small transformers before they are installed into the national grid. ZETDC requires ZENT to certify all the transformers that are manufactured locally or imported before they are installed on the grid. So, ZENT has an upper hand over other suppliers as they pass their product.

1.2.4.3 **The power of buyers:** Individual customers like farm owners, and small industrial customers like small business enterprises and other small entities tend to be price sensitive and they usually look for other options like buying from Nical Transformer Manufacturing, South Wales Electric or on-line. The introduction of multi-currency and increased internet connectivity has given the consumers access to more trading on the internet, cheap and heterogeneous product options.

1.2.4.4 **The threats of substitutes:** The marketing of ZENT products and services is very weak and customers, as well as the market are not aware of the services that the company offers. ZENT cannot be easily differentiated from ZETDC although the two companies have different mandates. This has resulted in products and services provided by ZENT being overshadowed by their competitors who advertise in papers and electronic media. Projects Division has a challenge in that construction service sector regardless of its speciality, is easily substituted or can be done in-house by clients as a way to reduce costs.

1.2.4.5 **Rivalry among existing competitors:** ZENT has two local and many foreign competitors in the manufacturing of transformers and several hundreds of local competitors in the construction industry. Although in construction of large electrical related infrastructure projects, the rivalry becomes less from locals and intensifies from foreign companies.
1.2.5 Macro Environmental Analysis

Thompson, Peteraf, Gamble, & Strickland III (2012) concurred that companies operate in a larger environment that goes well beyond just the industry in which it operates and it is called macro-environment which includes seven principal components: population demographics; societal values and life styles; political, legal and regulatory factors; the natural environment and ecological factors; technological factors; general economic conditions; and global forces. Some authors prefer the greater detail provided by PESTEL analysis (Botten, 2009). Although PESTEL analysis is the ‘industry standard’ for macro environmental analysis, this separates legal from political and specifies ecological separately. The changing environment factors are Political, Economic, Sociocultural, Technological, Environmental and Legal.

1.2.5.1. Political: The introduction of land reforms and the indigenisation programmes had a double edged sword impact on the business in that it took away reliable customers and introduced many new small customers with low financial base. The same policies also reduce competition from foreign firms and allow the organisation (ZENT) to be awarded more lucrative contracts. The COMESA agreement can be used by ZENT to expand into regional countries like what Delta Corporation has indicated. Although expanding into new territories introduces high initial costs to the organisation. ZENT has an advantage in that some of its activities are protected by government e.g. getting reliable orders from various government projects.

1.2.5.2 Economic: The introduction of dollarization brought a stable economy and steady economic growth. The business growth can be analysed and recapitalisation has increased after more than five years without proper recapitalisation due to unavailability of funds both local and foreign. The company was unable to access lines of credit for six years between the years 2002 to 2008. The flooding of low cost products like cheap transformers imports from China reduced ZENT’s individual market segment across the country. Some of the raw materials used in the manufacturing of transformers and equipment used in the construction of lines and substation is mostly imported and it attracts imported inflation from foreign countries like South Africa.
1.2.5.3 **Sociocultural:** The greatest impact of social and cultural dimension in ZENT was the loss of skilled manpower and the after effects are still haunting the organisation to date. Experienced skilled work force still prefer to work in South Africa and some contracts are won by foreign companies as they have Zimbabwean staff with broad knowledge and experience of the country than the inexperienced ones working in local companies. However, the booming of the economy has increased business activities, increased employees moral and employees are currently able to buy their own vehicles and houses as well as accessing lines of credits. The easy internet connectivity which has resultantly increased e-commerce has caused a great change in both industrial and consumer buyer behaviours.

1.2.5.4. **Technological:** Various customers and suppliers can now be accessed on the internet including online directory and products that organisations produce. ZENT has its own website for its customers to explore various ranges of products that it manufactures and services that it provides. On the other side the internet has also allowed prospective customers to seek new products on the internet especially buying cheap transformers from China. In recent years ZENT has been recapitalising its organisation by obtaining new equipment, vehicles and software. The introduction and use of SAP in its day to day activities will reduce labour costs in the short run of ZESA Holdings and its subsidiary companies as they are all interconnected but there is currently threatens of unbundling of the group.

1.2.5.5. **Ecological:** ZENT needs to build proper oil disposal for unrepaired transformers before the environmental law enforcement agencies catch up with them. Most of the projects executed by ZENT require that they do an environmental impact assessment, to comply with the laws of the country.

1.2.5.6. **Legal:** Changes in the Electricity Act also alter the strategic plans of management as they need to adjust to new legal amendments. ZENT has a challenge in that its divisions are under different industries and their collective bargaining agreements are negotiated differently and this brings disparity in the company, hence introducing low morale among employees. As evidenced by this analysis of the PESTEL business environment, one can safely conclude that
characteristics of a constantly changing business environment, presents opportunities and pose threats to Zimbabwean companies.

1.3 STATEMENT OF THE PROBLEM

During the period from 2009 to 2013 ZENT recorded decreasing losses between 2009 and 2011, in 2012 the losses increased by 197.4 % from the previous year, whilst the market share declined by 23.2% in the same period (see Table 1.1). If this current trend is allowed to persist ZENT faces imminent collapse. It is therefore in this context that the leadership must quickly transform ZENT into complex adaptive systems if it is to survive in this turbulent environment.

The impact of using the same strategies for managing and transforming the company has not been analysed in greater detail in ZENT. The current management strategies need to be relooked at and compare them with those of other leading international organisations, otherwise the organisation will not successfully realise sustainable growth and recover from being a loss making firm into a profitable entity. In the long run the organisation will become extinct because of globalisation, technological advancement, e-commerce and turbulent environment.

1.4 RESEARCH OBJECTIVES

Main Objective

The main objective is to establish whether there are any strategies for transforming ZENT into a CAS

Specific Objectives

1. To ascertain and explore types of organisational transformation strategies that are available.
2. To understand the application of complex adaptive systems to ZENT.
3. To determine the linkages between organisational transformation and complex adaptive systems or complex theory.
4. To establish whether CAS brings sustainable growth.
5. To ascertain and explore the implication of complexity theory and organisational transformation on management.

1.5 RESEARCH QUESTIONS

1. What types of transformation strategies can be applied to ZENT?
2. What CAS principles and approaches can be applied to ZENT?
3. Are they any linkages between organisational transformation and complexity?
4. How is CAS going to contribute in achieving sustainable growth?
5. What is the strategic importance and implication of organisational transformation and complexity to management?

1.6 RESEARCH PROPOSITION

This research suggests that by using complex adaptive systems as an organisational transformation strategy it will improve ZENT’s viability.

1.7 JUSTIFICATION/RATIONALE

The justification of this research is to improve efficiency and effectiveness of ZENT in delivering its service to its customers, the society in which it serves and enhance government/shareholder value. Responsibility for achieving outcomes is cascaded from the Managing Director at the top of the organisation to the lowest shop floor employee in the organisation.

The research may also be generalized to public and private organisations and thereby assist them to understand themselves. The research findings should provide some form of understanding to those wishing to use CAS as a basis on which to improve organisational understanding and behaviour in organisations. This will be useful to ZENT’s management and employees, and academia, as it provide a view of organisational understanding and behaviour as a dynamic process in this dynamic external environment.

The other contribution of this research will be the exposure of CAS as a useful model in understanding organisations and to ZENT management, who should apply this study in their work. The literature in CAS is very limited and this research
will try to contribute to this new body of learning and its application to project management and manufacturing organisations. The research will use CAS to transform ZENT into a more viable, sustainable and adaptable organisation more than the application of existing business models which are becoming out-dated in this fast changing business environment. This emanates from the fact that CAS visualizes and locates other CAS, in other words, all systems (departments) are nested within other larger systems (organisations).

1.8 SCOPE OF THE RESEARCH

The research shall be conducted in Harare, Zimbabwe. The company under research is a public company (parastatal) with four divisions and for this research two will be considered. The research will be based on using complex adaptive systems as an organisational transformation strategy in ZENT.

1.9 LIMITATIONS OF THE STUDY

The research only investigated two divisions within a public organisation which are in two different industries (manufacturing and construction) mainly in support of the electricity industry. Projects and Manufacturing divisions were the two to be studied in this research. The organisational transformation strategy was applied to an organisation within Harare, Zimbabwe located on one location.

The research study did not address Zimbabwean organisations in the same industries as ZENT. The study of complexity theory is still new in this part of the world and literature on application of complexity to Zimbabwean organisations is very limited, if there is any that had been done in this country. The period of the study is very short limited to five months (March to August 2013). Only a small group of employees within the two divisions of ZENT will be asked to contribute to the research.
1.10 DISSERTATION STRUCTURE
This research study is composed of five chapters; chapter one introduction, chapter two literature review, chapter three methodology, chapter four results and discussion and the last chapter conclusions and recommendations. Chapter one introduces the company under study, the objectives of the research. The second chapter reviews the existing literature on complexity as a transformational strategy and the link between structure, strategy and governance. The third chapter is the methodology; it states the ways how the research is going to be conducted and its justification. The fourth chapter will report on the findings, discussion, interpretation, comparing finding and the literature. The last chapter five presents the conclusions and recommendation of the research study.

1.11 CHAPTER SUMMARY
Chapter one introduce CAS and its applicability to organisations. The background of the case study of ZENT, was given including an assessment of the micro (SWOT analysis); macro (PESTEL analysis) environment of the company and the industry analysis (Porter's five forces model). The three analyses gave a clear picture of the organisation's environment in which it is operating in. the financial performance of ZENT since 2009 was also discussed. The research questions, objectives, statement of the problem and the proposition gave an in-depth structure on how the research is going to be done.
CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

Organisations in the past century were viewed as machines that need to be properly oiled for them to function effectively and management scientists called it the Taylor's management theory (The Health Foundation, 2010). Taylor's management theory suggested that if the world and organisations are considered as machines, then understanding the dismantled components was tantamount to understanding the whole. Many scholars however, towards the turn of the millennium, suggested that many things remain unpredictable and needs new ways of analysis, including the weather, ecosystems and organisational and human behaviour. This led investigators from many different fields to explore different theories and a new theory emerged among others known as complexity theory or complex adaptive systems. The theory was popularised and established in 1984 by physicists, economists, and others studying complexity at the Santa Fe Institute in New Mexico, USA (Brownlee, 2007).

This chapter provides the contextual background to CAS, particularly as it relates to organisational transformation to achieve sustainability in a way that management could foresee changes earlier and respond quickly. Literature has also shown that though CAS is a relatively new concept, it can be applied in project management and manufacturing organisations, as well as various departments in which this research will be conducted. The literature will be grouped into seven different sections that will cover the introduction, definitions, organisational change and transformation, complex adaptive systems, link between organisational transformation and complex adaptive systems, sustainable growth and implication of CAS to management.
2.2 ORGANISATIONAL TRANSFORMATION (OT)

Change is one of the few constants of life and it is the alteration and modification of the current state to a different one (Gian Jyoti Institute of Management and Technology, 2012). The changes in the global market in recent decades have necessitated minor to major alterations in the way businesses are conducted. Changes in awareness, educated customers, competitive products and dynamic changes in technology and this has resulted in practitioners and management academia requesting new different management styles of these organisations. Organisations need to adapt to current environmental changes so that they can outperform their rival competitors (Viljoen-Terblanche, 2008). Sustainable growth in the past was achieved through stable organisations and currently learning and adapting to environmental changes is now the survival strategy of many organisations. However, ecosystems and organisations are both constrained by resource limitations, internal structure of their interacting components and relationship to their external environment (Diment, Yu, & Garrety, no date).

They are many changes in an organisation’s point of view: market, legal, regulatory conditions and external to the organisation, shifts in tastes and preferences of customers; product features offered by competitors and government policies. These changes are known as environmental changes. Organisations need to respond to these environmental changes. Such changes are known as organisational changes which can range from incremental to evolitional.

Stratton (2011) argued that organisational transformations can be major when it involves change to the organisation’s strategic direction, redefining its company objectives, adopting new company structure, or changing its resources (new technology, outsourcing) or minor which include efficiency improvements to an organisation’s processes. Gilley, Gilley and McMillan (2009) stated that there are three types of change in organisations namely transformational change, transitional change and developmental change.

Transformational change also known as revolutionary change represents management driven modifications of culture, formulation of drastically different strategy, or demands for conformity due to a merger or acquisition by a dominant
company. GJIMT Research Team (2012) stated that it is change of a high magnitude that affects all parts and levels of the organisation.

Transitional change or evolutilional change the most common, improves the current state through minor, gradual changes in people, structure, procedures, or technology. These management-driven changes may be departmental or divisional specific, or organisational wide, in their attempt to enable the organisation to get better at what it does.

Developmental change or incremental change stems from an overall philosophy of growth and development that creates a culture of building competitive advantage through continuous dynamic, yet manageable change. Developmental change avoids infrequent radical, large-scale change by continually scanning internal and external environments, creating motivational work environments, and rewarding individual innovation, growth, and development.

GJIMT Research Team (2012) indicated that in general organisational transformation involves improvement in operations, strategic transformation and corporate self-renewal. Bloodgood and Marrow Jr (2003) argued that change in bureaucratic organisations is difficult because of strict reliance on rules and regulations, and inherently conservative and therefore resistance to change. Diment, Yu and Garrety (no date) stated that change encompasses people, culture and processes although some components overlap. The author also emphasises that technology is a primary driver of change, and managers and other organisational actors have little control over the nature of the organisational change. Van Tonder (2004) argued that organisational transformation depends on the structural differences in the form of organisation types (public versus private, small versus large, local versus national, multinational and international; profit versus non-profit; virtual and networked versus monolithic and bureaucratic, etc.), industry locations (retail versus banking, or mining or manufacturing, etc.) and operating in different contexts (developing versus developed, western versus eastern, stable versus turbulent, etc.). Although Gilley, Gilley and McMillan (2009) argued that transformational change is disturbing in nature but if it is successful, organisations can differentiate themselves competitively from the rest in the market.
Small and incremental organisational changes are no longer appropriate for managing current business challenges and this has forced business managers to bring transformation in their organisations (GJIMT Research Team, 2012). Gilley, Gilley, & McMillan (2009) stated that many authors agree that the pace of change is increasing regardless of whether it is radical or continuous. Organisational transformation involves reconfiguration of components of an organisation, and refers collectively to such activities as reengineering, redesigning and redefining business systems. The organisation needs to learn from mistakes and develop new capabilities which vary from new products, services, processes or business models. There is an intentional shift from the current state to the desired state, and this fundamental shift aims at meeting long-term objectives of an organisation. The combination of exploration and path creation will lead an organisation to “disruptive innovation” that will help it secure sustainable competitive advantage.

2.2.1 Organisational transformation defined

Many authors have referred to organisational change as “transformation”, “transformational change”, “corporate transformation” or “organisational transformation” (Van Tonder, 2004, p. 53) and business transformation (Morgan & Page, 2008). Van Tonder (2004) defined organisational transformation as an initiative that alters critical organisational processes that influence individual behaviours, which subsequently impact on organisational outcomes or as a dynamic process concerned with the modification of patterned behaviour and again as an empirical observation of difference in the form, quality, or state over time, in an organisational entity.

Gian Jyoti Institute of Management and Technology (2012) defined organisational transformation as a process of profound and radical change that orients an organisation in a new direction and takes it to an entirely different level of effectiveness. The author further stated that there is little or no resemblance with the past configuration or structure.

Mike Morrison as cited by (Stratton, 2011) defined organisational transformation as follows:
“Business Transformation is a change management strategy which has the aim to align people, process, and technology initiatives of a company more closely with its business strategy and vision. In turn, this helps to support and innovate, new business strategies.” (p.15)

Viljoen-Terblanche (2008) defined transformation as planned organisational transitional efforts intended to induce complete changes. The concept of change on the other hand is transitive and intransitive and is used in the context of describing dynamics on individual, group and organisational level as it passes from one transitional state to another during organisational transformation.

2.2.2 Importance of organisational transformation

Many businesses have managed to implement organisational transformation and reinvent their operations successfully (Khan, Business transformation: reinvent to succeed, no date). Benefits of OT vary from industry to industry and some of them include:

2.2.2.1 Radically improved products and services: Providing customers with radically improved products and service standards increases their level of satisfaction. Satisfying their current and future needs increases their loyalty and faith in the organisation.

2.2.2.2 Revenue increase: Businesses can harness collaboration and self-organisation to spur innovation, enhance growth, and drive dramatic improvements in productivity that increase revenues, reduce time to market, improve marketing return on investment (ROI), and lead to better and faster development of products and services.

2.2.2.3 Cost reduction: Improved processes, faster adaptability, and greater flexibility result in readiness for coming challenges both foreseen and unexpected. This readiness eliminates the potential costs (often major) of sudden change or breakdown.
2.2.3 Organisational Transformation strategies

Many authors have different classification of organisational transformation that include changes in organisational processes; organisational functions, organisation, co-ordination and control; changes in values, beliefs and human behaviour in terms of relationships to social rules and practices; and changes in the way organisational issues are influenced and power distribution (Cao, Clarke, & Lehaney, 2000). Although they are many diversity in classification but they are all interconnected organisational change concepts.

2.2.3.1 Transformation through values: Francis, Bessant and Hobday (2003) organisational strategies need to be reinvented or rewritten, organisational cultures realigned around different values, value chains redesigned and processes reworked. Gian Jyoti Institute of Management and Technology (2012) stated that values are foundation of culture and they are the guiding force in the changing organisational environment. Branson (2007) argued that before changing the non-human components (structures, processes and practices) of the organisation management it needs to change all the employees of the organisation. The author concluded that values are the foundation of truly successful organisational change.

2.2.3.2 Transformation through Organisation Development: This is slow change that organisations adopt in place of accelerated change. The basic thrust behind OD is that the world is rapidly changing and that the organisations must follow suit. The changes taking place in the environment make it necessary to revitalise and rebuild organisations. The only way to transform organisations lies in changing the climate of the organisation. A new social awareness is required by people in organisations. Burnes (2005) argued that in order to survive organisations must develop the ability to change themselves continuously in a fundamental manner.

2.2.3.3 Transformation through delayering: This is the removal of layers of management and administration in an organisation’s structure (Lynch, 2006 p.259). Traditional span of control believed that managers could have between seven to ten people under him and nowadays due to technological advancement
the manager can control up to 30 people. This has reduced the need of having many managerial layers.

**2.2.3.4 Transformation through Re-engineering:** Lynch (2006 p.259) defined re-engineering as the replacement of people mainly in administrative tasks by computer technology, often accompanied by delayering and other organisational change. Re-engineering occurs in lower levels of the company instead of managerial levels. Hill & Collins (2000) stated that re-engineering is revolutionary and it challenges the operation and even existence of fundamental processes. The author concluded that re-engineering seeks to improve the organisation to become competitive in this turbulent environment.

**2.2.3.5 Transformation through McKinsey's Plan:** Gian Jyoti Institute of Management and Technology (2012) stated that the McKinsey and Company’s plan is a ten-point blueprint for an organisation. The author stated that the plan looks at processes, flattened hierarchy, customer satisfaction, team building; combined non-managerial and managerial activities, employees with multi-competencies, reward individual skill development and team performance.

**2.2.3.6 Transformation through Competitive Benchmarking:** Benchmarking is the continuous process of measuring products, services and practices against the toughest competitions or those companies recognised as industry leaders (Gian Jyoti Institute of Management and Technology, 2012).

**2.2.3.7 Transformation through Six Sigma:** Gian Jyoti Institute of Management and Technology (2012) stated that six sigma is the statistical parameter used to describe variation. It can be described as going from approximately 35,000 defects per million operation to not more than 3 defects per million. It speaks the language of business and focuses on achieving tangible results. It uses an infrastructure of highly trained employees from various sectors of the company.

**2.2.3.8 Transformation through Kaizen Principle** which emphasizes small improvements, conventional knowledge, and personal involvement. It is based on incremental improvement in total quality management (TQM) which only addresses process changes (Hill & Collins, 2000).
2.2.3.9 **Transformation through Restructuring** is considered to reflect the internal configuration of the organisation, allowing flexibility and competitiveness to be key determinants of structure (Morgan & Page, 2008). Revitalization reflects the organisation’s ability to ‘ignite’ growth throughout the value-chain by improved alignment with marketplace opportunities. GJIMT Research Team (2012) argued that organisational restructuring includes decentralization of authority, development of teams, and downsizing of employment.

2.2.3.10 **Transformation through Technology and Atomisation** of many processes has also impacted on the reduction of production costs and improvement in quality of final produced products. The introduction of information technology has brought fundamental changes in the way organisations conduct their business (Guillemette & Pare, 2012). Hill and Collins (2000) argued that new technology have impacted on levels of global competition, making some business environments complex, turbulent and unpredictable.

2.2.4 **Challenges and Reasons for OT Failure**

Cao, Clarke and Lehaney (2000) argued that an everlasting change in organisational behaviour needs subsequent changes in the structural composition.

2.2.4.1 **Management’s role**: Organisational transformation usually emanates from the top leadership and the actual goal of transformation needs to be cascaded downwards by senior/line managers to employees in their respective departments. The major task for managers in transition is to deal with employees’ emotions which they rarely manage in their day-to-day operations (GJIMT Research Team, 2012). They need to invest in the future by empowering, motivating and enabling the employees. Gilley, Gilley and McMillan (2009) added that management need to coach, communicate, employee involvement, motivate, rewarding, promote team work. Management are the initiators of transformation and if they lose interest, the employees will not take them seriously. Transformation that is unsuccessful shows the employees that the management has failed to manage the organisation.
2.2.4.2 **Employee involvement:** During transformation, planning and implementation communication should be sent to every employee in the organisation to avoid challenges and failure of the planned process. Management needs to educate and encourage the entire organisation employees to participate in the transition as it involves alteration in behaviour patterns, work norms, systems and cultural norms. Employees resist transformation due to various reasons in which GJIMT Research Team (2012) grouped it into four categories: psychological, materialistic, employees’ constant capabilities and employees concern for the firm.

2.2.4.3 **Poor project planning:** In transition there are two conflicting processes in which management is caught in between; they want to cut costs while on the other side transition requires more resources for it to be successful. Many companies have failed to yield results from transformation because of complex change management (GJIMT Research Team, 2012). This process should be well planned and led.

2.2.4.4 **Time management:** The Change process usually takes time and tasks need to be performed timeously. If they are performed simultaneously, management will not be able to review their progress hence recommendations and explore new behaviours will be omitted (GJIMT Research Team, 2012). GJIMT Research Team (2012) concluded that change commences with behaviours and decisions of individual as well as the organisation.

2.2.5 **Enabling Organisational Transformation**

Chiloane-Tsoka (2013) stated that strategies to overcome resistance to change are as follows: participation and involvement, facilitation and support, negotiation and agreement, manipulation and co-operation and coercion. To enable OT, the boards of companies should remove blockers, rotate managers, and give a chance to young management with different vision, who do not have company heritage. GJIMT Research Team (2012) argued that not all from the past is should be thrown away and it varies from organisation to organisation. This varies from leadership style, leverage customer relationships, a strong R&D department, or the latent enthusiasm of organisational members for participating in new initiatives.
Many authors have argued that for OT to be successful it needs to be supported by legitimate strategic thinking and planning, innovation and creativity, capacity building and training of employees, managing resistance to change, strategic communication, restructuring and reengineering, enabling change through deployment of change agents, building trust, personal productivity and wellness of employees, stakeholder management, diversity management and emotions management during transformation, effective organisation transition models and strategy, transformational leadership and planning (GJIMT Research Team, 2012). There are many change theories like Lewin’s change management theory, Beckhard and Harris’s change formula, Kreitner and Kinicki’s systems model of change (Viljoen-Terblanche, 2008), Ulrich’s Seven-Step Model (Gilley, Gilley, & McMillan, 2009) and the eight step change phase model (Kotter, 2007) as summarised in Table 2.1.

Business transformation reinforces agility, enhances creativity and information sharing, improves processes, and most notably increases collaboration among users. Businesses that master the art of transformation delight their clients, increase value for their shareholders, and do greater good for society at large. No matter how major or how critical the challenge, business transformation with the right approach enables companies to successfully reinvent themselves and succeed with a better synchronized set of resources: people, processes, and technology.

Tan (2006) argued that change is becoming inherent and an integral part of the organisational life. Organisational changes have caused several emerging trends which are globalisation, diversity, and flexibility, flattened and networked organisations. Emerging trends have now created tensions for management and employees in the business world. The current opportunities and threats are outcomes from these tensions. Management are presented with the task to manage these tensions as they cannot be solved. Sammut-Bonnici and Wensley (2002) concluded that recent development in complex adaptive systems provide new explanations to these trends and tensions in organisations.
Table 2.1: Eight steps to transform your organisation

<table>
<thead>
<tr>
<th>Stage</th>
<th>Action needed</th>
<th>Pitfalls</th>
</tr>
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| Establish a sense of urgency | - Examine market and competitive realities for potential crises and untapped opportunities.  
- Convince at least 75% of your managers that the status quo is more dangerous than the unknown.                                                                                                                                                  | - Underestimating the difficulty of driving people from their comfort zones.  
- Becoming paralysed by risks.                                                                                                                                                                                                                           |
| Form a guiding coalition     | - Assemble a group with shared commitment and enough power to lead the change effort.  
- Encourage the group to work as team from normal hierarchy.                                                                                                                                                                                                 | - No prior experience in teamwork at the top.  
- Relegating team leadership to HR, quality, or strategic-planning executive rather than senior line manager.                                                                                                                                        |
| Create a vision              | - Create a vision to direct a change effort.  
- Develop strategies for realising that vision                                                                                                                                                                                                                     | - Presenting a vision that's too complicated or vague to be communicated in five minutes.                                                                                                                                                                     |
| Communicate the vision       | - Use every vehicle possible to communicate the new vision and strategies for achieving it.  
- Teach new behaviours by the example of the guiding coalition.                                                                                                                                                                                                     | - Under communicating the vision  
- Behaving in ways antithetical to the vision                                                                                                                                                                                                                  |
| Empower others to act on the vision | - Remove or alter systems or structures undermining the vision  
- Encourage risk taking and non-traditional ideas, activities, and actions.                                                                                                                                                                                      | - Failing to remove powerful individuals who resist the change effort                                                                                                                                 |
| Plan for and create short-term wins | - Define and engineer visible performance improvements.  
- Recognise and reward employees contributing to those improvements.                                                                                                                                                                                              | - Leaving short-term successes up to chance  
- Failing to score successes early enough (12-24 months into the change effort)                                                                                                                                                                             |
| Consolidate improvements and produce more change | - Use increased credibility from early wins to change systems, structures, and policies undermining the vision.  
- Hire, promote, and develop employees who can implement the vision.  
- Reinvigorate the change process with new projects and change agents.                                                                                                                                                                                                 | Declaring victory too soon – with the first performance improvement  
- Allowing resistors to convince ‘troops’ that the war has been won                                                                                                                                                                                                  |
| Institutionalise new approaches | - Articulate connections between new behaviours and corporate success  
- Create leadership development and succession plans consistent with the new approach.                                                                                                                                                                               | - Not creating new social norms and shared values consistent with changes  
- Promoting people into leadership positions who don’t personify the new approach.                                                                                                                                                                          |

Source: Kotter (2007, p.1)
2.3 COMPLEX ADAPTIVE SYSTEMS

Complex adaptive systems are special cases of complex systems that are complex and dynamic networks of interactions and relationships not aggregations of static entities. They are adaptive in that their individual and collective behaviour changes as a result of experience (Juarrero, 2000). In attempting to understand complex adaptive systems, Brown (2008) stated that it is about embracing a new way of thinking that involves a departure from traditional methods used to understand events such as considering the external environment as relatively static. A system composed of many intricate parts is merely complicated unless the interaction of those parts is rich, dynamic, and non-linear leading to a change in their organisation over time (Tredinnick, 2009). Brown (2008) argued that CAS are not complicated, which refers to a state where patterns cannot be made but details, parts, and subsystems can be understood, whereas complex refers to a state where the details cannot be understood but the whole, or can be understood by the ability to make patterns. Maylor, Vidgen and Carver (2008) defined complex as “composed of many interconnecting parts” and complicated as “composed of many elaborate interconnecting parts.”

There is no clear definition of a CAS as this concept covers a large range of fields and in many cases, different researchers in the field, try to define CAS in their own terminology and many uses CAS and complexity interchangeably. Palmberg (2009a) stated that concepts that deal with CAS have many names: chaos theory, complexity theory, complexity science and systems thinking. Sherman and Shultz (1998) defined complex adaptive systems as;

“a complex adaptive system (a business, a project team, a network of people) is composed of interacting “agents” (employees, managers, board members, customers, suppliers) following rules (blueprints, values, ethics, laws, economics, organisational or political, friendship, profit maximizing), exchanging influence (goods, ideas, money, trust) with their local and global environments and altering the very environment they are responding to by virtue of “simple” actions.”
John Holland’s (1995) definition

“Complex adaptive systems are systems that have a large numbers of components, often called agents that interact and adapt or learn.”

The author further described CAS as a system that emerges over time into a coherent form, adapting itself without any singular entity deliberately managing or controlling it. Cooke-Davies, Cicmil, Crawford and Richardson (2007) defined complexity as “the study of how order, structure, pattern, and novelty arise from extremely complicated, apparently chaotic, systems and conversely, how complex behaviour and structure emerges from simple underlying rules” (p. 52).

As it can be seen, CAS is defined in many different ways. Mitchell (2009) argued that there is not even a shared understanding of the core ideas that underlie the description of most complex systems and concepts such as self-organisation, adaptation, chaos and emergence are appealing and widely used.

For the purpose of this research I will use the following definition: ‘CAS are open systems in which different elements interact dynamically to exchange information, self-organize and create many different feedback loops, relationships between causes and effects are nonlinear, and the systems as a whole have emergent properties that cannot be understood by reference to the component parts (Barnes, Matka, & Sullivan, 2003).

Examples of complex adaptive systems include the stock market, social insect and ant colonies, the biosphere and the ecosystem, the brain and the immune system, the cell and the developing embryo, manufacturing businesses and any human social group-based endeavour in a cultural and social system such as political parties or communities, each of which, although driven by the aggregated behaviour of individual elements seems to function in coherent and motivated ways (Tredinnick, 2009). There are close relationships between the field of CAS and artificial life.

The agents in the system are all the components of that system and they are all interdependent (Palmberg, 2009b). In organisations agents are people, teams, departments, components, machinery, subsystems, suppliers, customers. These agents interact and connect with each other in non-linear, unpredictable and
unplanned ways. They modify their behaviour based on information they receive, they are diverse, which is a source of creativity and no agent knows the system but it pays attention on its local environment (McDaniel Jr, 2007). The author indicated that there is no “chief agent” who directs the behaviour of all of the other agents because no agent has the capacity to oversee the complexity in the whole system.

But from this mass of interactions regularities emerge and start to form a pattern which feeds back on the system and informs the interactions of the agents. These interactions can be illustrated in Figure 2.1.

![Figure 2.1: Simple representation of the components of a CAS](image-url)

**Source:** Fryer, (n.d.) and The Health Foundation, (2010, p.8)

For clarity, in the diagram above, the regularities, pattern and feedback are shown outside the system but in reality they are all intrinsic parts of the system.

Although Bovaird (2008) highlighted that complexity theory has already yielded some important insights, even in its current crude stage of application, however, some authors such as Brownlee (2007) argued that a unified theory of such complex systems still appears to be a long way off. Kleiman (2011) concluded that
CAS due to their dynamic and sometimes chaotic and random self-interaction cannot be reduced to simple parts, which relate to each other in very predictable ways.

The literature on CAS has a range of properties, approaches, applications in many fields and the implications to management that will be presented in greater detail below. Although many authors in CAS have classified it in different manners, authors such as Levin’s three distilled properties, Holland’s four properties and Arthur’s six properties (Brownlee, 2007), all of them have only described the major characteristics not the minor ones. However the literature reviewed contains many variations and differences in features, classification, behaviour and names. The researcher found that the framework used by Palmberg (2009a) captures most of the properties and approaches from various researchers. The author had two classifications of CAS namely (a) properties of CAS (Figure 2.2) and (b) approaches for managing CAS (Figure 2.4). The literature on CAS shall be reviewed based on classification by Palmberg (2009a) with little additions from other authors where the framework seems deficient.
2.3.1 Properties of complex adaptive systems

The properties of CAS will be analysed as shown in figure 2.2.

Figure 2.2: An overview of the properties of CAS
Source: Palmberg (2009a, p. 3)

2.3.1.1. Interdependent agents (Connectivity): Connectivity is critical if agents are going to learn from one another. In an organisational or network setting, connectivity can be understood simply as communication (Mischen & Jackson, 2008). The ways in which the agents in a system connect and relate to one another is critical to the survival of the system, because it is from these connections that the patterns are formed and the feedback disseminated. Given the number and variety of these relationships, they extend beyond simple feedback into higher order, non-linear processes not amenable to modelling with traditional techniques (Manson, 2001).

Agents are not only connected in a CAS, they are interdependent (Mischen & Jackson, 2008) because each part in the system can affect the behaviour or properties of the whole (Palmberg, 2009a). Hornstein (2005) further went on to
add that the interactions can include attraction, combat, mating, communication, trade, partnership, or rivalry.

CAS is defined more by relationships and generally they are more important than the agents themselves (Manson, 2001 and Storey & Butler, 2012). Understanding and tracing the relationships of a single entity is difficult, while tracing them in an entire system verges on the impossible (Manson, 2001). Agents are diverse from one another, across roles and same roles, and it is necessary for quality relationships to be enacted, and plays out on how they perceive the world and events, and how they solve problems (Jordan, Lanham, Anderson, & McDaniel, 2010). Norberg (2004) concluded that species traits and trait diversity are of more importance than species numbers or taxonomic identity.

2.3.1.2. Non-linearity: A CAS does not have to be perfect in order for it to thrive within its environment (Blomme, 2012). Because behaviour in a complex system stems from the complex interaction of many loosely coupled variables, the system behaves in a non-linear fashion (Choi, Dooley, & Rungtusanatham, 2001). Non-linear relationships are relationships in which a change of given magnitude in the input to the system is not matched in a linear fashion to a corresponding change in output. However a direct correlation between the size of cause and the size of the corresponding effect is not guaranteed. A complex system can be hypersensitive to small changes in its environment. A simple adaptive response, which usually leads to a simple corrective action, can lead to a catastrophic outcome (the so-called “butterfly effect”).

It only has to be slightly better than its competitors and any energy used on being better than that is wasted energy (Blomme, 2012). A complex adaptive systems once it has reached the state of being good enough will trade off increased efficiency every time in favour of greater effectiveness. Although Senge (1990) further went on to say if you continue to push harder, the harder the system pushes you.

Houston and Rothschild (2001) stated that in nonlinear and evolutionary systems, the search for cause-effect relationships is replaced by an examination of relationships that looks beyond the superficial and apparent order of the universe.
to reveal a hidden dimension, one that contains an underlying order and structure that is unobservable when reduced to its parts.

2.3.1.3 Not predictable in detail: The inability to determine the future behaviour of a complex system in an exact manner does not imply that the future is random (Choi, Dooley, & Rungtusanatham, 2001). McDaniel, Lanham and Anderson (2009) argued that CAS are unique and nonrepeating, and if researchers and management practitioners are to treat them as routine they are likely to miss their unique nature. It is true that small changes may lead to drastically different future paths; however, the same characteristic pattern of behaviour emerges despite the change. One finds that systems will tend to be involved in certain prototypical ways and, thus, our predictive capacity, although limited to the exact prediction at a future point in time, can benefit from the knowledge of these patterns.

Choi, Dooley and Rungtusanatham (2001) gave an example stating that, even though its exact nature is not predictable, the boom-and-bust characteristic of a business cycle is a well-accepted pattern of behaviour embedded in the economy. Likewise, it has been observed across a large number of diverse types of systems that the frequency that events of a given magnitude occur follows an inverse power law. Various statistical techniques exist that enable us to determine what types of long-term, underlying patterns of behaviour (sometimes called attractors) are embedded within the system.

Even if initial conditions and generative mechanisms are exactly specified (which they cannot be), prediction of the future often becomes fruitless as specification errors grow exponentially as one progresses into the future (Peitgen et al., 1992 as cited in Choi, Dooley & Rungtusanatham, 2001). The behaviour of a complex system cannot be written down in closed form; it is not amenable to prediction via the formulation of a parametric model, such as a statistical forecasting model.

2.3.1.4. Emergence: Emergent properties are intrinsic to a given system, and invariably reflect real physical phenomena (Halley & Winkler, 2008). Rather than being planned or controlled, the agents in the system interact in apparently random ways (Jones & Brown, 2011 & Blomme, 2012) which might be simultaneous and parallel actions of agents within the system itself (Choi, Dooley & Rungtusanatham, 2001) and change the behaviour of the agents (The Health
Foundation, 2010). Stacey (1996) added that global patterns cannot be reduced to individual behaviour. Emergent phenomena may lie beyond our ability to predict or control disappointment or annoyance especially when caused by failure or mistake (Manson, 2001). The author argued that as we increasingly discover to our chagrin, any single change to an ecosystem can have far-reaching, large-scale effects due to not understanding emergence from complexity. Seel (2006) believed that for emergence to occur there should be seven conditions namely; connectivity, diversity, rate of information flow, lack of inhibitors/ anxiety containment, proportionate power, identity maintenance, good boundaries, intentionality, positive emotional space and watchful anticipation. McCarthy, Rakotobe-Joel and Frizelle (2000) concluded that emergence is an important characteristic of CAS as it allows the identification of new opportunities although McDaniel Jr (2007) highlighted that it is the key source of novelty and surprise in CAS.

**2.3.1.5. Edge of Chaos/ Complexity:** This theory assumes a set of starting principles or rules, or initial conditions, on which is patterned a long-term system behaviour that reflects the system's almost infinite choices of behaviour within defined boundaries. These order-generating rules permit self-organisation to take place and allow some systems to remain at the edge of chaos, whilst others fall over the edge (Burnes, 2004). Complexity theory is not the same as chaos theory, which is derived from mathematics. But chaos does have a place in complexity theory in that systems exist on a spectrum ranging from equilibrium to chaos. Fuller and Moran (2001) shared the same sentiments in that complexity is neither the study of chaos (which is a result of entropy), nor of randomness. It is a study of changing patterns of order, self-organisation and constrained diversity. A system in equilibrium does not have the internal dynamics to enable it to respond to its environment and will slowly (or quickly) die. The Figure 2.3 below done by Kleiman (2011) illustrates how a system works between chaos and stasis (static), and the edge of chaos at which the author labelled the ‘zoo’ or ‘zone of optimal operation’.

A system in chaos ceases to function as a system. Several authors gave the condition different names such as bounded instability, far-from-equilibrium and chaordic (Burnes, 2004). The most productive state is to be at the edge of chaos
where there is high levels of responsiveness, maximum variety, creativity, vitality and growth, leading to new possibilities (McCarthy, Rakotobe-Joel, & Frizelle, 2000; Lansing, 2003; Burnes, 2004 and Grus, Crompvoets & Bregt, 2010). Kleiman (2011) concluded that at the edge of chaos is where the levels of energy and emotion are high; risk taking, excitement and exhaustion co-exist in a commotion of activity. It is characterised by encounters with uncertainty, anxiety, doubt, chance, error and muddling through.

![Diagram: Between Stasis and Chaos](image)

**Figure 2.3: Between Stasis and Chaos**  
Source: (Kleiman, 2011) page 62.6

### 2.3.1.6. Self-Organising:
Stacey (1993, p. 240 as cited in Bovaird, 2008) defined self-organisation as “a process in which the components of a system in effect spontaneously communicate with each other and abruptly cooperate in co-ordinated and concerted common behaviour”. Cilliers (1998 as cited in Grus, Crompvoets, & Bregt, 2010), defines self-organisation as a process in which a system can develop a complex structure from fairly unstructured beginnings. The process occurs under the influence of both the external environment and the history (memory) of the system. There is no planning or managing, and no hierarchy of command and control in a complex adaptive system, but there is a constant re-organising to find the best fit with the environment. The system is continually self-organising through the process of emergence and feedback (Lansing, 2003, Holbrook, 2003, and Grus, Crompvoets, & Bregt, 2010). The ability of CAS to develop new system structure by themselves is a result of their
internal constitution and not as a result of external management. Self-organisation in human systems is spontaneous group activities, like revolts, and social movements, group dynamics, and open market economics (Choi, Dooley, & Rungtusanatham, 2001). Burns (2005) concluded that creativity, growth and useful self-organisation are at their optimal when a complex system operates at the edge of chaos.

2.3.1.7. Distributed control: The property of distributed control is opposite to hierarchical central authority, which directs all agents (Palmberg, 2009a). “Just because no one is ‘in control’ does not mean that there is no control. In fact, all healthy organisms have processes of control.” (Senge, 1990, p. 292 as cited in Palmberg, 2009a). Different hierarchical levels of CAS have a similar structure (the ‘fractal building’) (Grus, Crompvoets, & Bregt, 2010). This feature can be found in organisations where the same characteristics (e.g. functional dependencies, relations between employees, policies and rules) can be seen from the bottom to the top of the management chain.

2.3.1.8. Co-evolution: All systems exist within their own environment and they are also part of that environment. Therefore, as their environment changes they need to change to ensure best fit. But because they are part of their environment, when they change, they change their environment, and as it changes they need to change again, and so it goes on as a constant process (Hall & Clark, 2010). (Perhaps it should have been Darwin’s Theory of Co-evolution). Some theorists draw a distinction between CAS and complex evolving systems. Where the former continuously adapt to the changes around them but do not learn from the process. And where the latter learn and evolve from each change enabling them to influence their environment, better predict likely changes in the future, and prepare for them accordingly (Hall & Clark, 2010). The Health Foundation (2010) argued that others in this field do not draw any distinction and instead suggest that ‘adaptive’ systems are also able to learn. This research is based on CAS that are adaptive, learn and evolve.

2.3.1.9. Iteration: Brown (2004) highlighted that these structures require disequilibrium for the system to grow. The author suggested that the system is far from equilibrium, singular or small influences can have enormous impact. Grus,
Crompvoets and Bregt (2010), and Brown (2004) concurred in that it is not the law of numbers or critical mass that creates change, but it the butterfly effect. Grus, Crompvoets and Bregt (2010) gave an example of changes on to a single legal document may have a major effect on many organisations, or even on society as a whole. Jordan, Lanham, Anderson and McDaniel (2010) concluded by saying instead of focusing on averages and standard deviations, researchers should consider outliers because it is often the exceptional that drives change.

2.3.1.10. Nested Systems: Most systems are nested within other systems and many systems are systems of smaller and different systems (Holbrook, 2003, and Hall & Clark, 2010). An example in self-organising above and consider a construction organisation is itself a system with its staff, government, customers, suppliers, and competitors. It also belongs to the construction system of that town and the larger construction system of that country. It belongs to the construction system locally and nationally and the economy system locally and nationally, and probably many more.

2.3.1.11 Adaptability: As part of the wider environment, CAS are able to adjust and adapt themselves to external influences (Grus, Crompvoets, & Bregt, 2010). For example, increasing concurrence in the sector may force a particular company or organisation to adapt by changing its organisational model to a more efficient one. However, system adaptability may also be a result of internal factors, like the operation of a system’s memory: the system may change as it learns from its own experience. According to Holland (1998), adaptation can also be described as a change in the system’s structure (strategy) resulting from the system’s experience.

2.3.1.12 Sub optimal: CAS does not have to be perfect and some suggested that any energy used on being much better than alternatives is wasted energy (The Health Foundation, 2010).

2.3.1.13 Requisite variety: CAS thinking suggests the greater the diversity within the system, the stronger it is, and the more likely it is able to create new possibilities and co-evolve (The Health Foundation, 2010) but can be a source of communication problems (McDaniel, Lanham & Anderson, 2009). Learning is not one-dimensional, focusing on uncertainty reduction, but it also incorporates learning aimed at uncertainty absorption.
2.3.1.14 Learning: According to Jordan, Lanham, Anderson and McDaniel (2010), patterns of learning vary with patterns of relationships and this results from variation in the dynamics of CAS. The author explained that learning agents or a top-down approach to teaching people or giving them information may not lead to proportional increase in knowledge or to the intended behaviour changes. Learning requires a confluence of events. Agents need to notice things and discuss about those irregularities and making learning dependent on local interaction and the relationship in the system. The authors concluded that it is difficult to develop intuitions about diverse learning agents who influence and are influenced by their nonlinear relationships. They also concluded that interaction and learning among diverse agents cannot be recognised as reducing or increasing agent diversity.
2.3.2 Approaches for managing complex adaptive systems

2.3.2.1. Visioning: If any one idea has inspired organisations, it is the capacity to hold a shared picture of the future that seeks to be created (Senge, 1990 as cited in Palmberg, 2009a). For the vision to be realised, was broken down into strategic plans and action plans. Palmberg (2009b) argued that strategic plans and action plans should be replaced by simple documents that show the direction of the organisation. Vision with minimum specification generates a shared image of the desired future of the system and it encourages flexibility, adaptability and creativity. The agents become more active in the process.

2.3.2.2. Attractors: It is argued that there is no such thing as resistance – there is only attraction (Palmberg, 2009a). To make something happen, one has to create stronger attractors than the ones in place. Senge (1990, p. 95 as cite in
Palmberg, 2009b) stated that “do not push growth, remove factors limiting growth”. Zimmerman et al. (1998, p. 12 as cited in Palmberg, 2009b) suggested that it is important “to move the natural energy in the system rather than to fight against it”.

2.3.2.3. Simple Rules: Complex adaptive systems are not complicated and according to Innes, Campion and Griffiths (2005) they can rise from simple rules particularly when they are in small number of agents. The author called it simple complexity. The emerging patterns may have a rich variety, not deterministic and not necessarily predictable. A classic example is that all the water systems in the world, all the streams, rivers, lakes, oceans, waterfalls etc. with their infinite beauty, power and variety are governed by the simple principle that water finds its own level (Lansing, 2003, and Grus, Cromptvoets, & Bregt, 2010).

2.3.2.4. Experimentation and reflection: While the traditional approach of problem-solving is to start with an extensive analysis of the problem, the problem-solving approach when managing CAS, is to experiment; to act and learn, instead of planning, try to analyse until a certainty is reached and then act.

Palmberg (2009a) argued that organisations should be managed through several small experiments, reflect carefully on what happens and gradually shift with time and pay attention towards those things that seem to be working every well. The author added that this is a key skill in CAS and reflection is learning from experimentation. Knowledge shared through learning continuously increases the learning of an organisation to higher levels.

2.3.2.5. Chunking: This approach deals with new or solves a problem that is complex in nature and should be solved through simple experiments (Palmberg, 2009a). Chunking builds good complex systems by dropping elements that do not work and linking new pieces that work together. The author suggested that interconnections may bring unpredicted emerging behaviour.

2.3.2.6. Feedback: The system has a tendency to use its own output to adjust its inputs and processes (Grus, Cromptvoets, & Bregt, 2010). The author stated that the system’s behaviour emerges because many of the simple components interact simultaneously therefore there is a constant exchange of information and needs between the components and the actors in the system. They are two types of
feedback loops positive (mutual reinforcement) and negative (destabilising or mutual attention) (Mischen & Jackson, 2008). The feedback loops can be negative or positive and evaluation process is one of the examples. Positive feedback can facilitate change and adaptation of the system and negative feedback can discourage programme participants.

2.3.2.7. Tension: Just because the approach of simple rules is suggested above, it does not mean that everything should be simplified (Palmberg, 2009a). In fact, just the opposite is required. Building tension can be done by paying close attention to unexpected interactions between individuals that have the potential to create new meaning and that will allow new questions to emerge and re-emerge (McDaniel Jr, Lanham, & Anderson, 2009).

2.4 THE LINK BETWEEN ORGANISATIONAL TRANSFORMATION AND COMPLEX ADAPTIVE SYSTEMS

2.4.1 Applications of CAS in organisations

Many researchers, academics and practitioners argued that organisations are complex adaptive systems or function as one not really machine like (Burnes, 2004; Beinhocker, 2006 and McDaniel Jr, 2007). Mason W. H. (2006) observed that CAS provides organisations with opportunities to create new markets, establish new ways to spread emerging knowledge and enabling the organisation to respond faster and better to on-going change. Edgren and McDaniel, Lanham and Anderson (2009) highlighted that in understanding key properties of CAS it is helpful to think about problems of research. For instance, understanding the notion of self-organisation helps one recognize the fact that seemingly insignificant but highly critical aspects of organisations can easily be overlooked. According to Diment, Yu and Garrety (no date) one approach to CAS is to use biological ecosystems to illuminate organisational processes and according to Dooley (1997) is perhaps the most widely cited example of this approach.

Kleiman (2011) stated that the greatest challenge that chief executive officers (CEOs) are facing nowadays is dealing with or managing complexity and they identified three factors that might provide solutions namely in creativity, operational dexterity, and reinventing customer relationships. In the same context
other authors have added the need for balanced distribution of power and an orientation towards community service (Burnes, 2004) and the importance of quality assurance (Palmberg, 2009a). How to manage complexity instead of reducing it is a challenge for the management of contemporary organisations.

McCarthy, Rakotobe-Joel and Frizelle (2000) argued that organisations need to learn and adapt, and constantly revising and reorganising its agents as experience is gained from past interactions. The author added that learning leads the system to develop strategies for the future by changing its plans. The author concluded that without this adaptability the system can have a natural death. Burnes (2004) added that organisations that pursue continuous innovation are subjected to transformation of some sort and it is necessary for survival. The transformation is not through innovation alone but through watching what others are doing on competition and adapting the world’s best practice in all aspects of its business operations (Muneera, Anuar, & Zulkiflee, 2013). Many authors have also argued that project management (PM) in recent times has been used to translate corporate strategies into actions (Golafshani, 2003; Aubry, Richer, Lavoie-Temblay & Cyr, 2011; GJIMT Research Team, 2012 and Muneera, Anuar & Zulkiflee, 2013). According to Horton (2011) most innovative companies do not wait for sales drop or reduction in profitability. They continue to look into ways that can transform and improve their organisations for long term success.

In research and development R&D, new-born ideas and technologies are usually weak; requiring much care and attention before they are able to meet market needs. However, each idea or technology has the possibility of becoming an innovation. In innovation every company tries to adapt its own ideas and technologies to the market in order to differentiate itself from other competitors and innovation can be viewed as complex adaptive systems. Burnes (2004) shared the same sentiments in that companies that pursue continuous innovation are operating at the edge of chaos and they are likely to succeed as they are constantly changing their normal operations and constantly risk falling over the edge. CAS tries to predict the future based on the system’s internal models and react not necessarily to the actual effects of the environment. Ishimatsu, Sugasawa and Sakurai (2004) stated that R&D activity of companies can be described as a complex adaptive system similar to biologic evolution, leading to a
variation in R&D activities. The authors concluded that innovation creation process model have three characteristics of a complex adaptive system namely variation, separation and interaction. McDaniel Jr (2007) gave examples of emergence in an organisation setting which are; improved product designs released through the diverse contribution from different departments and the dishonesty intensify within a work team, even though each group member is deemed trustworthy. Hundreds

Burnes (2004) indicated that Visa is a well known self-organizing company with customers nearing a billion in number from hundreds since 1970 and comprised of 20 000 financial institutions. A number of authors have argued that organisations need to promote change through self organisation as it enables growth, evolve with will and operate on democratic principles (Burnes, 2004). Operating these systems within the organisation boundaries of vision and culture, they can harness the power of creativity, evolution and free will. It can be seen that CAS require effective management that can promote open communication, organisational beliefs, strong values and guiding the company’s vision.

Manson (2001) highlighted that they are three different types of transition: self-organisation the property that allows it to change its internal structure in order to better interact with its environment. Second, dissipative when outside forces or internal perturbations drive it to a highly unorganised state before suddenly crossing into one with more organisation. The author gave an example of an introduction of new technologies, such as in the industrial revolution, which can spur radical change in the internal structure of an economy. Third, the term self-organised criticality ability of complex systems to balance between randomness and stasis. Instead of occasionally weathering a crisis, a system can reach a critical point where its internal structure lies on the brink of collapsing without actuality is a form of self-organisation where the rate of internal restructuring is almost too rapid for the system to accommodate but necessary for its eventual survival. This critical point is very difficult for companies to maintain (Geraldi, 2007).

Evolution is a historical process and it requires the acquisition and storage of knowledge in order for agents to make decisions (Mischen & Jackson, 2008). In
organisations, evolution is in the cultural, tacit and explicit knowledge of the individuals and information repositories of the organisation. On the other end Mason (2004) stated that up-side down, the organisations needs to embrace the revolution.

Choi, Dooley and Rungtusanatham (2001) gave an example of a large-scale change such as organisational restructuring may in fact lead to little change in the way organisational members carry out their activities, or a small change in the work policy may end up having an overarching outcome such as a labour–management dispute. Mason W. H, (2006) indicated that high functioning teams resulted from changes in decision making processes through chaos. Most successful leaders understood that teams are most important and especially the relationship between individuals and the organisation.

2.4.2 Application of CAS in Project management

Interests in project management (PM) are growing significantly; however, projects continue to fail at an astonishing rate despite increasing interests. Thomas and Mengel (2008) stated that the role of CAS within both our projects and project environments is gaining recognition within academics and management practitioners. Although PM is gaining some interests and application it still has not divorced from its roots in mechanistic thinking (Geraldi, 2007).

The project life-cycle of any project is unique and employees usually face diverse types of challenges (Geraldi & Adlbrecht , 2007). The authors stated that projects tend to emerge as chaotic systems especially as projects commences, the scope is still not clearly defined, project stakeholders are not sure of its feasibility, unsigned contracts, authority and responsibilities are not clearly defined, the new members of the project are still at the initial stage of team formation and are yet to discover the best way to cooperate. The success of construction projects depend on various factors namely project complexity, contractual arrangements, and relationships between project participants, the competency of project managers, and the abilities of key project members (Muneera, Anuar, & Zulkiflee, 2013). Geraldi (2007) argued that competitive advantage can be achieved if multi-projects organisational structures function at the edge of chaos.
The initial stages of a construction project have a lot of different stakeholders’ involvement from procurement, production and assembly, and there is need to decentralise authority and responsibility so that the manager will cope with the amount of work. The final stages of a project also require high coordination of tasks, companies on site and among members of the team although unpredicted issues always emerge on site (Geraldi and Adlbrecht, 2007). A complex system has path dependence and is highly sensitive to initial conditions. Maylor, Vidgen and Carver (2008) observed that projects take place in a historical context and its starting conditions cannot be calibrated precisely to be able to make reliable predictions especially trust among team members and relationship between stakeholders. During the life cycle of a project there is need to review the activities, critique some of the operations and introduce organisational change as the work increases from commencement (Maylor, Vidgen, & Carver, 2008).

Maylor, Vidgen and Carver (2008) in an attempt to produce a working model, synthesized complexity as comprising three factors: organisational complexity (the number of people, departments, organisations, locations, nationalities, languages, and time zones involved, level of organisational buy-in, authority structure), resource complexity (the scale of the project, often indicated by the size of the budget), and technical complexity (the level of novelty of any technology, system, or interface, and uncertainty about the process or the requirements).

Maylor, Vidgen and Carver (2008) used what they called MODeST (mission, organisation, delivery, stakeholders and team) to conduct their research on the structural and dynamic complexity elements that projects managers encounter when they execute projects (see Table 2.2 below).

Maylor, Vidgen and Carver (2008) noted that complexity in projects arise from external stakeholders have who an impact on the way projects are managed (e.g supplier); language used on projects affects the initial conditions, organisational structure and organisational changes during projects. The author concluded that for every structural element there is a corresponding dynamic element. Complexity arises from dynamics of individual structural elements being compounded by interactions with other structural and dynamic elements. The author gave an example of changes in the organisation where the project was conducted through
restructuring provided a complexity in itself but had a dynamic interaction with external stakeholders, resources and decision making/governance.

Table 2.2: Examples of MODEST structural and dynamic complexity elements

<table>
<thead>
<tr>
<th>Structural dimension</th>
<th>Dynamic dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission</td>
<td>Are the requirements clear? How frequently do the requirements change?</td>
</tr>
<tr>
<td>Organisation</td>
<td>Is there a mismatch between matrix structure of project and department structure of organisation? Is there on-going organisational restructuring that impacts the project?</td>
</tr>
<tr>
<td>Delivery</td>
<td>How well does the project team understand the project management methodology? Is a new PM methodology being introduced?</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>How many stakeholders are there? Are the stakeholders changing?</td>
</tr>
<tr>
<td>Team</td>
<td>Are the team members motivated? Is the level of motivation of team members changing?</td>
</tr>
</tbody>
</table>


The project managers also increase the complexity of the projects by not breaking down a project sufficiently or failing to recognise activity interdependences and unidentified stakeholders (Maylor, Vidgen, & Carver, 2008). The authors argued that the adaptive approach in PM has been borrowed from software project management though they differ from CAS principles in that entire projects should be broken down to smaller planning durations (i.e. 30 days). The project managers need to understand the salience (power, legitimacy, urgency) of different stakeholder groups and develop strategies for stakeholder management, practical techniques for identifying and communicating with stakeholders. The amount of interference and support (too much or too little) from senior management on projects increases the level of complexity that project managers experience.

Projects are vital for both revenue generating activities and organisational change. They are many established tools for managing projects but they are poor in dealing with variations in which each project pose (Maylor, Vidgen, & Carver, 2008). Many practitioners indicated that complexity is one of the reasons.

A virtual team has different organisational, stakeholder, and team complexities from a collocated team (Maylor, Vidgen, & Carver, 2008). Establishment of trust
is problematic in virtual teams especially when they have not worked together before. Maylor, Vidgen and Carver (2008) identified problems of management that are unique to virtual teams: delayed communication, misunderstanding arising from lack of response, lack of a shared context in which to interpret messages, and inability to monitor team members. Projects with such dynamic complexity will require managers who are able to deal with such dynamics.

Changes in a project are inevitable but the scale and frequency of change are important factors in what makes a project complex to manage. The dynamic elements of the project are managed through risk management, configuration management and change control, and however literature has shown that the nature of the change considered by existing approaches is limited, such that programmatic responses may be inappropriate. The limited nature and the interactions of such change with other changes and other structural elements cause further complexity. They showed that changes may elicit managerial responses that, although consistent with accepted practice, exacerbated issues in the form of a positive feedback loop. Critical success factors are important influence in project success (Golafshani, 2003 and Muneera, Anuar, & Zulkiflee, 2013). This was due to the complexity that arises within the organisation and application of OT through CAS has been the breakthrough for many organisations.

2.4.3 Application of CAS in Manufacturing Industry

A small number of authors have studied the application of CAS in the manufacturing organisation with the aim of continuously adapting to the ever changing environment (market, political, economic, etc.) and satisfy the ever complex buying behaviour of customers (McCarthy, Rakotobe-Joel, & Frizelle, 2000). The studies are still continuing because the industry is always changing and many solutions are being discovered. This field of study had many adaptive changes from industrial revolution, the quality revolution, the lean movement, the agile, the learning organisations and currently the complexity age that came to being because of the advancement in the manufacturing sector. According to McCarthy, Rakotobe-Joel and Frizelle (2000) complexity has always existed in many organisations including manufacturing sector and this has led to exploration in CAS.
Manufacturing organisations are CAS (Figure 2.5) and they consist of an integrated assembly of interacting elements or agents, relationship which brings together various elements \( (\text{Materials + Resources} = \text{Products}) \) (McCarthy, Rakotobe-Joel, & Frizelle, 2000). They are also designed to carry out cooperatively a predetermined objective or multiple of objectives that can result in conflict, which is the transformation of raw material into marketable products. These objectives can vary from one organisation to the other in the form of rules or procedures, processes and design specifications, time scales, quality and costs. McCarthy, Rakotobe-Joel and Frizelle (2000) summarised that manufacturing organisations are CAS whose productivity, adaptability and profitability are dependent on the role if its agents and the resulting rules and procedures.

Chaotic behaviour in manufacturing industry is a daily realization and some of the behaviour can be witnessed in rush orders for customers, strikes, supply chains, quality control issues, organisational change programs and machine reliability. Another example of chaotic behaviour is the rapid introduction of new products and quick responds to ever changing customer demands (manufacturing agility or responsiveness). Many manufacturing managers believe that the systems under their management are behaving randomly and out of control, but chaos theory can show that the system behaviour may have deterministic origins and processes which will show patterns of behaviour.
Similar to PM organisations, manufacturing organisations that exhibit self-organizing characteristics are operating within small stretches of the edge of chaos, that provides them with high responsiveness to their environments opportunities but not enough structure to act and perpetuate themselves (Figure 2.6).

The chaordic (volatile environment) nature of manufacturing industries calls that management should have a strategy at the edge of chaos compared to their desire of having stability and equilibrium in their factories. In a study done by Maclntosh & MacLean (2001) in declining manufacturing company provided evidence that decrease in market share and profitability was caused by order-generating rules and a rigid structure. Burnes (2004) concluded that the organisation should create appropriate order-generating rules (such as faster, better and cheaper) and implemented a new structure with greater freedom of self-organisation to its
constituent parts. McCarthy, Rakotobe-Joel and Frizelle (2000) summarized the characteristics of self-organisation as the spontaneous emergence of new structures and new forms of behaviour in open systems far from equilibrium. These systems include internal feedback loops.

Figure 2.6: Organisational responsiveness at the edge of chaos
Source: McCarthy, Rakotobe-Joel and Frizelle (2000, p. 570)

McCarthy, Rakotobe-Joel and Frizelle (2000) believed that there are five levels of self-organisation that exist as shown in Table 2.3 below. The table presents each level in terms of the nature of the processes taking place within the organisation, the ways in which decisions are made, the types of trade-offs taken into account during decision making, the attributes of the organisation’s knowledge and the types of agent available to the organisation.

Applications have shown that agent based approaches have the following advantages for enterprise integration and supply chain management in the form of increasing the responsiveness of the enterprise to the market requirements; involving customers in total supply chain optimisation, realising supply chain optimization through effective resource allocation, achieving dynamic optimization of materials and inventory management, realising total supply chain optimization
including all linked enterprises and increasing the effectiveness of the information exchange and feedback.

Table 2.3: Levels of self-organisations

<table>
<thead>
<tr>
<th>Self-organisation level</th>
<th>Process</th>
<th>Decisions</th>
<th>Trade-offs</th>
<th>Knowledge</th>
<th>Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consciously competent</td>
<td>Enterprise always improving</td>
<td>Value-based</td>
<td>Mutually beneficial</td>
<td>Evolutionary relationships</td>
<td>Dynamic and changing</td>
</tr>
<tr>
<td>Quantitatively guided</td>
<td>Based on statistics</td>
<td>Data based</td>
<td>Anticipated</td>
<td>History and simulation based</td>
<td>Quantified</td>
</tr>
<tr>
<td>Guided</td>
<td>Units that work</td>
<td>Rule based</td>
<td>Objective</td>
<td>History team based</td>
<td>Leveraged</td>
</tr>
<tr>
<td>Conscious</td>
<td>Loyal to team plan</td>
<td>Integrative</td>
<td>Visible</td>
<td>Team based</td>
<td>Common and public</td>
</tr>
<tr>
<td>Unconscious</td>
<td>Agent ad hoc</td>
<td>Reactive</td>
<td>Unclear</td>
<td>Personal</td>
<td>Private</td>
</tr>
</tbody>
</table>

Source: Kelly and Allison (as cited in McCarthy, Rakotobe-Joel and Frizelle, 2000, p. 571)

Genetic algorithms developed from the use of computers to solve computational problems and are based on the idea of a population-based search that mimics the principles of evolution and are thus a type of evolutionary computing. John Deere uses genetic algorithms in scheduling of transportation and delivery, factory scheduling and production capacity. Each solution in the algorithm was made up of manufacturing constraints such as: manufacturing hours available, sequencing/spacing, changeovers, parts/components availability, priority to orders (retail and earliest scheduled shipping date) and shipping off the end of the line.

The concept of fitness is the ability of a manufacturing organisation to survive by inheriting, imitating and searching solutions (of any form) that produce a desired outcome (measurable or immeasurable) such as profit, organisation goal and sustainable growth. The CAS do not offer a single approach to management but it takes variety of possible states and solutions that one could encounter during the manufacturing operations. They can also devise a contingency plan in the event of extraordinary strategic and operation matters.
2.4.4 Application of CAS in other fields

The field has spawned much work, such as Holland’s contributions of genetic algorithms, classifier systems, and his ecosystem simulator, which assisted in provoking the fields of evolutionary computation and artificial life. The framework of inducted principles derived from many natural and artificial examples of complex systems has assisted in the investigation in such diverse fields of study as social science (Langton 1995 and Janssen, 1998), economics (Arthur, Durlauf, & Lane, 1997), biology (Holling, 1992 and Levin, 1998), geography (Manson, 2001 and Messier & Puettmann, 2011), law (Hornstein, 2005) and business management theory- supply chain management (Wang & Wang, 2009). Brownlee (2007) cited some more examples that include: the development of embryos, function of the adaptive immune system, ecologies, genetic evolution, thinking and learning in the brain, weather systems, market economies, trading systems, social systems, cultures, politics, traffic systems, insect swarms, the flocking of birds, implementation of new ideas, the testing of scientific theories, and bacteria becoming resistant to an antibiotic. The Health Foundation (2010) added some applications of CAS in engineering where it is used to understand the structures and properties of objects and the people who use them; in management to investigate leadership styles, organisational change, team dynamics and sustainability; in urban planning to add value over traditional accounts of cities and healthy cities movements; in environmental sciences; education; health care and in transportation in the study of flow of traffic behaviour. The literature has shown that CAS are being researched and applied in many different fields to demystify the unknown behaviour of various systems in the environment.

2.5 SUSTAINABLE GROWTH

The most primary reason for existence of organisations is to have sustainable growth that will result in increased production efficiency and effectiveness hence realising high profitability. Stratton (2011) stated that sustainable competitive advantage can be achieved through OT that results in better customer operations, product operations, and better corporate operations that produce better profits, better returns on assets, and better positioning for the future.
Bottomley, et al. (2003) defined growth as *an increase in size or the importance of something* (p. 554) and *sustainable as able to continue over a period of time* (p. 1291). Hornby (2010) defined growth as *an increase in economic activity* (p. 660) and sustainable as *that can continue or be continued for a long time* (p. 1492). Huff, Floyd, Sherman, & Terjesen (2009) defined sustainable as capable of being maintained over time (p. 267). The literature has no clear definition of sustainable growth. However, the researcher managed to produce the meaning of sustainable growth from the definition of sustainable and growth. Combining the definition of sustainable and growth given by Bottomley, et al. (2003), sustainable growth can be defined as an increase in size and able to continue in economic activity.

If creativity is about change, transformation, and working at the edge of chaos, then, in order to occur in a meaningful or sustainable way, it needs to become an intrinsic part of a larger complex adaptive system in which the people, the systems, the procedures, the processes, and the environment are, in that clichéd phrase, fit for purpose or, better, and fit for creative purpose (Kleiman, 2011). The literature has shown that there are many ways of achieving sustainable growth through various strategies.

### 2.5.1 Strategies to deter entry

Hill and Jones (2010) stated that there are three methods of detering entry by potential rivals which are; product proliferation, price cutting and maintaining excess capacity.

Product proliferation – organisation uses this strategy and fill all market niches or catering to the needs of customers in the whole market segments.

Price cutting – organisation lowers their prices whenever there is a new entry so that they keep the new entrant out of business. Although this strategy does not work on new entrant that want to adopt new technology that will give cost advantange over existing player.

Maintaining excess capacity – Existing companies can produce more products than the current customer demand. This will lowers the prices of existing industries that will deter new entrant.
2.5.2 Strategies for managing rivalry

They are several strategies for managing rivalry namely price signalling, price leadership, non-price competition and capacity control.

Price signalling - Hill and Jones (2010) defined it as the process by which companies increase or decrease product prices to convey their intentions to other companies and so influence the way they price their products (p. 197).

Price leadership – weakest companies with high cost structure set the price and companies with lower cost structure they use the same price hence realising more profit. The disadvantage for this strategy is that companies with high cost structure realise profits and they will not implement strategies to become more productive and efficient. Although in the long run high cost producers are at risk of survival as new entrants will enter the market with new low cost technique.

Non-price competition – this strategy is achieved through product differentiation among rivalry within an industry. This is also used to deter new entry and to manage existing companies within the industry. Four non price competitive strategies that are available on product differentiation are namely; market penetration, product development, market development and product proliferation.

Capacity control – this arises when a company cuts prices and others in the industry might fear that they need to follow as they will have unwanted stocks. Technological developments usually cause companies to lower their prices and others normally follow causing price wars.

2.5.3 Five generic competitive strategies

They are many strategies that are used by organisations as shown above to have sustainable growth. These strategies will be to please customers, and strengthen the company’s offensive and defensive moves to counter the manoeuvres of rivals, its responses to shifting market conditions, its initiatives to strengthen its market position and competitive advantage (Thompson, Peteraf, Gamble, & Strickland III, 2012). The five generic strategies are as follows a low cost provider, a broad differentiation, a focused (or market niche) low-cost, a focussed (or market niche) differentiation and a best-cost provider. Kolter & Keller (2006) summarised the generic strategies as overall cost leadership, differentiation, and focus.
2.5.3.1 Overall cost leadership. The business works hard to achieve the lowest production and distribution costs so that it can price lower than its competitors and win a large market share. Firms pursuing this strategy must be good at engineering, purchasing, manufacturing, and physical distribution. They need less skill in marketing. The problem with this strategy is that other firms will usually compete with still lower costs and hurt the firm that rested its whole future on cost.

2.5.3.2 Differentiation. The business concentrates on achieving superior performance in an important customer benefit area valued by a large part of the market. The firm cultivates those strengths that will contribute to the intended differentiation. Thus the firm seeking quality leadership, for example, must make products with the best components, put them together expertly, inspect them carefully, and effectively communicate their quality.

2.5.3.3 Focus or market niche. The business focuses on one or more narrow market segments. The firm gets to know these segments intimately and pursues either cost leadership or differentiation within the target segment.

2.5.4 Other competitive advantage strategies

Baum, Ittner, Larcker, Low, Siesfeld and Malone (2000) stated that the key non-financial factors in creating value for modern corporations can be rank as follows customer satisfaction; ability to attract talented employees; innovation; brand investment; technology; alliances; quality of major processes, product or services and environmental performance. This section will omit some strategies such as customer satisfaction and brand investment in the review.

2.5.4.1 High performance or technology: Special levels of performance or service can be developed, that simply cannot be matched by other companies for example, through patented products or recruitment of especially talented individuals. The well-known global consulting companies and merchant banks operate in this way.

2.5.4.2 Quality: Some companies offer a level of quality that others are unable to match. For example, some Japanese cars have, until recently, provided levels of reliability that Western companies have had difficulty in reaching. Voerman (2003) argued that it is not the technical quality of the product that is important, but the consumer quality, reflected in keeping deadlines and the customer service.
2.5.4.3 **Service**: Some companies have deliberately sought to provide superior levels of service that others have been unable or unwilling to match. For example, McDonald’s set new levels of service in its fast food restaurants that were unmatched by others for many years.

2.5.4.4 **Vertical integration**: The backward acquisition of raw material suppliers and/or the forward purchase of distributors may provide advantages that others cannot match.

2.5.4.5 **Synergy**: This is the combination of parts of a business such that the sum of them is worth more than the individual parts. This may occur because the parts share fixed overheads, transfer their technology or share the same sales team.

2.5.4.6 **Culture, leadership and style of an organisation**: The way that an organisation lead; and how it trains and supports its members may be a source of advantage that others cannot match. It will lead to innovative products, exceptional levels of service, and rapid responses to new market developments and so on. Maguire (2010) urged that culture can be a barrier if it is not aligned to the new behaviours within an organisation. This area is more difficult to quantify than some of the other areas above, but this only adds to its unique appeal.

### 2.6 IMPLICATION OF CAS FOR MANAGEMENT

Burnes (2005) stated that the fastest-growing area of interest in recent years has been in the continuous transformation model, which seeks to apply complex adaptive systems to organisational transformation. The application of complexity theory is the only way that management can eradicate the problems that are facing modern organisations. Management also need to allow organisations to evolve in response to ongoing messages from customers (Mason, 2009). The author highlighted that the best management models do not adapt to the new economy; they emerge from it. It’s no longer the survival of the fittest but the arrival of the fittest.

**2.6.1 Organisational structure**

In CAS, management and change take on a new dimension, a fundamental shift in the role of management as these organisations are no longer linear but non-linear (Burnes, 2004). Complexity theory assumes that these fast-growing and
evolutionary organisations with bright, ambitious workers need more management rather than less control which was common in the traditional management. Like in OT and management change, many authors pointed out that self-organizing principle explicitly reject cause and effect, top-down, command-and-control styles of management (Burnes, 2004). The author emphasised that flat, flexible organisational structures and employee involvement is essential for sustainable growth and organisational success. Complexity will require managers to learn how to use small changes to create large effects as highlighted earlier, they need to rethink the use of bureaucratic management and learn the art of managing and changing contexts as well as promote self-organisation processes (Morgan G., 2006).

2.6.2 Reconfiguration of organisations

Destabilisation of organisations and the development of new skill of managing order and disorder are required from management (Burnes, 2004). The author urged that large-change programmes are difficult to predict their outcomes, control, plan and manage. The current environment requires managers to experiment and diverge from the existing views and even allowed to break rules and recognise that people need freedom to think innovatively and operate in a new system. The key to survival is to develop rules which are capable of keeping an organisation operating “on the edge of chaos”. Burnes (2005) concluded that if organisations are too stable, nothing changes and the system dies; if too chaotic, the system will be overwhelmed by change. In both situations, an organisation can only survive and prosper if a new, more appropriate and set of order-generating rules are established.

2.6.3 Human resources

CAS application calls upon managers to effectively manage personnel and job performance, reward and groom talented performers, develop business relationships and networks, resolve conflict, and divest the company of nonperformers who may be holding the company back from adapting well to emerging trends and technologies (Mason W. H., 2006). The author also highlighted that there are many complications in organisations such as in
teamwork and collaboration, with potential issues such as nonperforming team members, the effects of stress on job performance, personality conflicts and opposing business styles. Burnes (2005) highlighted that planned change is aimed at improving the operation and effectiveness of the human side of the organisation through participative, group and team based programmes of change. The author emphasised that unless employees have the freedom to act as they see fit, self-organisation will be blocked, and organisations will die because they will not be able to achieve continuous and beneficial innovation. Managers have pressures to remain innovative and flexible and this state needs a little bit of tension and instability (Tan, 2006). The tension and instability should be kept at levels that generate dynamic imagination without introducing stress to employees.

2.6.4 Organisational strategy

Mason W. H. (2006) argued that managers should see emergent strategy as a cure rather than a problem. The author stated that most organisations are not moving fast and traditional elements of strategy have lost their ability to build value. The author concluded that reinventing the future is the best way of predicting it. For management to have effective change through complexity they need to push control downwards into the system providing the employees with clear articulated vision and the information resources they need (Brown, 2008).

The time dependence of many CAS is crucial to the survival and success of the organisation (Van Bilsen, Bekebrede, & Mayer, 2010). Managers are required to intervene timeously as both postponed and immediate interventions may result in unpredictable reaction from adaptive agents. Naturally, agents self-organise themselves to solve issues in the system in a positive way and it can descend into chaos in a negative way. CAS theory argues that organisations are radically unpredictable and where even small changes can have massive and unanticipated effects, top-down change cannot deliver the continuous innovation which organisations need in order to survive and prosper (Burnes, 2005). The author stated that organisations can only achieve continuous innovation if they position themselves at the edge of chaos. The author concluded that the position can be achieved and maintained through self-organisation, which in turn depends on the possession of appropriate order-generating rules. Mason W. H (2006)
argued that once managers understand CAS they will learn that organisations can be left alone to function and organise themselves.

In CAS, managers should be creative, change originators and risk takers not managers of paper and forms (Geraldi, 2007). This will eliminate bureaucratisation and rigidities of organisations (Hodgson, 2004). Geraldi (2007) argued that flexibility and efficiency can be realised through the coexistence of order and chaos that enables organisations to deal with heterogeneous demands in the same period of time. CAS enhances dynamic capabilities in the form of support dealing with a changing span of challenges in the course of time.

2.6.5 Communication

Edgren and Barnard (2012) argued that managers should communicate the CAS approach to their employees so that they can all embrace the new concepts as it works best through interdependency. The author highlighted that if the message of transforming through CAS does not reach employees well, they will operate as separate bodies. Free flowing information is good for building and maintaining relationships between agents. The traditional managerial models are of little help as more planning, more meetings, more directives and more specification may be helpful when dealing with routine procedures but not in complexity. In complex and unforeseen needs a more flexible approach is crucial in management. The author concluded that simple rules are better than detailed specifications.

2.6.6 Organisational culture

Burnes (2005) argued that Lewin’s Culture-Excellence called for organisations to adopt flexible cultures which promote innovation and entrepreneurship and that encourage bottom-up, continuous and co-operative change. The CAS theory advocates to maintain top-down coercion, and rapid transformation, might also be necessary to create the conditions in which this type of approach could flourish. As many authors have indicated, organisation cultural shift takes a lot of time if at all management manages to change it (Edgren & Barnard, 2012). The authors added that the delays pile pressure on management as they are required to produce early results by stakeholders. The authors argued that this works against the application of CAS in organisations unless they can be presented with some
outcomes that they can claim as success. Brown (2008) argued that managers need to know what has made the organisation successful in the past so that they plan for the future of this dynamic environment.

2.7 CONCEPTUAL FRAMEWORK

The researcher developed the conceptual framework to summarise literature review and illustrated the concept in a diagrammatical representation presented in Figure 2.7.

Figure 2.7: Conceptual framework for OT through CAS

Source: Adapted and modified from Maguire (2010, p. 25)

An organisation operates in its ‘as is’ state within an internal context (within the company), which itself operates within an external context (the industry, country and the world). The internal and external changes stimulates decisions transform the organisation into future state by changing organisational elements (content) in some way (process) through feedback, learn, adjust and adapt. Enablers are new opportunities that arise from outside the company and barriers are events that deter the organisation from operating smoothly. The same conceptual framework will be applied to both ZENT’s two divisions under study Manufacturing and Projects Divisions.
2.8 CHAPTER CONCLUSION

The chapter presented a thorough review of the literature related to organisational transformation, complex adaptive systems, the link between organisational transformation and complex adaptive systems, implications of both organisational transformation and complex adaptive systems to management and sustainable growth. The topics in the literature review were based on the research objectives and they were answering the research questions in chapter one. The literature has shown that there is a link between organisational transformation and complex adaptive systems. The use of complex adaptive systems as a transformation strategy has a lot of implications on management. The preceding chapter will elaborate research methods and methodologies that will be used to answer the research questions in chapter one.
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

Chapter two has given a contemporary critical debate on the concepts of organisational transformation and change, complex adaptive systems, sustainable growth, and the implications of organisational transformation and the implications on management. This chapter outlines the systematic procedures and methodologies that were followed in this research to achieve the intended research objectives set out in chapter one.

3.2 RESEARCH DESIGN

Research design is a blueprint for fulfilling objectives and answering questions (Cooper & Schindler, 2011, p. 87). It is a general plan of how you will go about answering your research questions (Saunders, Lewis, & Thornhill, 2009, p. 136). The framework of references have three dimensions: the scale of data collection, the use of time order and the use of inter-group comparisons or the comparative dimension (Kelly, 2011). The researcher used the conceptual framework to obtain the research objectives and answering the research questions. The research was done in five months, seventy three questionnaires were sent out to Manufacturing Division, Projects Division and Head Office, and some few questionnaires were sent to employers of ZENT but not in the above mentioned divisions. The research did not require money as the researcher worked in the same organisation that was researched. The research was conducted in an organisation that was located in one industrial area and located in Harare, Zimbabwe. The researcher did not find difficulty in searching for data as the study was approved by management and employees.
3.3 RESEARCH PHILOSOPHY/APPRAOCH

Research philosophy relates to the development of knowledge and the nature of that knowledge (Saunders, Lewis, & Thornhill, 2009, p. 128). Research philosophy is grouped in three ways of thinking, epistemology, ontology and axiology. Epistemology is concerned with what constitutes acceptable knowledge in a field of study. Ontology is a branch of philosophy which is concerned with the nature of social phenomena as entities. Axiology is a branch of philosophy that studies judgements about value. The literature has shown that organisational transformation strategies using CAS or complexity theory is very little. The researcher saw it fit that an interpretivist or phenomenological approach be used in order to develop an understanding of these organisational transformation strategies. However, an inductive approach was used for the research.

3.4 RESEARCH STRATEGY

A research strategy is a collection of philosophical and theoretical commitments that may influence decisions made about the research design and the choice of specific methods of data collection and analysis (Kelly, 2011, p. 19). The research strategies are many and varied; they range from experiments, census survey, case study, ethnography, archival, grounded theory and action research. However, for purposes of conducting this research the researcher utilised the survey and case study as the most appropriate and revealing strategies given the problem under investigation. Therefore, this section discusses the research strategies sequentially.

3.4.1 SURVEY

Survey is usually associated with deductive approach (Saunders, Lewis, & Thornhill, 2009). A popular and common strategy in business and management research, it is most frequently used to answer the who, what, where, how much and how many questions. The survey collects large amounts of data from a sizeable population in a highly economical way. The researcher bias is eliminated as there will be no direct questioning with the respondants, anonymity is assured hence honest responses. The survey is more cost effective and respondents are willing to answer more personal and sensitive questions (Wegner, 2007). Data
collected can be used to suggest possible reasons for particular relationships between variables and to produce models of these relationships.

The employees and management of ZENT were the research population as the researcher sampled mostly management and supervisory staff, and few employees. A survey was conducted as it took a less time to collect data from respondents and also most employees had tight schedules and others were field based, dotted across the country. The survey was easier for the researcher as in most cases was completed by employees at their own spare time and for those who were outside Harare they were sent back using drivers. The respondents were given four weeks to respond to the questionnaires although others returned them within a short space of time.

3.4.2 CASE STUDY

Robson (2002, p. 178 as cited Saunders, Lewis, & Thornhill, 2009) defined case study as “a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence” Yin (2009) stated that a case study is considered when (a) “how” and “why” questions are being posed; (b) the researcher cannot manipulate the behaviour of those involved in the study; (c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context (p. 2). Many authors are using case studies because of its ability to investigate little-known and complex phenomena such as organisations (Gummersson, 2007). Lee et al. (2007 as cited in Palmberg, 2009b) argue that empirically based case studies have the potential to contribute to the development of both theory and practice. The study and application of complex adaptive systems is not popular in Zimbabwean organisations and the literature is scarce on the subject as a transformation strategy.

Yin (2009) indicated that case study method allows investigators to retain the holistic, meaning and characteristics of real life events such as individual life cycles, small group behaviour, organisational and management processes, neighbourhood change and the maturation of industries. The researcher could not
control or change the organisation’s processes or strategy as indicated by (Yin, 2009) as a second identification factor.

Research strategy can have single case study or multiple studies (Saunders, Lewis, & Thornhill, 2009). A single case is used where there is a critical case or a unique case and because it provides the researcher with an opportunity to observe and analyse a phenomenon that few have considered before. In multiple cases the researcher wants to establish whether the findings in one case occur in the other cases and the need to generalise the findings. Two of ZENT’s four divisions were studied during the research; therefore an embedded case study was applied on this study.

Yin (2009) stated that when a research is based on only one organisation as a whole, the researcher is treating the organisation as a holistic case study. However, the researcher might also be examining different work groups or departments or divisions then the case will involve more than one unit of analysis that is called an embedded case study. Saunders, Lewis and Thornhill (2009) argued that case study is appropriate when exploring existing theory and a well-constructed case study can enable the researcher to challenge an existing theory and also provide a source of new research questions. The researcher used both qualitative and quantitative approaches in the research in which Creswell, Shope, Green and Clark (2006) agreed that both approaches can be used in case study.

The research on “a study of strategies for transforming ZENT into a CAS for achieving sustainable growth” was based on a single embedded case study. The case study explored on the application of CAS as a transformation strategy different from other transformation strategies previously applied to the organisation.
3.5 POPULATION AND SAMPLING TECHNIQUES

The researcher used non-probability sampling in which there are four types namely convenience sampling, judgement or purposive sampling, quota sampling and snowball sampling. Purposive sampling was used in the study of strategies for transforming ZENT into a CAS for achieving sustainable growth as the researcher had a good knowledge of the entire population. The researcher used personal judgement alone to select the participants, that were appropriate sampling units and that would address the management problem under study (Wegner, 2007). The entire employees for ZENT were the population and within the four divisions of the organisation, two divisions (Manufacturing and Projects) were selected for the study. The targeted population is illustrated in the table 3.1 below. The two divisions selected, management and supervisors in ZENT and employees from ZENT’s two divisions Head Office, Manufacturing and Projects were selected as the researcher identified them as the most likely participants to answer all the research questions without errors or incomplete questionnaires or both.

Table 3.1: Population and sample characteristics

<table>
<thead>
<tr>
<th>Strata</th>
<th>Size</th>
<th>Location</th>
<th>Gender</th>
<th>Size</th>
<th>Selection method</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top management</td>
<td>7</td>
<td>Head office, Manufacturing &amp; Projects</td>
<td>4 3</td>
<td>5</td>
<td>Judgemental sampling</td>
</tr>
<tr>
<td>Senior management</td>
<td>11</td>
<td>All divisions</td>
<td>9 2</td>
<td>9</td>
<td>Judgemental sampling</td>
</tr>
<tr>
<td>Middle management</td>
<td>16</td>
<td>All divisions</td>
<td>12 4</td>
<td>14</td>
<td>Judgemental sampling</td>
</tr>
<tr>
<td>Supervisors</td>
<td>14</td>
<td>All divisions</td>
<td>10 4</td>
<td>12</td>
<td>Judgemental sampling</td>
</tr>
<tr>
<td>Workers</td>
<td>142</td>
<td>All divisions</td>
<td>21 12</td>
<td>33</td>
<td>Judgemental sampling</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
<td></td>
<td></td>
<td>73</td>
<td></td>
</tr>
</tbody>
</table>
3.6 SOURCES OF DATA

Saunders, Lewis, & Thornhill (2009) defined primary data as data collected specifically for the research project being undertaken (p. 598) and secondary data as data used for a research project that were originally collected for some other purposes (p. 600). The research data on ZENT was collected through observations and self-administered questionnaires. The observations were not recorded but they were used to develop the questionnaire.

3.7 DATA COLLECTION METHODS

Data collection techniques are many and can be used in combinations (Saunders, Lewis, & Thornhill, 2009). These techniques can be interviews, observation, documentary analysis and questionnaires. Questionnaires offer an objective means of collecting information about people’s knowledge, beliefs, attitudes, and behaviour (Boynton & Greenhalgh, 2004). Unlike other methods, questionnaires require relatively little specialist equipment or materials, which means that inexperienced and unsupported researchers sometimes embark on questionnaire surveys without completing the necessary formalities. The researcher used the survey in the form of questionnaires to collect all the data that would answer five research questions which were stated in chapter one. The questionnaire included yes/no questions, rating scale questions and open ended questions. The second and third part of the questionnaire was coded for easy analysis in the SPSS software. The questionnaire had a likert type scale in which Adejimi, Oyediran and Ogunsanmi (2010) argued that it can be used in qualitative analysis. The mix of open ended and closed questions were used to check whether the respondents were not just marking the questionnaires in some parts. The researcher delivered all the questionnaires and collected them by hand as the respondents were employees in the same organisation as the researcher. The researcher gathered the primary data from questionnaires from key respondents that were identified using a purposive non-probability sampling technique.

The researcher was a participant observer as the researcher is an employee in one of the divisions under study. The researcher collected the information regarding the research topic from February to April 2013 and it was used to design a questionnaire. The questionnaire was structured into two major sections,
demographic data and research questions data (see Appendix C). In the second section, the first part was to check whether the respondents knew about the topic. The second part evaluated whether the respondents came across various elements of the subject under study. The third part required ranking of variables that were found in the research questions. The fourth and last part, requested the respondents’ opinion on the subject of transformation, CAS, managerial implications of OT and CAS and sustainability in an open ended manner.

3.8 RESEARCH PROCEDURE

The researcher wrote a letter to conduct a research on the topic “A study of strategies for transforming ZESA Enterprises (ZENT) into a complex adaptive system for achieving sustainable growth” to the Managing Director of ZESA Enterprises (see Appendix A). A letter of introducing the researcher to respondents was attached on the top of all questionnaires (see Appendix B). The questionnaires were composed of two sections demographics and, data gathering and collation (see Appendix C). Seventy three questionnaires were sent out to ZENT employees and thirty-five were returned. All returned questionnaires were recorded and analysed.

3.9 DATA ANALYSIS

The researcher after collecting thirty-five questionnaires out of seventy-three questionnaires found that only thirty-three questionnaires could be appropriate to be used in the research. On each research objective and research question there were three closed questions which were analysed using Statistical Product and Service Solutions (SPSS) software version 20 and the output of the respondents was in the form of graphical presentations in chapter four. The last part of each objective and research question was an open-ended question in which the respondent gave their opinion on the subject under study. The summaries of the respondents were used in the next chapter and the full write ups are found in Appendix E.
3.10 RELIABILITY AND VALIDITY

Yin (2009) proposed four ‘design tests’ to increase the quality of any empirical social research and the common tests are construct validity, internal validity, external validity and reliability (p. 40). The author defined the design test as follows;

- **Construct validity**: identifying correct operational measures for the concepts being studied
- **Internal validity** (for explanatory or causal studies only and not for descriptive or exploratory studies): seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships
- **External validity**: defining the domain to which a study's findings can be generalized
- **Reliability**: demonstrating that the operations of a study - such as the data collection procedures - can be repeated, with the same results

The researcher used the validity and reliability tests when designing this research and summarised them as illustrated in Table 3.2.

Table 3.2: Validity and reliability in the research

<table>
<thead>
<tr>
<th>Tests</th>
<th>Case study tactic</th>
<th>Application in the this research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct validity</td>
<td>Use of multiple sources of evidence</td>
<td>Focussed literature review, questionnaire, internal and external documentation</td>
</tr>
<tr>
<td>Internal validity</td>
<td>Do pattern matching</td>
<td>Data from two divisions under study was matched</td>
</tr>
<tr>
<td>External validity</td>
<td>Use theory in single-case study</td>
<td>The conceptual framework used in this research was compared with the findings and literature and they tally.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Use case study protocol</td>
<td>The protocol was developed and used to guide the self-administered questionnaire (Appendix C) The questionnaire feedback was recorded and all documentation were printed (Appendix D)</td>
</tr>
<tr>
<td></td>
<td>Develop case study database</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted and modified from Yin (2009, p. 41)
3.11 RESEARCH LIMITATIONS

The research was based on one company although with divisions under study within two different industries construction and manufacturing. However generalisation to other industries should be done with extreme care. Complex adaptive systems were used as an organisational transformation strategy to achieve sustainable growth but did not mean that other organisations that did use this strategy achieve their desired goals. The sample size was every small but many authors have argued that this is enough in judgemental sampling in the study of qualitative methods (Matthews & Thomas, 2007).

The researcher was unable to interview key members of the organisation involved in the organisational transformation decisions due to company commitments. However, the researcher managed to send questionnaires to various employees that were able to answer. Employees that could have answered the questions without writing were not considered in this research. The survey was conducted only once and suggestions from respondents were not included in the research as there was a need for another survey to correct the suggestions or a different source of data to correct the short comings in the questionnaire.

3.12 ETHICAL ISSUES

The research composition will be based on information which was published in company’s annual financial reports, Megawatt Bulletins, government publications and newspapers. Information which is available for the public shall be used throughout the research. The names of the research respondents were not disclosed to anyone except to the researcher. The questionnaires did not request any identity from any respondents (see Appendix C).

3.13 CHAPTER SUMMARY

The chapter provided the most appropriate research methodology and the most suitable research strategy that the researcher followed during the study of complex adaptive systems as an organisational transformation strategy. The survey and case study were the most suitable strategies chosen by the researcher. The researcher made efforts to avoid misrepresentation of respondents’ information and avoid bias in the entire study.
CHAPTER FOUR

ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

Chapter three presented the methods and methodologies that were used to obtain data from participants from the survey done in ZENT between June and July 2013. This chapter is going to analyse data of each of the five objectives and research questions that were presented in chapter one and reviewed in chapter two. The chapter also provides further evidence of the reliability and validity of the questionnaire.

4.2 RESPONSE RATE

Questionnaires were used to collect data for the research and seventy three were sent out to various employees in divisions in ZENT. The demographic characteristics of participants who took part in the research are recorded in Table 4.1 below.

Table 4.1: Questionnaire response rate

<table>
<thead>
<tr>
<th>Strata</th>
<th>Distributed questionnaires</th>
<th>Returned questionnaires</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gender</td>
<td>Size</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Top management</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Senior management</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Middle management</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Supervisors</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Workers</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Thirty five questionnaires were returned and thirty three were valid and usable responses in the research with a response rate of 45.2%. Baruch and Holtom (2008) stated that the average response rate for studies that utilised data collected from organisations was 35.7% with a standard deviation of 18.8. The author’s studies of response rate can range from as low as 16.9% and as high as 54.5%. The high response was due to the fact that the researcher works in the same company as the research participants. The sample of respondents represented 72.72% from Head Office, Projects and Manufacturing Divisions, and 27.27% from Transport and Retail Divisions and 9% were at top management level, 18.18% at senior management level, 24.24% at middle management level, 18.18% at Supervisory level and 30.3% at employee level. The population of ZENT was represented in the study as all level participated in the research as shown in Table 4.1 above.

4.3 ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

The results are interpreted and discussed for each objective as they are listed in chapter one. The graphical percentage results used were extracted from closed questions and the open-ended question answers used in this section were extracted from SPSS.

<table>
<thead>
<tr>
<th>Summary of views of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZENT functions as a complex adaptive system</td>
</tr>
<tr>
<td>CAS approach brings sustainable growth</td>
</tr>
<tr>
<td>Complexity theory is crucial to management</td>
</tr>
<tr>
<td>Is there a link between OT and CAS</td>
</tr>
<tr>
<td>Are they any changes that took place in ZENT</td>
</tr>
</tbody>
</table>

Figure 4.1: Summary of views of respondents
The Figure 4.1 above summaries what the respondents thought about organisational transformation, complex adaptive systems, sustainable growth, implication of transformation through complex adaptive systems to management and sustainable growth.

4.3.1 To ascertain and explore types of organisational transformation strategies that are available.

Majority (93.9%) of the respondents agreed that ZENT had held organisational transformation in previous years (see Figure 4.1). The background of the organisation in chapter one also highlighted that they were several bundling and re-bundling in-order to improve efficiency of the organisation. Organisational transformation is vital to the well-being of the organisation and it enables the organisation to keep pace with the ever changing environment.

4.3.1.1 Organisational transformation strategies

![Types of organisational transformation](image)

Figure 4.2: Types of organisational transformation

The respondents reported that they were several changes in the organisation mainly culture changes (69.7%), organisational development (63.6%), quality improvements (66.7%) and reduction in defects (72.7%) as shown in Figure 4.2 above. In open-ended questions the respondents suggested that there is need for
restructuring of the organisation and one of the respondents wrote “Streamline operations and discard/abandon unprofitable divisions like sales and marketing”. The proposed strategies are vital for continuous improvement of the organisation and the literature also agrees with these suggestions. The organisation transformation strategies can be implemented using one strategy or combination of two or more. The strategy to be used depends on the management or the implementers. Literature has indicated that by empowering and encouraging multi-skills on employees will trigger delayering of some levels in the organisation.

Companies that used to be public utilities or that are public utilities need drastic changes in culture if they want to compete with the world’s leading private owned organisations and ZENT is such an organisation. “Change employee organisational culture” is in agreement to what Branson (2007) said before changing the non-human components of the organisation, management needs to change culture of all the employees of the organisation.

In the case of using modern machinery and advanced technology in the organisation, participants in ZENT they want the transformation to lean towards atomisation of their operations as indicated in the open ended answers in Appendix D. Majority of the respondents 60.6% disagreed that re-engineering was used in ZENT. Atomisation of operations and processes bring efficiency and produce high quality work, less time spend on product change over and resulting in targets being easily achieved. Machines with constant maintenance, production does not stop and quality will always be maintained. Machines do not take time to adjust for new products, unlike human beings in the early stages of which have high levels of defects and low quality in the early stages of production.

The respondents also suggested that ZENT should use the Japanese Kaizen approach which focuses on the TQM where they leverage on quality of the products produced. Their competitive edge is on quality only. Majority of the respondents (72.7%) agreed that ZENT used this strategy to improve the quality of its products and services.

Organisation development was implemented in ZENT and 69.7% of the respondents agreed to this strategy. This transformation strategy is very important in that it keeps the organisation changing in a slow pace although the current
market changes now require drastic changes compared to slow changes. The changes that are taking place in the environment and the losses the organisation is making, necessitates the revitalisation and rebuilding of the organisation. It is ideal for managers to thoroughly assess their change management before they implement it and weigh the pros and cons of the programme. This is similar to the quote of one of the respondents, “When implementing changes to a department, I would first look at a model organisation which had implemented a similar strategy in the past. I would then analyse the positives obtained from such a change process, I would then try to build on these positives. However, the negatives effects are also important, so I would have to come up with plans to mitigate the risks posed by a change process”.

4.3.1.2 Challenges and reasons for organisational transformation failure

Previous organisational transformation had been implemented in ZENT to improve the processes and operations to achieve sustainable growth and competitiveness but its profitability has remained in the negative side. This research identified some of the causes of organisational transformation failure that affected ZENT and they are shown in Figure 4.3 below.

![Figure 4.3: Challenges and reasons for transformation failure](image)

Figure 4.3: Challenges and reasons for transformation failure
Majority (78.8%) of the respondents reported that employee involvement was either very poor or poor. Some of the respondents concurred with the results of the above graphical presentation by saying “Employees should be involved in change management since they are the individuals who are involved in day to day running of the organisation”. Everyone in the organisation is important when it comes to transform the organisation. Organisations that include everyone in their change process are likely to succeed and achieve the desired goals.

Most (90.9%) of respondents reported that time management was ranked between very poor and satisfactory. Change process requires more time like what the respondents have highlighted in the above quotations “Spread drastic changes over time, giving enough time for adjustment and coping”.

The role of management in the changes process was reported as either good or satisfactory (60.6%). Some of the respondents reported that “Effectively communicate the intention and justify for all players to understand “why” the change – for their total participation. The “how” part will now not be left for me alone to figure out but it will now be a joint stakeholder contribution”. Even if management apply a good change strategy, without proper communication the change strategy is doomed to fail. Some of the respondents wrote “Measure success at every stage and handle employee concerns and resistance” and this emanated from poor evaluation from management. There is need of evaluation for all completed project milestones. This will give the implementers time to review and adjust some of the activities that will not be working properly.

More than half of the respondents (54.6%) reported that proper planning of the whole change process needed to indicate clear goals to be set, implementation strategy should be known, the team tackling the project should be competent and everyone should be consulted. Omitting one of the above it has led companies to fail to yield results from the transformation because of complex change management (GJIMT Research Team, 2012). The Figure 4.2 indicates that respondents had mixed views on the previous planning that took place in ZENT as the views were ranked between very poor and satisfactory (78.7%).
4.3.2 To understand the application of complex adaptive systems to ZENT.

The respondents reported that they agreed to the notion that ZENT functions as a complex adaptive system (63.6%) as shown in figure 4.1.

4.3.2.1 Characteristics of complex adaptive systems

![Figure 4.4: complex adaptive system characteristics](image)

**Characteristics of complex adaptive systems**

Majority (72.7%) of the respondents agreed that employees, management and divisions in ZENT are interdependent. Some of the respondents were quoted saying “…… organisation should also engage all shareholders in strategy formulation and implementation”. The connectivity of agents in the organisation, industry, country and the world is critical as they network, learn and give feedback to one another. The respondents have indicated various areas that need to be interdependent, theory and practical, consumer and supplier, etc. even employees in the organisation they need to depend on one another.

Co-evolution was broken down into non-human and human and the respondents reported that it exists in ZENT, 75.8% and 63.6% agreed respectively. In open-
ended question some respondents emphasised on the non-human side “Take note of technological changes and embrace new technology ……” and the human side “Shift from parastatal mind-set and practices”. As the organisations grow and remain in business for a long time, there is need to change many processes, structures and culture so that the organisation will not be extinct. Knowledge of the past is important and even experience within the employees is also crucial to the organisation.

The majority (60.6%) of respondents reported that the future cannot be predicted and in complex adaptive systems they call it not predictable in detail. Some of the respondents indicated that when the organisation implements change it should predict the outcome. Prediction in CAS is not very important but at least to produce the desired outcome. Small changes can lead to drastic different future paths but the same characteristic pattern of behaviour emerges despite the changes.

Self-organisation is a crucial characteristic of CAS, ZENT sometimes it does not need the best human capital and the best strategy as viewed by respondents “It should promote young talent and implement the succession plan correctly” but it needs the best environment. The respondents (60.6%) had also reported that there is no self-organisation in ZENT as shown in Figure 4.4. For ZENT to survive, it needs to delight the customer as highlighted by one of the respondents rather than producing quality products.

The majority (60.6%) of the respondents reported that there is too much control from management and CAS approach advocates for decentralisation of decisions like what other respondents have highlighted “Decentralise decision making”. Distribution of control among employees creates urgency within the organisation and is important for the growth of the organisation. If all the employees within the organisation treats each other as a very important customers, then the organisation will not need centralised decisions as employees will be capable of producing quality work on their own therefore the quality service or product is also passed to the customer.

Non-Linearity was not discussed in the open-ended question however Figure 4.4 shows that the respondents have reported that ZENT had small changes (75.8%) that had big impact on the organisation and same with big changes (66.7%) that
had small impact on the organisation. The researcher chose the survey method to collect data from employees so that management can review and improve on areas that they cannot visualise but can be identified by shop floor employees or customers. The implementation of these small things regularly will improve the organisation so drastically and the losses that the organisation is making will disappear.

There is no adaptation in ZENT “benchmark its performance against others world class performers in similar business” and “Should adopt a professional approach to business”, and Figure 4.4 shows that majority (78.8%) of the respondents disagreed that there is adaptation in ZENT. The organisation cannot innovate everything even the greatest innovators they adopt some crucial components and processes from elsewhere. The respondents have stated that ZENT needs to identify leading companies in manufacturing and construction of substations so that they can learn, adjust and adapt the best ways of conducting business. Internal improvements and adapting the best processes will lead the organisation to sustainable growth.

Learning from mistakes is crucial to the organisation and majority (69.7%) of the respondents reported that ZENT is not learning from its mistakes. Mistakes are good for organisation development but too much of mistakes can be fatal to the organisation. The ability of an organisation to train and to have multi-task employees will bring competitive advantage. The respondents also emphasised on the “learn from their mistakes and correct them for the best of the organisation” and others advocated that ZENT should “send their employees for attachments to the companies such as ABB, or bring trainers from such reputable institutions to train and assess our process systems”. Multi-task and learned employees will reduce some layers in the organisation hence a flat structure. Learning from mistakes and other organisations, and discussing the identified issues before implementing is very crucial to the organisation’s sustainable development and growth. Instead agents (employees) need to notice things, discuss the irregularities and making learning dependent on local interaction and the relationships in the system.
The other crucial characteristic of CAS that was highlighted by respondents is emergence. The respondents noted that ZENT should utilise opportunities as they come and not to lag behind. New opportunities are able to be seen by those who are prepared for them.

The respondents reported that ZENT is not in chaos (54.2%) and stable (63.2%). Kleiman (2011) stated that an organisation should operate at the edge of chaos so that internal processes will match external dynamics (the environment). Fuller and Moran (2001) highlighted that stability will cause the organisation to die slowly (or die quickly) as reported by the respondents. The respondents reported that ZENT is not in chaos (54.2%).

![Employees' experience of service](image)

Figure 4.5: Employees' experience of service

This research was surveyed across all employees in the organisation and the suggested answers that emanated from different levels showing that variety is important as it can be witnessed on the range of experience within the organisation (Figure 4.5 above). If ZENT is to utilise suggestions from all its employees they will be masters in their area of expertise manufacturing and construction. The greater the diversity within the system, the stronger it is and the more likely it is able to create new possibilities.
4.3.2.2 Approaches for managing complex adaptive systems

The research looked at six approaches for managing complex adaptive systems and results are illustrated in Figure 4.6 below.

Figure 4.6: Approaches for managing complex adaptive systems

Almost half (57.5%) of the respondents reported that the vision was either satisfactory or good. Sometimes it is not the strategic plans that need to be reviewed regularly but the vision must be broken down so that the shop floor worker can understand it and contribute to that vision.

Almost half (54.5%) of the respondents reported that attractors in ZENT is either poor or satisfactory. In the real world, organisation that reward more than their rival or other organisation they tend to perform better especially when rewarding teams. The respondents also share the same sentiments that “reward employees when necessary” so that the organisation enables innovation and continuous survival and retention of talented employees. To make something happen, all one has to do is create stronger attractors than the ones in place.

A high number (36.4%) of respondents reported that processes and systems (simple rules) in ZENT are poor however 51.5% of the respondents reported that
they are either satisfactory or good. Rigid systems are not productive as it can be seen in public organisations (ZENT). Respondents highlighted that management should be flexible and listen to subordinates. Literature has also shown that simple way of doing things in the organisation will bring variety of solutions from various employees that are crucial to the organisation (Campion & Griffiths, 2005).

The respondents had mixed views on the experimentation and reflection as some reported that it was very poor (27.3%), poor (33.3%) and satisfactory (30.3%). Organisation should manage experimentation so that the results will be a source of competitive advantage. Some of the respondents highlighted that “….. variances should be analysed and causes be unearthed/identified and means be put in place for improvement the next time the task is undertaken or similar task”. Experimentation and feedback result in continuous increase in learning that brings the organisation to greater levels.

Majority (75.7%) of respondents reported that feedback it was either poor or satisfactory. The well-being of an organisation is determined by not only communication but also by meaningful feedback. Some of the respondents indicated that “Feedback alone is a tool that can correct mistakes, motivate and encourage adopted trends to continue and bring about brainstorming exercises to bring new innovative reinforcements to change

Tension in the organisation was reported to either very poor or poor by 66.6% of the respondents. Tension caused by criticism as reported by one of the respondents, highlighting that it should be welcomed in ZENT as it brings tension that will create meaningful opportunities and new questions to emerge and re-emerge. Simple rules that were suggested are important but does not mean everything should be simplified in fact the opposite is required (Palmberg, 2009a). Employees in ZENT have a tendency of relaxing when they conduct their business and transformation through CAS brings in tension to the organisation therefore they will earn their money out of their inputs as written by one respondent.
4.3.3 To determine the linkages between organisational transformation and complex adaptive systems or complex theory.

The literature has shown that there is a link between OT and CAS as indicated by various authors (Burnes, 2004; Beinhocker, 2006; McDaniel, 2007; Mason W. H., 2006 and McDaniel, Lanham & Anderson, 2009). Employees in ZENT reported that there is a link and 93.9% of the respondents agreed (see Figure 4.1) and they concurred with the literature. The importance of the above areas had been discussed earlier in this chapter in objective one and two, and objective three was to ascertain whether there is a link between organisational transformation and complex adaptive systems.

4.3.3.1 Organisational transformation and complex adaptive systems relationship

Figure 4.7: Link between organisational transformation and complex adaptive systems
More than 70% of the respondents (see Figure 4.6) agreed that improvement in communication (78.8%), processes and systems (84.8%) and turnover (81.8%); learning from mistake will improve (78.8%); limited control by management (72.7%); adopt best ways of conducting business available (81.8%); improved quality in project execution (84.8%) and manufactured products (87.9%); and creating the most suitable organisational structure (75.8%) will bring survival to the organisation. Most of these areas had been discussed above except for organisation structure. The thrust nowadays is to have a lean structure with few layers which enables decentralisation of control and communication is very effective, and employees should be encouraged to work in teams (Mason W. H, 2006).

Respondents highlighted that the link is there and they said “interaction with all stakeholders and being sensitive to need to adapt change in the environment” which is important factor in transformation and vital characteristic of CAS. The key characteristics of CAS are adaptation, edge of chaos, self-organisation, interdependence, coevolution, etc. but for these to be achieved in the organisation there is need to continuous innovation and it is also continuous transformation. Innovation brings new things to the organisation new processes and ideas.

4.3.3.2: Characteristics of complex adaptive systems that are crucial to organisational transformation

Most of the respondents agreed that there is a link between organisational transformation and complex adaptive systems as shown in Appendix D. Most of the respondents gave answers almost similar to the ones provided in the percentage above and this validates that there is a link between organisational transformation and complex adaptive systems. Although most of the areas have being covered in objective one and two there are some additions from open-ended questions.

Majority (66.7%) of the respondents reported that adaptation was either extremely important or important (Figure 4.8). Adaptation is an important characteristic of CAS and it can be used in the transformation to keep the organisation improving in “its structure and processes”. The organisation should be able to survive in this ever changing environment.
Interdependent was reported to be either extremely important or important by 81.8% of the respondents. Respondents have indicated that agents in the organisation should be interdependent and transformation of organisation that is complete without solid “integration” of its agents is likely to fail.

The respondents had ranked distribution control (authority) between extremely important and important (93%). The respondents reported that distributed control (strategy) was either extremely important or very important (63.6%). The respondents ranked linearity (Human) between extremely important and important (91%). Majority (69.7%) of the respondents reported that linearity (non-human) was either very important or important. The respondents reported that prediction was either extremely important or very important (75.8%). Self-organisation was reported to be both extremely important and very important (69.2%). The respondents reported that emergence was either extremely important or very important (66.7%).
The respondents reported that evolution was either extremely important or very important (69.7%). The co-evolution of the organisation should tally with the surrounding changes in legal, environment, political, etc. “otherwise is doomed to fail”.

The respondents ranked chaos between extremely important and important (84.8%). In transformation there is need to plan for new development and CAS requires the organisation not only to plan but to operate at the edge of chaos. One of the respondents highlighted that transformation in the organisation should move at par with that of the environment. Organisations that do not innovate are likely to fail and transformation through CAS without innovating there is no transformation through complex adaptive systems. One of the respondents also highlighted that “there is exchange of influence which can be supported by innovation in organisation transformation”. Transformation through CAS should enable organisation’s processes and systems to become simple to operate and “enable employees to implement new ideas”.

4.3.4 To establish whether CAS brings sustainable growth.

The main reason why organisation exists is to have maximum profit and sustainable competitive advantage and growth (Stratton, 2011). This objective looks at various strategies that can bring sustainable growth through complex adaptive systems the literature has identifies many of them. Majority (87.9%) of the respondents agreed that complex adaptive systems will bring sustainable growth in ZENT (see Figure 4.1).

Majority (90.9%) of the respondent agreed that improvement in pricing structure brings sustainable growth. Continuous research and development and efficient material procurement enables the organisation to have overall cost leadership than competitors. Some of the respondents highlighted that “Continuous R & D to attain cost leadership (pricing)”.

Majority (90.9%) of the respondents agreed that differentiation of products and service will bring sustainable growth to ZENT. Similar to what has been discussed above R & D is critical in producing variety in products. Acquiring latest technology also plays a pivotal role in differentiation of products and pricing. Some of the
respondents noted that “Product differentiation will go a long way in propagating the company to a higher position”.

4.3.4.1 Complex adaptive systems and sustainable growth factors

The respondents agreed that excess products into the market will bring sustainable growth (63.6%). Some of the respondents had mixed views as this will have more money locked in stock and the organisation can loss large sums of money if the product is phased out or if a competitor finds a substitute.

Majority (90.9%) of the respondents agreed that increase in market share will bring sustainable advantage. An increase in market share will increase turnover in the long run and this will also deter entry from new competitors.

Majority (93.9%) of the respondents agreed that improved performance in the organisation will bring sustainable growth. Performance of an organisation is improved in various ways that had been mentioned before i.e. technology and innovation.
Almost all respondents agreed that technological advancement is crucial to sustainable growth (97%). Many authors agreed that special levels of performance or service can be developed and cannot be simply matched by other companies.

All the respondents agreed that improvement in quality of products/service brings sustainable growth (100%). This point had been discussed in objective one at great length.

Majority (87.9%) of the respondents agreed that strategic partnership is important for sustainable growth. In manufacturing and construction strategic alliances are important as all business activities will be performed by experts in various fields (Hill and Jones, 2010).

The respondents agreed that improvement in quality manufactured products is important to the sustainability of the organisation (97%). Quality had been discussed in greater detail in objective one, and improvements had been implemented in the previous organisation restructuring.

All the respondents (100%) agreed that improvement in employee moral will bring sustainable growth. The point was emphasised in objectives above, moral can be increased as a result of attractors, employee involvement and communication within an organisation.

Majority (63.6%) of the respondents disagreed that the current structure is the best for the organisation. In objective one and two, various participants and literature (Palmberg, 2009b) advocates for a lean structure that is flexible and efficient.

Respondents have agreed that several sustainable strategies are available and they are crucial for continuous survival of the organisation. Respondents emphasised that the following are the most appropriate for ZENT’s sustainability:

The respondents reported that deterring entry was ranging from important to least important (72.7%). The organisation needs to select the best method that will deter entry from new entries but respondents did not rank it as the best sustainable growth strategy.
Managing rivalry was reported to be either extremely important or very important by 87.9% of the respondents. ZENT can use any of the strategies especially capacity control in the manufacturing of transformers and construction of substations, and the use of technology will have pivotal role on this strategy as well as the remaining strategies. One of the respondents indicated that “ZENT also has to produce better products than competitors’ such as ABB and Power-Network-Projects” which is a non-price competition.

The respondents reported that market targeting was either very important or important (66.6%). Participants indicated that the organisation should target particular markets and this allows the organisation to pursue either cost leadership or differentiation within a targeted segment (Thompson, Peteraf, Gamble and Strickland III, 2012). One of the respondents wrote “ZENT should produce
products targeting a particular market and pricing better than competitors” to emphasise the need for market targeting.

Technology was discussed in objective one and three, and it is also fundamental in achieving sustainable growth. The respondents reported that technology was either extremely important or very important (78.8%). Technology and high performance is critical to current manufacturing and construction industry as it brings high quality products, lower production costs, sustainable growth and competitive advantage. Participants identified that ZENT should acquire the latest technology to improve its performance and one of them wrote “..... needs to adapt to the modern technology with high advanced machinery and programmes in order to meet the standards of other competitors”.

Majority (66.7%) of the respondents reported that quality of products is extremely important for sustainable growth. The respondents reported that service was either extremely important or very important (94%). The respondents suggested that ZENT should use quality as competitive advantage for sustainable growth and literature agrees with this in that some companies offer a level of quality that others are unable to match (Hill & Jones, 2010). One of the respondents wrote “improving quality of service and products” and this concurred with the literature.

Strategic synergies were reported to be either very important or important by 72.8% of the respondents. Various respondents reported that vertical integration was ranked between extremely important and important (75.7%) Leading organisations in the world have partners providing raw material suppliers and their contracts are efficient that they will be no shortages of raw materials. Participants encouraged ZENT to form alliances with its major suppliers of raw material to achieve competitive advantage. This can be one of the greatest strategies of sustainable growth. The participants agreed with the literature and wrote “ZENT needs partnerships in terms of technology, equipment, market/consumers and raw materials”.

Culture was discussed in objective one and 84.8% of the respondents reported that culture is either extremely important or very important. Sustainable growth of leading companies is built on the foundation of strong culture like what “Jack Welch did at General Motors”. Participants highlighted that ZENT should
implement adaptive culture in the organisation to embrace new ways of doing business.

4.3.5 To ascertain and explore the implication of complexity theory and organisational transformation on management.

Organisational transformation through complex adaptive system is new to most management and its implication to management is very important to business transformation studies. Various implications were aired by participants that took part in the survey. Most of the respondents 93.9% (see Figure 4.1), agreed that transformation through complex adaptive systems is crucial to the organisation.

4.3.5.1 Changes that management should implement. Several changes have been highlighted in the literature and emphasised by several respondents in the open-ended questions. Most of these changes are discussed in the preceding section.

![Figure 4.11: Important changes for management to achieve OT through CAS](image-url)
Most of the respondents (87.9%) agreed that management should change organisational structure. Public organisations are usually top heavy and some management structures needs to be removed to achieve sustainable growth. ZENT needs to empower its employees and remove some layers in the structure so that it has a “right organisational structure” as quoted by one of the respondents.

Majority (90.9%) of the respondents agreed that reconfiguration of the organisation need to be changed by management. Using all CAS characteristics and approaches will cause the organisation to transform organisational structures, distributed control, communication efficiency and feedback, etc. so that ZENT will realise sustainable profits. Once a public organisation intends to become efficient, it is likely to have resistance of these changes from management as well as employees as highlighted by some of the participants, “Loss of power and authority - loss of prestige. Fear of uncertainty of the future”.

Majority (93.9%) of the respondents require management to change the human resources set up in the organisation. The change process requires the best of ability from both management and employees. Complex adaptive systems application calls for the managers to effectively manage personnel and implement job performance, reward and groom talented performers, resolve conflict and divest and discipline nonperformers who may be holding the company back from adapting well to emerging trends and technologies (Mason W. H., 2006). In the same context ZENT should do the same “improve employee satisfactory, motivation .....” as highlighted by some of the respondents.

Almost all the respondents (97%) require management to change or review its organisational strategy for it to achieve sustainable growth. Some of the respondents reported that the strategy should be aligned with the global trends “The changes that are implemented are globally accepted and are taken in as home grown solutions have making them more effective”. ZENT should implement what is best for the organisation and transformation into a CAS is one such strategy. Some of CAS strategies do not require capital injection but they improve the processes and creating an environment for innovation.
The entire sample (100%) of the respondents that took part in the survey agreed that communication in the organisation should be changed. New ways of doing business require employees to be trained so that they are able to implement the changes and some participants highlighted that “Not all employees will understand”.

Majority of the respondents (97%) agreed that organisational culture should be relooked at for the organisation to successfully implement OT through CAS. 97%. Once change has been initiated results should be produced otherwise management will lose their jobs either by not implementing changes or implementing but perform poorly.

4.3.5.2 Organisation areas that need management attention and review: Most of the areas that have an implication on management have already been discussed in other objectives and are been emphasised in this objective.

Figure 4.12: Implication of other areas on management
The respondents reported that grooming of talented employees was either extremely important or very important to the organisation (78.5%).

The respondents reported that long term planning was extremely important (51.5%) and short term planning ranged between extremely important and important (78.7%). Continuous change in strategy was reported to be either very important or important by 66.7% of the respondents. The literature stated that there is no need for long term strategies as most of them will not be used in turbulent environment.

The respondents reported that intervening timeously on unresolved issues was both extremely important or very important (91%) and distribution of power among employees ranged between extremely important and important (87.9%). Employees in ZENT need timeously intervention of essential issues and literature advocates for more managers instead of less that was witnessed in Taylor’s model. More managers in organisation means less conflicts and each and every employee will be a manager in flat, flexible and team based organisational structure.

The respondents reported that transformation changes ranged between extremely important and important (90.9%), transition changes were either extremely important or very important (69.7%), developmental changes were either extremely important or very important (72.7%). The literature advocates that neither small-scale incremental change nor radical transformational change works, instead, innovative activity can only be successfully generated through new products and process development brought about by self-organising teams (Burnes, 2005). The literature departs from most of the respondents in that the organisation should have change that is between small-scale incremental change and large-scale radical transformation.

The respondents reported that allowing employees to innovate was either very important or important 66.7%, experiment in new ideas and breaking the rules was either very important or important 80.8% and grooming of talented employees was either extremely important or very important (78.5%). CAS theory emphasised on these areas and management needs to introduce and improve these critical organisational activities.
4.4 TESTING OF RESEARCH PROPOSITION

The research findings agree with the research proposition in chapter one that suggest that by using complex adaptive systems as an organisational transformation strategy it will improve ZENT’s viability.

Objective one agrees with the proposition: To ascertain and explore types of organisational transformation strategies that are available. Several types of strategies were identified.

Objective two agrees with the proposition: To understand the application of complex adaptive systems to ZENT. Many characteristics and approaches for managing complex adaptive systems were identify, some are already been applied and some need to be adjusted, reviewed and adopted.

Objective three agrees with the proposition: To determine the linkages between organisational transformation and complex adaptive systems or complex theory. The link between organisational transformation and complex adaptive systems exists as some transformation strategies are characteristics of complex adaptive systems.

Objective four agrees with the proposition: To establish whether CAS brings sustainable growth. Several strategies were established some suits and some need to be adjusted for them to contribute to sustainable growth.

Objective five agrees with the proposition: To ascertain and explore the implication of complexity theory and organisational transformation on management. They were several implications on management as complexity theory totally changes the behaviour and the way management understand the organisation.

4.5 CHAPTER SUMMARY

The findings suggested that ZENT can be transformed into a complex adaptive system as various levels of employees are aware of characteristics and approaches of complex adaptive systems. The research findings also show that ZENT employees are aware of transformation strategies that can be implemented to achieve sustainable growth. It can be concluded that the findings agrees that transformation strategies through complex adaptive systems will achieve sustainable growth. The conceptual framework proposed in chapter two also agrees with the findings.
CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION
The current study has explored the study of organisational transformation, complex adaptive systems and linkage between the two fields, sustainable growth through the use of complex adaptive systems and the implication of using CAS as a transformation strategy. The findings have shown that complex adaptive systems can be applied to ZENT as most of the participants were aware of the characteristics and approaches for managing complex adaptive systems.

5.2 CONCLUSIONS
This section will conclude on the findings that were gathered from respondents in ZENT. The data that is going to be considered is that from the findings and literature review.

5.2.1 What types of transformation strategies can be applied to ZENT?
Several organisational transformation strategies have being applied to ZENT as shown in chapter four. Many transformation strategies have been discussed in the literature and most of them have been considered to work for ZENT by the researcher. Delayering and restructuring is the solution to the sustainability of the organisation as the findings indicated that some positions and departments need to be redeployed to other departments. Secondly, transformation through technology and atomisation was the other strategy that was identified. This strategy will give positive results in the divisions under study Manufacturing and Projects, as they require the latest machinery for manufacturing activities and construction equipment for project execution respectively. Technology and atomisation also increases productivity and improvement in quality of service and products produced. Thirdly, the Kaizen principle should be applied to ZENT and it dwells mainly on TQM. The organisation should continuously improve its processes and procedures to achieve sustainable growth and survival in turbulent
environment. The documentation should be fewer and approval procedures should be done in the shortest possible time for simple processes like quotations, and procurement of common raw materials. Fourthly, a change in values was also a major finding in the research, transformation without changes in values, mainly culture, is most likely to fail. Before embarking on a change process, ZENT should create willingness among junior management and employees so that they will be part of the transformation process. The fifth and final strategy that was identified was organisational development which is slow change that suits well with the current environmental changes that are being faced by ZENT and should not be very slow but at the edge of chaos.

Transformation through complex adaptive systems of ZENT is an important strategy in its long term survival, but it also has some challenges that might render the process unsuccessful. The researcher identified the following challenges poor time management, lack of employees’ involvement, poor project planning and project evaluation. Time management is crucial in any transformation as this process needs to be done in the shortest possible period of time especially in this ever shifting environment. Delaying transformation will result in another transformation being suggested before the implementation and completion of an earlier process. Any successful transformation hinges on the acceptance of the process by employees, their participation and suggestions. Feedback is important for the organisation as new ideas regularly crop up. Project planning of the change process is a key stage in the transformation process as management should consider all positive and negative factors that are likely to be brought up by the process. Management should review successful and unsuccessful transformations of other organisation so that they have a clear picture of the anticipated outcomes. Project evaluation is a crucial stage in the project implementation for review of completed or uncompleted milestones. Reviewing the processes allows management to decide to revert back or continue or to abandon the project before it is too late.

5.2.2 What CAS principles and approaches can be applied to ZENT?
Complex adaptive systems have many characteristics and most of them were identified in the findings except for two of the characteristics, edge of chaos and
non-linearity. These were likely to be omitted because they are new concepts in the study and application in the organisation, in that the firm should operate at the edge of chaos and their processes should be non-linear. The two characteristics are mostly witnessed during the commencement of a project where many activities are involved and employees who will be part of the project team will be running around to meet targets and when big orders are received with limited delivery time. Planning of projects in most cases is non-linear because each and every project that is undertaken has different challenges compared to other projects. Manufacturing of different orders and components/equipment requires different strategies, which are, in most cases non-linear. The researcher concluded that although these two characteristics were not identified in the research but they should be considered and applied to ZENT.

The researcher concluded that most of CAS characteristics they link with each other and they were found to be imperative to the survival of ZENT. The researcher concluded that ZENT’s two divisions should always adapt to the new ways of doing business. Co-evolution, like adaptation requires the organisation to evolve with time. It requires that management should discard the old ways of conducting business; however the concept does not say experience is not crucial to the organisation’s well-being. The system (people, processes, machinery, industry, government, etc.) should be interdependent, as this makes the organisation sustainable. Employees should interact among themselves, with companies within the industry, industries within the country and beyond borders, etc. so that new ideas and opportunities are realised. The researcher concluded that change process and innovation should be gradual and iteration especially improvement of processes and procedures requires small increments.

ZENT’s employees require decentralisation of control and management requires that control but CAS suggests that control should be distributed and the organisation will have few employees and more managers. ZENT should empower its employees to have managerial responsibilities, employees should know the implications of producing faulty products or poor quality in final products. This concept of distributed control does not suggest there is no control. Sub-optimal can be applied to ZENT’s product and services because it does not require processes service, products, etc. to be perfect but it requires them to be better
than alternatives. Management in ZENT should know that organisations that operate as a CAS cannot exactly predict the future, however, management usually comes up with something similar which does not replicate the future. CAS calls this *not predictable in detail*. Most companies recruit the best talent available but do not mean organisations without that talent cannot outperform them. In a concept of self-organisation it suggests that when different views converge from employees, they are likely to come up with brilliant ideas that will be helpful to the organisation in what the researcher emphasised that employees should interact frequently in ZENT and work in team and organisational structure should comply. Requisite variety, like self-organisation suggests that variety in the organisation is very healthy as it is a source of ideas and innovation. The research shows that various employees have brilliant ideas that might be used in ZENT for competitive advantage. Emergence is a property of CAS that needs to be embraced by management and employees, as it requires management to take each and every opportunity that comes their way. Management should be aware that many orders came without being planned or controlled and they should be always be prepared. Any changes to the organisations by management usually brought unplanned and uncontrollable events such as strikes or results that can be a source of new opportunities. Learning is a key factor in CAS as most of the characteristics require the agents in the organisation to learn from each other and mistakes. ZENT should always learn, adjust and adapt so that it survives.

They are also approaches for managing complex adaptive systems and the researcher highlighted some that can be used in ZENT in the findings. Visioning is very important for employees to understand and embrace the vision of the organisation. The vision needs to be simple and visioning also requires strategic plans and actions plans to be replaced with simple documents that show the direction of the company. Simple rules approaches have rich variety that emerge when agents interact and dependents on one another. The researcher concludes that management should be flexible and this can emanate from simple rules. ZENT should introduce team-based performance bonuses which are attractors to employees to do work timeously and promotes innovation. Experimentation and reflection is crucial to the organisation as this allows ZENT to become an innovative entity and can use this approach as a competitive advantage.
Experiments and reviews are important for any organisation as it improves the processes, products and services. Feedback like reflections is necessary to the well-being of any healthy organisation. With Feedback, management can review their actions and allows them to adjust, abandon and improve certain activities.

5.2.3 Are they any linkages between organisational transformation and complexity?

The researcher concluded that there is a link organisational transformation and complex adaptive systems and the findings have shown that linkage. In organisational transformation there is employee’s involvement and in CAS they call it interdependent or connectivity or nested systems were everyone interacts and contributes to the cause of the company. Connectivity also brings innovation into the organisation and an innovative organisation is always evolving than an organisation that is not well connected. OT requires that management should plan for the process and review other organisations that have successfully and unsuccessfully applied transformation. CAS requires that organisations should have continuous improvements which are changes in the organisation that will bring efficient processes and procedures. In CAS it is enabled by simple rules approach were everything in the organisation should be simple. From the above conclusion it can be seen that CAS and OT have a link.

5.2.4 How is CAS going to contribute in achieving sustainable growth?

Sustainability is the thrust that any organisation needs to achieve and literature has shown that they are many strategies that are available and the researcher concluded some can be applied to ZENT. The organisation should strive to produce products and services that meet high quality standards and this can be achieved by the acquiring modern machinery and technology. The combination of technology and quality usually reduces prices of the products and services, on the other hand advanced machinery can be used to differentiate products in a very short space of time. Differentiation will also become a source of sustainable growth that will deter entry of new competitors. Technology and advanced machinery lowers production costs and more products can be produced that saturate the market and deter entry from new competitor. Saturation of market needs a lot of
capital injection and this might not be the best strategy in the short term as money will be locked in stock. Lowering of prices cause other competitors of ZENT to reduce their prices hence managing its rivalry. A company with superior technology can target all markets as they can adjust their production to satisfy a particular market segment.

5.2.5 What is the strategic importance and implication of organisational transformation and complexity to management?

Success or failure of any transformation strategy dwells on management. They are implications to management especially when the organisation wants to transformation using a different strategy from what other organisations are doing. This cause uncertainty among management and employees and this can be eliminated by selecting competent implementers of change. Management needs to involve all employees otherwise they will face resistance. Employees need to be told what exactly is going to done in the transformation processes and all questions should be answered and clarified. Communication is very crucial in the life span of the transformation project. Management needs to review the changes frequently so that they can be adjusted, adapted and reviewed until the process is complete. Culture has been discussed in greater detail and it is usually the foundation of any change initiative. The researcher concluded that there will be a need for much greater democracy and power equalisation in all aspects of the organisational life, instead of just narrow employee participation in change. The researcher also concluded that change should be between small-scale incremental change and large-scale radical change, at the edge of chaos. The researcher also concludes that in achieving effective change, order-generating rules have the potential to overcome the limitations of rational, linear, top-down, strategy-driven approaches to change. The researcher concluded that the conceptual framework provided in chapter two can be used in the organisational transformation through complex adaptive systems.
5.2.6 Research proposition

The research proposition was that by using complex adaptive systems as an organisational transformation strategy it will improve organisation viability. Based on the findings and conclusion the researcher concluded that organisational transformation through complex adaptive systems will bring sustainable growth to the organisation.

5.3 RECOMMENDATIONS

The researcher recommends the following to management of ZENT.

5.3.1 Organisational transformation

- Restructure and delayer some of the organisation departments and positions that are duplicated and inefficient respectively.
- Provide advanced technology to all processes that can be atomised.
- Provide systems that enable and encourage proper communication and regular feedback to all employees regardless of levels in the organisation.
- Involve all employees in all organisational transformation strategies that will take place in the organisation.
- Review change processes and adapt what is good to the organisation and discard what is not successful.

5.3.2 Complex adaptive systems

- Encourage innovation in the organisation so that there is continuous improvement in processes and quality of service and products.
- Apply CAS to the ZENT or part of the characteristics at different stages. The many characteristics that need to be applied in ZENT are self-organisation, co-evolution, self-organisation, adaptation, interdependent, edge of chaos and emergence.
- Reward teams not individuals and team-based activities should be encouraged as it improves innovation and communication.
- All activities and strategies should be lied down in a simple format so that every employee understands them.
5.3.3 Sustainable growth

- Innovate new products and use superior services to become leaders in manufacturing and substation construction in the world, and using it as a competitive advantage.

5.4 AREAS OF FURTHER RESEARCH

This research was based on selected sample of supervisory staff up to top management in ZENT excluding work floor employees that could not write. Further research is needed on the entire composition of the employees that represent ZENT. Further studies are required in different organisations in Zimbabwe so that the results produced in this research can be criticised for the benefit of management practitioners and academia. Although there are plenty of alternatives in studying transformation through complex adaptive systems, there are many ways of studying transformation in organisations. As a researcher in the field of complex adaptive systems, there is need for further exploration using case studies and mixed methods. The final area of study is a comparative study of applying CAS transformation strategy with other strategies in public institutions.
REFERENCES


2. Alder, R. M., & Koehn, D. J. (no date). CALM: Complex adaptive system (CAS)-Based decision support for enabling organizational change.


30. Diment, K., Yu, P., & Garrety, K. (no date). *Complex adaptive systems as a model for evaluating organisational change caused by the introduction of health information systems.*


INTERNAL CORRESPONDENCE

From : F. Chinhengo (Civil Engineer)  
At : Projects

To : A/Managing Director  
At : Head Office

Date : 6 March 2013  
Ref : FC/fc

APPLICATION TO CONDUCT A RESEARCH STUDY

I am currently studying for Master’s Degree in Administration (MBA) with the Graduate School of Management at University of Zimbabwe and I am expected to conduct a research study as a requirement for the degree. May I therefore, request your permission to conduct the study in ZESA Enterprises mainly to employees who are in managerial and supervisory positions.

The research topic is: “A study of strategies for transforming ZESA Enterprises (ZENT) into a complex adaptive system for achieving sustainable growth.”

This is a qualitative research study as it involves the use of structured questionnaires and observations to collect data and recommend properties of complex adaptive systems that ZENT can use as an organisational transformation strategy to achieve sustainable growth. The target population are ZENT’s managerial and supervisory employees who are in mostly Manufacturing and Projects divisions.

F. CHINHENO
CIVIL ENGINEER

Approved/Not Approved

P. DHAFANA
A/MANAGING DIRECTOR
Dear Sir/Madam

RE: MASTERS DEGREE IN BUSINESS ADMINISTRATION QUESTIONNAIRE

The researcher is a third year student studying for a Masters Degree in Business Administration with the Graduate School of Management at the University of Zimbabwe. The researcher is conducting a research on “A study of strategies for transforming ZESA Enterprises (ZENT) into a complex adaptive system for achieving sustainable growth”. This study is important as the researcher will learn more on the subject and the organisation might use the results in the near future.

You are one of the small numbers of people who are required to give your opinion on this issue. The researcher would greatly appreciate it if you could assist by completing and returning the attached questionnaire by 17 July 2013.

If you have any questions you wish to ask or there is anything you wish to discuss, please do not hesitate to telephone the researcher on the following numbers 0772 882 180 or 0733543025 or extension 275 and my email fchinhengo@zent.co.zw or farichinhengo@yahoo.com .
All information you provide will be totally confidential and will not be disclosed to third parties without your permission. You will notice that your name and address will not appear on the questionnaire and that there is no identification number. This is purely an academic research and all the information received will be treated in the strictest of confidence.

Thank you in advance for your assistance in this matter.

Yours faithfully

Farai Chinhengo

Masters Degree in Business Administration Student
APPENDIX C

Interview Questionnaire

Research Title: A study of strategies for transforming ZESA Enterprises (ZENT) into a complex adaptive system for achieving sustainable growth.

Thank you for agreeing to participate in this survey. The research focuses on the title above. Could you please answer the questions as honestly and please attempt to answer all the questions. I recommend that you read over the entire questionnaire before you begin to answer the questions. Thank you for your time.

Section A

Please tick ☑️ or fill in the appropriate answer.

1. Which division are you based in
   - Head Office
   - Manufacturing
   - Projects
   - Transport
   - Retail

2. Indicate your position in the organisation
   - Top management
   - Senior management
   - Middle management
   - Supervisory
   - Employee

3. Gender: Female ☑️ Male ☐
4. How long have you been employed in the organisation

1-5 years □ 6-10 years □ 11-15 years □ 16-20 years □
21 years and above □

Section B

1 Types of organisational transformation strategies

Organisational transformation is a change management strategy which has the aim to align People, Process, and Technology initiatives of a company more closely with its business strategy and vision. In turn, this helps to support and innovation of new business strategies (Stratton, 2011, p.15).

1.1 Are there any changes that have taken place in the organisation?

1.2 What types of changes where they? (Please tick in the appropriate box)

<table>
<thead>
<tr>
<th>Code</th>
<th>Types of transformation</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT1</td>
<td>Changes in organisational culture</td>
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<tr>
<td>TT2</td>
<td>Changes in organisational development</td>
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<tr>
<td>TT3</td>
<td>Removing some layers in the structure (e.g. top management or supervisory, etc.)</td>
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<tr>
<td>TT4</td>
<td>Re-engineering (replacing people with technology e.g. computers or machinery)</td>
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<tr>
<td>TT5</td>
<td>Changes in every aspect of the organisation tasks, rewards, structure, combining managerial and non-managerial activities, technological, etc.</td>
<td></td>
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<tr>
<td>TT6</td>
<td>Changes in increasing quality of product produced or services</td>
<td></td>
<td></td>
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<tr>
<td>TT7</td>
<td>Reducing the defects of produced products and reduction in customer complainants in services provided</td>
<td></td>
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<tr>
<td>TT8</td>
<td>Improvements in excelling beyond best companies in manufacturing of transformers and electrical related equipment, and substation and power line construction.</td>
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</tr>
</tbody>
</table>
1.3 How would you describe the following activities in previous organisational transformation? Please state your level of agreement with the following statements:

Score:  
1 - Very Poor
2 - Poor
3 - Satisfactory
4 - Good
5 - Excellent

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR1</td>
<td>Management's role</td>
<td></td>
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<tr>
<td></td>
<td>Outlining the intended to be done in the organisation</td>
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<tr>
<td>TR2</td>
<td>Employees involvement</td>
<td></td>
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<tr>
<td></td>
<td>Employee consultation, advise and agreements</td>
<td></td>
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</tr>
<tr>
<td>TR3</td>
<td>Time management</td>
<td></td>
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<tr>
<td></td>
<td>Whether the time lines were indicated and communicated to every employee (start and end dates)</td>
<td></td>
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<tr>
<td>TR4</td>
<td>Project Planning</td>
<td></td>
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<tr>
<td></td>
<td>How do you see the overall change process</td>
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</table>

1.4 If you were the one implementing changes to the organisation, department or team, what you would do for it to be successful?

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2. Application of complex adaptive systems to organisations

A complex adaptive system (a business, a project team, a network of people) is composed of interacting “agents” (employees, managers, board members, customers, suppliers) following rules (blueprints, values, ethics, laws, economics, organisational or political, friendship, profit maximising), exchanging influence (goods, ideas, money, trust) with their local and global environments and altering the very environment they are responding to by virtue of “simple actions” (Sherman and Sultz, 1998).

2.1 Do you agree that ZENT functions as complex adaptive systems?  

Yes  
No

2.2 What characteristics of complex adaptive systems that are exhibited by ZENT?

<table>
<thead>
<tr>
<th>Code</th>
<th>Characteristics of CAS</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS1</td>
<td>Divisions, employees and management are interdependent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS2</td>
<td>Processes, structures and plans in ZENT keeps on changing</td>
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<tr>
<td>CAS3</td>
<td>Can the future of ZENT be predicted?</td>
<td></td>
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<tr>
<td>CAS4</td>
<td>Is the behaviour of management and employees keeps on changing</td>
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<tr>
<td>CAS5</td>
<td>After some changes in the organisation, do affected divisions, departments or teams function properly</td>
<td></td>
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<tr>
<td>CAS6</td>
<td>Is there too much control from supervisors and managers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS7</td>
<td>Are they any small changes that have large impact on the organisation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS8</td>
<td>Are they any big changes that have small impact on the organisation?</td>
<td></td>
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</tr>
<tr>
<td>CAS9</td>
<td>Does the company adapt from other world class companies?</td>
<td></td>
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</tr>
<tr>
<td>CAS10</td>
<td>Does the company learn from its mistakes?</td>
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<tr>
<td>CAS11</td>
<td>Is ZENT a stable organisation</td>
<td></td>
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<tr>
<td>CAS12</td>
<td>Is ZENT in chaos</td>
<td></td>
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</tbody>
</table>
2.3 Can you rank the following approaches of complex adaptive systems? Please state your level of agreement with the following statements:

Score: 1 - Very Poor
2 - Poor
3 - Satisfactory
4 - Good
5 - Excellent

<table>
<thead>
<tr>
<th>Code</th>
<th>Approach</th>
<th>Description of the approach</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP1</td>
<td>Vision</td>
<td>Is it broken down and well understood</td>
<td></td>
<td></td>
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<tr>
<td>AP2</td>
<td>Attractors</td>
<td>Rewarding system in the company</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AP3</td>
<td>Simple rules</td>
<td>Easy of the processes and system</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AP4</td>
<td>Experiment &amp; reflection</td>
<td>Is the company reviewing the changes that it implements with employees and management</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>AP5</td>
<td>Feedback</td>
<td>The ability of the company to use feedback to alter processes and flow of information</td>
<td></td>
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<tr>
<td>AP6</td>
<td>Tension</td>
<td>Activities are done timeously and stimulates urgency employees within the company</td>
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</tbody>
</table>

2.4 What do you think the organisation should do to learn from its mistakes, learn from other companies, to be the best product manufacturer and service provider?

2.5 What do you think the organisation should do to learn from its mistakes, learn from other companies, to be the best product manufacturer and service provider?

3. Links between organisational transformation and complex adaptive systems

3.1 Do you agree that if ZENT change the way it communicates with employees, learn from mistakes, flat structure (where hierarchy is not important), simple rules, adapt the new ways of doing business etc. will bring profitability within the organisation.

Yes
No
3.2 Will changes in ZENT result in the following areas? Do you agree?

<table>
<thead>
<tr>
<th>Code</th>
<th>Link between CAS and transformation</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA1</td>
<td>Improvement in communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA2</td>
<td>Improvement in processes and systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA3</td>
<td>Improvement in turnover</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA4</td>
<td>Learning from mistakes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA5</td>
<td>Limited control of processes by management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA6</td>
<td>Adopt the best ways of conducting business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA7</td>
<td>Improve quality in projects execution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA8</td>
<td>Improve quality in manufactured products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA9</td>
<td>Best organisation structure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.3 Can you rank these characteristics in their importance to the organisation? Please state your level of agreement with the following statements:

<table>
<thead>
<tr>
<th>Code</th>
<th>Approach</th>
<th>Description of the characteristics of CAS</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAA1</td>
<td>Adaptation</td>
<td>Adapting to the best practice</td>
<td>1</td>
</tr>
<tr>
<td>LAA2</td>
<td>Inter-dependent</td>
<td>Divisions, departments, employees relying on each other</td>
<td>2</td>
</tr>
<tr>
<td>LAA3</td>
<td>Distributed control</td>
<td>Decentralisation of authority to lower levels</td>
<td>3</td>
</tr>
<tr>
<td>LAA4</td>
<td>Distributed control</td>
<td>Strategy of the company coming from every employee (shop floor worker to MD)</td>
<td>4</td>
</tr>
<tr>
<td>LAA5</td>
<td>Linearity</td>
<td>Behaviour of employees and management</td>
<td>5</td>
</tr>
<tr>
<td>LAA6</td>
<td>Linearity</td>
<td>The processes and systems remain the same</td>
<td>1</td>
</tr>
<tr>
<td>LAA7</td>
<td>Evolution</td>
<td>Learning and improving from the past experiences</td>
<td>2</td>
</tr>
<tr>
<td>LAA8</td>
<td>Predictable</td>
<td>Determining the future of environment and organisation</td>
<td>3</td>
</tr>
<tr>
<td>LAA9</td>
<td>Self-organisation</td>
<td>Cooperation of employees, systems to achieve the best possible way of working despite of structure and hierarchy</td>
<td>4</td>
</tr>
<tr>
<td>LAA10</td>
<td>Emergence</td>
<td>The ability of the organisation to deal with the unforeseen that is not planned or controlled</td>
<td>5</td>
</tr>
<tr>
<td>LAA11</td>
<td>Chaos</td>
<td>Level were employees create new ideas, emotions are high, excitement and exhaustion coexist in projects execution and manufacturing of products</td>
<td>1</td>
</tr>
</tbody>
</table>

Score: 1 - Least Important
2 - Fairly Important
3 - Important
4 - Very Important
5 - Extremely Important
3.4 In your own view is there a link between organisational transformation and complex adaptive systems?

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4. Complex adaptive systems and sustainable growth

Sustainable growth is defined as ability to increase in size and continue over a period of time (Bottomley, et al., 2003).

4.1 Do you agree that if ZENT changes the way it communicates with employees, learn from mistakes, flat structure (were hierarchy is not important), simple rules, adapt the new ways of doing business etc. will bring sustainable growth within the organisation.

Yes  No

4.2 Which of the following factors bring sustainable growth to ZENT? Do you agree with the following?

<table>
<thead>
<tr>
<th>Code</th>
<th>Sustainable growth factors</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGF1</td>
<td>Improvement in pricing structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF2</td>
<td>Differentiating products and services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF3</td>
<td>Increase in product excess to the market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF4</td>
<td>Increase in market share</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF5</td>
<td>Improved performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF6</td>
<td>Increase in technological advancement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF7</td>
<td>Improvement in quality of products/service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF8</td>
<td>Increase in partnership</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF9</td>
<td>Improved quality in manufactured products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF10</td>
<td>The organisational structure is the best for the organisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGF11</td>
<td>Improvement in employee moral through training, support and rewarding</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.3 Can you rank these sustainable growth strategies in their importance to the organisation? Please state your level of agreement with the following statements:

Score: 1 - Least Important
2 - Fairly Important
3 - Important
4 - Very Important
5 - Extremely Important

<table>
<thead>
<tr>
<th>Code</th>
<th>Strategy</th>
<th>Description of the strategy</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGS</td>
<td>Deter entry</td>
<td>Keeping away competitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS1</td>
<td>Managing rivalry</td>
<td>Pricing better, advanced technology and different product and services than competitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS2</td>
<td>Market</td>
<td>Targeting a particular market</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS3</td>
<td>Pricing</td>
<td>Pricing lower than competitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS4</td>
<td>Differentiation</td>
<td>Different and better products than competitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS5</td>
<td>Technology</td>
<td>High advanced machinery and systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS6</td>
<td>Quality</td>
<td>High levels durable and reliable products</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS7</td>
<td>Service</td>
<td>Superior levels of service</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS8</td>
<td>Vertical integration</td>
<td>Buying raw material companies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SGS9</td>
<td>Synergy</td>
<td>Combining parts of the business with other companies</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>SGS10</td>
<td>Culture</td>
<td>The way a firm lead, train and support its members</td>
<td></td>
<td></td>
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</tbody>
</table>

4.4 In your on view what would be the best strategy that ZENT might use to achieve sustainable growth?

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5. The implication of organisational transformation and complex adaptive systems on management

5.1 Organisational transformation through complex adaptive systems is it important to management?

<table>
<thead>
<tr>
<th>Code</th>
<th>Management implications</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMC1</td>
<td>Organisational structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMC2</td>
<td>Reconfiguration of the organisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMC3</td>
<td>Human resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMC4</td>
<td>Organisational strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMC5</td>
<td>Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMC6</td>
<td>Organisational culture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.2 What important changes should management implement to achieve organisational transformation through complex adaptive systems? Do you agree that the following are important to management?
5.3 Can you rank these sustainable growth strategies in their importance to the organisation? Please state your level of agreement with the following statements:

<table>
<thead>
<tr>
<th>Code</th>
<th>Strategy</th>
<th>Description of the strategy</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMS1</td>
<td>Planning</td>
<td>Long term 3 to 5 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS2</td>
<td></td>
<td>Short term 1 to 2 years</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>OMS3</td>
<td>Managing</td>
<td>Intervening timeously on unresolved issues</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>OMS4</td>
<td>Control</td>
<td>Distribution of power among employees</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>OMS5</td>
<td>Strategy</td>
<td>Continuous changes in strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS6</td>
<td>Transformation changes</td>
<td>involves all parts and levels of the organisation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS7</td>
<td>Transitional changes</td>
<td>Gradual changes in people, structure, procedures or technology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS8</td>
<td>Developmental changes</td>
<td>Continuous scanning internal and external environments; creating motivational work environments; rewarding individual innovation, growth and development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS9</td>
<td>Experiments</td>
<td>Try new views and breaking rules</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS10</td>
<td>Innovation</td>
<td>Allow freedom on employees to solve problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMS11</td>
<td>Talent</td>
<td>Groom talented employees</td>
<td></td>
<td></td>
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</tbody>
</table>
5.4 In your own view, what would be the implication on management of applying organisational transformation through complex adaptive systems?

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APPENDIX D

The section provides some quotations from the research questionnaire

1. **Organisation transformation**
   - Employee engagement would be increased. I would also set up a change management team to be on the ground to ensure common understanding is established with employees and targets adhered to.
   - Explain the objectives to all. Ensure that the objectives are smart. Monitor progress and ensure all are enlightened on the way forward. Continuous improvement on feedback after stage evaluation. Involve top management to participate actively as the project progresses.
   - Improve communication and involve all the affected parties in the change process. Spread drastic changes over time, giving enough time for adjustment and coping.
   - Centralise all operational and management activities. Analyse departmental activities, redesign and organogram, realign and reassign staff and may be retrenched all excess baggage. Result is to collapse head office.
   - Set clear goals. Consult employees at levels and create dialogue. Ensure employees “buy in” to the change process. Communicate fully at every stage of the implementation process. Measure success at every stage and handle employee concerns and resistance.
   - Change management-follow the due processes required for successful transition. Communication would be my fundamental tool throughout the whole change management process. Effectively communicate the intention and justify for all players to understand “why” the change – for their total participation. The “how” part will now not be left for me alone to figure out but if will now be a joint stakeholder contribution. The actual change implementation must involve joint review, evaluation and feedback.
   - Coming up with a suitable structure. Employee relocation according to skills. Getting suitable and modern equipment to ease the work and best...
quality. Training of employees in total quality management and other suitable skills.

- Change employee organisational culture.
- Consult and engage employees.
- I would encourage the use of bottom-up-approach to be adopted by ZENT’s management. Do away with the current red tape on recruitment as it wastes time for directors instead of team concentrating on vital operational issues they spend their energy on petty unproductive issues.
- Respect for employees as they are the core drivers of business. Respect for employees as they are the core drivers of business.
- Reward employees when necessary.
- Increase communication downwards.
- Fully engage all staff at all levels.
- Improve communication between management and employees and all stakeholders. Properly manage change including all those affected so that they could have an input in the process embracing change. Liaise with all stakeholders for their input. Offer free courses and workshops so as to encourage participation of all. Draw a plan for organisational changes which should be gradual rather than sudden change.
- Put up a team that plays as a unit in order to achieve set goals
- Employee involvement and consultation so as to line up political support. Communicate. Have a clearly defined change management strategy. Ensure change is not ultra vires the laws of the country e.g. labour act. Ensure I am surrounded by team players and also people who give sound advice not a bunch of incompetent and self-centred managers.
- Engage employees, communicate the benefits of change, and ask for stakeholder input. However the change would still proceed not with standing opposition. According to Kotter, a sense of urgency is key. Beckhard emphasised discomfort levels that rendered change inevitable anyway.
- Management needs to consult each other often so as to outline the progress and best they can manage the organisation and agree on certain changes to implement. Employees should be involved in change management since they are the individuals who are involved in day to day
running of the organisation. Time should be managed properly in order to avoid repletion and project planning should be well presented to be successful.

- Engage and agree with all stakeholders on the modus operandi. Ensure that the legal framework has seen laid starting to implement any changes envisaged. Motivate all the parties to the change to embrace them as a welcome development. Set time frames and milestones with the concurrence of all involved.

- When implementing changes to a department, I would first look at a model organisation which had implemented a similar strategy in the past. I would then analyse the positives obtained from such a change process, I would then try to build on these positives. However the negatives effects are also important, so I would have to come up with plans to mitigate the risks posed by a change process. Consultations with all employees should also be done so as to judge, the possible response to the change strategy by the employees.

- The change philosophy has to be sold to the employees so that they become part of the change or own the change.

- For any change to be successful it must be planned and every employee should be involved from the shop floor up to top management, otherwise any changes that disregard other employees will face stiff resistance. Resources must also be availed so that the implementation is possible. Training must also be done for smooth implementation.

- Involve employees on transformation.

- Improve employee engagement. Source and support all initiatives with the necessary resources for task accomplishment. Timeously address industrial relations issues raised by employees. Undertake a baseline survey to establish employees to well performing organisation to facilitate benchmarking and inspiration amongst employees to achieve better results.

- I would involve employees from planning to implementation. Employees should be advised/engaged of the intended changes before implementation. There should be benefits for both employees and the shareholder for the intended changes to be implemented successfully.
- I would imperatively ensure unfiltered involvement of all stakeholders.
- Reduce top management levels. Streamline operations and discard/abandon unprofitable divisions like sales and marketing. Engage people with appropriate competency. Develop human capital.
- Start with a comprehensive study and analysis of the system. Incooperate personnel at all levels within the context of system analysis and study. Identify appropriate technology and tools and partners. Outline an implementation plan involving all levels of the organisation. Adhere to implementation timelines. Continues review of the thrust of changes being introduced and are they flexible enough to allow for adjustments.
- To implement the bottom-top method. To promote brainstorming at all levels regardless of position.
- Re-write (restructure) partnerships with technology partners. Engage reputable partners with well-known products e.g. ABB, Siemens. Improve marketing by introducing prompt response to enquiries. Improve communication across from top management to supervisors by adopting brainstorming sessions.

2. **Complex adaptive systems**
- The company should review its strategic and operational plans more regularly and benchmark its performance against others world class performers in similar business. The company should also engage in research and development activities.
- The company needs to follow laid down procedures to process successfully in all its systems.
- Management must be flexible in operation and make decisions that improve operations and revenue generation rather than cost cutting. The organisation should also engage all shareholders in strategy formulation and implementation.
- Should adopt a professional approach to business. Fuse together theory and practice. It has too many offices with a theoretical approach to business, yet there is no practicality.
- First create a consultative culture with employees to improve employee satisfaction and ‘buy in’. Benchmarking with “best in the world” organisations. Take note of technological changes and embrace new technology in transformer manufacturing. Adopt effective marketing strategies to compete with the best for business outside the ZESA group.
- The vision of the organisation must be understood by all echelons. Changes require buy in, especially from employees so that the organisation can bank full participation. Feedback alone is a tool that can correct mistakes, motivate and encourage adopted trends to continue and bring about brainstorming exercises to bring new innovative reinforcements to change.
- The organisation should compare itself with the best in the world so that it can take steps to improve its products and services. Feedback from customers should be taken seriously.
- Hold strategic management meetings across companies these help in learning from other companies in the same sector.
- Not sure
  - Benchmarking. Train employees.
  - Reward and respect employees, encourage participatory approach from workers like they do in Japan, ZENT will be the best product manufacturer in SADC. Also management should learn not to be rigid and not to shoot down initiatives from junior employees, even the shop floor workers, and lastly not to oppress employees.
  - Reassign and reduce management personnel.
  - Decision made by the board and directorate should be in tandem with the current political and economic environment.
  - The company should do consultative work before implementation a change and predict the impact to the customer. Should involve employees since they drive the vision and mission of the company. An ours concept by stakeholder will bring best results.
  - The organisation should not make abrupt decisions. They should consult employee representatives and other companies in order to improve productivity. They should also consult the customers.
- Admit that mistakes have been made. Accommodate criticism and advice. Management not to personalise trivial issues.

- Drive employee performance and link it to rewards. Recruit crème de la crème avoid nepotism as such favoured employees are indolent as they feel “entitled”. Use world class technology and value chain. Get rid of lagging spent forces.

- The management needs to take a survey within the employees and ask them what challenges they are facing and the hindrance to their work. In doing that they can learn from their mistakes and correct them for the best of the organisation. They need to consult other companies on how they are managing their company. Employees need to attend courses on how they can also add value to the organisation.

- Management should be made up of mature and visionary professionals capable of embracing managerial values, ethics and practices. Management should “walk the talk” and should manipulate situations and not the reverse. Management should be frank and realistic in their business approach not to: run with the hare and hunt with the hounds”.

- To learn from other companies, ZENT should send their employees for attachments to the companies such as ABB, or bring trainers from such reputable institutions to train and assess our process systems as well as product quality and make recommendations. ZENT should also learn from its mistakes by implementing the changes recommended by clients in future projects.

- Benchmarking with the best and successful companies. ZENT products must delight the customers rather than producing quality products. Brainstorming should be held from the shop floor to improve processes and cutting costs. Avoid reworks.

- The organisation should benchmark with other companies and also performance appraises the employees.

- Engage employees, communication with employee before implementing changes. Find out employees’ views on the intended changes.

- Widen supplier base to enable it to retain independence on its processes and quality of products and services. Review organisational structure to make ZENT a much leaner and compact organisation which is geared
towards customer satisfaction. Empowers different levels within the organisation to add value to the decision making powers. A decision that has to be endorsed by more than 3 levels is probably not being made at the correct level.

- The organisation should have targets and be able to measure them against actual. The variances should be analysed and causes be unearthed/identified and means be put in place for improvement the next time the task is undertaken or similar task. The organisation should identify companies in the same industry that perform better than themselves. Identity where it misses to match or surpass similar organisations.

- The organisation need to realize that the participation of all stakeholders lead to a sense of bringing thus commitment.

- Carry out post project implementation evaluation. Obtain feedback from users and employees. Intensify inter-company interactions.

- Shift from parastatal mind-set and practices. Invest in its human resources. Decentralise decision making.

- It should promote young talent and implement the succession plan correctly.

- The marketing must be empowered to reach out to all the potential clients. Marketing should be technically skilled. The organisation should invest in training to design its own products and not rely on partnerships.

- Activities must be done timeously.

3. Organisational transformation and complex adaptive systems

- Yes there is a link. An organisation can only transform itself successfully by involving and interacting with all stakeholders and being sensitive to need to adapt to change in the environment.

- Yes there is a link as organisations transform there is need to devise a system to equip management and staff in accepting the new order/developments

- The link is missing within the organisation and this is hindering progress in many spheres
- Organisation change requires employee involvement and communication. New approach to business required in organisational transformation. Organisational change involves processes (work routines, documentation, etc.)

- Yes there is a tight link between the two. Being a complex adaptive means quickly adapting to stimuli for business excellence. The matrix operations in a complex adaptive system can only be maintained with timeline transformations. A complex system whose change internally is slower than the external change is therefore not adaptive and doomed to fail.

- Yes the link is there although not enough to bring proper alignment of the whole organisation so as to be profitable.

- There is nothing at ZENT that shows transformation, dilapidated machinery and ancient management oppressive styles are the order of the day.

- No.

- There is a close link in that in organisational transformation the aim is to align people, processes and technology initiatives and in CAS is an integration of the people, processes and technology with the environment in which the organisation exists. Other factors outside the organisation are involved and enhanced.

- Yes, because the organisation will be guided by co-existence and coherence in the system.

- There is. Being a CAS an organisation will be constantly transforming and evolving for the better.

- Employees are in deep comfort zone and detest changes that will see them “earning” their money.

- There as affair link between OT and CAS because management communicate less to the employees for the changes, employees seem to resist to the changes made by management.

- In theory yes; but in practise no. there is so much lip service to theory on the part of the Stewarts.

- There is a strong link between the two since CAS involve the interaction of all employees against set rules while OT involves, aligning the employee activities towards achieving organisational goals.
- There is a link because for the organisation to be able to change and transform, it should be able to adapt to new and complex systems.
- Yes - for the transformation to be success CAS must be put in place.
- I view the two as closely interrelated as there is need for organisations to continuously improve on its structure and processes to be able to adapt to changes in the environment. The current political economic environment in particular can be viewed for a ‘PESTEL ANAYLISIS’ requires that these be continues transformation to help the organisation to adapt to the various changing environment.
- There is a link between organisational transformation and complex adaptive systems as first one relies on the latter for this implementation.
- Yes there is.
- Complex adaptive systems encompass organisational transformation.
- There is a link between organisational transformation and complex adaptive systems, transformation is a result of the business” ability to adapt towards complex systems which are more in line with the current business environment within which the business is operating.
- In a CAs there is exchange of influence which can be supported by innovation in organisation transformation.
- There is a link in that, altering the environment as per CAS you require to be innovative. However CAS operates on set rules, this tends to slow down implementation of new ideas.

4. Sustainable growth
- Producing durable and reliable products targeting a particular market and pricing better than competitors. Service levels should also be superior and improve the way the firm is lead, train and support its members.
- At the moment ZENT would adopt the culture strategy to achieve sustainable growth. No capital outlay is required.
- Forming strategic alliances with material suppliers and market/consumers as a way of improving quality of service and products and also boosting market capacity.
- Improve product (transformer) in line with the technological changes (quality). Continuous R & D to attain cost leadership (pricing). Product development (introduce related products to fill gap in the market).

- Strategies for buying raw materials are vital sustainable growth in that the material or raw material component of production is greater than any other. It also determines the management of rivalry (competition) and pricing as well. Synergies with other partners maybe the best strategy to obtain the quality raw materials in Zimbabwean scenario. Sustainability has an attachment and so the costing side of an organisation becomes fundamentally imperative. Coupled with quality raw materials, the culture of all employees needs no emphasis in engaging in efficient and effective methods of production.

- ZENT should improve and excel in its products and service delivery so that it can be preferred by customers.

- Product differentiation will go a long way in propagating the company to a higher position.


- Learn from its mistakes, do away with the current directorate which does not have employees at heart. Participatory approach from employees and do away with NEC, migration idea.

- Pricing better on their products.

- Encourage and reward innovation on a regular basis e.g. quarterly, half yearly and yearly.

- Aggressive marketing strategy supported by efficiency in execution of projects. Behavioural change in management so that they adapt the ‘ours’ concept and thinking outside the box. Sending employees for continuous improvements.

- No link

- Increase market share by being more competitive in product quality and pricing that is customer oriented.

- Differentiation of products and pricing.

- Recruit cream, develop and retain talent, introduce variable pay (profit share, bonus schemes linked to real productivity) avoid skewed business
deals and employment on merit is a must. Change the culture the way Jack Welch did at General Motors develop the 70% layer and the rest to look to other less agile industries where they will possibly fit.

- ZENT as an organisation needs to adapt to the modern technology with high advanced machinery and programmes in order to meet the standards of other competitors. Employees need to perform their duties in an effective manner so as to attract the best customers in the world.

- Manage rivalry. Product differentiation. Superior level of service.

- ZENT must try to improve on product quality. This is a very important factor since; the product is what the client is left with, not the process. The clients usually evaluate the company by the quality of product. ZENT also has to produce better products than competitors such as ABB and Power-Network-Control. This enables clients who are already employing the series of these companies to reconsider engaging ZENT in the future projects.

- Pricing better, advanced technology and different product and services than competitors.

- ZENT needs partnerships in terms of technology, equipment and raw materials. ZENT needs to practise real marketing where it must have a deliberate effort and drive to sell its products and services.

- ZENT must use competitive prices; they can achieve this by sourcing for cheaper suppliers or by importing raw materials in bulk.

- Structure and coordinate an effective supply chain management system. Ordinarily materials take up to 80% of ZENT’s costs and as such it is critical that the organisation adopts efficient materials procurement procedures to enable it to be profitable at input stage. ZENT can also sustainably grow through targeting the ‘non-ZESA’ market that has the ability to timeously pay for products/service supplied. The current service where ZETDC is the sole key customer exposes ZENT to funding challenges which then constrains the organisation’s growth prospects.

- Increase the market share and be the preferred organisation to constant project and manufacturer of transformers. The organisation should be able to survive without clashing with employees i.e. refusing employees salary increase. Taking away benefits currently enjoyed by employees.
- ZENT should manage its supply chain in order to be agile on the market. The organisation should enunciate its position on the market, i.e. are they leaders, followers or nichers. Embrace dynamism of culture as the market evolves into one borderless market.
- Providing superior levels of service and managing rivalry.
- ZENT should invest and realise value installed in its human resources. ZENT should move from parastatal mentality and ways of doing business and move towards better corporate governance. ZENT must invest towards new product development and create synergies with world class manufacturers and improve its product base.
- The best way is to find alternative suppliers of raw materials, cheap and locally available to reduce import duties and transport costs.
- Change raw material suppliers and adjust product pricing.

5. Implication of organisational transformation and complex adaptive system to management
- Applying organisational transformation through complex adaptive systems will result in sustainable growth for the company and successful management of the company to attain sustainable profits.
- To achieve their goal management need to be flexible as they scrap old techniques and acquire new systems that may be above their skills.
- Improved employee satisfaction, motivation and alignment to goals of the organisation. The changes that are implemented are globally accepted and are taken in as home grown solutions have making them more effective.
- Long term success.
- Might take a lot of time to achieve. Resistance from employees.
- Not all employees will understand.
- Unnecessary stress free life and good industrial relations with employees.
- Will bring improved profit and revenue to the company.
- Management is exposed to its environment thereby exposing poor performers, this they end up losing their jobs/reputation.
- Management will face resistance from affected personnel and this may result in a lot of idle time thereby affecting production.
- It will bring out a reduced management structure that is very effective.
- Value creation so that all stakeholders benefit.
- When applying transformation through CAS management needs to be very cautious and be able to manage the organisation properly. Employees need to be controlled and managed properly in order to produce the efficient and best results for the organisation.
- Fear of collapsing the “empire”. Loss of “power” and authority- loss of prestige. Fear of uncertainty of the future.
- The result is a better performing organisation, since the complex adaptive systems try to align the organisational strategies with the economic environment. The processes are also meant to affect everyone in the company so this means every employee will try to improve his/her own standing, resulting in overall organisational change.
- A coherent unit.
- The CAS allows management to understand its business process and procedures. It is also allows the management to understand its business environment. When the organisation understands its processes and systems, it helps in the control of the business.
- Employees are likely to be innovative. Employees' engagement would assist in achieving the company’s goal.
- The organisation would continuously seek to improve its performance by staying ahead of its competitors. Employee involvement will ensure goal congruence i.e. Employee personal goals will be aligned to organisational goals results in employees seeking to achieve organisational goals so that their personal goals can also be fulfilled. Innovative potential in employees will be unleashed once management allows employees to learn from their mistakes and also experiment on new things or ways of doing things.
- Loss of control/power. Some managers may lose jobs or influence in decision making processes.
- A well primed organisation capable of going through complex situations at all times.
- Management will reap benefits by applying OT through an inspired and motivator workforce with better quality products which makes the organisation overall competitive.

- Positive implication of innovativeness leading to new product development. The main disadvantage is that it requires injection of capital which is not always available.

- CAS is not so good for a dynamic system as it is based on set rules that might slow responses to the market requirements if the responses called for are in violation in any of the CAS rules.