T.C.
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İŞLETME ANABİLİM DALI
TEZLİ YÜKSEK LİSANS PROGRAMI

Does Self-Organization Facilitates Adaptability and Success In Complex Adaptive Systems?

YÜKSEK LİSANS TEZİ

HAZIRLAYAN
Yussif Mohammed Alhassan

TEZ DANIŞMANI
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Prof. Dr. H. Cenk Sözen

KABUL VE ONAY SAYFASI

Yussif Mohammed Alhassan tarafından hazırlanan Does Self-Organization Facilitates Adaptability and Success In Complex Adaptive Systems? adlı bu çalışma jürimizce Yüksek Lisans Tezi olarak kabul edilmiştir.

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Prof. Dr. İpek KALEMCİ TÜZÜN

Enstitü Müdürü

DEDICATION

I dedicate this piece of work to my wife, my daughter (Hameedat Tipagya), my parents and my loved ones.

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I thank my supervisor, Prof. Dr. Hulusi Cenk Sözen, for his immeasurable guidance and patient throughout the course of the thesis. I am most grateful for his insightful comments. I also appreciate the efforts of Mr. Sumaila Chakurah towards the completion of this work, may God richly bless him. Finally, I sincerely appreciate the participation of the respondents for making this thesis possible. Overall I thank the Almighty God for His guidance and protection throughout my life.

ABSTRACT

The recent business environment has forced managers and organizations to start looking for management paradigms that will allow them to fully appreciate the happenings in the environment. This need has triggered so much efforts and researches into the field of self-organization theory as an alternative management paradigm to help them adapt to the environment. This empirical research is an effort to assess the roles played by self-organization in promoting adaptability to the business environment. In undertaking the study, the mixed methods research was employed as an experimental study was accompanied with social network analysis and observation. The results of the study revealed that self-organization plays a major role in facilitating and promoting adaptability and success of the organization. Also, it is noticed that teams or groups have to understand the goals and objectives of performing tasks clearly in order to be successful. It further revealed that; strong interactions, high levels of autonomy, and strong and positive value system- drives self-organization processes in the organization. Based on this study, it is recommended that further empirical studies are conducted and replicated in other locations and also using other research methodologies that are appropriate. Finally, organizations and policy makers should adopt organizational designs and policies that are appropriate for self-organization processes to thrive within the organization.

Key Words: *Self-organization; Adaptability; Complex Adaptive Systems; Complexity Theory; and Chaos Theory.*

ÖZET

Gunümüz iş ortamı, yöneticileri ve kuruluşları, çevrede meydana gelen olayları tam olarak anlamalarına izin verecek yönetim paradigmalarını aramaya zorladı. Bu ihtiyaç, çevreye uyum sağlamalarına yardımcı olacak alternatif bir yönetim paradigması olarak öz-örgütlenme teorisi alanında çok fazla çaba ve araştırma başlatmıştır. Bu ampirik araştırma, iş ortamına uyum sağlamanın teşvik edilmesinde öz-örgütlenmenin oynadığı rolleri değerlendirmeyi hedeflemektedir. Çalışmada, karma yöntem uygulanmış, deneysel bir çalışma sosyal ağ analizi ve gözlem eşliğinde gerçekleştirilmiştir. Çalışmanın sonuçları, örgütlenmenin uyarlanabilirliğini ve başarısını kolaylaştırmak ve teşvik etmek için öz-örgütlenmenin önemli bir rol oynadığını ortaya koymuştur. Ayrıca, takımların veya grupların başarılı olabilmeleri için görevleri gerçekleştirmenin amaçlarını ve hedeflerini net olarak anlamaları gerektiği de dikkati çekmektedir. Sonuçlar; güçlü etkileşimler, yüksek otonomi seviyeleri ve güçlü ve pozitif değer sistemi, organizasyondaki öz-örgütlenme süreçlerini yönlendirdiğini göstermektedir. Bu çalışmaya dayalı olarak, başka yerlerde ampirik çalışmaların yapılması, çoğaltılması, ve ayrıca uygun diğer araştırma yöntemlerinin kullanılması önerilmektedir. Son olarak, kuruluşlar ve politika yapıcılar örgüt içinde gelişmek için öz-örgütlenme süreçlerine uygun örgütsel tasarım ve politikaları benimsemelidir.

Anahtar Kelimeler: *Öz-örgütlenme; Uyumlama; Karmaşık Uyumsal Sistemleri; Karmaşıklık Kuramı; ve Kaos Kuramı.*

PREFACE

This study has been conducted for a partial fulfillment of a Master of Business Administration. The choice of the research topic has stemmed from my belief that the world is too complex to be reduced to a dichotomy of cause-effect relationship. Thus, I hold the view that the principles of the old Newtonian philosophy can no longer be applied successfully to our recent world. Based on this I turn to favour the opinion that organizations are complex systems just like the society, and therefore can be understood accurately using theories like the complexity theory. This coupled with my passion to carry out empirical research to expand existing knowledge motivated me throughout the conduct of the study. This is an original work prepared by Mr. Yussif Mohammed Alhassan whose contents (part or whole) have never been presented or published anywhere.

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CHAPTER ONE: INTRODUCTION

The recent environment of our business has been experiencing turbulence making it difficult for managers to properly and adequately execute their roles. As a result of this, managers and businesses are often caught up in a dilemma of; 1) trying to master their business environment to increase profitability and/or 2) submitting to the dictates of their environment. Given this, the environment of businesses has been considered to be extremely complex such that it becomes difficult if not impossible to predict with certainty-future happenings in the environment as well as the relationship and interrelationships between and among individual employees within organizations. This has great impacts on the operations and decisions of organizations in recent times.

In response to the above, experts and business professionals have embarked on wide search for the best and reliable ways or tools to master and understand the environment and the organization. This search can be dated back to more than two hundred years ago (Prigogine, 1976). This search has resulted into the clash of management perspectives and paradigms. Thus, the earlier management perspectives and paradigms adopted by managers and their organizations were based on the principles of the Newtonian philosophy. This philosophy holds the view that the organization can be seen to be or act like a machine with several different parts fits together to form a functioning whole (Wheatley, 1994:27). Based on this, earlier scholars of the Newtonian paradigm argue that the several structures and parts of the machine organization can be manipulated and/or modelled to suit the interests of the organization and its managers without any difficulty. With this, they turned to adopt the scientific management principles put forward by F.W Taylor- where all the thinking processes are undertaking by managers with less or no contribution from employees at the implementation hotspot (Morgan, 1986:30). That is the employees of the organization only concentrate on implementing the thoughts of managers, whether favorable or otherwise to themselves and the implementation process. Also, the principles of the Newtonian paradigm consider the organization to be 'closed' with self-regulating capabilities (Weisskopf 1979). Consistent with this idea is the opinion that organizations operate at an equilibrium position where the condition or state of the organization is stable and balanced with no changes in the organizational system (Meyer et al. 2005). This

means managers work hard to always maintain or reestablish the equilibrium condition of the organization in times of crisis and/or uncertainties. Unfortunately, the Newtonian perspective and its Cartesian counterpart have failed woefully in delivering the results they intend to achieve. This is because majority of the basic assumptions of these ideologies are faced with serious flaws.

The results have led to the emergence of a new paradigm to deal with the flaws of the above management perspectives. Thus, in the 21st century and beyond the application of the old Newtonian-Cartesian paradigms in studying organizations is highly restricted. This is because the world can no longer be reduced to the dichotomy of cost and effects relations (McMillan and Carlisle, 2002). Thus, the old paradigms are too artificial and do not fully capture the realities of complex, complicated, multidirectional, multi-faceted, turbulence, and constantly changing world. With this, the conditions and the nature of the recent organization do not allow managers to adequately manipulate it to achieve their goals. Due to this, complexity theorists argue that the assumptions of the Newtonian-Cartesian paradigms can only exist in theory and cannot be applied in the real world. They therefore proposed the use of complexity theory in studying the organization and its environment. Thus, they argue that complexity theory will deliver the numerous advantages from a highly connected and networked world (like ours) to managers and their organizations (Lewin, 1993). In line with this view, the organization is considered to be a complex living or adaptive system whose constituents are non-linear, self-organizing, highly connected, uncontrollable, and unpredictable. Key to the complexity theory is the self-organization theory. Pascale et al (2001) argue that the complex theories of self-organization would be a savior to organizations. Self-organization theory is adopted from the natural sciences and has been considered to be very successful and helpful in understanding a system. But there is still the need for empirical researches to support its application to the organization and in management studies. Much literature has been produced over the years to build the foundation for the application of self-organization to organizations but only a few of them are based on empirical evidence (Carapiet and Harris, 2007).

Based on the above, it is imperative for more empirical studies in the fields of complexity and self-organization theories so that adequate foundation can be laid for their application to the study of management and organizations. It is in the light of this that this study is important. Thus

this study aims to uncover the roles of self-organization, a central part of complexity theory, to the development of adaptive capabilities of the organization. That is, it assesses how strong interactions among organizational constituents promotes self-organization within the organization. Also, it investigates whether high level of employee autonomy promotes and facilitates self-organization. Finally, it tried to ascertain whether organizations with good and strong value systems exhibit high self-organization characteristics than those with low value systems.

CHAPTER TWO: LITERATURE REVIEW

This section of the study seeks to review the existing literature on the topic under study. In this section, the review would be conducted as follows: Theoretical Framework, Conceptual Framework, and Conclusion.

2.1.0: Theoretical Framework

Henry Ford is known to have said in the past that "history is bunk" (Swigger, 2008). This is, by way, fundamentally specious. This is because history is very important as it help us to put happenings in our present world into perspective (Robbins and Coulter, 2012). In the light of this, it is important to illustrate the ideological fit of the topic of the study into the perspectives of existing theories. For the purpose of this study, the researcher limits the review to the following theories: Contemporary approaches to management, the Contingency theory, the System theory and the Complexity theory. This will give a deeper understanding of the theoretical foundations and underlying ideologies behind the theory of organizational self-organization. These theories are further discussed in the sections below;

2.1.1: Contemporary Approaches to Management

Today's management approaches are based on the flaws of earlier management perspectives. One of the most apparent weaknesses of earlier thoughts about management is that most theorists concentrated much on the *'inside'* of the organizations (Robbins and Coulter, 2012). The narrowed nature of these ideologies pushed maverick scholars, in the 1960s, to start the search for a more-broad perspectives of appreciating management phenomena. With this, management researchers formed the opinion that studying the happenings in the external environment *'outside'* the boundaries of the organization; is of immense help in understanding the organization (Ibid).

Based on the above, two key perspectives of management has been formed. These are; the Contingency and the Systems theories. These theories form the basis for which todays organizations are managed. In the following sections, these theories are discussed in details;

Contingency Theory

Earlier management theorists formulated several management principles with the view that they can be applied universally to every situation. But repeated application of these principles revealed that they cannot be applied to every situation with certainty of expected results. Thus, the application of these theories often produces mix results. This is often because organizations have varying characteristics. Based on this, what is perfectly applicable to one organization may not be workable for another.

Inspired by this, some management researchers argue that organizational management ideas should be based on a fit between or among two or more factors (Islam and Hu, 2012). For instance, Van de Ven and Drazin (1985) provided detail explanation to the concept of fit by proposing three criteria- selection, systems and interactions approaches. The selection approach perceived organizational management ideas to be based on the organizational context. Thus, the organization has to adapt to the characteristics and/or conditions of its environment in order to survive and become effective within the environment (Islam and Hu, 2012). Following this argument, it means that the organizational context or settings should determine the organization's design and its operating principles. Majority of the early studies on the contingency theory was based on the selection approach. The interactions approach sees the match/fit to mean the effects of the interactions between the organization's structure and its context on performance (Van de Ven and Ferry, 1980). With studies using this approach, the differences in correlation between the context and the design is not important among low and high performing organizations (Islam & Hu, 2012). Rather the most important things are; technology, delegation, authority, structural dimensions of vertical integration, and complexity of control systems of organizations. Thus, the management issues mentioned are more significant in effective organizations than in ineffective ones (Khandwalla, 1977). The systems approach argues that the only way to understand the organizational design is simultaneously study the contingencies, structural alternatives, and performance criteria of the organization (Islam and Hu, 2012). A term in the systems approach called Equifinality (Van de Ven and Drazin, 1985) suggests that there is no best way of designing an organization arguing that there may be several and equally effective ways. Therefore there is no one best fit for all, and all the alternatives should be considered when designing the organization.

Systems Theory

Having its roots from the natural and physical sciences, the systems theory of management has been one of the most impressive theories that help scholars in their appreciation of organizations and how they behave. As inspiring as it is, it was not until in 1938 that it was first applied to the study of organization by Chester Bernard (Robbins and Coulter, 2012) in his book, *The Functions of an Executive*. He asserted that organizations function as cooperative systems (Ibid). Even with this, management researchers showed interest in the study of organization as a system only in the 1960s. A system is "*a set of interrelated and interdependent parts arranged in a manner*

that produces a unified whole" (Ibid). With this definition, the functions of the manager under the systems school of thought is envisaged to be the coordination of the various parts or subsystems of the organization. This suggests that various parts of the organization must work together for the attainment of organizational goals and objectives.

There are two system types identified by scholars of management. They are; closed and open systems. Closed systems are those which do not interact with their environments and is not influenced either. Open systems are those which are influenced and interact with their environments. In general systems theory, scholars place much emphasis on organizations as open systems. For example, Ludwig Von Bertalanffy noted that the concept of organization as open system is founded by the fact that living organism is not formed by the combination of several parts whose activities are not related (Bertalanffy, 1968:38). "*But it is a definite system, possessing organization and wholeness"* (Johnson et al, 1964). By this, the business organization is in constant interplay with its environment. This means it influences and is influenced by the environment within which it operates (Ibid).

Complexity Theory of Management

Unlike the conventional scientific wisdom, complexity theory or science started flourishing as a means of understanding and explaining management phenomena between the periods of 1960s and 1970s. During these periods, the flaws of mainstream scientific wisdom was apparent as it turned to neglect minor and dissipate aspects of phenomena in order to elevate scientific theories or laws. Due to this, it took the efforts of maverick scientists to provide an all-encompassing and radical understanding and explanation to scientific phenomena. It is no surprising that complexity or chaos theorists made several breakthrough discoveries by the 1980s (Burnes,

2005). The theory is born out of the physical and natural sciences. Scholars from disciplines such as physics, biology, meteorology, mathematics and computer sciences contributed immensely to the evolution of the theory of complexity.

The complexity theory is premised on the idea that the organization can be depicted as an ecosystem whose arrangement is not accidental, but as a result of the rules of nature which cannot be fully understood. This idea is contrary to the old 'machine' notion that the organization is an arrangement "whose parts and functions have been plucked out in advance" (Carapiet and Harris, 2007).

The terms *chaos* and *complexity* are often used interchangeably, even though there are some differences between them (Pascale et al, 2001). We often refer to things as Chaotic if we cannot control them. This definition of chaos is confusing. Chaos can be scientifically referred to as that whose unexpected occurrence has no intelligible patterns or interrelationships (Sherman and Schultz, 1998: pp. 16, 67). Cohen and Stewart (1994) noted that chaotic situations arises when complex things give rise to simple things while complexity arises when simple things give rise to complex systems.

2.1.2: Key Central Concepts of the complexity movement

For further appreciation of the complexity movement, it is appropriate to understand that the main complexity theories have some common features, whether it is weather systems or turbulence in biological systems (Lissack, 1999). For example, every complex system explored is characterized by self-organizing capabilities and non-linearity. Due to this, it is important to look at the three main concepts of complexity theories in order to improve one's understanding of the complexity thinking. These concepts are explained in detail below;

Chaos and Order

The concepts *'chaos and order'* are not opposites (Fitzgerald, 2002a), as a hidden order can be found in *chaos*. Chaos is often considered to be *'pure randomness'* (Burnes, 2005) but in a complexity perspective it refers to a complex, unpredictable, and orderly disorder in which patterns of behavior unfold in irregular but similar forms (Tetenbaum, 1998).

From the above, it is realized that 'chaos and order' are two twin features of every complex system. Thus, the system does not exhibits one pure attribute at any point in time. That is to say, within the *chaos* attribute lies some form of *order* and vice versa.

In an attempt to identify the best order-disorder condition that is beneficial to any organizational system, Stacey (2003) classified the order-disorder states in complex systems as: stable equilibrium; explosive instability; and bounded instability. He concluded by noting that; the complex system is only able to transform itself in order to survive within its environment only when it is experiencing bounded instability. To support this point, he argues that complex systems ossify and die when they become too stable; likewise, complex systems loss control and destroy themselves when they become too unstable (Frederick, 1998). Therefore, an organizational system can only benefit from a merger of stable equilibrium and explosive instability called the bounded instability. But the question that still lingers in one's mind is; how can an organization manage to experience this bounded instability as stated above? This research will delve into aspects of the answer to this question.

Edge of Chaos

In their works, several scholars refer to this condition in different terms. Some call it a situation "far-from-equilibrium" (Stacey et al, 2002). Others such as Hock (1999) refer to it as a state of "chaordic" (Burnes, 2005). Whatever it may be referred, it is a state during which the system constantly surf at the edge between order and disorder (Ibid). According to Smith and Humphries (2004), this idea demands a new approach of understanding organizational management, change and transformation. With this, systems are perceived to exhibit relatively stable behaviors until they reach the bifurcation point and become unstable and out-of-equilibrium (Ibid). Based on this, the systems opens up to the external environment for inputs and energy which produces unexpected outcomes. This allows the system to always be updated with the happenings around it by constantly scanning its environment for information necessary for its survival.

But it is still a mystery as to how the edge of chaos makes organizational individuals to gain new energy to innovate new ideas within the organization (Tasaka, 1999). Thus what actually happens in a social organizational system, different from physical system, that allows its people or employees regain energy for creative and innovative purposes? This is still a controversial matter worthy of further studies by complexity researchers. Previously, there have been attempts

to answer this question by researchers. Their efforts led us to the next most important concepts of complexity theory: order-generating rules.

Order-generating Rules

Gell-Mann (1994; pp.100) states that complex structures and behaviors emerge from systems that are characterized with very simple rules. This emergent features manifest themselves through the process of self-organization. Self-organization takes place within the confines of simple order-generating rules that allow restricted amount of chaos and provide relative order (Frederick, 1998; Stacey et al, 2002).

All in all, the order-generating rules concept suggests how self-organized systems try to preserve themselves at the edge of chaos even though its environment might be turbulent (Burnes, 2005). Even complex systems have the ability to generate new order-generating rules under new and unfamiliar conditions if the old ones are not good enough for them to adapt to a new environmental change (MacIntosh and MacLean, 1999). Order-generating rules work to provide the boundaries of action within the organization. Thus, it establishes a set of boundaries for the edge of chaos conditions to be achieved and induced. It does that by providing limited chaos and at the same time preserving relative order (MacIntosh and MacLean, 2001). The most important question to tackle on order-generating rules is, whether there is a framework that defines the nature of these rules as mentioned in the literature.

Based on the above, MacIntosh and Romme (2004) argue that order-generating rules can be defined based on different dimensions. The first is based on *Intention,* where they are argue that order-generating rules can be intended. By this, they mean that rules can emerge from some sections of the actors of the organization at a given time regarding aspects of new ideas. These rules will be subsequently recognized and codified into rules that are applied to the new ideas (Ibid). Second, they suggested that rules can be defined from the dimension of the *Content* of strategy and the *Processes* of shaping a change. The literature of complexity theory promotes the integration of these two dimensions in defining rules. Finally, rules can generate order at different levels of the organization. That is, it can do at the group, organizational, industrial, national, and global levels within an organized system (MacIntosh and Romme, 2004). They were quick to note that rules at the higher levels co-evolve with those at the lower levels over a period of time. With this work, there are still more to be done unravel a proper and a working

framework for defining the nature of the order-generating rules in the organization. This will be important in advancing knowledge in the field of self-organization.

2.1.3: The Three Basic Theories under Complexity Theory

Complexity theories attempt to predict the emergence of order from the ever-changing and unpredictable systems operating at the edge of chaos. These systems are constantly dynamic such that the *'laws of cause and effect'* might not be applicable in understanding their behaviors (Haigh, 2002). This is because order emerges within the system in an irregular but similar manner through self-organization. This self-organization, in turn is governed by simple order-generating rules.

There has been several diverse opinions regarding the definitions of complexity. This is often influenced by the field of the researchers. Even though there are several competing ideas about complexity, Stacey et al (2002) posit that there are three basic theories under which they can be classified. They are; chaos theory, dissipative structures and complex adaptive systems. These theories are further explained below;

Chaos Theory

The work of Lorenz (1993) on the weather systems has been considered the backbone of chaos theory. In his words, chaotic systems are; *'Processes that appear to proceed according to chance, even though their behavior is in fact determined by precise laws'* (Ibid). Thus, chaos theory is based on the principle that complex dynamic systems are in constant transformation of themselves in an irregular manner (Haigh, 2002). In other words, what seem to be chaotic are in themselves contain some form of order even though unpredictable but similar. In this sense, a slight change from one end will lead to varied outcomes at the other end. This is illustrated in the 'Butterfly Effect' example given by Lorenz (1993) in his work on the weather systems.

Chaos theory do not ascribe to the widely propagated arguments of the 'laws of cause and effect' (Burnes, 2005). Thus, the Newtonian, mechanical laws, and linear causality are rejected by chaos theorists (Styhre, 2002). Therefore, the Newtonian assumption that systems are no more than the sum of their parts and that these parts can be studied separately through reductionism do not hold. This is because, engaging in reductionism will not allow for the consideration of multiple causes, multiple effects and their interrelationships. Meanwhile, our recent world cannot be

properly understood without seeing it through several angles. Thus the concept of multiple causes, multiple effects, and their interrelationships is very essential to understanding the world of uncertainty, turbulence, and unpredictability. This is what complexity theory and its component theories seek to advance.

Dissipative Structures

Noted for his work on dissipative structures, Prigogine argues that chemical systems go through a state of randomness to evolve into '*higher-level of self-organized dissipative structures'* (Rosenhead, 1998). These structures turn to dissipate if energy is not fed into them from outside the system such that they can be maintained (Burnes, 2005). Dissipative structures are made up of partly-stable configurations which work in a non-linear way. Thus, at some point it will be able to contain external pressure and in others it will react radically to the slightest disturbances in its environment (Styhre, 2002; McMillan, 2004).

Dissipative structures may experience instability and reach out to the edge of chaos in order to acquire spontaneous self-organization. With this, the resultant behavior or structure cannot be predicted perfectly with full knowledge of the previous state of the structure (Stacey, 2003). Consider convection of heat in liquids as an example. The liquid at room temperature exhibits a particular structure characterize by randomness. But when it is heated the structure starts to change, then reach a critical temperature (edge of chaos) where an unpredictable new structures emerges where its molecules move in a regular direction producing *'hexagonal cells'* (Stacey et al, 2002). Note, even though the new structure is determined by the liquid's internal dynamics through self-organization it is not possible to predict the position and movement of the liquid's molecules from the previous state (Ibid). This theory or conception consider a self-organizing system to produce behaviors that are unpredictable since they cannot be predicted based on the past behaviors of its components parts. In other words the concept of reductionism, which is a key philosophy of the Newtonian theory, is not an appropriate way of understanding.

Complex Adaptive Systems

For the purpose of this study, emphasis will be placed on complex adaptive systems view. This is because, chaos theory and dissipative structures emphasize whole systems and populations; as compared to the complex adaptive systems ideology which seeks to appreciate how behavior is formed by individual members of a system and population (Stacey et al, 2002).

Also, complex adaptive system seeks to use *'agent-based approaches'* to understanding behavior of the system. Thus, it comes out with rules for individual members of the system and from which tries to predict the behavior of the system as a whole (Burnes, 2005). This view is contrary to those of chaos theory and dissipative structures which seek to use mathematical models at the macro level of the system in order to understand its behavior (Stacey, 2003).

The complex adaptive systems (CASs) are systems consisting of several individual members (agents) behaving within the confines of their own local rules but are required to adapt their behaviors to those of other members or agents (Stacey et al, 2002). This theory is often applied to works on non-linear biological systems. Complex adaptive systems are self-organizing because there is no external interference of how the system evolves; rather behavioral patterns are due to the internal interactions of individual members of the system. This self-organization process allows the system to easily cope or adapt to the outside environment for survival (Burnes, 2005). It should be noted that CASs are extremely sensitive to their initial states (Frederick, 1998).

2.1.4: Features of Complex Adaptive Systems

Complex Adaptive Systems (CASs) exhibit the following major attributes;

***Sub optimal*:** A complex adaptive systems does not need to be perfect for it to survive within its environment (Kaisler and Madey, 2009)**.** Rather it has to be better than its rivals and that is all. There is no need to waste any energy on being better than that. A CAS, once it has reached the state of being good enough, will trade off increased efficiency every time in favor of greater effectiveness.

Large numbers of agents interacting in a non-linear way: CAS is made up of large number of disparate agents interacting with one another within the internal and external environments of the system (Holland and Langton, 1980). Thus, these agents respond to changes in their environment- both individually and collectively. These responses and reactions are done spontaneously or in a non-linear way.

No central control mechanism: CAS has no centralizing mechanism that directs the system, even if there exist man-made central control systems (McMillan, 2004: 60). This is because man-

made control systems are based on perceptions of the organization. For instance, it is competition and collaboration that leads to order and coherent behaviors in a self-organizing system. This suggest that there should be freedom and autonomy of components of the system. This autonomy is considered to be essential in stimulating self-organizing behaviors within the system.

Constant learning: Learning and adaptation are key properties of complex adaptive systems. CAS do not react to circumstances passively, however when learning they modify and revise their structures and behaviors (McMillan, 2004: 61). Think of flu viruses and bacteria. As we have developed drugs and healthcare technologies that threaten their survival so they have responded by changing their structure and behaviors. Some have been successful, others less so.

Constant anticipation of the future: CASs always try to forecast happenings in the future. They have the ability to recognize patterns, shifting patterns and emerging patterns (McMillan, 2004: 62). They learn to use this to recognize and anticipate changes and modifications in patterns of process or structure. This enables them to speculate about possible futures.

Exist at the "Edge of Chaos": Complex adaptive systems evolves and seek to operate at the edge of chaos (McMillan, 2004: 27). This is so because the edge of chaos is where CAS are able to operate flexibly and creatively. Here, they can operate at the highest level of flexibility which will allow it to survive. In order to do this they experiment and test out their assumptions and ideas, try out new processes and structures, and to do this they need to constantly explore the world around them. Another feature of these systems is that they have emergent properties.

Self-organizing: Complex adaptive systems are self-organizing with all the attributes of these systems (Kaisler and Madey, 2009). But not all self-organizing systems are complex adaptive ones. The significant difference, as I have pointed out, is that complex adaptive systems learn and cope with changing events. Consider a laser beam as an example of a self-organizing system. It has changed according to changing situations. However learning is not part of nor a by-product of, its processes of adaption. As systems with self-organizing attributes, complex adaptive systems need energy to exist– without energy they will wind down over time and die.

2.2.0: Conceptual Frameworks

This section highlights on the definition of concepts relevant to the subject of the study. It further establishes the interrelationships among the variables or concepts and finally, it formulates the operational definitions.

2.2.1 The self-organization theory

One of the most important areas of research carried out by complexity researchers has been in the area of self-organization. Self-organization is the ability that complex systems have to self-organize spontaneously into even greater states of complexity (Pascale et al, 2001). Self-renewing system is sometimes used to refer to a self-organizing system because it dissipates its energy so as to reinvent or recreate itself. The capacity to develop new forms of structures and new ways of behaving identifies the basic distinction among the early concepts of self-organizing systems presented by the cyberneticists. Self-organizing systems can be noticed everywhere in the living world. Self-organization forms the basis of explanation of the emergence of the large number of complex systems and forms that exist; be it physical, biological, ecological, social or economic. It appears to be an evolutionary survival response in many species such as fishes, birds, and even humans that has improved their survival chances.

Ashby (1947) views self-organization as the set of processes during which systems are highly organized and involves self-stimulated variations in organization without external control and manipulation. In fact his opinion has been one of the earliest views on self-organization in management. Ashby (1947) is not alone with his opinion. A similar view is expressed by Goldstein (1994) who suggests that self-organization is the need for a system to evolve into modes of functioning characterized with more complexity and coherence in patterns. Also, Haken (1978) considers self-organization to be the occurrence of patterned behavior produced through the joint actions of various actors within a system, through mutual understanding, without external controls. In the view of Molleman (1998), self-organization is the self-autonomy to take decisions on both; 1. The transactions and 2. How transformations are organized to realize those transactions.

In autogenesis where the principles of self-organization is applied, three levels of structure is identified after the observation and the classification of the interactions among actors. These are; “deep structure, elemental structure, and observed structure”. From those levels, the “Deep

Structure" directs the actions of actors without external order. During the observation, it is realized that the interactions among actors "is governed by a system of recursively applied rules" (Drazin and Sandelands, 1992).

Based on the above, there are three major factors that influence the self-organizational abilities of complex adaptive systems (organizations). Figure 1 below clearly defines these factors and their driving factors.

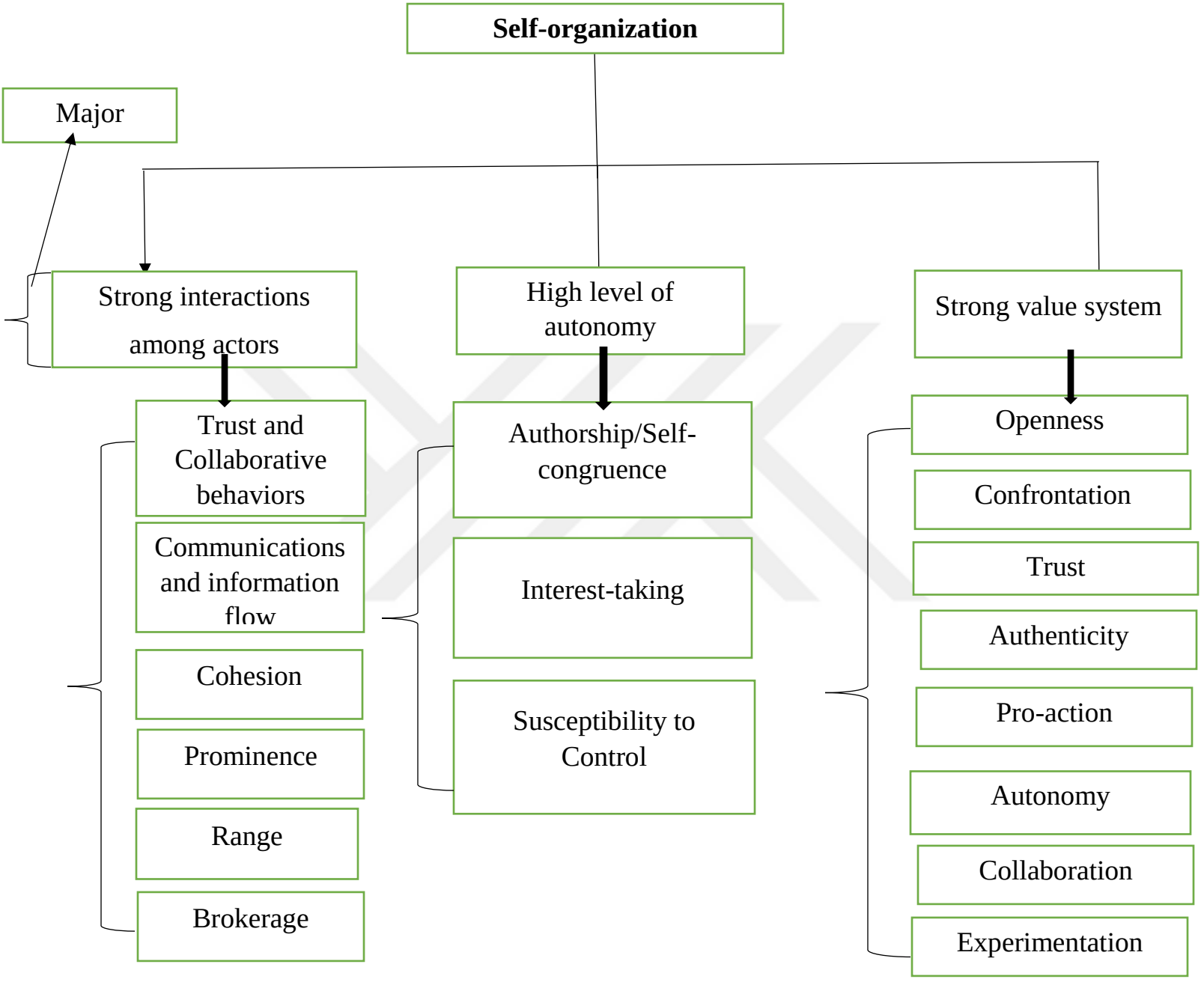

Figure 1: A Conceptual Framework for Measuring Self-organization Adapted from Carapiet (2006), Weinstein et al (2012) and Rao T.V. and Abraham E. (1999).

2.2.2: Features of Self-organization in Complex Adaptive Systems (CAS)

The evaluation of literature conducted above under self-organization theory revealed three main features of self-organization. All other features of the concept can be carefully classified under either of them (Carapiet, 2006). The three main characteristics of self-organizing systems are explained as follows:

Strong Interactions among Agents

For the purpose of this study, the network analysis is adopted to help the researcher in investigating the level and strength of the interactions of respondents considered for the study. There are many methods of assessing the extent of the links that exists among actors within the organization. According to Haythornthwaite (1998) there are five main principles to be considered in an attempt to assess the networks of actors within a social system. These five principles are the most famous principles used by scholars in network studies. These principles are: Cohesion; Prominence; Range; Structural equivalence; and Brokerage (Haythornthwaite, 1998). Thus, these principles can be used to measure the relative and *positional* characteristics of the networks of groups (Alba, 1982; Monge and Eisenberg, 1987). They will help you to determine how cohesive a group is and also identify the positions of various actors within the group. But for the purpose of this study, the researcher made used of only four out of five of the principles. Thus the researcher used Cohesion, Prominence, Range, and Brokerage in order to measure the level and strength of the network that exists within the organization. Two additional measures are added to the four principles to measure the level of trusts as well as the extent of the communication among the actors within the group. The conceptual framework adopted to guide the researcher in measuring the targeted variable is shown below;

Q1: Does strong interactions among organizational constituents improves its agility and complex learning?

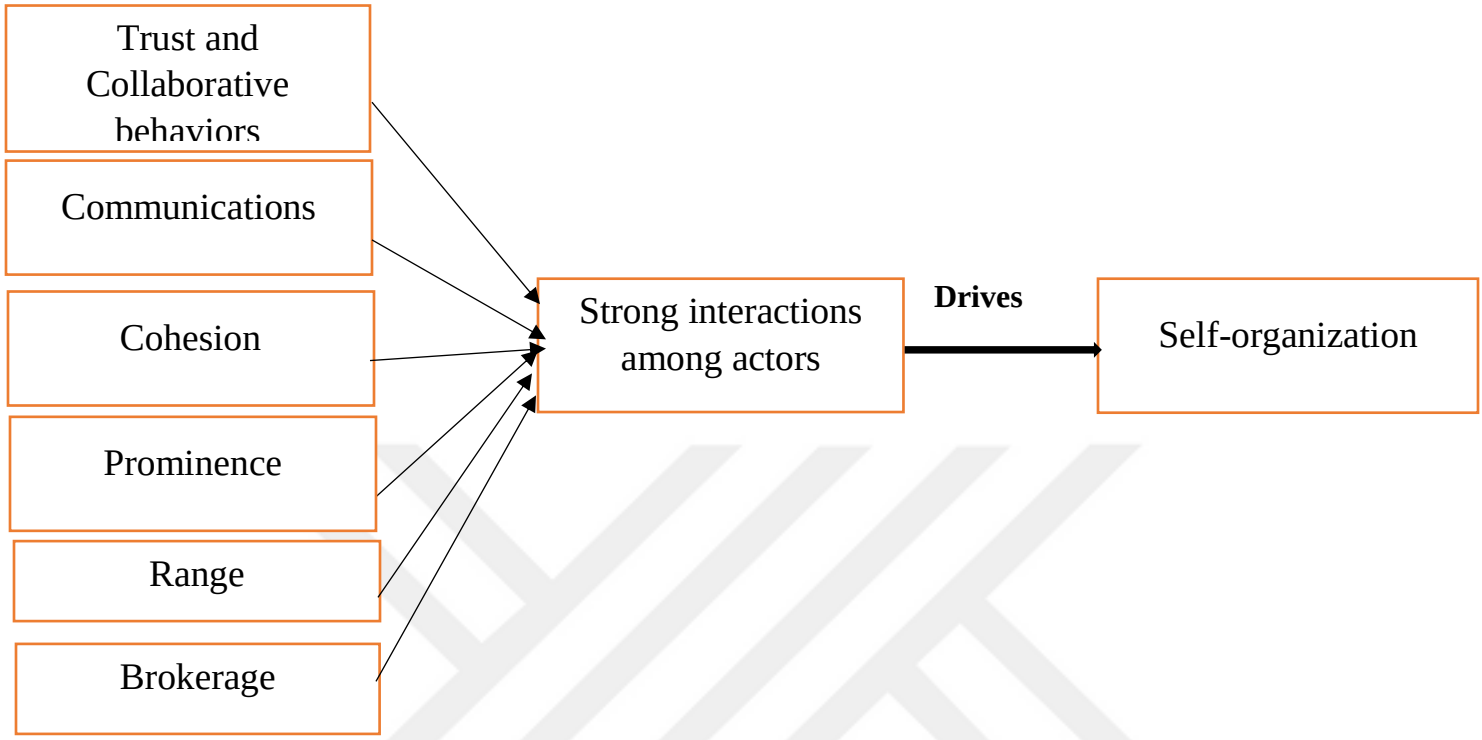

Figure 2: Conceptual Framework for Measuring Strong Interactions

From Figure 2, it is realized that strong interactions among members is facilitated by the presence of: Trust and collaborative behaviors; Strong communications; Cohesion; Prominence; Range; and Brokerage. Each section of the framework above explained below;

Trust and collaborative behaviors

An important variable considered to play major role in facilitating interactions among actors is trust. This characteristic of self-organization is considered to be very beneficial to complex adaptive systems (CAS). For example, Pascale et al (2001) argue that the mixing of people from different fields and backgrounds is essential to the system as their histories and experiences are capable of enriching self-organizing networks. Trust serves as the binding agent for facilitating the peaceful coexistence and sharing of valuable information and ideas to achieve organizational goals. Thus the cooperation and collaboration of these varied people can open a new opportunity

for self-organization to take place and it is trust which stimulates cooperative and collaborative behaviors.

Communication

In synergetic, self-organization is characterized as the occurrence of patterned behavior as a result of joint action *by various constituents* of the system without external control (Bushev, 1994). This is important as; the healthier the nodes and connections of actors are, the more self-organizing the system will be. Thus, the nodes and connections among constituents of the system drives self-organization within the system (Pascale et al, 2000). The result of having enriched nodes and connections are; collaborative behaviors, strong communication, and high level of trust among actors.

Cohesion

Cohesion measures the attributes of a socializing relationships that exist among actors of the group. It also measures the probability of the group actors to have same information and resources within the group or organization (Haythornthwaite, 1998). Cohesion is often measured using the *Centralization* and *Density* measures. These measures help in identifying the interaction of organizational actors with all other members of the organization. It also ascertain the degree to which there is higher degree of interconnectedness among actors. According to Haythornthwaite (1998) the structures of the network such as cliques and clusters can be revealed through the measures of cohesion. The *Density* of a network measures the degree to which members of the network are connected to all other members. It is the ratio of the actual connections in a population to the number of possible connections within the network (Ibid). A higher density network indicates that the individuals within that network are highly interconnected with one another, whereas a low-density network refers to a network whose individuals are lowly interconnected with one another. Thus, information flows freely and smoothly within a higher density network than a low-density network. *Centralization* measures the extent to which network actors' are arranged around a central point or actor. If a network is organized around a particular actor, it means that that actor acts as an intermediary in the communication and information flow processes.

Prominence

Prominence tries to measure and identify those actors who are influential and/or powerful- "who is more or less in demand", within the network (Nohria, 1992, p. 6). This can be measured by checking the *centrality* of each individual in the network (Haythornthwaite, 1998). Thus, counting the number of connections maintained by an individual actor helps in measuring his/her centrality (in other words the demand of the actor) within the network. This means the actors with the highest number of connections have the highest degree of centrality in the network while those with lowest and/or no connections have the lowest degree of centrality. The actor without any connection in the network is considered to be isolated (Ibid). Another measure use in determining the *Prominence* of an actor in the network is *Global centrality/Closeness.* This measure looks at the shortest path between an actor and the rest of the actors in the network. An actor who occupies this point has the opportunity to control, facilitate or inhibit the flow of information to the rest of the actors within the network.

Range

The measures of *range* tries to assess the various sources of information that an actor can access within the network. This is measured as the number of ties an individual actor has and/or maintains (Haythornthwaite, 1998). Also, the number of social resources and places an actor has access to and can use within the network can be used to measure the range of the actor's ties (Burt, 1992a). With this, the range of an actor's network depend on the size of his/her network from one point to another that he maintains. Also, the number of the extended and/or bridging ties maintained by the individual actor is very important in determining the range of his/her network (Haythornthwaite, 1998). An information gotten from outside the network by an actor is often shared with his/her ties to increase the number of information resources within the network (Dourouka, 2013).

Brokerage

It measures the degree to which an actor have connections with disorganized others (Haythornthwaite, 1998). Thus, an actor who occupies this position acts as an entrepreneur and carries information from one group to another within the network. This actor plays an intermediary role in conveying information from group to group while retaining control of the

information. The measures of *betweenness* is often used to measure the brokerage role of actors. It measures the extent to which an actor sits at a central point in the network without being connected to many others (Ibid).

High Level of Autonomy among Employees

There is no central controlling mechanism instructing these self-organizing systems. Pascale et al (2001) suggested that there should be no too many rules or fewer rules, stressing that it will create tension between discipline and freedom on which self-organization resides.

Exhibition of spontaneous behaviors is a key characteristic of self-organization natural systems (McMillan, 2000:191). The ability to spontaneously self-organize is found everywhere in complex living systems. People, insects, animals, bacteria and cells are able to react and remain adaptive to the activities of others around and unintentionally reorganize themselves to their advantage. For instance, people have self-organized over the centuries as they have sought to improve their chances of survival. By self-organizing spontaneously in response to a need or a threat they have created new structures in the form of small trading communities, market towns, and national and international economies (Ibid). The theory adopted in the analysis of the level of autonomy among organizational agents is based on the Theory of Self Determination. This is because proponents of this theory argue that '*dispositional autonomy'* (Weinstein et al, 2012) enables organizational agents to act in a self-organize manner by providing them the following benefits according to Weinstein et al (2012);

"*Creative learning and engagement (e.g., Roth, Assor, Kanat-Maymon, & Kaplan, 2007), greater energy and vitality (Ryan & Frederick, 1997), lower stress and higher well-being (Weinstein & Ryan, 2011), and more rewarding socialization and relationships (Knee, Lonsbary, Canevello, & Patrick, 2005; Niemiec et al., 2006), among other positive outcomes."*

Based on the above benefits identified, the kind of autonomy considered in this research is the Dispositional Autonomy. Therefore, level of autonomy measurement scales are based on the construct of this type of autonomy. Dispositional Autonomy, according to the Self Determination Theory (SDT), is an autonomy where individual behavior is volitional and regulated by the self without any outside forces or contingencies (Ryan and Deci, 2004). Individual behavior, when considered autonomous according to the Self Determination formulation, means peoples'

behaviors are self-endorsed and congruent with their values and interests (Weinstein et al, 2012). The concept of 'Control' is the direct opposite of autonomy as defined in this study. Thus, 'Control' is when the behavior of an individual is regulated by external contingencies and not the self. The analysis above leads us to our second hypothesis as shown below;

Q2: Does high level of autonomy promotes self-organization and adaptive behaviours?

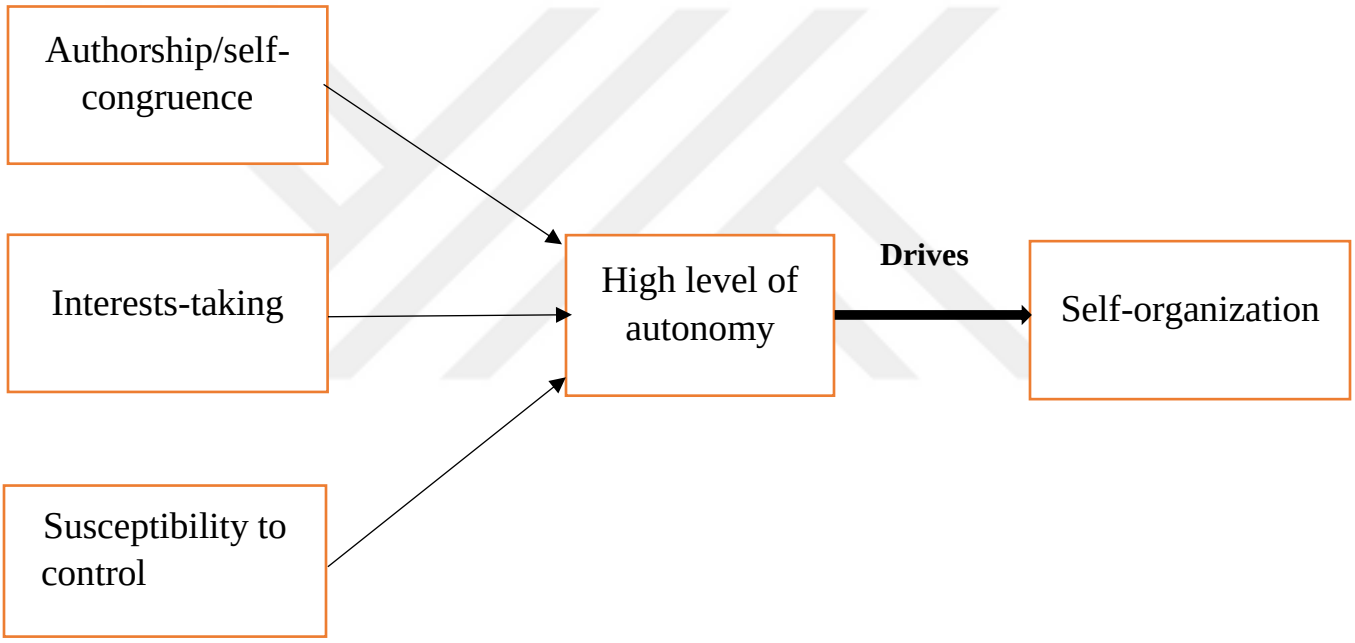

Figure 3: Conceptual framework for measuring high level of autonomy adapted from Weinstein et al (2012)

From the above, it is important to note that: authorship/self-congruence; interests-taking; and susceptibility to control drive self-organization by producing high levels of autonomy to members of the organization. The following provide detail definitions of the construct identified in the framework above;

Authorship/self-congruence

The concept of authorship is considered the central feature of autonomy according to existing literature on the topic. This concept means and postulates that an individual, when autonomous, should be the sole author of his or her experiences and behaviors (Ryan and Deci, 2004). He or she should also be approved of the actions he or she undertakes. Based on this construct, one is autonomous when one's behavior is regulated by one's abiding values, needs and interests (Deci and Ryan, 1985b; Koestner et al, 1992). There has been considerable empirical evidences that support the concept of authorship as a characteristic of autonomous individuals (Ryan and Deci, 2006).

Interest-taking

Another construct considered to be central in measuring autonomy is the concept of interest-taking. This concept measures how organizational agents spontaneously and openly reflect on inner and outer happenings (Weinstein et al, 2012). Thus according to SDT proponents, interest-taking facilitates the awareness of the individual to events around him/her and also motivates him/her to be receptive to both the positive and the negative experiences (Deci and Ryan, 2011). It is therefore argued that an autonomous individual, according to SDT philosophy in its dispositional autonomy assumption, should be interested and engaged in continuously learning more about oneself (Ryan and Deci, 2006). This is very important in measuring how autonomous the individual can be in an organization.

Susceptibility to control

This construct tries to measure how the individual employee is externally controlled and/or responds to external pressures of control from authority. Thus, it is SDT scholars postulate that organizational agents should be strongly motivated to act in response to their internal forces rather than to external pressures or expectations (Deci et al, 1994). Individuals who are autonomous, according to the dispositional autonomy under SDT philosophy, have low and respond little to pressures and expectations of others. Autonomous individuals are therefore seen as those who are highly motivated by internal pressures to behave with the absence of external pressures (Weinstein et al, 2012). There are substantial empirical evidence that support the argument that organizational agents should be motivated to act and/or regulated by their internal pressures.

Strong and Positive value system

Another important characteristic of self-organization identified in literature is the existence of strong value system shared by all actors (employees) within the organization. It is in the light of this that Fredrick (1998) opined that "the value system of an organization is it attractor". Organizational culture (which shapes the attitudes and social system) has been touted as playing a major role in producing and sustaining social schema (Carapiet, 2006). Organizational culture can be viewed as a set of basic assumptions accepted by members of an organization, as a solution to "the problem of external adaptation and internal integration" (Schein, 2004:17), transferred from one generation to another. Organizational culture is proved to be essential in facilitating self-organization processes as it lubricates and facilitates interactions within agents, which is key for self-organization (Carapiet, 2006).

Organizations need energy to renew themselves. Therefore, the value system should cherish a culture of openness to the external environment of the organization for self-organization to be efficient. This is because they need energy for self-organization to occur, and they do that by opening themselves to their environment. By being open they can exchange inputs (raw materials, labor etc.) and outputs (final products) in order to survive and operate far away from equilibrium. Thus, they are able to operate on the edge of chaos as much as is possible. A simple living cell is an example of a self-organizing system that derives its energy from food while excreting energy in the form of heat and waste within its living environment. For the purpose of this study, strong value system is measured using the OCTAPACE questionnaire. The above lead us to the third hypothesis as;

Q3: Does the nature of the value systems affects self-organization and adaptive behaviors within the organization?

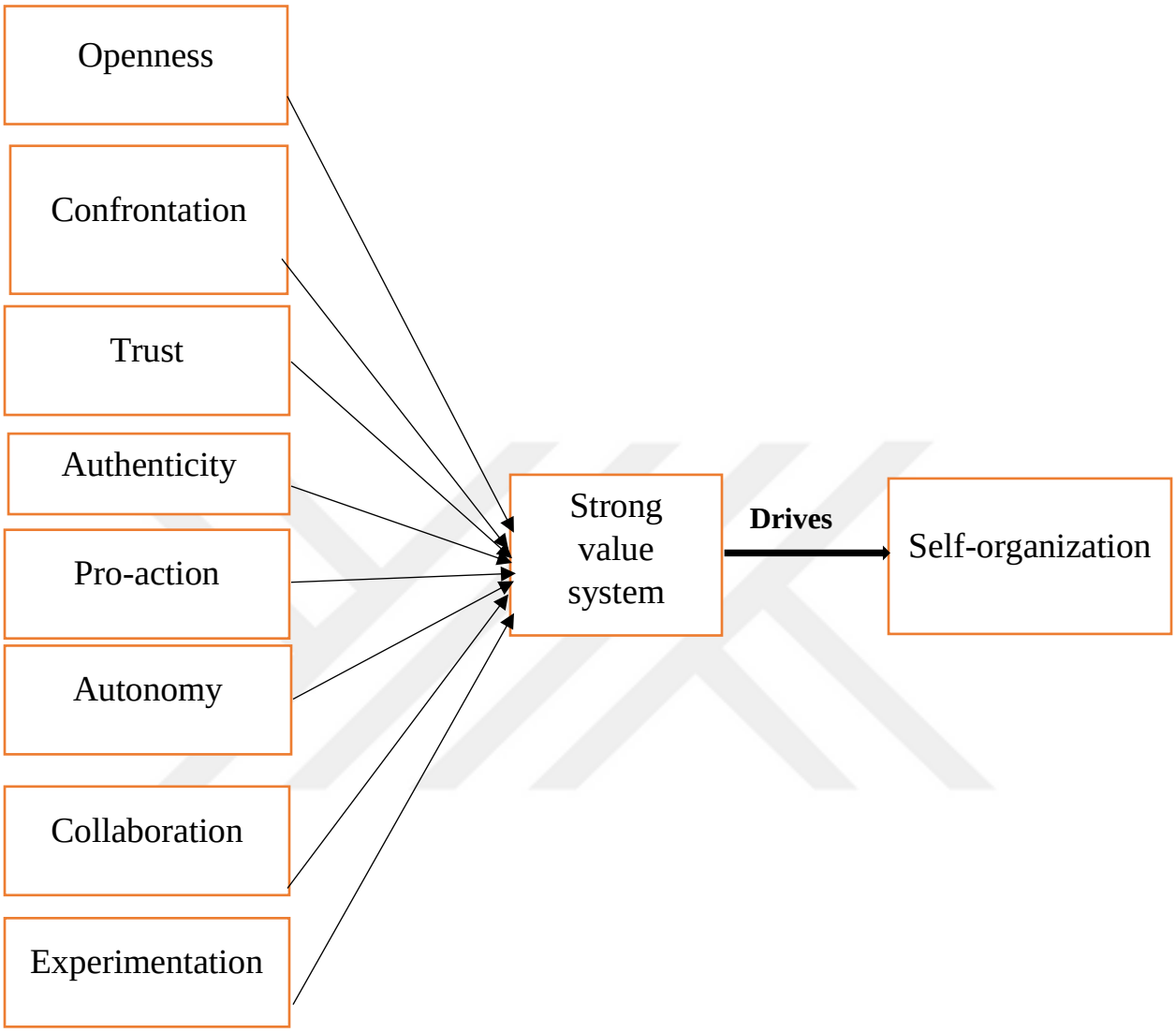

Figure 4: Conceptual framework for measuring strong value system adapted from Rao T.V. and Abraham E. (1999)

The variables identified above are considered to be the drivers of strong value system. Strong value system on the other hand serves as an attractor and lubricates the level of communication within the organization. Below are detail description of the constructs of the OCTAPACE organizational value dimension;

Openness

The concept of openness is a measure of the ability of organizational agents to freely express their views and ideas regarding the organization's operations. According to Lather et al (2010) openness is when an organization's employees are free to express their ideas and are ready to take responsibility and/or risks in doing that. Choudry (2011) considers openness to be the product of an increased communication, feedback, and collaboration in the organization. Kantur and Iseri-Say (2012) see openness as a kind of employee involvement and interactions with communication, involvement, and interaction as its focus. As for Subrahmanian (2012) openness helps facilitates the implementation of systems and innovations that encourage strong interactions among teams members and provides clarity in setting organizational objectives.

Confrontation

This concept tries to measure the ability of employees to work together to find solutions to problems of the organization. The word 'confrontation' is conceived differently from its original meaning. It is seen as being able to boldly tackle a problem without shying away rather than challenging one another (Subrahmanian, 2012). With this, employees do not shy away from tackling problems even if it will hurt others but tries to engage those who is/will be hurt in finding solutions to the problem (Siddiqui et al, 2013). Kantur and Iseri-Say (2012) see confrontation as the *'sense of reality and wisdom'* of not avoiding problems. From the above it can therefore be argued that the presence of this value in the organization will help prevent the occurrence of problems, which will be very beneficial for the success of the organization.

Trusts

Trusts is an important value in every human setting. The presence of high level of trust among organizational agents proves to be necessary in facilitating communication and collaboration among individuals, departments, and teams. This view is in line with that of Choudhury (2011) who argues that the presence of trust promotes high level of empathy and creates positive,

friendly, and disciplined environment. Moreover the results high level of trust among employees is reduced stress, simplification of procedures, support, and high empathy (Subrahmanian, 2012).

Authenticity

This value system underlies trust (Subrahmanian, 2012) and openness (Choudhury, 2011). It is defined as the willingness of organizational actors to be real without faking their feelings, thoughts, and actions (Panchamia, 2013). According to Panchamia (2013) authenticity is exhibited when the individual is ready to accept his/her mistakes and also to do whatever s/he says. This value plays a major role in facilitating and improving communication and collaboration among individual actors within the organization. In line with this thought, Subrahmanian (2012) postulates that there is improved communication and interpersonal relationships when organizational actors are authentic.

Pro-action

Pro-action involves the value that employees can foresee and respond to issues yet to occur in the organization. Thus, the degree to which employees forecast future happenings and respond to concerns at hand is referred to as Pro-action (Lather et al, 2010; Siddiqui et al, 2013). This means preplanning and taking risks (Mittal and Verna, 2013) should be some of the key values cherished within the organization. With this, the organization and its employees will be able to adapt and manage the business environment which will provide with long life. Another values that can be touched under this value system are the promotion of diversity and the management of outside relationships (Siddiqui et al, 2013). This is very important as it will open up the organization to the outside environment to allow for imbibing information and ideas necessary to improve organizational operations and processes.

Autonomy

Autonomy measures the ability of employees to act independently and freely in expressing ideas and performing their tasks without fear, panic and external pressures. Autonomy should be observed in relation to the individuals specified job role (Lather et al, 2010). With the presence of autonomy within the organization, employees and actors are intrinsically motivated and confident in the performance of their roles (Choudhury, 2011). Autonomy comes together with openness, authenticity, trust and confrontation. This means the existence of autonomy means the

values of openness, trust, confrontation, and authenticity are guaranteed (Fukofuka and Locke, 2015).

Collaboration

The concept of collaboration dictates that organizational actors should work together for the attainment of organizational goals. Thus, it involves the sharing of efforts by employees to achieve the common goal of the organization. Lather et al (2010) suggest that the philosophy of interdependence should be at play to allow employees to help one another and work as a team. This means individuals should share information, ideas, and experiences with others to help in strategy formulation, implementation and evaluation. The results of collaboration are efficiency, effectiveness, and improved communication within the organization (Subrahmanian, 2012).

Experimentation

Experimentation focuses on the ability of employees to try new ways of performing their job roles. This is central to innovation. Experimentation yields flexibility, creativity, and pro-activeness (Kantur and Iseri-Say, 2012). According to Siddiqui et al (2013) the focus of experimentation is to innovate and create new ways of tackling organizational problems. Experimentation comes with mistakes and employees should be motivated to move beyond making mistakes to correction and creation of new perspectives in solving problems. Thus, employees should be motivated not to be discouraged by their mistakes during experimentation (Siddiqui et al, 2013; Choudhury, 2011). The presence of this value system propels creativity and innovation within the organization. Creativity and innovation are the main factors that keep the organization in operation and in existence. Thus, the organization will fade out without creativity and innovation.

2.2.3: Problem Statement/Contributions of the Study

The evaluation of literature above revealed that several theories have been proposed to guide organizations in their quest to promoting innovation and adaptability within their environments. Among these theories are those that sought to help managers and organizations to master and dominate their environments. That is the Newtonian and the Cartesian managerial paradigms consider the world (business environment) as a machine that can be manipulated and predicted

with certainty (Carapiet and Harris, 2007). Thus, the future happenings within the environment can be predicted with certainty by analyzing happenings in the past. With this, management experts and professionals have suggested the application of the complexity theory in the study of organizations. According to this theory, the organization is a complex adaptive system with emergent features that allows it to adapt continuously to the uncertain/unpredictable environment within which it operates. The theory of self-organization is a major aspect and/or feature of Complex Adaptive System (CAS). There is no universal definition of self-organization in the literature. According to Stacey (2003:252) two perspectives exist regarding the role of self-organization in the emergence of order in the complex adaptive system- orthodox and radical. According to Holland (2000), the orthodox perspective is known as;

... a complex system is understood in somewhat mechanistic, reductionist terms and is modelled by an objective observer in the interests of predicting its behavior. Self-organization/emergence is not seen to be a new ordering principle in the evolution of the system. Evolution occurs through the random mutation and competitive selection (Stacey 2003:252).

The radical perspective is viewed by Kauffman (1993:173) and Goodwin (Reason and Goodwin, 1999) as;

... Self-organization, rather than random mutation, plays the central role in the emergence of new forms. Those new forms emerge and are radically unpredictable. Agency lies not at the level of the individual agent but at the level of the agent and the morphogenetic field (Stacey 2003:252).

According to proponents of the complexity theory, the best way to understand the organization is to view it from the perspectives identified above (Stacey, 2003:252). It is being argued that the self-organization theory plays a central role in promoting emergent orders in the organization. The argument is based on the success of the self-organization theory in the study of systems within the field of the natural sciences. Thus, self-organization facilitates the promotion of the necessary capabilities for complex systems to adapt to their environment (Kauffman 1993:173). There has been so much literature that laid the foundation for the application of the concept of self-organization to systems in the natural sciences. Thus, self-organization has been successfully applied and proved to be useful in the natural sciences. From this, the basic question that is

needed to be addressed is whether the theories of self-organization will be able to deliver the needed benefits to managers and organizations as it has done in the natural sciences. This has attracted the interest of social scientists, management experts, and business professionals to try to apply the theory to the social systems in organizations. Thus in recent times, much resources are being allocated to the study and practice of the self-organization within organizations.

However it appears that much is yet to be known, empirically, about the successes and/or otherwise the application of the theory to the study of the organization. Thus, the application of the theory of self-organization to the study of organizations has been faced with serious challenges. There has been some amount of studies conducted in this field but their results have not been based on empirical data (Carapiet and Harris, 2007). Especially, there exist limited empirical studies on the ability of self-organization theory to promote the self-emergent behaviors necessary for the adaptation of the organization to its environment. With this, there is no convincing measurement scales for the assessment of self-organization within organizations. Also, there has not been an attempt to investigate self-organization behaviors in organizations using experimental designs.

From the foregoing, complexity theory has been successfully applied in the natural sciences. It is recently that modern scholars try to employ the self-organization theory to the study of organizations. But there are fewer empirical studies to support the argument of the complexity theorists that self-organization provides the numerous benefits espoused. This is where this study would be necessary as it provides empirical data to support or reject the arguments of the complexity theorists. Thus it tried to answer the question; what are the roles of self-organization in stimulating and facilitating the production of emergent behaviors necessary for the continuous reinvention of the organization for survival within its environment. Specifically, it tries to investigate how strong interactions among organizational constituents improves its agility and complex learning. It also tries to ascertain how high level of autonomy promotes self-organization and adaptive behaviours. Finally, it assesses how the nature of the value systems affects self-organization and adaptive behaviors within the organization.

2.2.4: Operational definition

From the review of literature above and for the purpose of this research, the following represent the definitions of the key terms used;

Self-organization: It is the ability of the organization or system to constantly reinvent itself- through high levels of individual interactions, high level of autonomy, and strong value system- in order to adapt to its environment for survival (Carapiet and Harris, 2007). This leads to production of emerging behaviors from within itself without outside influence to adequately cope with the happenings around the system or organization. The major components of self-organization are: Strong individual interactions; high level of autonomy; and strong value system. Thus, scholars believe that the existence of these factors within any system will made that system produce emergent behaviors to allow it reinvent itself continuously.

Adaptability: It refers to the ability of the organization to continually transform and/or reinvent itself to adapt to its uncertain and unpredictable business environment (Pascale et al, 2001). For this study, it is being argued that organizations whose conditions stimulate and facilitate self-organization behaviors will definitely exhibit adaptability features. It is therefore important to note that the major features of self-organization- that is strong interactions among organizational constituents, high levels of employee autonomy, and strong value systems- will be key in making the organization to be adaptable to its business environment. It therefore follows that a self-organizing organization is an adaptable one.

Success: It is the ability of the business to achieve sustained growth and to continue business in to the foreseeable future. From this, success is measured by the availability of adaptability and the mere achievement of final results. The researchers therefore argued that sustained growth and survival can be achieved if the organization experiences adaptability and self-organization capabilities.

Complex Adaptive System: This is a term used to refer to an organization in the complexity literature (Fuller and Moran, 2001; Regine and Lewin, 2000). Thus, referring to the organization as a complex adaptive system gives an interesting perspective to the analysis of the organization and help us understand how order occurs in social systems.

2.3: Conclusion

The literature revealed that the theories of complexity and self-organization have gained popularity mostly in the natural sciences (Burnes, 2005). These theories have produced wonderful results as noted by scholars of the natural sciences. Based on their success, tremendous efforts are being made for the application of these theories to the field of management and organization. But these efforts are being challenged by the inadequacy of universally accepted frameworks for the application of the theories to organizations. It is also constrained by the inadequacy of empirical data and evidence proving or otherwise rejecting the capacity of these theories to deliver the results for which they are praised (Carapiet and Harris, 2007). Due to this there are still much to be done to produce empirical data/evidence to test the capabilities of these theories, especially the self-organization theory, to help managers and their organizations to adapt and survive within their business environment. With this, this study will delve into the question of whether self-organization plays a role in producing and stimulating adaptive behaviors within the organization. Self-organization is conceptualized as having three main features and components. These are; Strong interaction among organizational agents, High level of autonomy, and Strong values system. These components have been the basis of analysis and measurement of self-organization in this research.

CHAPTER THREE: METHODOLOGY

3.0: Introduction

This chapter covers the research methods, instruments, and procedures employed in gathering and analyzing data. The choice of the research methodology is dependent on the objectives of this study. This chapter is divided into the following subsections: research design; overview of the experiment; sample and sampling techniques; measures; data collection techniques and tools; data collection procedure; and data analysis.

3.1: Research Design

In order to answer the research questions, the quasi-experimental design is adopted. This is because it is the strongest design that can allow us to investigate the causal relationships that exist between self-organization and improvement in organizational performances. Thus experimental designs best meet the three conditions of causality; temporal order, association, and no alternative explanations (Neuman, 2003). The experiment was accompanied with other qualitative data collection tools such as the researchers' observation guide. This help the researcher to compare the results from various data collection tools. Finally for the purpose of analyzing the network information of participants, a survey was conducted to the network data of participants.

3.2: Overview of the Experiment

The research was conducted to determine how students of Wa Nursing and Midwifery Training College (WNMTC) self-organizes when performing their roles at the hospital. Thus the researchers only tested; Strong interactions among members, High level of freedom, and Strong values system as the main components of the self-organization theory. This was done by assessing the exhibition of self-organization capabilities and behaviors of the students as they worked in teams. Thus, it did not assess any other issue aside the topic under consideration.

Geographically, the research area covered Wa Municipality in the Upper West Region of Ghana.

This location was selected because it was convenient for the researchers to gather the necessary data for the conduct of the study. Also, the college was chosen because the students of the school have been working together for a while and have satisfied all the conditions of the theory being

tested. The college also presented the researchers with simulated work environment as the students always work together both at the hospitals and laboratory experiments. This was particularly relevant to the methodology adopted for the conduct of the research.

In order to determine the role of self-organization in promoting and facilitating adaptability in organizations, a manageable sample was used. The sample unit for this research comprised of 60 students in the Nursing and Midwifery Training College in the Wa Municipality. Also the technique of sampling used was convenience sampling method. Convenience sampling method is a technique where the study population and sample unit were chosen based on the availability and suitability of the participants. This made it possible and convenient for the researcher to select a sample population that is more appropriate to the study based of the objectives of the study (Sarantakos, 2005).

3.3: Measures

During the conduct of this research, the following dimensions were adapted to investigate the three key elements of self-organization. They are explained in detail below;

3.3.1: Strong Interactions among employees

Interactions among organizational agents is a vital process in every organization. Thus, effective communication within the organization is important in promoting employee satisfaction (Chuang and Hsieh, 2009), which is key in fueling self-organization and its attendant adaptive benefits. This view is like that of Neves and Eisenberger (2012) who postulate that organizations with open and free information sharing systems and conditions have higher job satisfaction among their workforce. In assessing the interactions among respondents, part of the variables were measured and analyzed using the Network Data Analysis in UCINET and the rest with the Organizational Communication Survey (OCS). The network data analysis was carried out to determine the rate of Cohesion; Prominence; Range; and Brokerage among the network of respondents. This is appropriate because the UCINET has been proven to be a reliable tool for analyzing the measures of the targeted variables. The variables of Trust and Collaborative Behaviors and Communication were measured using a modified form of the Organizational Communication Survey (OCS).

3.3.2: Level of Employee Autonomy

In measuring the level of employee autonomy, the dispositional autonomy (according to Self-Determination Theory) was adapted. This is appropriate because it is a reliable measure of the level of an individual's autonomy within the organization (Weinstein et al, 2012). The items of this scale have internal reliability of; $\alpha = .89$ for authorship/self-congruence, $\alpha = .83$ for interest-taking, and $\alpha = .84$ for susceptibility to control. The total scale has an internal reliability of $\alpha = .81$. This shows that there is a very strong interrelatedness among the construct in measuring Dispositional Autonomy.

3.3.3: Strong and Positive Value System

To measure how strong the value system within the organization can stimulate the self-organization behaviors of organizational actors, the researcher adapted the famous OCTAPACE measurement scale. The OCTAPACE was developed by Professor T.V. Rao to help in measuring organizational ethos. The emphasis of this scale is on organizational culture of which cherished values is a major component. The scale is made up of eight construct with 40 items that gives the profile of organization's ethos. It has an internal reliability of $\alpha = .89$ and its validity is said to be good.

3.4: Data Collection Techniques and Tools

In gathering data relevant to this study, a survey was conducted with the use of a questionnaire to know the extent to which respondents relate or interact with others within the group. A pilot study was conducted and during this, the reliability and validity of the questionnaire used was checked. The survey proved useful as the data from this was used to conduct the network analysis of participants using the UCINET Software. This was necessary because members of the experiment and control groups were selected based on the results of the survey data. Also, the researcher employed observation in assessing the performances of groups based on how they performed various steps of the tasks. An observation guide was used for researchers to observe and understand the reactions of participants during the research. This guide was structured around the objectives and aims of the research. Data from the observation was used to complement the results of the experiment. This formed the basis for which the performance of the tasks by each group was measured.

3.5: Data Collection Procedure

In an attempt to gather data relevant to the subject matter of this study, the researcher used the following steps and procedures;

3.5.1: Selection of Subjects

1. Using the Network Questionnaire, the researcher gathered data on the extent of connection/network among respondents.
2. The researcher selected five teams of five members each based on the findings of the network data (people with strong connections and people with less or weak connections).
3. Respondents with strong connections were grouped into the experimental group and those with less or weak connections the control group.
4. The groups were selected based on the following criteria:
   a. High degree centrality
   b. High out-degree nodes
   c. High in-degree nodes
5. The first five individuals to score highest in the criteria specified in (4) above were classified into the experimental group and the remaining people made up the control groups.

3.5.2 Selection of the Task

1. The teams were given the same tasks to perform within a deadline.
2. The subjects had a satisfactory knowledge in the field of the task.
3. In order to challenge the groups and put them at the edge of chaos, the subjects had not studied the topic in class. Thus, subjects had limited or no prior knowledge in the procedures in performing the task.
4. The task was on how to dress a wound of a patient at the hospital.

3.5.3: Experimental Procedures

1. The researcher clearly explained the goals of the task to the groups at the initial briefing period.
2. Subjects had only 20 minutes to perform the tasks.
3. The experiment was carried out in the school's science laboratory.

4. In order to reduce the level of autonomy among the control groups, the researcher chose leaders for the control groups. Also, the researcher and the Clinical Supervisor occasionally interrupt the activities of the control groups by offering solutions and imposing some ideas on them. All these were meant to reduce the level of autonomy of the control groups in performing their tasks.
5. The treatments were introduced to the experimental groups and the differences that arose were observed and assessed using observation forms and score sheets for the tasks.
6. Make comparisons between the control and the experimental groups showing the differences in the performance of the given tasks.

3.5.4: Constituents of the treatment

1. Explain the objective of the tasks to the group and make sure they understand it.
2. Simple rules and structure in place to help volunteers complete various tasks.
3. Allow the group to select its own leader.
4. The tasks should be a challenging one.
5. The groups were allowed to learn from outside in order to perform the tasks (open system).
6. The experimental groups were given an operational autonomy with no interruptions whatsoever.
7. The researcher tried to encourage values of honesty, openness, collaboration, coordination, trust, and creative behaviors among team members by explaining to them why these values are important in performing the tasks.

3.6: Data analysis

In the analysis of the data gathered, the questionnaires administered about the connection or network of respondents were edited to detect errors. This makes the data collected very uniform, and makes it very easy for coding and tabulation. This network data was analyzed using UCINET Version 6. Further, this software was used to analyze and measure the level of interactions of members of the groups during the experiment. Also, other data gathered from the experiments have been analyzed qualitatively using tables and content analysis. Thus, the data analysis was conducted according to the objectives of the study.

CHAPTER FOUR: FINDINGS

4.1: Results of Pilot Study

Prior to the conduct of the main study, a pilot study was conducted to try the feasibility of the methods and conceptual framework adopted for the research. The results of the research revealed the following;

4.1.1: Network Results

The measure of prominence adopted for the study was the degree of centrality measure. The ego-net from the analysis of the network data on UCINET v.6 revealed the following results;

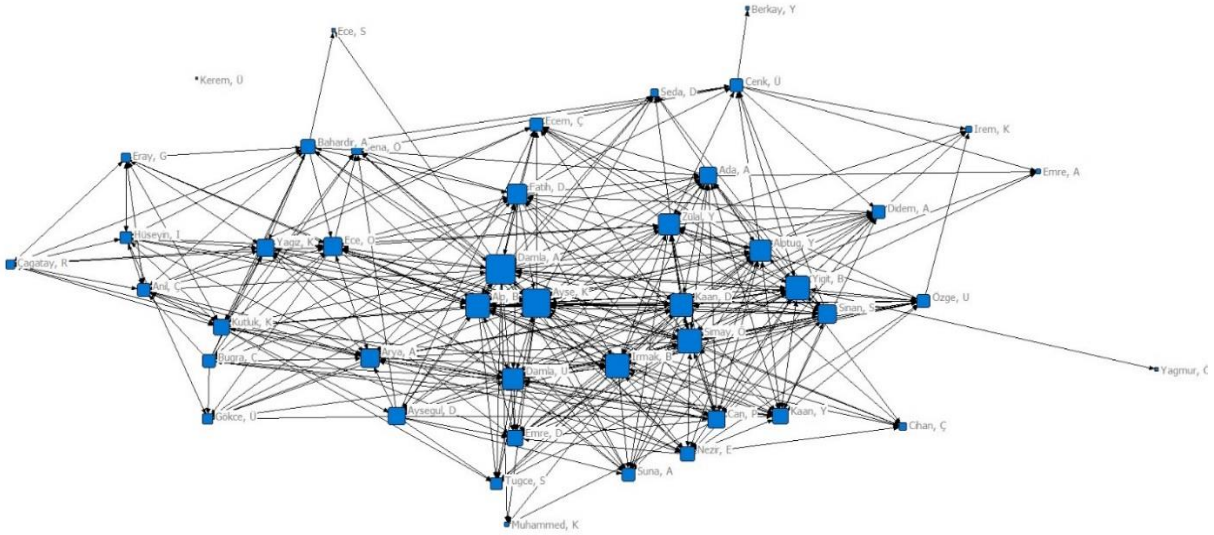

Figure 5: The degree of centrality respondents' nodes

The degree of centrality is the number of connections an actor (node) has. The research subjects were selected from the ego-net above. Thus, the participants with the highest degree centrality (network nodes) were grouped into the experimental group and those with the lowest degree centrality (weak network nodes) the control group. Thus, the first five individuals with the highest centrality degrees and who occupy the structural position at the center or near the central location constituted the experimental group since those individuals are highly connected with the

others. This was necessary because these people will likely interact well with one another. The other group (control) made up of those with weak centrality degrees.

Table 1: Results of analysis for "Interaction" relationship

Level of analysis	Measure of the network	Result
Overall	Density	20%
	Degree centralization	52.25%
	Betweenness centralization	9%
	Average distance	1.7%

From the table above, the density of the network is 0.2006 (20%) which means that information flow among members of this network is relatively low. This therefore suggests that there is relatively low level of cohesion among members of the network. Thus, information flow and sharing among members are relatively low. However, degree centralization of the network is high at 52.2%. This suggests that there is high level of cohesion among members of the group. All in all, the level of cohesion among actors in this network is quite low. Furthermore, betweenness degree is low at 9%. This means that brokerage rate is very low in this network. It therefore follows that, few actors exhibit entrepreneurial behaviors by acting as intermediaries to import from or carry information to subgroups. This affects information sharing effectiveness and efficiency. Finally, average distance between an actor and other actors within the network is high at 1.7 steps. This suggests that there is greater cohesiveness among members of the group.

4.1.2: Experimental Results

Based on Figure 5 above, the researcher selected two groups of five members each. The first group was the experimental group whose membership was made up of the people with the strong degree centralities. It was assumed and argued that these people will have strong connection with one another and will depict a typical self-organizing group/team. The second was the control which was composed of the people who occupy the periphery of the network as shown in Figure 5 above. In other words, these people do not have strong connections or ties with the rest of the group members.

The results of the experiment saw the control group scoring higher as compared to their counterparts at the experimental group. Thus, the control group scored 60 points as against the

52 points scored by the experimental group. This results came as a shock to the researcher and prompted further investigation. This is because it is being argued in literature that a team with the features of the experimental group should be adaptable and achieve success in performing its activities. With this, group interviews were conducted to ascertain why the experimental group performed below expectation. It was finally noticed that the experimental group did not understand the instructions leading to the performance of the task. Aside that, the experimental group exhibited strong interactions among themselves as communication was flowing smoothly.

Information was often shared throughout the group. The reverse was the case in the control group as communication was slowly done. The experimental group also proved to be independent without any control or influence from outside the group. Finally the experimental group exhibited strong values of openness, tactfulness, independence, experimentation, collaboration, authenticity, and trust.

4.2: Results of Main Study

The challenges faced during the conduct of the pilot study allowed the researcher to make necessary improvements to various aspects of the experiment. The results of the main research are presented below:

4.2.1: Network Results

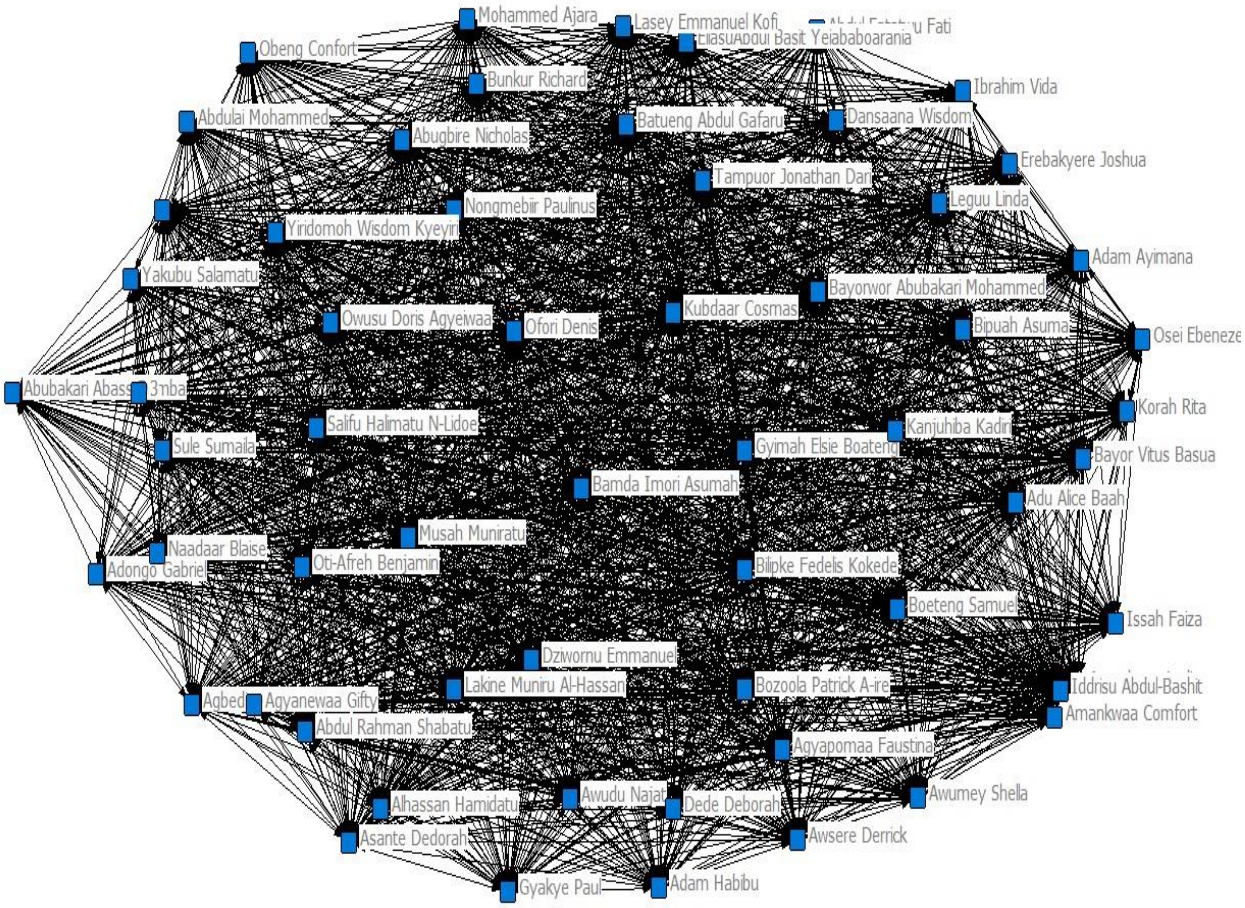

Figure 6: Results of Overall Network Data

The figure above shows the network of relationships that existed among respondents who took part in the study conducted. This network is very dense as members have many ties among them. The measures of cohesiveness, prominence, range, and brokerage are very high within this network. Further analysis of these are conducted in **Table 3** below.

	Experimental Groups						Control Groups					
	1	2	3	4	5	Total	1	2	3	4	5	Total
COMPONENT TASK RATINGS												
1. Explains procedure to patient and ensures privacy	3	4	2	3	4	**16**	3	3	4	2	3	**15**
2. Puts on mask, prepares and takes trolley to bedside	4	4	2	4	3	**17**	3	2	2	3	3	**13**
3. Asks assistant for:												
I. Put patient into desired position												
ii. Protect bed clothes and exposes area												
iii. Pour out lotions into gallipots												
IV. And remove plaster or bandage	3	2	1	4	4	**14**	3	4	3	2	2	**14**
4. Washes and dries hands and wears sterile gloves or uses sterile forceps	3	3	1	4	1	**12**	4	1	2	1	3	**11**
5. Removes soiled dressings using dissecting forceps	2	2	3	5	2	**14**	3	4	2	2	1	**12**
6. Cleans wound with swabs soaked in normal saline the wound outward using on	4	2	2	3	2	**13**	1	2	1	1	1	**6**
₹Cleans wound with series of swabs until clean	4	2	3	2	2	**13**	4	2	0	2	0	**8**
8. Applies sufficient sterile dressings and secures into position	2	2	4	3	4	**15**	3	2	4	2	4	**15**
9. Informs patient about state of wound, thanks and makes him comfortable in be	2	0	4	3	3	**12**	4	1	2	1	3	**11**
10. Discards trolley, decontaminates used items and removes gloves.	3	2	4	4	4	**17**	3	3	3	4	2	**15**
11. Washes and dries hands, and removes screen.	3	2	2	2	4	**13**	3	4	2	2	2	**13**
12. Documents and reports state of wound.	4	3	4	4	4	**19**	0	2	2	2	1	**7**
						0						**0**
TOTAL SCORE OBTAINED:	37	28	32	41	37	**175**	34	30	27	24	25	**140**

Table 2: Tasks Scores of Experimental and Control Groups

Table 2 above contains the lists of scores of the tasks performed by the various experimental and control groups. A total of five experiments were conducted by the researchers to ascertain the level of self-organization behaviors exhibited by groups and their members during the performance of their tasks. The following are the breakdown of the results of the groups:

Table 3: Results of analysis for "Interaction" relationship

Level of analysis	**Measure of the network**	**Result**
Group level	Density	70%
	Degree centralization	24.92%
	Betweenness centralization	60%
	Average distance	1.302
	Closeness Centrality (in and out-network)	23.06% and 44.01%

From Table 3 above, it is realized that the network under consideration is highly dense with a density of 0.70. Thus, 70% of the possible ties are present within the network. The density of a network represents the ratio of actual ties over possible ties existing among members of the network. Higher density suggests that there is so much communication or information sharing paths among actors in the network. Thus, information flow is fast and more freely. This means there is so much cohesion among members of the group/network. Thus, there is the presence of strong socialization among members. Also, there is the probability that network members will have access to same information and resources. Further, there is relatively high degree centrality of 24.92% within the network. This is evident in the fact that clusters of interconnected members are seen radiating around a central point/actor as shown in figure 6 above. This is another evidence to support the case that there is high cohesion among members of the network.

Another observation worth mentioning is the fact that there is high betweenness centralization of 0.60 within the network. This is an evidence to suggest that the level of brokerage is high in the group. Thus, there are so many members serving as intermediaries between and/or among different subgroups within the network. This measure is important because it measures how easier members of the group can share information among subgroups within the network. Thus, it measures the effectiveness and efficiency of sharing information among groups in the network.

It also measures how intermediary actors import information into the group for the benefit of all members.

There is high degree of prominence in the network. This is evident in the results of the average distance and closeness centrality. Thus, the average distance between actors is 1.302 steps. Averagely, every member of the network can reach others at 1.302 steps. This means members are quite closer with one another according the results shown in Table 3 above. Also, closeness centrality is quite high for both in and out-network connections at 23.06% and 44.01%. This means there is high opportunities for access and forwarding information within the network.

4.2.2: Results of the Experiments

Experiment 1

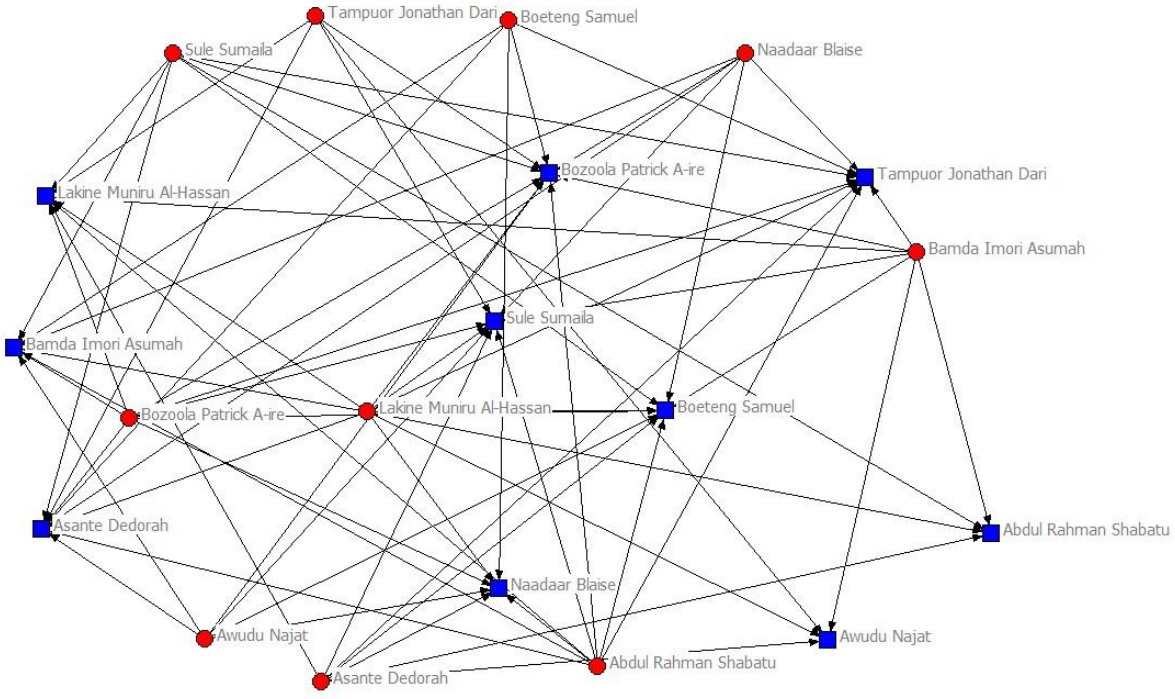

Figure 7: Results of Network Data of Group 1

From Figure 7 above, five members each were selected to be part of the experimental and the control groups based on each actor's score on; degree centrality, out-degree nodes, and in-degree

nodes. The lists of the experimental and the control groups is attached to this report as Appendix 2. Thus, the top five members who scored high in all were classified into the experimental group and the remaining into the control group.

Results of Experiment: From the results presented in Table 2 above, it is realized that the experimental group scored better than the control group. Thus, the experimental group scored 37 points as against the 34 points scored by the control group. This result supports the argument that the experimental group should perform better than the control group. The results of the researchers' observation report is shown below;

The experimental group exhibited behaviors that are in line with the self-organization philosophy. Thus, there was high level of interaction and communication among team members. The group did not have difficulty in selecting their leader. There was a pre-experiment discussion and the task issues was discussed among the group. Each team was thus, assigned a task to perform in the experiment. This thus, facilitated the participation of the group members. Also, there was a high level of independence and freedom in the completion of the task. This is attributable to the fact that the group understood what is to be accomplished. They had confidence in themselves and demonstrated that in completing the task. Information shared was thus unambiguous for the understanding of the team members. Finally there was the values of; free interaction, high level of communication, team work, and free and open discussions.

With the control group, team participation was averagely high. Some level of confidence was shown. About 35% of their time was spent interacting with each other. Information shared was clear to members' comprehension. Though the task was performed well, there was no creativity demonstrated. They had some level of freedom and independently completed the task. There was low supervision and interruptions by the Clinical Supervisor. Their actions reflected what they know. Finally, members were honest in admitting their weaknesses. There was an acceptable level of collaboration, free communication and team work displayed. There were obedient to their leader and the Clinical Supervisor as they were often seen keenly listening to directives given.

Experiment 2

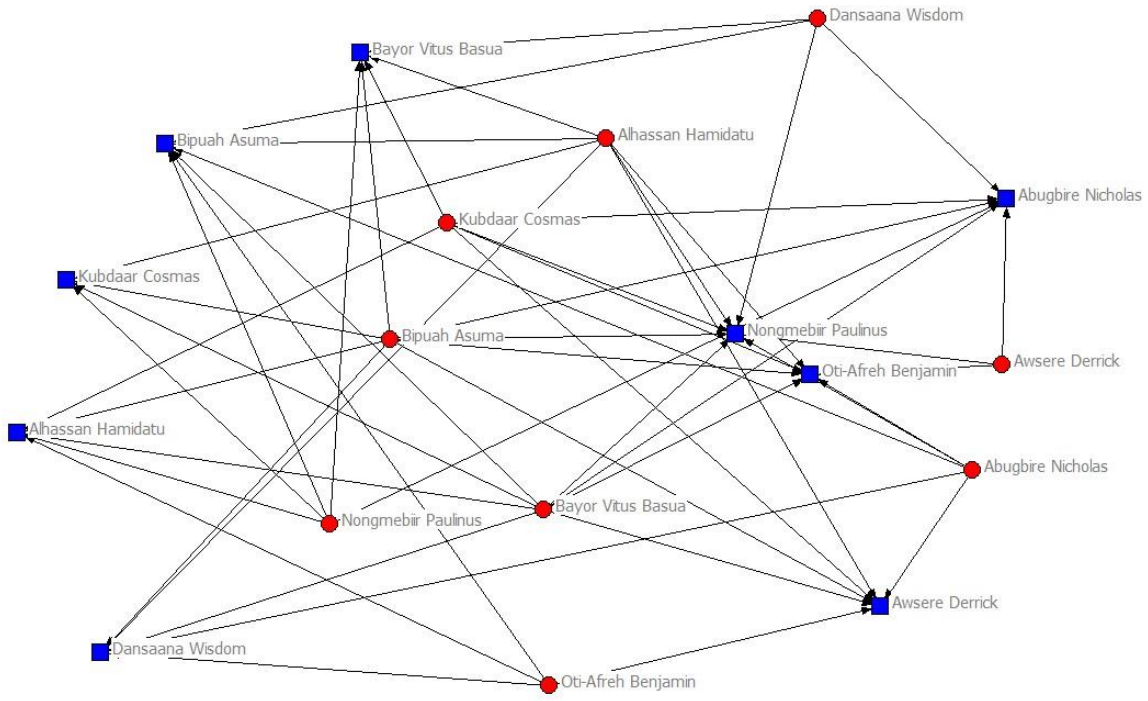

Figure 8: Results of Network Data of Group 2

Figure 8 presented above helped the researcher to choose the members of each of the experimental and the control groups. The selection was based on members' scores on degree centrality and number of out and in-degree nodes. First five members who scored high on all were categorized into the experimental group and the rest in the control group. Appendix 2 provides the lists of members chosen for this experiment and their respective groups.

Results of Experiment: The results in the table above revealed that the control group performed better than the experimental group. Thus, the control group scored 30 points as compared to the 28 points obtained by the experimental group. This result contradicts the expectation that the experimental group should perform better than the control group as evident in the self-organization literature. Below is the result of the researchers' observation report:

The experimental group exhibited some behaviors contrary to the principles of Self-organization. Thus, it was observed that communication among group members was quite low. Members participation was poor with only few (2) actively performing the task. Some members enjoyed free-ridership. This resulted from the inability of the leader to effectively control the team. Further, some decisions were solely taken by the active participants without the involvement of the dormant ones. For fear of showing their little knowledge (ignorance) in the task, some team members folded up their hands and watch as observers. Thus, demonstrating no self-confidence in completing the task. Finally some values exhibited by this group were; low discussion and communication, low tactfulness, poor coordination and team work. Some members stood unconcerned and offered no support. Those who actively took part were quick to acknowledge their weaknesses and admit their mistakes.

The control group also exhibited behaviors contrary to the principles of self-organization as expected. Example, Interaction was averagely low. Information was hardly shared. There was little team work since communication was ineffective. Also, there was a very low autonomy with high level of interruptions by the supervisor. Members feared committing errors because they had little confidence in their ability. The task was thus slowly done and the leader failed to ensure group participation. Finally the values of low participation, poor communication, and low team spirit affected the manner in which the task was performed.

Experiment 3

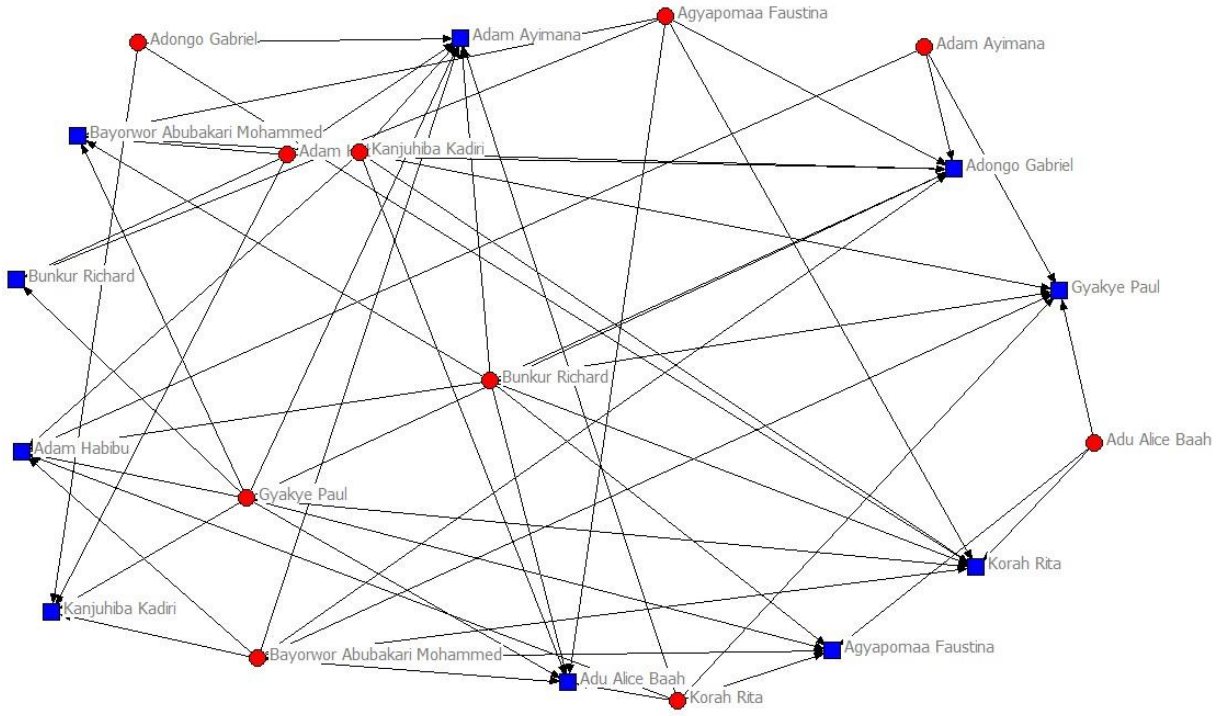

Figure 9: Results of Network Data of Group 3

Based on the Figure 9 above, the researcher selected the members of each group. The top five members who scored high on degree centrality, number of in and out-nodes were grouped into the experimental group. The rest of the members of the network were grouped into the control group. Details of the lists of each group are provided in the appendices as Appendix 2.

Results of Experiment: From the table, the experimental group scored a total of 32 points which is higher than the 27 points obtained by the control group. This means that the experimental group showed behaviors that are positive for better performance of the task as compared to the control group. Analysis of the researchers' observation report showed that the behaviors exhibited by the experimental group was much more consistent with the principles of self-organization as shown in the following;

The researchers observed high levels of interaction and participation among members of the experimental group. Information sharing was done though with some level of inaccuracy members were able to decode that. All group members were seen trying to actively participate in one activity or the other. Because no clear task units were assigned to each member, there are some little role conflicts. Also, members demonstrated what they know with confidence. Some level of creativity was shown possibly because they were using a lifeless body. Decisions were quick due to the brief discussions they had before embarking the task. Finally, researchers observed that there was good coordination and collaboration-that is communication was free flowing. The team leader was seen consulting with team members during the performance of the task. Thus, members were encouraged to share their thoughts to enhance the accomplishment of the task.

However, the situation of the control group was different. Thus, trust levels were low as members were seen winking their eyes to others to show a wrong procedure being done. There was poor communication with low participation from team members. The group was highly disorganized and had no clear focus. Some members obviously became observers in their own group whiles few of the team members try completing the task. Further, the Clinical Supervisor had to provide more guidance to the group. This reduced the levels of independence and autonomy of the group. This was because they did not show much knowledge and confidence in performing the task. Finally, the team leader hardly encourage members was seen trying to perform the entire task in solo. Thus, members had difficulty in confiding in their leader their weaknesses or sharing relevant information to facilitate the completion of the task. Some members therefore openly expressed their feelings about some of these actions. Invariably, there was poor coordination, low team work and participation.

Experiment 4

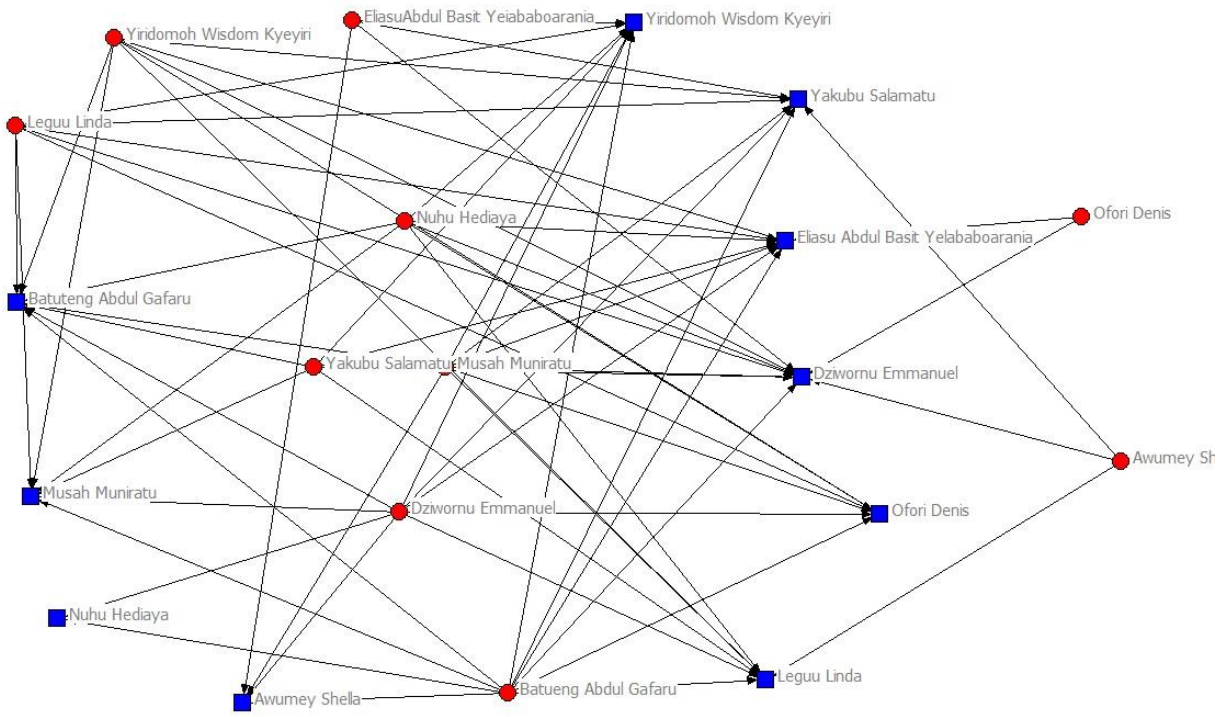

Figure 10: Results of Network Data of Group 4

From Figure 10, the researcher was able to choose members of the experimental and control groups. Thus, the selection was based on members' scores on; degree centrality and number of out and in-nodes. The first five members who scored high on each measure was grouped into the experimental group. The remaining members were put into the control group.

Results of Experiment: The results revealed that the experimental group scored a higher points of 41 as against their counterparts from the control group who scored 24 points. This results can be attributed to the exhibition of self-organization behaviors by the experimental group. The researchers' observation report showed similar results stating that the experimental group portrayed behaviors consistent with the philosophy of self-organization as argued in literature. The results of the researchers' observation report are shown below;

Communication among members of the experimental group was high. Members' participation was good almost all members were actively participating in performing the task. Members thus

coexisted very well with high levels of interactions. This resulted in the performance of their task effectively and within schedule. Also, all decisions were solely taken by the group with active participation from all members without the involvement of outsiders. Members did not fear making mistakes in performing the task. Thus, they demonstrated self-confidence in completing the task. Finally there was high discussion and communication, tactfulness, good coordination, and team work. All members showed concern and offered support to others.

But the control group showed low Interaction among members. Information sharing was poor. This lead to poor team work since communication was ineffective. This affected the performance of their task effectively and within the schedule time. Also, there was low autonomy as the group could not perform most of the task without some guidance from the supervisor. Members feared committing errors and exhibited low confidence in their ability. Therefore, they performed the task slowly and the leader could not ensure extensive group participation. Finally the values of low participation, poor communication and low team spirit were observed in the control group. This affected the manner in which the task was performed.

Experiment 5

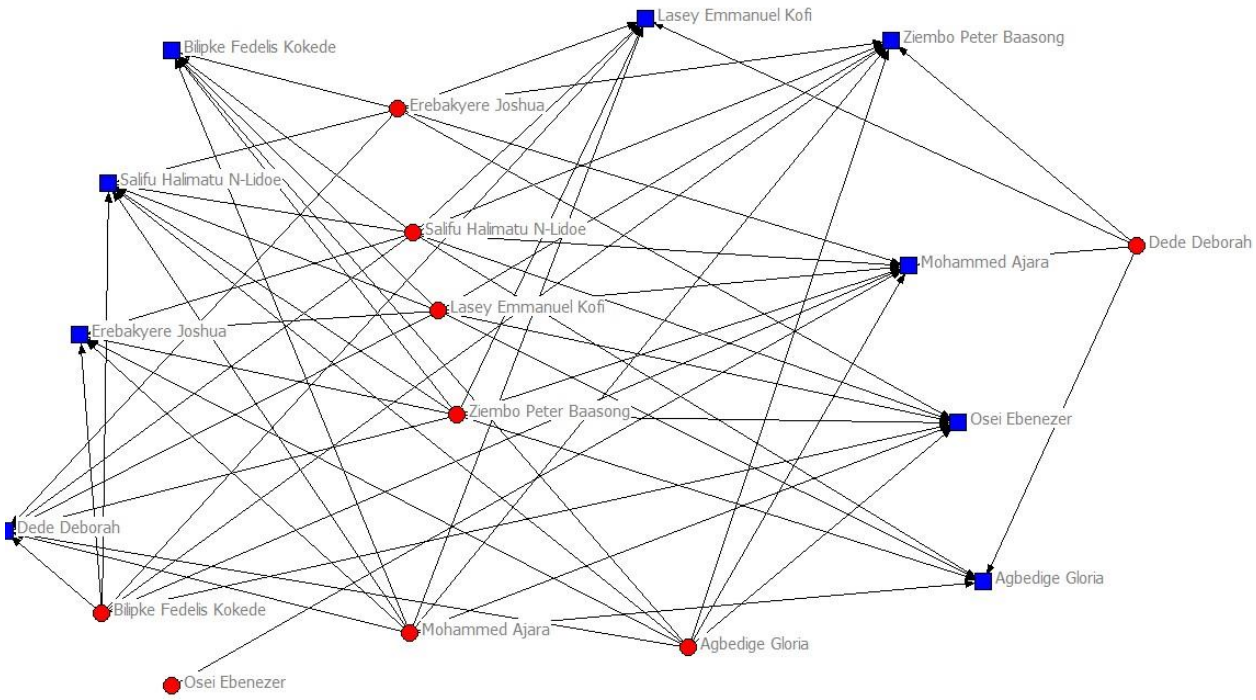

Figure 11: Results of Network Data of Group 5

To categorize the groups, the top five members who scored high on degree centrality and in and out-nodes were classified into the experimental group. The rest constituted the control group. Figure 11 above served as a guide for the researcher in doing the groupings. Details of the lists of participants are provided in Appendix 2.

Results of Experiment: From the results, the experimental group performed better than the control group. Thus, the experimental and the control groups scored 37 and 25 points respectively. Comparing this results with that of the researchers' observation report reinforced the finding that the experimental group stand the chance to perform better due to the behaviors exhibited by the group. Below are the findings of the observation report from the field researchers;

The experimental group interacted much with one another throughout the period of the experiment. This impacted much on the results and performance of the group as compared to

their colleagues in the control group. From the look of events, there existed much trust among members of the group. Further, there was relatively high level of autonomy and independence among the group. They performed all activities on their own through constant sharing of ideas and experimentation. Finally, they exhibited strong values such as trust, openness, communication, experimentation, and confidence.

However, there was averagely low interaction and communication among members of the control group. This influenced the results obtained by the group. Thus, only few members were seen communicating well in an attempt to perform the task. There was also a high level of dependence and low autonomy among the group as they constantly ask for clarifications and solutions from the tutor.

CHAPTER FIVE: DISCUSSION

5.1: Strong Interactions among Constituents of the Organization as a Feature of Self-Organization

The findings of the study revealed that the experimental group or team exhibited numerous characteristics of self-organization as postulated by scholars. For example, the experimental group exhibited the features of strong interactions among members of the group. Thus, the researchers observed that there was strong collaboration and communication among members of the experimental group. This is an important feature of self-organization which allows teams to adapt well to their environments for survival (Carapiet, 2006). It is not surprising that all but one of the experimental groups performed better than their counterparts from the control groups, even though they were left to their fate to figure out what to do to achieve and perform the tasks at hand. Consistent with the previous view is the argument that teams or groups are better able to exhibit self-organization behaviors if they are challenged (Pascale et al, 2001). This was not the case with the control group who waited for a tip from the researchers as to what and how to achieve the objectives of the tasks presented. However, it has been argued in literature that a team or group that is not given the chance to experiment and always wait for guides and procedures from authorities will have difficulties operating at the edge of chaos. Thus, the team will luck the creative abilities to innovate new ideas as stated by scholars in literature (Tasaka, 1999). This was the reason why the control group was not able to experiment their independent ideas enough to find other ways of performing the tasks. That is the collaboration and communication among members of the control group was low as compared to their counterparts from the experimental group. This impeded the level of self-organization processes within this group making it unable to adapt easily and succeed in the performance of the task without the help of the guide and clues provided by the researcher.

Also, the results of the network analysis revealed that group cohesiveness facilitates self-organization within the group (Pascale et al, 2000). This is because the more a group is cohesive the more the strength of interactions that goes on among members of the group. This feature of the experimental groups are important in stimulating self-organization behaviors as innovative ideas generates from strong communication and collaboration among members of the organization.

5.2: High Level of Autonomy among Members of the Organization as a Feature of Self-Organization

With regards to the level of autonomy among the groups in performing their expected tasks, it was noticed that the control group was somewhat dependent on the help provided by the researchers. Thus, they relied on that guide to perform their tasks. Meanwhile the researcher provided those helps and interrupted in the activities of the control group in order to limit their level of autonomy and independence. This was intentional and part of the treatments during the researcher. Also, the researcher chose a leader for the control group as part of the intentional processes of limiting the group's autonomy and independence. These actions by the researchers played major role in restricting the autonomous behaviors of the control group. This significantly affected the attainment of their tasks. Unlike the control group, the experimental group were allowed to do everything on their own without any interruptions. It was not surprising to see members of the group to communicate, collaborate, and interact a lot in order to find solutions to their tasks. This group spent much of its time brainstorming and sharing ideas regarding the performance of the tasks within a strategic and competitive process which was the subject matter of their tasks.

The results showed that high level of autonomy is an important component of self-organization. This is because it makes members of the organization to be more creative and innovative. Consistent with this opinion is the belief of Pascale et al (2001) that freedom of employees will aid propel creativity within an adaptive system (organization). Also, Pascale and his colleagues are not alone in their opinion. For example, Amabile (1988) concluded, after his research that freedom of individual employees is crucial in harnessing the innovative behaviors of employees. This opinion was based on a research finding that suggested that about 74% of the surveyed population made specific reference to *operational autonomy* as a key ingredient for enhancing their intrinsic motivation. It is noted in the literature that intrinsic motivation is a key element of self-organization. Furthermore, ensuring high level of autonomy of members of the group means that there will be simple rules governing the behavior of individuals. This also considered an important element of self-organization. It is in the light of this that Pascale et al (2001) argue that the organization should have "too many or too few" rules for guiding behavior within the organization. Thus, they postulated that the existence of simple rules will provide the

organization with emergent characteristics that will allow it to always reinvent themselves to adapt the fluctuations of the business environment.

5.3: Strong and Positive Values System as a Feature of Self-Organization

The researchers observed the values of; openness, trust, confidence, collaboration, cooperation, independence, experimentation, authenticity, confrontation, and pro-action within the experimental group. This is evident in the presence of the other features of self-organization. Thus, the exhibition of the features of; trust and collaborative behaviors and communication; supported the presence of the above mentioned values within the group. The control group exhibited some of and/or amount of these values but they were not sufficient enough for it to exhibit the resilient behaviors shown by the experimental group.

From the above it is important to note that attitudes, social system, and culture play important roles in influencing the communication processes among members of the organization (Berlo 1960:72). Thus the type of attitudes, social system, and corporate culture within the organization in part determines how communication processes are conducted. Therefore the presence of high communication as evident from the behaviors of the experimental groups under this study showed that there are cherished values that facilitate self-organization. Chandler et al. (2000) argue that the functions of organizational culture gives a sense of identity and generates commitment among the individual towards the group goals. Following from this, it is important to note that values are the cornerstone of every organizational culture (Hofstede, 1984:18). Supporting this position, it is suggested in the literature that the culture and shared values of an organization strengthens the level of interactions among members of an organization (Carapiet, 2006). Consistent with this view, Carapiet (2006) suggest that the organizational culture and for that matter the cherished values in an organization serves as a lubricant that stimulates and facilitates self-organization processes through the promotion of strong interactions among organizational agents.

To be specific, the findings of this study hold that the values of: openness (Subrahmanian, 2012); trust (Choudhury, 2011); confidence; collaboration (Lather et al, 2010); cooperation; independence (Fukofuka and Locke, 2015); experimentation (Siddiqui et al, 2013); authenticity (Panchamia, 2013); confrontation (Kantur and Iseri-Say, 2012); and pro-action (Mittal and Verna, 2013)- are key ingredients in ensuring in promoting the processes of self-organization

within the organizational setup. Thus the presence of high levels of these values makes the organization more adaptable and resilient (Fukofuka and Locke, 2015). This is like what Professor T.V. Rao suggested about the measurement of organizational ethos. He argues that his eight value construct called the OCTAPACE (openness, confrontation, trust, authenticity, proactive, autonomy, collaboration, experimentation) are the best measures of organizational culture suggesting that the presence of these values in an organizational culture is relevant in generating resilient behaviors (Ibid). Therefore, it is imperative to note that organizations with high levels of these values will have improved self-organization processes and hence, high levels of adaptability and resilience.

5.4: Self-organization as a Measure of Adaptability and Success

Adaptability is a much sought for by managers and organizations. This is because recent business environments have proven to be turbulent (Prakken, 2004) presenting organizations with that hard choice of "either adapt or die" (Denton, 1998). Thus the contemporary business environment is much unstable, ever-changing, and flexible such that organizations who lack agility and flexibility easily die off. Based on this, the majority of the business and management scholars have launched a search for management theory and paradigm that is capable of providing organizations with the needed adaptability and agility to adapt to the business environment. It is in the light of this that complexity theorists argue that the self-organization, adopted form the natural sciences with much successes, can be the savior (Pascale et al, 2001; Carapiet, 2006). Self-organization comprised of three major components according to evidence from the literature. There are: Strong connection or interaction of agents; High level of autonomy; and Strong and good value systems. According to the literature, all other feature can be carefully classified under these three main components.

The evidence provided from this study revealed that four out of the five experimental groups exhibited behaviors that mirrored the presence of three main features of self-organization as stated above. Thus, there were high levels of connections and interactions among these groups. Similarly, there were high levels of autonomy or freedom among members of the groups. Finally, it was found that the experimental groups had strong, shared and good values system that aid them to coexist well. Based on these findings, it can be argued that organizations with

self-organization capabilities are more adaptable, agile and successful as compared those with none. This opinion is similar to that of Pascale et al (2001) as they opined that self-organization help makes the organization to more creative, innovative, and adaptable to their business environment. It is therefore suggested that all the three main components of self-organization can be used to measure how adaptable an organization can be.

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATION

6.0: Introduction

This chapter comprises the overview of the study, key findings, recommendations for policies and practices, suggestion for further research and conclusion to the study.

6.1: Summary of the Study

Through the analysis, the following are the major findings of the study:

First of all, four experimental groups performed better than their colleagues at the control group after being exposed to the treatment during the study. The results of other study tools especially the researchers' observation report similar results about the experimental group which failed to perform as expected. It was noticed that there were low amounts of the self-organization components (Strong connection or interaction of agents; High level of autonomy; and Strong and good value systems) within the group. On the other hand, the clues provided by the researcher (as part of experimental treatment) helped the control group to outperform their colleagues.

More to the point, the study revealed that strong connections and interactions among actors played an important role in their success. That is, members of successful groups were seen communicating heavily during the conduct of the experiment. They discussed and argued out all doubts regarding the performance of their tasks.

Furthermore, high level of autonomy was one of the important elements that led to the success of the experimental groups. Even though they were left to decipher everything for themselves, they did not fall back in terms of their performance. They utilized the lack of strict rules and control to succeed as they got the opportunity to experiment all their ideas to help them achieve their goal.

Also, it was realized that the successful groups had the following values; openness, trust, confidence, collaboration, cooperation, independence, experimentation, authenticity, confrontation, and pro-action. This was very key to the successful performance of their tasks. It therefore holds that strong and good value systems help the group or team to achieve optimum performance.

Finally, the analysis conducted in this study showed that organizational adaptability can be measured by the presence or absence of conditions that stimulate and facilitate self-organization within the organization. That is the major components of self-organization can be used as measurement construct for organizational adaptability and resilience.

6.3: Conclusion

From the study, it can be concluded that self-organization plays an important role in promoting adaptability and agility within the organization. Thus, adaptability and success was achieved in the performance of the tasks when the self-organization processes was stimulated through; strong connections among members, high level of autonomy, and strong value systems. Also, strong connections and interactions among team or group members stimulated the level of self-organization processes and help the successful groups during the experiment. Furthermore, high level of autonomy played a major role in lubricating the processes of self-organization among the successful groups. Finally, it can be concluded that strong value systems helped successful groups to succeed in the performance of their tasks. In all, self-organization plays an important role in promoting and facilitating adaptability and success in the organization.

6.4: Limitations of the Study

Just like any other research, there are inevitable challenges face by researchers in the conduct of every research. The following are some of the constraints experienced by the researcher during the research;

First of all, settling on the location of the research was difficult. This is because the researcher had to write several letters and correspondences in order to get ethical clearance from authorities of the school and other research stakeholders. These processes were carried out at the time when

there were so many holidays coming up in Ghana. This delayed the ethical clearance process and the researcher had to wait for more than one and half months to be cleared.

Furthermore, the time scheduled for the experiment to take place coincided with the time students were preparing for their final term examinations. At this time too, the students were going for their clinical attachments. This complicated the data gathering processes and delayed it. It was also difficult for the researcher to access the Clinical Supervisor assigned by the school authorities to help in the conduct of the experiments needed to meet the requirements of the study. These problems coupled with financial difficulties limited the number of experiments conducted by the research team to only five.

Finally, the research method adopted presented the research team with one of its own inherent limitations. Thus, it was very difficult and really impossible to control all extraneous variables. Example, the life experiences and mood of the test subjects may have influenced their reactions. Some these variables may not have even been known to the researchers.

6.5: Recommendation

6.5.1: Recommendation for Policy and Practices

Base on the findings of the research, the researcher recommends the following for policy and practice;

Firstly, organizations need to have clear goals and objectives for carrying out various tasks as it will help teams to be focus even though they are free to operate. Making teams to understand with clarity the goals and objectives of performing their tasks will get them to commit to those goals/objectives.

Secondly, organizations have to put in place conditions to promote strong connections and interactions among their employees. This will always trigger the exhibition of self-organization behaviors within work teams and groups. Thus, every organization is a complex adaptive system and therefore management should have appropriate designs that lubricate and stimulate self-organization.

Thirdly, high level of autonomy should be considered a key ingredient in promoting success in the organization. With this, appropriate policies should be kept in place to promote operational autonomy within the organization. This will stimulate self-organization in the organization.

Finally, the organizational culture and values are very important in the success of the organization. Therefore, organizations should design policies that will yield good and strong values cherished by all in the organization. This will further promote self-organization and yield the much needed adaptability and success for the organization.

6.5.2: Recommendation for Further Studies

The research team recommends the following further research based on the findings of this research;

First of all, this research can be replicated in other locations and also using other research methodologies that are appropriate. This will test the reliability and validity of the findings of the research.

Moreover, further researches can focus on applying the self-organization theory to other issues in the management. Thus, more researches can focus on developing models for the measurement of self-organization processes in social systems like the organization. However, care must be taken in using models to understand happenings in the social systems as the reality is much more complex contains mixed elements such as rationality, formality, order, disorder, informality and intuition (Thietart and Forgues, 1995).

REFERENCES

1. Alba, R. D. (1982). Taking stock of network analysis: A decade's results. *Research in the Sociology of Organizations*.
2. Allport, G. (1968). The open system in personality theory. In W. Buckley (Ed.), *Modern Systems Research for the Behavioral Scientist.* Chicago: Aldine.
3. Amabile, T. M. (1988). A Model of Creativity and Innovation in Organizations. *Research in Organizational Behavior*. https://doi.org/Article.
4. Berlo, D. K. (1960). The process of communication: an introduction to theory and practice. New York: Holt, Reinhart and Winston.
5. Bertalanffy, L. V. (1968). General Systems Theory: Foundations, Development, Applications. London: Allen Lane.
6. Bushev, M. (1994). Synergetic: chaos, order, self-organization. Singapore: *World Scientific*.
7. Burnes, B. (2005). Complexity theories and organizational change, *7*(2), 73–90.
8. Burt, Ronald S. (1992a). Structural holes. *Cambridge, MA*: Harvard University Press.
9. Carapiet, S. (2006). The role of self-organization in the handling of adaptive challenges by enterprises.
10. Carapiet, S and Harris, H (2007). Role of self-organization in facilitating adaptive organization: a proposed index for the ability to self-organize. *Production Planning and Control: The Management of Operations*, 18:6, 466-474, DOI: 10.1080/09537280701495005
11. Chandler, G. N., Keller, C., and Lyon, D. W. (2000). Unraveling the determinants and consequences of an innovation-supportive organizational culture. *Entrepreneurship Theory and Practice*, 25(1): 59-76.
12. Choudry, G. (2011). The Dynamics of Organizational Climate: An Exploration. *Management Insight*, 7(2), 111-116.
13. Deci, E. L., and Ryan, R. M. (1985b). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, 19, 109–134.
14. Deci, E. L., Eghrari, H., Patrick, B. C., and Leone, D. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality*, 62, 119–142.
15. Denton, D. K. (1998). Creating a winning organization. *Empowerment in Organizations*, 6(3): 81-93

16. Dourouka, M. M (2013). Using network analysis to describe an information exchange network. Delft University of Technology - Department of Technology, Policy and Management.
17. Fitzgerald, L.A. (2002a). Chaos: the lens that transcends. *Journal of Organizational Change Management*, **15**(4), 339–358.
18. Fukofuka, S and Locke, D. T. (2015). OCTAPACE and Organizational Resilience: A Correlational Study. *International Journal of Business and Management Review*. Vol.4, No.1, pp.1-10, February 2015.
19. Fuller, T., and Moran, P. (2001). Small enterprises as complex adaptive systems: a methodological question? *Entrepreneurship 8, Regional Development*, 13: 47-63.
20. Frederick, W. C. (1998). Creatures, corporations, communities, chaos, complexity: a naturological view of the corporate social role. *Business and Society*, **37**(4), 358–376.
21. Gell-Mann, M. (1994). *The Quark and the Jaguar*. New York: Freeman.
22. Haigh, C. (2002). Using chaos theory: the implications for nursing. *Journal of Advanced Nursing*, **37**(5), 462–469.
23. Haythornthwaite, C. (1998). Social Network Analysis: An Approach and Technique for the Study of Information Exchange. *Graduate School of Library and Information Science University of Illinois*, Urbana-Champaign. LISR 18, 323-342 (1998).
24. Hock, D. (1999). *Birth of the Chaordic Age*. San Francisco, CA: Berrett-Koehler. In Burnes, B. (2005). Complexity theories and organizational change, *7*(2), 73–90.
25. Hofstede, G. (1984). Culture's consequences: international differences in work related values. Beverly Hills, CA: Sage Publications.
26. Holland, J and Langton, C. (1980). Complex Adaptive Systems and Emergence.
27. Islam, J., and Hu, H. (2012). A review of literature on contingency theory in managerial accounting, *6*(15), 5159–5164. https://doi.org/10.5897/AJBM11.2764.
28. Johnson, R. A., Kast, F. E., & Rosenzweig, J. E. (1964). Management Science, (November 2015).
29. Kaisler, S. H. and Madey, G. (2009). Complex Adaptive Systems: Emergence and Self-Organization. T*utorial Presented at HICSS-42 Big Island*, HI January 5, 2009.
30. Khandwalla, P. N. (1977). The Design of Organizations. New York: Harcourt Brace Jovanovich, Inc.

31. Kantur, D., and Iseri-Say, A. (2012). Organizational resilience: A conceptual integrative framework. *Journal of Management & Organization*, 18(6), 2012.
32. Keeves, J. P. (Ed.). (1988). Educational research, methodology, and measurement: An international Handbook. Oxford, UK: Pergamon.
33. Koestner, R., Bernieri, F., and Zuckerman, M. (1992). Self-regulation and consistency between attitudes, traits, and behaviors. *Personality and Social Psychology Bulletin*, 18, 52–59.
34. Lather, A. S., Janos, P., Singh, A., and Gupta, N. (2010). Organizational Culture: A Study of Selected Organizations in the Manufacturing Sector in the NCR. *Agriculture Economy*, 56(8), 349-358.
35. Lewin, R. (1993). Complexity: Life on the Edge of Chaos, London: Phoenix.
36. Lissack, M. R. (1999). Complexity: the science, its vocabulary, and its relation to organizations. *Emergence*, **1**(1), 110–125.
37. Lorenz, E. (1993). *The Essence of Chaos*. London: UCL Press.
38. MacIntosh, R. and MacLean, D. (1999). Conditioned emergence: a dissipative structures approach to transformation. *Strategic Management Journal*, **20**(4), 297–316.
39. MacIntosh, R and MacLean, D (2001) Conditioned Emergence: researching change and changing
research, *International Journal of Operations and Production Management*, Volume 21, Number 10, 2001, pp. 1343 – 1357.
40. MacIntosh, R. and Romme, A.G.L. (2004). Exploring the Nature of Order Generating Rules. *University of Strathclyde Graduate School of Business Working Paper Series.*
41. McMillan, E. (2000). Using Self Organizing Principles to Create Effective Project Teams as Part of an Organizational Change Intervention: A Case Study of the Open University'. In McCarthy, I. and Rakotobe-Joel, T. (Ed.) *Complexity and Complex Systems in Industry: A Conference Proceedings*, Warwick University, September.
42. McMillan, E. (2004). Complexity, Organizations and Change. Routledge, New York.
43. McMillan, E and Carlisle, Y. (2002). Complexity, Strategic thinking and Organizational change. Open University, Milton Keynes, United Kingdom.
44. Meyer, A. D., Gaba, V., and Colwell, K. A. (2005). Organizing far from equilibrium: nonlinear change in organizational fields. Organization Science, 16: 456-473.

45. Mittal, S. and Verma, B. L. (2013). HRD Climate in SBI Bank. *Pacific Business Review International*, 5(11), 17-22.

46. Monge, P. R., and Eisenberg, E. M. (1987). Emergent communication networks.

47. Morgan, G. (1986). Images of organization. Beverly Hills, CA: Sage Publications.

48. Neuman, W. L. (2003). Social research methods: qualitative and quantitative approaches (5th Ed.). *Boston, MA*: Allyn and Bacon.

49. Nohria, N. (1992). Introduction: Is a network perspective a useful way of studying organizations? In N. Nohria & R.G. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. l-22). Boston, MA: Harvard Business School Press.

50. Panchamia, J. (2013). A study of OCTAPACE culture in civil hospital, Gandhinagar. *IUP Journal of Organizational Behavior*, 12(2), 43-50.

51. Pascale R. T., Mark M., and Linda G. (2001). Surfing the Edge of Chaos. New York: Three Rivers.

52. Prakken, B. (2004). Uncertainty, Information and (Re) Organization. *Information Society*, 20(1): 53-57.

53. Prigogine, I. (1976). Order through fluctuation: self-organization and social system. In Jantsch, E. and Waddington, C. H. (Eds.), Evolution of consciousness: human systems in transition: 93-126. Reading, MA: Addison Wesley.

54. Rao T. V. and Abraham E. (1999): Reading in HRD. Oxford and IBH Publishing Co Pvt. Ltd., New Delhi.

55. Regine, B., and Lewin, R. (2000). Leading at the edge: how leaders influence complex systems. *Emergence*, 2(2): 5-23.

56. Robbins S. P and Coulter M. (2012). Management. 11th Ed. Pearson Education, Inc., publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey 07458.

57. Rosenhead, J. (1998). *Complexity Theory and Management Practice. Science as Culture*. Retrieved from: http://humannature.com/science-as-culture/rosenhead.html.

58. Ryan, R. M., and Deci, E. L. (2004). Autonomy is no illusion: Self- determination theory and the empirical study of authenticity, awareness, and will. In J. Greenberg, S. L. Koole, and T. Pyszczynski (Eds.), *Handbook of experimental existential psychology*. New York: Guilford.

59. Ryan, R. M., Deci, E. L., Grolnick, W. S., and LaGuardia, J. G. (2006). The significance of autonomy and autonomy support in psychological development and psychopathology. In Cicchetti, D. and Cohen, D. (Eds.), Developmental psychopathology: Theory and methods (2nd ed., Vol. 1, pp. 295–849). New York: *John Wiley & Sons*.
60. Sarantakos, S (2005). Social Research (3rd Ed). New York: Palgrave McMillan.
61. Schein, E. H. (2004). Organizational Culture and Leadership (3rd Ed.). *San-Francisco, CA: Jossey-Bass*.
62. Siddiqui, M. U., Khan, N. A., and Dhugana, H.N. (2013). Perceptual mapping of private and government doctors as regards to organizational values: A comparative study. *International Journal of Management Research and Business Strategy*, 2(4), 52-60.
63. Smith, A. C. T. and Humphries, C. E. (2004). Complexity Theory as a Practical Management Tool: A Critical Evaluation, Organization Management Journal, 1:2, 91-106, DOI: 10.1057/omj.2004.18.
64. Stacey, R. D. (2003). Strategic Management and Organizational Dynamics: The Challenge of Complexity. Harlow: FT/Prentice Hall.
65. Stacey, R. D., Griffin, D. and Shaw, P. (2002). Complexity and Management: Fad or Radical Challenge to Systems Thinking. London: Routledge.
66. Styhre, A. (2002). Non-linear change in organizations: organization change management informed by complexity theory. *Leadership and Organization Development Journal*, **23**(6), 343–351.
67. Subrahmanian, M. (2012). Achieving High Involvement and Satisfaction through OCTAPACE Culture in IT Companies. *ZENITH International Journal of Business Economics & Management Research*, 2(5), 13-138.
68. Swigger J. I. (2008). *History is Bunk: Historical Memories at Henry Ford's Greenfield Village.* Austin: University of Texas.
69. Tasaka, H. (1999). Twenty-first century management and the complexity paradigm. *Emergence*, 7(4), 115-123.
70. Tetenbaum, T. (1998). Shifting paradigms: from Newton to chaos. *Organizational Dynamics*, **26**(4), 21–32.
71. Thietart, R. A., and Forgues, B. (1995). Chaos theory and organization. *Organization Science*, 6(1): 19-31.

72. Van de Ven A. H, and Drazin R (1985). The concept of fit in contingency theory. Res. Organizational Behavior, 7(4): 333-365.
73. Weinstein N, Andrew K. P, and Ryan R. M., (2012).The index of autonomous functioning: Development of a scale of human autonomy. *Journal of Research in Personality,* 46 (2012) 397–413.
74. Weisskopf, W. A. (1979). The method is the ideology: from a Newtonian to a Heisenbergian paradigm in economics. Journal of Economic Issues, 13(4): 869-884.
75. Wheatley, M. J. (1994). Leadership and the new science: learning about organization from an orderly universe. San Francisco, CA: Berrett-Koehler Publishers.

APPENDICES

Appendix 1: Respondents Network Data

Respondents Network Data

Please indicate the level of interaction or ties between you and the other class members in the lists below. For example:

a. People you most communicate with (e.g., meetings, phone calls, text messages, or emails).
b. People you share your ideas or materials with most often.

In doing so, list the level of interaction using the following scales: **1**- No interaction or linkage **2**- Less interaction or linkage **3**- Neutral **4**- Strong interactions or links **5**- Very strong interactions or links. **Before proceeding, please remove your name from the list.**

NAME- SURNAME	1	2	3	4	5

Appendix 3: Task to be performed

Task: Wound Dressing

INSTRUCTIONS: For each step draw a circle round the appropriate numeral to indicate the candidate's level of performance.

RATING KEY:

0- Step omitted

1- Step performed incorrectly

2- Step performed correctly with hesitation

3- Step performed correctly with confidence

4- Step performed correctly, speed and style excellent

COMPONENT TASK RATINGS

1. Explains procedure to patient and ensures privacy 0 1 2 3 4

2. Puts on mask, prepares and takes trolley to bedside 0 1 2 3 4

3. Asks assistant for:

I. Put patient into desired position

ii. Protect bed clothes and exposes area

iii. Pour out lotions into gallipots

IV. And remove plaster or bandage 0 1 2 3 4

4. Washes and dries hands and wears sterile gloves or uses sterile forceps 0 1 2 3 4

5. Removes soiled dressings using dissecting forceps 0 1 2 3 4

6. Cleans wound with swabs soaked in normal saline the wound outward using one swab at a time. 0 1 2 3 4

7. Cleans wound with series of swabs until clean 0 1 2 3 4

8. Applies sufficient sterile dressings and secures into position 0 1 2 3 4

9. Informs patient about state of wound, thanks and makes him comfortable in bed. 0 1 2 3 4

10. Discards trolley, decontaminates used items and removes gloves. 0 1 2 3 4

11. Washes and dries hands, and removes screen. 0 1 2 3 4

12. Documents and reports state of wound. 0 1 2 3 4

TOTAL SCORE OBTAINED: ..... **GROUP:** …….

Appendix 4: Researchers Observation Form/Guide

Researcher's Observation Form

Group No: ……

Group Type (Experimental/Control): ……

1. What is the level of interactions among group members?
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
2. What is the level of autonomy of the team and its effects on the performance of the task by the team?
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……
   ……..
3. What are some of the observable values within the teams, if any?

……
……
……
……

Appendix 5: Average Distance between Actors

GEODESIC DISTANCE

Type of data: ADJACENCY

Nearness transform: NONE

Input dataset: edited data (C:\Windows\system32\edited data)

Output distance: edited data-Geo

For each pair of nodes, the algorithm finds the # of edges in the shortest path between them.

Note: Data were dichotomized.

Average distance = 1.302

Distance-based cohesion ("Compactness") = 0.849

(Range 0 to 1; larger values indicate greater cohesiveness)

Distance-weighted fragmentation ("Breadth") = 0.151

Frequencies of Geodesic Distances

	1	2
Frequency		
Proportion		
1.	1924.000	0.698
2.	832.000	0.302

Appendix 6: Freeman Betweenness Centrality

Input dataset: edited data (C:\Windows\system32\edited data)

Important note: This routine cannot handle valued data, so it binarizes your data automatically.

It DOES handle directed (non-symmetric) data, so it does NOT symmetrize.

Un-normalized centralization: 820.971

		1	2
		Betweenness	nBetweenness
		----------	----------
27	Dziwornu Emmanuel	31.358	1.182
42	Nongmebiir Paulinus	29.914	1.128
53	Ziembo Peter Baasong	28.202	1.063
30	Gyakye Paul	28.013	1.056
50	Tampuor Jonathan Dari	24.188	0.912
39	Mohammed Ajara	24.079	0.908
37	Lasey Emmanuel Kofi	23.889	0.901
51	Yakubu Salamatu	21.478	0.810
31	Gyimah Elsie Boateng	20.729	0.782
18	Bayor Vitus Basua	20.713	0.781
2	Abdul Fatatwu Fati	20.537	0.774
43	Nuhu Hediaya	18.984	0.716
40	Musah Muniratu	18.533	0.699
46	Oti-Afreh Benjamin	18.340	0.692
17	Batueng Abdul Gafaru	17.831	0.672
38	Leguu Linda	17.828	0.672
5	Adam Ayimana	17.779	0.670
8	Agbedige Gloria	17.758	0.670
36	Lakine Muniru Al-Hassan	17.233	0.650
21	Bipuah Asuma	17.175	0.648
9	Agyapomaa Faustina	16.981	0.640

52	Yiridomoh Wisdom Kyeyiri	16.653	0.628
11	Alhassan Hamidatu	16.434	0.620
23	Bozoola Patrick A-ire	16.364	0.617
28	EliasuAbdul Basit Yeiababoarania	16.332	0.616
29	Erebakyere Joshua	16.014	0.604
24	Bunkur Richard	15.903	0.600
19	Bayorwor Abubakari Mohammed	15.610	0.589
33	Kanjuhiba Kadiri	15.598	0.588
3	Abugbire Nicholas	14.454	0.545
14	Awudu Najat	14.440	0.545
44	Ofori Denis	13.898	0.524
32	Ibrahim Vida	13.511	0.509
34	Korah Rita	13.339	0.503
48	Salifu Halimatu N-Lidoe	12.845	0.484
13	Asante Dedorah	12.648	0.477
49	Sule Sumaila	12.417	0.468
22	Boeteng Samuel	12.262	0.462
4	Adam Habibu	12.145	0.458
16	Bamda Imori Asumah	11.922	0.450
35	Kubdaar Cosmas	11.636	0.439
41	Naadaar Blaise	11.266	0.425
10	Agyanewaa Gifty	10.943	0.413
1	Abdul Rahman Shabatu	9.862	0.372
20	Bilipke Fedelis Kokede	9.393	0.354
25	Dansaana Wisdom	9.167	0.346
26	Dede Deborah	9.104	0.343
47	Owusu Doris Agyeiwaa	8.752	0.330
12	Awsere Derrick	8.564	0.323
15	Awumey Shella	7.526	0.284
45	Osei Ebenezer	7.309	0.276

6	Adongo Gabriel	6.587	0.248
7	Adu Alice Baah	6.557	0.247

DESCRIPTIVE STATISTICS FOR EACH MEASURE

		1	2
		Betweenness	nBetweenness
		----------	----------
1	Mean	15.868	0.598
2	Std Dev	5.873	0.221
3	Sum	841.000	31.712
4	Variance	34.487	0.049
5	SSQ	15172.738	21.573
6	MCSSQ	1827.814	2.599
7	Euc Norm	123.178	4.645
8	Minimum	6.557	0.247
9	Maximum	31.358	1.182
10	N of Obs	53.000	53.000

Network Centralization Index = 0.60%

Output actor-by-centrality measure matrix saved as dataset edited data-bet

Appendix 7: Closeness Centrality

Input dataset: edited data (C:\Windows\system32\edited data)

Method: Geodesic paths only (Freeman Closeness)

Output dataset: edited data-clo (C:\Windows\system32\edited data-clo)

Note: Data not symmetric, therefore separate in-closeness & out-closeness computed.

WARNING: Data matrix dichotomized such that Xij > 0 was recoded to 1

Closeness Centrality Measures

		1	2	3	4
		inFarness	outFarness	inCloseness	outCloseness
42	Nongmebiir Paulinus	59.000	61.000	88.136	85.246
27	Dziwornu Emmanuel	60.000	54.000	86.667	96.296
50	Tampuor Jonathan Dari	60.000	71.000	86.667	73.239
30	Gyakye Paul	62.000	55.000	83.871	94.545
5	Adam Ayimana	62.000	75.000	83.871	69.333
22	Boeteng Samuel	63.000	72.000	82.540	72.222
49	Sule Sumaila	63.000	79.000	82.540	65.823
53	Ziembo Peter Baasong	63.000	56.000	82.540	92.857
32	Ibrahim Vida	64.000	83.000	81.250	62.651
26	Dede Deborah	64.000	82.000	81.250	63.415
31	Gyimah Elsie Boateng	64.000	62.000	81.250	83.871
28	EliasuAbdul Basit Yeiababoarania	65.000	71.000	80.000	73.239
46	Oti-Afreh Benjamin	65.000	78.000	80.000	66.667
47	Owusu Doris Agyeiwaa	65.000	84.000	80.000	61.905
23	Bozoola Patrick A-ire	65.000	68.000	80.000	76.471
6	Adongo Gabriel	65.000	91.000	80.000	57.143
10	Agyanewaa Gifty	65.000	77.000	80.000	67.532
41	Naadaar Blaise	66.000	71.000	78.788	73.239
3	Abugbire Nicholas	66.000	76.000	78.788	68.421

29	Erebakyere Joshua	66.000	61.000	78.788	85.246
38	Leguu Linda	66.000	61.000	78.788	85.246
44	Ofori Denis	66.000	76.000	78.788	68.421
16	Bamda Imori Asumah	67.000	73.000	77.612	71.233
9	Agyapomaa Faustina	67.000	79.000	77.612	65.823
51	Yakubu Salamatu	67.000	60.000	77.612	86.667
39	Mohammed Ajara	68.000	57.000	76.471	91.228
19	Bayorwor Abubakari Mohammed	68.000	58.000	76.471	89.655
34	Korah Rita	68.000	78.000	76.471	66.667
12	Awsere Derrick	68.000	77.000	76.471	67.532
45	Osei Ebenezer	68.000	92.000	76.471	56.522
21	Bipuah Asuma	68.000	55.000	76.471	94.545
37	Lasey Emmanuel Kofi	68.000	53.000	76.471	98.113
17	Batueng Abdul Gafaru	69.000	54.000	75.362	96.296
18	Bayor Vitus Basua	69.000	52.000	75.362	100.000
52	Yiridomoh Wisdom Kyeyiri	70.000	60.000	74.286	86.667
13	Asante Dedorah	70.000	68.000	74.286	76.471
35	Kubdaar Cosmas	70.000	62.000	74.286	83.871
25	Dansaana Wisdom	70.000	77.000	74.286	67.532
4	Adam Habibu	70.000	68.000	74.286	76.471
48	Salifu Halimatu N-Lidoe	70.000	59.000	74.286	88.136
36	Lakine Muniru Al-Hassan	71.000	54.000	73.239	96.296
8	Agbedige Gloria	71.000	62.000	73.239	83.871
20	Bilipke Fedelis Kokede	71.000	65.000	73.239	80.000
14	Awudu Najat	71.000	70.000	73.239	74.286
15	Awumey Shella	72.000	87.000	72.222	59.770
40	Musah Muniratu	73.000	54.000	71.233	96.296
2	Abdul Fatatwu Fati	74.000	55.000	70.270	94.545
7	Adu Alice Baah	74.000	89.000	70.270	58.427
24	Bunkur Richard	75.000	55.000	69.333	94.545

43	Nuhu Hediaya	75.000	59.000	69.333	88.136
33	Kanjuhiba Kadiri	76.000	67.000	68.421	77.612
11	Alhassan Hamidatu	77.000	61.000	67.532	85.246
1	Abdul Rahman Shabatu	78.000	73.000	66.667	71.233

Statistics

		1	2	3	4
		inFarness	outFarness	inCloseness	outCloseness
1	Minimum	59	52	66.667	56.522
2	Average	67.868	67.868	76.931	78.617
3	Maximum	78	92	88.136	100
4	Sum	3597	3597	4077.328	4166.721
5	Standard Deviation	4.340	11.033	4.885	12.424
6	Variance	18.832	121.737	23.863	154.357
7	SSQ	245119	250573	314936.563	335757.531
8	MCSSQ	998.076	6452.076	1264.742	8180.900
9	Euclidean Norm	495.095	500.573	561.192	579.446
10	Observations	53	53	53	53
11	Missing	0	0	0	0

11 rows, 4 columns, 1 levels.

Network in-Centralization = 23.06%

Network out-Centralization = 44.01%

Output actor-by-centrality measure matrix saved as dataset edited data-clo
(C:\Windows\system32\edited data-clo)

Appendix 8: Freeman Degree Centrality

Input dataset: edited data (C:\Windows\system32\edited data

Output degree dataset: edited data-deg (C:\Windows\system32\edited data-deg

Output centralization dataset: edited data-degcz (C:\Windows\system32\edited data-degcz

Treat data as: Undirected

Output raw scores: YES

Output normalized scores: YES

Allow edge weights: YES

Exclude diagonal: YES

Degree Measures

		1 Degree	2 nDegree
1	Abdul Rahman Shabatu	39.000	0.750
2	Abdul Fatatwu Fati	49.000	0.942
3	Abugbire Nicholas	47.000	0.904
4	Adam Habibu	44.000	0.846
5	Adam Ayimana	45.000	0.865
6	Adongo Gabriel	40.000	0.769
7	Adu Alice Baah	33.000	0.635
8	Agbedige Gloria	48.000	0.923
9	Agyapomaa Faustina	42.000	0.808
10	Agyanewaa Gifty	44.000	0.846
11	Alhassan Hamidatu	45.000	0.865
12	Awsere Derrick	45.000	0.865
13	Asante Dedorah	45.000	0.865
14	Awudu Najat	45.000	0.865
15	Awumey Shella	37.000	0.712
16	Bamda Imori Asumah	45.000	0.865

17	Batueng Abdul Gafaru	52.000	1.000
18	Bayor Vitus Basua	52.000	1.000
19	Bayorwor Abubakari Mohammed	51.000	0.981
20	Bilipke Fedelis Kokede	46.000	0.885
21	Bipuah Asuma	49.000	0.942
22	Boeteng Samuel	47.000	0.904
23	Bozoola Patrick A-ire	45.000	0.865
24	Bunkur Richard	50.000	0.962
25	Dansaana Wisdom	39.000	0.750
26	Dede Deborah	45.000	0.865
27	Dziwornu Emmanuel	52.000	1.000
28	EliasuAbdul Basit Yeiababoarania	49.000	0.942
29	Erebakyere Joshua	48.000	0.923
30	Gyakye Paul	52.000	1.000
31	Gyimah Elsie Boateng	59.000	1.135
32	Ibrahim Vida	43.000	0.827
33	Kanjuhiba Kadiri	43.000	0.827
34	Korah Rita	45.000	0.865
35	Kubdaar Cosmas	47.000	0.904
36	Lakine Muniru Al-Hassan	51.000	0.981
37	Lasey Emmanuel Kofi	51.000	0.981
38	Leguu Linda	49.000	0.942
39	Mohammed Ajara	50.000	0.962
40	Musah Muniratu	51.000	0.981
41	Naadaar Blaise	46.000	0.885
42	Nongmebiir Paulinus	50.000	0.962
43	Nuhu Hediaya	47.000	0.904
44	Ofori Denis	43.000	0.827
45	Osei Ebenezer	39.000	0.750
46	Oti-Afreh Benjamin	47.000	0.904

47	Owusu Doris Agyeiwaa	43.000	0.827
48	Salifu Halimatu N-Lidoe	46.000	0.885
49	Sule Sumaila	53.000	1.019
50	Tampuor Jonathan Dari	48.000	0.923
51	Yakubu Salamatu	46.000	0.885
52	Yiridomoh Wisdom Kyeyiri	48.000	0.923
53	Ziembo Peter Baasong	51.000	0.981

53 rows, 2 columns, 1 levels.

Graph Centralization -- as proportion, not percentage

	1
	Degree
	------
1 edited data	0.2492

1 rows, 1 columns, 1 levels.

Appendix 9: Density / Average Matrix Value

Input dataset: edited data (C:\Windows\system32\edited data)

Output dataset: edited data-density (C:\Windows\system32\edited data-density)

	1	2	3
	Avg Va lue	Std De v	Avg Wt d Degr ee
	------	------	------
1 edited data	0.700	0.493	36.302

1 rows, 3 columns, 1 levels.

Appendix 10: Pictures Taken During the Experiments