

CHAPTER 3 - HUMAN FACTORS



3.1 INTRODUCTION

Organisations can be described as socio-technical entities (Chapter 1). Simon's (1996:49) statement that "organizations are social schemes that facilitate coordinated behaviour, at the same time conserving the critical scarce resource of human ability to handle complexity and great masses of information" is relevant and describes the point of departure to this study. Drucker (1955:61) states that the "performance of an enterprise is the performance of its community of human beings". The complexity of human involvement in organisations has been described for decades and in various disciplines. As authors from different disciplines over many years (Amoroso , 2004; Amoroso & Knight, 2007:245; Argyris, 2008:1; Beer, 1972; Beer, 1975; Beer, 1985; Dietz, 2010a; Hofstede & Hofstede, 2005:20; Hoogervorst, 2009:428) have agreed, it is in the interaction of people, resources, systems and money that complexity resides. Despite progress and establishment of modern technologies and techniques, the rate of change today demands tools and strategies to help enterprises cope with complexity to maintain their status in a fast-changing, competitive global world. Effective management and utilisation of human capital and information in organisations are indisputable and necessary in dealing with complexity. According to Ramadier (2004:425), complexity can be approached only through transdisciplinarity. Keeping in mind that EA is used to describe complexity in organisations, it is necessary to move beyond a complementary model or common model of understanding into coherence of knowledge in a transdisciplinary community.

In Section 3.2, the concepts *enterprise* and *organisation* are defined, followed by a description of the organisation-as-a-human-system as used in cybernetics. The organisational relation to IS and IT is also highlighted. The role of humans and human factors in organisations is discussed in Section 3.3 from an organisational culture perspective. Sections 3.4 and 3.5 follow with a discussion of acceptance models and theories and other related models and theories relevant to my research. Human factors identified from acceptance models, theories and frameworks and human factors identified from the EA literature are listed in sections 3.6 and 3.7.

3.2 ENTERPRISES / ORGANISATIONS

The business of an enterprise is contained within its declaration of existence and operation. Globally, successful enterprises depend on how well they manage their business, which today is supported by their IT and information management (IM) infrastructure. Outcomes of case studies performed in different countries on how EA promotes and supports integration of an enterprise's business goals with its IT and IM infrastructure have highlighted EA's contribution to successful operation and management of change (Ross *et al.*, 2006:xi). Figure 3.1 illustrates how EA relates to the socio-technical environment of an enterprise with respect to business management, IM and IT.

In defining success in enterprises, Ross *et al.* (2006:204) state that people are key in making a difference. Humans are involved in and responsible for the management and business operations of an enterprise. Humans are also involved in and responsible for the generation and management of business information in enterprises. Business- and information management are reliant on IT as a support system. Human- and social

factors are different from technical information-handling factors. According to Schwalbe (2014:395), it is essential to treat people with consideration and respect, to understand what motivates them, and to communicate carefully with them. Human factors as perceived in my research concern character- and personality-related factors that may be motivated and influenced by human interaction with other humans, technology and systems.

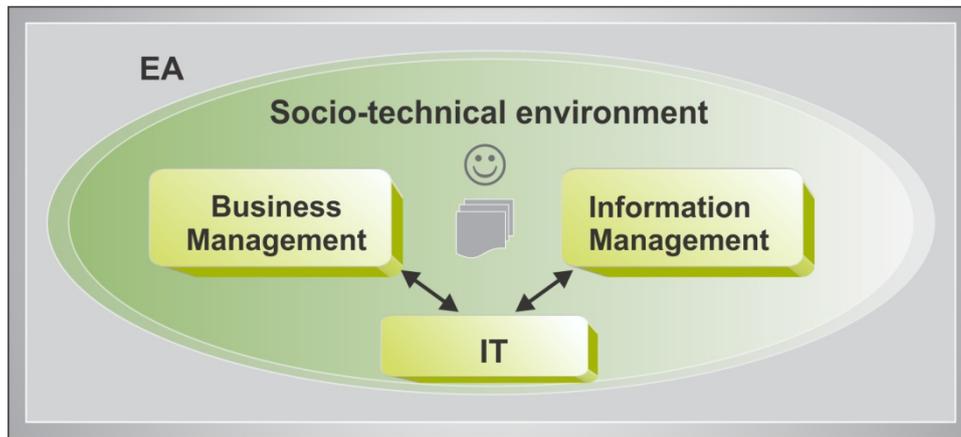


Figure 3.1: Enterprise architecture in relation to business, information management and information technology

Traditionally, IT was introduced in organisations to provide solutions to business and operational problems. Software systems were purchased or developed and computer technology was implemented to solve problems and provide automated solutions. In some instances, IT was even perceived by people as threatening to their work and work roles in organisations. Du Plooy (1998:1) explains that IT was initially adopted in organisations to solve organisational problems but that it soon turned out to be responsible for causing organisational change that technology experts were not equipped to solve. Although technology had been responsible for major changes in organisational management, it became clear that management of technology was no longer problematic, but that the focus in organisations had shifted towards management of people. Brooks (1995) supports views of others such as DeMarco and Lister (1999) and Schumacher (1993) in stating that management of people, their qualities and creativity is far more important than management of technology.

According to Hevner and Chatterjee (2010:147), the only constant in this world is change. In enterprises today where “management of complexity” and “striving for success in a competitive and fast changing local and global environment” are general aims, use of legacy systems have become problematic (Kappelman, 2010:256). EA is a strategy to assist enterprises over time to integrate their ‘business’, IT and IM and in doing so enhance their ability to manage complexity and change. In 1995, Brooks (1995) quoted the discipline of software engineering (SE) and wrote:

The complex craft of software systems will demand continual development of the discipline, learning to be composed in larger units, best use of new tools, best adaptation of proven engineering management methods and intellectual control over complexity.

Although not as yet proven as a matured discipline, EA relates to the statement about SE above. It can be said that the complex craft of EA demands continual development of models and methods in enterprises. Complexity demands that learning and management should be composed to incorporate business, IT and IM integration in local and global environments with the use of the best tools available. Intellectual property and organisational information should be valued and retained.

In Section 3.2.1 the concepts of *enterprise* and *organisation* are defined. Section 3.2.2 provides the reader with an overview of cybernetics with the purpose of outlining the origin of an organisation as a self-regulatory system. The literature set out in Section 3.2.3 is used to provide an overview of the enterprise/organisational relation to information systems and EA.

3.2.1 Enterprise and Organisation Defined

The terms “enterprise” and “organisation” are used interchangeably in the literature to describe the socio-technical systems of humans, procedures, processes, information and technology – all working together in a self-regulated environment towards the achievement of common goals.

The focus of my research is on individual human factors within the context of a social organisational environment that impact on the implementation of new strategies used for integration of business, IM and IT – therefore, the social and technical organisational systems views are discussed. Gortner *et al.* (1989:2) define an organisation as a “collection of people engaged in specialized and interdependent activity to accomplish a goal or mission”. The concept of an organisation as a system of systems originated with Ackoff (1971:661). This author explained the holistic systems view of organisations by stating that a system is a set of interrelated elements. According to Ackoff (1971:662), organisations are concrete, open, dynamic systems with their own environment and properties.

As described in Chapter 1, an enterprise is seen as a complex system consisting of interrelated, interacting entities and processes (systems), operating in a socio-technical defined environment with the purpose of achieving common goals (Giachetty, 2010; Nadler & Tushman, 1997; Ross *et al.*, 2006). An enterprise is therefore a system of enterprises. Since the early 1980s, IT started to replace manual data processing in organisational operations (Drucker, 1988:46). The role of IT in social and organisational research was mostly described as cultural-centric (Giddens, 1981:161; Giddens, 1984; Knorr-Cetina & Cicourel, 1981). Since then, IT has become a global information tool. Walsham (2001:18) describes the role of IT in a worldwide context and points out that cultural diversity should be acknowledged and incorporated into organisational operations.

3.2.2 Cybernetics and Organisations

Cybernetics is defined as “the science of communication and control in animals (e.g. by the nervous system) and in machines (e.g. computers)” (OPD, 1979:770). Cybernetics and management cybernetics provide background knowledge of the scientific understanding of an organisation as a system and the equilibrium of humans and information processing. According to Beer (1975:136), cybernetics addresses the issues of social

institutions. Cybernetics is also the discipline concerned with the scientific description of information processing between either humans, machines or humans and machines.

The history of an organisation as a system is described in cybernetics and its management. Cybernetics and the management of cybernetics are reviewed in this section to report on the history and importance of human involvement in IM of organisations.

Mathematical logical theories and switching systems in electrical engineering lay the foundation for recognising similarities between machine systems and the human nervous system (Wiener, 1961:14). Being part of a group of scientists originally introducing the term “cybernetics” and naming the discipline of cybernetics more than 60 years ago, Wiener (1961:20) and Ashby (2009:47) were some of the first scientists to describe control and communication in terms of a message and feedback. According to Wiener, whether information processing happened mechanically (in a machine) or humanly (in an animal) it was to some extent an indication of organisation of a system. Wiener (1954:16) stressed the importance of communication in understanding the organisation and operation of any society. Communication could be between humans, between machines, or man-machine communication. Humans control their environment externally through communication of information and have to fight against their natural tendency to disorganise or destroy its meaning. Internal communication and its integrity account for the well-being of a society (Wiener, 1954:131). Ashby (1954) invented the term “self-organisation” and described the state of a system in terms of definable variables. Hayles (1999:99) writes about Wiener’s observations of boundaries of systems and how he saw analogy as communication and communication as analogy; for example, a pattern of data identified in one discipline (system) could analogically be reconstructed in another discipline (system). According to Hayles (1999:99), Wiener perceived cybernetics as relations. According to Ramage (2009:48), Ashby laid the foundation for describing complex systems in proving that the number of possible states of a system is an indication of the variety present in a system. In order to control complexity, Ashby’s Law of Requisite Variety stated that the regulator must contain as much variety as the system being regulated, which means that the management of an organisation needs to match the variety generated by the organisation.

Beer (1975) was one of a group of management cyberneticians applying findings from scientists in earlier cybernetics to organisational management (Ramage & Shipp, 2009). Beer (1975:110) used Ashby’s (Ashby, 1954) introduction of self-organisation and complexity of systems to describe management of change in organisations. Beer (1985:ix) states: “Cybernetics is the science of effective organisation”. From the findings of cybernetics, information and, more specifically, feedback of information and laws and principles of control proved to be typical of any complex system. Entropy of a system is an indication of the disorganisation of a system. In cybernetics, Beer (1972; 1975:27) describes how understanding the structure of a system as a whole means understanding the arrangement of the system and how its parts relate. This description relates to understanding that a complex system such as an enterprise is being held in balance by its “entropy” (energy flow) and “negentropy” (information). Beer (1985:6) explains that a viable system, of which an organisation is one, can exist independently within an environment and that its identity develops from its ability to recursively propagate itself in two ways: “lower” into a self-produced sub-system of itself or “higher” as an embedded sub-system in an extension of itself. Wiener (1961:202) used history of parallel mechanical systems to explain that where frequencies interacted, attraction resulted in self-organising systems. This phenomenon is also true for human brain waves. Wiener (1961) distinguishes between

learning experience and “self-propagation” – a phenomenon that makes it possible for humans to adapt to their changing or dynamic environments. In an organisation, humans and the organisational culture of which they are representatives constitute such a self-organising and self-regulating system.

Communication is seen by Wiener (1961:161) as a binding factor for an entity such as an organisation. Wiener (1961:161) states that humans in organisations are “means for acquisition, use, retention, and transmission of information” and are, therefore, the driving force of communication. Money and power are, however, used by human elements to disrupt so-called “homeostasis” or balance in socially constructed communities.

Ashby’s law of requisite variety states that “only variety can absorb variety” (Beer, 1975:35). It is only possible for management of an organisation to regulate variety through accountability. Beer (1975:92) argues that although it is not always possible to ignore hierarchical order in organisations and that management is in charge of resources and operations from a power position, enterprises as viable systems need contributions, shared responsibility and accountability from sub-systems.

There is a reason why a system such as an organisation exists. The purpose of a system is defined by what it does (Beer, 1975:102). Investment of money, time, care, talent, attention and reward must be properly balanced between an enterprise’s as-is and to-be states according to Beer (1975:118). Lucouw (2004:29) and Covey (1989:263) explain that the composition of the human parts of an organisation with their attributes and interaction bring synergy with a potential to grow and produce more. Growing or changing organisations are dynamic entities.

Beer (1975:24) names three so-called ‘stereotypes’ to validate his argument for social and organisational change: firstly, although humans are adaptive to change and have to change, they often resist change; secondly, the historical and cultural belief about a whole consisting of parts is now better understood as ‘the whole is more than the sum of its parts’ when it comes to contributions made by humans in organisations. Human energy flow (entropy) and exchange of information (negentropy) constitute a system that is not static but dynamic, flexible and adaptive; thirdly, hierarchical organisational decision and action defined by authority do not provide for modern, horizontal, synergetic, human interaction and information flow and processing. Beer (1975:136) explains that a complex organisation of sub-systems is kept in a stable state by its social mechanism of people, their behaviour and their relationships. Any change affecting variables or sub-systems of a system results in internal adjustment to maintain its stability. Usually, organisational social systems are not isolated systems but form part of social metasystems. Beer (1975:146) argues that historical metasystems of authority and ethics have disappeared and that ‘new’ metasystems should be formed. Systems protecting their own identity and fast-developing technology generated a need for establishing metamodels of structural governance. Beer (1975:35) proposes structural change for handling the problem of more pressure (variety) from outside as opposed to continuously increasing control variety from inside.

In Figure 3.2, Beer (1975:148) explains metasytemic governance of society. In a first rule of behaviour a social institution can see itself as part of a higher-order system. Secondly, a superior authority may control several institutions and rationalise and optimise their behaviour. Thirdly, the superior authority acts as a

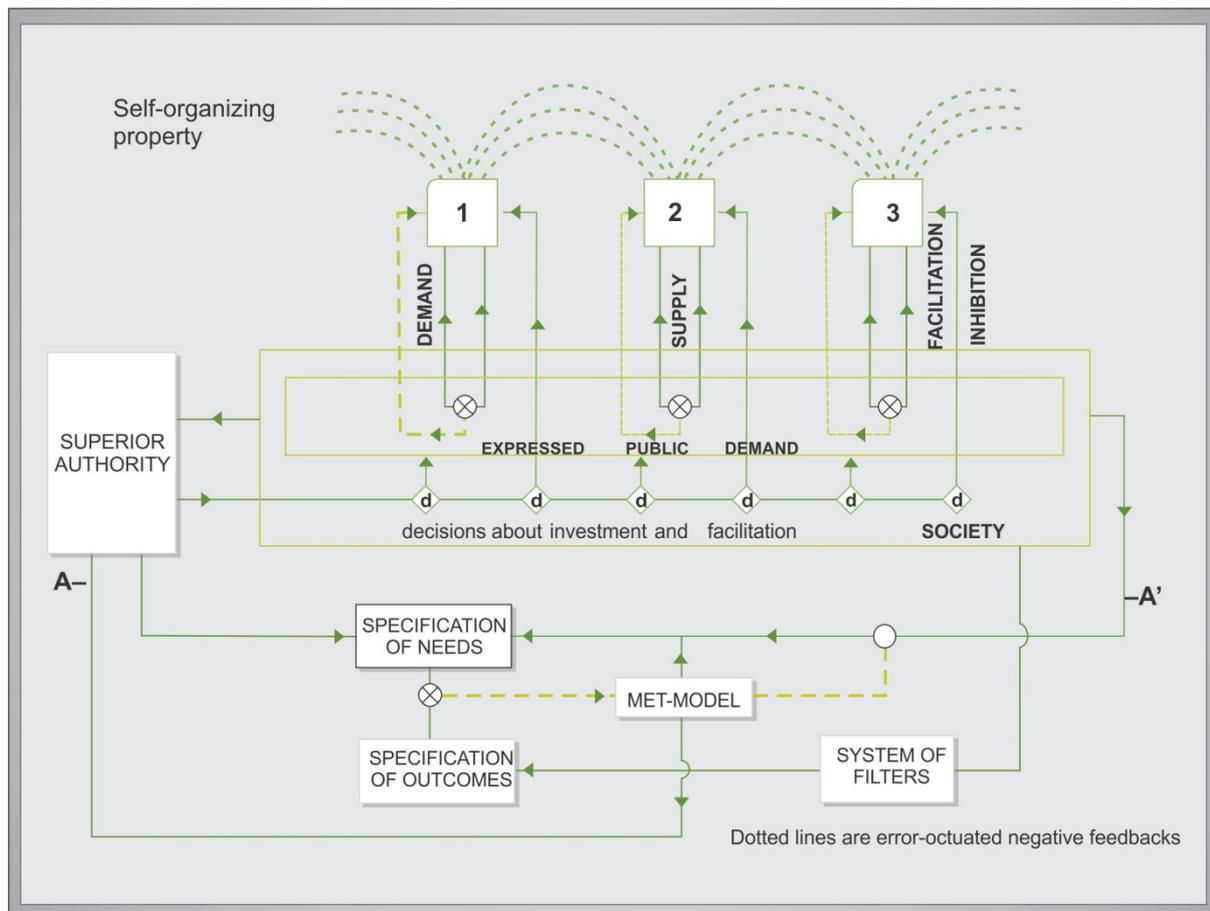


Figure 3.2: Societary control by self-organisation under metasystemic governance (Beer, 1975)

facilitator and uses specialised committees to control and run the social institutions. This author states that society uses established methods to ensure that social institutions adhere to one or more of the above-mentioned rules with sustained integrity. This type of system is, however, called a ‘spurious’ metasystem and is not capable of handling change. Beer’s (1975:146) beliefs of almost 40 years ago are still true when he claims that today technology advancement and the lack of respect for religion and power have resulted in the need for society to allow control of its social institutions by self-organisation of its metastructure through metasystemic governance. All activities below the AA’ line should be the responsibility of the institution.

EA was explained as an organisational strategy for understanding complexity and managing change in Chapter 2. The similarities between EA (providing descriptions of needs, process models and outcomes) and the entities described below the AA’ line are confirmation that Beer’s argument of years ago is still relevant today and serves as motivation for my research.

Beer (1975:221) noticed and acknowledged that addressing complexity had been identified as a major problem of his era. The cybernetic laws of self-regulation and self-organisation describe the dynamic behaviour of a system’s structure and Beer (1975:146), therefore, believed that answers to the management of complexity could only be found in the outcomes of the dynamic structure of systems and organisations. Exploiting technology for the management of information and the acknowledgement and management of

human input were perceived as a challenge then (Beer, 1975:265). Although technology is a given in organisational management today, the challenge of integrating, managing and retaining human and 'business' knowledge in enterprises remains.

Beer (1975:354) writes about how humans are trapped: by their own perceptions, a belief that money is the only measure of value, by their own technology and a society dominated by these three beliefs. He advocates that human values, understanding and knowledge empower humans to make choices.

Beer (1975:279) highlights technological change, better interaction, participative management and involvement of all humans in an organisation as problem-solving methods across organisational divisions. Multiplication of data entities stored contributes to complexity and waste. EA can be implemented as an instrument to address these issues.

Cybernetics originally described the similarities between operations of organisms and operations of organisations. Organisations exist because of human involvement and depend on humans and human factors to operate and grow. Wiener (1954:162) describes the mechanism of "human voluntary activity" feedback and "postural" feedback. He and other scientists realised how complicated the process of information exchange in organisations was and that information needs to be transferred, divided and digested by humans. Wiener (1954:162) describes how machines can be used for learning and gaming but says that machines can never *exhibit the purposive independent behaviour of the human being*.

Once EA is adopted as a strategy in organisations, human acceptance of EA is needed to implement it successfully. EA implementation is a long-term endeavour and it is the argument of this study that human acceptance of EA can make the difference between success or failure of a new strategy as Wiener (1954:146) emphasises that it sometimes takes years for new inventions or strategies to be understood and their full implications to be realised. Wiener (1954:146) writes:

I have been delighted to see that awareness on the part of social dangers of our new technology and the social obligations of those responsible for management see to it that the new modalities are used for the benefit of man, for increasing his leisure and enriching his spiritual life, rather than merely for profits and the worship of the machine as a new brazen calf.

The purpose of Section 3.2.3 is to give an overview of and briefly explain how the context of an organisation and the human element responsible for organisational operation are described in various disciplines in the literature.

3.2.3 Enterprises as Systems

In this section enterprises as systems are firstly described which is followed by a discussion of the role information systems (IS) in organisations.

Systems are often distinguished as 'hard' or 'soft'. Hard systems are technical, machine related, predictable systems. Soft systems are people related and unpredictable. In systems thinking, systems are perceived and classified into three different categories: hard, soft and critical systems. The research reported on in this study is concerned with humans in organisations and therefore with so-called 'soft' systems.

According to Checkland (1999:317), a system is “a model of a whole entity; when applied to human activity, the model is characterized fundamentally in terms of hierarchical structure, emergent properties, communication and control”. Furthermore Checkland (1999:277) states that soft systems methodology embodies starting with a situation rather than a problem. The author explains that one should accept that a human activity system can be perceived differently by different people and should realise that a conceptual model is a single reality of a more complex real system. Also, one should understand that findings are subjective and should finally realise that in reproducing the method it is possible to start anywhere from any point and follow any direction – following the so-called hermeneutic circle (Checkland, 1999:277).

In describing how to establish an activity system of improving a problem situation Checkland (1999:224) lists six elements (CATWOE) of an adequate root definition of a system (Figure 3.3). Checkland and Poulter (2006:40) explain that the root definition is a model description of action to bring about change or transformation of a problem situation. The questions *What? How? and Why?* are used to model the root definition. The questions posed and related to *What? How? and Why?* when the elements of CATWOE are being considered correlate with my research and are discussed in Chapter 6:

- Customers – who will be the users of the system but also who are affected?
- Actor – who will be responsible for doing the functional work?
- Transformation – what change is foreseen as a result of the implementation?
- *Weltanschauung* – what is the view behind the definition, system, model or framework?
- Owner – who is the owner of the system?
- Environment – in which context(s) is the system valid?

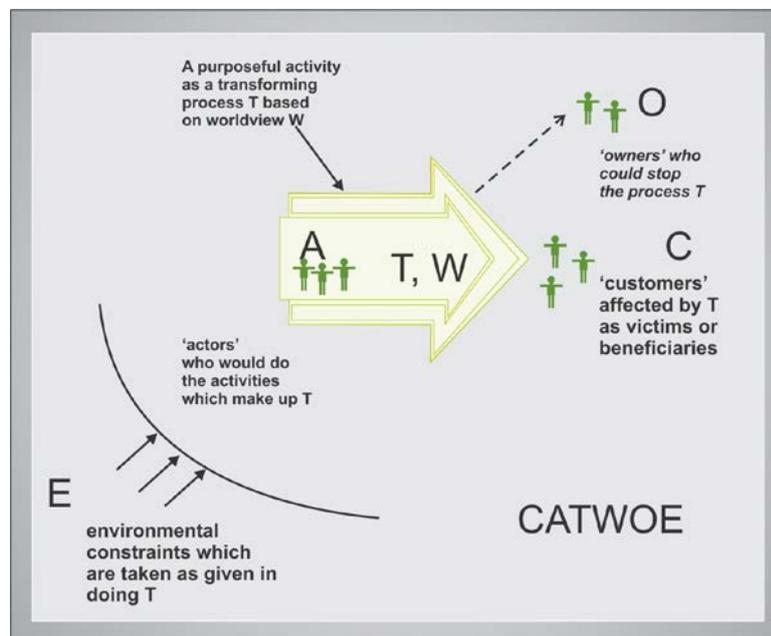


Figure 3.3: CATWOE - a generic model of any purposeful activity (Checkland & Poulter, 2006:41)

Meadows (2008:2) defines a system as *a set of things – people, cells, molecules, or whatever – interconnected in such a way that they produce their own pattern of behaviour over time. The system may be*

buffeted, constricted, triggered, or driven by outside forces, but the system's response to these forces is characteristic of itself, and that response is seldom simple in the real world. Meadows's definition of a system is relevant for my study where the behaviour of humans in organisations in relation to acceptance of new strategies is researched. Meadows (2008:188) further provides a list of principles of systems relevant to enterprises as systems:

- A system is more than the sum of its parts;
- Many interconnections of systems operate through flow of information;
- The least obvious part of a system, its function or purpose, is often the most crucial determinant of the system's behaviour;
- System structure is the source of system behaviour; and
- System behaviour reveals itself as a series of events over time.

In Figure 3.4, Gharajedaghi (1999:17) uses examples to describe how organisations as systems evolved over time as a result of paradigm shifts in both the nature of organisational thinking and methods of inquiry.

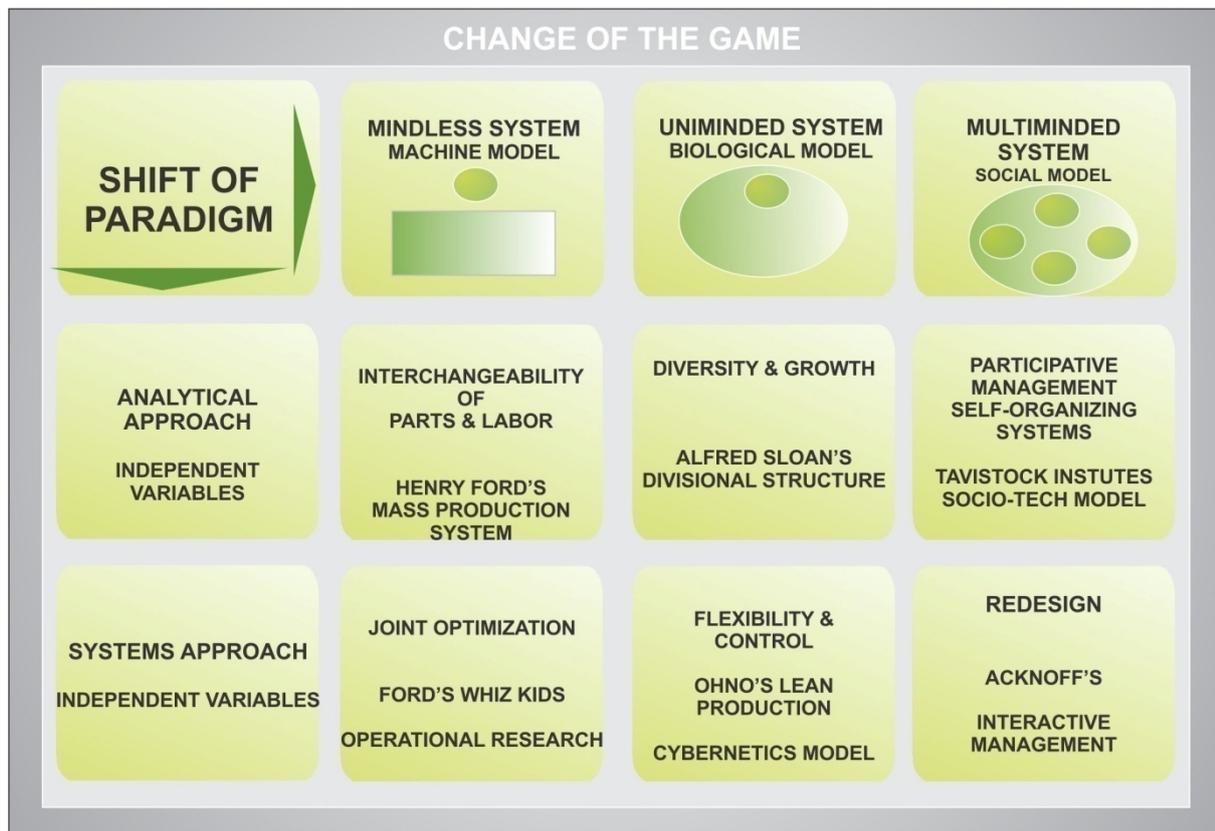


Figure 3.4: Change of the game (Gharajedaghi, 1999:17)

During the industrial age organisations were viewed as mindless systems with no purpose of their own. The organisation was a blueprint of a machine – a fixed structure that operated well in a stable environment. Humans performed tasks to deliver service and goods with the goal of making a profit. According to the uniminded system based on the biological model, if the elements of the organisation worked together to achieve a profitable result, the organisation was a growing and socially acceptable system. The multiminded

system or socio-cultural model was established when goals and choices of individuals were considered as part of the organisational purpose and objectives, not only to benefit the organisation but also to serve a greater and external society (Gharajedaghi, 1999:17).

Gharajedaghi (1999:15) and Covey (1989:262) explain the concept of independence and interdependence of elements in a socio-technical system. In an independent environment the elements and their functions make up the analytical thinking system. If you understand the functioning of the elements of the system, you understand the functioning of the whole system. In an interdependent system the elements and their relationships to each other result in more than the whole system. Von Bertalanffy (1969:47) proposes general systems theory and shows that irrespective of what type of system, its elements and interactions, general principles, concepts and laws apply. General systems theory addresses the integration of natural and social science. Organisational characteristics of unity, growth, hierarchical structure, relationships, control, and differentiation show that human involvement demanded explanations beyond scientific laws and methods of natural science. Von Bertalanffy (1969:51) admits that organisations lack knowledge of the laws of human society and, consequently, a sociological technology.

Systems thinking is based on the concept of interdependency and has evolved over time from mechanical systems to cybernetics into modern socio-technical systems. These systems are characterised by cooperation between human elements, relationships of human elements, self-organisation and human-made choices. Interdependent systems are dynamic and synergistic because of human involvement.

The interactive management model of Gharajedaghi (1999:23) (Figure 3.5) uses design as the vehicle, lists all the parts of an organisational system and shows how interaction of those parts and systems dimensions and principles integrate.

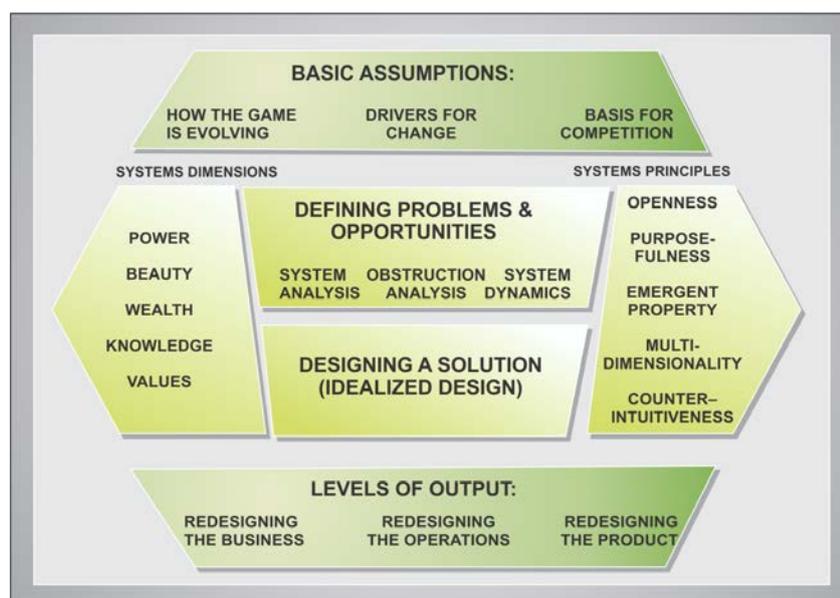


Figure 3.5: Interactive management (Gharajedaghi, 1999:23)

EA concerns the description of the enterprise as a system of systems and, more specifically, how its 'business', information and technology are managed to ensure successful operation. It is also vital that complexity is understood and information and knowledge are retained to enable an enterprise to manage change. Meadows (2008:80) explains that self-organisation of systems used to be seen as complex and not manageable but that systems can learn, grow and organise themselves into new structures. The author describes successful systems as resilient, self-organised and hierarchical. EA can assist organisations in this process of understanding, managing and growing themselves as systems of systems (Dietz & Hoogervorst, 2010:7; Gharajedaghi, 1999:136; Nadler & Tushman, 1997:26).

Information systems or, as they also often referred to, "IT systems" encompass people, procedures and resources responsible for data collection, processing and storing and for information distribution in organisations (Chaffey & Wood, 2005:43; Ferreira & Erasmus, 2010:2; Laudon & Laudon, 2007:15). According to Hoffer *et al.* (2002:551) and Laudon and Laudon (2007:14), information systems use historical or current data to support decision making and organisational control. An IS consists of interrelated components (also called "sub-systems") working together for a purpose in an environment (Hoffer, 2002:32). According to Lyytinen (1987:35), IS failure occurs as a result of conceptual, data and people problems and is mostly the result of changes in language and organisation environment.

Du Plooy (1998:87) also describes the human element of an organisation as a "non-deterministic sub-system". The reason for this is that human factors such as goals, perceptions, behaviour and agendas are unpredictable, often not known and may be very different from organisational objectives and goals. Du Plooy (1998:87) explains how technical and social systems influence each other. Du Plooy (1998:87) refers to the technical implication of an IS as deterministic when he states that the human system of an organisation is the driving force of deterministic subsystems such as computer systems. The reverse is also true: deterministic subsystems such as an information system influence human attitudes and behaviour as Du Plooy (1998:91) indicates when he states: *Information systems as social systems, their adoption and use constitute a social intervention that is more complex than can be controlled by a deterministic methodology.* IS and the organisational environments in which they operate are seen as non-deterministic systems (Du Plooy, 1998:88). Organisations need to acknowledge and manage the influence of human factors to ensure that complexity is understood and operations and information are managed as well as possible. Von Krogh (2009:119) appeals for research in IS to gain understanding of IS and its interaction with people and individuals as its roots.

3.2.4 Enterprises and Systems Development

Seen from an IS development viewpoint and relevant to my research in EA, organisational context is described by Lyytinen (1987:17) as *a viewpoint, which confines object systems to the origin, nature, purpose and form of systematic relationships and interaction between people.* Dietz (2010:1) and Hoogervorst (2009:428) distinguish between "functional and constructional" enterprise design areas and confirm that people (customers, suppliers, partners, stakeholders), products and the relationships between them are "functional" enterprise elements whereas everything concerned with the internal organisational construction of employees, processes, practices, IM and IT support forms part of the 'construction' of an enterprise.

An IS can be a representation of an object system. Two IS development approaches are distinguished by Hoffer *et al.* (2002:9): a process-oriented approach and a data-oriented approach. The process-oriented approach describes the IS development strategy of the flow, use and transformation of data processed by an information system. The data-oriented approach to IS development focuses on the organisation of the data or the data model used for organising the data of an organisation. The data-oriented approach is also called “information engineering”. Both approaches are necessary to assist organisations in handling of useful information and business knowledge.

Business Dictionary (2010) and Finkelstein (1989; 1992:11) define *information engineering* (IE) as a *top-down enterprise information systems development approach, which forms a part of the strategy for the overall systems architecture. IE employs data models and process models for each business function or area, to formulate a basic framework of how an enterprise functions and how information technology can help it to function better.*

Finkelstein (1989; 1992:11), who explains that IE is as *an integrated set of techniques, based on corporate strategic planning, which results in the analysis, design and development of systems, which support those plans exactly* could be described together with Martin (1989) as the founders of IE. IE is meant to assist managers and users concerned with the business of an organisation and provide them with information needed for planning and feedback for refinement of the strategic plans (Finkelstein, 1992). Martin (1989) describes IE as *the application of an interlocking set of formal techniques for the planning, analysis, design and construction of information systems on the enterprise wide basis or across a major sector of the enterprise.*

As seen from definitions mentioned, IE is a technique used to assist in the understanding of the functions of an enterprise and how IT is used to store and manage information regarding functions of the enterprise. All of these actions are necessary operational elements in modern organisations. All of these actions are people-driven actions. It is the argument of the researcher that human factors affect the successful implementation of organisational strategies, of which EA is one.

Martin (1995:80) explains that business methods and IT methods of modern organisations need to be integrated to enable handling of change. The platform used for the integration is enterprise engineering (EE). Figure 3.6 shows the evolvement of business reengineering and IE into EE over time.

Dietz (2010:63) describes a complete generic system development process for the development of an ‘object system’ that is meant to support a ‘using system’. Dietz (2010:63) uses the ‘white-box model or construction perspective’ and the ‘black-box model or function perspective’ to explain that there is a definite difference between the one physical construct of an entity and the many functional, conceptual meanings attached to this entity by various stakeholders. The development phases (Figure 3.7) are function design, construction design, engineering and implementation.

Function design starts with the use of system construction supported by functional principles and requirements. The result is the functional model of the object system. Construction design starts with the object system function supported by constructional properties and requirements and the result is an ontological model of the object system.

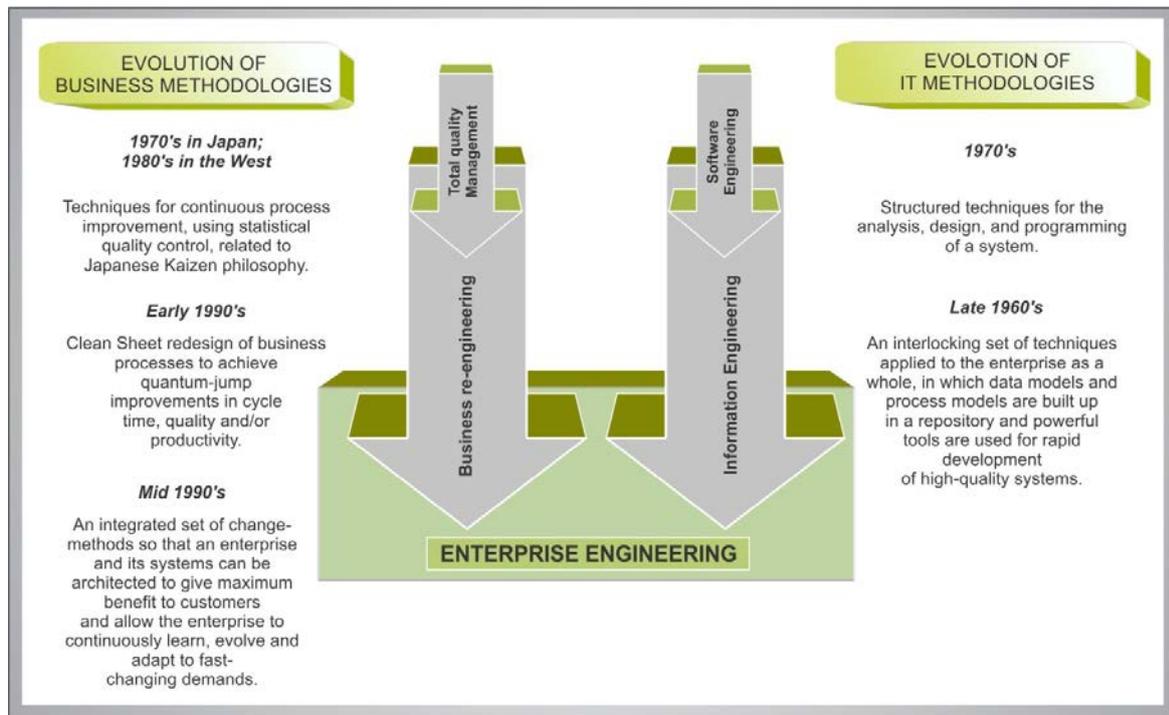


Figure 3.6: The fusion of business methods and IT methods (Martin, 1995:80)

Engineering is the technical design process of converting the ontological model of the object system into the implementation model of the object system. Reverse engineering may be necessary if the ontological model does not exist.

Implementation is the first realisation of a technology solution.

Finkelstein (2011:600) distinguishes between “forward” “reverse” and “reengineering” when he refers to information engineering. He describes the top-down way of creating data and process models as “forward” engineering, calls it “reverse” engineering when the process starts at technology level with the description of data and technology resources. “Re-engineering” according to Finkelstein happens when only technology and not business requirements changes. Enterprises have become so complex and information management so diverse that “modelling”, “engineering” or “re-engineering” requires that people understand, describe and manage complexity as far as humanly possible (Ballangee, 2010a:46; Dietz, 2010a; TOGAF, 2009:744; Vernadat, 1996; Zachman, 2009).

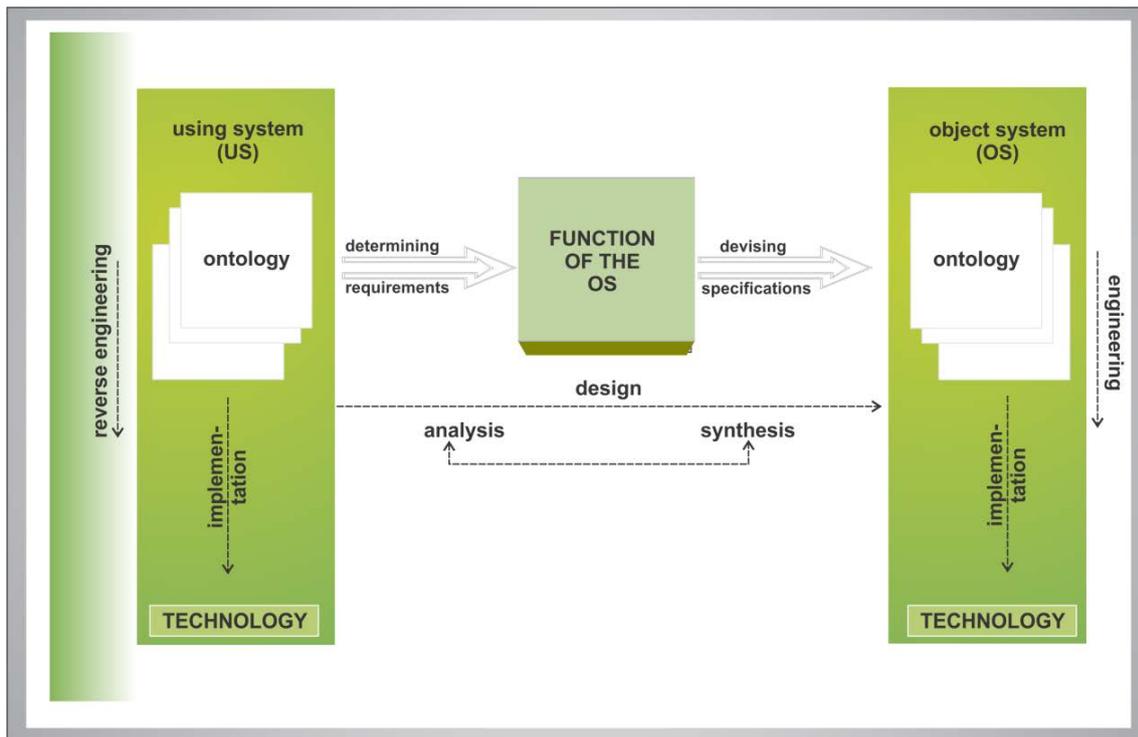


Figure 3.7: The system development process (Dietz, 2010a:77)

3.3 ORGANISATIONAL CULTURE

“Organisational culture” is a term with a wide-ranging meaning that defines the beliefs, rules, norms, values and artefacts of an organisation as well as the ways in which an organisation operates (Beckhard & Harris, 1987:7). According to Stein (2010:79), humans in an organisation are satisfied with their working situation if they understand their work role, the meaning of what they do and relate to what they do. When humans are at ease with what they do, feel secure and valued in their working situation, they are prone to take more responsibility and be more creative. If humans have equal opportunities, they become citizens of their organisation. According to Stein (2010:61), the enterprise is a community of human beings and its performance is the performance of human beings. A human community such as an enterprise must be founded on common beliefs, must symbolize its cohesion in common principles (Stein, 2010:61).

3.3.1 Organisational Culture – History

The way in which human factors influence work relations and productivity has been researched for many years. Gortner *et al.* (1989:69) describe how the impact of social relations and human factors became apparent when organisations in the late 1930s tried to increase productivity and rationality. Human factors could not be separated from working obligations and when organisations tried to focus only on working policies and cognitive human issues workers began to show resistance to working rules and regulations. Even in those years, organisations realised the importance of recognising individual work competency as well as character and personality traits such as commitment and attitude. Gortner *et al.* (1989:71) found that

the relationships between job satisfaction, material rewards, productivity, the physical and psychic environment of work, and numerous other factors associated with individual attitudes correlated with the success of organisations, but in varying ways and degrees. Individuals in organisations form part of working and social groups in an organisation. According to Gortner *et al.* (1989:72), formal and informal groups are responsible for setting values, norms, roles and status and thus establishing the socio-technical context and organisational culture.

Stein (2010:69) describes Drucker's views on the corporation as a human organisation. The author emphasises that although people thought that problems they experienced in the 19th century with alignment of natural resources and technological inventions during the industrial era were industry related, that was not the case. Although the focus of organisations had a technical purpose, problems experienced were related to human organisational issues. According to Wiener's (1954:142) description of the era of factories and machine systems, humans lacked motivation and discipline because the ultimate aim of organisations was production and profit.

When Senge *et al.* (1994) at first described the learning organisation, he emphasised that the perspective of humans in organisations should be on cognitive input into the organisation as a whole. Senge (1999d:7) later adds that people should have a sense of purpose, shared vision based on intrinsic values and the capability to reflect on their assumptions. Nonaka and Takeuchi (1995:10) agree with Senge (1999a:10) and state that not only human cognitive contribution but humans in their holistic capacity provide organisations with renewal, innovation and tacit knowledge. Organisations need and thrive on human creativity and innovation and should not only encourage these human traits but also capture and retain knowledge of innovation. It is the argument of my research that differences in humans should be acknowledged and that work-role-related acceptance of EA in organisations underlies information and knowledge retention. Complex environments such as modern enterprises should utilise human cultural differences. Meadows (2008:182) confirms this statement in stating that *some people celebrate and encourage self-organisation, disorder, variety, and diversity*. According to Senge (1999f:10), innovation happens in communities of people and is often the result of failure and new questions being asked by diverse individuals' sharing a common purpose.

Drucker's (1955:299) management by objectives theory states that workers should be made responsible for their work and must be able to judge their own performance against organisational objectives. Workers need organisational information to understand their role and the contribution they make to reach set objectives. Workers need to cooperate with other humans and share in managerial objectives and vision. Communication and cooperation between human workers at different work levels in an organisation result in overcoming weaknesses and utilising strengths of people. Informed and satisfied workers bring synergy into an organisation (Drucker, 1955; Senge, 1999a:10).

3.3.2 Organisational Culture and Human Factors

Hofstede and Hofstede (2005:59, 189) show differences in respect of organisational culture between so-called "small power distance" and "large power distance" as one of the dimensions on the one hand and weak and strong uncertainty avoidance in the working environment on the other hand. For example, in an organisation with a large power distance index and a strong uncertainty-avoidance index, people accept

decisions made by their superiors, prefer rules and are motivated by security, whereas in organisations with a small power distance index and a weak uncertainty-avoidance index people want to be consulted when decisions are made, accept rules only if it is absolutely necessary and are motivated by achievement. In globally distributed organisations where different cultures have to be acknowledged within an enterprise, being aware of human factors in EA acceptance can assist management with implementation of new strategies such as EA.

Stein (2010:26, 33) describes the impact of human factors on organisational operation. Humans gain experience and learn skills in their working environment. Organisations rely on workers to achieve goals and grow and workers have to be intrinsically motivated and satisfied in the working environment to be effective and be socially recognised. Knowledge workers are no longer tied to execute only what they have been trained for but through utilisation of technology as an aid and a need to secure their jobs have become life-long learners with knowledge in more than one discipline. Drucker (Stein, 2010:26) is quoted as stating: *technology unites knowledge and action* and *technology is culture and its foundation is knowledge*. The systematic way in which technology allows organisations to be productive and allows an organisation to become economically global is a result of this marriage between knowledge and action.

Organisations, enterprises and businesses form part of a greater society and, although every entity has its own internal objectives and goals, they exist because of an external relationship with an outside society. Stein (2010:86) explains Drucker's (1955:119) viewpoints on the role played by large organisations in society and says that society wants to know about problems and efficiency of organisations. According to Stein (2010:29), task execution and the achievement of an external objective for the benefit of the individual and society are the reasons why organisations exist.

Drucker (1955:366) states that complex tasks need to be simplified through methods and systems to enable humans to cope. Accepting EA as a strategy in organisations is a way of using methods to understand and simplify tasks and cope with complexity and change.

Drucker (1955:59) lists eight objectives of performance for organisations:

- market standing;
- innovation;
- productivity;
- physical and financial resources;
- profitability;
- manager performance and development;
- worker performance and attitude; and
- public responsibility.

Enterprises are people-driven entities and human stakeholders are regarded by enterprises as a core asset. Hofstede and Hofstede (2005:272) write: *Any organisation in any culture depends on the performance of people*. Performance of people in an organisation should be managed and acknowledged. Drucker's Management by Objectives (MBO) technique (Drucker, 1955:119), where results of employees are objectively measured, is seen as one the most successful management techniques. Some human factors are

difficult to measure because they are a result of a subjective experience. An experience perceived by one person as life threatening and dangerous can be perceived by another person as challenging and easy to control. Hofstede and Hofstede (2005:164) describe, for example, uncertainty as a subjective experience.

The role of humans as a central element in the operation of organisations has been described by many authors for example the work of Banbury, Drucker, Stanford, Lyytinen and du Plooy (Banbury, 1987:79; Drucker, 1955; Du Plooy, 1998:1; Lyytinen, 1987:3; Stanford, 2007:343).

Banbury (1987:82) states:

The term “organization” implies order with a purpose in mind, and hence structure. Yet at the same time organizations are complex social institutions in which individuals with their own particular interests, values and concerns necessarily interact with each other in the enactment of their work roles. It is formally hierarchical in accordance with the distribution of authority within it and it is broken down laterally into specialisms.

Drucker (1955:190) describes three structural requirements and two structural principles of an enterprise but emphasises the human *citizenship of unity through diversity*:

- The requirements for an enterprise are: knowing what its business is and how to manage its business performance for one, secondly to restrict management levels and thirdly to provide for “training and testing” of future leaders.
- Drucker (1955:202) calls the first principle “federal decentralization”, meaning that organisations within an enterprise should be allowed to act autonomously and take responsibility for their actions. Drucker (1955:202) explains that functional decentralisation means that functional units within an enterprise are integrated and managed to perform the business of the enterprise.

The elements of an organisation listed by Stanford (2007:11) include the vision/mission, structure, people, performance measures, processes, culture and systems. Stein (2010:29) lists Drucker’s three factors for how an organisation operates as: goals, management, and individual participation and performance.

3.3.3 Organisational Culture and Management

Drucker (1955:339) sees lack of information as a risk and states that information in all its facets is a managers “tool” enabling coordination of “business” operations and people. Organisations need to use their information to keep their competitive advantage alive. EA is the strategy to assist organisations with management and reuse of information.

Stein (2010:28) describes how in the new context of organisations, leadership roles are based on function and not power. An organisation fits into a world of organisations. Organisations need to rely on humans for leadership, organising, assigning tasks and responsibilities, establishing criteria to measure results, successes and identifying problems early. Drucker (1955:370) emphasises the human factor of integrity and adherence to organisational principles as central character traits of managers.

In his book “The Practice of Management”, Drucker (1955:6) defines the work of a manager and Stein (2010:104) explains Drucker’s four functions of management of organisations:

- 1) economic performance;
- 2) recognising that the whole is more than the sum of its parts;
- 3) management of work and worker; and
- 4) time management.

More than 50 years ago Drucker (1955:359) stated that information-processing tools, techniques and technology such as operations research, mathematical probability and games theory can be used but that human vision and judgement are needed in management decision making. In Chapter 5, adoption of strategies such as EA is described as being a top-down organisational action, starting at executive and management level.

3.4 ACCEPTANCE MODELS AND THEORIES

In this section, the distinction between “adoption” and “acceptance” is explained for the purpose of how these terms are used in my research after which theories and models of importance to the human-technology relationship in a socio-technical enterprise environment are reviewed in sections 3.4.2 to 3.4.4.

3.4.1 Adoption and Acceptance Distinguished

In the initial early stage of the research it was realised that the words “adoption” and “acceptance” are both used by organisations and industry to describe the decision to adopt EA as an organisational strategy. The concepts of *adoption* and *acceptance* of technology are not always distinguishable and in many cases considered the same (Adam, 2010:23). For the purpose of the research it is necessary to distinguish between the two concepts of adoption and acceptance.

The words “adoption” and “acceptance” are used interchangeably in literature to describe the initial *decision to use* or *introduction and actual use* of new technology or strategies in organisations. Adoption is to *choose and follow a plan* (Collins Concise Dictionary, 2004:18). Adoption may be regarded as a follow-up action of acceptance resulting in actual use of a methodology or technology (Premkumar & Bhattacharjee, 2008:64). In my research this is not the case and, although adoption is regarded as choosing to follow a plan, it is not seen as a follow-up action to acceptance. In my research a distinction is made between adoption and acceptance of a new strategy such as EA. “Adoption” refers to the process of decision to use new technology or strategies and the follow-up actions of planning, acquiring and implementation of such technology or strategies in organisations. “Acceptance” refers specifically to human acceptance of technology and strategies in organisations.

Adoption of IT innovations is described by Jeyaraj *et al.* (2006:6). Best predictors of IT innovation adoption are classified into individual and organisational predictors. Predictors can be seen as dependent or independent variables. Top management as an independent variable acts as a linking factor between

individual and organisational adoption of IT innovations. In their study, Jeyarah *et al.* (2006:6) found that innovation and organisational characteristics were two common independent variables of individual and organisational adoption factors (Adam, 2010:1)(Adam, 2010:1).

Riemenschneider and Hardgrave (2002:1136) distinguish between adoption of methodologies and technology tools and stress that adoption of methodology occurs at management level and results in greater behavioural change and co-worker influence.

The premise in my research was that acceptance of EA as an organisational strategy follows after EA has been adopted as an organisational strategy. Acceptance is defined as “favourable reception” (Collins Concise Dictionary, 2004:7) and described as the intention to use (Adam, 2010:23; Renaud *et al.*, 2008:210). Acceptance is concerned with human traits such as awareness, attitude, intention, motivation, approval, taking responsibility, etc.

In sections 3.4.2 to 3.4.4 technology acceptance models and theories from the literature are investigated.

Human factors influencing adoption and acceptance of IS and technology have been described by many researchers (Davis *et al.*, 2003:425; Davis *et al.*, 2004:31; DeLone *et al.*, 1992:60; DeLone *et al.*, 2003:9; Du Plooy, 1998:1; Gal *et al.*, 2008:133; Galup *et al.*, 2000:48; Greenfield *et al.*, 2009:263; Hoffer, 2002:733; 2005:21; Horst *et al.*, 2007:1838; Jeyaraj *et al.*, 2008:205; Klein *et al.*, 2008:280; Lee *et al.*, 2003:752; Lee *et al.*, 2009:191; Markus, 1983:430; Nemeth, 2012; Ong *et al.*, 2004:795; Orlikowski, 1993:309; Sage, 2006:1; Thompson, 2012:188; Vithessonthi, 2009:49).

A few decades ago, when technology was introduced into organisations and soon developed as an organisational support system, human acceptance of technology was an issue, which resulted in many studies being conducted in many organisations (Davis, 1989a:319; Díez *et al.*, 2009:588; Hoogervorst, 2009:88; Jeyaraj *et al.*, 2008:205; Venkatesh *et al.*, 2003:425; Venkatesh *et al.*, 2008:273).

Although EA is considered more a strategy and is not concerned with technology only, its close relationship with the “business”, information and technology of an organisation necessitates revision of some acceptance models of which the technology acceptance model (TAM) is probably the most well-known. TAM, other acceptance theories and UTAUT (Unified theory of acceptance and use of technology) are discussed in the next sub-sections.

3.4.2 Technology Acceptance Model (TAM)

TAM (Davis, 1989a:319) is a well-known model that lists factors of perceived ease of use, perceived usefulness and behavioural intent as the major factors affecting IS and IT acceptance. More factors affecting the acceptance of technology and information systems have been identified and addressed in many studies over the past three decades (Brown *et al.*, 2008:52; Polančič *et al.*, 2010:575; Riemenschneider *et al.*, 2002:1135; Venkatesh *et al.*, 2003:425).

Research building on TAM have identified and added factors such as gender, experience and voluntary use to the original factors of TAM. For example, Díez and McIntosh’s study (2009:588) distinguishes between three different attributes of human involvement: technological, work and personal/organisational. In an

empirical analysis, these authors investigate how socio-technical factors in an organisation influence the use of environmental IS. Acceptance of IS happens within the implementation phase of the three-stage IS life cycle of pre-implementation, implementation and post-implementation. Two dependant variables of usefulness are listed: success (as defined for organisation and user) and user satisfaction.

User involvement and participation are the dominating factors of importance to account for success and user satisfaction in the pre-implementation phase and post-implementation phase of IS.

In the implementation phase, factors influencing individual and organisational adoption of IS are computer experience, external pressure, external information sources, IS professionalism, subjective norms, management and user support. Factors accounting for actual system use are behavioural intention of use, perceived usefulness, quality of the system, and training.

Apart from the quality of system factors mentioned above, all the factors are non-technical. Technical factors are controllable whereas non-technical or human factors are partially or not controllable.

There is strong evidence that technology acceptance is no longer a problem in the business and technology divide. It is the way in which non-technical/socio-technical/human issues and change are managed in organisations that are problematic and are responsible for waste of time, money and effort in complex enterprises (Kling, 1980:61; Markus, 1983:430; Orlikowski, 1993:309; Schein, 2004:437; Sia *et al.*, 2010:59; Tilson *et al.*, 2010:4; Zacarias *et al.*, 2007:840).

3.4.3 Other Acceptance Theories

A few other acceptance theories have been described in the literature.

The innovation of diffusion theory (IDT) (Bhattacharjee, 2012:33; Taylor *et al.*, 1995:145) describes how innovations are perceived and adopted by individuals and organisations. Five factors of importance for initial adoption by individuals are described: perceived relative advantage, compatibility, trialling, observability and complexity. Diffusion of innovation and acceptance by groups are dependent on communication and collective decision making.

The theory of reasoned action (TRA) was the first of two reasoned action models compiled by Ajzen and Fishbein. TRA investigates individual human attitudes towards the behaviour and subjective norms (how an individual perceives pressure to show expected behaviour) as predictors of human social behaviour (Ajzen *et al.*, 1980:249; Fishbein *et al.*, 1975:521).

The theory of planned behaviour (TPB), compiled by Ajzen, extended the TRA and underlines individual, human, cognitive intention affected by social environment as factors affecting human behaviour in organisations (Ajzen, 1991:179; Bhattacharjee, 2012:32). Intention is a function of individual attitude towards behaviour, subjective norms and own perception of control of behaviour.

Social actor model discusses the impact of technology on individuals and groups in organisational and other contexts. The social actor model of Lamb and Kling (2003:218) considers information technology users as actors with different requirements. Users are often restricted to the use of prescribed technology and systems.

Information technology systems are used to communicate within and outside of their organisations. Through such communications human actors represent their professions through use of available technology systems. Wong and Steinhof (2009:5) use empirical evidence to extend the social actor model by stating actors' dimensions of individual identity, social interaction, affiliation or group membership and institutional or environmental issues. The results of this study indicate that factors related to individual use of technology in an organisational environment are more significant than factors related to group usage. This contradicts the importance of social context in user acceptance of technology as defined by the innovation diffusion theory.

Mathieson (1991:187) uses three criteria to compare TAM and TPB and comes to the conclusion that: both TAM and TPB are good at predicting intention of use; TAM provides more general information about ease of system use and usefulness where TPB considers performance of systems and more specifically the factors that might be responsible for individual- and group-user resistance. Measures of the TPB have to be adapted for each different context of use where TAM uses standard measures and is therefore easier and less expensive to use.

The unified theory of acceptance and use of technology (UTAUT), described in Section 3.4.3 is a composition of acceptance theories, appropriate and useful for the purpose of my research.

3.4.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh *et al.* (2003:428) review eight models of individual user acceptance. These authors design and empirically test UTAUT. UTAUT is a more comprehensive combination of models and theories to reflect on user intention and acceptance of technology. Factors identified as playing a role in human acceptance of technology, classified by theories and models from the literature, are:

- Behaviour, driven by attitude towards using technology, and subjective norm as described by the theory of reasoned action (TRA).
- Perceived usefulness, ease of use, and subjective norm as described by the technology acceptance model (TAM and TAM2).
- Extrinsic and intrinsic motivational factors as described by the motivational model (MM).
- Perceived intention of behaviour, combined with the factors from TRA, behaviour driven by attitude and subjective norm, describe the theory of planned behaviour (TPB).
- All factors from the TAM and TPB combined into a hybrid model (C-TAM-TPB).
- Relevance of usage in work situation, difficulty of understanding and use, long-term benefit, affectivity, social behaviour, and facilitation of environmental issues as described by the Model of PC Utilization (MPCU).
- Relative advantage, ease of use, advancement of social status, system in organisation visibility, compatibility, manifestation of results, and voluntariness of use, as described by the innovation diffusion theory (IDT).
- Performance and personal expectations of outcome in the working environment, self-efficacy, affect and anxiety, as described by the social cognitive theory (SCT).

As shown in their research model for describing UTAUT (Figure 3.8), Venkatesh *et al.* (2003:447) identify three constructs as direct significant indicators of user intention and four indicators of user acceptance: performance and effort expectancy as well as social influence are factors influencing user intention and all the factors depending on facilitating conditions are indicators of influence on user acceptance of technology. The role of key issues impacting on these constructs – gender, age, experience and voluntariness of use – is discussed. Venkatesh *et al.* (2012:160) later extended the original UTAUT to UTAUT2. Theories developed in a specific context can be changed or extended to be valid in other contexts (Venkatesh *et al.*, 2012:158). In a study on consumer usage of technology, Venkatesh *et al.* (2012:160) added three more constructs namely that of enjoyment, costs and habit to the original three constructs of performance and effort expectancy, social influence and facilitating conditions. In my research the human factors related to UTAUT are referenced. UTAUT was developed in an organisational context and correlates with my research whereas UTAUT2 relates to a consumer context.

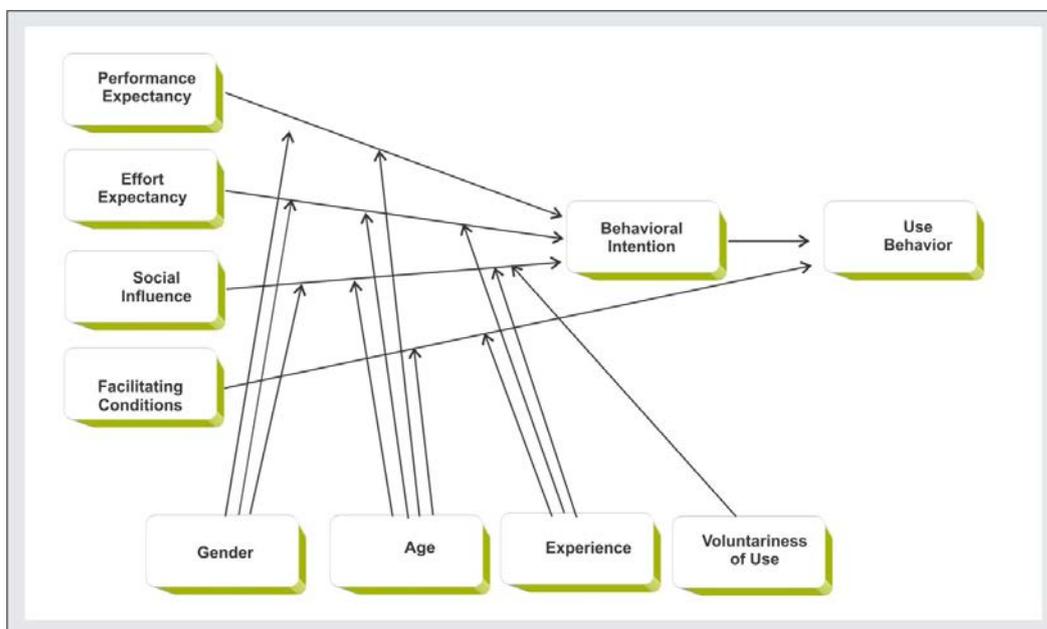


Figure 3.8: Unified theory of acceptance and use of technology (UTAUT) (Venkatesh *et al.*, 2003:447)

Lee and Kim (2009:200) investigate factors affecting intranet usage and extend UTAUT to include intranet usage as a factor of acceptance, together with subjective norm, perceived usefulness and perceived ease of use. Web experience and technical support are external factors that impact on all four factors of acceptance. Task-related characteristics impact on subjective norm, perceived usefulness and intranet usage while subjective norm acts as the mediating variable.

Examples of research where specific models and theories were used are:

- Brown *et al.* (2008:52) discuss theoretical models and use TAM to test satisfaction with a new IS implementation in an organisation. Satisfaction was viewed as a function of expectation and experience. An experiences-only model where expectation almost had no effect confirmed the ease-of-use factor and a variation of the model confirmed an increase in expectation with positive system experience.

- Premkumar and Bhattacharjee (2008:64) compare TAM and expectation-disconfirmation theory (EDT) and suggest an integrated model for user acceptance and continuation of use of technology. Underlying factors of intention of use is perceived usefulness, perceived ease of use and satisfaction consisting of expectation, disconfirmation and performance.

3.5 OTHER RELATED THEORIES

Two theories identified from the literature and briefly discussed here are the actor-network theory (ANT) (Callon *et al.*, 1981:277; Law, 1999:1) and the structuration theory (ST) (Giddens, 1984; Jones *et al.*, 2008:127). ANT describes and highlights how any society is continuously changing as a result of action, collective action and interaction of its components or actors (human, non-human or a combination of both). Structuration theory (ST) as a conceptualised theory and adaptive structuration theory (AST) describe the concepts of social structuring and restructuring of organisations, and how humans as stakeholders in institutional contexts generate social construct and direct change.

After reviewing these two theories, the human factors referenced by these theories were found to be relevant to my research. Therefore, *ANT and ST are used in my research only for the purpose of referencing the human factors identified by these theories and not as basic reference theories to build upon or prove something.*

3.5.1 Actor-Network Theory (ANT)

Actor-network theory (ANT) was originally described by Callon and Latour (Callon *et al.*, 1981:277; Callon, 1986:196; Knorr-Cetina *et al.*, 1981). ANT explains that entities are formed as a consequence of the relations in which they occur and that their performance is defined in, by and through those relations (Law, 1999:4). Latour (1999:15) stresses the original meaning of the terms “actor”, “network” and “theory” and points out that ANT has been used for so long that modern technology terminology has resulted in much misunderstanding of the original meaning of the term. In an organisational setting, ANT describes the interconnections of organisational structures, technology and tacit knowledge from an actor’s viewpoint. The conceptualisation of an actor may include human, non-human or a combination of both in a socio-technical context (Kaghan *et al.*, 2001:259). In an example of a market, Callon (1999:184) explains that for coordination to happen people (agents) should only be able to do something (action/work) and to know about the essence of their action/work. No social or interpersonal relations are necessary and seller, buyer and product are entities that can be framed. Three possibilities for coordinated actions are: 1) coordination can only be sustained when agreements between people are reached and the “contracts” are revisable when unexpected problems arise; 2) common knowledge between people; and 3) people are inherent in their world where cooperation is required (Callon, 1999:184). Callon (1999:190) shows in the market example that ANT goes beyond the notion of a network and social relations, and that it is possible to extend ANT to include *operations of disentanglement, framing, internalization and externalization*. Walsham (2001:49, 241, 202) addresses usefulness and limitations of ANT. ANT has many advantages for describing social interaction in local working communities, but should also be usable in global communities. Factors other than social, actor,

and network have proved to influence the complicated modern working environment. Factors such as resources, culture, politics and moral issues have to be considered along with ANT.

According to Tatnall and Gilding (1999:963), ANT is useful in information systems research or research where humans use a process of networking to promote their own views of acceptance or problem solving.

Siderova and Kappelman (2010:74) use concepts and perspectives from ANT to discuss the meaning of enterprise, architecture, aligned interests and network creation. These authors show how architecture can be viewed as a formation of actor networks (ANs) and illustrate the network formation of interests and alignments in an enterprise AN. Some parts of the holistic description of an enterprise using EA comply with ANT's description of the interconnections of organisational structures, technology and tacit knowledge in an organisation. Siderova and Kappelman (2010:78) explain how aspects of ANT relate to challenges of integration, transparency, alignment and actor identification in EA. Alignment of an employee AN to an enterprise is shown in Figure 3.9 and alignment of IT as an AN to an enterprise, for example, is shown in Figure 3.10.

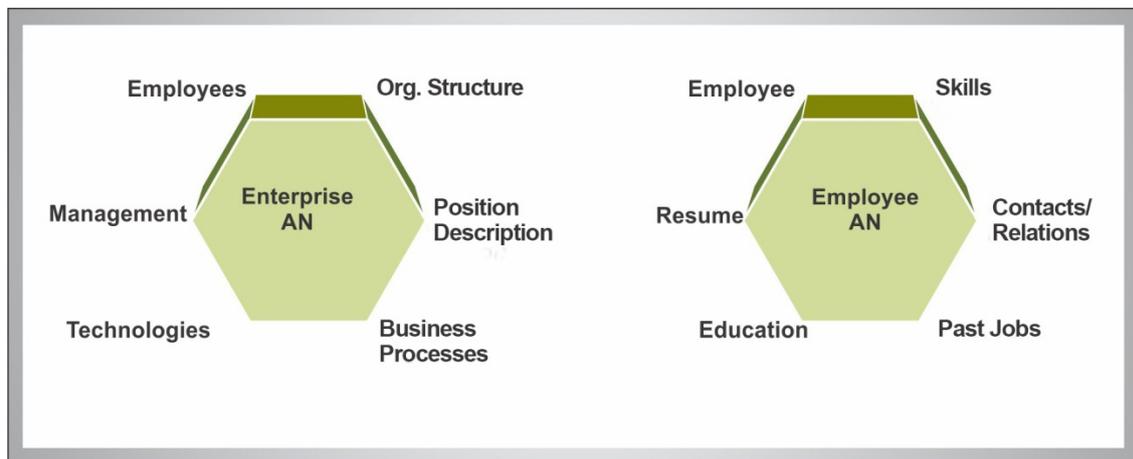


Figure 3.9: Enrolment of an employee AN (Siderova *et al.*, 2010:80)

Enrolment of ANs does not happen in isolation. For example, the appointment of a new manager or promotion of an existing employee can result in change that affects other associated actor networks in an enterprise (Figure 3.9).

In modern organisations, IT solutions in the form of systems development and implementation, incorporating all humans, their actions, processes, technology, management and all that is involved have to be aligned with enterprise actor networks (Figure 3.10).

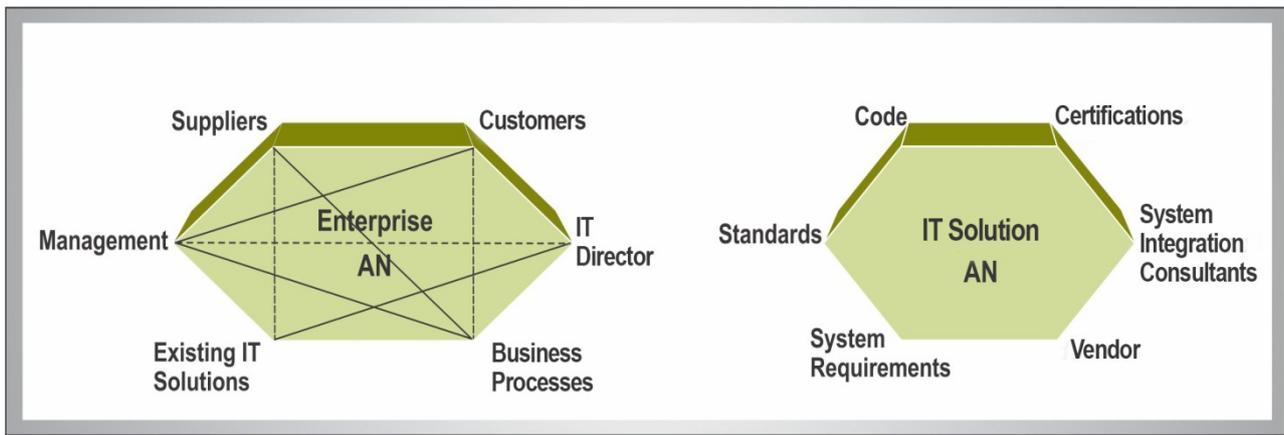


Figure 3.10: Enrolment of an IT solution AN (Siderova *et al.*, 2010:81)

3.5.2 Structuration Theory (ST)

Structuration theory (ST) describes social structure as the result of everyday human action, human interaction and the context of occurrence.

Giddens (1984:25) describes how interaction can structure and change social systems. In their diverse actions in context, actors use rules and resources. During analysis of the structuration of social systems, modes in which such systems are produced and reproduced in context are studied (Giddens, 1984:25). Giddens (1981:172) define structure, system and structuration as:

- Structure: Recursively organised rules and resources, having a virtual existence outside time-space.
- System: Reproduced relations between actors or collectives, situated in time-space.
- Structuration: Conditions governing system reproduction.

Giddens's (1984:29) original dual dimensions of structure (signification, domination and legitimation) and interaction (communication, power and sanction) and how they are interlinked through interpretive schemes, facility and norm are shown in Figure 3.11.

Giddens (Giddens, 1984) describe elements of ST found to impinge upon the research of social problems:

- Humans are able to describe their actions, conditions for their actions and reasons for their actions.
- Human knowledge about their actions is restricted by their perceptions of their actions (bounded by unconsciousness about actions, unacknowledged conditions or unintended consequences of their actions).
- Human descriptions of their actions are reproductions of events and should be understood in the context of social- and system integration.
- Most of the everyday practices of humans are routine actions and not specifically motivated.
- The context of human interaction in social related research should be acknowledged in terms of time-space boundaries, direct human communication together with related behaviour such as gestures and body language and an awareness of how the interaction is affected by all these phenomena mentioned.

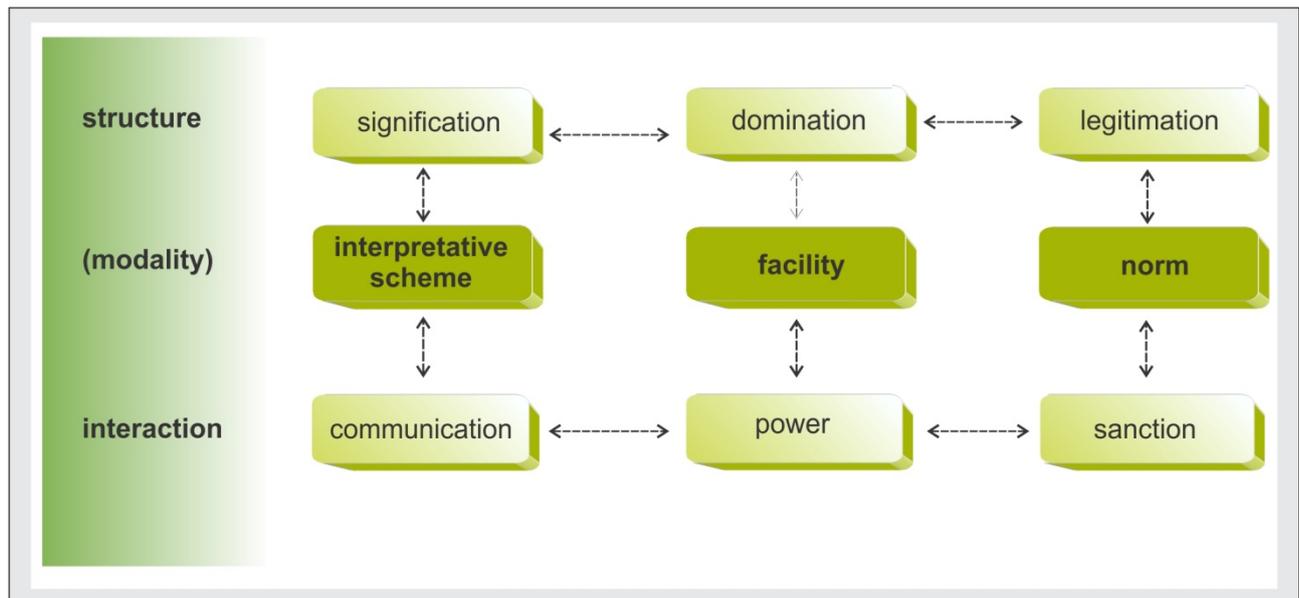


Figure 3.11: The dimensions of the duality of structure (Giddens, 1984:29)

- The social identities of humans or their human roles are time/space connected and associated with normative rights, obligations and sanctions.
- Constraints occur in all socially analysed situations.
- Society system types are directed by structural principles of which there may exist many within a social system.
- Power, which is imbedded in social human action and structure, can influence the actions and circumstances of other humans.
- Humans have the ability to extend their knowledge and skills of any organisational mechanism and incorporate such knowledge and skills into their actions and behaviour without intervention of social analysts.

3.6 HUMAN FACTORS IDENTIFIED FROM ACCEPTANCE THEORIES, MODELS AND FRAMEWORKS

In my study, where human factors were identified in an exploratory study at one organisation, Giddens's (1984:29) findings of duality of structure are of significance. Work role structures in organisations are not fixed structures of human interaction and knowledge. In a later discussion of the organisational setting in which the exploratory study was conducted, the following guidelines of Giddens's (1984:29) ST are acknowledged:

- Double hermeneutic: Gathering information from participants and interpretation of the information gathered relates to an investigation of participants' organisational knowledge with the purpose of finding out what they know and then to report about the knowledge in a meaningful way. In my research, participants' descriptions of knowledge are respected and interpreted.

- Description of the social setting of the research: The social environment is that of the modern organisation where participants in my study represent different work role descriptions. Participants' motivational considerations in context of their work-role- and social-working situation are acknowledged.
- Frame of meaning: In a study of this kind, I acknowledge that as a researcher I communicate and report on mutual knowledge of participants and therefore attach a subjective meaning.
- Unintentional consequences: It is one of the aims of my research to establish what human factors in context are contributing to non-acceptance of EA in organisations.
- Time-space of social settings: Although the initial exploratory study to identify human factors impacting on EA acceptance was conducted in one particular organisation, the entire research was based on the assumption that enterprises exist in different contexts and comprise many different entities in context. In my research I have to recognise the globalisation effect of IT, IM and EA. Time and space of social settings in enterprises accepting EA as a strategy are inherent in the explanations of the research.
- Structural constraints: The researcher becomes aware of participants' reasons, motives and expectations in creating conditions and consequences affecting others.
- Stability and change: Since one of the main aims of EA is to manage change and complexity in enterprises, I describe outcomes of the exploratory study's data collection, acknowledging that functional organisational changes affect and impact social communities in context.
- Analysis of strategic conduct: Strategic decision making influences organisational operation and should be acknowledged especially in the case of research concerning EA.

In his "dialectic of control" Giddens (1984:16) explains two directions of control of power: structural according to work role (top-down) power distribution; and where humans with less power use resources to influence and control superiors. The focus of my research is on management of human factors and involves people from all work levels of an organisation, therefore both assumptions of Giddens (1984:16) are relevant and applicable to my research.

Jones *et al.* (2008:30) show that ST has been used in IS research studies. Despite some critical comments on Giddens's lack of recognition of the role of technology in these authors' discussions on social structure, they argue that IS researchers should consider using structuration as a reference theory when investigating social issues in organisational environments where IS or IT influence human action and interaction.

In a research case study on the adoption of health information exchange in small-to-medium sized family medicine practices by Ross *et al.* (2010:127), technology issues – for example, alignment of new and existing interfaces and workflow – were identified as obstructive whereas social networking and trust were issues promoting adoption of technology.

The premise of adaptive structuration theory (AST) is that adaptation of technology structures by humans in organisations is a key factor in organisational change (DeSanctis *et al.*, 1994:122). In a comprehensive study based on AST, DeSanctis and Poole (1994:123) tested a strategy of integrating advanced information technology and social structure to support human activities. These authors found that organisational change is effected by the adaptive nature of humans. In another study that is related to my research, Walsham and

Waema (1994:168) use IS strategy and implementation to highlight the following implications of human action on organisational success:

- a clear business vision;
- a stakeholder participative approach in strategy planning;
- a more human ‘responsible-for-own-actions’ approach to encourage creativity and shared business vision;
- active role of management in IS strategy and implementation; and
- well planned technology design, development and implementation to support business vision and organisational strategy.

Human factors identified from acceptance models, frameworks and theories as summarised by Venkatesh *et al.* (Venkatesh *et al.*, 2003:440) and from other sources are listed in Table 3.1.

Table 3.1: Human factors from acceptance theories, models and frameworks

REFERENCES TO MODELS, ACCEPTANCE MODELS, FRAMEWORKS AND THEORIES	HUMAN FACTORS IDENTIFIED FROM ACCEPTANCE MODELS AND FRAMEWORKS
Theory of Reasoned Action (TRA) (Venkatesh <i>et al.</i> , 2003:425)	Attitude Subjective norm
Technology Acceptance Model (TAM), TAM2 and TAM3 (Davis, 1989a:319; Venkatesh <i>et al.</i> , 2003:425; Venkatesh <i>et al.</i> , 2008:273; Venkatesh <i>et al.</i> , 2008:273)	Perceived usefulness Perceived ease of use Behavioural intent or Subjective norm
Extension of TAM ((Díez <i>et al.</i> , 2009:588))	User involvement and participation Computational experience External pressure External information sources IS professionalism Subjective norm Management and user support Quality of system Training
Motivational Model (MM) (Venkatesh <i>et al.</i> , 2003:425)	Extrinsic motivational factors Intrinsic motivational factors
Theory of Planned Behaviour (TPB) (Ajzen, 1991:179; Ajzen <i>et al.</i> , 2009:1356)	Intention of behaviour Attitude Perceived behavioural control Implementation Intention Commitment Conscientiousness
Model of PC Utilization (MPCU) (Venkatesh <i>et al.</i> , 2003:425)	Relevance of usage in work situation Difficulty of understanding and use Long-term benefit Affectivity Social behaviour Facilitation of environmental issues

REFERENCES TO MODELS, ACCEPTANCE MODELS, FRAMEWORKS AND THEORIES	HUMAN FACTORS IDENTIFIED FROM ACCEPTANCE MODELS AND FRAMEWORKS
Innovation Diffusion Theory (IDT) (Venkatesh <i>et al.</i> , 2003:425)	Relative advantage Ease of use Advancement of social status System in organisation visibility Compatibility Triability Manifestation of results Voluntariness of use as described by the innovation diffusion theory
Social Cognitive Theory (SCT) (Venkatesh <i>et al.</i> , 2003:425)	Performance and personal expectations of outcome in the working environment Self-efficacy Affect Anxiety
Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh <i>et al.</i> , 2003:425)	User intention factors: <ul style="list-style-type: none"> • Performance expectancy • Effort expectancy • Social influence Facilitating conditions impact on use behaviour Human factors: <ul style="list-style-type: none"> • Gender • Age • Experience • Voluntariness of use
Social Actor Model (Lamb <i>et al.</i> , 2003:197; Wong <i>et al.</i> , 2009:1)	Identity of humans Interaction Affiliation with usage Environment of use
Actor Network Theory (ANT) (Callon <i>et al.</i> , 1981:277; Callon, 1986:196; Callon, 1999:181)	Human use of technology Human use of information Human fit in organisations Tacit human knowledge and distribution Culture Politics Moral issues
Structuration Theory (ST) (Giddens, 1981:161; Giddens, 1984; Jones <i>et al.</i> , 2008:308)	Structure: organisational, domination, legitimation Interaction: communication, power, sanction Responsibility for own actions Trust Interaction Voluntarism

Kwon and Zmud (1987:233) discuss a number of studies performed on organisational innovation, adoption of technology and IS implementation and then list positive and negative influence of human factors in five areas that are believed to contribute to successful technology implementation in organisations (Table 3.2).

Table 3.2: Positive and negative influence of human factors (Kwon *et al.*, 1987:233-241)

INDIVIDUAL FACTORS	
Job tenure	Functional and organisational knowledge result in acceptance whereas work role boundaries may contribute to resistance of new technologies
Cosmopolitan	Wider than organisational perspective and contact with outsiders may result in acceptance of change
Educational background	Education leads to acceptance of change
Organisational role involvement	Involvement in managerial actions correlates positively with acceptance of change
STRUCTURAL FACTORS – FORMAL AND INFORMAL	
Specialization (complexity and functional)	Diversity of specialists impact positively on acceptance of change
Centralization	Centralized decision making are perceived as restrictive with decreased autonomy but more efficient
Formalization	Role and functional differentiation mean more precise work definition but less autonomy
Informal networking	Informal information transfer between adopters of technology promotes diffusion
TECHNOLOGICAL FACTORS	
Compatibility	Successful adoption depends on how compatible a new technology is to an organisation and the impact on its people
Relative advantage	The advantage of the new technology compared to the as-is or another technology
Complexity	Lack of information, skill and knowledge lead to resistance of new technology
TASK-RELATED FACTORS	
Task uncertainty	Difficult tasks may initiate motivation and usage of new technology or prevent implementation
Autonomy	Self-regulation and personal work control lead to an increase in motivation, innovation, satisfaction and performance
Responsibility	More responsibility leads to motivation and acceptance
Variety	With more task variety comes better performance, more satisfaction and adoption, adaptation and usage
Identity	Humans involved, associated and identifying with tasks tend to be more creative and satisfied
Feedback	Informing humans on performance and reinforced learning may result in increased creativity, satisfaction and better performance

ENVIRONMENTAL FACTORS	
Heterogeneity	In interacting, organisations have to adapt to a diverse environment
Uncertainty	Environments are different and known ones may change. Uncertainty promotes innovation that may lead to growth
Competition	Environmental issues such as scarcity of resources may result in competition and increased creativity
Concentration/Dispersion	Adequate and concentrated resources facilitate learning and innovation, which lead to acceptance
Inter-organisational dependence	Sharing ideas and resources may lead to adoption, adaptation and diffusion of organisational innovation

My research is concerned with the management of human factors in EA acceptance. Two factors of acceptance identified in the literature also apply to acceptance of EA as an organisational strategy – perceived usefulness of EA as a strategy and subjective norm. As stated in the main research question, the focus of the research is, however, *identifying human factors hindering EA acceptance and proposing a framework of how the human factors can be used in an organisation to promote EA acceptance.*

Factors described above were mostly identified in an era when technology acceptance was an organisational issue. The focus was therefore on human acceptance and use of technology. Today technology use is widely accepted and forms the basis of organisations and it is with the complexity surrounding technology and organisational-business- and IM and the handling of constant change and personal and human-in-relationships issues that organisations struggle. Human factors affecting EA acceptance in organisations have not explicitly been described. The research reported on in this study identified human factors related to EA acceptance in organisations. The human factors identified and described in this section serve as a reference base and a possibility exists that human factors identified from the literature could be combined with human factors affecting EA acceptance identified in the research.

3.7 OTHER HUMAN FACTORS FROM LITERATURE RELATED TO ENTERPRISE ARCHITECTURE

Human concerns related to acceptance of ‘new’ ideas or strategies include human factors such as communication, creativity, discipline, courage, focus, cooperation, commitment, self-examination, responsibility, coordination, language, culture, attitude and more (Chuang *et al.*, 2010:5; Markus *et al.*, 2000:203; Markus, 1983:433; Ross *et al.*, 2006:81, 204; Strong *et al.*, 2010:731; Vithessonthi, 2009:56). The following human factors are listed in key literature on EA and enterprise systems:

- Ross *et al.* (2006:200) in their description of the operating model of an organisation define *discipline* and *commitment* to EA (foundation for execution) as human factors impacting on strategic decisions and business processes. *Creativity* (Ross *et al.*, 2006:199, 85) from inside an organisation happens when foundation possibilities are deployed to customers; creativity from outside happens when opportunities

and products from outside the organisation benefit the foundation. Ross *et al.* (2006:200) state: *Senior managers should take responsibility for converting an architecture into a foundation for execution both directly and via enforcing governance.* EA is described as *a communication tool* serving as a blueprint for the organisation's direction. *Coordination* is described as a type of operating model where customers, products, suppliers and data are shared and consensus is needed for implementation of systems (Ross *et al.*, 2006:29). Alignment and coordination of business and IT processes are achieved through transparent, regular, two-way *communication* (Ross *et al.*, 2006:136).

- Chuang and van Loggerenberg (2010:7) list both internal organisational *communication* and communication with EA stakeholders as barriers to institutionalisation of EA.
- Markus (1983:430) lists organisational politics related to interaction theory (users' and designers' intentions of system use are considered) as a cause of resistance to IS. It is suggested that an existing organisational setting is thoroughly investigated to identify factors that may impact (facilitate or hinder) on change strategies before its implementation. *Self-examination* of interest, motives, payoffs, and power bases are human factors proposed for systems analysts and implementers of systems.
- Markus and Tanis (2000:201) list managerial decision making and good information distribution as possible processes for enterprise systems (ESs) success. *Communication, stakeholder politics, ownership of KPIs, challenging of untested assumptions, acceptance of need to change, lack of long-term support, gaps in knowledge and skills and flexibility* are factors identified for ES success.
- Vithessonthi (2009:56) defines *attitude* as *an individual's preference for or disinclination to an idea, issue, item or object* and distinguishes between the belief and affective aspects of attitude.
- Culture in organisations is defined by Schein (2004:7) as the climate and practices that organizations develop around their handling of people, or to the espoused values and credo of an organization. Schein (2004:59) illustrates by means of case studies how organisational culture in the form of visible artefacts, beliefs, norms, behaviour, values and basic underlying assumptions have to be considered in combination with and in the context of organisation to understand organisational behaviour, success or failure. Menghua *et al.* (2013:52) propose that apart from considering organisational culture, IT organisational culture should also be considered because of its dynamic and integrated nature in organisations. According to Strong and Volkoff (2010:745), an integrated system (ES and EA are examples) incorporates a culture of discipline or doing things the right way. Human handling of process action steps have an effect on follow-on process steps and addressing or reversing errors may result in time, revenue and quality loss when it comes to project efficiency.

Human factors related to EA are summarised in Table 3.3.

Table 3.3: Other human factors related to enterprise architecture

REFERENCES FROM LITERATURE TO OTHER HUMAN FACTORS	HUMAN FACTORS RELATED TO ENTERPRISE ARCHITECTURE
Ross <i>et al.</i> (2006:200)	Discipline Commitment to EA Creativity Senior management’s responsibility for EA acceptance enforcement of EA governance Coordination Communication
Chuang and van Loggerenberg (2010:7)	Communication
Markus (1983:430)	Self-examination
Markus and Tanis (2000:201)	Communication Ownership of KPIs Stakeholder politics Challenging of untested assumptions Acceptance of the need to change Lack of long-term support Gaps in knowledge and skills Flexibility
Vithessonthi (2009:56)	Attitude
Schein (2004:7), Menghua <i>et al.</i> (2013:52), Strong and Volkoff (2010:745)	Organisational culture and discipline

3.8 SUMMARY AND PURPOSE OF THE RESEARCH

The purpose of Chapter 3 was first to review human involvement in organisational practice and management. History of humans in the systems relation of organisations and cybernetics were discussed. Second, human acceptance of technology was reviewed and models and theories relevant to the research were discussed. A set of human factors applicable to my thesis were identified from these models and theories.

Complexity and change management have become issues that modern enterprises have to deal with. People provide the creative support when organisational management has to adapt to new directions to ensure that organisational business is maintained, improved or expanded. If people do not accept new support strategies such as EA, organisations struggle to meet business objectives with regard to time, costs and quality of work constraints. Apart from references to the problems related to human acceptance of EA (Section 1.6), there is little evidence of research and literature specifically concerned with human acceptance of EA (Handler, 2007:1; Serban *et al.*, 2001:48; Siderova *et al.*, 2010:70). The premise of the research described in this thesis is that once EA is adopted as a strategy, acceptance by stakeholders is necessary for the successful implementation of EA.

No framework currently exists to guide organisations during the implementation of EA, specifically referring to the human factors hindering the acceptance of EA. The purpose of the research described in this thesis is to provide organisational management with a framework of human factors to assist in management of EA acceptance – something that might retain the wellbeing and the prosperity of organisations.

The research design and research methodology of my study are discussed in Chapter 4.

