Human factors affecting enterprise architecture acceptance

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***Abstract*— An enterprise is a complex composition of different entities in context and is defined by its environment, scope, goals, systems, culture, information, processes, technology and by humans. The focus of an enterprise is on its "business" which is context bound. The success of an enterprise is attributable to its ability to manage its business processes, stay economically viable and improve its competitiveness, and therefore enterprises invest significantly in human capital to successfully manage business processes and change.**

Enterprise architecture (EA) is a foundation strategy implemented to assist enterprises in management of complexity and change. EA is a plan or blueprint of an enterprise's business operations, information management and technology support. Adoption of EA is costly and usually occurs at executive and management levels. The effect of adopting EA as a strategy, however, filters through to all work levels in an enterprise. Acceptance of EA as a basic strategy, which needs to be followed over time, and the role of EA in an enterprise are often not fully understood by all stakeholders in an enterprise.

In this paper, we specifically focus on the human factors during acceptance of EA. This focus develops the contribution this article makes, which is the exploration of human factors affecting acceptance of EA as an enterprise-wide strategy.

Keywords—Enterprise Architecture; Enterprise Architecture Acceptance; Human Factors and Enterprise Architecture

I. Introduction

Technology has become indispensable as support system for organisational and personal use, and it is accepted as such. However, even though the advantages and disadvantages of new ideas, concepts, technology and methodologies may be well communicated and illustrated in organisations, the processes of adoption and acceptance thereof are not always easy or without obstacles [1, 2]. Organisational settings, culture and social work environments have been proven to influence technology acceptance [3, 4]. Several authors [5-7] have emphasized that due to the organisational change caused by the introduction of computers and information systems (IS), it has become important to reconsider the management of people, rather than the mere management of information technology (IT).

Enterprise architecture (EA) is the plan, description or 'blueprint' of how the business processes, information management (IM) and IT of an enterprise integrates and operates. Understanding the complexity of business and IT integration and handling change and information management, of which EA is a basic strategic building block and operational aid, have become recent issues that organisations have to deal with. The importance of human involvement in successful execution of business, IM and IT processes has been proven over many years.

The premise of this paper is that although EA as a new direction is understood for its broad enterprise-wide implementation, when EA is introduced, wherever and in whatever division of an enterprise, it is necessary for humans to accept EA for the benefit of the enterprise as a whole. Based on an exploratory case study in a South African enterprise, this paper examines the human factors that impacts on the acceptance of EA as a 'new' strategy in an enterprise.

In section II, the concept of EA is introduced in more detail. In section III, existing literature is used to provide background information on human factors in organisations, human factors and technology acceptance, and human factors in EA. In addition, the difference between adoption and acceptance is explained. In section IV, the research approach and data collection process is discussed. Moreover, the issues identified and the results of the research are also presented in section IV. This paper concludes with a discussion on the importance of acceptance of EA and recommendation for further research is imparted as part of the conclusion.

II. Enterprise Architecture

Enterprise architecture is a description or 'plan' used to assist organizations in understanding the impact that change, development or growth would have on business outcomes in a competitive and dynamic world [8].

Enterprise architecture originates from the work of Zachman [9]. Zachman [10] defines EA as the total set of descriptive representations, artefacts or models, relevant for describing the knowledge infrastructure of an enterprise. EA is not a fast, once off project or exercise. Ross *et al*. [11] see EA as "the organizing logic for business processes and IT infrastructure reflecting the integration and standardization

requirements of a company's operating model." Another perspective of EA is that of the recurring methodology of describing the "as is" and "to be" states of an enterprise and all developments, interventions and processes to evolve from the one state to the other [12, 13].

In this paper, EA is therefore defined in its broader context as "*the continuous practice of describing the essential elements of a socio-technical organisation, their relationships to each other and to the environment, in order to understand complexity and manage change*" [14].

III. Human Factors and Acceptance

Over the years, organisations have been described as complex systems and socio-technical entities. According to Dietz and Hoogervorst [15], an enterprise is a heterogeneous and complex system constructed by many homogeneous systems, of which its internal social system is one.

In this section, existing theories and models related to the acceptance of 'new' ideas in organisations are discussed followed by a discussion on the adoption and acceptance of EA in organisations.

A. Human factors in technology acceptance

This section briefly introduces prominent socio-technical models and theories of acceptance to illustrate the importance of the impact 'new' strategies in organisations have on people.

Actor-network theory: Actor-network theory (ANT) was originally described by Callon [16, 17] and Latour [18, 19]. ANT describes the interconnections of organisational structures, technology, and tacit knowledge from an 'actor's' viewpoint. Siderova and Kappelman [20] describe the enterprise, architecture, and IT solutions as actor-networks and then imply EA as an "integrated and transparent representation of aligned interests" in complex organisations.

S**tructuration theory:** Structuration theory [21, 22] demonstrates the impact of human action and interaction at different social structure levels in an organisation. Guidelines given by Giddens [21] to consider when research is conducted in the social environment of an organisation include: organisational context; true reporting of organizational information and tacit knowledge and; considering of work roles.

Technology acceptance models: The TAM [23] of perceived ease of use, perceived usefulness, and behavioural intent as the major factors affecting IS and IT acceptance and use has been proven to be a basis for further research on human behaviour when it comes to acceptance of new technology over many years. Research studies building on TAM identified and added human factors such as gender, experience, voluntary use, involvement, participation, user support, subjective norm, and training impacting on successful and satisfactory usage of IS and IT [3, 24-27]. Venkatesh *et al.* [4] constructed the model Unified Theory of Acceptance and Use of Technology (UTAUT) and identified three constructs (performance and effort expectancy, and social influence) as significant direct indicators of user intention of use and four indicators (all the factors mentioned, together with facilitating conditions) of user acceptance (Fig. 1). Key factors impacting on these constructs were gender, age, experience, and voluntariness of use.

In contrast with organisational technology acceptance problems experienced a few decades ago, organisations presently have to address problems dealing with complexity, change, and socio-technical processes [1, 2, 28-33].

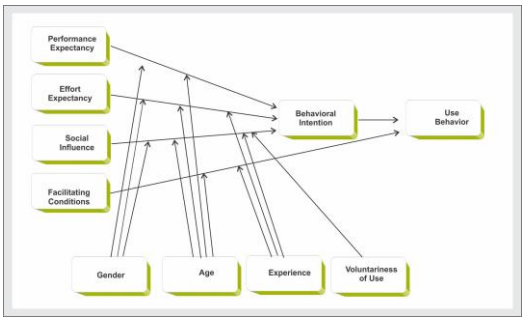

Fig. 1. Unified theory of Acceptance and Use of Technology (UTAUT)

B. Human factors and EA

Human interaction in the enterprise environment is usually goal driven through the relationships formed in that environment. Communication is an example of a human factor and the primary tool used in interaction. The product of communication is information, which is a vital component of successful enterprise operations. Chuang and van Loggerenberg [34] identify human related challenges in EA as: communication, buy-in from stakeholders, ownership, perceptions of enterprise architects, and organisational politics.

Human factors are mentioned when cultural change in organisations adopting EA is discussed [13, 34, 35] but human factors impacting on EA acceptance have not explicitly been identified and described.

C. Adoption and acceptance of EA

In existing literature, the concepts of 'adoption' and 'acceptance' are both used to describe the process of 'choosing and following a plan' [36] or to 'approve and accept' a method, report or strategy [37]. For the purpose of this paper, adoption is perceived as choosing, approving and following a plan, method or strategy and acceptance is perceived as an individual human endeavour and response which occurs after a method, plan or strategy has been adopted by an enterprise.

Adoption of enterprise systems (ES), their impact on organisational operation and human involvement in ES has been described by many researchers [38-41]. Organisational adoption of EA may happen in one of following ways: modern organisations realizing and experiencing a need to align business, information technology, structure and people;

organisations in the process of re-evaluation, restructuring, or expanding may realize the need for assessing and recording some or all of its data, assets, processes, and knowledge to support a new mission; consultants or vendors may persuade organisations to consider new technology or upgrade existing systems and suggest EA as a methodology; organisations may consider accepting EA to gain a cost-effective competitive advantage in a complex and fast changing world; organisations may need a descriptive foundation to build a strategy [9, 11, 12, 42].

IV. Research Context, Approach and Results

The aim of the research conducted was to identify human factors affecting EA acceptance by applying the interpretivist paradigm. The enterprise chosen for this research is a world-wide, complex, chemical manufacturing organisation. Enterprise architecture as a business and information management strategy was introduced and adopted at one of several decentralised sub-organisations of the enterprise. The research approach was inductive in nature and agreed with guidelines listed by Saunders *et al.* [43] stating that researcher involvement has to be acknowledged and that data are gathered from humans with the belief that the nature of the problem and context of the research events are understood. Semi-structured interviews and semi-structured focus group interview were used to identify possible non-technical, human issues affecting the acceptance of EA (Table I). Individuals representing different work roles (five participants) in the organisation and a focus group (five participants) representing two different sub-organisations of the enterprise were interviewed to collect qualitative data. The aim of the study was twofold: first to investigate the organisational setting in which EA was adopted and second to identify and describe human factors of relevance that have proved to impact on EA acceptance.

TABLE I. QUESTIONS POSED TO PARTICIPANTS

QUESTIONS	
What is enterprise architecture?	Describe the EA environment
How was EA adopted?	How does EA address processes?
Stakeholder involvement?	General human factors?
Human factors important for EA team members?	Human factors for stakeholders?

Processing of data included transcription of audio recordings into text and the expansion of researcher notes. Data analysis methods used included tagging [44], and, context and thematic analysis [45]. Using analytic induction, similarities between opinions, explanations and words of participants were combined into meaningful explanations of human factors. The qualitative data gathered during the study supplied the researcher with evidence of human factors affecting EA acceptance in one organisation enabling their identification.

The EA implementation process was perceived as successful in one of the sub-organisations of the broad enterprise. EA was however not readily accepted by all stakeholders in other sub-organisations of the same enterprise.

Table II provides evidence of participant responses and corresponding human factors derived.

V. Discussion

Enterprise architecture is a relatively 'new' and contested strategy proposed to assist enterprises in dealing with handling complexity and change (Section II). Although the need for EA has been acknowledged by business leaders, up to very recently EA has been believed to be the responsibility of enterprise architects and IT divisions in organisations [34, 46]. Involvement in EA and acceptance of EA concern many more people in an organisation.

It has been the argument of this paper that enterprises are complex, human-driven entities. The broad, complex enterprise cannot function successfully without good integration and alignment of business goals, information management, and technology support – all of it: human-driven.

Acceptance of EA as a strategy should happen at all stakeholder levels to ensure that functionality of enterprises is understood in order to handle change fast and effectively and stay competitive in their business. Information management and IT technicians take responsibility for EA operations. However, business, IM and IT management, guided by enterprise architects, need to understand the organisational value of EA, approve EA and take ownership of EA (Fig. 2).

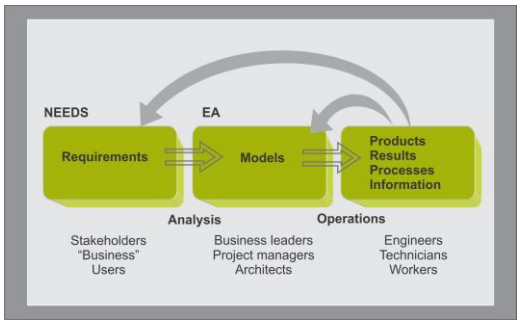

Fig. 2. Human involvement in EA

As a result of the limited scope of this study, further investigation and research opportunities include:

- More in-depth research on social structures in more enterprises where EA has been adopted as a strategy;
- New and innovative assessment of human factors impacting on strategic initiatives in organisations and ways to address these factors.

TABLE II. RESPONSES AND HUMAN FACTORS

PARTICIPANT RESPONSES	HUMAN FACTORS DERIVED
Management should take ownership of EA; Managers of organisations, sections and departments within the scope of an enterprise have to accept ownership and responsibility for architectural business and information management alignment or EA; At management level, acceptance of EA is important. If people do not understand the language, grasp the practical benefits and see regular progress and results, they do not accept the "new" direction;	Management needs to accept ownership of EA; Facilitate and manage transformation and cultural change; EA involvement; Share perceived EA benefits; Recognise that non-acceptance of EA poses an organisational risk that needs to be managed; Realistic expectations; Coordinate diversity and change; Coordination of business processes with IM and IT;
Management should accept an EA long term vision versus short term problem solving focus; Long-term vision is impaired by urgent problems; EA calls for a "mind change" in organisations;	Understand the long-term EA vision and share this vision with others; Understand "as-is" and "to-be" roadmap;
Culture and organisational politics influence acceptance of "new" directions in organisations; Culture of sub-organisations differ and should be acknowledged;	Acknowledge and utilise cultural differences; Involve stakeholders, address needs and share motives and small victories;
Start the EA process where the need for business and IT alignment is high. Address stakeholders' needs; A starting point for successful EA implementation is to identify stakeholders' needs and requirements and addressing these needs and requirements by continuously sharing results;	Understanding business, IM and IT alignment need;
Understanding the concept of EA as an enterprise and not an IT endeavour; It is very important that stakeholders understand the motives and the essence of the EA operation; EA is the alignment of resources with strategy. Keep the definition of EA and communication language simple. Resources include everything from finances to roles of people to operations and technology. Alignment means to meet objectives by using resources. Alignment of processes, information and applications is seen as vital for the enterprise; Understanding complexity of the business, IM and IT processes integration;	Understanding EA concept; Use a common language; Improve communication between different EA stakeholders; Understand meta models; Follow standardised procedures;
Accepting of responsibility by stakeholders – work role related; Cooperation of stakeholders;	All EA stakeholders to acknowledge and understand the human role in integration of organisational business, information management and technology support; Humans providing and accepting support; Accept organisational shared values and authority; Cooperation; Understand importance of work role;
Gradual introduction of EA where mostly needed; Acknowledging maturity levels of organisational sections and stakeholders. Maturity levels of processes, projects and humans are often different. This results in delays. EA should address these discrepancies;	Acknowledge human and EA maturity differences
Communication between all humans involved in the EA integration process;	Acknowledge human input and effort; Understanding user concerns; EA guidance, not only governance; Enable information exchange and information preservation ; Provide feedback and results;
EA team members should be able to: Conceptualise, Use organisational principles and principle terminology, Be persuasive, Implement practically, Think analytically, Understand meta models, Show passion and be open for challenge, Never hide behind governance;	Personal, group and organisational dynamics; Professionalism; Accept challenge; Mediator skills; Passion; Facilitate architectural modelling;
Stakeholders should or should be: Open minded; Prepared to listen; Prepared to give enterprise architects and EA a chance; Allow decisions to filter through; Trust; Show responsibility; Show accountability; Have patience; Show perseverance	Patience; Open-mindedness; Perseverance; Responsibility; Trust; Accept and provide training; Interaction; Collaboration; EA engagement; Accountability; Social networking; Integrity, honesty and ethical behaviour; Guidance; Teamwork skills; Loyalty; Honesty
Implementation of EA is a long-term, ongoing and engineering process. Commitments often need adjustment and reformation. New ideas need reification; It is difficult but necessary to standardise the operations management of business units in a complex enterprise. The risk of reengineering is too high	Optimise and standardise; Adapt and adjust; Advisory skills; Retain and reuse information resources; Stay focused; Understand balance between needs, quality of work and expenditure; Identify reusable information; Think analytical, implement practically; Dedication; Participate;

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