ENHANCING DESIGN SCIENCE FOR SOCIAL DEVELOPMENT

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Abstract

This paper argues on the importance of extending the capabilities of design science from its traditional orientation domain of 'solving organizational problems' to include general social development. The focus of the argument is taking into consideration the prevailing socio – economic characteristics of the developing countries of Africa (DCoA). It is conflated in this paper that, to enhance the service of Information and Communication Technologies (ICTs)in their totality in the social development of the nature of the developing countries of Africa, the institutions of higher learning in Africa need to design technical training programs that will be able to blend design science with social development theories. Bloom's taxonomy conception of knowledge categorization is used to highlight rooms for improvement in the current technocentric curricula. The purpose is to produce professionals with the necessary insight in the socio-economic conditions of the target contexts for them to develop useful artifacts.

Keywords: Design science, Social development, Developing countries of Africa (DCoA), Curricula.

Reflections of Social Development in Design Science

In Information and Communication Technologies (ICTs), design science (DS) can be perceived as the area that accommodates the backstage activities in the framework of the discourse under discussion in general and in Information Systems (IS) in particular, from the understanding that it is through this field that the technological aspects of ICTs are addressed. Apparently, faced from its traditional corporate domain (referring to the definitions of DS featuring in a number of papers), the idealization of the interplay between DS and social development is not straight forward. Furthermore, unless explored through the window of innovation as an operationalizational contribution to Heeks' (2008) observation that, ICTs for development need champions who are "tribrids" (*to mean professionals who understand enough about the domains of computer science, IS and development studies with broader world views to guide the application of ICTs for development*) the value system of social development does not seem to be a subject in the knowledge body envisaged for design scientists who back ICTs. Or put differently,

the motivations for contribution to social development are not set clearly in the DS field as it is for organizational goals.

In particular, the contemporary packaged body of knowledge for the Africa's design scientists to be acquired through training does not address the pressing technological relevancies of the developing countries of Africa (DCoA), like the emancipation of the indigenous masses from the miserable social and economic conditions they are facing.

Hubka and Eder (1987, as cited by Cross 2001) describe design science as comprising of "*a collection of logically connected knowledge in the area of design that contain concepts of technical information and design methodology where by all regular phenomena of the systems to be designed and the design process are categorized*". Further summarized by Cross (2001), the subject matter is expressed as one that refers to an "*explicitly organized, rational and wholly systematic approach to design"*. The conception from these expressions is in essence organized around technology, principles and technical processes.

Applied to IS research, Hevner, March, Park, & Ram (2004) do not dedicate to the definition of the term per se but rather its derived concept. According to the authors, the result of design science research in IS is a "*purposeful IT artifact created to address an important organizational aspect*" (Hevner, et al., 2004). However, with regard to the contemporary developments in IS, the scope attached to the application is not accommodative enough. In the contention of this paper, it need be extended to include any social groupings/societies beyond corporate settings as also observed by Byne & Lotriet (2007) and Ashraf, Swatman and Hanisch (2007) in whose views, ICTs in IS have 'crossed' corporate boundaries to reach out to society at large. It then becomes appropriate to challenge the field to the tasks of social development as well.

Basically, design science works on intended efforts (Sneller and Bots 2006). It is comprehended as a problem solving frame (Cross, 2001; Hevner et al., 2004). Functionally, DS has played a fundamental role in the areas of e-governance, e-education, e-health, and e- business by providing direct benefits through breaking of time, space and distance barriers. According to Hevner et al. (2004), DS has sought to extend the boundaries of human and organizational capabilities by creating new

and innovative artifacts. However, the focus of this observation '*organizational*' is limiting to the corporate oriented economy of the developed economies leaving the un-incorporated types of economies of the DCoA marginalized.

The economies of the industrialized countries have realized derived economic benefits as the result of DS being at the hub of the technologization process in manufacturing, business and trade. However, the nature of the economies of the Developing Countries of Africa (DCoA) that are characterized by varied and different economic factors of production and their relations, different environmental conditions, different social and political setups from the developed economies, do definitely lead into new forms of demand on DS. The needed and meaningful innovations will have to be custom driven for that matter. This implies that, the IS community is challenged to situate DS in a broader inclusive context to accommodate such differently organized economies of the DCoA. The peoples of such countries stand to benefit more from the works of DS the paper speculates, where the field work to promote systems for the overall economic transformation, mitigation against corruption, promotion of democracy for peace and stability, provision of universal education, improvement of transparency in the relations of developing and developed economies etc.

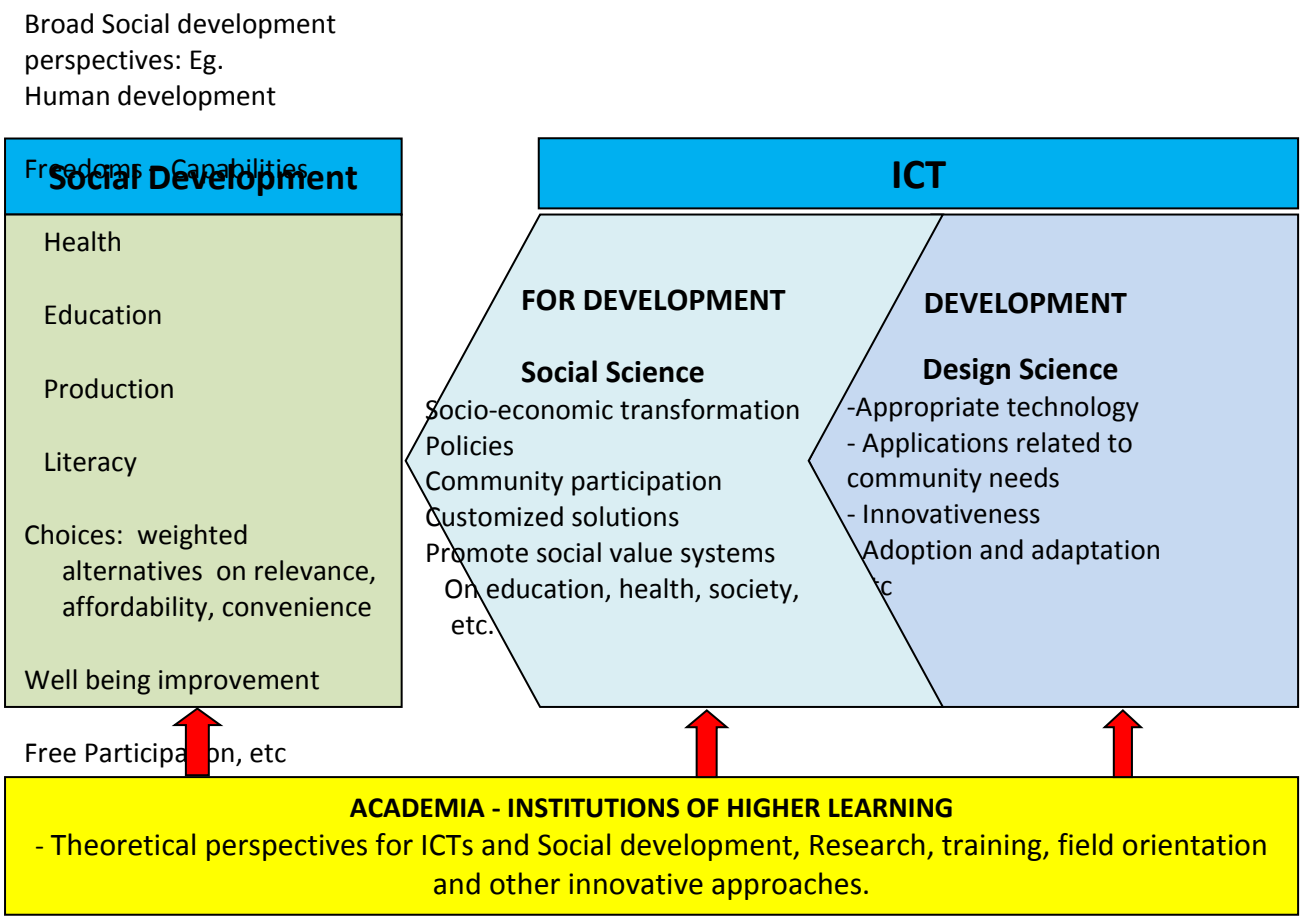
On the other hand, the induction of African relevancies in digital technology training has a potential to reduce the 'brain drain' effect complained about by governments (The National ICT Policy of Tanzania 2003) and scholars who blame it on limited demand for advanced knowledge and low quality of life in the home countries of graduates (Lundvall 2007; de Alcántara 2001), investments in higher education without corresponding improvement in the economies of home countries (Ng'ambi 2006) and the like.

The focus of argument in this paper is that, DS is capable of high payoffs in ICTs for social development in the DCoA if the discipline is strategically advanced to mould professionals with wide understanding of social development issues beyond the corporate environment, and capable of accommodating context specific dictates in the learned design rules. A careful analysis of the relationships between the bottom-line social development aspects as grounded in the DCoA and DS is essential. This is fundamental in order to capacitate the field for the yielding of useful artifacts. It is however a challenging task as also underlined by Hevner et al. (2004) that

‘designing useful artifacts is complex due to the need for creative advances in the domain areas’. Therefore, it is argued in this paper that, there is a need for capacity development in DS in order to equip the IT design scientists with social development theories that extend to the specifics as they exist in the DCoA, bearing in mind that the relevance of different functioning vary from context to context as also underscored by Zheng and Walsham (2008). The documentation of the Organization for Economic Co-operation and Development (OECD): ‘*The Development Dimension, ICTs for Development, Improving Policy Coherence’* (OECD 2009) is indicative of the emphasis on the requirement to equip the DS field well enough to deliver ‘context specific’ solutions which match with the host environments and social economic conditions. Heeks (2008) is of the opinion that the old established methods in ICT including design are implicitly challenged to establish new expertise and new world views in order to harness digital technologies in the service of the world’s severest problems (Heeks, 2008) *like* (link by paper) poverty, lack of access to education and health services by marginalized communities, alternatives to shortage of service providers in the areas of capital and so on.

The derivative concept from the proceedings above is that future practitioners in DS need to be prepared through education programs by exposing them to the relevant links between digital technologies and development paradigms as stipulated in the conceptual framework presented below.

Figure 1 Design Science in Social Development Conceptual framework



In the framework, an analytical orientation of DS is geared towards the development of understanding the position of DS's envisaged contribution to human and social development. The framework has three main blocks; the ICTs, Social development and Academia blocks. The ICTs block is subdivided into ICTs development to refer to the outputs of design science or artifacts that entail appropriate technology relevant to, and addressing real world phenomena of the host contexts etc., and the ICTs based solutions for social development subdivision. This second subdivision is meant to accommodate applied social development theory contents as they are generated by Social science studies for instance issues of social value systems inherent in African societies, policies on education, health communications; innovations for socio-economic transformation, and international linkages to mention a few. Thus, the output of DS developed in the enriched knowledge body of digital technology and social development information, feed into the appropriate transformation of African societies to realize social development in the integral spheres of health, education, production, economic growth and other realizations. The underlying is the Academia block. This is viewed as the main role player in informing the actors, learners and other related fields of the theories, concepts and policies through training and research.

In essence, there is a comprehensive mutual enrichment between DS and social development studies hinged on the characteristics of DS as a problem solving oriented field that strives to make sense of life issues that individuals, organizations or communities face.

To complement the framework, it is asserted that the social context in which ICTs are either embedded or designed to operate do influence the ways in which they are developed, implemented and used, and the range of consequences (intended and unintended) they have for such social groupings (Sawyer and Rosenbaum 2000). Extending on this observation, it can be implied that chances exist for positive as well as negative consequences. But to maintain the goals, it should be desirable to minimize the chances for negative consequences resulting from the ICTs for social development interventions like possibilities for exclusion of some social groupings (Truth and Howcoft 2006); Zheng and Walsham, 2008). Within this ideological context, the extant paper is of the views that, among the viable approaches for the purpose is to enrich the professional programs with social development theories that supplement the core design techniques.

Enhancing the Contribution of DS in Social Development through training

Innovative capabilities in ICTs are critical in the operationalization of design science in social development. They are as necessary as a prerequisite for the design of artifacts with potential to yield utility in the context of DCoA. It is also argued in the undergoing discourse that the role of higher education is essential in the enhancing of social transformation through technology on one hand, and fostering the emergence of adaptable skills on the other. The influence of context on the type of innovation and speed of skills adaptation cannot be underplayed if the designs versus reality gaps, as also highlighted by Heeks (2008), are to be mitigated in design science and complex real world social development problems.

The fundamental role played by the institutions of higher education in the creation of knowledge, application, and/or synthesis with the already existing phenomena is universally recognized in the academic, organization and social spheres. From this conjecture, the paper observes that a high form of thinking is required for effective technological innovations that are capable of catapulting social development in the developing countries. It is from this contention that the extant paper proposes the

need to develop capacity for higher contextual forms of thinking among the learners in design science as they are prepared in the institutions of education.

One of the immediate challenges to DS as a field necessary for social transformation is to help extend the horizons of thinking and creativity among design scientists for their effective participation in the implementation of digital technology to solve the prevailing socio-economic problems in the DCoA. This entails enriching the technical specific competences with the knowledge of field socio-economic conditions. A behavioural shift is required here where practical training should extend from the almost traditional corporate only attachments to include other community areas of need.

Since DS is a problem-solving centred field (Hevner et al., 2004; Cross, 2001), knowledge of the real world phenomena in focus is essentially fundamental in its processes and products. According to authors Hevner et al. (2004 p 6), the design processes include a sequence of expert activities that produce an innovative product referred to as the artifact. Further broken down by March and Smith (1995), the design processes are identified as 'build and evaluate' while the design products or the artifacts (as defined by the authors and adopted in this paper) are the constructs, the models, methods and instantiations. For the detailed description of each one of these objects, the reader is referred to the original paper of Hevner et al. (2004 p 6). Of interest for the current discussion is the modelling aspect. The tabled argument here is that, again the potential to build effective representative models draws heavily on the base knowledge about the candidate phenomena. In this case, for the design scientists to function more effectively in the developing countries they have to be further informed on the features of the contexts of significance.

DS is further complicated by the 'transformative' dimension it has to address apart from the 'aiding' function in the process of affording social change towards developed information societies of the DCoA. This means, there is an implied call to extend the conceptual framework for IS research from the one presented by Hevner et al. (2004 p5). In their framework, the underlined entities are business strategy, IT strategy, organizational infrastructure & IS infrastructure and the interplay among them as the only subjects of IS research. The paper's proposition is to include **social development strategies** within the frameworks of periodic global development goals like the current millennium development goals (MDGs) (Chacko 2005) for

example, and social infrastructure as guided by the World Summit on the Information Society (WSIS) 2003 and 2005 (ITU 2005). This is a complex scenario that requires an interdisciplinary capacity base. In the earmarked MDGs framework for instance, the requirements for ICTs are to be delineated within the context of the proposed social development strategies by the responsible or intervening entities.

When investigated from the traditional perspectives of IS where according to Hevner et al. (2004 p 38) IS research lies at the intersection of people, organizations and technology, DS is expressed as focussing on the creation and evaluation of innovative IT artifacts that enable organizations to address important information related tasks. However, in the views of social inclusion, DS should be challenged to function in a **people/social layup** and technology setting with deviating features from ordinary organizations. In this perspective, DS has to think of creating utilities for communities apart from organizations. In such an environment, behavioural science research has to be consulted in order to underpin the appropriate contextual theories beyond organizations through which technological capabilities to address social changes can be identified. Within this setup, the need to promote the knowledge of social-economic development theories among IS scientists is made explicit.

Learning is understood to be a cognitive and social process in which students construct meaning through reflection and through their interactions with the environment (Allen 2004; Krathwohl 2002). In the process, the attitude, belief and value system is developed that underlay the application of learned skills in problem solving. Within this respect, the surroundings and exposure that confront the learner have a bearing on one's learning and development of the value grid.

In the current scenario, the individual beliefs with respect to technology are developed along business and corporate mainstreams. As a result, this is the area which the learners tend to perceive demands their service. To address affection in the social development dimension, training has to demonstrate the relevance of the subject matter in that context. It is here that the items for social development and their linkages with technology need to be made explicit in training.

In the following section, the Bloom's Taxonomy Model (Bloom et al. 1956) is used to flashlight the space for possible operationalization of the social development knowledge in the general knowledge body of IS.

Developing the Social Development Value System in the IS Curricula

In the analysis of the stated learning objectives in the IS, Computer Science and ICT programs' curricula, it is revealed that the organizational value system is the focal point in training in contrast to other social value systems. In the table below, the guiding curricula frameworks: 'The IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems' (J.T Gorgone et al. 2003), the 'MSIS 2006: Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems' (J Gorgone et al. 2006), and a sample of curricula from East African universities are used to provide the general view of the value system orientation in training.

Table 1 Alignment of stated objectives to implied value orientation

Objective	Source document	Value system orientation
Graduates will have the following skills and values • A core of IS management and Technology knowledge • Integration of IS and business foundations • Broad business and real world perspective • Communication, interpersonal and team skills • Analytical and critical thinking skills • Specific skills leading to a career	MSIS 2006 guidelines	Organizations
• The overarching objective for IS professionals is to enable organizations to utilize computer and communications and related information technology to achieve their strategic objectives	IS 2002 Model Curriculum	Organizations
• To develop professionals with knowledge of technical foundations of Information Systems, capable of making decisions about the implementation of Information Systems and information management in an organization. • To develop professions with theoretical and practical skills in computer science and build management capacity with a practical orientation needed to link up the computer science field with industries • To provide the students with concepts necessary to support the design and implementation of Information Systems that will support decision making in an organization • To produce skilled professionals whose innovations and expertise can make them understand the complex and fast changing IT environment. The graduates are grounded in business and management skills which are an essential requirement of employers. • To build human resource capacity in the areas of Computer Science, Information Technology, Software Engineering and Information Systems disciplines in both the public and private sectors, especially in universities and to develop professionals with theoretical and practical skills in the ICT sector. • The curriculum (for Bachelor in	Sampled Universities in East Africa	Organization and ICT industry

Information Technology) is designed with emphasis on having the student acquire the business, manufacturing, media computer and communication skills necessary for employment and career opportunities in ICT industries and business organizations.		

Deducing from the table, the affective domain of the Bloom's taxonomy is obviously influenced in the direction of organizational values. In essence, graduates cannot realize their relevance elsewhere apart from the corporate world. For them to feel needed in the local conditions of Africa, their affection has to be developed with vivid links to the living conditions surrounding them and the respective value system for social transformation.

On the other hand, the revised Bloom's taxonomy (RBT) (Anderson 2001; Krathwohl 2002; Forehand 2005) helps to shed light on the other possible area of action. This appears at the metacognitive knowledge category in the knowledge dimension of the cognitive domain. The specified subcategories in this category include strategic knowledge, knowledge about cognitive tasks including appropriate contextual & conditional knowledge, and self knowledge (Krathwohl 2002). The implication here is that, to help learners appropriately adapt their learned skills to social development phenomena, their training has to cover the relevant aspects that pertain to specific social, economic and technological contexts. In the objectives mapping grid that appear below (table 2), it can be observed that the gray area in the knowledge dimension is significant at the metacognitive knowledge. The metacognitive level is the one at which learners can understand their role and effects of their metacognitive activity, appropriately adapting their thinking (Krathwohl 2002). The explanation for the observation follows directly from the learners' value system orientation that was projected in table 1. From the conception of the program formulations as it can be implied through the objective statements, the focus of training is to serve the business/corporate sphere. Respectively, at the metacognitive level, learners will perceive their positions and function to be in corporations while their relevance in social development does not become clear in their value systems.

Table 2: Mapping of learning objectives to Knowledge levels in the RBT framework

Objective	Knowledge dimension			
	Factual knowledge	Conceptual knowledge	Procedural knowledge	Metacognitive knowledge
Stated objectives in the MSIS 2006 guidelines				
Stated objectives in the IS 2002 Model Curriculum and Guidelines for undergraduate Degree Programs in Information Systems At the apex, it is stated that 'the context for IS is an organization and its systems' and IS as a discipline is geared to prepare students for the organizational environment.				
Stated objectives in the select universities' curricular (see table 1)				

Derived from the above observation, it is worth pointing it out here that the learning objectives and course alignment (Allen 2004) have to be revisited in teaching and training in ICTs for social development in the DCoA. The reflections emanating from the pointed out dissatisfaction on the development in the affective domain include the possibilities to undermine the context specific potential for technological innovations in the region under discussion.

Conclusion

ICTs in IS have extended beyond their traditional corporate confinements to touch the society at large. To make DS responsive enough to these evolutions, the knowledge of social development theories has to be blended with technological training. The institutions of higher learning in Africa are therefore challenged to think of designing and implementing enriched programs especially through the affection and metacognitive domains, that will be able to prepare future professionals that are well equipped to support social development in the DCoA through design science.

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