

An argument for Systems Thinking as paradigm to examine individual career choice in rural communities with specific reference to careers in ICT

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Abstract: This paper is written within the context of the significant focus of governmental agencies on expanding e-Skills capabilities at a national level in South Africa. It goes without saying that these initiatives should also benefit rural communities, and a natural outcome of a successful drive towards improved e-Skills would inevitably also be a raised awareness of the benefits of e-Skills, not only for the rural communities, but also for individuals within these communities. Evidence exists of individuals from rural communities who, having realized the benefits of ICT in society choose to further their studies in this scarce-skilled area and following successful technology careers elsewhere. However, this seems to create some tension lines, when viewed from a systems perspective. A community member deciding to follow a career in ICT, constitutes a boundary crossing event, with implications for the community (as a social system), and the hierarchy of social systems that constitute society in South Africa. Knowledge about this boundary event is at the intersection of two different and divergent knowledge domains - Socio-economics and Career Choice, which essentially is a branch of social psychology). Neither the discourses related to technology based developmental interactions, nor do the discourses on Career Choice adequately account for this phenomenon. This paper asks whether Systems Thinking would be an appropriate paradigm to approach this intersection of fields and what potential insights could be gained from using such an approach.

Keywords: Career Choice, Community Informatics, South Africa, South Africa, ICT

Introduction

South Africa as a country has significant challenges in terms of achieving its socio-economic goals. One of these relate to the level of e-readiness required for the country to achieve its own National Development Plan goals in 2030. A drop of 25 positions on the World Economic Forum global e-readiness rankings period 2007 – 2012 highlights the challenge facing the country (Department of Communications, 2012). As a result, the South African government has pushed forward strongly with a national e-Skills initiative, aimed at coordinating country wide efforts to improve e-astuteness in the country. The notion of “e-astuteness” is explicitly defined as “the use of ICT for job creation, financial processes, service delivery, flexibility, innovation and creativity” (Department of Communications, op. cit.). The intervention of government is advocated as a requisite to ensure equitable distribution of the benefits of e-skills across all sectors of society, rather than a situation where the benefits are concentrated in specific “hubs” (Department of Communications, op. cit.). The nature of the benefits spread in this way is envisaged to be at various levels, i.e. personal, community, work, society, and by implication to all within society, which would therefore include rural communities.

A distinction is generally made between the highly specialized ICT skills that are needed to keep the “engine room” of the ICT industry going (typically obtained through tertiary education in ICT) and the lower level “literacy skills” needed by all citizens to enhance human activity within society. The e-Skills action plan for South Africa is mainly focused on the improvement of literacy skills. Significant is however the identification of “the necessity

for an ICT career structure that will advance the attractiveness of the IT profession” as a major issue that needs attention (Department of Communications, op. cit.).

Career choice in ICT has been a subject of intensive research over the past decade (Alexander et al., 2009), triggered by the turn-of-the-century dot-com collapsed which resulted in a sharp slump in student numbers in ICT-related qualifications at tertiary institutions. In South Africa a steady stream of research has emerged related to the characteristics and ICT related career choice factors of South African adolescents, given the importance of ICT skills for the country’s developmental path. Examples include studies done by Alexander et al. (2011a, 2011b); Alexander and Pieterse (2010) and Alexander et al. (2009). Notable is that contextualization of the career choice discourse in terms of the vital socio-economic aspect of South Africa’s development has happened in only one paper to date (Alexander and Twinomurizi, 2012). This paper had as its focus the correlation between Career Choice and economic conditions.

However, within the specific context of technology related rural community development, the notion of e-skills vs. the notion of a career choice in ICT creates some interesting tension lines that are not addressed by either developmental discourses (specifically related to community informatics, ICT4D and the Information Society) or the mainstream discourses on career choice in adolescents. Technology related community development initiatives by government or developmental agencies have as their main aim some degree of technology mediated socio-economic development process that benefits the local community (and eventually the country at large). E-Skills fit this scenario well, as it implies a located improvement of technology skills of community members within a rural community, which would be expected to have long-term socio-economic benefits for the community. On the other hand, if a community informatics focused intervention (such as the eSkills project) results in young persons in the rural community discovering an aptitude and talent for working with technology and subsequently choosing to follow an ICT career, this creates a different situation. As the type of training required for a career in ICT and the job opportunities are still largely concentrated in a small number of geographical locations in South Africa, the implication for a rural person choosing this direction would be that the person would normally have to leave the community to pursue the necessary training and a technology career elsewhere. Given the significant differences between the typical rural community context, and the typical (urban) organizational context of the ICT industry in South Africa, the choice of a career in ICT essentially constitutes a boundary crossing from one complex social system to another. An unintended consequence for role players in the original technology-focused intervention is that the resulting loss of talented young persons (and quite conceivably “technology champions” in the local context) to careers elsewhere effectively reduces the beneficial impact of the original intervention on the community, although obviously the young person ultimately has the potential to make significant material and career gains, which would also be to the benefit of the larger system (the country) even though it is potentially to the detriment of the sub-system (the community).

Current discourses do not address this dichotomy adequately, as the unit of analysis is typically at national or community level, without necessarily extending sufficiently to individual level and the psychological dimensions typically examined by career choice researchers. Nor do the mainstream (mainly decontextualized) discourses on career choice allow for a good understanding of the challenges and experiences of the rural young person who negotiates a complex boundary crossing in order to establish him/herself in a career within another complex social system. Career choice literature (even when allowing for contextual impacts) is focused on the individual as unit of analysis and therefore does not have an interest in assessing the socio-economic implications at other levels of analysis of career decisions by individuals.

The reality is that significant numbers of rural adolescents do make decisions to follow ICT careers. Knowledge about this journey, and its impact on individual, community and society promises real benefits at all levels; for the individual in terms of better support along the journey; for the community and society in terms of understanding how to account for these movements when crafting technology related interventions that need to benefit the

community and society socio-economically. As intuitively there seems to be systemic characteristics and boundary crossing involved in the phenomenon, as well as hierarchical systems (individual, community, society) this paper examines whether a Systems Thinking paradigm can contribute to provide new perspectives and contribute to the discourses regarding the tension field of rural community and individual behaviour, specifically with reference to career choice in ICT.

The paper is structured as follows: Firstly a brief overview is presented of the extent to which Systems Thinking has been applied to the area of socio-economic development (with specific reference to community informatics); and the extent to which Systems Thinking has been applied to vocational choice studies. Secondly it examines the potential benefits of Systems Thinking in creating knowledge about the intersection of ICT career choice and socio-economic community development through ICT-related projects. Thirdly it examines potential issues that may arise should Systems Thinking be adopted as paradigm. Finally there is a concluding section.

It should be noted as a possible limitation to the paper that the author has a significant bias towards human-centric development and ICT development that contributes to improvement of the human condition. This bias does have an impact on preferences in terms of types of Systems Thinking.

Evidence of Systems Thinking in existing discourses around Community Informatics and Career Choice

The use of Systems Thinking in research on socio-economic development that involves ICT

It should be noted at this point that in South Africa as a developing country, Community Informatics would normally imply a consideration of rural communities where technology-related interventions are expected to make a beneficial socio-economic contribution to the community. In this specific context, Community Informatics, ICT4D and the notion of “Information Systems for Developing Countries” become very closely related because of the specific conditions that apply. This literature review should be read with this understanding in mind.

Human activity around technology has long been recognized as social systems in the broader field of Information Systems in general and specifically the work of Checkland (1981, 1999) on Soft Systems Thinking has been core in informing a significant body of research in this field (Turpin and Alexander 2013). However, even though human activity systems in community development in specific has been recognized as social systems with complex characteristics (Walsham et al., 1988), Turpin and Alexander (2013) argue that Systems Thinking has been applied in the domain in a limited and fragmented way. This in spite of the complexity and “messiness” of the technology for development field that would intuitively seem ideally suited for the holistic perspective of Systems Thinking. In the context of this paper “holistic” would imply an understanding by individuals of the bigger picture of their reality and their relationship with their contexts (Morgan, 2005). These contexts can be expressed as various systems and sub-systems, with elements, relationships and boundaries. In the context of community informatics examples of such systems may include for instance the physical environment, socio-cultural aspects of the community, political systems, economic systems, etc. (Andrew and Petkov, 2005).

The literature search conducted by Turpin and Alexander produced a limited collection of eight papers that applied Soft Systems Methodology (SSM), Total Systems Intervention (TSI), Sociotechnical Systems (STS), Analytical Hierarchy Process (AHP), pluralist and work system views. These were (eclectically) applied to such diverse areas of concern such as for example conceptualization of ICT4D as a field, technological innovation, ICT infrastructure

evaluation, curriculum development and IT project management. Turpin and Alexander (op. cit.) argue that the benefits in applying Systems Thinking to the domain of technology and development would largely relate to the potential for understanding the complex social context of ICT4D.

The use of Systems Thinking in Career Choice literature

The major theories related to career choice and vocational behaviour have long been criticized for being too a-contextual (Collin, 1997) and accordingly being too reductionist (Pryor and Bright, 2003). Yet these theories still hold sway, with currently popular major theories being those of Holland and the Five Factor model (Barrick et al., 2003).

A (minority) view arguing that career choice should be seen as embedded in multiple systems has been propagated for decades (Young, 1983), and Soft Systems Thinking has been argued to be particularly appropriate in that it allows for subjectivity related to career choice to be taken into account (Collin, 1997), as well as for a more holistic view that would inevitably be associated with a contextualist view of career choice.

Another example of an argument for a more systems-oriented approach is the paper by Pryor and Bright (2003), in which they argue that given the complexity of reality, traditional career choice theories are outdated and therefore do not adequately account for the impact of characteristics such as change and chance in the environment on career choice. In this regard they argue that systems theory provide better explanations and they specifically argue for seeing career choice as part of a complex system, with more focus needed on system dynamics, complexity and non-linearity, uniqueness, purposefulness, openness and emergence.

A systems approach that has received some attention in career choice literature relates to the application of Bronfenbrenner's ecological model to career development (see e.g. Young, 1983, Collin, 2006). This approach conceptualizes career development as spanning various systems at various levels (Young, 1983, op. cit.) These include microsystems (directly related to the adolescent making the career choice), mesosystems (at the level of interacting microsystems), and exosystems (considered to be non-interactive at individual level), and the macro system which essentially constitutes all of society that the other systems are embedded it (Young, op. cit.).

It could therefore be seen that both fields of knowledge (technology related community development; and career choice) have vocal minorities arguing for the appropriateness of Systems Thinking to better understand the social complexity and context of these phenomena.

Does the benefits of a Systems Thinking approach hold promise?

The potential benefits of a Systems Thinking approach

It is worthwhile to consider the potential benefits related to the adoptions of a Systems Thinking approach as listed by Turpin and Alexander (2013):

- (1) What can the systemic tendency towards a holistic view contribute?
- (2) How can Systems Thinking's emphasis on understanding systems dynamics contribute?
- (3) How can systemic insights into systems performance contribute?
- (4) Is there the need for understanding of structure and process?
- (5) How significant is transdisciplinarity in this area of research and does Systems Thinking provide a means of dealing with this?

Each of these is discussed in more detail in the following sub-sections with specific reference to the topic of this paper.

Systemic tendency towards a holistic approach

Broadly speaking it is still evident that the overall field of study of the interaction between humans and ICT is overly dominated by technocentric knowledge creation, and that it might be a good time to broaden the project – also for technology based community development (Andersson and Hatakka, 2013).

It should however be stated that there is a recent tendency in technology based community development to move towards more holistic approaches. For instance the importance of context is well understood (Avgerou, 2001), although better ways of incorporating this insight into developmental efforts is still required. The notion of career choice in rural areas holds potential for a further challenge towards holism in that it challenges those engaged with Community Informatics to improve understanding of the relationship between individual and community. Here Systems Thinking has the potential to inform the discourse, as it allows both for a relational approach and the possibility of understanding structure and process in the social systems present – a good example is the community analyses using a soft systems approach undertaken in rural communities in South Africa by Turpin et al. (forthcoming, op. cit.).

A systems approach provides the capability to deal with dynamics

The movement of young persons between different complex social sub-systems to pursue careers, thus impacting on systems characteristics and boundaries is the core issue that this paper focuses on. The author would argue that a soft (“epistemological”) systems paradigm that could shed light on the lived experiences of those persons creating the system dynamics could contribute, both in the formulation of technology related socio-economic development efforts and in the practical support of those who cross boundaries pursuing careers. It could furthermore also contribute to a better understanding of systemic embeddedness of the individuals involved (Collin, 1997).

The systemic approach provides insights into systems performance

As previously argued in this paper the act by an individual of making a career choice impacts on the performance various social sub-systems as well as the larger (national) system in ways that could potentially create tensions between these systems. While the selection of ICT careers is beneficial for the large societal system, it may be detrimental to the community sub-system. Although not much literature has examined the movement of ICT professionals from rural areas in developing countries, it can safely be assumed that similar to other parts of the world, most would not return to their communities of origin due to lack of economic opportunities (Ferry, 2006). For the individual involved the move would again be beneficial, at least from an economic perspective. Systemic insights might therefore contribute towards better understanding of how to formulate technology related socio-economic interventions in order that society, community and individual benefit simultaneously. Approaching these from a Sociotechnical Systems Thinking approach would seem to be a productive way forward, although the hierarchy of systems involved is complicated and complex.

Exploring these aspects may also provide new insights into monitoring and evaluation related to developmental interventions and more systemic approaches to do this.

The need for understanding structure and process

It has been argued that the work by Giddens (1984) holds much potential for informing the interactions between society and technology (Stillman and Denison, 2011). It is therefore informative to read systems approaches where the work of Giddens on structuration theory has been incorporated (see for instance Turpin et al. (forthcoming)). A significant move

forward in terms of the topic of this paper would be if indeed the dynamics of adolescent career choice-related movement could be explicitly accounted for, rather than effectively being an unintended consequence of technology based community development projects. Given the importance of especially gender in career choice literature, it is important to note that SSM can at the lowest level incorporate both political and gender dimensions (Collin 2006).

The significance of transdisciplinarity

Although limited work has been done in this regard, the confirmation by Turpin et al. (forthcoming) that notions borrowed from autopoiesis such as structural coupling, self-production and others are useful in providing ways of systems impact assessment in technology based community development would indicate that carefully considered new metaphors for the social systems involved may provide new insights and new avenues of exploration.

Issues in the application of systems methods

The following issues need to be noted when a Systems Thinking approach is adopted for research into this area: (1) The approaches adopted should preferably be human-centric and should be able to accommodate personal constructions within a systems view (Pryor and Bright, 2003); (2) The tension line between hard and soft systems views could emerge in terms of the (typically) largely top-down approaches of agencies involved in socio-economic interventions vs. the focus on the individual in terms of career choice (and the preferred bottoms-up philosophy of community informatics) – the understanding of systems approaches as epistemology vs. ontology may therefore need to be considered and explicitly accounted for; (3) Both the risk of oversimplification and consequent loss of cultural nuances (Turpin et al, forthcoming) and the risk of too much complexity (Pryor and Bright, 2003) need to be considered; (4) There is a risk of too much description and too little explanation (Pryor and Bright, 2003, op. cit.).

Knowledge contribution and benefits of a systems approach

Given the preceding arguments, would the addition of systems views therefore have potential to better understand the tension line between (top-down) national ICT4D initiatives aimed at national and community level benefits, with the potential individual agency related to individual betterment through career choice, and the bottoms up philosophy favoured at community level in Community Informatics?

It seems that there is potential, through first of all creating awareness of the overall landscape, its systemic properties and by focusing on the relationships that exist within the landscape. Through an explicit accounting of the sociotechnical impact of a technology based community development intervention on the hierarchy of systems involved (individual to society), the impact of individual agency can also be better understood.

At a practical level there is the potential for the development of practical guidelines for incorporating individual career choice and development as concept in technology based community development initiatives and allowing for an explicit articulation for individuality within the context of community-based technology based community development initiatives. Also there is the potential for the development of more holistic articulation of such developmental initiatives that will allow for the conceptualization of intervention that simultaneously benefit all levels of society (individual, community and national). This holistic articulation would be bottom-up and include understanding of the interaction between human systems (i.e. those related to inter alia career choice) and technological systems implemented at community level. Improved human-centric monitoring and evaluation frameworks and processes may emerge. Better understanding of unintended consequences of

technology based community development interventions conceived at national level but impacting on other levels of society may improve the formulation of these initiatives.

From a career choice perspective there is the potential for better understanding of the impact of contextual factors, i.e. factors outside of the cognitive and affective domain of the individual on career choice thus expanding insights related to the importance accorded in traditional studies to the socio-economic status of parents and the impact on career choice (Young, 1983).

Importantly, better understanding of the individual lived experience of the significant boundary crossing moment from school and community system into training and vocational systems, which has long been a burning issue in vocational literature (Young, 1983 op. cit.) could lead to the implementation of practical ways to assist these young adolescents during the boundary crossing phase (Collin 2006) – thus enabling practical support for choice of career by individuals from rural areas (taking into account their specific circumstances), guidance on overcoming the challenges of moving to a new learning and work environment and finding ways once settled in the new system of dealing with the relationship with the previous social system (i.e. the community).

The implications of systems thinking for community development

Systems thinking, with the exception of Soft Systems Thinking does not provide clear indications of the immediate actions that need to be taken as part of community development (Morgan, 2005). Instead the benefits of Systems Thinking are that it is a mental model that advocates a certain mindset when engaging with the notion of community development. This mindset is one which according to Morgan (ibid) has the following important characteristics: (1) It leads to awareness of the systems that one is part of and the bigger systems surrounding the local sub-systems; (2) It enables better understanding of time implications of developmental initiatives (in the instance of this paper it would entail both thinking about the short term technology implications and longer-term human capital implications around the future careers of young community members); (3) Systems thinking is particularly good for the understanding the connectedness and nature of relationships of systems actors. Understanding the nature of connections and networks between various sub-systems (e.g. community and professional sub-systems that would be of interest in the instance of the junction between career and community development) has the potential for yielding valuable insights; (4) Systems thinking does not consider change and instability as inherently threatening, therefore the adoption of a systems view would allow for searching opportunities and strengths in these unstable conditions where there is human movement in and out of systems. These benefits have the potential for both changed thinking and changed action (Morgan, op. cit.).

Systems thinking in general is dialogue friendly and fosters dialogues to take place. From a community perspective systems thinking is therefore more closely suited to a bottom-up approach to development than some more traditional project-based thought systems based on high levels of top-down control and prescription.

The following table has been compiled to highlight examples of how notions of career choice (and human capital development in general) can intersect with community development projects through technology at both wider (societal and community) levels and more (project) specific levels:

Table 1: Suggested application of Systems Thinking to the intersection of career choice and technology-based community development projects

	Thinking (Expanding the mental model)	Doing (Changed activity)
Community and Societal levels	Viewing the bigger system and understanding the system boundaries better and	Movement and advocacy by community members of a preference for non-

	<p>empowering community representatives to understand this</p> <p>Adopting a socio-technical view amongst all role players</p> <p>Expanding the socio-technical system by adding human capital (and career choice) as a sub-system and understanding its impact/interrelationship with other sub-systems and empowering community members to understand the longer term human impacts related to shorter term technology innovations and projects (Andrew and Petkov, 2003).</p> <p>Explicitly trying to understand the impact on career and employment of technology initiatives within rural communities. Some lessons could potentially be learnt from the Swedish Biofuel Industry (See Hillring, 2002) where systems thinking contributed to understanding the context as well as to allow integration of ethics and values.</p>	<p>reductionist planning approaches</p> <p>Expressing preference for community engagement approaches using critical systems approaches or other emancipatory systems approaches.</p>
Project implementation level	<p>Mindshift from operational control towards better understanding by all role players of the importance at project level of embeddedness of choice and interdependency of actors in the formulation of projects; thus enabling community members to advocate for inclusion of matters related to the human capital development as part of choice and interdependency issues.</p>	<p>Adopting project management measures that allow for constant agile adoption of project direction in terms of multiple role player views. Implementing projects that focus on human capital development (and careers in technology) as an explicit part of sociotechnical community development.</p>
Monitoring and Evaluation	<p>Awareness of role players of the need to assess impact of technology on human capital in communities</p>	<p>Developing measures to assess the impact of technology projects on human capital in communities.</p> <p>Better monitoring by communities of the impact of projects on community</p>

		human capital
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Conclusions

Both technology based community development as well as career choice are well established areas of research with significant bodies of knowledge informing those active in these fields. This paper does not attempt to argue otherwise, however the existence of socio-economic ICT related (top-down) initiatives imposed from higher levels onto communities, that create potential for individual development through vocational choice and career development seems to create interesting tension lines that need to be further explored. Technology based community development discourses do not adequately address individual development needs in the context of rural communities, and career choice discourses largely tend towards a de-contextualised view of the individual. In this context, the author argues that the phenomenon seems to present systemic properties, which, if better understood, could clarify the interaction of individual, community and society at large, and provide guidance for improved ways in which technology-based developmental initiatives by government and other developmental agencies at higher level should be formulated in order to allow for benefits to accrue at all levels, especially community level. Although both technology-based community development and career choice knowledge areas have voices arguing for a more extensive Systems Thinking approach, this approach is not mainstream in either discipline. However wider adoption of Systems Thinking in this context has the potential to enable significant knowledge creation at a conceptual level, combined with a more holistic approach at a practical level to technology based community development initiatives, specifically those aimed at increasing e-skills and e-astuteness in South Africa as a society overall, but especially in developing rural communities.

Acknowledgements

This research has been supported by the National Research Foundation of South Africa.

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