

# INDIGENOUS KNOWLEDGE: A PATHWAY TOWARDS DEVELOPING SUSTAINABLE ICT SOLUTIONS

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**Abstract - Rapid development strategies are needed in the third world, particularly in rural areas, to come with innovations that could help curb the digital divide and improve the livelihoods of many. Indigenous knowledge (IK) stands as a key element to foster ICT driven solutions that are owned and used by the people. This paper reports on the use of indigenous knowledge to provide solutions for underprivileged and disadvantaged communities focusing on localized e-commerce solutions using indigenous knowledge. This will allow developers to start bridging the digital divide and will encourage development of computer tools that will foster better learning habits, literacy and community involvement in e-commerce implementations.<sup>1</sup>**

**Keywords:** e-commerce, SME, ICT, Indigenous knowledge,

## I. INTRODUCTION

Many of the community-related projects involving technology which have been implemented in rural areas so far have failed. At national level, this has resulted in the inefficient expenditure of millions of Rand. Potentially, such money could have used to fund viable sustainable projects, ideally owned and maintained by the target community itself. In order to contribute to addressing this issue, we have developed a framework of intervention, in the form of a cycle based on indigenous knowledge (IK). This will facilitate projects, allowing the community to partake in the development of ICT solutions and also to reap benefits from whatever output the project may have. An added benefit is that we are able to preserve the

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cultural aspects of the community while promoting excellence and modernity.

Areas in which IK could play a crucial role are: education, music, crafts, technology, communication platforms, data structures, written or oral history etc. It is estimated that the unemployment rate in South Africa is approximately 80%, and the figure is strikingly similar in most developing nations. A new approach that could get technology to work effectively in different contexts, thus solving community problems, could make a valuable contribution. As an example, this could be applied to an e-commerce platform for Small Micro Enterprise (SME) ventures. By experimenting with IK in new contexts, we also attempt to challenge the view of IK as referring simply to old-fashioned traditional or cultural knowledge.

The paper is structured in the following way: first we will discuss IK, then the framework we have developed, followed by a discussion of its adaptability to e-commerce and to development in general. Finally, we describe the implementation of a localized e-commerce music component for the Fort Hare Centre of Excellence project in Dwesa. This paper is a follow up to the one presented at ICACT 2006 conference [1].

## II. INDIGENOUS KNOWLEDGE

### A. *What is indigenous knowledge?*

Indigenous knowledge (IK) refers to the large body of knowledge and skills that have been developed outside the formal educational system and that enables communities to survive. Indigenous knowledge is local knowledge, unique to every culture or society, which provides problem solving strategies for communities. For this reasons, it is generally knowledge shared within a community rather than held by individuals [2].

As other forms of knowledge, it is difficult to codify. It is embedded in community practices,

institutions, relationships and rituals. It is dynamic and based on innovation, adaptation, and experimentation. The dominance of the western knowledge system has largely led to a situation in which non-western indigenous knowledge is ignored and neglected. It is therefore easy to forget that, over many centuries, human beings have been producing knowledge and strategies enabling them to survive within their natural and social environment. In a nutshell, IK is knowledge shared within a particular community.

#### *B. What are IK Systems (IKS) and how they helped develop the framework*

IK Systems are systems based on IK. They are systems of ideas, methods or strategies that have been devised by communities as a way of adapting to their environment [6] [7] [8]. They usually define widely accepted standards for doing things, and as such are valued and respected. In most cases, they are an integral part of the foundation of each community and are still valued today. IKS could be briefly described as the sets of processes that are followed by a community to solve problems.

Patterns emerging from the observation of the behaviour of people in communities should be taken into account when planning an intervention [9]. This would facilitate the active engagement and ownership of projects. In fact, the community would recognize and appreciate familiar patterns of problem solving in the new context. This behaviour appears to occur in cycles, thus led to the framework of the community-based development cycle discussed in this paper.

We will be using a music /e-commerce platform as a test measure for this intuition. The underlying assumption is that technology has the potential to improve people's lives and help them perform existing tasks more effectively. Each community has its own types of music, traditional dances, songs, singing styles and musical instruments (e.g., overtones in the Eastern Cape Province of South Africa) [10]. These elements can be integrated into an e-commerce platform. Local IK can inform the development of a system that is easy to use and understand for the community.

#### *C. IK and e-Commerce, a way for Africa*

We are convinced that African indigenous products could be sold through electronic media to the world. As it is, the internet is becoming the most convenient global market to reach wealthy potential customers. IK could play a crucial role in the development of new computer-based market solutions. These could help creating job opportunities for the non-formally-

educated but skilled rural communities. This could motivate a faster growth of computer literacy in Africa as the basis for open and localized e-commerce, e-government and e-business solutions in the continent. This could be an initiative to get people interested into using technology. We believe that there is growing interest in original African products and that integrating IK could give such products the "cutting edge" to conquer the market.

#### *D. Role of IK today*

The major aims with respect to IK are to adopt the four P's, which are [3]:

1. **P**reserve the IK and cultural heritage.
2. **P**rotect it in the form of copyright.
3. **P**resent IK to the world and share the knowledge.
4. **P**romote IK in global market enterprises.

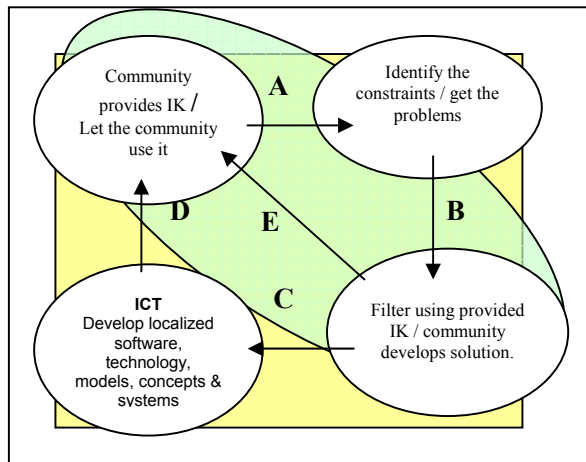
In particular, IKS could make a valuable and innovative contribution to global knowledge. Possible examples could be efficient pedagogies for schools, better tools for farming, new programming algorithms based on societal structures and behaviours etc.

#### *E. IK Summary*

All communities are rich in IK and all communities have IK systems that can be used to inform the development of ICT solutions that work. In the next section we describe a development cycle which takes IK into account.

### **III. THE FRAMEWORK**

Figure 1, below shows a development cycle based on IK. In theory it could be applied to all communities, work environments and the like. The cycle was refined based on a discussion with Sutinen [4] [11]. As a result, it developed into a double iterative system. In particular, the outcome of that discussion is denoted by arrow "E". The darker shade of grey (the ellipse) represents the first cycle and the lighter grey shading (the square) represents the other cycle.



**Figure 1 IK Developmental Cycle**

- A- Access difficulties, they become problems that we solve
- B – Understand the community, use everyday knowledge
- E – Sustainability, when system is in place in the community
- C - Develop a solution, localized to their language and culture
- D – Test it, allow the community to use it with minimum training
- A (I) – Community receives product and begins using it
- / - Defines a separate process

#### *A. The beginning of the cycle*

The cycle is intended to be a pathway towards the development of innovative educational, technological and economical solutions in rural areas. It could also be used to revive dead projects that have been dormant in the community. In detail, the cycle requires the developer or consultant (technological, educational, or economical) to observe the community, collect the existing IK, get a clear picture of the IK systems in place and be innovative with the indigenous technologies. It is important to understand the community one is working with so as to avoid misleading assumptions. No two communities are exactly the same. To be able to come up with community-driven solutions, one has to become “part” of that particular community, in a sense.

(Arrow A) Once in the community, it becomes clear what drawbacks are there and what factors determine them. For example, in the domain of education; questions such as the following should be asked: “Is the way students learn at home better than the way they learn at school?”, “What is the difference?”, “Can we incorporate the pedagogy being used at home in the classroom?” These questions could be triggered by problems such as low pass rates and slow receptiveness of the learner. In this example, the role of the researcher is to take note of the skills, tools and systems within the community used to solve problems,

and see if they can be applied to different contexts in an innovative way.

(Arrow B) It is important to take note of which solutions are appropriated by the community, possibly because they resonate somehow with their daily routine, and which ones are perceived as foreign.

(Arrow C) The outcome is the design of a localized computer system (hardware or software) that uses elements that are familiar to the community. At this stage, it is important to ensure that the system is easy to understand. At this stage, it is possible to design specific tools, possibly redesigning or improving on existing ones.

(Arrow D) The system is given back to the community to be used.

#### *B. First iterative cycle (sustainability: A-B-E)*

The primary goal for this cycle is to have a system owned by and totally suited for the community; localized; generating revenue and that qualifies as an indigenous product with minimal constraints. The community maintains the system on their own and the developer or consultant is no longer part of the cycle. This could also mean that the community can develop their own technology solutions, educational approaches or any other community driven solution based on the IK.

When the system is “looping” in such a manner we can call it a perfect or ideal cycle. This translates into a sustainable model based on IK. Sustainability is by far the best indicator that proposed projects will not die out, as is often the case according to statistics collected at the University of Fort Hare.

#### *C. Second iterative cycle (Maintenance A to D)*

Once the system is in place the community continues to use it and they let the consultants or developers know where they find difficulties with the system or where the strengths are. They test and see if it matches the IK criteria that define the community. Here the developer is re-introduced in the loop and refines, improves the design of the system, which then returns back to the community. Then the cycle continues, according to its iterative nature.

#### *D. The indigenous perspective*

The system does not assume that a user is formally educated, so it simplifies learning in many ways. The solution is understood and owned by the community. The system will use familiar objects that will make it more accessible for a wider range of users. The process of economic and social inclusion of rural areas should follow the various reiterations of the cycle. As companies learn to integrate IK elements with

changing technologies, these will become more accessible to the relevant communities.

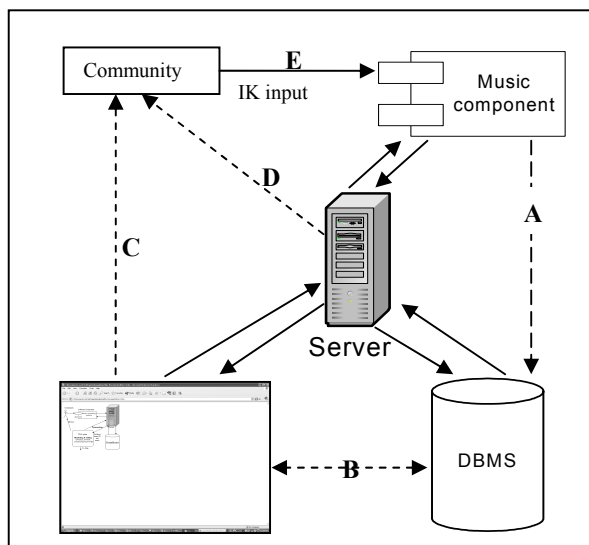
#### E. Developmental Cycle Summary

The pathway encourages localized technology solutions. It will help in the implementation of successful rural projects. The participants also learn to be self-reliant as they can improve the system in the absence of the developer.

### IV. E-COMMERCE COMPONENT

#### A. An e-Commerce framework

Figure 2 shows an initial idea of how the community might use an e-commerce component. The server is used both for a web platform and music component. The database will be used to store music and other material relative to IK. The expected output is the income generated by selling such material on the Web. This is going to benefit the community but it is also important to make the system sustainable. In this example the music component is handled through localized software, custom-made for a particular community. The music component is the only variable in the diagram, and it can be replaced by any other IK-related component. Other examples of components could be e-learning, e-government or knowledge management. All knowledge can be stored. The platform can be generalized and setup so that many components could be applied simultaneously. The database will be used to preserve, protect, present and promote IK according to the principles outlined above.



**Figure 2 E-Commerce platform**

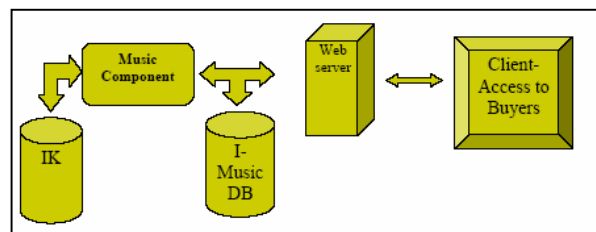
The dotted lines assume proposed actions which are:

- (A) Music is stored in the database
- (B) Transactions between web front-end and database
- (C) Community benefits in cash
- (D) Community getting CD media to sell
- (E) Community provides IK

The solid lines represent actual transactions between the server (which runs all processes), the music component, the web front-end and the 3-tier database system.

The community benefits from the whole structure. This would imply job creation opportunities and could provide a means to alleviate poverty in rural communities.

#### B. How does the developer benefit



**Figure 3 (A to Z) and (Z to A) Analogy**

As explained previously, the developer, investor or consultant are part of the system but are not necessarily involved in the use of a successfully implemented system (see figure 1). Using figure 3 in relation to figure 2, we can actually conceptualize how music data (knowledge) is collected. In any transaction made by the clients, the system developers get a small percentage or profit. This could act as an incentive for more developers to start engaging in this process.

### V. DWESA, A CASE STUDY

The framework described above is being applied to work done at Dwesa [16], a deep rural community area located in the Mbashe Municipality of the Eastern Cape. It is situated in the central Wild Coast, in the former Transkei. There is a nature reserve with the potential to attract tourism, an internet connectivity project, computer literacy projects based on free open source software and various art craft activities. It is also the site of a case study involving field work research and the deployment of a localized e-commerce platform with a music component. An e-mail is being setup and should cater for various e-commerce components to market the sale of music and IK-related material as well as the nature reserve and some small businesses that are in the area, namely B&B's, crafters, etc.

### A. Background Work

In 2004 the main author of the present paper developed a recording platform that allows the community to make music using pre-recorded traditional samples, synthesized to play various notes on the Musical Instrument Device Interface (MIDI) music keyboard [5]. It used a method called *Rhythm per Time (RpT)*, where sound is recorded according to the beat and repetitive rhythm of the African drum. It also works with more complicated instruments such as overtones. The studio had a generic structure, similar to most existing platforms, but will be modified and improved [15]. The main difference compared to existing systems lies in the software, which will be created with the following characteristics:

- Graphical User Interface which uses objects familiar to the community.
- Full localization in Xhosa, the native language of most prospective users of the system [12].
- The sound sample bank will be recorded from the community artists.
- Open Source Software will be used [13][14].
- Easy interfacing to the e-commerce database and other related projects running at Dwesa [16].

### B. The Community

There are unique traits that characterize different communities. In order to understand them, the main author had to spend some time living in the Dwesa community. This provided the opportunity to learn in particular about local music, myths, colours, signs and symbols. This helped to determine, for example the structure and types of icons to use for the graphical user interface.

Learning the language becomes paramount so that the GUI could be localized. Nevertheless, in the process it became clear that people understand pictures better than reading, partly because in rural Eastern Cape the literacy rate is very low. Similar conditions are to be found all over Africa as well. This suggests that the use of a simple but well-thought GUI will improve the rate of computer usage in developing countries. It was interesting to note that, although many people cannot read, they know the basic numeric pad values. As shown in the example of Dwesa, this is because most people have mobile phones.

### C. IK collected

The ways members of the community sing, dance and play instruments were recorded as samples that could be looped later on. For some groups full

recordings were done. Small notes are taken for reference and stored as a knowledge resource. All the data collected was turned into reusable objects for the system. If anyone outside the community wants to use them, they can either pay for the usage or purchase a CD.

## VI. CONCLUSION

It is time to stop developing generic systems and expect them to solve problems in Africa. We should concentrate on developing solutions that will solve African problems more directly by implementing new strategies based on resources such as IK in education, arts, tourism, medicine and many other fields. IK has a major role to play in the development of more efficient systems.

In this paper we presented a framework for the implementation of IK in developing software, hardware and specific tools for interventions in rural areas. We also provided an example of a methodology in system development which can help promoting community ownership, usage, maintenance and sustainability.

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**Gary O.G Ndlovu** is a final year interdisciplinary MA Student in Computer Science, IK and music at the University of Fort Hare in the Eastern Cape in South Africa under the guidance of Professor Alfredo Terzoli and Dr. Gere Pennells. This research is being done for the

establishment of an integrated e-commerce, value add music component for the ICT platform that is being setup and tested in Dwesa/Cwebe. His passion is developing simpler yet effective ways at looking at ICT community development, community involvement and sustainable project deployment. He has a Computer Science background

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