

## **Outcome Mapping as methodology to monitor and evaluate Community Informatics projects: A case study**

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**Abstract:** The purpose of this paper is to indicate how Outcome Mapping (OM) can be used as a methodology to monitor and evaluate a specific developmental informatics project currently under way in the Meraka Institute. OM was applied in the Broadband for All (BB4All) wireless mesh network project which focuses on the provision of broadband to selected citizens/rural communities in South Africa, funded by the Department of Science and Technology (DST). In this project the main focus is the deployment of broadband connectivity in and around selected schools and other government centres such as clinics, Thusong Centres (multipurpose community service centres) and community libraries. Selected areas include Nkangala, Sekhukhune and John Taolo Gaetsewe (Kgalagadi) districts. OM was mainly applied as a monitoring and evaluation framework during the initial/planning phase through to the implementation phase of the project. The result of the usage of this methodology indicated that it can support any development informatics project if applied from the beginning. Detailed feedback from all stakeholders in the project proved to be the major challenge and specific changes in behaviour were documented from the project team right through to the Village Operators in the identified rural areas. This article will also outline what unexpected results and lessons were learnt from specific groups involved in the project.

**Key words:** Monitoring and evaluation, Wireless mesh network, Outcome Mapping, broadband for all, unexpected results

### **Introduction**

Monitoring and evaluation (M&E) frameworks for large scale, multi-level initiatives with a range of stakeholders like BB4All should make provision for ongoing learning and feedback throughout the design, planning and implementation stages of a program. Monitoring and evaluation is planned for upfront and should include continuous assessment of results during the delivery and at the end in relation to the original objectives set for the project. Program implementers sometimes regard M&E as an externally driven and imposed 'policing' action with little perceived value, while policy makers try to understand 'what happened' after project completion and what the short and long term influences (positive or negative) were, which is very difficult in the typically complex environments where even the very idea of causality may not be appropriate. Both of these are common occurrences with M&E in ICT for development (ICT4D) projects. We acknowledge the existence of other M&E methodologies for impact assessment of ICT4D projects (Heeks & Molla, 2009) and want to indicate that recent trends have been moving more towards a participative, learning approach with improved local ownership of M&E efforts, and greater collaboration between policy makers, implementers and community members. This requires that sound M&E frameworks and practices be put in place at the inception stage of an implementation program or research exercise, rather than as an afterthought once implementation is well underway. The M&E framework should be fully aligned with the program design or research methodology, drawing on both quantitative and qualitative data. Ongoing M&E then becomes a project output in its own right, with the added benefits of learning from past experience. The outputs from a well-designed M&E plan can in turn influence the future directions that an ICT program may take. This will allow levels of flexibility and adaptability to changing circumstances to be able to deal with the unexpected and to incorporate the unanticipated into the research results. Emphasis is placed in this article on our interpretation of what M&E should be for the purpose of this project.

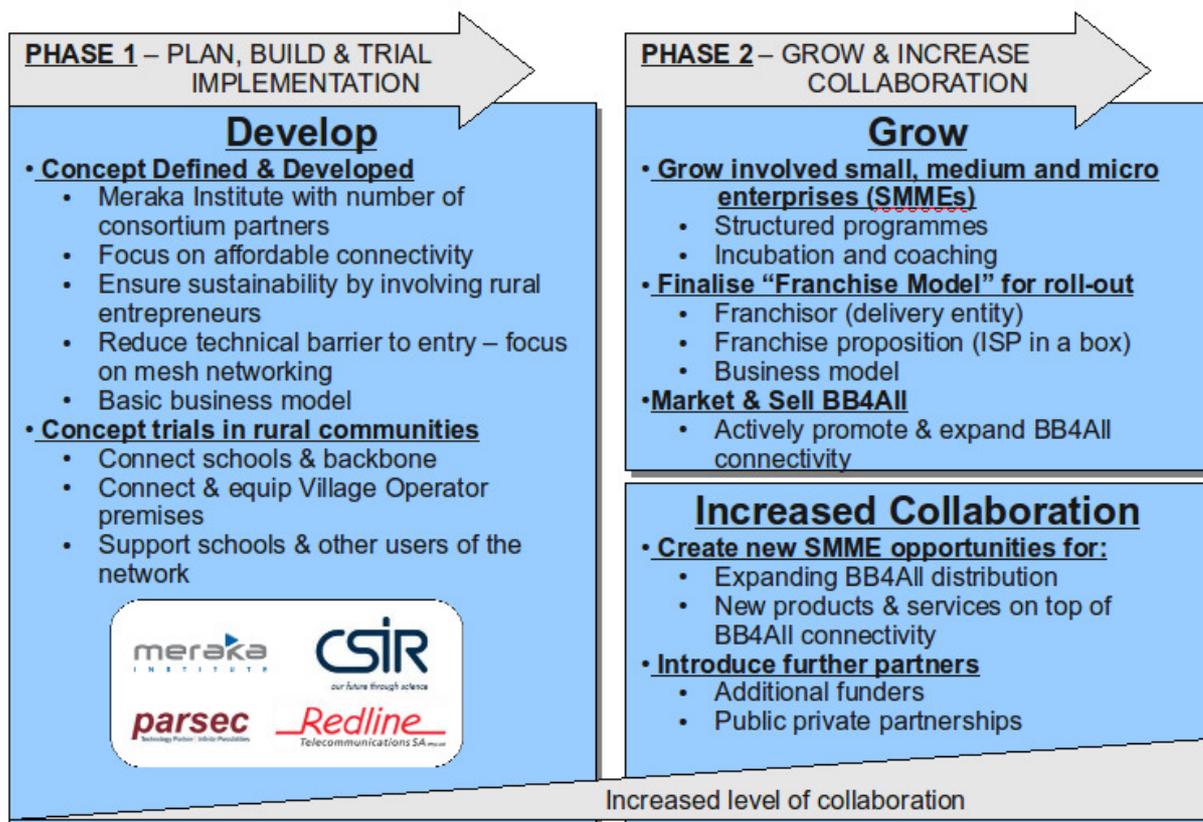
### **Project description**

Broadband 4 All™ is the outcome of a collaborative effort spearheaded by the Meraka Institute of the CSIR to bridge the digital divide and bring social and economic benefits offered by broadband connectivity to rural communities in South Africa and other developing countries. The objective of the project is to offer broadband access to rural communities in an affordable and sustainable fashion.

This will be made possible by utilising:

- inexpensive off-the-shelf and open-source solutions;
- available spare capacity on existing backhaul links; and

- enabling low cost sharing of available connectivity through utilising *Mesh Networking* principles and equipment to expand coverage within local communities negating the need for expensive network equipment and high radio towers. Figure 1 illustrate the project:



**Figure 1: BB4ALL project description**

The *Broadband 4 All*<sup>TM</sup> project is funded by the Department of Science and Technology (DST) through the Sector Budget Support programme of the European Commission, and implemented by the Meraka Institute of the CSIR. This project is deployed in various underprivileged communities in selected areas (Nkangala, Sekhukhune and John Taolo Gaetsewe/Kgalagadi) districts in South Africa. In this project the deployment of broadband connectivity started around selected Dinaledi schools (schools with a specific focus on Science and Mathematics teaching) and expanded to other schools and government offices and centres such as clinics, Thusong Centres (Multipurpose community based service centres) and community libraries. It provides affordable broadband connectivity to areas that are currently not connected utilising low-cost, locally-owned and supported infrastructure to create socio-economic and commercial opportunities.

To ensure sustainability of this initiative, the local community and more specifically an adequately skilled and trained local entrepreneur also known as a Village Operator will be responsible for operating, promoting and expanding the *Broadband 4 All*<sup>TM</sup> offering in their respective communities. As part of the first wave of ICT4D, called ICT4D1.0 (Heeks, 2008) telecentres has provided important learning on how to bring internet access to rural areas and the sustainability issues have been extensively researched (Kendall & Singh, 2006; Tschang, Chuladul & Thu Le, 2002). However Donner, Gandhi, Javid, Medhi, Ratan, Toyama & Veeraraghavan (2008) point out the need for face-to-face communication as a natural way for microenterprises to do business and hence the need for the physical presence of the Village Operator, and not just a centralised Internet Service Provider. The physical presence of a support person was also made explicit in research done by Van Rensburg, Smit & Veldsman (2007), Van Rensburg, Veldsman & Jenkins (2008a) as well as Van Rensburg, Veldsman, A & Lähde, K.(2008b) in their work on the role of the Infopreneur, social incubation and taking a technologist to become social enterprise developers. Internet access should

therefore not only be allowed but should also be made a reality through the intervention of a specific person who can support and maintain the infrastructure provided in a specific community.

Citizens living in rural communities will be the primary beneficiaries targeted by this initiative. They will however not be the only group to benefit from the Broadband 4 All™ project. The following is a non-exhaustive list of parties that could derive direct or indirect benefits from the initiative:

- Traditionally unconnected rural communities and individuals within these communities;
- Village Operators that will be responsible for operating the service;
- The greater SA society towards bridging the digital divide, reducing poverty and creating opportunities for job creation, new business development and community wealth generation:
  - National & Local Government;
  - Other Public Service Providers;
  - SA Private enterprises of all sizes
- Prospective Broadband 4 All™ partners that will be assisting with funding, rolling out and introducing further opportunities to make use of infrastructure and connectivity.

The system features mesh networking, low cost voice/messaging devices, low cost access points and antennas and network security. With the basic infrastructure in place, a rural community can grow a wireless network in an ad-hoc manner without the need for large capital investment in radio masts. Affordability, sustainability and innovation were the key drivers to establish locally owned, community driven and self-supported broadband access that could allow even people of the most remote rural villages to leverage a national innovation system for broadband access. This access in turn would stimulate local economic development, open innovation and create a bottom-up value system for the provision of a communications infrastructure for government offices and the poor in under serviced areas. The opportunity for local communities including local entrepreneurs to provide input and define value-added services will stimulate the development of local technologies, local innovation and local services.

The project will not only focus on providing access to the Internet via a wireless mesh network for communities, but will also ensure that capacity development and social upliftment of community members are supported through the selection and training of Village Operators (VOs). These VOs have been identified by their communities as potential candidates and underwent an extensive screening process, which included numeracy, literacy and entrepreneurial aptitude assessments. Those who were successful underwent training in computer literacy, business planning, technical training in maintaining the network as well as safety training (most of which are accredited SA Qualification Authority unit standards).

It therefore implies that people from specific rural communities will be invited to start their own small businesses that will provide specific ICT and related services in their communities by maintaining the wireless mesh network and providing Internet access.

### **BB4All strategic plan**

The BB4All project is thus a multi-level, multi-stakeholder initiative seeking to provide connectivity in different rural areas to a range of users. The complexity of the project demanded particular attention to the strategic approach. The strategic plan covered the main elements of vision, mission, objectives, action plans and guiding principles in a multi-faceted implementation environment. The vision formulated for the project from an executive perspective started with the concept of providing broadband connectivity for all people and then delved into the specifics of delivery. The vision statement developed during the strategic planning sessions was:

*The BB4All programme seeks to influence policy, mobilise resources and position people in government, education and the community to work towards the vision of low cost broadband access in previously underserved areas. This requires direct policy and implementation support from government across a number of departments, integration into learning and teaching and incorporation into community life.*

Clustering of stakeholder groups was done to deal effectively with the range of people involved in the project and to be able to develop mission statements for each of the clusters. From the executive perspective, the main clusters identified were government, education and the Village Operators. The strategic planning exercise was repeated at the operational level from a VO perspective. The focus of the mission statements at the VO level was on the operational details of a VO business. In the process a broad range of mission statements were developed across all the levels of the project. The important issue is the key words used in the mission statements. These were: supporting, aligning, prioritising, influencing, demonstrating, creating, testing, refining, expanding and sustaining.

The objectives of the project were defined as specific project partner activity outcomes, which is a requirement of Outcome Mapping as a M&E framework (Earl, Carden & Smutlyo, 2001) which is discussed in the next section. At the government cluster level it included changing policy, relaxing regulatory constraints, supporting research, allocating budgets, endorsing initiatives, aligning strategies and contracting service providers. In the education cluster, attention was paid to dealing with e-education policy, assigning responsibility, support of ICT enabled teaching/learning and schools becoming champions of e-learning. At the VO level the objectives dealt with user take-up, sustainability, service excellence and network growth.

Action plans were developed in support of achieving the objectives with regards to individuals in the project as well as the environment in which the project has been deployed. Strategies for individuals included generating and distributing information, arranging meetings and contact sessions, training, capacity building, support, mentoring, capturing lessons learnt and building relationships. Strategies for the environment involved providing a realistic mechanism and eco-system for implementation, influencing policy on achieving broad-based connectivity, using publications and the press to promote BB4All, and establishing ICT communities of practice in rural areas.

The guiding principles of the project are defined according to the research agenda of the project, with a specific emphasis on prospecting for new ideas, identifying opportunities and resources, seeking feedback from key informants, gathering support, assessing and redesigning processes, capturing and sharing best practices, sharing wisdom, experimenting to remain innovative and engaging in organisational reflection and to build a connectivity network that is practical, easy to manage and maintain and speaks to the needs of the people.

The main emphasis of the BB4All project is to conduct research in cooperation with a range of partners, to find innovative solutions to connectivity problems in deep rural settings, and to implement the solutions in a systemic and replicable way. The focus of the monitoring and evaluation activities in the project therefore is on ongoing learning and innovation.

It is thus evident that many aspects of the projects can be discussed but for the purpose of this article the main focus will be on explaining how the M&E aspects were planned, arranged and implemented over a period of one year since inception of this project.

### **Monitoring and evaluation requirements**

The progression chain for monitoring and evaluation covers the following: planning, activities, outputs, outcomes and possible impact. The BB4All project dealt with the M&E requirements systematically through all the elements of the chain. The funding was allocated for Key Performance Areas (KPA) with specific indicators and targets. The broad details are shown:

**Table 1: KPAs, indicators and targets**

<b>Key Performance Area</b>	<b>Indicator</b>	<b>Targets</b>
Social Imperatives	SMME development	15 x rural SMMEs ('Village Operators') delivering broadband in each of 3 areas (a total of 45 SMMEs over a period of 3 years)
	Job creation	Minimum 1 person employed (entrepreneur/manager) and 1 person contracted on part time basis for every SMME in the

		network
	Skills development	Training in Wireless Mesh Networking and entrepreneurship / business to be provided to 50 youngsters for future capacity. Network of local mentors and trainers to be established to deliver training and support SMME development
Access – local affordable broadband	Cost of access	Free (public) access to ICTs at the municipal ward level in 15 clusters – Internet Café style. Local (SMME) charging only for selected services.
Service delivery	Government facilities connected	Minimum of 450, and a potential of up to 900 government facilities to be connected and supported by the ‘Village Operators’ by Dec 2011
Local manufacturing	% Local content	Local (SA) production line for at least 2 key products in local (community) networks (by Dec 2011)

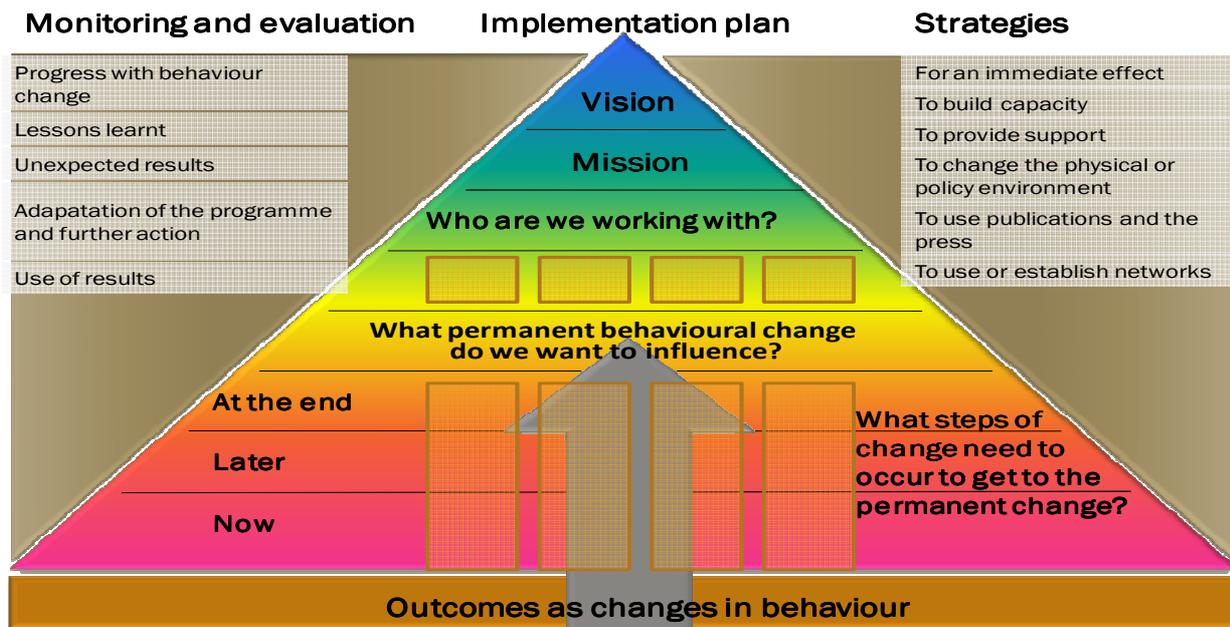
The project implementation is a phased approach of concept development, concept trials, leading to growth and increased collaboration. Beyond the project KPAs, the project brief also describes anticipated benefits to stakeholder groups regarding service delivery. For example a rural community would experience improvements in communication, healthcare, access to information, job opportunities and even quality of life.

The BB4All™ project is therefore faced with the requirements of having to integrate quantitative measurements with qualitative results to satisfy the overall research and implementation requirements of learning and documenting the results. Provision also has to be made for tracking changes in stakeholder behaviour, measuring attitudes and opinions and dealing with the unexpected.

### **Planning the project and M&E activities**

When this project was initiated one key requirement from the funding body (DST) was to provide feedback by applying the Logical Framework Approach (LFA) as a methodology in order for them to reflect on the impact they have had through quantitative evidence. For the purpose of this project it was decided that we cannot only reflect quantitative data but also need to provide feedback on how this project changed the behaviour and lives of people within the communities and therefore qualitative data should also be provided. Outcome Mapping (OM) was designed to build learning and reflection into development programs (Earl, Carden & Smutlyo, 2001). OM is a monitoring and evaluation framework which allows researchers to track behavioural changes. OM together with the Logical framework methodology of the funder was thus applied to measure progress. OM focuses on influencing changes in the behaviour, relationships, activities, or actions of the people, groups, and organizations with which a program works directly (boundary partners). OM provides the route map and data gathering tools to produce evidence based results (Earl, Carden & Smutlyo, 2001). Ambrose and Roduner (2009) refer to the combination of the LFA and OM methodologies as a fusion approach.

Outcome Mapping provides a central M&E implementation plan framework (IDRC, 2008) to specify everything you need to consider to create a rich tapestry of activities in support of achieving the overall objectives of a project. The vision sets the overall direction, supported by a set of mission statements. These broad considerations become meaningful when applied to the groups and people that the project will be working with directly (Boundary Partners) and what final behavioural changes in the group are anticipated (Outcome Challenge). Within each group of Boundary Partners, also known as the stakeholders, a systematic approach to behavioural change is envisaged as a series of rungs on a ladder of progress in influencing behaviour towards achieving the overall objectives. The ladder starts at the bottom rung in terms of behavioural change to be influenced immediately (Expect to see), how this relates to changes in behaviour that will happen later (Like to see), how this creates the foundation for progress towards the top rungs of the ladder in terms of what will happen at the end (Love to see). This progress can then be placed in the context of the remaining rungs of the ladder involving the outcome challenges for project partners, the mission statements and the vision at the top of the diagram as is indicated below:



**Organisational practices**  
**Figure 2: OM implementation diagram**

Strategies are formulated in support of the central core of the implementation. These strategies focus on what the project executive needs to put in place and to influence the participants and the environment. Organisational Practices documents the underlying philosophy and policy as well as how the project executive will reflect on their internal processes to achieve the project objectives.

The overall emphasis is on changes in behaviour of all the participants and mutual behavioural change influences. This does not only involve the boundary partners, but should extend to the project executive. The monitoring and evaluation process measures progress against planning, based on recording the results in journal format, tracking progress, recording lessons learnt, dealing with unanticipated results, adapting the programme and using the results (Earl, Carden & Smutlyo, 2001).

### Outputs and outcomes envisaged

The idea behind this project was not only to provide new and cost effective ways of using broadband but also to build capacity amongst community members in rural areas through the identification, selection and training of VOs from the different communities. Also important is to influence policy on broadband provision at governmental level and to stimulate local manufacturing and maintenance of the network by members of the different communities.

The Broadband 4 All™ project will benefit rural communities and individuals within these communities in the following ways:

- Improved basic communication
- Direct savings in travel expenses
- Creating economic opportunity in the rural communities
- Improved Quality of Life
- Access to employment
- Improved delivery of Education
- Enhanced access to Healthcare and Point-of-Care solutions
- Access to Financial Services
- Access to other virtual services

Village Operators will benefit through:

- Employment
- Skills acquisition and career development
- Developing sustainable businesses and contributing to economic development
- Transfer ICT knowledge obtained to other members of rural communities
- Earn credits towards formal ICT qualification
- Growing local Broadband 4 All businesses to create opportunities for more people

The Broadband 4 All™ project offers national, regional as well as local government a very effective channel for delivering services and communicating with traditionally unconnected rural communities, with specific benefits in:

- Education
- Health Care and Point-of-Care Solutions
- Virtual points of presence and service delivery points for all government departments
- Extending the Public works program to include services sector
- Acting as channel for general government communication
- Collection of field data

Monthly reporting is done by an executive project team which represents key facets of the project: stakeholder engagement, project management, backbone infrastructure, technical development, direct and regular access and communication with communities and VOs, business modelling and monitoring and evaluation by using progress markers. Responsibilities were identified in the executive team after OM training was provided as to who will be reporting on what aspect on a monthly (Progress Markers), quarterly (Strategy Journals) and six months basis (Performance Journals). This will ensure that all the intentions and influences, unexpected results, lessons learnt and additional categories are addressed.

The focus of the reporting will be on:

- 1) Village Operator & network as well as the Village Operator customers
- 2) The education sector: locally, provincially and nationally
- 3) Government and Organisational practices: locally, provincial and nationally

This will assist the project team to keep focus, communicate regularly and check progress.

The dialogue with the VOs will be facilitated through direct face-to-face interviews, email and Skype sessions in order to ensure consistent feedback after they have also received training in what OM is and why their feedback is important.

### **Impact**

The BB4All project seeks to change the face of rural connectivity, by providing backbone infrastructure across underserved areas, creating points of access in a mesh configuration in these regions and placing competent and equipped VOs at these access points to provide a range of affordable ICT services to rural communities. The long term permanent change created by the BB4All™ project starts with bridging the digital divide for rural communities in Africa, bringing the social and economic benefits offered by broadband connectivity to these communities, assisting the development of a new generation of ICT users, creating an enabling environment for people to change their lives and ensuring long term community ownership of the ICT resources.

### **Lessons learnt/unexpected results**

A few lessons learnt from this project were documented and can be summarized under specific headings. The first area where unexpected results have occurred were under the **Education cluster** where it became evident that the current education system is driven by paper-based documents and hence Internet-based banking, faxing and fax to email services will save time and reduce travel costs. Suppliers to schools are paid with cheques or deposit slips which are faxed after the deposit was made at the bank. There is also a costly dependence on mobile phone services where the circuit office is frequently called around examination times

using the headmaster's or teachers' mobile phones. Subject advisors are also phoned frequently. E-mail and Voice over Internet Protocol (VOIP) would reduce these costs. Distance education students are a big market as these students have to pay a high fee for doing Internet research, printing and binding of their assignments. Computer repair services are in high demand. Many school computers are crippled by viruses. These services are however, mostly non-local and expensive, or local and of questionable quality. The circuit managers of the Provincial Department of Education are key partners. Some principals refused access to schools if they had not been informed via the circuit managers of the project.

Key lessons or unexpected results from the **Government cluster** were that the Department of Communication has initiated a consultation process on national broadband policy and the Independent Communication Authority of South Africa (ICASA) has published regulations for class licenses which the VO's will have to comply with. The South African Presidency has published the medium term Strategic Framework and the Department of Science and Technology in SA's 10-year Innovation Grand Challenges documents. Both focus on ICT and how it can initiate human capital development. It is difficult to manage expectations (political and delivery) with capabilities and readiness (in the field).

Unexpected results from the **Village Operator network** were mainly (1) the level of commitment from the Field Support Personal (FSPs) who are local business and technical experts, responsible for supporting and mentoring the VOs; and (2) the social commitment of the selected VOs to create a trust relationship with businesses in their own communities and to market the use of the Internet in order to show people how it can improve their lives. The VO business should only be a one-man business initially, as there is not enough business to sustain two persons until the business grows substantially. An additional 25% of VOs were trained to cater for attrition and business growth. A blanket written permission to access schools prior to commencing with surveys, was secured so that it could be presented directly to Headmasters when first approaching them to set up survey appointments. Good working relationships with Circuit level managers and Province representatives proved to be critical when working with government departments in rural communities. Their involvement in identifying potential Village Operators are imperative when conducting the assessment and selection processes, as well as technical site surveys. VO support persons needed to be appointed as soon as possible, so that they could assist in "smoothing the way" with local authorities when moving into new areas.

Unexpected results from the **Backbone deployment** were that there are not always high sites available from the companies with which Meraka had prior experience (Eskom and Sentech) to cover the areas into which the backbone must be extended. Thus the project team had to initiate new relationships which caused significant delays (e.g. using Vodacom towers or SA Defence Force towers for access). Meraka acquired an existing wireless telecommunications backbone in order to gain more control over deployment and extension. In addition, cellular phone providers' cost for site sharing is prohibitive. The lesson learned was advance identification of possible high-sites and relevant contact people required (build a database of high-sites and contact people). Regular quality checks are essential to ensure that installers and equipment suppliers will do a quality job (check quality of physical installation as well as wireless links). Ensure that access procedures to backbone equipment sites are formalised and in effect (know who the high-site owner is, know who the land owner is, who must be informed and how that site will be visited, who has keys, procedures if something goes wrong - e.g what if power goes down/vandalism takes place). Try to choose sites in such a way that risk of not gaining access is minimised. Keep in mind that lead-time for equipment orders are invariably longer than expected. Remember that internal organisational procurement processes must be followed. These formalities can add delays to processes of identifying suppliers and ordering of equipment if multiple quotations are required. Equipment must be chosen in such a way that:

- it is easily upgradable to higher bandwidth (software vs. having to replace equipment);
- can be re-used in other places on network should it become redundant / unsuitable for current site;
- use of different types of radios are minimised – It decreases number of spares that need to be kept on hand (and therefore the cost of support and maintenance); makes support and maintenance easier.

Ensure that the network architecture is properly documented and plans are kept up to date: types of equipment, Internet Protocol addresses, etc. This prevents surprises when arriving on site to do support and maintenance and facility troubleshooting. Although wireless bandwidth is "free" and equipment costs usually a once-off outlay, high-sites rentals are (significant) recurring costs. The project team needs to consider upfront who will pay for this.

Unexpected results from the **business modelling side** of the project was the way in which it provided the project team with a means of integrating the different (natural) silos of project activity such as technical development and Village Operator deployment through the documenting of business processes that are being developed on demand as the project progresses. The modelling activities also highlighted that the project team is dealing with a *designed physical system* (the telecommunications and business infrastructure) and a *human activity system* (the development of Village Operators) (Checkland, 2001). The mapping of processes for each area of the project highlighted dependencies that were not self-evident in the project planning phase.

## Conclusions

The specific integration of OM as a M&E framework for identifying the changes in behaviour together with a Logical Framework Approach to reflect quantitative data is therefore evident. Emphasis throughout each phase of the BB4All™ project is placed on feedback on progress markers which were identified for each boundary partner or stakeholder and to ensure that the project is still focussing on its key vision, mission and objectives. OM as an approach assists the executive team in keeping this focus and allows for rich data from VOs to ensure that quality feedback is incorporated and lessons are learnt from each intervention in each specific community. Without the application of OM in this project much of the rich information would have been lost and access to technology will not be understood by all members of the community. The use of OM since the inception of the project until the end also may ensure better sustainability of ICT interventions in the rural communities selected and affected through this project as the physical presence of the Village Operator will allow for better uptake of the technology within the community and this can allow for sustainability of use and adoption. To only use the Logical Framework Approach as M&E methodology could limit the details of what is revealed in a project with this complex nature, while the addition of OM allows for the discovery of unexpected results and unintended findings. What is also pertinent is to incorporate OM from the beginning until the end phases of a project and not to wait for the last phase before applying a M&E framework. The usefulness of OM in this project was clear during the planning phase right through to the impact phase.

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