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Networks for Development: Caribbean ICT Research Programme, Trinidad and Tobago

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Research Theme 3: Mobile Opportunities 2.0 - mFisheries

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by

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Abstract

The Mobile Opportunities 2.0: mFisheries research project was a two-year exercise, extended to two and a half years, which focused on the small-scale fishing industry of Trinidad and Tobago with particular emphasis on examining the potential of mobile technology as an enabler of social and economic development. This initiative enabled the University of the West Indies' Department of Electrical and Computer Engineering, assisted by a number of key partners, to conduct ground-breaking studies among fisher folk in Trinidad and Tobago. This work developed and applied capacity in pro-poor mobile application needs assessment, design, development, deployment and evaluation.

Mobile Opportunities 2.0: mFisheries was motivated by key development-focused priority areas articulated by Caribbean public and private sector leaders. Caribbean policy-makers have, for example, expressed keen interest in the development of Caribbean innovative capacity. In the case of Trinidad and Tobago, the Government has set a number of priority areas to which built capacities can be directly applied. These include the narrowing of the digital divide for equity; and the development and growth of the fishing industry on account of its economic and social significance. This project responds to these intersecting calls through the development of innovative, context-appropriate mobile applications and services for small scale fisher folk.

Prior to the mFisheries initiative, there had been little in the region by way of related case study resources, documented methodology and process mapping relating to the design and application of technology to address challenges faced by the poor. Empirical and analytical research therefore comprised a central component of the project and are promoted as the foundational basis for the creation and execution of sound developmental programmes to empower low-income earners such as fisher folk; and to build mobile innovative capacities. The project also highly values institutional collaboration and demonstrates very effective models as core to achieving developmental programming efficiency and effectiveness.

Keywords: *development-focused mobile application; marginalized communities; ICT; bottom of the pyramid; innovation for livelihood benefits; needs-based application development; fisheries sector; Trinidad and Tobago fisher folk practices and challenges.*

The Research Problem

Prior to November 2009, reports conducted randomly within the fishing sector by various interest groups, although insufficiently benchmarked, suggested that the penetration of the mobile phone among local fisher folk as a key communication resource was unprecedented. Even though a rise in technology use and mobile penetration in Trinidad and Tobago was evident, there was little by way of case study resources, documented methodology and process mapping. To a large extent, the mFisheries research project arose from the dearth of reliable and relevant quantitative and qualitative data regarding the small-scale fishing industry and ICT indicators on the usage and impact of mobile communication services on human and economic development. This situation had hindered the capability of policy-makers and stakeholders to make transformational changes and to develop informed frameworks within which various telecommunications opportunities could be harnessed. The logic of mFisheries was therefore to address the absence of critical and consistent empirical and analytical research by applying and ensuring greater uniformity in the data acquisition process as well as comparability with global indicators for the creation and execution of sound developmental programmes to empower low-income earners, such as fisher folk, and to build mobile innovative capacities. From its inception, it was clear that the paucity of enabling institutional linkages would compound the fundamental research problem.

The mFisheries research project took advantage of the opportunity to engage an industry „earmarked' for an overhaul. The PESTLE and SWOT analyses conducted by the Caribbean Fisheries Training and Development Institute (CFTDI) during the development of its Strategic Plan 2009-2013 had outlined the need for decentralized training, open and distance learning initiatives, new business enterprises, improved technology in all areas of operation, introduction of new areas of training, updated legislation and regulatory frameworks, health and safety procedures, advocacy for free flow of information within the industry as well as multi-stakeholder collaboration. In addition to supporting CFTDI's re-engineering of its operations and realignment of the small-scale fisheries sector to meet the challenges of the 21st Century, the mFisheries research project would explore the information and communication needs of fisher folk, their revenue earning activities and their perceptions regarding mobile usability and fitness for purpose as well as the opportunities associated with the provision of mobile services for of this particular group of low-income earner.

The research conducted within the mFisheries project would provide insights into the physical, social, economic and cultural machinery, the players and their operations since the ability to develop a broader understanding of the profiles and processes existing within this ecosystem, was seen as crucial to the

delivery of mobile opportunities that were responsive, functional and relevant to human beings. By exploring a shift from the design of mobile information systems to mobile intelligent systems, the research would uncover knowledge of the possible cycles of innovation necessary to leverage mobile applications for development not only in Trinidad and Tobago but the Caribbean region.

The empirical question central to the overall research exercise was how could the data unearthed by mFisheries inform the design of mobile applications to improve livelihoods by increased economic activity and efficiency at the bottom of the pyramid? Further to this, how could the mobile phone be used to indulge best practices and encourage cycles of use in the small-scale fishing sector? This information would form the analytical and empirical bases for the selection of ICTs in developmental programmes and would be used to inform policy and regulation in the telecommunications as well as the marine sector as policy-makers and private sector social entrepreneurs were keen on the possibilities of offering innovative mobile applications and services through the ubiquitous mobile phone.

Objectives

Various components of the overarching programme, **Networks for Development: The Caribbean ICT Research Programme 2009-2011**, were executed by teams at ECLAC, CTU and The UWI Mona and St. Augustine. The research undertaken by the Trinidad and Tobago team was guided by general and specific objectives, agreed upon through consultations between the IDRC and the project execution team lead:

General Objectives

The general objectives of the Mobile Opportunities 2.0: mFisheries research project, inherited from the parent programme were:

1. To promote multi-stakeholder knowledge exchange and dialogue about the potential contribution of ICTs for economic development and poverty alleviation in the Caribbean.

2. To develop capacity in the Caribbean to pursue opportunities arising from the provision of innovative mobile-enabled services for its poor communities, and to provide related empirical data and analysis to inform Caribbean policy and regulation.

Specific Objectives

The specific objectives of the Mobile Opportunities 2.0: mFisheries research project were as follows:

1. To map mobile service and application use in the fishing industry, with particular emphasis on the Caribbean;
2. To gather data on activities, challenges and needs of fisher folk in Trinidad and Tobago to explore their usage patterns and perceptions of the mobile phone;
3. To develop a Mobile Service Cost Model as a methodology for selecting appropriate mobile implementation technologies and end-user services for the delivery of, and access to, mFisheries applications;
4. To facilitate institutional capacity building in the area of mobile innovation;
5. Based on outputs of the foregoing activities, to design and implement mFisheries applications (envisioned as 3 applications) and to deploy and evaluate their use and applicability among a group of fisher folk;
6. To evaluate the overall project as a means of empowering low-income earners through the mobile phone, building mobile innovative capacities and establishing institutional linkages for collaboration.

Methodology

From as early as the start date in November 2009, the mFisheries project identified and brought key project partners together to plan, execute and synthesize data acquisition efforts necessary to the aforementioned specific objectives 1 through 5. These objectives were carefully distributed across the duration of the project with related tasks and partner contributions.

The first specialized stage in the mFisheries research project was data acquisition related directly to specific objectives 1, 2 & 3 and thus began with immediate effect in November 2009. All intensive fieldwork exercises envisaged in the execution of the stated objective 2 were expected to be completed by May 2010 so as to allow for progression to a second critical stage of data compilation, analysis and needs assessments to inform the development of the stated deliverables in 1 & 3.

Significant to the stated objective 4, was the participation of the UWI in the Massachusetts Institute of Technology (MIT) NextLab Cycle. This partnership which took place concurrently with the data

acquisition stage, served as a timely precursor and impacted formidably on the specific objectives 5 & 6. It actively engaged UWI developers in the full development cycle of mobile innovation for poor communities and provided an ideal incubator for skills development.

Objective 5 was begun in earnest by mid-year 2010 and continued through various iterations of consultation, validation, revision and evaluation through the programme's lifetime. These iterative phases were executed under consultation, as appropriate, with fisher folk and other stakeholders through pre-trial, trial and extended trial phases until the end of the project cycle. Consultations were also held with fisher folk in four other islands to assess comparative inter-island nuances.

The overall undertaking of the mFisheries project comprised several categories of activities including research, implementation, stakeholder engagement, capacity building and dissemination, each executed according to different methodologies.

Research Methodology

Desk, empirical and analytical research were required in support of the Map and the Cost Model as well as the field work, assessments and evaluations. Desk research gathered in the first three months of the mFisheries project included insights into the existing categories of fisher folk in Trinidad and Tobago and matching job-related activities, various fishing methods, depth of operations, local fishing terminology and references, fishing port locations as well as common communication modes, levels of training, literacy and cultural practices.

This introductory knowledge was used by researchers and development engineers to build an initial awareness of the target audience and its environment, to forecast and contemplate the type of data required to achieve the overall project objectives and thus inform the development of a comprehensive survey instrument as well as the project implementation strategy and its phases.

It was determined that a combined quantitative and qualitative survey investigation would be conducted to best understand and assess the needs and challenges of fisher folk which may then be used to pursue meaningful mobile opportunities for improved livelihoods. The identified target group would be the self-employed, who do not own large production or processing facilities. They would comprise four main categories of small-scale fisher folk, namely: fishermen/women (those who catch fish at sea); fish vendors (those who purchase fish from fishermen and sell to customers); fish processors (those who buy fish, process, make and sell fish products) and fish farmers (those who farm fish for consumption).

In consideration of acceptable bounds of error, it was estimated that 500 respondents would be required to complete the instrument across Trinidad and Tobago. The Quantitative Survey instrument (http://cirp.org.tt/mfisheries/pdf/mFisheriesQuestionnaire08%2002%202010.pdf) comprised a common set of questions posed to all categories of fisher folk and was used to gather general information regarding individual characteristics of a sample of fisher folk, their mobile service and usage particulars, general aspects of their work patterns and perceptions and preferences regarding information and communication services.

The Qualitative investigation took place within the structure and setting of a dual moderator focus group in fourteen (14) of the most critical fishing communities to gauge the opinions of fisher folk communities and to identify concerns, needs, wants, and expectations of small-scale fisheries. The qualitative exercise was based on a carefully-crafted agenda with points for discussion. Major conversation themes included community revelations into self image/ societal stratification, quality of life, motivation and measurements of success, current appraisal of industry, future plans, linkages between technology and livelihood benefits, mobile usage, as well as relevant and functional innovation. Using a pre-determined work schedule, as well as the logistical arrangements outlined in the partner contributions of the established MOU, the CFTDI and the UWI were able to conduct and manage the entire exercise in a systematic manner.

Additional research methods included naturalistic observation and immersion in the operational environment of the fisher folk at ten (10) of the fourteen (14) fishing communities. These observations were digitally captured using video, photo and audio in order to provide greater authenticity to the research experience and to efficiently inform the subsequent design and development phase of the project. An informal interview agenda was developed by the UWI to generate multi-media footage documenting ICT user profiles within the fisher folk communities and its public, clients and customers of the small-scale fishing sector, cultural practices and idiosyncrasies, geographical locations, accessibility and operational challenges, critical products as well as the larger machinery of the fishing ecosystem and its economic activity.

Subsequent to the concentrated data acquisition exercise at the project's start, other key data was acquired intermittently over the duration of the project. This variously utilized desk research, for example to identify ICT use in fisheries; and empirical research, for example to assess mobile usage and perceptions of fisher folk in a handful of other islands. Data acquisition also included offshore tests using the triangular return scan method to determine the areas of acceptable cellular coverage for voice and data off

the coast of Trinidad. Subsequent data was acquired using an open source date-, time- and location-stamped android RSSI measurement application running on a mobile phone managed by the Trinidad and Tobago Coast Guard, with scheduled data down loads to the CIRPTT team.

Another key aspect of data acquisition that was conducted on an intermittent basis, starting when the mFisheries application suite was first deployed in a pre-trial in January 2010 and running to the end of the project cycle, is feedback from users. This feedback was gathered in structured ways through brief quantitative surveys as well as unstructured ways, solicited qualitatively through regular face to face and phone check-ins by the project's Field Liaison. Towards the end of the project, an open-ended feedback tool and a survey tool were included as components of the mFisheries mobile application suite.

Implementation Methodology

Key to the implementation methodology was a scheme of human resource allocations in which each team member was given clear responsibility for certain aspects of project work and its deliverables, while sharing responsibility for the overall progression and outcomes of the project. In addition to various specific contracted duties, for example, one team member had the responsibility for all administrative, financial and logistical arrangements, and related reporting, for the duration of the project. The team lead was responsible for the overall vision of the initiative, general supervision of its various components, stakeholder engagement, building of strategic partnerships, advocacy, and technical reporting. Another team member had chief software architect responsibility; another operational leadership of the software development team and related reporting; another field liaison responsibilities; another analytical research and writing, and so on.

The main focal point of implementation for this project was the design and development of the mobile application suite. For this, the agile software model was employed as a best fit for applications targeted at low income earners in the informal sector. Its inherent participatory and iterative nature provide the opportunity for developers and target users to learn with, and from, each other through repeated cycles of contemplation, articulation, exploration, assessment and acceptance. Yet, the process of ongoing engagement in the design and development process requires a great deal of time and other resources for both users and developers. The Field Liaison was therefore a critical role over the duration of the project cycle and ensured that close and regular contact was maintained between fisher folk and the development team.

The application of the technical aspects of the implementation methodology for each of the project's applicable components is captured in the Developer's Manuals, with links provided in the ***Outputs*** section of this Report.

Stakeholder Engagement

A critical aspect of the mFisheries undertaking was relationship building and maintenance. Following the pivotal and enabling commitment of the IDRC through the grant of funds, key strategic and operational partners included the Distance Learning Secretariat in the Ministry of Science, Technology and Tertiary Education (DLS-MSTTE); the Caribbean Fisheries Training and Development Institute (CFTDI); the Seafood Industries Development Company (SIDC); Digicel Trinidad and Tobago; British Gas Trinidad and Tobago; the Trinidad and Tobago Coast Guard; the Fisheries Division in the Ministry of Food Production, Land and Marine Affairs; the Institute of Marine Affairs; the Caribbean Telecommunications Union; the Trinidad and Tobago Network Information Centre (TTNIC) and the Ministry of Tobago Development.

Stakeholders were engaged through regular face to face, phone and electronic communications. The Boundary Partners in particular, that is those whose mandates relate to the small scale fisheries sector, played a key role in the articulation of the direction and particulars of project execution. In many cases stakeholders were invited to share the hosting of mFisheries activities and mFisheries articles were included in their newsletters. A great deal of time and other resources were invested in the maintenance of stakeholder relations over the course of the project.

Capacity Building

The general methodologies used to build capacity were (i) an aggressive approach to collaboration with entities which could provide guidance and support for capacity within the team and (ii) the adoption of an open and inclusive approach to all activities undertaken within the umbrella of the project to facilitate the building of capacities outside of the team.

Dissemination Methodology

The project's dissemination strategy deliberately targeted a broad audience of sector stakeholders, policy leaders, development programmers, software developers, academics, students, fisher folk and regular citizens. The methodology employed a rich variety of channels to reach the various audiences. These included policy and programming briefs, websites, conference and seminar organization and presentation, competitions, workshops, a book chapter, newspaper, news letter and magazine articles as well as

participation on national stakeholder consultations and committees. Face to face outreach activities were also conducted amongst fisher folk in Trinidad, St. Vincent, Bequia, Dominica and Tobago.

Project Activities and Phases

Mapping of Mobile Application and Mobile Service Use among Fisher Folk

The ICT in Fisheries application was built and populated over the course of the entire project. It is an open source web based tool that allows for the location based cataloging of the use of Information and Communication Technologies (ICTs) in the fisheries industry. The application collects reports of ICT in fisheries activity and organizes them into the following categories:

1. Applications (software or ICT services for fisheries)
2. Fisheries Challenges (fisheries problem spaces)
3. Open Data Sets (freely available fisheries data)
4. Research and Case Studies (fisheries research)
5. Other Resources (anything that does not fit into the above categories)

Reports may be associated with any location on the globe. They are presented on an interactive map that users can zoom and pan to discover ICT in fisheries resources. Additionally, reports may be accessed as a list that can be filtered by category, location and attached media. All stored data is freely available through open data facilities via a REST compliant API so that it can be reused in other applications.

The application was designed to expand its initial data set through crowd sourcing. Anyone with Web access can submit a new report. Submitted reports are moderated by an administrator before becoming publicly accessible. Desk research, used to populate the Map, failed to identify any similar research or operational projects addressing low income fisher folk challenges through mobile data solutions.

Gathering of Data on Activities, Challenges and Needs of T&T Fisher Folk

The gathering of data on activities, challenges and needs of small scale fisher folk in Trinidad and Tobago represented the main activity in the preliminary appraisal phase of the mFisheries project. Related stakeholder engagements, survey instrument design, survey deployment, related field work, data aggregation and analysis occupied the attention of the CIRPTT team for the first eight months of the

project. This activity formed the foundation of all subsequent activities relating to the design and development of the mobile applications and related analysis.

As described in the Methodology Section of this Report, quantitative and qualitative surveys were conducted and analysed in order to develop insights into information and communications needs and related challenges and opportunities of Trinidad and Tobago fisher folk. These exercises explored the following general issues:

1. Activity components of fisher folk
2. Key challenges faced by fisher folk
3. Perceived benefits of the mobile phone for fisher folk activities relating to revenue generation
4. Perceptions of the mobile delivery media (user interface; presentation, usefulness, availability of required services, cost factors etc.)
5. Perceptions of mobile action issues (user and system operation; navigation; screen size; keypad input requirements; speed of information entry; media requirements; quality etc.)
6. Perceptions of impact issues (health and wellness effects, productivity gains etc.)
7. Awareness of, use of, willingness to use, and pay for, more-than-voice mobile services
8. Recommendations for supporting services and aspects of an enabling environment

Related outputs capture the perceptions of surveyed fisher folk with regard to the usability and suitability of the mobile phone as a solution to their information and communications needs and provide an analysis of the desk research as well as the empirical data gathered from the surveys and stakeholder consultations. The outputs of this work include requirements specifications documenting the information and communication needs that may be used by policy makers and regulators to inform mobile communications interventions and actions leading to increased productivity in the livelihoods of the fisher folk. The analysis has been disseminated primarily in the form of various seminar presentations, a conference paper, book chapter and ICT magazine article.

Developing a Mobile Service Cost Model

The development of the Mobile Cost Model ran throughout the duration of the project, with refinements and adjustments made according to the general agile model employed throughout the mobile application development activity.

Analytical and empirical research alongside consultation with relevant stakeholders was used to generate a quantitative reference for estimating service costs and comparing mobile communication services, on the basis of costs, for users of mFisheries applications. The result, the "Mobile Service Cost Model for mFisheries" facilitates:

1. Matching of user activities to information and communication attributes
2. Matching of information and communication attributes to technical parameters
3. Selection of a technology base appropriate for users
4. Observation of input user communication activities to develop user activity profiles
5. Estimates of service implementation details from operator pricing schedules
6. Application of service operator implementation details to activity profiles in order to generate technology usage profiles under operator-supplied services
7. Development of profiles of calculated numbers of service usage units across available technologies, whose technical parameters facilitate communications according to the attributes of user communication activity
8. Calculation of relative costs of performing given tasks across available operator-supplied services.

The Web application facilitates:

1. Manual acceptance of user inputs for activity profile generation
2. Tabular and graphical presentation of activity, usage and cost profiles to individual users
3. Provision of comparative profiles of usage and cost for selected profiles
4. Suggestions on operator packages that offer the best cost-benefit matches for individual or group user activity profiles.

This tool is currently being used to estimate the capacity requirements, and associated cost, of mobile data service for fisher folk in Tobago. Based on assessed profiles, estimates range from 450 kBytes to 9.1 Mbytes per week for medium usage, spanning profiles including: regular sea-farers who do not conduct business transactions; regular sea-farers who conduct business transactions; mobile (that is to say, does not sell in one fixed place) fish trader; fixed trader and fixed business. It is planned that the tool will be used to estimate data requirements, and related costs, for mobile service in the Cook Islands.

Facilitating Institutional Capacity Building in Mobile Innovation

The building of capacity in mobile application development, in the context of purpose-driven innovation, ran as a thread throughout the duration of the mFisheries project. The building of such capacities has been recognized by Caribbean policy makers as an important enabler of social and economic development in the region. They are particularly concerned that the region's global competitiveness is increasingly linked to innovation and that, in this area, Caribbean countries do not generally rank well. At the project's inception, the highest ranked Caribbean country by the World Economic Forum for 2010 was Barbados at 43rd out of 139 countries, with an innovation ranking of 53rd. Trinidad and Tobago was the next highest ranked at 84th with an innovation ranking of 94. Jamaica lagged at an overall global competitiveness index of 95 with a ranking of 93 in innovation. Guyana brought up the rear with an overall ranking of 110th and innovation ranking of 114th.

The extensive mobile penetration among the Caribbean poor, the tremendous versatility of mobile applications as well as the relatively low cost and deployability of related solutions, present an opportunity for mobile innovation as the basis for interventions among low income earners. Yet at the start of this project there was little capacity in the Caribbean to undertake mobile application development.

A collaboration between the University of the West Indies and MIT's NextLab program (http://nextlab.mit.edu/) Program was established in order to develop UWI's capacity in the area of entrepreneurial mobile research. A multidisciplinary team from UWI participated in the 2010 Nextlab course which, in collaboration with MIT and ITESM, designed, developed and deployed a mobile logistics application in Mexico. Two young researchers from UWI, Mr. Mark Lessey and Mr. Kevon Andrews, visited MIT and participated in the end-of-course presentations to MIT staff and industry invitees in 2010. Another of the UWI team, undergraduate student and young researcher, Mr. Yudhistre Jonas, spent a few weeks in Mexico with staff from MIT participating in the deployment of the Nextlab mobile application in the summer of 2010. The NextLab exercise facilitated key capacity building for the UWI development team and established the technical foundation for undertaking this localized mobile innovation project dubbed "mFisheries" (mobile Fisheries) in Trinidad and Tobago.

Capacity building in mobile application design and development facilitated by the CIRPTT programme has been extended directly to the undergraduate programme in Electrical and Computer Engineering at The University of the West Indies, the only regional department of its type. Structured programmes include annual programmes comprising a structured sequence of half-day workshops on mobile

application as well as related Web services and database design and development, open to all undergraduate students; a half-day session on development-focused mobile research to all Year 1 students and structured support for students undertaking final year projects in mobile application development. Capacity building has also been extended to the public via workshops and competitions.

The project has also built a Resource Pack for Development-focussed Mobile Innovation as a compilation of information that documents the process of the mFisheries mobile innovation exercise in the context of a generic toolkit. Its target audience is university students but it is also relevant to other mobile application enthusiasts and researchers as well as regional policy and regulatory stakeholders. The pack focuses specifically on the development of context-appropriate applications for low-income earners.

The Pack provides resources to support the contemplation; design; implementation; testing; deployment; maintenance and evaluation of a mobile software product in the context of a specific user environment. It comprises three component toolkits: the Software Development Toolkit; the Software Process Toolkit and the Localization Toolkit. The Software Development Toolkit provides resources relating to software development. The Software Process Toolkit provides resources in support of quality improvement. The Localization Toolkit provides resources relating to context-appropriate insights, challenges and opportunities.

Designing and Implementing mFisheries Applications

The design of the mFisheries mobile suite of applications for fisher folk was guided by the results of the preliminary appraisal and analysis of requirements of the surveyed fisher folk. This activity therefore started roughly eight months into the project's life. Its implementation drew heavily on the skills and knowledge gained through the capacity building component of the project. This implementation followed the agile development model as discussed in the Methodology Section of this Report.

mFisheries functionality revolves around five application components, variously implemented for (i) Android smart phones with data service (ii) regular phones with SMS service and (iii) the mobile and fixed Internet, as follows:

1. Got Fish Need Fish and Prices Virtual market place applications: Android, SMS, Web
2. Compass, S.O.S, GPS and Location Tracking for at-sea safety: Android, (Tracking has a Web interface)
3. First Aid Training Companions and Tips for training support: Android

4. Camera Tool for citizen's reporting and participation: Android
5. Info Zone (mTellUs, mFisheries Feedback and Web Links) for various information services: Android.

At the centre of mFisheries is the suite of Android (mobile) applications for fishermen. Installation of the mFisheries suite of applications onto fishers' phones was purposefully accompanied by a number of free applications relevant to their livelihoods. These include a "Tide App" and "Weather Bug" which display tidal and weather information, respectively; as well as a multimedia Spanish tutorial.

SMS and Web versions of the virtual market place application components have been implemented to facilitate networking of all agents in the small scale fisheries value chain. Web applications have also been built in support of at-sea safety. The *mFisheries Web At Sea Management* application was designed to provide the Coast Guard, or any other authorized agent, a management tool to support emergency response for mFisheries at-sea users. It provides authorized agents access to a map that displays SOS emergency data and GPS tracking data for mFisheries mobile application users at-sea. The logical components of the application are:

1. SOS: This section displays SOS Alerts on a Google map, for registered mFisheries users when they initiate an mFisheries SOS. These alerts are displayed until the SOS situation is resolved. The user's location is identified by a Google marker, color-coded to distinguish between different mobile at-sea users who are in distress. Each SOS Alert includes the following data:
    - Name of the mobile user
    - Date in the format (YYYY-MM-DD)
    - Time in the 24 hour format (hh:mm:ss)
    - Current GPS latitude and longitude
    - Bearing.
    - Contact number of the phone sending the SOS Alert

2. Tracking: This section displays the last known position referred to the "Last Known Point Details" of each existing mobile user who is currently at sea. This position is identified by a Google marker, color-coded to distinguish different anonymous at-sea mFisheries users. Each "Last Known Pont Details" is displayed through a Google Maps info Window, upon clicking the marker, an includes the following data:

- Track Id: Each user's journey is recorded as a track and a pseudo ID is assigned for distinguishing purposes.
- Date & Time
- Last Known GPS latitude and longitude
- Bearing

The tracking section also includes a retractable menu that provides a select list of track ids, used to select and view a track for a given user, a calendar that is used as a filter to get tracks on a specific date, and an auto refresh option that tells the client how much time to wait before refreshing the data. The primary data for the mFisheries Web At Sea Management application is acquired through web services that access databases populated by the mFisheries mobile application for at-sea users. SOS data is explicitly sent by mobile application users while tracking data is implicitly acquired and transmitted by the mobile application once the mobile hand set is powered on and outside of the geo-fence defined by the Trinidad land boundary.

The mFisheries Web Virtual Marketplace application was designed to provide an alternative access channel for the mFisheries applications, *Got Fish Need Fish* and *Market Prices*, nominally accessible through a smart phone. This Virtual Marketplace application facilitates access to fish offer and bid prices from various locations, as advertized by mFisheries users. It also displays the prices of various fish species in two public markets in Trinidad, as acquired by national data collectors. The Web application comprises the following components, each accessible via a main menu item:

1. Got Fish Need Fish: This component, implemented as a web service, displays the seller's fish offer prices and customer's fish bid prices. It also displays matches between the user's posts and posts of other users.
2. Market Prices: This component, implemented as a web service, displays wholesale market prices from sources external to mFisheries. Market prices for fish can be viewed via two options:
    i. By location: The price per lb and the price per kg of all the fish types available at the selected location is displayed
    ii. By fish type: The price per lb and the price per kg for the selected fish type is displayed.
3. Tools: This component hosts a user manual and a link to current weather data
4. Resources: This menu section features a list of hyperlinks that each point to websites relevant to the fishing industry.

Evaluating the Applications

Evaluation of the Web and mobile applications represented the final phase of the 2.5-year mFisheries project and has yielded key inputs into follow on work. Post-deployment surveys and regular engagement with participating fisher folk were conducted to retrieve feedback regarding the application suite's ability to meet fisher folk requirements. In this way, the mFisheries project provided a perfect opportunity to study an authentic cluster of first-time end users of a suite of mobile interventions within a Caribbean specific context. Work processes were examined; and design and development decisions were tested based on user perceptions and acceptance. Evaluations focused on the usage and perceptions of a mobile application suite among fisher folk communities in Trinidad who had, until recently, remained virtually unchanged by information and communication technologies.

In order to explore opportunities for replicability in other Caribbean islands, brief face to face consultations were held with fisher folk in St. Vincent and Bequia in 2011 and in Dominica in early 2012. In the first quarter of 2012, also, consultations and surveys were conducted with fisher folk in Tobago. These consultations provided insights into comparative inter-island nuances and are being used as key inputs for recommendations to policy makers in Tobago.

Evaluations of the applications motivated the development of a diffusion model to guide application developers with a keen interest in development-focused interventions and to provide key inputs into policy making. Evaluations also guided recommendations for follow-up strategies.

Project Outputs

The specific outputs for each of the project components, as itemized below, are hosted at:

Url: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=128&Itemid=100

Username: idrcguest

Password: idrcaccess.

Map of Mobile Application and Mobile Service Use among Fisher Folk

1. Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=129&Itemid=100
2. Map: http://scsee.uwi.tt/mfisheries/map/

3. User Manual: http://scsee.uwi.tt/mfisheries/map/documentation/mFisheries_ICT_in_Fisheries_(Ushahidi)_-_User_Manual.pdf
4. Administrator Manual: http://scsee.uwi.tt/mfisheries/map/documentation/mFisheries_ICT_in_Fisheries_(Ushahidi)_-_Administrator_Manual.pdf
5. Open Data API: http://scsee.uwi.tt/mfisheries/map/page/index/2

An Analysis of Mobile Opportunities among Caribbean Fisher Folk – A Trinidad and Tobago Case Study

1. Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=133&Itemid=100
2. Quantitative Survey Instrument issued to 542 fisher folk in Trinidad and Tobago, prepared by CIRPTT Team 2009/ 2010. Available at: http://cirp.org.tt/mfisheries/pdf/mFisheriesQuestionnaire08%2002%202010.pdf. Last accessed 1 May 2012.
3. Report on Quantitative and Qualitative Surveys of 542 fisher folk in Trinidad and Tobago, prepared by Caribbean Development Strategies (CDS), May 2010. Available at: http://cirp.org.tt/mfisheries/pdf/mFisheriesReport%2025%20May%202010.pdf. Last accessed 1 May 2012.
4. Distribution of Phone Models amongst Surveyed Fisher Folk, compiled by CDS, 2010. Available at: http://cirp.org.tt/mfisheries/pdf/CDS%20PhoneModelsAnalysis.pdf. Last accessed 1 May 2012.
5. Conference Presentation "Mobile Services: The Untapped Resource". Mallalieu, K. 8th Ministerial ICT Strategic Seminar. Port of Spain, Trinidad. February 8, 2011. Available at: http://www.ctu.int/download/KimMallalieu_MOBILE%20SERVICES%20THE%20UNTAPPED%20RESOURCE%20Feb%207%202011.pdf. Last viewed 1 May 2012.
6. Conference Paper "Mobile Opportunities: Exploring Innovative pathways for Marginalized Communities (A Trinidad and Tobago Perspective)" Mallalieu, K.I. and Sankarsingh, C.V. 6th Pan-Commonwealth Forum on open Learning. Kochi, India. November 24 – 28, 2010. Available at www.col.org/pcf6/fp/zTT2307.doc. Last accessed 28 March 2012.
7. Book Chapter: Mallalieu, K. & Sankarsingh, C. (forthcoming, 2012). Contemplating Mobile Applications for Small-Scale Fisheries in Trinidad and Tobago. In Dunn, H. (Ed.) Ringtones of Opportunity: Policy, Technology and Access in Caribbean Communications. Kingston: Ian Randle Publishers.
8. Photo Gallery: http://cirp.org.tt/mfisheries/index.php?option=com_joomgallery&Itemid=88
9. Video Profiles: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=113&Itemid=87

Mobile Service Cost Model for mFisheries

1. Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=142&Itemid=100
2. Report: http://cirp.org.tt/mfisheries/pdf/Mobile_Service_Cost_Model_for_mFisheries_Report.pdf
3. User's/ Administrator's Manual: http://cirp.org.tt/mfisheries/pdf/Mobile_Service_Cost_Model_for_mFisheries_User-Admin_Manual.pdf

4. Developer's Manual: http://cirp.org.tt/mfisheries/pdf/Mobile_Service_Cost_Model_for_mFisheries_Developer_Manual.pdf
5. Conference Paper "Mobile Service Cost Profiler", Lessey, M. and Mallalieu K.I. Proceedings of the Ninth LACCEI Latin American and Caribbean Conference (LACCEI' 2011), Engineering for a Smart Planet, Innovation, Information Technology and Computational Tools for Sustainable Development, Medellín, Colombia. August 3-5, 2011. Available at http://www.laccei.org/LACCEI2011-Medellin/RefereedPapers/EA203_Lessey.pdf. Last accessed 30 April 2012.
6. Service Cost Model (software application): http://scsee.uwi.tt/mfisheries/profiler/.

Resource Pack for Development-focussed Mobile Innovation

1. Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=135&Itemid=100
2. Software Development Toolkit: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=147%3Asoftware-development-toolkit&catid=66%3Aoutputs&Itemid=100
3. Software Process Toolkit: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=148%3Asoftware-process-toolkit-&catid=66%3Aoutputs&Itemid=100
4. Localization Toolkit: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=149%3Alocalization-toolkit&catid=66%3Aoutputs&Itemid=100.

Mobile Suite of Applications for Fisher folk

1. Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=137&Itemid=100
2. mFisheries Brief: http://cirp.org.tt/mfisheries/pdf/mFisheries Brief May 2012.pdf
3. Understanding mFisheries: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=118&Itemid=94
4. mFisheries Mobile - Full mobile application:
    a. Administrator's Manual: http://cirp.org.tt/mfisheries/pdf/Mobile_Suite_of_Applications_for_Fisher_folk_Admin_Manual.pdf
    b. Developer's Manual: http://cirp.org.tt/mfisheries/pdf/Mobile_Suite_of_Applications_for_Fisher_folk_Developer_Manual.pdf
    c. User's Manual: http://cirp.org.tt/mfisheries/pdf/Mobile_Suite_of_Applications_for_Fisher_folk_User_Manual.pdf
    d. Application Suite download: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=125&Itemid=98
5. Photo Gallery: http://cirp.org.tt/mfisheries/index.php?option=com_joomgallery&Itemid=88
6. Video Profiles: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=113&Itemid=87

mFisheries Web - Virtual Marketplace (Companion Output to Mobile Suite of Applications for Fisher folk)

1. mFisheries Web Applications Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=146&Itemid=100
2. mFisheries Web Virtual Marketplace Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=139&Itemid=100
3. Administrator's Manual: http://cirp.org.tt/mfisheries/doc/Administrator_Manual_for_mFisheries_Web_Applications.docx
4. Developer's Manual: http://cirp.org.tt/mfisheries/doc/Developer_Manual_for_mFisheries_Web_applications.docx
5. User's Manual: http://cirp.org.tt/mfisheries/doc/User_Manual_for_mFisheries_Virtual_Marketplace.docx
6. mFisheries Web – Virtual Marketplace Site: http://scsee.uwi.tt/mfisheries (Username: testuser; Password: password).

mFisheries Web – At Sea Management (Companion Output to Mobile Suite of Applications for Fisher folk)

1. mFisheries Web Applications Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=146&Itemid=100
2. mFisheries Web At Sea Management Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=140&Itemid=100
3. Developer's Manual: http://cirp.org.tt/mfisheries/doc/Developer_Manual_for_mFisheries_Web_applications.docx
4. Administrator's Manual: http://cirp.org.tt/mfisheries/doc/Administrator_Manual_for_mFisheries_Web_Applications.docx
5. User's Manual: http://cirp.org.tt/mfisheries/doc/User_Manual_for_mFisheries_At_Sea_Management.docx
6. mFisheries Web - At Sea Management Site: http://www.scsee.uwi.tt/mfisheries/website/ (Username: CGuard; Password: coastguard)

Evaluation of the Applications

1. Homepage: http://cirp.org.tt/mfisheries/index.php?option=com_content&view=article&id=153&Itemid=100
2. Policy Brief: Mobile ICT for Development: Are low income earners willing to utilize targeted m-ICT4D interventions to facilitate improvements in operational efficiency and market reach? A Trinidad and Tobago case.
3. Programming Brief: mFisheries Recommendation to CFTDI for Financial Management Training for small scale fisherfolk
4. ICT Update Magazine Article "A Smart Fishing Suite" Mallalieu, Kim and Lessey, Mark. ICT Update Magazine. Technical Centre for Agricultural and Rural Cooperation ACP–EU (CTA), Netherlands (publishers). Issue No. 64 February 2012." Available at http://ictupdate.cta.int/en/Feature-Articles/A-smart-fishing-suite. Last accessed 28 March 2012.
5. Report: Evaluation of the mFisheries Applications: http://cirp.org.tt/mfisheries/pdf/Evaluation_of_mFisheries_Applications_Report.pdf

Project Outcomes

In its short life, the mFisheries project has led to a number of meaningful outcomes amidst the rich portfolio of varied findings. These outcomes include changes in behaviour, capacity and attitude within the target group under study; new knowledge and awareness amongst policy makers and other stakeholders; important new relationships; observations that suggest the production of new handsets; and the introduction of new technologies that have the potential to promote sustainable and equitable development, reduce safety risks at sea and ultimately contribute to a reduction in poverty. Some specific outcomes that have come to pass during the lifetime of the project include:

Changes in Behavior within Pilot Target Group

Even among the varied profiles of extended field trial participants (vendors, processors and fishermen) changes in livelihood-related behavior, motivated by the mFisheries intervention, has been observed. For example:

- 3 out of 4 regularly use "Weather Bug" for planning trips to sea, while 7 out of 10 regularly use "Tide App" for the same purpose
- Half use GPS for marking and recovering the locations of fishing gear and catch sites
- Significantly, 84.4% indicate that they believe that mFisheries tools responding to operational matters, including "Weather Bug," "GPS" and "Tide App," can save them a minimum of a quarter of the time it takes to conduct fishing activities. Of this group, almost 60% feel that at least half of the time it takes to fish could be saved by using these apps.
- 4 in 5 (78.1%) did not know prior to mFisheries that smart phones could be used for navigation and their work-related information management needs. Having been exposed to mFisheries, 9 out of 10 are now confident that smart phones with the right mix of apps could be used to improve their fisheries-related work.
- 78% rely more on market prices than before mFisheries when they buy or sell fish, with almost all using "Prices" to get an idea of fish market pricing before buying or selling fish (90.6%), and for setting their own wholesale and retail prices (96.9%).

Direct Dissemination of Research Findings to Caribbean Policy Makers

On the basis of the mFisheries initiative within the Caribbean ICT Research Programme, (the principal investigator, Dr. Kim Mallalieu, of) The UWI has been invited to address the second UNESCO Management of Social Transformations (MOST) Regional Forum of Ministers of Social and Sustainable

Development of the Caribbean themed ***Promoting Equity and Social Inclusion: Pathways to Prosperity for All***. MOST focuses on "improving the linkage between research and policy-making, including the formulation, monitoring and evaluation of development actions and processes, the dissemination of research results, best practices and capacity-building."

The key expected outcomes of the Second Forum include:

1. Greater cohesiveness of the Regional social policy agenda for vulnerable groups and a more coordinated approach to implementation;
2. Development of perspectives on regional social policies and processes that can be modified and adapted to suit different political, socio-economic and cultural contexts
3. A more inclusive society for the countries of the Region;
4. The enhancement of the social development networks among the Ministers of Social and Sustainable Development in the Region.

This invitation represents important engagement of technical faculty in a regional policy forum relating to social transformation. Previous invitations were received for CIRPTT leadership to address other Ministerial fora including the 7th and 8th Ministerial Strategic Seminars in 2010 and 2011.

Other Government-led initiatives for which invitations to address were extended, include the National ICT and Business Symposium 2010 and the Launch of the National *Closing the Digital Gap Initiative* in 2012.

Direct Inputs into National ICT Plan 2012 - 1017

On the basis of the mFisheries initiative within the Caribbean ICT Research Programme, (the principal investigator, Dr. Kim Mallalieu, of) The UWI has been invited to sit on the Bridging the Divide/e-Democracy Working Group for the National ICT Plan 2012 - 2017. This invitation represents important engagement of technical faculty in a national policy forum relating to the knowledge economy.

Advice to Government Councils

The Council for Competitiveness and Innovation (CCI) of the Ministry of Planning and the Economy is charged with the responsibility of significantly improving Trinidad and Tobago's global competitiveness ranking, and mainstreaming innovation as key drivers of a diversified knowledge-based economy. Within the CCI's mandate are several areas related to research and diagnostic projects, policy analysis and development support, business support activities, communications and awareness-raising activities, and

implementation of the government's development agenda in the area of competitiveness and innovation. On the basis of work undertaken over the 2009 – 2011/2 research cycle, the CIRPTT team has been asked to provide resources in support of a national "Call for Innovations and Inventions" event.

Requests such as these, made over the course of the project's life time, signal that the UWI team, through its mFisheries research, has achieved recognition as a source of knowledge, experience and/ or competence on matters relating to innovation.

Penetration of Research Outputs into Government-Led Social Programmes

The Ministry of Tobago Development has integrated mFisheries SOS and Tracking applications, with context-appropriate mobile phones, into its planned programme of support for fisher folk whose at-sea range is within cell coverage. The mFisheries Team is currently making recommendations to the Ministry regarding selection criteria for various emergency communications strategies and appliances that best suit different fisher folk profiles. The portfolio of solutions under consideration includes marine radio, satellite phones, satellite emergency data systems, beacons and rugged smart phones. Fisher folk profile data used to guide best-fit selection include personal preference, nominal at-sea fishing range, literacy, current appliances and services in use (including marine radios and gps units), market activity and existing infrastructure.

This initiative represents an important step regarding the early and effective penetration of research outputs, and associated dialog, into social programmes as directed by government policy makers.

Penetration of Research Outputs into Regular Coast Guard Operations

The Trinidad and Tobago Coast Guard has included the mFisheries SOS alert and at-sea tracking as regular components of their operations, with a structured response programme that is initiated on receipt of SMS, email and phone alerts from mFisheries safety applications.

This development represents an important step regarding the diffusion of action research outputs into national operations.

Institutional Collaboration

A significant outcome of the mFisheries project is the consolidated research partnership established between the University of the West Indies (UWI), the Caribbean Fisheries Training and Development Institute (CFTDI) and the Distance Learning Secretariat of the Ministry of Science, Technology and

Tertiary Education (DLS-MSTTE) as it enabled the UWI to contextualize its mobile communications research and teaching according to local and regional realities and to provide a focal point for such activities to respond to related needs. It contributed to the mission of CFTDI to promote, enhance and sustain careers in fisheries by exploring opportunities for mobile-facilitated training as well as a suite of career specific information and communication services of direct relevance to Fisher Folk. Furthermore, it enabled the DLS-MSTTE to facilitate learning access and human development via open and distance learning in the fishing sector and to develop relevant results-based policy guidelines and frameworks for the implementation of its work nationally.

Consideration for Cellular Service Adjustments in Response to Research Outputs

On the basis of the mFisheries initiative within the Caribbean ICT Research Programme, a local mobile service provider has agreed to review its cellular coverage at sea with the view to making no- or low-cost improvements and analyzing more costly increased coverage. The provider has also expressed keen interest in developing a preferential pre-paid rate plan for mobile data service linked to local fisher folk livelihoods. This plan would be developed on the basis of outputs from the mFisheries Cost Model.

Replication in South Pacific

The mFisheries team has been approached by the Cook Islands to introduce a phased deployment of the application suite there. To start with, local funds have been secured in the Cook Islands to cover the cost of content development for the mFisheries Training Companions, starting in the summer of 2012. A student from The UWI will also customize the mFisheries at-sea components for the Cook Islands over the summer period.

This development represents anecdotal validation of the replicability of the mFisheriees suite of applications outside of a Caribbean context and is supported by very many expressions of strong unsolicited endorsement from, for example, World Fish (http://worldfishcenter.org/) and CTIC Foundation (www.fundacionctic.org).

Case for Ruggedized Mobile Handsets with Data and GPS Capability

The eagerness on the part of sampled low income fisher folk to use the facilities offered through mobile data with GPS functionality in support of their livelihoods, and the potential benefits of such use, makes a compelling case for the production of affordable, ruggedized mobile handsets with data and GPS capability. Such handsets may usefully feature basic processing capability, with emphasis placed on usability and ruggedness.

Fisher folk Use of Smart Phones to Record and Produce Videos

In November 2011, the mFisheries Team and the Caribbean Natural Resources Institute (CANARI) collaborated on the facilitation of a participatory video exercise in which fishers of Blanchisseuse documented the challenges in their community and shared these with key industry partners. The input segments to the video production "*Fish for Gas: the Challenge for Blanchisseuse Fishermen*," were captured, using mFisheries phones, by fishers who were comfortable using this ICT appliance for more-than-voice applications. The fishers also drove the production of the final video. The following resources are available:

1. Workshop Report: http://www.canari.org/documents/BlanchisseusePVvideoworkshopFinal08.12.11.pdf
2. Fish for Gas: the Challenge for Blanchisseuse Fishermen Video: http://www.youtube.com/watch?v=8SFnazhiu9Y&feature=youtu.be
3. Report on Meeting of Partners: http://www.canari.org/documents/BlanchisseusePVpartnersmeetingFinal08.12.11pdf.pdf.

Overall Assessment

The **outputs** documented in this report indicate that the *Mobile Opportunities 2.0: mFisheries* component of the *Networks for Development: Caribbean ICT Research Programme*, has met all of its Specific Objectives. Adoption of the handset with mobile data and GPS facilities was high amongst participants. Adoption of "Tier 1" Prices was very high, even amongst fisher folk who do not trade regularly; and reliance on "Tier 1" SOS, , "Weather Bug" and "Tide App" as well as "Tier 2" GPS was also high amongst regular sea-farers.

As discussed in the Report on the Evaluation of the Applications (link provided in the Outputs Section), the scope of the project did not allow the evaluation of those "Tier 3" application components which required advanced cognitive skills and transactions within an entire small scale fisheries ecosystem. However, important insights were gained to guide the agile development and operationalization of the *Got Fish Need Fish* component of the Virtual Marketplace, which has been highly rated by fisher folk for its value.

The **outcomes** documented in this report suggest that the *Mobile Opportunities 2.0: mFisheries* component of the *Networks for Development: Caribbean ICT Research Programme*, has met its General Objectives:

1. To promote multi-stakeholder knowledge exchange and dialogue about the potential contribution of ICTs for economic development and poverty alleviation in the Caribbean.

   Indeed, the CIRPTT team in the Department of Electrical and Computer Engineering has been able to raise keen interest and awareness amongst communities of academics, students, policy makers, regulators, programming agencies, software developers and regular citizens regarding the **context-appropriate application of technology to policy and social good**. This outcome is particularly important in the Caribbean which has strong traditions of social and technical disaggregation.

   The Team has effectively engaged a rich and diverse range of stakeholders in the developmental dialog on a sustained basis over the course of the research cycle.

2. To develop capacity in the Caribbean to pursue opportunities arising from the provision of innovative mobile-enabled services for its poor communities, and to provide related empirical data and analysis to inform Caribbean policy and regulation.

   CIRPTT's capacity building in mobile application design and development within, and outside of, the undergraduate programme at The UWI and the vivid example of the application of such capacity to pursue opportunities arising from the provision of innovative mobile-enabled services for low income fisher folk has catalyzed an interest in this application space. The availability of empirical data and analysis has created interest on the part of policy makers and plans are in place for exploring regulatory interventions regarding safety at sea.

mFisheries' findings represent an important resource to inform the data acquisition, contemplation, design and deployment of mobile applications to improve livelihoods. Evaluations have revealed that the increased economic activity and efficiency at the bottom of the pyramid, according to the bottlenecks and challenges identified by fisher folk, require the engagement of a full small scale fisheries ecosystem extending to consumers and wholesalers, with fishermen located at source. While the engagement of such an ecosystem was beyond the scope of this research, examinations of perceptions of value and use across the ecosystem confirm that important opportunities exist.

The observation of a small sample of fisher folk, in some cases over a 1-year period, suggests that a mobile phone with data and GPS capability can well be adopted as an indispensable tool of the trade. A Tiered Model for long-term development-focused intervention, to be described in a journal publication,

maps a deliberate progression of intervention phases which ultimately have the potential to yield not only direct efficiency gains but to meet richer objectives relating to social and digital inclusion within marginalized clusters. This work has provided the analytical and empirical bases for the selection of ICTs in developmental programmes and is being used to inform policy and regulation in the telecommunications as well as the marine sector in Trinidad and Tobago.

Quite apart from the project's outputs and outcomes relating to the target community of low income fisher folk in the context of the policy environment and national and regional developmental agendas, mFisheries has had a pivotal impact on various communities within The University of the West Indies. These communities of students, staff and administration are now more keenly aware of the need for development-focused engineering design and development; for the power of, and possibilities for, interdisciplinary work even within single Faculties; and the possibilities for action research, even in short time frames.

This work could not have been undertaken without the generous support of the International Development Research Centre which has, itself, come to be associated with important action research initiatives in the Caribbean.

Recommendations

It is important that mFisheries research is continued in support of policy makers and programming agencies who rely on analytical and empirical evidence to guide the passage through the Digital Divide. Research conducted under *Theme 3: Mobile Opportunities 2.0 - mFisheries* within the *Networks for Development: Caribbean ICT Research Programme* in Trinidad and Tobago (CIRPTT), lead to the following recommendations which would build on project findings:

1. Development of a Dynamic Open Data Mobile Information Zone as a Logical Access Channel for the informal sector:

   A dynamic open data mobile information zone is recommended for marginalized communities who currently have physical access to communication services but who currently derive little or no benefit from underlying information and related services. This channel would enable both the access to

context-appropriate information and the contribution to fora established to include all citizens in national governance mechanisms.

Key content for the Information Zone would be acquired from datasets collected by democratic Caribbean governments and their various state agencies, through the use of public funds, to better inform planning and policy decisions aimed at improving the quality of life for their citizenry. Access to relevant, contextualized, and purposeful information derived from these datasets is recommended as a logically-accessible value proposition to those who currently rank among the digital poor. The long-term vision for this intervention is the creation of critical knowledge seekers who could actively and productively participate in the knowledge economy on their own terms, utilizing applicable literacies.

2. Design of a generic Tier 2 mobile training schema, and novel assessment strategy, to inform policy interventions seeking to increase digital literacy in the informal sector:

   Developing countries are keen on the possibilities for offering educational mobile applications and services and governments have engaged in a multitude of small-scale mobile training initiatives with varying success. In the context of small island states, learning objectives of a Tier 2 training schema would benefit from the physical acceptance and basic fluency achieved by users during the mFisheries project cycle involving the introduction of disruptive technology.

3. Action research into novel means of emergency communications via mobile phones outside of cellular coverage to inform policy, regulatory and social programming interventions:

   With further insights provided by mFisheries into the emergency communication needs, particularly of fisher folk engaged in deepwater activity and within zones generally underserved or outside the scope of local service providers and existing solutions, the ability to maintain interactions and systematically network with community agents in relevant problem-solving activities should be a continuous exercise.

4. Examination of the adoption and performance of the mFisheries Virtual Marketplace in a representative ecosystem:

   Recognizing national priorities in the fisheries sector and that a "*virtual marketplace allows a structured exchange of tested methods or knowledge resulting from experience, analogue to the*

situation on a real marketplace. The virtual marketplace is a platform where buyers and sellers deal with their knowledge or tools. A direct contact to a 'seller' is established. 'Buyers' get sure answers to their questions. Beyond this, there is the possibility of contacting experts in the case of demand,[1]" contemplation of an enabling framework for the systematic mobilization of Caribbean society and appropriate agents is seen as an important next step.

[1] *"The Virtual Marketplace Method" from The Success Mart Project Handbook (2004) by Investitionsbank Berlin & Arid Austria. Retrieved from http://www.v-market.biz/idea.html*