

# ICT in Small-scale Fisheries: Linking Governance, Livelihoods, and Organizations

## Las TIC en la Pesca Artesanal: Vinculación de Gobierno, Modos de Vida y Organizaciones

### TIC dans la Pêche Artisanale : Relier la Gouvernance, les Moyens de Subsistance et les Organisations

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#### ABSTRACT

In this contribution, small-scale fishers are the focal point for contemplating solutions to the vexing confluence of competing interests between stakeholders at the micro- and macro- levels of the marine resource. Building on the notion of the vertical value chain, the paper highlights a compelling need for a tiered multi-dimensional strategy capable of producing operational, informational and organizational value to small-scale fisheries livelihoods through the use of development-focused ICTs. The paper proposes a model and supporting framework for the operationalization, integration, adoption, and management of information and communication technology (ICT) interventions aimed at bridging and enhancing meaningful exchanges between these users and other stakeholders to achieve shared aims of the marine resource.

KEY WORDS: Development-focused ICTs, small-scale fisheries

#### INTRODUCTION

The traditional fisheries value chain maps the propagation of harvested fish through various stages originating in the marine or aquaculture environment and terminating in consumption. The instantiation of the chain varies according to the consumer (human, animal, agricultural system, etc.), stage at which consumption occurs (pre-processing, post-processing etc) and the depth of value added (fresh, preserved, otherwise processed, etc.) (De Silva 2011, Hempel 2010, Mahon et al 2007). Notwithstanding, the efficiency and effectiveness of the fisheries value chain are not only important to the livelihoods of the agents at the source but also to very many intermediaries who together provide services such as storage, transportation, processing, packaging, retail; distribution, wholesale, and export. An efficient and effective fisheries value chain also adds legitimacy to the sector in the national economy.

It is increasingly evident that for sector resilience, the traditional value chain cannot be divorced from the complex system of policy, legislation, and practice within which fish is legitimately harvested, handled, processed, and sold. The practice of sustainable management of a natural resource, such as the marine resource, is a complex undertaking particularly as it addresses several domains of interest that are themselves intertwined. These include food security, protection of marine habitats, monitoring of species, industry profitability and competitiveness, and quality control. In the developing world, the small-scale fisheries sector has provided ample evidence that the livelihoods, practices and needs of fisherfolk, primary agents within the small-scale sector, are often in direct confrontation with the sector-driven mandates, decisions and interests of other ecosystem agents such as policymakers and resource managers (Mallalieu and Sankarsingh 2013). In recent times, perhaps as a measure of attenuation in an otherwise unpleasant impasse between fisherfolk and resource managers, participatory and adaptive approaches to the management of the marine resource have been increasingly endorsed, among others, as a means of engaging those afflicted in the process of influencing or providing workable solutions. Participatory initiatives may prove extremely useful for marginalized coastal communities who have in the past not been substantially involved due to a lack of formalized representation, and who have not shown immediate interest themselves in matters of resource governance (McConney et al. 2014).

Despite the considerable potential for Information and Communications Technologies (ICTs) for development in general (Heeks 2010) and the development of the fisheries sector in particular (FAO 2007), its use in small scale fisheries has been limited, particularly so for the fishers who are closest to the source. The use of ICTs amongst small-scale fishers has been largely limited to open-loop notifications through media such as radio broadcasts (McKay 2003), as well as voice calls (Jensen 2007) and SMS messaging (Abila et al. 2013). Pressing problems articulated by small-scale fishers have also motivated the development of smart phone solutions with greater instrumental, informational and communications capabilities. The mFisheries field trial (Mallalieu and Sankarsingh 2012a, b, and c), for example, provides evidence that the smart phone with an appropriate suite of applications can be a highly valued tool of the trade for small scale fishers. The studies also suggest challenges in moving from pilots to various forms of scaled deployments capable of addressing pressing needs in the policy cycle as well as the value chain.

This paper is motivated by the need for strategies for planning development-focused ICTs for small-scale fishers. It sets out to provide resources for contemplating outcomes-based specification of ICTs, taking account of fisher-focused developmental objectives in the context of the shared marine resource.

## METHODS

The paper adopts an outcomes-based approach to planning development-focused ICT tools for small-scale fishers. Its starting point is a record, drawn from published literature of (i) existing frameworks for outcomes assessment of ICT for Development (ICT4D) interventions and (ii) the unresolved challenges of moving ICT4D interventions beyond the stage of pilots. It directs its examination to the Caribbean Network of Fisherfolk Organizations, CNFO, which has expressed a mission for the Organization as well as a vision for Caribbean small-scale fisheries. Interviews and a programme of meetings with the Caribbean Network of Fisherfolk Organizations over a period of a year have supplemented secondary research on the Organization and its needs. A 2-dimensional value chain (2DVC) has been formulated to describe the primary fisher in his traditional role as well as in the expanded role imposed on him by many environmental pressures. Analysis of the 2DVC vis a vis desired outcomes, the findings of intervention studies and application of Duncombe's (2011) impact assessment recommendations, lead to the specification of a set of planning instruments which have been developed for the CNFO.

## ICT4D ASSESSMENT

There exists a great deal of variability in the goals for ICT intervention. These may focus, for example, on the development of an enabling environment or on the provisioning for, and uptake of, services. They may alternatively set out to improve service delivery efficiency or facilitate direct livelihoods returns (Bachelor and Norrish 2005). There are also very many criteria used to constrain and qualify assessment both within and across intervention goals. A variety of basic assessment frameworks have therefore been applied with variations across, and within, different disciplines and sectors. These include but are by no means limited to cost-benefit analysis, project goals, capabilities framework, sustainable livelihood framework, information economics, information needs/mapping, and enterprise (Heeks and Molla 2009).

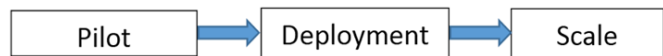
An important aspect of an intervention is an established monitoring and evaluation (M&E) methodology which applies an assessment framework appropriate to stated goals. Such methodologies may be ex-ante, that is to say executed while the project is in progress, in which case it is predominantly formative. Ex-post M&E on the other hand, performs evaluation at or after the project's life cycle when there has been sufficient time to assess performance across long-term criteria such as economic, social, and environmental impacts, and is therefore summative (Bachelor and Norrish 2005, Walker et al. 2008). A mixed methodology may be constructed to monitor and evaluate outcomes in the short, medium, and long terms, employing measurements for both formative and summative purposes.

## PILOT TO PERMANENT

There is growing concern regarding the failure of many ICT4D interventions to persist beyond project time lines and to otherwise yield sustainable outcomes. However, several established assessment frameworks do not treat matters of sustainability, while many projects are specifically formulated as pilots to generate insights for shaping ICT interventions, not as the staged interventions themselves. Additionally, oftentimes sought outcomes include scaling, that is to say moving beyond the scope of a pilot in terms of some aspects or combination of functional, social, physical, political, and conceptual dimensions (UNDP 2013).

- i) The functional dimension refers to extension of the functions and/or functionality included in the scope of the pilot,
- ii) The social dimension refers to the extension to include additional social groups,
- iii) The physical dimension refers to the extension of geographical and/or headcount coverage,
- iv) The political dimension refers to legitimization and institutionalization within policy and related contexts, and
- v) The conceptual dimension refers to transformations in systems of thought and power relations.

Though chronologic, the passage from pilot to scale is not generally a linear nor immediate transition. An intervening first deployment stage, shown in Figure 1, is necessary for grounding the intervention within the entire set of user, environmental, and process parameters that constitute the ultimate host.



**Figure 1.** Phased Progression to a Scaled ICT Deployment.

The frame and terms of reference for ICT pilots, first deployments and scaling are quite different. Pilots revolve around innovation while first deployments rely on institutionalization by key boundary partners; and scaling is primarily an exercise in diffusion (Rogers 2003, Mallalieu and Sankarsingh 2012a, Foster and Heeks 2013). Not only do the three phases call for very different execution and planning strategies, they each require a particular, and different, balance of executing agents and partners. An inadequate constitution of partners, poorly defined roles, and failed or flailing commitment by partners are recipes for failure to scale or sustain.

Scalability is often ascribed to sustainability and alternatively, sustainability is often ascribed to scalability. In any event, both scalability and sustainability are broadly understood to be long-term propositions variously challenged by the many daunting aspects of the requirement for greater, deeper and richer reach, alongside persistence over

a long period of time. For both, enduring cross-sector partnerships, programming and policy coherence as well as heterogeneous institutional networks of technology, people, and processes have been found to be important precursors of longevity and predictors of developmental resilience (Madon 2009). Clarity of intent and the selection of a fit for purpose assessment methodology for ICT4D projects, cognizant of timescales and phases, is a critical, though not straightforward, component of a planning framework for ICT intervention.

### A SMALL SCALE FISHERIES CASE

#### Caribbean Network of Fisherfolk Organizations

There is an established need for strategic application of ICTs in fisheries to meet the needs of the poorest in the industry and to facilitate participative, people-centred communications for development and knowledge sharing (FAO 2007). In the case of the Caribbean, the Caribbean Network of Fisherfolk Organizations (CNFO) was established in 2007 primarily to give voice to the interests and concerns of primary fishers through their national fisherfolk organizations. The Organization's need for expression is primarily a consequence of the many competing demands on the marine environment, the host for catch fisheries livelihoods which fishers had hitherto ploughed at will, with little or no challenge. Increasing pressures on the shared resource and a general understanding that command and control regimes are largely ineffective, and at the same time deepen animosity between resource users and managers, has led to adoption of Ecosystems-Based Management (EBM) and Ecosystems Approach to Fisheries (EAF) management with supporting participatory governance mechanisms (McConney et al. 2014).

The formulation of the CNFO accords with trends in sector management. In particular, the Organization's Vision is a *primary, national and regional fisherfolk organization with knowledgeable members collaborating to sustain fishing industries that are mainly owned and governed by fisherfolk who enjoy a good quality of life achieved through the ecosystem based management of fisheries resources* (McIntosh et al. 2009). This is a long-term vision that requires a great deal of planning, persistence of leadership and visible incentive as ecosystem-based management of fisheries resources inherently includes controls on the harvesting of, and interaction with, the living marine resource. In the case of the Caribbean, where historically such controls have existed, they have largely been unenforced. There is thus the possibility of the perception, on the part of fishers, that ecosystem based management regimes impose a threat to immediate livelihoods, notwithstanding the awareness of long term return. The CNFO's Mission, *to improve the quality of life for fisherfolk and develop a sustainable and profitable industry through networking, representation and capacity building* (McIntosh et al. 2009), also projects into the future with objects only

progressively realizable in the short, medium and ultimately long term.

#### Context

The desired outcomes of the CNFO resonate with capabilities (Sen 1999) and livelihoods (Rijn et al. 2012) assessment frameworks, both of which rely heavily on personal and community context. However, the traditional small scale fisheries value chain from "hook to cook" does not adequately capture the context within which an applicable ICT4D intervention can be applied. As the ecosystems approach to management strongly features dotted as well as solid communications pathways between fisher, sector managers and policy makers, a value chain that is more expansive and at the same time fisher-focused provides a useful basis on which ICT interventions can be planned and assessed. We contemplate a view that takes account of all of the entities, human and otherwise, which influence fishers' current and future state; and with whom, and with which, they interact in order to effect target outcomes. A fisher-focused perspective calls for emphasis on vertical scalability through which the fisher may derive value in the short, medium and long term. Together, these lead to a 2-dimensional value chain which comprises the traditional value chain along one axis as well as a newly constructed "vertical value chain" along an orthogonal axis.

In the same way that progression from hook to cook in the traditional (*horizontal*) value chain is associated with the addition of value to the (fish) product at each stage, so too is progression up the vertical value chain associated with the addition of value, in this case to the fisher. This latter value is expressed in terms of categories of ICT-enabled capabilities which are associated with improved livelihoods capabilities, quality of life (QoL) and acquisition of knowledge; and are necessary to enable broad-scale collaboration, networking and representation. These capabilities effect a pathway from fisher to the system of policy, legislation and practice which constrain and otherwise influence his operation. Small scale fishers' penetration into the horizontal value chain is typically shallow, often with sale at landing sites, directly following harvest. ICT interventions that successively add value to a fisher's business operations yield increasing levels of integration into applicable environmental contexts through the application of increasingly complex practices and resources, from instrumental to informational to transactional to organizational and ultimately to strategic. Small scale fishers' penetration into this value chain is typically shallow, often limited to the use of ICTs for instrumental purposes, for example through the use of GPS devices, at best.

Fisherfolk have complained bitterly about the lack of recognition accorded to them within the larger context of the national and global economy (Jacinto and Pomeroy 2011). However, their adoption of basic tools and strategies necessary for marked penetration into both the vertical and traditional components of the value chain is generally very

low. A natural context for deeper penetration of small scale fisherfolk into the vertical value chain is a co-management regime which, in the strictest sense, entails the sharing of responsibility and authority between the state and resource users. Fisheries co-management sets out to protect the marine environment as well as the stakes and rights of all marine resource users through ongoing engagement across a broad base of stakeholders; and inclusive decision making. By doing so, it links fisheries agents and organizations within a governance framework that is sensitive to, and takes explicit account of, the livelihoods needs of the small scale fisher. It places a premium on communications.

### Deconstruction

Examination of the CNFO Mission and Vision motivate a strategy capable of producing operational, informational, and organizational returns to small-scale fishers. Due to the nature of policy cycle (Mahon et al. 2007) and human development timescales, it is not expected that the Organization's portfolio of representation and other activities would have rapidly or simultaneously led to improvements in the quality of life for fisherfolk or to evidence of marked improvements in the sustainability or profitability of the industry. Realistic expectations, taking account of the considerable practical, operational, physical, and cultural barriers to change, call for a deliberate, tiered, multi-dimensional strategy to progress the various threads of needs alongside each other, yet according to their individual timescales.

### Engagement as Priority

Since its establishment, the CNFO has provided inputs into various agreements and made considerable strides with policy representation and multi-stakeholder engagement (Phillips and Nembhard 2014). Through a programme of interviews and meetings, the Coordinating Unit of the CNFO has expressed the need for an agile and nimble mechanism for broad reach to ensure that such representation is legitimately representative of the views of the membership. They have identified communications up, down and across the system of primary stakeholders as the most pressing priority; and the formalization of the Organization as a legal entity as a pivotal requisite. Improving the communications skills, as well as addressing the asymmetric information flows of small-scale fishers with the rest of the marine ecosystem, have also been otherwise recognized as critical to strengthening and consolidating the fragmented voices of these agents nearest to the source (McConney and Haynes 2011).

The Caribbean ICT Research Programme (CIRP) at The University of the West Indies has been asked to assist with the design and development of an electronic platform to satisfy the CNFO's priority engagement needs. As ICT features strongly in the CNFO Communications Strategy and Plan (Roopchand 2013), as well as in its Strategic Action Plan (unpublished), it is a reasonable companion to the

many face to face capacity building exercises currently in train (Phillips and Nembhard 2014).

Most communications for development (C4D) strategies, though focused on initiating micro-level behavioural change through exposure to specific, pre-determined content, weaken the operating philosophy of participatory approaches especially if such strategies take the form of mass communication campaigns. Recognizing that without well-established agreed-upon criteria for ensuring multiple flows of information throughout the ecosystem, engagement remains traditionally unidirectional, paternalistic and simply cosmetic (Lee 2013), CIRP has developed a baseline assessment framework as the basis of a design for a CNFO Engagement Platform.

### ENGAGEMENT PLATFORM

CIRP researchers have drawn on Duncombe's (2011) impact assessment recommendations by determining the extent to which the engagement platform can address the needs of the CNFO, selecting the core units of information that will be extracted for impact assessment purposes, and designing a workable framework with the explicit intention of testing the rigor of the methodology.

Contemplation of an engagement platform for the small-scale fishers of the CNFO essentially resides in the stated mission and vision of the Organization, as well as the ambitions made known to ICT4D practitioners by CNFO leadership. The framework consists of a disaggregation of the broad goal of the Organization into outcomes that have been classified as short-term, medium-term and long-term (Table 1.)

The outcomes become the priority targets for key stages during and beyond the life of the project. Long-term outcomes (LTOs) are dependent on the achievement of medium-term outcomes (MTOs) which are themselves made possible via the successes of short-term outcomes (STOs). For the CNFO's position in the value chain to be legitimized, critical contributory processes must be started in the short-term and sustained by others in the medium-term. This is also true of any claim by sector leaders or resource managers that capacity has been built by small-scale fishers as a result of training programmes aimed at strengthening their overall professional profile. Without demonstrated practice and integration of new knowledge and skills to which they are exposed, there is little by way of showing how and if resources spent on fishers have improved performance. Similarly, the CNFO's influence within decision-making processes in the value chain will be heavily dependent on its ability to build a critical mass of new knowledge workers and to sustain its membership. Finally, autonomy, or the freedom to act independently, is inherently linked to the ability to self-organize or to self-govern as a cohesive and collective body. This will mean that the culture of fragmentation is immediately addressed and that the proposed management structure must not just take root but show resilience.

**Table 1.** Disaggregation of Broad Goal of the Caribbean Network of Fisherfolk Organizations

Short-term Outcomes (STOs)	Medium-term Outcomes (MTOs)	Long-term Outcomes (LTOs)
Visibility of CNFO within and external to the sector	Representation of CNFO position to other stakeholders in the value chain	Legitimization of the CNFO within and external to the Sector
Exposure of CNFO members to best practices & recommended methods related to QoL, EAF, Livelihoods & Industry Profitability	Informed practice by CNFO of recommended methods related to QoL, EAF, Livelihoods & Industry Profitability	Demonstrable built capacity for improved QoL, EAF, Livelihoods & Industry Profitability
Access to CNFO network	Member participation & collaboration on CNFO network activities	Network cohesion for joint action and decision-making with external agents
Interest in CNFO network		
CNFO Formalization	Adoption of CNFO member roles, tasks and leadership protocols	Autonomy & Resilience

The motivation of ICT4D practitioners is further from the mere opportunity to test *the bells and whistles* of existing technology, and necessarily closer to an understanding of the needs of those human beings who must use, interact and derive benefit from a technological alternative which itself should be as unobtrusive and intuitive as possible. The Engagement Platform, in other words, becomes the machinery that must not just give life to the ambitions of the CNFO through the careful selection, design, and customization of a range of software, but also house fair and transparent operations in keeping with the core values of participatory approaches (PA). Central to the system definition then is the replication, automation, and eventual proliferation of recommended communication flows identified as critical to strengthening engagement at all levels of the value chain. McConney and Hayes (2011) highlighted four communication flows, the use of which are of interest particularly for their application within a model promoting participatory approaches, as well as their localization in an ICT-driven intervention. Not only does an attempt to electronically engineer, re-create, and drive the four flows of communication: *downward or enabling, upward or compliance, lateral or coordinating, and the grapevine*, dispel the threat of a unidirectional flow of information, it also provides a unique environment for user-generated data capture related to impact assessment.

#### ICT ASSESSMENT FRAMEWORK

In the case of the Engagement Platform, indicators or proxy measures can be used for tracking the anticipated changes in the short, medium, and long-terms by extracting quantitative and qualitative information from an array of user-generated data capture exercises. Web analytics may provide fact-based intelligence to project managers, as it involves the establishment of patterns among large amounts of data, the extraction, and then the conversion of targeted data into easily interpretable, often visual, information resources. For such automated insights to be meaningful however, analytic programming relies on the specifi-

cation of indicators that are relevant to the ICT-based strategies designed to achieve the overall project goal. Indicators are used to characterize and make visible the kind of progress expected. This approach is particularly useful for assessing and analysing trends as project managers can set appropriate baseline metrics for each indicator.

Following from the disaggregation and re-framing of the broad goal of the CNFO into short, medium and long-term outcomes, Figure 2. shows the mapping of the framed outcomes to specific ICT-driven indicators that are possible within the platform environment in support of eventual legitimization of the Organization.

Visibility of the CNFO is tied to data capture of web audience demographics, behavior, and geo-data as it provides immediate and comprehensive insights into interest levels shown during the Organization's first attempt to be *seen*. Emerging as a new *visible* agent via the World Wide Web necessarily means that the CNFO will be competing for interest via this medium. Having a modern communication interface and presence on the World Wide Web is not in and of itself an indication of the Organization's achievement of visibility, and thus requires them to gain traction laterally as well as upward through the support of related parties in the fisheries sector. This mobilization process is critical to the Organization's credibility. Once the demonstration of critical mass, or the minimum amount of registered users required to maintain and drive the work of the CNFO in the online environment, has been attained (see Medium-Term indicators, Figure 2.), then it becomes useful to track the display of, subscription to and absorption of CNFO-generated artefacts to determine the range of the Organization's influence in wider participation platforms by other stakeholders within and even external to the value chain.

The versatile application of ICTs to human beings in action fuels interest in its integration with human development initiatives. An engagement platform may serve as a tool for driving social learning (Schusler, Decker and Peffler 2003, Smith and McGregor 1992), new governance

approaches of *learning-by-doing* (Lee 2013) and may even be seen as an adult version of a self-organizing learning environment or SOLE (Mitra 2012). Figure 3 shows the mapping of framed outcomes to specific ICT indicators in support of capacity building initiatives.

Capacity building is the cornerstone of human development initiatives. While small-scale fishers in this context may lack the knowledge and skills in support of resource management, leadership, conflict resolution, and effective

communication, these thematic areas of expertise in support of a participatory approach to the resource have been identified by established actors higher up in the vertical value chain. The exposure of CNFO members to best practices in the areas of Quality of Life practices, Livelihoods, Ecosystem Approaches to Fisheries, and Industry Profitability is suggestive of a downward or enabling tactic. Though often times used as a proxy, the delivery of any number of workshops does not equate to an expansion in

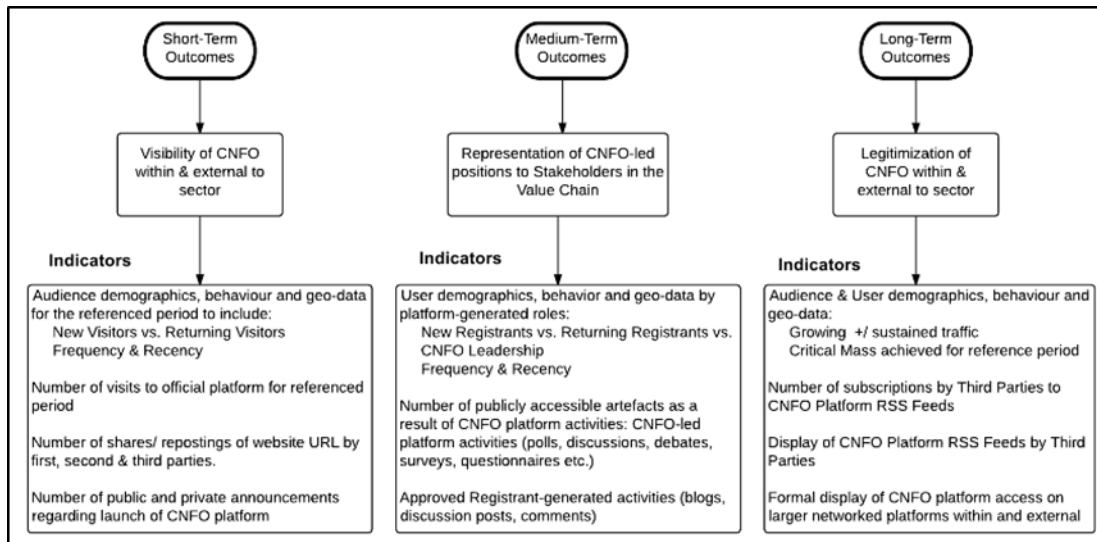


Figure 2. Mapping of ICT-driven indicators in support of legitimization.

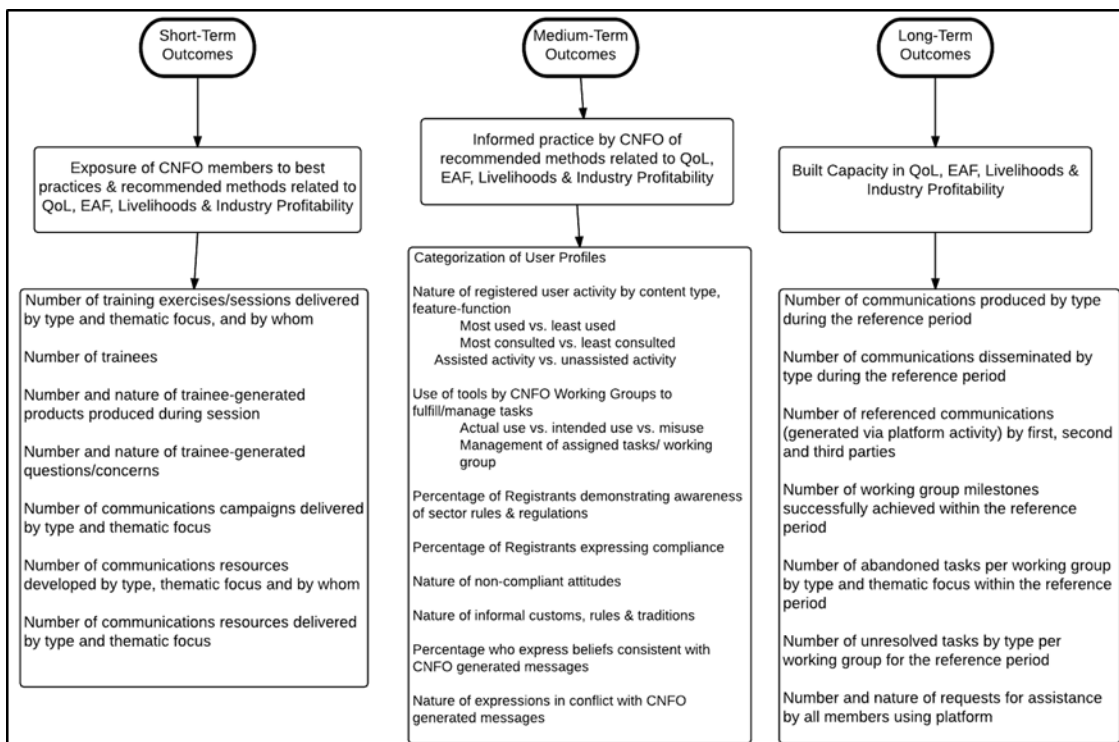


Figure 3. ICT-driven indicators in support of built capacity.

the knowledge, skills and attitudes of small-scale fishers. If the intention is to empower marginalized groups, then it becomes all the more necessary to assess to what extent and under what conditions, as well as which inputs from training (short-term indicators) have been practiced (medium-term indicators) and eventually made actionable by small-scale fishers (long-term indicators). The Engagement Platform becomes therefore the hub of simulated practice providing a programmed space capable of holding all parties accountable, and generating quantifiable and qualitative data on the user perceptions of inclusiveness and decentralized problem-solving.

Following from this sustained practice into action, are the dimensions of scalability that are critical to ICT4D projects but that require significant time, concerted effort, and additional resources to yield true benefits. Bigger, faster, and multi-purpose networks promoting greater interconnectedness are only as good as they are used by those who derive benefit from them, and only as valuable as the demand made for outputs they generate. Figure 4 takes into consideration indicators that would confirm or deny the existence of enabling conditions for scaling at different phases across the development cycle.

The introduction of an engagement platform, even in its most primitive form as that of an information website in the short term, necessarily requires a change in the traditions and ways in which small-scale fishers have accessed or sourced information that they deem to be valuable. Will the information contained on the website be so compelling in its applicability that small-scale fishers will choose to visit the site? Will fisherfolk themselves see the need to officially align themselves with the CNFO? Justifications

for scalability may rarely be seen in the short-term, and may be tied to practical demonstrations of formal registration, experimentation and participation in the basic functionality of the platform (medium term outcomes). A scalable network then, begins with a stated number of “nodes” of activity from users and groups, but over time must show an expansion through interactions with new *nodes* which continue to enhance the viability of the entire operation. In other words, is the engagement tool actually fulfilling its purpose of driving collaboration and participation amongst its small-scale fishers collective, and what are the perceptions of those using it? Further, are external parties finding value in the declared interactions and deliberations of the CNFO? If the Engagement Platform fails to demonstrate baseline user productivity, a sense of ownership, and trust in the ICT intervention by its users and visitors, the desired larger network cohesion is ultimately compromised.

In framing the vision and mission of the CNFO, it is acknowledged that the longevity of the CNFO’s Engagement Platform must be carried and sustained by the Organization itself. This means that the preliminary structures (physical, social, political, and even conceptual) under which the formalization process starts have to be deepened and evolve over time. Figure 5. maps sample indicators associated with platform use in support of greater autonomy and resilience. In the short-term, the use of the platform is focused on consolidating, organizing, and housing the otherwise fragmented starter resources that already exist. Channeling and leading its collaborative work is framed under medium-term outcomes, as the Organization is now in a position to “practice” decentralized problem-solving and decision-making. Are leaders executing their tasks in

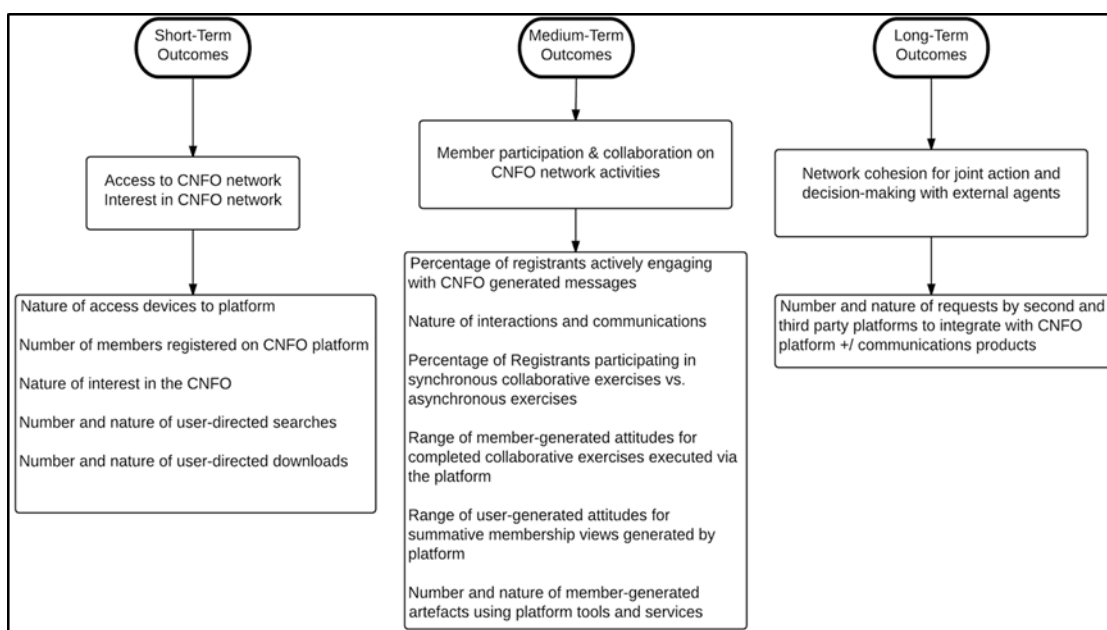


Figure 4. ICT-driven indicators in support of network cohesion.

the electronic space? How successful are they? Is knowledge transfer taking place amongst registered users and what are the emerging skill gaps? Ultimately, the suggestion in the long-term is that those closest to the source should demonstrate naturalization with ICTs in conducting decision-making exercises created for joint action.

### DISCUSSION

Participatory approaches purport to promote the critical involvement of local stakeholders, and to proffer richer insights and perspectives into ground realities and real-life circumstances that may otherwise elude established sector actors. Participatory approaches should typically involve dialogue between, as well as equitable contributions from groups of diverse stakeholders with a direct or indirect stake in the resource for the purpose of joint decision-making (Djalante, 2012). In proposing participatory approaches aimed at sustainability of the marine resource, managers should be prepared to confront and engage in solutions-driven dialogue that will benefit or provide reasonable relief to the most vulnerable agents in the value chain. Further, it is assumed that the outputs of these exchanges are mapped to development impacts which they oversee and on which they report. What is not readily disclosed however, are the issues which impact the marginalized group's capacity to participate meaningfully, to articulate and present a representative, unambiguous position that is visible to other stakeholders, and to do so responsibly.

Any serious attempt in the 21st Century at building the resilience of a community through engagement, particularly a participatory approach, cannot and should not be contemplated without attention to the diverse communication and the rich data-gathering possibilities afforded by digital technology. Similarly, communications-for-development strategies targeting behavioural change at the individual

level through improved knowledge, attitudes, and perceptions of self-efficacy would do well to understand that in contemporary society, attention to the capacity of a target group to engage electronically is both timely and relevant to the equity debate. The versatility and extensibility of ICTs underscore the contribution that can be made to complex human environments fraught with fragmented and competing interests. With the increase in ubiquitous information and communications technologies, the interest shown by marine resource managers and resource users regarding the potential and use of ICTs has moved beyond curiosity and towards significant investment or formal attempts at technology-enabled development.

Digital engagement platforms, private or public multi-user online collaborative spaces dedicated to a particular cause, have been used to assist in *practicalising* clearly defined goals and related targets associated with natural resource management (Djalante 2012). These platforms generally bring together a host of planning, networking, and decision-making tools, audio and video conferencing facilities, presentation and broadcast services, as well as multiple instantiations of information products and resources. The question therefore is not if ICTs have a role to play in driving participatory approaches, but rather how can ICTs be effectively harnessed to promote, drive, and ultimately measure resilience of a known disadvantaged group, small-scale fisherfolk, particularly in their interactions with the rest of the value chain.

### CONCLUSIONS

The means by which the potential of ICTs may not only be effectively and seamlessly harnessed, but also assessed and demonstrated, remains a challenge and a source of preoccupation, particularly in Small Island States. On account of the heterogeneity of the ICT4D landscape, assessment frameworks are not readily available and are

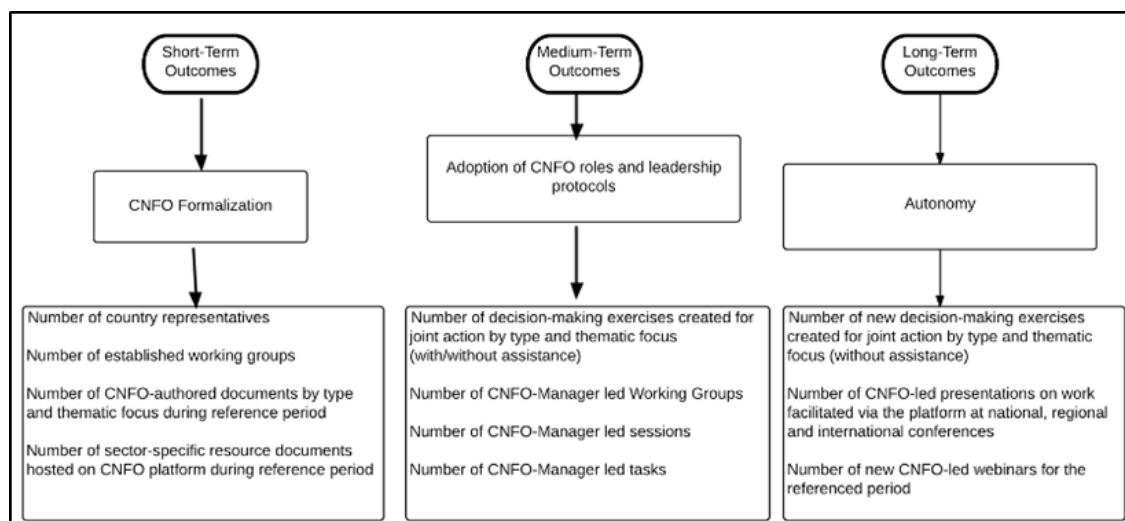


Figure 5. ICT-driven indicators in support of Autonomy.



hardly applicable to projects for which they were not conceived. In the absence of applicable Caribbean case material, this paper has deconstructed the priority needs of the CNFO to develop a set of resources for use in the operationalization, integration, adoption, and management of ICTs for engagement. It describes how the design, customization, and integration of supporting ICTs into existing communities offers open communications-for-development interventions which can provide tangible ways of tracking and thus, knowing to what extent small-scale fisher engagement is authentically quantified, meaningfully qualified, and of value to all agents of the sector regardless of their position and role.

The paper recognizes impact assessment in ICT4D as the process of quantifying and qualifying the actual effects, anticipated and unanticipated, of an intervention that have occurred in an identified human, social, economic and political context. It proposes a mix of ex-ante and ex-post indicators to account for any positive and negative changes that may occur and to recognize if little or no change has occurred. The process is necessarily multi-dimensional and multi-layered owing to the context-specific nature of development-based ICTs, the depth and width of data types that can be collected, and the range of possible, sometimes unique metrics that accompany the study.

As always with ICT4D, the most critical success factors are the human systems which give life to interventions. The Engagement Platform and its suite of planning and management tools, currently being designed, will test the electronic replication of the working structures, protocols and leadership roles specified in the CNFO formalization process. If the latter fails, the former will surely fail. The success of the Platform hinges on the extent to which designated mentors, leaders working group representatives and other community members execute their roles within and outside of the electronic space. So, too do scalability and sustainability outcomes critically rely on the actioned linking of governance, livelihoods, and organizations that have a stake in the marine resource.

#### LITERATURE CITED

- Roopchand, A.Z. 2013. Advocacy Strategy and Plan for Fisherfolk's Positions on Critical Issues concerning the Implementation of Regional Fisheries Policies in the Caribbean. CRFM Technical & Advisory Document – Number 2013 / 06. 71 pp.
- Abila, R.O., W. Ojwang, A. Othina, C. Lwenya, R. Oketch, and R. Okeyo. 2013. Using ICT for fish marketing: The EFMIS model in Kenya. *Food Chain* 3(1-2).
- Batchelor, S. and P. Norris. 2005. *Framework for the Assessment of ICT Pilot Projects: Beyond Monitoring and Evaluation to Applied Research* InfoDev. The World Bank. Available at: [http://www.infodev.org/infodev-files/resource/InfodevDocuments\\_4.pdf](http://www.infodev.org/infodev-files/resource/InfodevDocuments_4.pdf). Last viewed 28 October 2014.
- De Silva, D.A.M. 2011. *Value Chain of Fish and Fishery Products: Origin, Functions and Application in Developed and Developing Country Markets*. FAO, Rome, Italy. 58 pp.
- Djalante, R. 2012. Adaptive governance and resilience: the role of multi-stakeholder platforms in disaster risk reduction. *Natural Hazard and Earth Science Systems* 12:2923–2942. doi:10.5194/nhess-12-2923-2012.
- Duncombe, R. 2011. Researching impact of mobile phones for development: concepts, methods and lessons for practice. *Information technology for Development* 17(4):268-288.
- Fanning, L., R. Mahon, P. McConney, J. Angulo, F. Burrows, B. Chakallal, D. Gil, M. Haughton, S. Heileman, S. Martinez, L. Ostine, A. Oviedo, S. Parsons, T. Phillips, C. Santizo Arroya, B. Simmons, and C. Toro. 2007. A large marine ecosystem governance framework. *Marine Policy* 31:434–443.
- FAO. 2007. *Information and Communications Technologies Benefit Fishing Communities. New Directions in Fisheries – A Series of Policy Briefs on Development Issues, No. 07*. FAO, Rome, Italy. 12 pp.
- FAO. 2009. *Information and Knowledge Sharing*. FAO Fisheries Technical Guidelines for Responsible Fisheries, Number 12. Rome, Italy. 97 pp.
- Heeks, R. and A. Molla. 2009. Compendium on Impact Assessment of ICT-for-Development Projects. Manchester Development Informatics Working Paper 36. Development Informatics Group. Institute for Development Policy and Management. Commissioned by the IDRC. Available at: [http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/documents/di\\_wp36.pdf](http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/documents/di_wp36.pdf). 95-107.
- Heeks, R. 2010. Do information and communication technologies (ICTs) contribute to development? *Journal of International Development* 22:625-640.
- Hempel, E. NEPAD. 2010. *Value Chain Analysis in the Fisheries Sector in Africa*. Available at: [http://www.fao.org/fileadmin/user\\_upload/fisheries/docs/Value\\_Chain\\_Analysis\\_Report\\_FINAL\\_hempel.doc](http://www.fao.org/fileadmin/user_upload/fisheries/docs/Value_Chain_Analysis_Report_FINAL_hempel.doc). Last viewed 27 November 2013.
- Foster, C. and R. Heeks. 2013. Innovation and scaling of ICT for the Bottom-of-the-Pyramid. *Journal of Information Technology* 28(4): 296.
- Jensen, R. 2007. “The digital divide: information technology, market performance and welfare in the south Indian fisheries sector. *The Quarterly Journal of Economics* 122(3):879-925.
- Lee, J. 2013. Can you hear me now?: Making participatory governance work for the poor. *Harvard Law & Policy Review* 7:405-441.
- McKay, B. 2003. *Fishers and Radios: A Case Study of Radio Aids in Ghana*. Available at: [http://www.google.com/urlsa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCkQFjAA&url=http%3A%2F%2Fwww.kit.nl%2F%3Fid=15587&ei=x06SUuP0Jc21sAT9moCwBw&usq=AFQjCNG\\_xoM-hw-ndBHVzrzqczFPp7gaSw&sig2=IvneymNzvYy5ydpKyx6xA&bvm=bv.56988011.d.cWc](http://www.google.com/urlsa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCkQFjAA&url=http%3A%2F%2Fwww.kit.nl%2F%3Fid=15587&ei=x06SUuP0Jc21sAT9moCwBw&usq=AFQjCNG_xoM-hw-ndBHVzrzqczFPp7gaSw&sig2=IvneymNzvYy5ydpKyx6xA&bvm=bv.56988011.d.cWc). Last viewed 2 December 2013.
- Madon, S., N. Reinhard, D. Roode, and G. Walsham. 2009. Digital Inclusion Projects in Developing Countries: Processes of Institutionalization. *Information Technology for Development* 15(2):95-107.
- Mahon R., C. Parker, T. Sinckler, S. Willoughby, and J. Johnson. 2007. *The Value of Barbados' Fisheries: A Preliminary Assessment*. Barbados Fisheries Management Plan, Public Information Document No. 2. Available at: [http://cermes.cavehill.uwi.edu/publications/Barbados\\_fishery\\_valuation\\_2007\\_08\\_31.pdf](http://cermes.cavehill.uwi.edu/publications/Barbados_fishery_valuation_2007_08_31.pdf). last accessed 26 October 2014.
- Mahon, R., L. Fanning, P. McConney, and C. Toro. 2007. Governance for Caribbean living marine resources: seeking a path. *Proceedings of the Gulf and Caribbean Fisheries Institute* 60:3-10.
- Mallalieu, K.I and C.V. Sankarsingh. 2012. Contemplating mobile applications for small scale fisheries in Trinidad and Tobago. In: *Ringtones of Opportunity: Policy, Technology and Access in Caribbean Communications*. Ian Randle Publishing, Kingston, Jamaica.
- Mallalieu, K.I. and C.V. Sankarsingh. 2012. *ICT Innovation for Equity and Inclusion*. 2<sup>nd</sup> UNESCO Management of Social Transformations (MOST) Regional Forum of Ministers of Social and Sustainable Development of the Caribbean. Port of Spain, Trinidad.
- Mallalieu, K.I., and C.V. Sankarsingh. 2012. mFisheries: lessons in first cycle design of a context-appropriate mobile application suite. *International Journal of Technology and Inclusive Education* 1(1)8-16.

- Mallalieu, K.I., and Sankarsingh, C.V. (2013). Reconciling adult education needs for sustainable development: the case of Trinidad and Tobago small scale fisheries. *Problems of Education in the 21st Century* 52:72-84.
- McConney, P., R. Medeiros, and M. Pena. (eds.) 2014. *Enhancing Stewardship in Small-Scale Fisheries: Practices and Perspectives*. Too Big To Ignore (TBTI) and Centre for Resource Management and Environmental Studies, The University of the West Indies, Cave Hill Campus, Barbados. CERMES Technical Report No. 73. 162 pp.
- McIntosh, S. M. Lay, P. McConney, and T. Phillips. 2009. The development of a Caribbean regional network of fisherfolk organisations and its role in influencing fisheries policy. *Proceedings of the Gulf and Caribbean Fisheries Institute* 62:205-212.
- Mitra, S. 2012. *Beyond the Hole in the Wall*. Ted Books: Ted Conferences LLC.
- Phillips, T. and N. Nembhard. 2014. Caribbean Network of Fisherfolk Organizations: In Pursuit of its Mission. In: P. McConney, R. Medeiros and M. Pena. (eds.) *Enhancing Stewardship in Small-Scale Fisheries: Practices and Perspectives*. Too Big To Ignore (TBTI) and Centre for Resource Management and Environmental Studies, The University of the West Indies, Cave Hill Campus, Barbados. CERMES Technical Report No. 73.
- Rogers, E.M. 2003. *Diffusion of Innovations, 5th Edition*. Free Press, New York, New York USA.
- Sen, A. 1999. *Development and Freedom* Anchor Books, New York, New York USA.
- Schusler, T.M., D.J. Decker and M.J. Pfeffer. 2003. Social learning for collaborative natural resource management, *Society and Natural Resources* 15:309-326.
- Smith, B. and J.T. MacGregor. 1992. What is collaborative learning? In: A.S. Goodsell, M.R. Maher, and V. Tinto (eds.). *Collaborative Learning: A Sourcebook for Higher Education*. National Center on Postsecondary Teaching, Learning & Assessment, Syracuse University, Syracuse, New York USA.
- UNDP. 2010. *Evaluation of UNDP Contribution to Strengthening Local Governance*. Available at: <http://www.tinyurl.com/c6am5tf>. Last viewed 22 October 2014.
- UNDP. 2013. *Guidance Note: Scaling up Development Programmes*. Available at: Last viewed 22 October 2014. [http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/Participatory%20Local%20Development/ScalingUP\\_guidancenote\(Jan2013\)\\_web.pdf](http://www.undp.org/content/dam/undp/library/Poverty%20Reduction/Participatory%20Local%20Development/ScalingUP_guidancenote(Jan2013)_web.pdf)
- van Rijn, F., K. Burger, and E. den Belder. 2012. Impact assessment in the Sustainable Livelihood Framework. *Development in Practice* 22 (7):1019-1035.
- Walker, T., M. Maredia, T. Kelley, R. La Rovere, D. Templeton, G. Thiele, and B. Douthwaite. 2008. *Strategic Guidance for Ex Post Impact Assessment of Agricultural Research*. Science Council Secretariat, Rome, Italy. 88 pp.