MEASURING FOR THE REDUCTION OF UNCERTAINTY:
A Concept Note on the Use of Decision Analysis Tools to measure the Impact of Investment on Enhanced Resilience in the Horn of Arica

The past decade has been marked in the drylands of the greater Horn of African by repeated droughts, triggering recurrent crises of food insecurity and raising concern about the effectiveness of long term development prospects. Large numbers of people and livestock have been negatively affected during each of these episodes; over the past decade the Horn has experienced droughts in 1999-2000, 2005, 2008-9 and 2010-11.

The drylands are home to remarkable biodiversity, including wildlife and birds that support a thriving tourist industry, often in direct synergies with livestock. Currently, pastoralists living in these drylands also produce large amounts of livestock, satisfying demand for meat and milk not only within the IGAD region but also serving an export market to the Middle East. Pastoral and agro-pastoral producers have taken advantage of new market opportunities, communication technologies, and where possible, better infrastructure, to improve their livestock production and hence incomes. It is estimated that 90% of all animal and animal products destined for export from the Horn originate in pastoral lowlands.

Development partners and governments are faced with a complex development problem: how to support the productive potential of the Inter-governmental Authority on Drought (IGAD) drylands and also end the cycles of poverty and food insecurity?

In mid-2011 donor and national governments began a concerted effort to end the cycle of drought-related emergencies. In mid- September 2011 the Government of Kenya hosted a Heads of State meeting at which all IGAD members committed to Ending Drought Emergencies and IGAD was given the mandate to coordinate regional interventions.

One of the key features of initiatives that emerged from consultations between donors, development partners and governments was a focus on “resilience,” or the ability of households, communities and systems to manage change or adapt to stresses, without compromising future development prospects (IRWG 2012, Frankenburger et al. 2012). A resilience approach to development seeks to go further than solely reducing vulnerability, and aims at preventing repeated stresses and shocks from continually undermining development prospects. A key element of a resilience approach is therefore to understand and address the underlying factors that contribute to vulnerability and poverty.

Resilient growth and development focuses more holistically than traditional development on a systems-oriented approach and seeks to simultaneously strengthen institutions and socio-economic assets and make agroecological systems more robust, thereby enabling a range of actors to better manage risk and uncertainty, thereby reducing the vulnerability of populations. . Vulnerable households have multiple needs (social protection, land access, income generating opportunities, etc) and thus no single sector intervention is sufficient. Furthermore, individuals or communities are part of complex and adaptive

systems, and a holistic approach to planning is needed to manage risk, reduce vulnerability, and balance short-term needs with long term concerns.

A first step in building resilience is to understand the causes of chronic vulnerability. In the Horn, the root causes of vulnerability of livelihoods is complex, as households are vulnerable to multiple stressors, some of which are chronic and structural, and others such as drought, which are periodic but trigger food insecurity crises. These crises and the increased chronic poverty occur as a result of the inability of households to cope, both in the short and longer term, with the impact of droughts on livestock assets, household income and consumption. These drivers are a combination of political neglect of basic services, human and livestock population pressures, growing land fragmentation coupled with constraints on access to water and fodder and an increase in rangeland degradation, periodic large and small scale conflict and insufficient policy and institutional support for pastoral livestock production and viable long term economic development (HPG 2008, Davies 2008).

While evidence exists to support the benefits, both in terms of cost and impact, of longer term investment and the shifting paradigm from response to prevention (Cabot Venton et al. 2012), analytical frameworks[1] for evaluating how investments will enhance resilience are needed. The Technical Consortium for Building Resilience to Drought in the Horn of Africa (TC) has been tasked with supporting IGAD and the IGAD Disaster Risk Reduction Sustainability Initiative (IDRRSI) in developing a set of Monitoring and Evaluation (M&E) tools which will inform the M&E components of not only the investment planning documents, but help set the stage for evaluation for impact towards resilience, investment prioritization and assessing return on investment for all actors working in the Horn. These tools will focus on the following:

Analytical Tools and Frameworks

i) a framework with which to measure the impacts of interventions on resilience and a set of indicators which represent a systematic contribution towards resilience;

ii) a methodology for prioritization of investment for interventions that influence resilience; and

iii) a means of assessing return on investment with respect to projects and activities aimed at enhancing resilience.

In order to develop these frameworks it is critical to understand the systems that involved in determining resilience and the variables within and without that produce a system identity by their interaction within, and by their interaction across systems, produce a cumulative impact (see figure 1). Determining the dependent variables within these systems and quantifying the effect of their dynamic interaction as it pertains to attribution towards resilience is necessary to understand what types of interventions and in what sector, that will have the biggest impact on enhancing resilience. Potential indicators of resilience and productivity could include the asset base of households (social, human, and

[1](Alinovi et al. 2008; Frankenburger et al. 2012; Fraser et al. 2011)

financial capital), the institutions that enable them, and the health of their agroecosystems. Implementation activities in which investment is made should collectively aim to enhance the socio-economic assets, increase the strength of institutions, and lead to more effectively functioning agroecosystems.

An Expert Consultation on Resilience Measurement for Food Security was held in Rome in February of 2013. From this meeting, ten key resilience measurement principles emerged, indicating that resilience:

1. Is a dynamic process
2. Is context-specific — evaluators must always ask "*resilient to what*" and "*resilience among whom*"
3. Changes over time — measurement should be based on panel data if possible
4. May operate non-linearly, making critical tipping points important to capture
5. Should be measured by those who have the technical capacity to conduct complex analyses
6. Measures should account for cultural factors
7. Operates at multiple levels including individual, household, and community levels — measurement and data collection methodologies should reflect these levels
8. Measures should consider the dynamics between the different levels on which it operates
9. Is comprised of psycho-social factors, in addition to more traditional economic factors
10. Measures should capture the state of natural resources in a given community[2]

[2]Taken from "Why evidence-based resilience measurement is more important than ever" by Tiffany Griffin, M&E Specialist, USAID. April 22nd, 2013. http://agrilinks.org/blog/why-evidence-based-resilience-measurement-more-important-ever

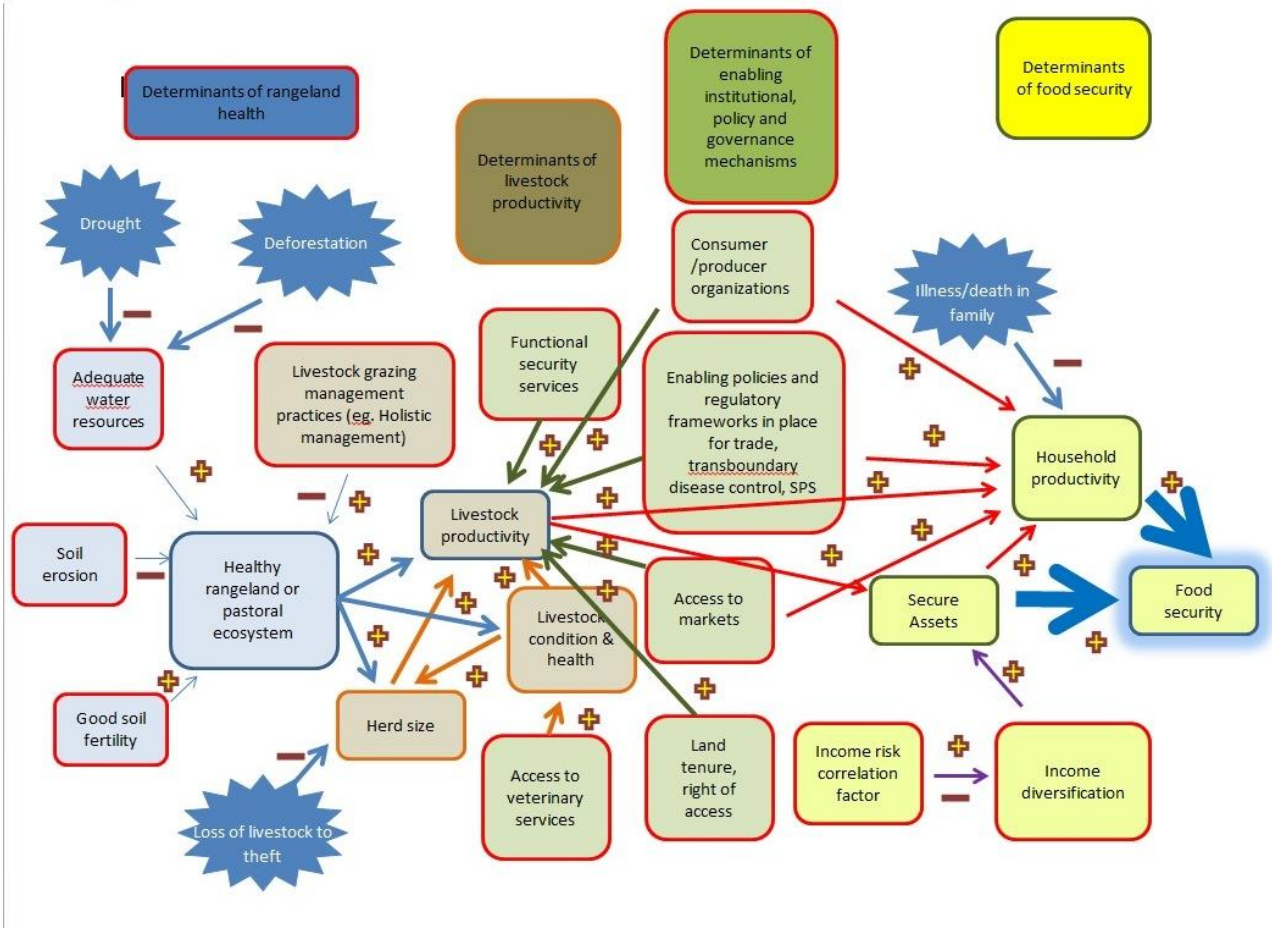

Figure 1: Potential systems, variables and respective impacts on resilience or food security: an attempt to illustrate complexity in dynamic interaction of variables

Baseline data requirements

The TC has been working closely with research partners within the Consultative Group on International Agricultural Research (CGIAR) and with external agencies to develop accurate and functional baseline datasets for the Horn. One of the activities the TC is prioritizing is to conduct a meta-analysis of available data in the region held by relevant stakeholder institutions.

The first phase of this activity will involve assessing data at multiple scales comprising multiple indicators and sectors (e.g. agricultural (crops and livestock) , spatial bio-physical layers (soil, climate, farming systems, etc.), population and poverty data, national household surveys (LSMS and agricultural census, including input uses, farm characteristics, nutrition, rough animal stocks), etc),. A classification and categorization architecture will be developed, in alignment with ongoing efforts from other data analysis activities such as the ICRAF/DfID Open Data for Agriculture in Africa survey and those within other CG centres such as IFPRI and Harvest Choice.

The second phase of this project will be the mapping and spatial analysis of the existing data to reveal geographical dispersion at multiple levels and scales and, based on revealed gaps, inform next steps to take with respect to further data collection.

The final deliverable from this exercise will be national baseline datasets at household level, maintained and populated by the IGAD Member State governments. A methodology for the continuous collection and maintenance of these datasets will have been developed, tested and operationalized for use by Member States.

Why is measuring resilience difficult?

- Resilience is difficult to measure as it cannot be represented by one, easily defined or quantified variable. It is rather, the accrual of multiple variables across multiple systems that in their dynamic interaction, represent the ability of interconnected systems to maintain their system resilience and identity, while contributing to an outcome which represents this cumulative product.

- Resilience is highly contextual and the current linear and causal socio-ecological models are inadequate to understand the micro, meso and macro processes of the relationships between stressors, components of community, social and ecological capital and outcomes. Building resilience is rarely a linear, cumulative process, increasing as each composite component improves. The dynamic interaction between components or variables is critical. An increase in one variable may produce, sometimes drastic, reductions in another, resulting in an overall drop in resilience. For example the creation of a permanent water sources (say a borehole) in an arid pastoral area is a typical drought mitigation measure aimed at improving human and animal health and productivity. During a drought however this could have the negative affect of increasing conflict between communities and / or overgrazing of the surrounding land resulting in environmental degradation. Attempting to anticipate and understand these dynamics and their impact on resilience is a major challenge.

- Disaster resilience also implies the need to measure how the variables affecting resilience are affected by disturbance. Again the range, nature and magnitude of disturbances affecting populations in the ASALs are multiple. Modelling the actual or potential impact upon resilience adds another layer to the whole measurement model. It entails identifying not only resilience but resilience to what?

- Finally the overall goal of the IDDRISI strategy is to create “disaster resilient communities, institutions and ecosystems”. This means any resilience monitoring framework needs to outline how resilience should be measured (with all the aforementioned challenges) for each of these units of analysis. It is not clear whether the variables that affect and result in community level resilience are the same as those that make an eco-system or an institution resilient. Even the

term ‘community’ needs to be clearly defined when establishing the appropriate monitoring data required to measure disaster resilience.

Challenges to measuring resilience: some questions

Which variables from which system will be of use in determining resilience of system and resilience of household, community etc? Which variables are essential? How can we determine what these are?

Resilience is a multi-sectoral and multi-dimensional concept. There are so many potential variables - socio-economic, political, environmental, physical, climatic etc – which different proponents justifiably claim to affect resilience. Consequently there is much debate over which variables constitute the most important elements of any measurement tool. Clearly any practical monitoring framework cannot measure all the potential variables (even if data were to exist). What criteria could or should be used to prioritise and synthesize potential options?

The availability, quality and coverage of data for all disaster affected areas of the HoA are a chronic problem. Some countries have very limited standard data collection processes due to years of conflict and weak governance e.g. Somalia, South Sudan. The sparse populations of the ASAL areas mean national level monitoring of many development indicators is not done at a scale that allows for differentiation across livelihood groups, ecological zones or wealth groups within the ASALs. Therefore even if key variables are identified the ability to monitor them may be limited.

How can we model the dynamic interaction of variables intra- and inter-system to ascertain their impact on resilience? How can we develop a framework that can accommodate the contextuality of scenario?

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The dynamic nature of the variables impacting upon resilience raises a major challenge for IGAD Governments and other donors. It is not enough for any monitoring framework to measure absolute and relative levels of resilience as an end state, although understanding the developmental impact would certainly be useful. Given the current lack of understanding as to what policies or interventions

most effectively and efficiently build resilience, the framework also needs to capture the variables that confer a resilient state. This means policy makers don't just want to know if resilience has been achieved but how the target group got there. This will enable policy makers to 'diagnose' the factors or variables that need to be impacted by interventions in order drive changes in resilience.

How can we quantify some of the more intangible variables and measure their impact on resilience and their dynamic interaction?

Many of the variables identified as critical to resilience are rather intangible and do not lend themselves easily to quantitative measurement. Typical examples include governance, security, social capital or eco-system health. Indicators do exist in all these areas but there is no, or limited, widespread agreement which best represent impact and few are comprehensively monitored. Hence there is no mechanism for consolidating and comparing findings.

To help answer meet these challenges to measuring resilience, the Technical Consortium is proposing to test a decision analysis approach, which is elaborated below.

How can Decision Analysis Tools be applied to the Horn of Africa resilience agenda?

A recent CGIAR review of global monitoring systems in agroecosystems and livelihoods concluded that there is little evidence that initiatives have had impact on decision making and proposed a decision analytical framework for the design of new initiatives (Shepherd et al, 2013). In partnership with Hubbard Decision Research the CGIAR has proposed an intervention decision modelling framework (IDM) for estimating the impact of interventions, determining how to measure and monitor development outcomes, and showing the value of research (Shepherd and Hubbard, 2012). The framework applied the Applied Information Economics (AIE) approach developed by Hubbard Decision Research (Hubbard, 2010). The IDM is currently being applied to a sample of six cases across the strategic research portfolios of the CGIAR Program on Water, Land and Ecosystems (http://wle.cgiar.org/) including sustainable intensification or rainfed agriculture including pastoralist systems. The Horn of Africa project will be integrated into this framework, with a focus on measurement of resilience and modelling of portfolios of investment options. Key elements of the approach are summarized below.

> **Clarify the decisions that measurements will support**. The need for data should be determined by the specific decision these data will inform. Once a decision is clarified, the data requirements become more apparent. Experience with the CGIAR decision analysis cases has shown that researchers find this step difficult and there needs to be substantive effort devoted to clarifying the decisions that researchers seek to influence, and the specific decision alternatives being considered,

Model the current state of uncertainty. Cost estimates, forecasts of benefits, project risks, and other variables in a typical big investment decision are almost never known exactly. Representing the uncertainties on all variables facilitates inclusion of important variables that are often ignored because they are seemingly too difficult to measure. The consequences of the uncertainty in variables are assessed using "Monte Carlo" simulation and a special method for training experts to assess probabilities. This initial model is effectively a snapshot of the current state of uncertainty about a problem before additional measurements are made.

Determine the "information value of variables and the identification of high value variables in a decision". Not all variables in a decision model are worth measuring and those worth measuring are often a surprise to the decision makers. In fact, normally a kind of "measurement inversion" exists in most decisions – that is, the most uncertain variables tend to be ignored while the variables that usually receive a lot of attention frequently have less bearing on the decision. With AIE, every variable in a model will have an "information value" that allows identification of high value variables in a decision. This approach targets only the variables in a decision that are the most likely to significantly reduce overall uncertainty in the decision.

The complexity inherent in dynamic social-ecological systems often hinges upon the interaction of three to six critical variables and processes that operate over distinctly different spatial and temporal scales (Gunderson & Holling 2002). Decision analysis tools can assist in isolating these variables.

Measure What Matters: Once the high-value measurements are identified, a variety of empirical methods can be used. Contrary to what is sometimes assumed, relatively little data or simple observations may be required for extremely uncertain variables. AIE often uses efficient "Bayesian" methods, which exploit prior knowledge and can be used even when data is messy or sparse. The measured variables will have less uncertainty and then the model of uncertainty can be updated. Variables with higher information values are also those that need closest monitoring during implementation, as those are the variables most likely to drift off course.

Make Better Decisions: The output of the Monte Carlo model, updated with targeted measurements, is compared to the risk/return preferences of the organization or decision maker. Research shows that the actual risk aversion and other preferences of decision makers changes frequently and unconsciously. Different preferences are applied to different investments even when management or believes they are being consistent. AIE addresses this major source of decision error by quantifying and documenting preferences such as risk tolerance and the value of deferred benefits so that the results of analysis can be assessed in a controlled, uniform manner. In this case, decisions may have large combinations of outcomes and have to be part of a portfolio of decisions. When necessary, AIE applies optimization methods to determine the best decision even from a large set of alternatives.

Forecasting intervention impacts is valuable in several stages: (i) investment prioritisation (which investment alternatives best contribute to system level outcomes; what information can most reduce uncertainty and improve intervention decisions), (ii) design of portfolio of investment (how can adjusting the intervention design reduce risk of negative outcomes), (iii) implementation (which variables are most likely to go wrong and so should be most closely monitored), (iv) impact assessment (if measured variables match projected variables then you have accumulated evidence for attribution).

The modelling approach will provide an empirical rationale for assessing potential impacts of investment by sector on enhancing resilience. This rationale is necessary to underpin decision-making processes for sectoral intervention prioritization in investment planning documents such as the IGAD Member States' Country Programme Papers and could assist considerably in aligning other investment initiatives (World Bank, IMF, AfDB, etc) in the region in a common Monitoring and Evaluation framework, including common impact variables.

Decision analysis activities

1. Convene a workshop of researchers and experts, supported by Hubbard Decision Research, with the following objectives (2nd week of July):
   1.1. Expose the group to the Applied Information Economics Methods (0.5 day instruction).
   1.2. Clarify the decision problems to be addressed drawing on country plans. Choose one pilot decision problem for developing and demonstrating the overall approach (1 day).
   1.3. Define dimensions of resilience in relation to the decision problems and identify variables to measure them (1 day)
   1.4. Define important variables for the models.
2. Identify a core group (including relevant stakeholders) who will contribute to further model development and provision of estimates.
3. Provide calibration training to the modelling group and anyone who will be providing estimates.
4. Develop a pilot decision model (preferably for a portfolio of investment alternatives) to further develop the approach. Document the model and approach into a report (complete by Dec 2013).
5. Identify a set of additional decision problems and teams and apply the modelling framework (2014)

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