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Improving Food Security Risk Management for Sustainable Development

Menghestab Haile[1] and Lieven Bydekerke[2]
[1]*World Food Programme*
[2]*Flemish Institute for Technological Research, VITO*
[1]*Ethiopia*
[2]*Belgium*

1. Introduction

The world is facing a complex challenge to reduce poverty and foster sustainable development. Food and nutrition security, compounded by climate change, bio-energy demand and rapidly rising food and energy prices is putting sustainable development on reverse gear. Achieving the Millennium Development Goals (MDGs), to which world leaders and development partners have collectively signed on, is at stake. To address food and nutrition insecurity and hence contribute to MDG achievement, there is a need to support the development of nationally owned policies and strategies. Such strategies needs to be supported by appropriate analytical tools and operational approaches incorporating recent technological developments. Current practices of developmental and humanitarian interventions require the integration of the various tools such as vulnerability and risk analysis, agricultural monitoring, food security early warning, environmental assessments, and resource mobilization activities. In this regard national governments, development partners and the humanitarian community need to address food insecurity with appropriate programmes that: (a) respond to the immediate humanitarian requirements of communities affected by natural and man-made shocks; (b) build the resilience and adaptation capacity of poor communities that include institutional support in building subnational, national and regional strategies to deal with the growing frequency of emergencies.

2. Risk and food insecurity impact on sustainable development

Any sustainable development effort is compromised by emergencies if not addressed timely. During emergencies, poor households are unable to continue to engage in economic activities that build and preserve household assets and enable sustainable development. Under such circumstances household vulnerability to future risks increases, trapping them Communities facing recurrent emergencies will be more vulnerable to future shocks and as a consequence they will not be able to effectively participate by themselves in any sustainable developmental efforts. In the absence of appropriate and functioning safety nets and risk management systems, poor households will have limited options to cope with emergencies and hence their involvement in sustainable development is curtailed.

To cope with emergencies and acute food shortages households may engage in short term strategies that are unsustainable and which often compromise the long term development objectives (UNICEF and NEPAD, 1992). Such strategies may include: increased fire wood sale leading to increased deforestation; divest productive assets; stress sale of livestock; consume seeds; pull children out of school; migrate looking for jobs often in less productive sectors; and migration to urban centers or neighboring countries becoming refugees. Furthermore recurrent droughts could increase the competition for pasture and water increasing the potential for conflicts. At the same time national governments and their development partners will be forced to divert their development funds to respond to emergencies forgoing investment in longer term development.

In conclusion, food emergencies threaten lives and livelihoods; disrupt long-term development and expose communities to future disasters. A comprehensive strategy that addresses the immediate food needs of households while ensuring support to longer term sustainable development is critical. Development partners and the humanitarian community need to work together to provide coordinated support to National Governments to implement appropriate strategies.

3. Risk assessments – Understanding the risks - Food security information management

Large scale emergencies that overwhelm national response capacities and require external humanitarian intervention often occur in poor countries with limited financial and technical resources. Decision making and strategic planning is hampered by the lack of reliable information on food security factors; poor infrastructure and weak government institutions; compounded by the lack of clear policies and strategies to address food insecurity and risk management. In this paper we focus on risk management. A key component of a good risk management system is the availability of timely and reliable information. There is a need to invest in a food security information system which will enhance decision making and strengthening national Emergency Preparedness and Response Capacity.

Establishing an effective food security risk management capacity requires a comprehensive understanding of the various risk factors that impact on food security. Risks need to be identified, assessed and monitored. A comprehensive food security risk analysis and monitoring system should provide information that allows for answering questions such as who are the food insecure and vulnerable; where they live; why they are food insecure and vulnerable; what intervention options are most appropriate. It is important to identify and understand the various food security hazards and vulnerabilities at sub-national level; identify knowledge gaps and national capacities; identify the temporal and spatial distribution of hazards both historical, current and expected ones; identify the magnitude, frequency and duration of the hazards; assess which of the hazards can be reliably predicted.

The various aspects of risk management need to be integrated using appropriate risk assessment tools that need to be developed. The tools should enable the integration of possible impacts of various natural hazards, such as floods, droughts and earthquakes with socio-economic and vulnerability factors. Risk assessment and monitoring is comprised of the following main elements: risk knowledge; hazard monitoring and early warning; needs

assessment; and communication. Assessments of risks require systematic collection and analysis of various data sets and should take into account the dynamics and variability of hazards and vulnerabilities from processes such as urbanization, rural land-use change, environmental degradation, climate variability/change. As such the main components in developing a comprehensive risk analysis should include:

- Risk identification and development of risk, hazard and vulnerability maps through comprehensive food insecurity risk and vulnerability analysis;
- Food Security Risk Monitoring systems based on key indicators identified above to provide early warning;
- Needs assessments during emergencies;
- A food security information management platform incorporating the latest advances in Geographic Information Systems (GIS) and spatial technology; and
- Capacity building of national and regional institutions

Essentially a food security risk management information system should include the following:

- Indicators that represent the three widely-accepted dimensions of food security (availability, access, utilization) and the risks to them;
- Identified geographical areas and communities that may be facing or will face immediate acute food insecurity;
- Information on the main causes of food insecurity and risks to livelihoods and the extent (or magnitude) to which households will be affected;
- Information on various risk management efforts that governments, communities and households dispose of to avoid or mitigate food insecurity situations;
- Tools for early detection of risks and how information on the available measures to address potential adverse impacts; and
- A comprehensive contingency plan, to support advocacy and resource mobilization efforts and market interventions, such as local purchase of food.

4. Food security risk and vulnerability analysis

In poor and disaster prone countries where external humanitarian interventions are often required, a comprehensive understanding of the national food security policy and disaster response strategy is an important factor in the development of a food security assistance framework. In this regard a Comprehensive Food Security and Vulnerability Analyses (World Food Programme, 2006) is required to identify the main causes of food insecurity and risks to livelihoods and understand the extent to which households and communities could be affected; identify various risk management efforts that governments, communities and households undertake to deal with food shortages; and provide opportunities for early detection of risks to livelihoods and how to address them so that potential adverse impacts can be minimized. A comprehensive food security and vulnerability analysis should contribute to:

- Building national capacity in food security information management and emergency preparedness;
- A road map for food security interventions;
- Strategy formulation in food insecure provinces and localities;

- Humanitarian interventions to be targeted effectively; and
- Efficient national resources allocation by governments

When undertaking a comprehensive food security analysis there are core analytical steps that are used. Here below is a summary of some of the key steps:

- **Secondary data analysis**: Using available data sets preliminary vulnerability and hazard analysis is undertaken. This requires acquisition of all relevant secondary data including socio-economic and environmental data. Secondary data analysis will enable development of household and community vulnerability profiles. It will identify geographical areas at risk as well as areas that may require further investigation through primary data collection. A key output of this process is the creation of geo-database at a national level and also identification of priority geographical areas that need further study.
- **Vulnerability, hazard and livelihood zoning**: Secondary data analysis will enable the production of vulnerability, hazard and livelihood zone maps at the sub-national national level. Hotspot areas that would require monitoring will be identified and relevant indicators selected. The outputs depend on the availability of data.
- **Primary data collection**: Very often secondary data analysis may not be adequate to answer all the relevant questions on food security. Primary data collection may be required to fill the gaps. Geospatial data analysis can be used to help the design of the survey. The use of Smart phones, handheld computer devices and a Global Positioning System device (GPS) improves field data capture and analysis. By geo-referencing the data it will be easily integrated when undertaking vulnerability and risk analysis.
- **Risk mapping**: By integrating secondary data analysis with primary data analysis hazard, vulnerability and risk profile maps are produced.
- **Geospatial data management and dissemination**: A geospatial information management and data exchange platform should be developed and maintained. All the relevant data and analysis will be managed and effectively shared with users.

In undertaking risk analysis, the first step in this process would be to assess if there is any relevant work done at the country level and identify partners both national and international. It is also important to assess the local capacity and institutions in the area of remote sensing, GIS and risk analysis. A risk analysis framework needs to be established and a step by step process that includes spatial data identification, analysis and dissemination of results.

5. Hazard, vulnerability and risk mapping

There are the two components of risk analysis, these are hazard and vulnerability each of them can be assessed separately and integrated to provide risk factors. Assessment and monitoring of risks requires systematic collection and analysis of various data sets and should take into account the dynamics and variability of hazards and vulnerabilities from processes such as climate change, land use change, environmental degradation, political and socio-economic changes. The maps should provide:

- Identification of the main hazards their frequency and magnitude
- Defining a common standard of presentation of hazards and vulnerabilities

- Developing exposure maps and when possible define trigger factors of the hazards
- Mapping socio economic factors
- Mapping of vulnerabilities and their magnitudes

Data layers need to include climatic factors, land use maps, environmental hazards, political factors and socio economic vulnerabilities. The various data sets should be integrated in a GIS environment and processed to establish how poor people make their living and what their coping capacities for dealing with risks. Such analysis provides a better context for interpreting food security information and the impact of shocks or hazards on people's lives. Livelihood zones and risk maps can then be established with composite indices of hazards and vulnerabilities. This is useful for geographical targeting of zones exposed to certain hazards and vulnerabilities. Such analysis will provide the basis for emergency response and shock preparedness strategies.

6. Baseline mapping and national capacity

The first step in the process is the identification and acquisition of the various data sets that are necessary for food security and vulnerability analysis. The various data sets need to be organized according to the type of data as well as the temporal and spatial scales. These data sets will be integrated to support the various types of analysis including food security monitoring. The specific activities in identification and data collection should include the following:

- Assess the national capacity in geospatial infrastructures, which include methodologies, datasets, technologies, policies, and human resources, under which data and/or tools are made available to users.
- Identify users and partners with similar needs in terms of data infrastructure and analysis requirements
- Identify the necessary data sets, where to find them and develop a strategy for collecting them
- Collect all the relevant data sets and create a standardized databases disaggregated at sub-national, regional and national levels. Databases may also include information products (e.g. text documents; photos; tabular data; maps; statistics; earth observation data)
- Inventory and compilation of relevant sources of data and information, metadata catalogues and information directories, information networks, and institutions.

7. Food security monitoring and early warning systems

A food security monitoring system is needed to assess on regular basis the food security status of a given population and provide timely information that would allow timely intervention. That means all the three aspects of food security (availability, access and utilization) should be monitored comprehensively. Appropriate food security variables or indicators associated with availability, access and utilization are selected and monitored. A food security monitoring system constitutes a continuous assessment of food security indicators to detect major changes in food security trends and advice on the likely occurrence of food crises ahead of time. Such warning should, in principle, trigger timely and appropriate preventive responses. The specific objectives and setups of food security

monitoring systems could vary from country to country but in general they should address the following:

- To identify geographical areas and communities that will be affected by food insecurity
- To identify main causes of food insecurity and indicate the extent to which households will be affected
- To identify factors affecting the food security status of households and community
- To trigger contingency planning and Emergency Needs Assessment
- Regularly assess nutritional status of people in the most severely affected areas
- Support advocacy and resource mobilization efforts

Some of the selected indicators may be classified as early, stress or late depending on the lead time between the indicators and their outcome.

At the national level often there already exist various monitoring systems under different government ministries or supported by UN, NGOs or international partners. Examples include:

- Agricultural Information Systems - Agricultural production patterns and performance, trade, inputs, farming systems, and rural income levels.
- Health and Nutrition Information Systems
- Climatic Information Systems - Topography, landform, soils, climate, water availability, land use, land suitability and productivity, land tenure, irrigation, and infrastructure.
- Early Warning Systems - crop production, agricultural production forecasts, estimates of stock levels, food requirements, imports and exports and information on household income
- Market Information Systems - agricultural input and commodity prices, marketing opportunities, and other information relevant to improving the functioning of agricultural markets.
- Vulnerability Analysis and Mapping Systems - Risk factors to which vulnerable population groups are exposed.

At present the institutional linkages between the different players (meteorological services, planning ministries, agriculture departments and humanitarian institutions) is weak or is on ad hoc basis.

Africa is currently heavily dependent on ad hoc early warning and monitoring systems that are run by various international agencies, NGOs and UN agencies (NEPAD, 2003). Such systems are often not integrated into national and regional strategies and may not be sustainable. There is a need for promoting an African led framework ensuring standardized approaches across countries and regions. The many institutional problems which limit the effectiveness of national food security information and early warning systems can be summarized as follows:

- Lack of appropriate food security policies and political commitments. Food security may not often be priority of governments which lack clear policies and regulations on food security and humanitarian interventions;
- Poor integration into government structures. Typically, data collection and reporting functions remain separated among several ministries;

- Separation of data collection activities from policy-making processes. People who collect and report food security data typically have no independent decision-taking responsibility;
- Problematic relationship between donors and governments. Donors provide technical support and funding for national systems, but governments have their own priorities;
- Existing systems generally operate with little coordination among themselves;
- Lack of institutional memory. Systems are rarely institutionalized, due to high staff turnover in government, donors and NGOs, combined with a "project" approach to early warning; and
- Emergency response dominates long term planning. Political enthusiasm and donor support for early warning systems tends to be high in the aftermath of a famine but then steadily evaporates year by year.

To address the above mentioned gaps it will be important to establish a framework under AUC/NEPAD by building on existing systems and capabilities. The key objective will be to consolidate regional early warning information systems where they exist, and initiate new ones in regional organizations where such systems are not available. Thus, integrating Africa's regional organizations' information systems will be the mechanism through which information will be fed into the AUC/NEPAD.

8. Application of new technologies

With recent advances in GIS, satellite technologies and Information Technology, geospatial data is becoming widely available for civilian use. Satellite data, computing capacity, and GIS software are becoming more and more affordable and accessible. The humanitarian community is quickly adopting these latest technological developments and tools to support humanitarian decision making through improved availability of timely and reliable information. New computer-based information and communication technologies are available that can significantly improve the analytical efficiency and the effectiveness of communicating results. Each country should carefully examine the new technologies and select those that can improve the operational efficiency of its system and meet national objectives within the existing resource constraints.

Space borne systems and related technologies and applications are quickly developing as new generations of satellites are rapidly becoming available for peaceful uses. Earth Observation (EO) applications provides advanced tools that enhance the collection, storage, analysis and integration of spatial/geographic data with related non-geographic information collected from ground surveys and stored in databases. The humanitarian community is currently using various types of EO products to support field level activities such as agricultural monitoring (crop and pasture), disaster assessments (such as flood extents) and operational planning.

For example as a result of technological developments and availability of satellite information, agricultural monitoring capacity is improving rapidly. Using latest satellite technologies we are now able to monitor more accurately cropped areas, crop development and estimate yields and production. Through integrated monitoring of crop models, water requirement satisfaction index, vegetation vigour and field reports crop and pasture conditions can be monitored more effectively (Brown, 2008). Crop failures can be identified

several weeks before the end of the agricultural season providing early warning information. It is now possible to estimate the level of expected production by mid-growing season. Depending on the analysis appropriate decision options could be taken. If the information indicates crop failure, further assessment will be initiated on whether humanitarian intervention would be required and trigger response planning. On the other hand, if analysis indicates exceptional surplus harvest then the decision could be to initiate a marketing strategy to avoid market failure.

In summary emerging applications of remote sensing for food security monitoring and risk analysis offers opportunities for improving the effectiveness of humanitarian decision-making. Remote sensing applications require field level validation and verification to be operationally viable. Once such applications are developed the challenge becomes how to integrate such information to support humanitarian decision-making more effectively. In the current humanitarian response model interventions to agricultural failure are planned following crop assessments at the end of the growing season. If such information would be used it will be possible to provide the necessary assistance in a timely manner, directly contributing to the sustenance of livelihoods.

9. Earth observation

One of the challenges in designing and operating food security and early warning systems is to ensure that the system is capable of providing up to date and continuous data to guarantee up to date information for policy makers and decision makers. This is a particular challenge when assessing the spatial impact of climatic conditions and human interventions, both on the short as the long term. While information collected in the field is indispensible, extensive field data collection is expensive and mostly done only at particular moments in time. As such it does not provide the comprehensive spatial and temporal overview required for an effective early warning system. Field data, in combination with satellite imagery provide however a very powerful resource. The specific advantages of satellite imagery are its timeliness, frequency and large continuous spatial extent whereby entire areas are covered at once at regular (and known) time intervals. In addition to these characteristics earth observation may play a particular role in standardizing data collection routines increasing objectivity and transparency of the system.

Space agencies have launched in the past several satellites which provide images of the earth at various time intervals and spatial detail. Space agencies further ensure the availability of satellites and related imagery for the future through comprehensive space programmes. It is expected that both quality and quantity of available imagery will increase significantly. Due to the different satellite characteristics, earth observation may contribute to various components in early warning such as the development of baseline information on land cover, as part of the methodology to generate agricultural statistics, continuous monitoring of weather and vegetation condition, among others.

10. Dissemination – Establishing a platform

The strength of an integrated food security information system would be its capacity to continuously provide national and international decision-makers with adequate, reliable, sustained and meaningful monitoring results focused on changes (magnitude of changes)

and trend analysis. The use of mapping software embedded into a GIS environment (at the lowest administrative level possible) would undoubtedly help decision-making to focus on priorities. Several other information products could be proposed, including monthly bulletins to inform the donors and the humanitarian community, more frequent internal reports, radio or television broadcasts, insertion into local press, fax, internet, etc. Questions related to language, formats and media to be used should be locally resolved.

The main goal of an integrated platform is to create a standardised but decentralised spatial information management environment that would enable individual countries, Regional Economic Communities, the New Partnership on African Development (NEPAD), the African Union Commission (AUC) and other partners to access geo-referenced food security databases and cartographic products from a variety of sources. The potential system includes tools and protocols for creating standards that can be used by various users. This supports and strengthens the appropriate use of spatial information and facilitates the collaborative efforts to increase accessibility to relevant food security and vulnerability information. Using this platform practical applications that allow analysis of food security and monitoring trends providing regular updates to guide humanitarian responses will need to be developed as well as data sharing mechanisms to be put in place. In summary a spatial tool should have the following attributes:

- A 'spatially enabled' database built on 'Object-Oriented Modeling' principles so as to incorporate the notion of geographic feature inherency
- A set of standard feature attribution and classification schemes for the most common geographic layers. This will be developed so as to comply with any pre-existing and authoritative standards in use
- A digital field data collection tool reflecting the database structure and feature classification scheme discussed above
- Guaranteed access to earth observation data, to ensure a continuous data stream to allow for monitoring climatic conditions and its effect on crop and pasture condition and the environment
- An online data archiving and querying interface, and the necessary routines to automatically ingest the acquired data into the system
- A set of training packages for field data collection and data archiving.

Africa is currently heavily dependent on ad hoc early warning and monitoring systems that are run by various international agencies, NGOs and UN agencies. Such systems are often not integrated into national and regional strategies and are not sustainable. There is a need for promoting an African led framework ensuring standardized approaches across countries and regions.

11. Policy framework – AU/EU partnership

Over the last decade, Africa and the EU have developed strategies and policies that enhance their cooperation. The 2007 Lisbon Summit marked a milestone in this cooperation where the African Union and the European Union formulated a strategic partnership. To implement this cooperation the First Action Plan 2008-2010 was adopted in 2007 and reiterated in the 2011-2013 Action Plan (African Union and European Commission, 2011). The Action Plan outlines 8 Areas for strategic partnership. The areas that have been

identified include among others Food Security, Climate Change, and Information Management. Under the Science and Information Management component the Global Monitoring for the Environment and Security (GMES) initiative and Africa Action Plan has been developed. This framework provides an excellent opportunity for partnership between Africa and EU including the private sector in Africa and the EU. To further strengthen the partnership between Africa and EU and in particular in the area of GMES, the Belgian Presidency of the EU Council hosted a High Level Conference "Space for the African Citizen" on the 16th of September, 2010. The main conclusion of the conference was a call for further collaboration between Africa and the EU and in particular calling for enhanced partnership and knowledge sharing between EU agencies and their African counter parts (Belgian Presidency to the EC Council, 2010). It is expected that the support programmes defined within the GMES framework will lead to improved access to earth observation data, improved decision making and strengthened Africa capacity to exploit remote sensing data for regional and continental decision makers (African Union and European Commission, 2011). These initiatives, in close collaboration with the private sector, technical and scientific partners and government agencies, could be build on to further integrate the various mentioned system components to design an integrated system supporting effective decision making on food security.

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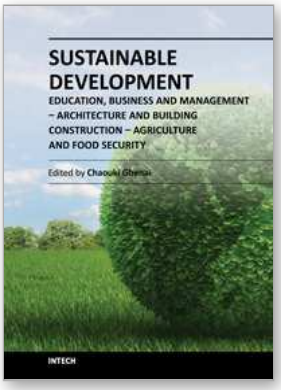

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Securing the future of the human race will require an improved understanding of the environment as well as of technological solutions, mindsets and behaviors in line with modes of development that the ecosphere of our planet can support. Some experts see the only solution in a global deflation of the currently unsustainable exploitation of resources. However, sustainable development offers an approach that would be practical to fuse with the managerial strategies and assessment tools for policy and decision makers at the regional planning level. Environmentalists, architects, engineers, policy makers and economists will have to work together in order to ensure that planning and development can meet our society's present needs without compromising the security of future generations. Better planning methods for urban and rural expansion could prevent environmental destruction and imminent crises. Energy, transport, water, environment and food production systems should aim for self-sufficiency and not the rapid depletion of natural resources. Planning for sustainable development must overcome many complex technical and social issues.

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INTECH
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InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821