# CLIMATE-RESILIENT AGRICULTURE AND FOOD SECURITY

## New Network Capabilities to Solve Global Problems

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**With a globalized food system, food has become a global problem more complex than ever before. Food security is** no longer just related to agriculture, it is interconnected with a wide range of issue areas such as climate change and population.

The digital revolution is creating new capabilities to solve an old problem. Four case studies of global solution networks—two networking platforms, a standards network and a knowledge network—demonstrate how an emerging problem-solving approach can fundamentally transform global food governance.

GLOBAL SOLUTION NETWORKS

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# Acronyms

| | |
|---|---|
| APEC | Asia-Pacific Economic Cooperation |
| BAIF | BAIF Development Research Foundation (India) |
| BRICS | Brazil, Russia, India and China |
| COCO | Connect Online Connect Offline |
| CSD 17 | The 17th session of the Commission on Sustainable Development (UN) |
| DFID | Department for International Development (UK Government) |
| FAO | Food & Agriculture Organization (UN) |
| G8 | Group of Eight (leading industrialized countries) |
| G77 | Group of 77 (developing countries) |
| GDP | Gross Domestic Product |
| GHG | Greenhouse gases |
| GIS | Geographical Information System |
| GM | Genetically Modified |
| GSN | Global Solution Network |
| ICT | Information and communications technology |
| IFAD | International Fund for Agricultural Development |
| IFPRI | International Food Policy Research Institute |
| IMF | International Monetary Fund |
| IPCC | Intergovernmental Panel on Climate Change |
| MDG | Millennium Development Goal |
| NEPAD | New Partnerships for Africa's Development |
| NGO | Non-Government Organization |
| ODA | Official Development Assistance |
| OECD | Organization for Economic Cooperation & Development |
| OECD-DAC | Development Assistance Committee under the OECD |
| PRADAN | Professional Assistance for Development Action (India) |
| R&D | Research and development |
| SAN | Sustainable Agriculture Network |
| SMS | Short Message Service |
| TFF | Thought for Food |
| TNC | Trans-national corporation |
| TRIPS | Trade-Related Aspects of Intellectual Property Rights |
| UN | United Nations |
| UNCSD (Rio+20) | United Nations Conference on Sustainable Development |
| USAID | United States Agency for International Development |

| | |
|---|---|
| WFS | World Food Summit |
| WHO | World Health Organization |
| WTO | World Trade Organization |
| WWF | World Wildlife Fund |

> *...the spread of mobile technology is creating new capabilities and networks for sharing and collaborating to solve global problem at lower cost but higher speed.*

# Idea in Brief

In an increasingly globalized food system, securing access to adequate food for a growing global population is more complicated than ever before. Food security is no longer just a matter of local agricultural productivity; it intersects a wide range of factors including climate change, population growth, land scarcity, energy resources, water supply and trade policy. Today there are over 800 million undernourished people, in part due to failures of the global food system (including massive food loss, disenfranchisement of smallholder farmers and widespread ecological damage resulting from industrial food production techniques), and in part due to the inability of state-based institutions to correct these market failures over the past two decades.

Thanks to the digital revolution, however, there is hope that emerging multi-stakeholder networks can advance new solutions to ensure food security. Even farmers in remote areas increasingly have direct access to what was once out-of-reach scientific and market information through the Internet and mobile connectivity. In fact, the spread of mobile technology is creating new capabilities and networks for sharing and collaborating to solve global problems at lower cost but higher speed. Four case studies of global solution networks working on these solutions demonstrate how technology-enabled approaches to problem-solving can fundamentally transform global food governance.

# Food Uprisings: Prelude for Global Catastrophe or Catalyst for Change?

The sheer scale and speed of the Arab Spring movements, which upset the stability of the Middle East and North Africa beginning in December 2010, are still vivid in the minds of many.* Social networks such as Facebook and Twitter may have provided the technological platforms for spreading and amplifying the dissent, but new studies have suggested that the underlying catalyst for the early uprisings was the lack of food security.

Food security means access to sufficient food by all people at all times. Analysts argue that a combination of food and water shortages, spiking food prices, intense droughts and other environmental factors have exacerbated the already tense politics of parts of the Middle East and will continue to do so in the foreseeable future.[1] The latest US National Climate Assessment

* Municipal officials have humiliated and confiscated the produce of a street vendor in Tunisia. It was this street vendor setting himself on fire that was the firing line for this "Jasmine Revolution."

*"While traditional state-based institutions have struggled to find an effective way to address issues of food security, the digital revolution is fostering a variety of global solution networks (GSNs) with the potential to make progress."*

Report,[2] and the IPCC's Fifth Assessment Report (AR5),[3] both warn us that climate change could have severe consequences for food security, including rapidly rising food prices, leading to social upheaval and disruptions in longstanding agricultural practices. In fact, one of the region's worst droughts is currently devastating two-thirds of the arable land in Syria, Lebanon, Jordan and the Palestinian territories and driving up wheat prices in international markets.[4] Outside the Middle East, food security issues are also affecting South America, Southeast Asia and even some of the world's most affluent countries like the United States. Indeed, the costs of fresh produce could jump 13-34% in the coming months due to a lingering three-year drought in California, which has destroyed 10-20% of its crops, including lettuce, avocados, broccoli and grapes.[5] The changing climate would even shrink the $50 billion Californian wine industry by up to 70% by 2050.[6]

While traditional state-based institutions have struggled to find an effective way to address issues of food security, the digital revolution is fostering a variety of global solution networks (GSNs) with the potential to make progress. This report will identify and delineate some of the key problems in global food production that are contributing to regional food shortages and creating concern for the future. It will also investigate the impact and success of a variety of GSNs that are bringing new knowledge, capabilities and models of problem solving to bear on food security. These GSNs include a knowledge network that transmits effective agricultural techniques between farmers in developing countries, a standards network that has set globally recognized standards for sustainable agriculture, and two digital platforms that facilitate the crowdsourcing of new food security ideas and innovations.

# A Primer on Global Solution Networks

Global Solution Networks[7] are emerging non-state networks of civil society, private sector, government and individual stakeholders that achieve new forms of global problem-solving, cooperation and governance. These GSNs address all of the urgent challenges facing humanity from poverty, human rights, health and the environment, to economic policy and food security.

GSNs are defined by a set of key characteristics. They are also distinguished in terms of the different types of functions they perform. The presentation of the case studies and the ensuing analysis follows the framework set out in the GSN concept.

The five characteristics are as follows:

1. **Diverse Stakeholders.** There are participants from at least two of the four pillars of society (government or

international institutions; corporations and business interests; the civil society; and individual citizens).

2. **Beyond One Nation-State.** The network should be global or at least multi-national, having participants from more than one country. There are, to date, few networks that are truly global and that operate on multiple levels. But the growing number of problems are truly global.

3. **Networking.** It must be a 21st century network in the sense that it harnesses the new forms of digital communications tools and platforms to achieve its goals.

4. **Progressive Goals.** The network seeks to improve the state of the world through developing new policies or new solutions, influencing states and institutions or otherwise contributing to economic and social development, human rights, sustainability, democracy, global cooperation, building empowering platforms and global governance. One way of thinking about this is that these networks seek to create global public goods.

5. **Operates with a "Management by Collaboration and Consensus" model.** Decisions are developed through collaboration with all of the stakeholders instead of being decided by the leaders at the top of the organization and then pushed down the chain of command. Consensus does not mean that everyone must agree with every detail before a decision is reached. Instead, consensus typically means that a decision is reached after dealing with as many objections as possible.[8]

The ten types of functional networks are:

1. **Knowledge Networks** develop new thinking, research, ideas and policies that can be helpful in solving global problems. Their emphasis is on the creation of new ideas, not their advocacy.

2. **Operational and Delivery Networks** actually deliver the change they seek, supplementing or even bypassing the efforts of traditional institutions.

3. **Policy Networks** create government policy even though they are not networks of government policy makers.

4. **Advocacy Networks** seek to change the agenda or policies of governments, corporations or other institutions.

5. **Watchdog Networks** scrutinize institutions to ensure they behave appropriately.

6. **Platforms** create the capability for other networks to organize.

> *A more interconnected food system requires stakeholders to closely coordinate their efforts with those in other domains that, until recently, were considered unrelated to the food systems.*

7. **Global Standards Networks** are non-state based organizations that develop technical specifications and standards for virtually anything, including standards for the Internet itself.
8. **Governance Networks** have achieved or been granted the right and responsibility of non-institutional global governance.
9. **Networked Institutions** provide a wide range of capabilities even similar to state-based institutions but with a very different *modus-operandi*.
10. **Diaspora Networks** pursue problem-solving through kinship and ethnicity connections.

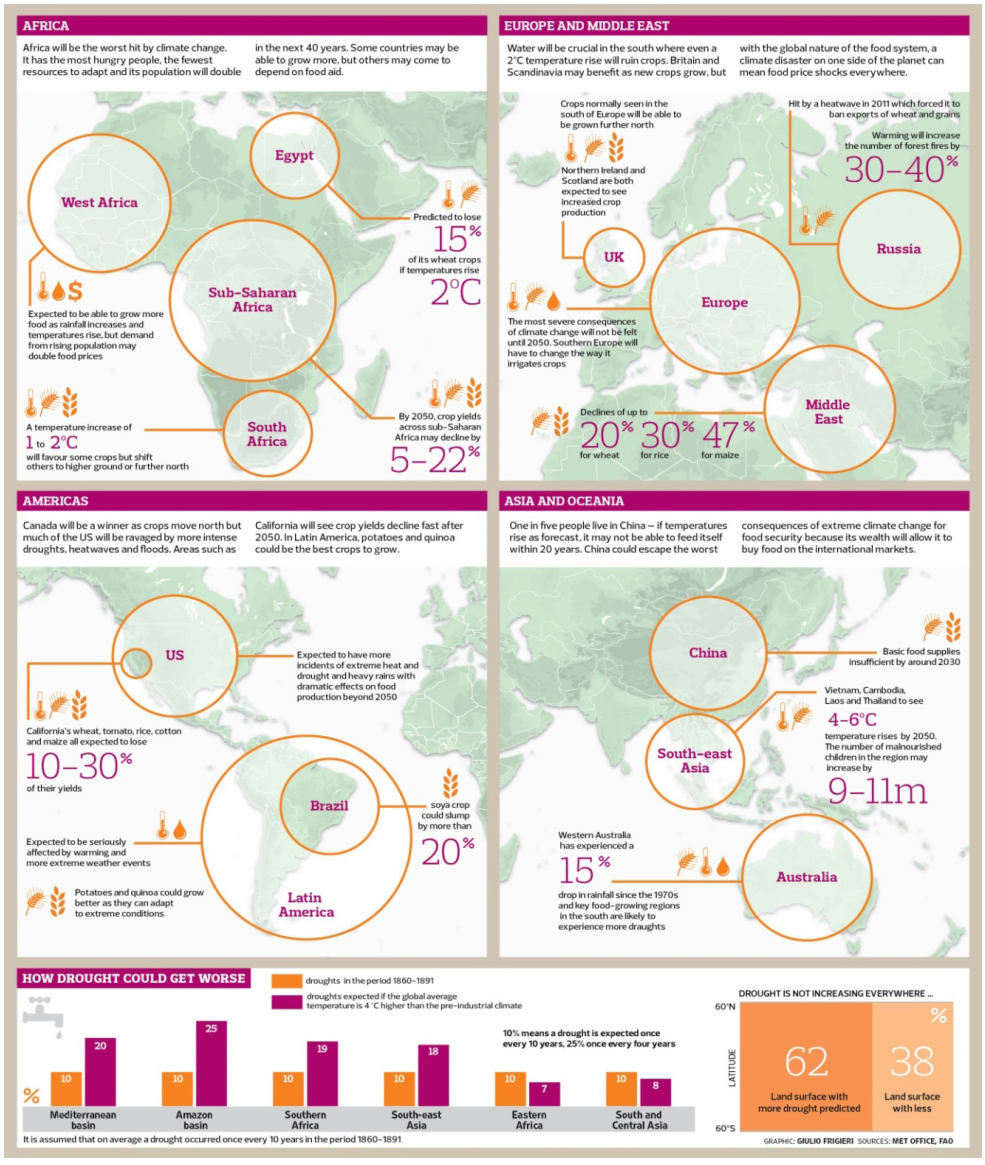
# Food as an Interconnected Global Problem

The rise of a global food system has made food security a much more complex endeavor. Food is no longer an isolated national or regional issue that can be addressed by refining agricultural policies within a country's borders. Growing international trade and globalization open borders to the free flow of agri-products, and require rapidly changing and evolving institutional and policy programs. As the food system expands, seeds, feeds, fertilizers, processing and selling of foodstuffs, which used to be local, have become related cross-border sectors of a globalized food value chain supported by multinational food producers. As a result, disruptions in one geographical region can rapidly proliferate, causing regional or even global food-supply shocks. On 3 March 2014, for instance, wheat futures jumped 4.6%, their biggest one-day gain in nearly two years. Traders were responding to concerns about the escalating crisis in Ukraine which could have the effect of decelerating its grain exports to Europe.[9]

A more interconnected food system requires stakeholders to closely coordinate their efforts with those in other domains that, until recently, were considered unrelated to the food systems. Events and disciplines that can impact the food system include climate change, population shift, land use, energy and water supply, environmental conservation, infrastructural planning, commerce and industry, finance and trade policies. Governments must pursue integrated policy-making that considers the impact of these domains on food productivity. NGOs working in these areas must be sensitive to the promotion of local civic values by seeking roles that have greater influence in the decision-making structures. Companies must be aware of potential sustainability issues in managing their global value chains. Inter-governmental bodies must maintain close relationships with each other to avoid duplication of effort or conflicting actions. Collectively, these

stakeholders participate in the governance of global food production in order to deliver the highest impact for a food-secure world.

## Climate Change Threatens Global Agricultural Productivity



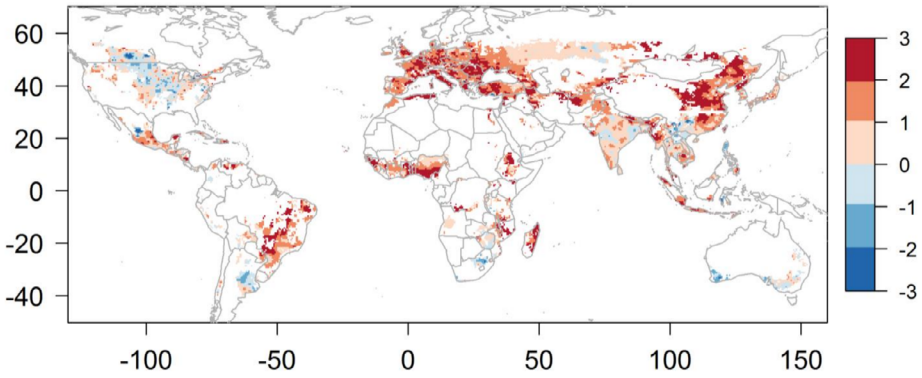

Impact of climate change on food productivity by region[10]

*"Modern farming technologies have reduced this vulnerability and increased production over the recent decades, but there is quantitative evidence showing that climate change is already effecting the quality and quantity of food produced globally."*

Agricultural productivity is highly vulnerable to climate change. A year of insufficient or excessive rainfall, or a hot or cold spell at the wrong time can have catastrophic effects on crop yields and livestock production. Rising concentrations of $CO_2$ in the atmosphere—the primary driver of climate change—could, *ceteris paribus*, increase production of some crops, such as rice, soybean and wheat in some regions. Nonetheless, the changing climate will disturb the length and quality of the growing season with a potentially devastating impact on crops.

In 2007, the IPCC's Fourth Assessment Report (AR4) predicted that parts of the sub-tropics could experience deteriorating conditions for food production were global average temperatures to rise by more than 1-3°C.[11] Crop yields across almost all regions would decline by 5-47% as a result of extreme weather events combined with the depletion of natural resources.[12]

Modern farming technologies have reduced this vulnerability and increased production over the recent decades, but there is quantitative evidence showing that climate change is already effecting the quality and quantity of food produced globally. The biggest losers from the warming trend are wheat in Russia, India and France, and maize in China and Brazil. A Stanford University study reported that global production of maize would have been approximately 6% higher and wheat 4% higher were it not for changing weather patterns since 1980.[13]




Observed changes in growing season temperature for crop-growing regions for 1980-2008. Values show the linear trend in temperature for the main crop grown in that grid cell, and for the months in which that crop is grown. Values indicate the trend in terms of multiples of the standard deviation of historical year-to-year variation. A value of two, for example, indicates that the expected growing season temperature in 2008 was two standard deviations above the expected value in 1980. Grid cells with less than 1% of land area covered by maize, wheat, rice or soybean, are omitted for clarity.[14]

These numbers suggest that global maize and wheat production, while increasing, has been diminished from its full capacity—already undermining global food security. The climatic effects on production are estimated to have inflated global market prices of these commodities by about 20-50%.[15] At current market prices and global production levels, this is equivalent to an additional $50 billion spent on food per year.[16]

# Population Growth—The Main Driver for Food Insecurity

On the demand side, an expanding global population and increasing household incomes in emerging economies are multiplying the demand for food (particularly meat). A 2011 Foresight report by the UK Science Office concluded that this increasing demand could alone lead to a food crisis in the next decade.[17] The world's population is forecast to increase from 7 billion today to 9 billion—Most of these population increases will occur in the developing world (the population of African countries is projected to double from one to two billion)—by 2050.[18] These increases will translate to rising global demands for food, energy, water and arable land and would require a 60% increase in agricultural production at today's demand levels.

## Global Meat Demand

Diets change in emerging economies as households can afford more costly protein in their budgets. Annual per-capita meat consumption is predicted to increase by over 60% (from roughly 32 to 52 kg) by 2050. Demand for fish will also increase, resulting in further expansion of aquaculture.[19] Grain used in the production of meat and farmed fish represents significantly more resources expended to produce than other protein sources per calorie. Such increases in meat and fish consumption will intensify competition for land, water and resources, disrupt aquatic habitats and challenge the sustainability of our food system.

## Global Energy Demand

Global energy demand is projected to double by 2050. Higher and more volatile energy prices will impact several parts of the food system. For example, nitrogen fertilizer production is highly energy-intensive: in 2005-08, skyrocketing oil prices resulted in a five-fold increase in fertilizer prices. Fuel prices are also closely connected with the economic viability of fishing, especially capture fisheries.[20]

## Global Water Demand

Total global water demand would also double by 2050 primarily due to increases in industrial and domestic use. Agriculture already consumes 70% of total global "blue water" reserves drawn from rivers and aquifers. Agriculture-related water demand is expected to increase by 30% by 2030 whereas major fossil aquifers in arid regions like Libya and Egypt have already been depleted and cannot be replenished.[21]*

* Food trade can actually promote more efficient global water use because the amount of water used in crop production depends heavily on the climatic conditions in the production region. According to the UK Science Office, exported foods have been estimated to consume only 16-26% of the total water used for food production worldwide. It takes, for instance, 2,700 liters of water to produce 1 kilo of cereals in Morocco, while only 520 liters to produce the same kilo in Germany. (Potsdam Institute for Climate Impact Research—PIK, 2014, March 18.) Global food trade can alleviate water scarcity. (Science Daily).

### Global Demand for Arable Land

Between 1967 and 2007, global crop yields increased by 115% while the area of agricultural land increased by only 8%, representing significantly higher yields per unit of land.[22] However, rapid population growth, urbanization and biofuel-generating energy crops compete with agriculture for already scarce land resources. Some governments plan to fuel 10% of transportation with biofuels by 2050, which would swallow a land area adequate for 32% of current global crop production but produce only 2% of global energy.[23] By estimate, approximately 24% of the 11.5 billion hectares of vegetated land on the Earth has experienced human-caused soil degradation, especially through erosion and deforestation.[24] Climate change is also expected to contribute to the loss of arable land to desertification, salinization, sea-level rise and soil depletion.

## Heading to an Era of Volatile Food Prices

Projected decreases in food supply coupled with increases in food demand will inevitably culminate in a food crisis. In 2007-08 when food prices surged,* the poorest countries were hit first and hardest. The Democratic Republic of Congo, Burundi and Rwanda saw food prices increase by double digits. Since January 2014 alone, food prices have already jumped 2.6% (the sharpest rise since mid-2012), probably due to the looming drought affecting wheat-producing regions in the Middle East.[25] Such fluctuations are set to repeat so frequently that the world is heading to an era when fluctuating but ever-increasing food prices are likely to become the norm. A research report launched in Dublin last year predicts that growing population and rising incomes would drive food prices up by 40-50%.[26]

## Food Loss

In the face of a looming food shortage, an overlooked yet critical issue is food loss—the decrease in edible food mass occurring at the production stage. According to the World Resources Institute, global food loss and waste (in calories) amounts to approximately 24% of all food produced, with nearly 65% of it occurring at the production stage of the food value chain—harvest, handling and storage, processing and packaging, distribution and market. In essence, roughly one out of four calories in the foods grown by farmers is lost in the production chain before being consumed. FAO estimates, based on weight, that 32% of all food produced globally in 2009 was lost or wasted.[27] This is roughly equivalent to over $727 billion or a loss of $107 per capita globally. In Sub-Saharan Africa, where many farmers earn less than $2 a day, post-harvest losses amount to $4 billion per year.[28]

In affluent countries, food loss occurs for political or commercial reasons. Thousands of tons of Ukraine's grain were dumped into the Black Sea due

* In the food crisis in 2007-08, high oil prices, increased biofuel production and export restrictions to protect domestic food supplies resulted in surging food prices in the global market.

> *In contrast to the ecological damage that has resulted from much of industrial agriculture, there are socially conscious agribusinesses that leverage their access to agrarian knowledge, technologies, capital and the global market to improve crop yields, farmers' livelihoods and the environment.*

to the trade embargo in 2007.[29] Some Western corporations have dumped surplus wheat and dairy products into oceans to stabilize market prices. About 30% of vegetable crops in Britain are not harvested as they fail to meet retailers' physical appearance standards.[30]

In less affluent countries loss occurs because of poor distribution infrastructure, lack of refrigerated transport and rodent infestation. In India, 21 million tons of wheat is lost every year—equivalent to the entire production of Australia—and 40% of all fruit and vegetables are lost between the growers and consumers. Similar stories are found in Pakistan and Vietnam with under-developed and under-invested food logistics chains.[31]

Crop loss also occurs when poor farmers, desperate for food and cash in the second half of the growing season, harvest crops prematurely. Further, when informal market systems are lacking, smallholder farm production can fail to reach consumers. If governments brand street vending a root problem for traffic obstruction and hygiene—not an uncommon government action in developing nations—another food distribution channel disappears. The World Resources Institute indicates that reducing food loss and waste by half from current levels would meet 22% of extra food needed in 2050.[32]

## Inconvenient Truth: Global Food System Failure

Food is a fundamental human right. Small, local family farms are the bedrock of traditional agriculture-based economies and of the food security of their communities. Yet today's global food production system features an unparalleled scale of centralization, intensification and concentration with a global agri-food industry controlling large portions of the value chain from agricultural inputs to food retail.[33]

Food yield today has reached record high levels. Undeniably, corporate investments in modern agricultural technologies in recent decades have contributed to improving food productivity. For example, agricultural mechanization has promoted more efficient use of labor, efficient operations, and more effective input management with lower input costs in crop production systems,* enabling a single farmer to manage larger areas of land.[34]

In contrast to the ecological damage that has resulted from much of industrial agriculture, there are socially conscious agribusinesses that leverage their access to agrarian knowledge, technologies, capital and the global market

* Agricultural mechanization leads to productivity enhancement, promoting (1) efficient use of labor by removing bottlenecks and making efficient use of time; (2) timely operations by hitting optimum agronomic or business windows and reducing spoilage and harvest losses; (3) efficient use of inputs (including water, seeds, nutrients, pesticides, etc.); and (4) enabling sustainable production systems.

to improve crop yields, farmers' livelihoods and the environment. Unilever (Lipton), for example, has partnered since 2006 with the British and Dutch governments, and several NGOs to reinvent a sustainable tea value chain. The company trained tea farmers and committed the brand to procuring its tea exclusively from certified farms and paying farmers a premium price.[35] This is just one of many examples of business being part of the solution.

Unfortunately, this is not the case for every agri-business enterprise. To expand market share, giant trans-national corporations (TNCs) vertically integrate their food production by acquiring smaller companies internationally. With "free trade" agreements, some TNCs have effectively rewritten the rules of the agri-food market and turned food into a commodity for profiteering rather than protecting the human right to food. They dictate prices, trading terms and conditions and, ultimately, the global agricultural economy and even political framework. The big winners are a few, predominantly Northern, companies that make most of their profits from food grown in the South. The big losers are the small farmers and laborers in the South, who are the "weakest links" in this value chain. These form the crux of the ailing global food system.

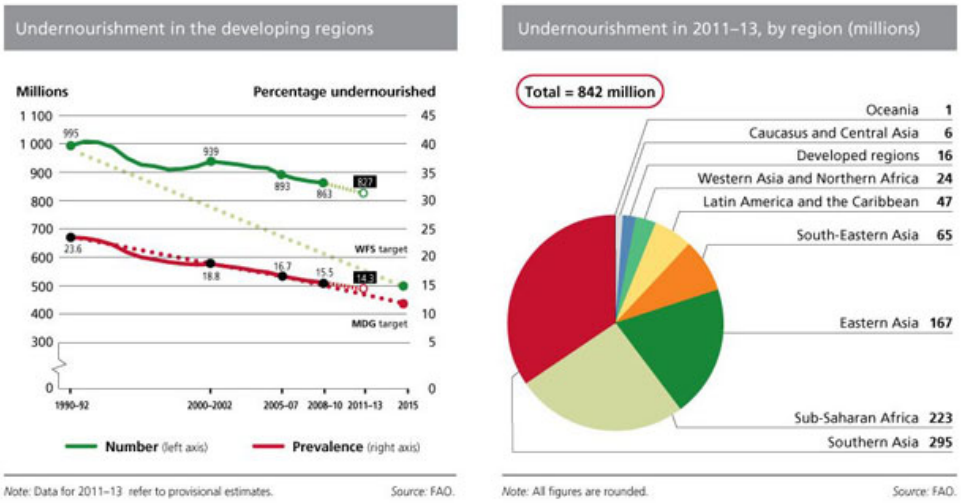
In the production stage of today's agri-business, the top 4 corporations have a market share of 99% in livestock breeding, the top 10 control 75% of seed production and the top 11 operate 97.8% of pesticides. At trading stage, the top 4 corporations account for 75% of grains and soya trading. At retail stage, although the top 10 supermarket corporations account for only 10.5% of the global market, the national market shares and the sheer volume of their sales in some markets mean they may be more powerful than the state in controlling price and supply.[36]

In securing their global supply chains, certain TNCs are engaging in some apparently hegemonic practices against small-holder farmers in developing countries. They include the patenting of seed and agricultural technology, unfair trading and land-grabbing, all of which contribute to a dysfunctional food system and food loss across the world.

| Issue | Current situation | Examples |
|---|---|---|
| Seed patenting | • Under the WTO's TRIPS Agreement, some TNCs patent seeds and farming techniques that farmers considered to be common and renewable resources. The TNCs term them to be their "intellectual properties". The royalties charged have wiped out a huge amount of agricultural production by smallholder farmers.<br>• Patented genetically modified seeds are sold to farmers at inflated prices. Genetic engineering actually injects a plausibly toxic gene into plant cells[37] and the hybrid seeds are not pest or weed-resistant, though scientists suggest bio-diverse chemical-free farms are more productive.[38] | • Around 95% of India's cotton seed is controlled by one major TNC through patenting and collection of royalty from farmers, who were the original breeders.[39]<br>• In addition to food speculators manipulating cereal prices, exorbitant royalties have pushed many poor farmers into unmanageable debt.<br>• In 2011 alone, nearly 14,000 smallholder farmers in developing nations committed suicide. The suicide rate among Indian farmers was alarmingly 47% higher than the rest of population.[40] Cotton farmers' suicide toll has been increasing since 2005 when India had to liberalize its domestic cotton market according to a WTO agreement.[41]<br>• Although a 2008 report by the US-based International Food Policy Research Institute dismisses the link between GM cotton and farmer suicides in India,[42] the incidence of farmer suicides is directly proportionate to a region's degree of integration with international trade and global markets. Ironically, almost no farmer suicides have been reported in "backward" regions where the industrialized seed and methods have not been imposed.[43] |
| Unfair trading conditions | • To minimize operation costs, some corporations pay farmers (who bear all the risks like pest, disease and weather problems) extremely low prices for their produce.<br>• Many farmers have become contract laborers to large agribusinesses in unfair working conditions.<br>• Today, at least 800 million people working in the agricultural sector live below the global poverty line.[44] | • Since 2001, some 7.7 million Indian farmers (main cultivators) have left agriculture whereas a few rich countries reported a larger agricultural workforce.[45]<br>• Cashew nut workers in northeast India are paid less than 50¢ a day for manually shelling nuts that expose them to a corrosive liquid causing permanent damage to their hands.[46]<br>• Aquaculture farmers in Vietnam earn only 10¢ per kilo of Pangasius fish produced while consumers in rich countries pay around $10. Many fisher farmers are indebted to aquaculture companies.[47] |
| Land-grabbing for monoculture | • Some corporations acquire arable land in poor countries for commercial use by hiring thugs to forcibly expel families from the land without paying promised compensation.[48]<br>• Most of the land grabbed is converted to large-scale industrial monoculture that causes soil depletion and contributes roughly 30% of global GHG emissions.[49] | • Some African governments offer tax breaks for TNCs and wealthy investors from China, Japan and Korea who purchase or lease productive lands. Land-grabbing allows ecological plunder masquerading as economic development and turns Africans into refugees and slave laborers in their homelands.<br>• Almost half of all of these land transactions occur in Mozambique and Ethiopia. Globally, the area of land grabbed has reached 46 million hectares,[50] an area ten times the size of Denmark.. |

In consequence, the cascading effect of such a capital-intensive, corporate agribusiness-driven and export-oriented food system, combined with domestic policies that fail to protect the interests of farmers and with a surge in subsidized imports after the lifting of quotas, is resulting in plummeting food prices and increasing concerns about food security for hundreds of millions of people in the developing world.

# Current Situation = 842 Million Hungry People




Undernourishment in the developing regions: actual progress and target achievement trajectories towards the MDG and WFS targets[51]

In 2011-13, according to FAO, there were 842 million undernourished people globally, with the majority of those facing severe hunger and poverty concentrated in Sub-Saharan Africa.[52] Although the number of hungry people has been decreasing, progress is still very far from reaching the target that was set at the World Food Summit (WFS) 20 years ago.

To meet the target established by the WFS, the number of hungry people in developing regions would have to be reduced to 498 million by 2015—a goal that is currently far out of reach at the global level. In WFS's metric, in 2011-13 the number of undernourished people should have fallen to below the 600 million threshold vis-à-vis 842 million that we are seeing today. Some attribute the growing deviation of actual progress from the target trajectory to the high rates of population growth in many hunger-affected countries, and blame an absolute number-based target, which is overly ambitious.

> *Unfortunately, expectations for government leadership on issues impacting food security are low. Professor Christopher Barrett of Cornell University observes that, 'The lofty rhetoric [of G8 summits] has not been matched by significant new investments or policy innovations by the world's major economies.'*

Instead, some bureaucrats may argue that the states are actually on track to achieve the target set under the Millennium Development Goals (MDGs). It is a less ambitious percentage-based target of halving the proportion of undernourished people: from 24% in 1990-92 to 12% in 2015. The percentage had reached 14.3% as of 2013. However, in reality, slow or almost no progress towards the MDGs has been observed in much of the developing world with the exception of East Asia and especially China.[53]

Of the 842 million hungry people, around 650 million live in regions that are at high climatic risk. Areas where floods and droughts, combined with price shocks, are anticipated to have the most impact, according to the UN's World Food Program. The recent humanitarian crises in the Horn of Africa and Sahel could become more common as weather changes and drought become more frequent. Studies also predict up to 200 million more undernourished people, including an additional 24 million malnourished children, by 2050.[54] The outlook for the least-developed countries will not improve unless massive and concerted international investments in climate-resilient and sustainable agriculture are made with great urgency.

Unfortunately, expectations for government leadership on issues impacting food security are low. Professor Christopher Barrett of Cornell University observes that, "The lofty rhetoric [of G8 summits] has not been matched by significant new investments or policy innovations by the world's major economies. [Progress towards sustainable agriculture has been] incremental and dwarfed by the fiscal and employment challenges faced by the OECD countries."[55]

## State Failure

History has told us that at the state level, financial limitation, technical and capacity gaps, climate calamities and political problems are the usual barriers to delivering international agreements. Food-security agreements are no exception.

*"The dysfunctional global food system today can be attributed in large part to governments, international institutions and even some major NGOs, which have proven unable to address food security as an interconnected policy issue..."*

| Year | Agreement | Relevant content | Progress[56] |
|---|---|---|---|
| 1992 | Agenda 21 | Chapter 14: Main targets for food security and sustainable agriculture | Insignificant |
| | | Chapter 18: Water for sustainable food production and sustainable | Some |
| 1996 | Rome Declaration on World Food Security | To halve the number of undernourished people by 2015 | Limited |
| 2000 | Millennium Development Goals | To halve the proportion of the undernourished by 2015 | Some but uneven |
| 2002 | Johannesburg Plan of Implementation | Chapter III: Changing unsustainable patterns of consumption and production | Limited |
| 2009 | CSD 17 Report on priorities of action | Decision on agriculture, rural development, drought and desertification | Not adequately monitored[57] |
| 2012 | Rio+20 outcome document – The Future We Want[58] | Articles 108-118: Food security, nutrition and sustainable agriculture | Unknown to-date |

Notwithstanding the new set of goals after Rio+20, it is, again, a great deal of lofty rhetoric that is weak and vague and without specific targets or serious inclusion of civil society. The West and the G77 were divided by different foci: resource efficiency and biodiversity versus strong socio-economic packages (including financing and technology transfer). In addition, many commitments are not legally binding, rather they are agreed upon on a voluntary basis without essential international enforcement mechanisms.[59] The result is a repeat of the failure to deliver solutions, which has been the outcome since the 1990s.

## Incapacity in the DNA of State-Based Institutions

The dysfunctional global food system today can be attributed in large part to governments, international institutions and even some major NGOs, which have proven unable to address food security as an interconnected policy issue, or to collaborate across institutional boundaries or to engage effectively with the local communities in food-insecure regions.

| | Challenges | Examples |
|---|---|---|
| International institutions | Overly fragmented policy efforts with too many organizations addressing food governance in a piecemeal manner (also applicable to NGOs) | World Bank, IMF, FAO, IFAD, WHO and WTO all influence food governance, but each addresses only one aspect of the system (e.g. finance, agriculture, health and trade). |
| | Contradictions among the agendas of different institutions leading to uncoordinated response to global issues | • One of the MDGs goals—to halve the proportion of hungry people by 2015—contradicts WTO that actually allows developed countries to impose trade barriers against hunger-affected developing countries as "exceptions."[60]<br>• Poor countries that produce enough to export must pay tariffs to export it to the countries that are generously subsidizing their own producers. These tariffs are levied on producers who also receive aid from the wealthy countries to help in their production process. In 2010, for example, agricultural subsidies for food producers in developed countries amounted to $242 billion.[61] Tariffs levied on agricultural goods by developed countries cost developing countries $14.6 billion.[62] However, the total agricultural aid disbursed in 2010-11 was only $10.14 billion,[63] down by 43% since the mid-1980s because donors have shifted their emphases to market-led development.[64] |
| | Endowed with a mentality that concentrates action steps within individual countries to solve a multinational or regional problem | MDG design fails to direct action that the world "as a whole" is required to take to provide food security. Effective solutions to this complex problem should transcend the traditional nation-state boundaries and embrace authentic citizen voices and innovative community-model initiatives. |
| Regional institutions | Lack of harmonization of approaches or practices across different areas of the food system in the interest of sovereignty | • APEC countries took 10 years to create the "Policy Platform for Food Security" because of tensions among governments and massive lobbying from the private sector regarding "how to get there."<br>• NEPAD failed to get African governments to commit to a proposal to increase agriculture-related budgets 10% by 2008 with annual increments of 6% by 2015. The regional program has never involved small-scale farmers.[65] |
| Developing-country governments | • Governments operate with a low level of transparency, out of touch with the genuine needs of the people<br>• Policy-making and negotiation processes often led by officials who are laymen in food systems, yet believers in top-down governance | • Informal trading activities (including street vending by small-holder farmers) often receive unfair treatment in legal and policy processes such as hyper-complicated registration process for vendors. Some governments even criminalize the sales of foods from "illegal" family farms for falling short of the stringent "health standards" that favor only the monoculture production methods used by large agribusinesses.<br>• Low-income countries in conflict zones allocate, on average, less than 5% of public spending to agriculture, despite its centrality in their employment, exports and GDP. Many West African countries, threatened by "net loss in aid or trade." suffer from extremely low state investment in agricultural R&D. In contrast, nearly 16% of their budgets are devoted to defense.[66] |

*"...food producers are not only beneficiaries but also becoming knowledge creators—using their mobile phones and the latest Internet platforms to swap techniques, share experiences and even mobilize support from global audiences."*

| | Challenges | Examples |
|---|---|---|
| Donor-country governments | Incoherent policies frequently undercutting both North-South development cooperation and Southern efforts to achieve food security | • Incompatibilities or even contradictions are often found among the technical regulations applied in developed and developing countries regarding quality, safety, health and the environment, and labeling standards for agri-food exports. Small farmers in the South encounter major financial and institutional barriers in complying with these standards and, hence, in integrating into the global market.<br>• A great proportion of defense spending in developing nations is, ironically, spent on arms procurement from the five permanent members of the UN Security Council, plus Germany and Italy. In 2011, the value of arms sales agreements with developing countries hit a record high—over $71.5 billion[67], more than seven times the "agricultural aid" received from developed countries.<br>• Even with debt relief initiatives, in 2010 debt service obligations of many developing-country governments ($184 billion) still exceeded the total amount of ODA received ($147.4 billion).[68]<br>• Expenditure on arms procurement and debt payments could have been invested in food production systems. |

# Digital Revolution for Agriculture— "New Green Revolution"

The keys to addressing food security as an interconnected global problem: "sharing" and "collaborating." The digital revolution (or "new green revolution") is creating new capabilities and networks for solving an old problem. To meet ambitious food productivity targets for nine billion mouths, we need to leverage the digital revolution into agricultural innovation against the threat of climate change and the current deficiencies in the agricultural supply chain.

The digital revolution has created access to scientific and market information that was once only available to traders, academics and government officials and that information is increasingly directly available to agricultural producers, even those in remote villages. In fact, food producers are not only beneficiaries but also becoming knowledge creators—using their mobile phones and the latest Internet platforms to swap techniques, share experiences and even mobilize support from global audiences. All of these, in turn, stimulate agricultural innovation by helping spread and adopt best practices.

Web-based social networks enable authentic citizen voices to be collected more easily and effectively than ever before. In one example, Rockefeller

Foundation leveraged Twitter to understand the food security challenges facing urban dwellers. During two Twitter chats reaching 1.2 million users, nearly 400 contributors shared their stories and a wealth of ideas about alternative food supply chains, urban agriculture, the role of street vendors and strategies for food waste reduction. Participants even connected with each other, mobilized and built their own networks around hunger, food systems and other issues.[69]

With open-source code the web creates new opportunities for cooperative solutions to sustainable agriculture at lower cost and higher speed. Sequencing the cassava genome, for example, was once a 13-year task. Today, it can be done in 27 hours. When linked with phenotypes and climatic data observed in the fields, breeders in developing countries can use data derived from digital technologies to predict seedling performance and produce higher-quality yields in shorter cycles.

Other examples of emerging digital initiatives that could help address some issues in the troubled global food system include:

| Issues | | Examples |
|---|---|---|
| Seed and technology patenting | | **Seeds4Needs**[70]<br>Led by Biodiversity International since 2009, Seeds4Needs initiative researches how agricultural biodiversity can help minimize cultivation risks associated with climate change. It seeks to identify crop varieties better suited to existing or projected conditions and to strengthen local seed systems accessible for farmers. |
| | Approach | Being piloted as a crowdsourced approach whereby farmers participate in experimentation with climate-resilient varieties of seeds in their own fields as "citizen scientists." Seeds4Needs uses GIS to identify promising seeds and planting materials for field trials by farmers. Farmers then report their observations to researchers through Internet-based technology or mobile telephony, with field weather data collected by iButton sensors. |
| | Progress | Over 6,000 farmers in 11 countries including India, Cambodia, Honduras and Ethiopia, are involved in research on rice, wheat, barley, sweet potato, beans, etc. |
| | | **E-Farming**[71]<br>E-Farming is a text-messaging service in Kenya that has provided farmers with agronomic advice on crop management, fertilizer use and choice of maize varieties to plant since 2011. |
| | Approach | Farmers can register via SMS and indicate their crops of interest and whether they want information on agronomy, soils, fertilizer or pesticide application. They can also choose to send a separate SMS requesting specific information regarding ways to boost food production on their individual farms, costing as little as $0.12 per message. |
| | Impact | Farmers are able to purchase the most appropriate seed and fertilizers when they need them. Maize yields have doubled. Information can reach farmers much more quickly than an extension advisor visit, which is particularly important when heavy rains make road travel in rural areas difficult. |

*"...access to market information through mobile technology has increased farmers' incomes by 16.5-36% in Uganda and 10% in Ghana."*

| Issues | | Examples |
|---|---|---|
| Unfair trading conditions | | **M-Farm**[72] Against "asymmetry of information," M-Farm is a mobile app-based program developed in Kenya to provide smallholder farmers with market pricing information to help them negotiate fairer crop prices with brokers. |
| | Approach | The service supplies wholesale market price information on 42 crops in five markets (including Nairobi, Mombasa, Kisumu, Eldoret and Nakuru) to farmers via a free mobile phone app or SMS. M-Farm offers farmers the chance to sell their crops as a collective of members in order to increase their leverage. Farmers can also create cost efficiency by pursuing group purchases of seeds and fertilizers simply by using their mobile phones or logging on to the M-Farm website. |
| | Impact | About 5,000 farmers are using M-Farm as a virtual middleman. In some regions, farmers selling collectively more than doubled their return for their produce. |
| Land-grabbing | | **Stop Africa Land Grab**[73] A web-based global grassroots movement to stop and reverse the land grab and to encourage productive foreign investments in Africa. |
| | Approach | The page both names and shames countries and companies involved in land-grabbing, and presents information with a news feed and blog to encourage discussions. It is targeting 250,000 signatures for its online declaration to raise international awareness. |
| | Progress | This online movement has just started and over 1,500 people have already signed its declaration. |

According to a 2012 World Bank report, access to market information through mobile technology has increased farmers' incomes by 16.5-36% in Uganda and 10% in Ghana. A recent Vodafone report estimates a potential $48 billion agricultural income boost in African nations by 2020.[74]

In addition to the use of digital technology to share agrarian knowledge and real-time market information, there are numerous organizations working on the potential for new models of collaboration to promote sustainable food production. The rest of this paper will examine the impact on global food governance of the following case studies:

| Case Study | Network Type in GSN Taxonomy | Key Strength in Addressing Food Security |
|---|---|---|
| **Thought for Food** | Platform | Engaging young generations for innovative solutions to increasing food productivity |
| **NABUUR.com** | Platform | A networking site that connects volunteers and locals for grassroots development cooperation |
| **Sustainable Agriculture Network** | Global Standards Network | Setting globally recognized socio-environmental standards to promote sustainable agriculture |
| **Digital Green** | Knowledge Network | Transferring agrarian knowledge to poor farmers in remote villages through an innovative digital platform |

# Case Study: Thought for Food—Crowdsourcing Food Security

Founded in 2011, Thought for Food (TFF) is a fast-growing network of university students (so-called digital natives),* seeking to develop breakthrough approaches to tackle global food security challenges. Partner networks include: Ashoka Changemakers (a network of thought leaders), Sandbox Network (a network for young entrepreneurs) and Syngenta (a multinational agribusiness).

### *The rationale*

TFF aims to tap into the unique talents, passions and the powerful digital tools of the Millennial generation† in order to change the way state institutions approach food security issues. According to Christine Gould, founder of TFF, incentive competitions are often the best way to harness the innovative potential of young people.

> *You have to engage [the Millennial generation] in new ways. Asking questions is the right way to engage. They don't want propaganda. They don't want the answers. They want to come up with the solutions themselves.*[75]

### *Engaging the new generations*

In the TFF Challenge—its annual innovation competition—each participating university team of students submits a project proposal containing a business plan and creative pitch to a judging panel. Finalists are given seed money to apply to further development of their ideas into a prototype. At the end of an annual summit, winning teams are awarded funding to implement their projects.

Through an online educational platform, TFF also provides students with cutting-edge learning resources as well as virtual mentorship from experts, innovators and entrepreneurs in its partner networks that are known for driving social change.[76] On the learning platform, students can gain further momentum by mastering new skills like social media or design thinking.

The judging panel—comprised of leaders in social entrepreneurship, communications and social media, disruptive science and technology, and public policy—receives numerous innovative ideas from students worldwide that address the issues of food security. In 2013, for example, the winning team was "Henlight," which developed a solar lamp solution to increase egg production and improve protein intake of laying hens for smallholder farmers in developing countries. In 2012, the winning project was "The Second World," an online role-playing game and comic seeking to raise young

* "Digital natives" refers to individuals born after the widespread adoption of digital technologies including the Internet, computers and mobile devices.

† "Millennial generation" refers to those born between 1980 and 2000, which represent the largest, most well-educated, globally aware, politically progressive, technologically-savvy and socially-engaged generation ever. (Source: Grown Up Digital: The Rise of the Net Generation, Don Tapscott.)

*"Every contributor to TFF leverages its unique strengths to cross-fertilize partner networks for impact."*

peoples' awareness of the impending food crisis. After the competitions, TFF has sponsored and supported the winners by connecting them to partners, mentors and communication professionals who can help them to scale their projects.[77]

*Network start-up and early achievements*

TFF reached a turning point in 2013 after two years of momentum-building on social media. In 2011 when TFF was first piloted in Europe, just 11 universities signed up for its inaugural competition. But in 2013, there were 118 entries, comprising over 1,000 participants from 66 universities and 24 countries.

*Leveraging the unique strengths of contributors*

Every contributor to TFF leverages its unique strengths to cross-fertilize partner networks for impact. Syngenta brings in food-issue expertise and research funding to collaborate with students on the development of multi-dimensional course materials and robust project tools. Sandbox provides brainstorming tools, human resources and entrepreneurial mentorship. Ashoka offers access to thought leaders, best-practice case studies and some *gravitas* with its brand equity when students interact with its huge promotion network on social media. TFF members are also encouraged to join Ashoka's competitions and events. The cultural or opinion differences encountered when managing a multi-stakeholder network are not a barrier and are often a powerful driver for better approaches.

TFF never seeks ownership of the ideas that students put forward. "We are a platform for ideas to develop and be nurtured," says Gould. "It is really up to the students to move forward." Students' commitment is spontaneous and persistent because they feel empowered and rewarded on this platform as their small ideas snowball into something much bigger that draws media and government attention.[78]

# Case Study: Nabuur.com—The Global Neighbor Network

Started in 2001, Nabuur.com* is an online "platform" for sharing knowledge and solving problems related to rural development. It allows individuals and communities in developing countries to post problems and teams of volunteers self-organize to provide solutions. Typically, a local representative of a community in a developing country might sketch the local situation and describe a problem that needs solving, like improving crop irrigation or establishing a dairy co-operative. An online facilitator helps divide the project into tasks that can be completed by online volunteers ("neighbors"), who may find information on specific irrigation techniques, help write a business plan or arrange equipment.

* "Nabuur" is an Old Dutch word meaning "neighbor" in English.

nabuur.com
the global neighbour network

"The Internet now makes it possible to connect the local demand of the local community directly to the global supply of people who want to be of help… They are 'neighbors' in the global village," says Siegfried Woldhek, the founder of Nabuur.com.[79] Volunteers on the site find tasks matching their interests, skills and expertise, and collaborate online as part of a virtual neighborhood centered on the community and its projects.[80]

*Born amid a "systemic crisis"*

Siegfried Woldhek, former CEO of the WWF Netherlands, founded Nabuur.com. During his tenure, his organization often dismissed people offering their time and ideas because the organization was fully occupied. However, according to Woldhek, "The ironical [sic] fact is that, on one hand, there was so much more work to do than all existing organizations combined [whether it is NGOs, businesses or governments] can ever handle; and, on the other hand, there are so many people who would like to help." In a speech for the Clinton Global Initiative, former US President Bill Clinton, who was inspired by the ideas behind Nabuur, described this state of affairs as "a systemic crisis" and a lost opportunity to apply a significant pool of talent to some of the world's most urgent problems. Clinton continued, "We need to find ways to come together, organize, to do things." Woldhek founded Nabuur in order to match the growing willingness to volunteer time to important causes in developing countries with an evident need for problem-solving and assistance.[81]

*Achievements*

Over time, almost 42,000 "neighbors" from over 180 countries joined the network and implemented numerous projects in nearly 300 villages. They have made a big difference to the livelihood of many poor communities over the last decade. Notable examples include:

**Menengai (Kenya)**—A group of women dairy farmers from a rural community were struggling with low milk production and requested help to set up a dairy co-operative. "Neighbors" initiated key contacts with local organizations and a donor (Néstle) to transmit farming techniques such as a zero-grazing concept to feed the cows. Their milk production subsequently increased by 250% and so did income.

**Walungu (Congo)**—"Neighbors" collaborated on a community-based farming project in Congo to fight malnutrition. A US "neighbor" sent in initial seed and shared knowledge about drip irrigation with Congolese farmers, who then learned how to raise organic tomatoes out-of-season. "Neighbors" also provided a plan for a goat shed. They created a graphic manual out of a goat-keeping manual donated by a Hong Kong "neighbor" and delivered via a Burundi "neighbor." A local vet then trained the community to breed and keep goats using that manual.[82]

> *"A lot of solutions that we saw did not rely on the transfer of goods or money, but just offered new options to people with local skills and resources available, and new ideas which used those skills and resources."*

*"Zero-budget" aid*

In 2012, the total aid from OECD-DAC member countries amounted to $127 billion.[83] This is in stark contrast to the many zero-budget projects implemented through Nabuur. Nabuur avoids any role in fundraising or grant dispersal (along with the need for appropriate checks and balances to satisfy the donors), fearing that financial governance issues could undermine the voluntary exchange dynamics among "neighbors," local authorities and NGOs.

While local ownership is often undervalued in projects sponsored or led by development agencies, Nabuur only supports projects that engage local communities. Thus, Nabuur functions more like a social networking site in which local communities organize themselves and seek out external support to complete their own development projects. "A lot of solutions that we saw did not rely on the transfer of goods or money, but just offered new options to people with local skills and resources available, and new ideas which used those skills and resources," says Pelle Aardema, Director of Nabuur.com. Some successful projects, like the one in Congo, have even evolved into independent NGOs. Indeed, Nabuur projects are not confined to food production. Many projects address other areas such as education, health and entrepreneurship.

From 2001 to 2009, Nabuur was funded by multiple donors. This core funding allowed the platform to develop and gain leverage. However, this finance model also caused tension with donors. Nabuur encountered difficulties in quantifying its project-by-project impact in the reports that institutional donors required. This became a problem for donors who later withdrew their funding in spite of their recognition of Nabuur's inherent value. Nabuur was then transformed to be literally a zero-funding network, which continues to run mainly by itself, albeit on a lower level of activity.[84]

# Case Study: Sustainable Agriculture Network

The Sustainable Agriculture Network (SAN) is a "global standards network" that promotes environmentally-friendly agriculture, biodiversity conservation and sustainable community development by supporting producers in their efforts to implement good practices and by creating social and environmental standards throughout the agricultural value chain. SAN links responsible farmers with conscientious consumers through the Rainforest Alliance Certified™ seal of approval, encouraging purchases of responsibly produced farm goods. SAN develops, manages and owns a set of sustainable agriculture standards applicable to a variety of farms. It is planning mobile technology-based mechanisms to optimize the collection of crop performance data from the fields and its applicability to support producers.

Consisting principally of leading conservation groups in Latin America, SAN's members include: Conservation & Development (Ecuador), Inter-American Foundation of Tropical Research (Guatemala), Fundación Natura Colombia, Institute for Cooperation & Self-Development (Honduras), Institute for Agricultural & Forestry Management and Certification (Brazil), ProNatura Sur (Mexico), SalvaNATURA (El Salvador), Center of Studies, Training, Consulting & Audit (Ivory Coast), Royal Society for Protection of Birds (UK) and Rainforest Alliance (USA).

Understanding the linkages between the predominant development model and deforestation in the 1980s, SAN was formed based on realizing the need to engage farmers in the implementation of best practices. Rather than campaigning for new government agricultural subsidies similar to those supporting monoculture, which is environmentally unsustainable, SAN believes that developing a universally recognized farm certification system could well be a cost-effctive tool to promote sustainable agriculture and food supply chains among agribusinesses.

*Network development and worldwide impact*

Although SAN has existed as an informal network since 1997, its International Standards Committee was set up in 2007. The committee is comprised of NGOs, corporations and relevant experts who develop social and environmental standards for approval by the Board.[85]

As of 2014 Q1, certification, ranging from single farm to cattle production standards, expanded to approximately 2.7 million hectares in 43 countries worldwide, covering 76 crops in 1.03 million farms (over 95% of which are small-holder farmers in Africa) with 1,641 certificates. "The biggest achievements are the social and environmental impacts on farms SAN has certified," says Andre de Freitas, SAN's Executive Director. Some of its specific achievements include:

- **Economic impacts:** Salvadoran coffee farms receiving technical assistance in preparation for Rainforest Alliance certification increased their harvests by an average of 89% over the previous year. Net incomes also grew much faster on certified farms.
- **Environmental impacts:** Tree diversity (indicating soil health) in certified Salvadoran coffee farms is over 40% higher than full-sun coffee farms. Certified cocoa farms in Ivory Coast implemented more water protection measures against erosion than non-certified farms.
- **Social impacts:** Certified farms employ more than one million workers in fair conditions. In Colombian coffee farms, certification leads to more responsible farm management, including increased usage of protective equipment for chemical applications, specialized warehouses for chemical storage, employee training on pesticide application, and solid-waste collection.

> *"...the network's success in achieving its socio-environmental objectives builds on its one-stop approach to fostering sustainable agriculture."*

While achieving considerable success across the Americas, SAN has encountered some challenges in growing its membership in Africa and Asia. Although demands for certification are increasing, not all the NGOs believe in the market-driven approach to agriculture improvement. Some farmer groups also view the certification system as burdensome without sufficient commitments from governments and companies to purchasing products from sustainable sources.[86]

*Successful strategies*

According to de Freitas, the network's success in achieving its socio-environmental objectives builds on its one-stop approach to fostering sustainable agriculture. SAN not only sets standards, it also builds capacity among farmers to meet those standards. It links farmers to markets that value sustainable agriculture to ensure there is demand for their products. In addition, SAN educates consumers about the benefits of sustainable agriculture in order to increase demand. Together these efforts help justify producers' participation by providing enough economic value to cover the costs of adopting sustainable practices.

As a network, SAN is funded by fees collected from exporters or importers in the supply chain who pay a royalty-based fee for linking them to farmers of sustainable produce. This self-sufficient funding model for the network allows it to operate independent of donor funding (and hence donor agendas) and to stay focused on the problems that are being addressed.[87]

## Case Study: Digital Green—An Agrarian Knowledge-Sharing Network

"Watch, learn and share" is what Digital Green is all about. A multi-stakeholder network comprised of volunteers, philanthropists, NGOs, private companies and governments, Digital Green is an agricultural knowledge-sharing network that seeks to amplify world-changing development efforts by leveraging technology and social organization into community transformation in India and parts of Africa.

Digital Green uses an innovative digital platform to engage communities, improve rural livelihoods and promote sustainable agriculture and food security. Funded by The Gates Foundation, Google, DFID, USAID and the Indian Ministry of Rural Development, it works with partners like Samaj Pragati, BAIF, PRADAN, Oxfam and IFPRI to share knowledge on improved agricultural practices. While working with existing, people-based extension systems, its innovative communication approach focuses on a low-cost and effective peer-to-peer learning process.[88]

digitalGREEN

*An ICT-enabled approach*

Digital Green engages and empowers rural communities to produce local videos that transfer targeted agricultural knowledge to small and marginal farmers. This approach leverages pre-existing group structures to disseminate these videos and includes:

- A participatory process for video content production;
- An instructor-moderated learning model for video dissemination and training;
- A hardware and software technology platform for data management customized to limited or intermittent Internet and electrical grid connectivity; and
- A continuous community feedback-oriented model with web-based analytical tools and phone-based response channels.[89]

*A spin-off from Microsoft*

Digital Green began as a research project in Microsoft Research India in 2006 and was spun off as an interdependent non-profit in 2008. The inspiration came from the use of ICT in an education project that filmed lessons taught in prestigious private schools for sharing with rural schoolteachers. Translated to an agricultural setting, the idea was to work in partnership with NGOs to transfer improved practices from successful farmers to farmers still operating at a subsistence level. This model of video-based learning was also perceived to be very helpful in areas with high illiteracy rates and consistent with local culture where "seeing is believing."[90]

*Notable achievements*

As of March 2014, Digital Green served over 330,000 farmers (70% women) across 3,600 villages in eight states in India, and select areas in Ethiopia, Ghana, Mozambique and Tanzania. By 2015, it is expected to reach over one million farmers in 11,000 villages in South Asia and Sub-Saharan Africa. Nearly 3,000 videos in over 20 languages have been produced by local partners, with viewership reaching 1.3 million.

This approach is found to be 10 times more cost-effective and uptake of new practices seven times higher than classical approaches to agricultural education. Agricultural productivity has reportedly increased by 30-50% in the areas where the farming practices featured in Digital Green's videos have been implemented. Now similar approaches are being piloted to boost awareness and adoption of better health and nutrition practices.[91]

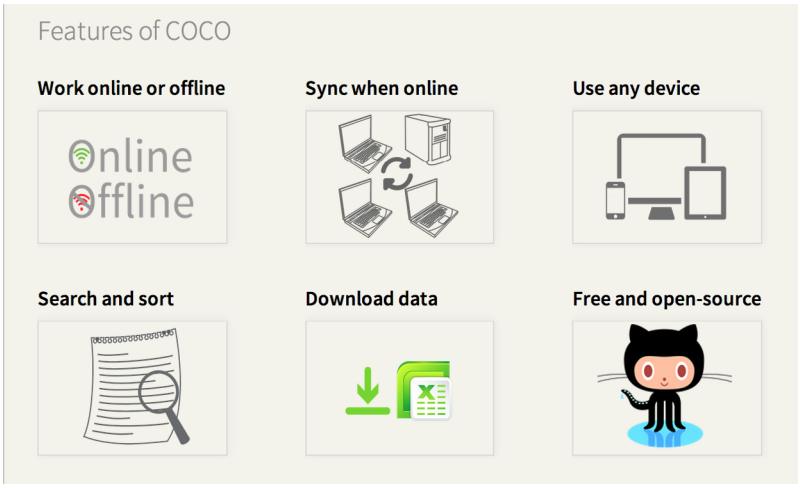
*Treading a fine line*

With multiple stakeholders on board, an obvious benefit is achieving synergy with the unique expertise of each partner. Nonetheless, Digital Green often has to manage conflicts of interest among its partners. For example, conflicts arise when private companies have promoted the adoption of GM hybrid seeds while the government or an NGO ideologically against genetic modification promotes organic cultivation. Digital Green endeavors to find a common denominator by "smoothing out of some of these relationships,

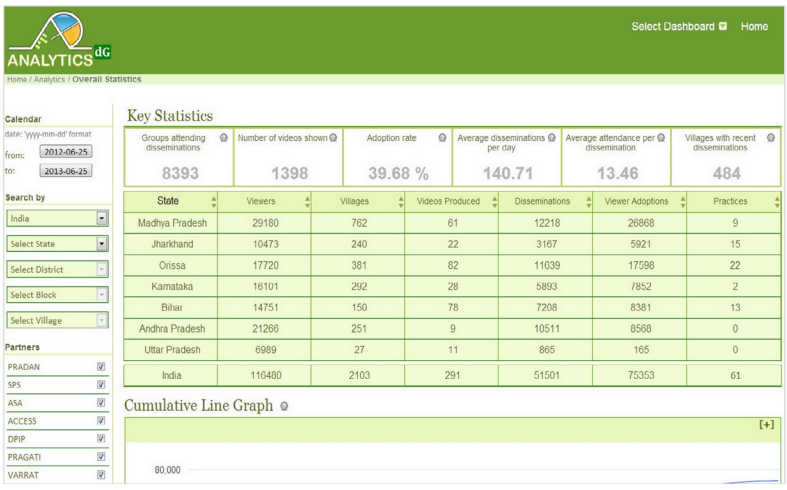
which sometimes have some rough edges," notes Rikin Gandhi, CEO of Digital Green. In such cases, the network tries to provide an opportunity for the proponent to demonstrate the effectiveness of a technology with a particular community at a grassroots level. It emphasizes use of data and feedback from the community to circumvent these ideological debates.[92]

### *Open-source impact tracking*

Digital Green also leverages technology to measure the impact, effectiveness and resiliency of each village project.93 It has developed a versatile, open-source technology platform for data management, including COCO (Connect Offline Connect Online) and Analytics Dashboard to generate near real-time information for learning, monitoring and evaluation (functional even in challenging conditions like limited power supply and connectivity in remote areas).

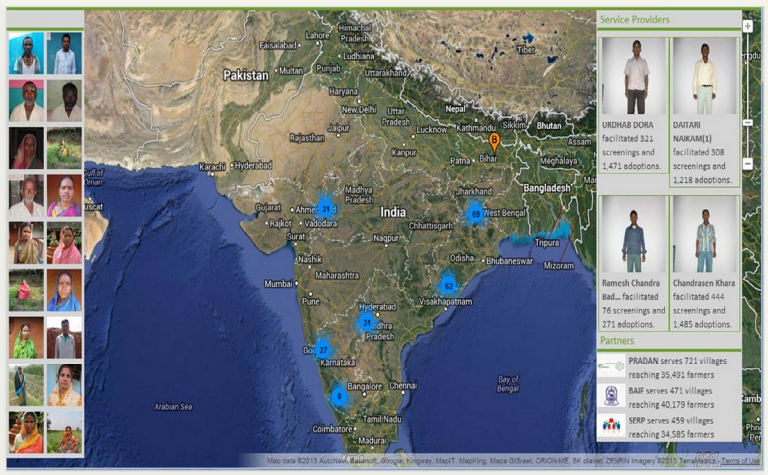



The dashboard captures data about who watches which videos, what questions farmers have when adopting the practices and which participants maintained new practices afterwards.



*"...a versatile, open-source technology platform for data management...to generate near real-time information for learning, monitoring and evaluation."*

This database represents the most authentic source of feedback from user communities and will also shape the agendas of the network and agricultural research. "Farmerbook" and a video library also form part of the technology suite available online, which can be used by different actors for different purposes.




# Implications for Network Leaders

Many traditional state-based institutions addressing global food governance have grown too big and are hampered by their blind spots. These blind spots have caused them to lose sight of the real issues involved in food security as a global problem entangled with other issue areas, particularly those critical problems arising from the globalized food system. Albeit unique in mission, strength and membership, the four cases above demonstrate an alternative approach to making progress on food security—an approach that puts collaboration and sharing at its core. These GSNs are harnessing previously untapped sources of knowledge and ingenuity by collaborating with citizens and other public and private entities that are motivated to take action to address world hunger. In order to maximize their impact, network leaders should consider adopting the following strategies:

**Support local ownership and respect local customs.** Network leaders must recognize and value local ownership of and involvement in all development projects, particularly those that address food security. A genuine bottom-up approach requires multi-dimensional engagement with small communities while demonstrating cultural and language sensitivity. For example, Nabuur does not take ownership of volunteers' projects. Instead, it encourages and facilitates local representatives and their communities to self-organize to make the projects happen. It is hardly effective for an aid worker to go into a remote village in Ethiopia and try to explain to farmers, who

> *"The combination of inclusive governance processes and a strong track record that demonstrates impact is a recipe that network leaders should seek to replicate."*

are subsisting on $1 a day, what works in Europe. As Rolf Kleef, Nabuur's board chairman, comments, "Development agencies funding aid workers to inflict their ideas on other people are the crucial systemic failure." To succeed, knowledge-sharing networks like Digital Green educate Indian and Ethiopian farmers about the best deployable practices in local languages and through gender-sensitive organizational structures. Network leaders should fully recognize and respect such cultural differences.

**Keep stakeholders engaged and empowered by adopting the principles of lean management.** Keeping stakeholders engaged and empowered is vital to maintaining the dynamism of a food-security GSN. In particular, network leaders must not underestimate the importance of lean management (as opposed to centralized micro-management), which emphasizes the need for regular cycles of experimentation and iteration in the pursuit of a better value proposition for stakeholders.

The Thought for Food (TFF) platform, for example, crowdsources new ideas to promote food security by engaging constituents in continuous dialogues on food security. To this end, TFF offers a one-stop learning and mentorship program, which not only features a tailor-made curriculum preparing students for the flagship competition—its crowdsourcing exercise—but also grants participants access to a network of agribusiness experts who provide advice and guidance through interactive blogs, chatrooms and web conferences. Regular opportunities for engagement and collaboration help maintain participants' initiative and drive momentum for the overall network.

Too many GSNs, on the other hand, rely on outmoded project platforms that offer online discussion boards, but not much else, to engage stakeholders. Network leaders could also reflect on the opportunities that Seeds4Needs has opened up for local farmers to become active participants in its global agricultural research team. Some 800 farmers in India, for example, have not only helped Seeds4Needs collect climate data, but are also testing a large variety of wheat crops for their robustness in the face of climate change.

**Impact + inclusion = legitimacy.** Food-security GSNs garner legitimacy by demonstrating their ability to make a significant impact on the problems they are solving. The worldwide legitimacy of SAN, for instance, stems from neither a grand governance structure, nor a large amount of money invested in certifications. Rather, SAN earns it from the far-reaching impact this network has achieved in boosting agricultural productivity, improving environmental outcomes and raising incomes for farmers. "The more we're able to show the impact of our work, the more legitimacy we'll have," said Andre de Freitas, SAN's Executive Director. Inclusion of diverse stakeholders in the standard-setting process has also played a key role in ensuring that its user community perceives SAN's standards as legitimate. The combination of inclusive governance processes and a strong track record that demonstrates impact is a recipe that network leaders should seek to replicate.

**Standardize toolkits to increase scale and boost project impact.** Network leaders could amplify the scale of the impact and the ability to replicate projects with a standardized ready-to-adapt toolkit. For example, Digital

*"Funding and monitoring always go together."*

Green, which has developed an open-source technology suite, COCO, for impact data management, mainly serves as a "replicator" by introducing its agricultural knowledge-sharing model to local clients. Once the clients have acquired the capacity to use the tools, it moves on to other villages. Not only does this virtual toolkit maintain the impact of current projects, it can also extend the impact to many other regions and organizations.

A standardized toolkit could further transmit the success of a project to other issue areas because of its open-source nature, which makes it sharable with people who may use it, or combine it, with other tools for other purposes. The impact of a project initially developed for sustainable agriculture would then evolve into sweeping changes to the conventional paradigm of problem-solving. By developing a translatable toolkit, network leaders could also cushion a GSN against any financial shortfalls arising from momentary withdrawal of support from donors or volunteers.

**Increase the financial security of a network.** A network with good ideas, but no funds or resources to implement them, will not go far in solving the world's problems. In seeking financial sustainability, network leaders should consider the following principles:

**Core income-generating business**
Arguably, the most secure income stream for a global solution network is a profitable "social business" that subsidizes and enhances the sustainability and resiliency of the network's projects. To set up a social business, network leaders need to blend mission with business acumen. The success of GSNs like SAN, which has survived for decades, is largely attributable to its "social business"—fees collected from users of its globally-recognized standards certification services.

**Low-budget delivery**
The digital revolution enables low-cost sharing and collaboration, which can dramatically expand a network's access to ideas, skills and resources. Low-cost access, in turn, means that it doesn't necessarily take millions to have an impact on addressing interconnected global problems like food security. Functioning as a quasi-social networking platform, Nabuur facilitates many development projects on very low or even zero budgets. Rather than adopt a "go big or go home" strategy, especially when resources are scarce, network leaders should ask themselves whether the project could start with little or even no money, demonstrate impact and then approach local authorities, corporations or foundations for project funding.

**Build impact-tracking into platforms**
Funding and monitoring always go together. Donors supporting a GSN understandably want to see outcomes in exchange for their investments and goodwill. Certain networks we studied have seen core funding withdrawn due

> *"Liberating, unifying and sharing databases would further unleash the world's capacity to tackle not only food security, but also such other connected areas as climate change, poverty, energy and water shortages, population growth and so forth."*

to an inability to demonstrate project impact with concrete figures (e.g. the number of locals engaged, the exact locations of community facilities built or the amount of income gains for villagers) required by the funder. Instead of engaging in resource-consuming bureaucracy-style impact assessments, however, network leaders should build impact tracking directly into their platforms. Simple, easy-to-use impact reporting tools like Digital Green's COCO system, which tracks the direct impact of their training programs on local farming practices, could even be co-developed with donors.

**Crowdfunding**
If a network relies on the continued generosity of philanthropists, its projects are vulnerable to changes of their strategic directions. Network leaders could utilize crowdfunding sites such as Kiva, Kickstarter and IndieGoGo to raise funds for projects in developing countries. Other examples include a Bulgaria-based platform, Farmhopping, which has specialized in crowdfunding sustainable farms since 2012;[93] and AgFunder, a US-based equity crowdfunding platform launched in 2013, which raises capital from certified investors to finance innovations in the food and agricultural industry.[94] This funding source could present unlimited opportunities for GSNs to enhance their financial sustainability.

**Migrate to an "open door" policy for food security data.** The world has a great deal of agricultural knowledge and market information at its disposal, but this information is unequally shared. Liberating, unifying and sharing databases (created and controlled by different organizations and disciplines) would further unleash the world's capacity to tackle not only food security, but also such other connected areas as climate change, poverty, energy and water shortages, population growth and so forth. All stakeholders in the food security ecosystem should migrate towards an open-door approach to making their data freely and openly available. This data would create a global platform for experimentation, analysis, debate and innovation on a large scale. It would further allow network leaders to identify higher-impact strategies and make better decisions. As a former Google executive, Wael Ghonim, wrote in his memoir, "Revolutions are process, not events." The process of saving the world's food supply has just begun.

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## About Global Solution Networks

The Global Solution Networks program is a multi-million dollar investigation into new, networked models of solving global problems and governing important global resources and capabilities. The program is offered through the Martin Prosperity Institute at the Rotman School of Management, University of Toronto and is funded by a dozen of the world's leading corporations as well as by the Rockefeller Foundation and several governments. This report is a deliverable from one of 40 projects that constitute the GSN program.

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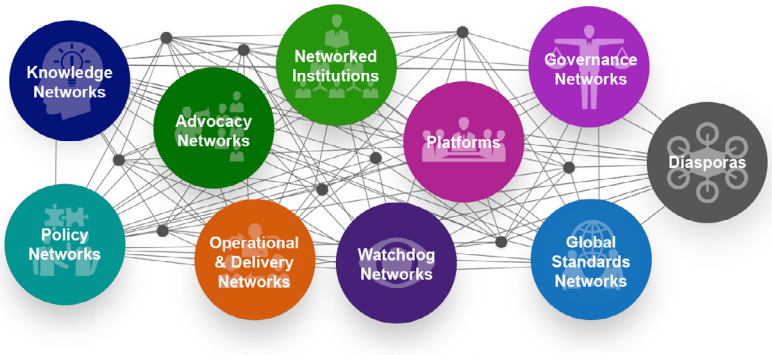


Ten Types of Global Solution Networks

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