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Trade and development

II. The global dimension

Photo: Jörg Bothling

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Editorial

Dear Reader,

Since the turn of the century, global agricultural trade flows have roughly tripled, reaching 1.2 trillion US dollars in 2015. However, the forecasts for future developments are mixed – also because of uncertainty caused by the new US President's statements on trade policy. This second part of our trade focus isn't meant to be a rehash of the familiar "free trade versus protectionism" arguments. But the framework really is different. Climate change, price volatility in the agricultural markets as well as Agenda 2030 all call for a review of how individual aspects relate to one another in the overall context. We have asked our authors to concentrate on food security and sustainability and emphasise scientific evidence instead of scientific debate.

Giving a brief overview of international agricultural trade patterns in the past decade, Kym Anderson of Australia's University of Adelaide arrives at the conclusion that removing trade barriers is the best way of helping global food availability to keep up with the growth in food demand (p. 6). Especially in times when global warming is becoming more and more damaging to food production, it makes sense to allow trade buffer seasonal fluctuations in domestic production. Christophe Bellmann of the International Centre for Trade and Sustainable Development agrees. He also shows that in assessing the carbon footprint of agricultural production and trade, "regional" need not automatically mean "better". To him, making trade more sustainable above all calls for removing some of the perverse economic incentives which still encourage unsustainable agricultural practices (p. 9).

The links between trade and food security are inherently complex. However, this is not always sufficiently considered in policy design. Frequently, national trade policy interventions are only geared to short-term objectives and neglect the long-term consequences (p. 12). Taking a look at horticultural products, our authors of Belgium's Catholic University Leuven have examined how trade affects the individual pillars of food security. The conclusion they draw is that export may contribute to improved availability, access, and utilisation of food in the country of produce. However, especially with regard to stability, the fourth pillar they assess, important challenges remain, for instance when it comes to export companies providing secure employment at remunerative conditions (p. 24). What all surveys have revealed is that monocausal explanations always fall short of the true context. This also applies to the European Union's chicken meat exports to West Africa, whose (supposed) impacts have been taken a closer look at by our authors from the German Stiftung Wissenschaft und Politik (p. 15).

High quality standards are above all making it more difficult for small farmers and enterprises in developing countries to enter international markets. The Standards and Trade Development Facility at the World Trade Organization assists developing countries in meeting international sanitary and phytosanitary standards and gaining market access (p. 20). In the Enhanced Integrated Framework, donors and international agencies co-operate with the Least-developed Countries to promote inclusive development through increased and better trade (p. 22).

Voluntary standards such as Organic, Fairtrade and UTZ are also regarded as a good opportunity to improve the livelihoods of poor farmers – while protecting the environment into the bargain. But do these standards really live up to what they are promising? Surveys by Germany's University of Göttingen in Uganda have shown that Fairtrade households invest more in child education than non-certified households, and that Organic certification has positive effects on household nutrition and dietary diversity of small coffee farmers (p. 27). These effects are also confirmed by a project run by Helvetas Swiss Intercooperation. This organisation has been mandated by Switzerland's second largest retailer, Coop, to support smallholders in Northern India and Eastern Thailand to convert to organic farming and sell their produce at Fairtrade conditions. The scheme has enabled more than 4,500 small farmers to become integrated in sustainable rice value chains. Coop's processing and trading company Reismühle Brunnen have substantially increased their sales of sustainable rice, and today they are the largest suppliers of organic and Fairtrade specialty rice in the European market (pp. 32 and 35).

The Supply Change initiative run by the NGO Forest Trends also confirms the increasing engagement of the private sector in developing sustainable supply chains. Just below 450 companies world-wide have pledged to reduce their impact on forests by changing the way they produce the "big four" commodities, the products that are chiefly responsible for tropical deforestation – palm, soy, cattle, and timber & pulp. In addition, at least 100 companies have committed to help small farmers improve their practices in an effort to slow deforestation (p. 30).

We hope that our articles will provide you with exciting topics for discussion so that you can take a fresh look at an old but still highly relevant issue, and we look forward to your feedback.

Sincerely yours,

Silvia Richter

Partner institutions of Rural 21:

Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung

DLG

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Photo: Center for Development Research (ZEF)

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Food price risks and food security

Considerable price swings on global agricultural markets that set in with the 2007/08 financial crisis have caused concern over the stability and reliability of the global food system. The 1974 world food crisis triggered public investment in agricultural innovation and prompted the founding of the International Food Policy Research Institute (IFPRI) as well as the International Fund for Agricultural Development (IFAD). In comparison, however, the 2007/08 food crisis saw no quick response on the part of the United Nations, and institutions were slow to implement reforms or left them incomplete, Joachim von Braun, Director of the Center for Development Research (ZEF), told a public seminar on "Food Price Risks, Food Security and G20 – Policy lessons from a new book" held in Bonn, Germany, in mid-February. Von Braun also contrasted the slow progress made in addressing the 2007/08 food crisis with the fast pace of developments in trade policy. Deregulation was gaining momentum, while Donald Trump's election in the USA could be ushering in a new era of increased protectionism.

The event highlighted the new publication "Food Price Volatility and its Implications for Food Security and Policy", authored by Matthias Kalkuhl, Joachim von Braun and Maximo Torero. The book sums up the results of five years of intensive collaborative research conducted by Bonn University's ZEF and IFPRI focusing on the stability dimension of food security, the causes and consequences of extreme events in food markets and what can be done to counter them.

Access to price information can help coping with volatility

Kalkuhl, a Professor on Climate Change, Development and Growth at the University of Potsdam, discussed various new drivers of food price volatility such as financialisation, real-estate transactions, cross-asset spill-overs and futures. Speculation, while accounting for 20–30 per cent of price increases, does not appear to have such an impact on price volatility. Global commodity prices appear to affect domestic food prices to a varying extent. Over longer periods, higher prices lead to more investment and more jobs. Food prices impact on consumption in various ways, and may also affect non-food prices. In 2008, the price of Afghan wheat rose by 50 per cent, reducing consumption by 40 per cent, although poorer people nevertheless remained above the minimum caloric intake level.

Co-author Mekbib Haile, a senior researcher at ZEF, told the seminar that the 2006–2010 period had seen huge food price increases as well as a greater level of volatility compared to the previous 20 years, and noted that unlike price increases, volatility was not an incentive for investment. Furthermore, global food supply responded positively to food price increases, but not to price volatility. In the wake of the 2008 food crisis, volatility more than cancelled out growth in global wheat production brought about by price increases. Farmers needed better access to information on prices to reduce forecasting errors. The research had shown that this above all applied to relatively young farmers and those living far away from the markets. Coping with volatility thanks to better information could generally enhance food security.

Attending the seminar via a video link with Lima, Peru, Maximo Torero, Executive Director for Southern American Countries at the World Bank and former IFPRI Division Director, referred to some general international development trends. He warned that big climate shocks could exacerbate price volatility, the potential risk being not only temperature rise but also climate variance. The frequency of famines appeared to be on the increase. The world economy was set to grow two- or even threefold up to 2050, with 60 per cent of the global poor then living in fragile states. Torero stressed that access to food was paramount, while food sovereignty came second, and he warned that import tariffs could put a heavy burden on the poor. He welcomed the internationalisation of food markets and pro-trade policies improving food availability, although he also cautioned that trade openness was creating greater inequality. Furthermore, instruments like AMIS, the Agricultural Market Information System, but also insurances, could boost resilience.

Are we better prepared today?

The discussion centred above all on whether the world was now better prepared to respond to food crises. Kalkuhl maintained that there had been improvements such as the setting up of AMIS, although developing countries had to expand their safety nets, which in turn required more funding. Haile held that countries were now better prepared and were also responding better and giving more attention to the food sector. Torero was less optimistic. "We've just been very lucky," he remarked. "Countries aren't really prepared for a world of uncertainty. Food resilience must be increased." This was backed by Stefan Schmitz, Deputy Director General of the German Federal Ministry for Economic Cooperation and Development (BMZ). "Resilience has to be at the centre of development co-operation," he noted. "We have to help countries cope with uncertainty."

Coming back to price volatility, von Braun noted that while speculation did not matter in normal circumstances, it acted as a spike booster when spikes occurred. He also noted that immediately after US President Donald Trump's signing of a directive aimed at reversing the Dodd Frank Act, passed by US Congress to protect consumers from bad investment, "fishy financial instruments" were emerging again that disturbed food and other markets. Furthermore, von Braun warned of looming protectionism that could stifle much needed investment in agriculture.

Mike Gardner
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Financing agricultural mechanisation

Mechanisation is an important component of agricultural modernisation. However, especially in the context of smallholders, it can prove to be a very difficult venture – also owing to a lack of financial resources. In order to identify solutions to this problem, the German Development Institute (DIE), together with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), organised an expert round table on "Agricultural mechanisation and adapted financial solutions" in November 2016.

Mechanisation potentially encompasses many elements, from soil preparation through sowing, ridging, weeding and harvesting to post-harvest operations, water pumping and the transportation of bulky and heavy items and products on-farm and to the market. It is almost indispensable for the development of economically, socially and ecologically sustainable agriculture since it allows for larger farm units with higher labour productivity providing sufficient income to escape poverty, it facilitates decent working conditions, and it allows the realisation of agro-ecological technologies with bulk transportation of organic matter. In addition, it creates new value chains and jobs around machinery sale and maintenance. Young people, particularly if educated, are unlikely to stay in agriculture if it is not at least partially mechanised. This is why the African Union, in its vision 2063 "the Africa we want", declares in its first of seven ambitions that "the hand hoe will be banished by 2025" – maybe overambitious, but highly symbolic.

However, in many cases, mechanisation requires special financial products and support packages because is is expensive and beyond the means of most smallholder farmers. Often, their farms are too small for individual mechanisation – then a group solution or a service provider may be the only alternatives. Mechanisation requires long-term capital, credits or leasing arrangements. Often mechanisation concepts have to consider the entire farm. Thus, mechanisation credit is beyond the typical micro-finance, seasonal credits which are at best accessible for smallholder farmers, frequently in the frame of value-chain finance. In addition, without a package of additional activities and inputs, farmers may be unable to utilise the mechanisation potential fully, which endangers the profitability of the investment and thus the repayment of the credit or lease. A steady cash flow is required, and in addition to stable production, that requires stable market access. All this demands carefully co-ordinated technical, organisational and financial services and structures. In poor rural areas, these are often unavailable or deficient, making successful mechanisation a challenging, complex endeavour. These complexities may explain why in Latin America and in parts of Asia mechanisation has made huge advances, while in sub-Saharan Africa (SSA), hardly any progress has been made. On the contrary, there are indications of retrogression. While in other world regions particular farm structures and non-farm processes have facilitated mechanisation, in SSA, where agriculture must be the motor of economic development and cannot rely on many of the external structures and processes, different strategies must be developed. This does, however, not exclude learning from experiences elsewhere. But care has to be taken to not simplify and over-generalise them. This was exactly the approach of the workshop.

Several presentations and rounds of discussions shed light on the status-quo of agricultural mechanisation in sub-Saharan Africa and financing options and innovations, and contrasted it with the progress of agricultural mechanisation in Germany after the Second World War. Participants brainstormed in parallel working groups whether it is possible to derive recommendations for the current need for mechanisation in sub-Saharan Africa from the agricultural mechanisation developments in Germany, and if so, what this would mean for the German SEWOH initiative. Rather than developing blue-prints, specific conditions for specific pending projects such as leasing, co-operatives or private mechanisation service providers were discussed.

In sub-Saharan Africa, mechanisation is beyond the means of most smallholder farmers. Photo: Jörg Böthling

Michael Brüntrup
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The export round table was organised within the context of the Special Initiative One World – No Hunger (SEWOH) of Germany's Federal Ministry for Economic Cooperation and Development (BMZ). It was the second workshop of the knowledge platform 'AgriFiP' (Agricultural Finance in Practice) initiated by the same organisations plus KfW, the German Development Bank, which seeks to bring together the experiences of German organisations both in Germany and abroad in terms of modernising and financing farming.
For more information and a related DIE study, see: ➤ www.rural21.com

Why trade matters

Will the world be able to feed itself adequately in 2030? Yes, our author maintains – provided that countries opt for lifting trade restrictions and thus ensuring an optimum and sustainable use of the world's scarce resources. A brief history of international agricultural trade and some suggestions.

Long-distance agricultural trade has contributed to global economic growth and poverty reduction for millennia, but only in recent centuries via international trade in major foods. Its predominant contribution in earlier periods was through trade in crop seeds or cuttings, breeding animals, and farm production technologies. Since 1800, the ever-lowering cost of international commerce gradually allowed trade in farm outputs in raw or processed form. That has led to the prices of farm and other products converging within and across countries and indeed continents. Hence prices of labour and capital are also converging.

However, trade restrictions at national borders have limited international trade between relatively lightly populated economies that are well-endowed with agricultural land and those that are densely populated – as have sectoral and exchange rate policies. Price convergence across space and the efficiency of global resource use in agriculture are therefore less than they could be. This is worrying. If global food availability is to keep up with the growth in food demand, the productivity of resources employed in agriculture needs to increase. That can certainly happen by investing more in agricultural research, but it is expensive and involves decades to yield results. A far more-immediate and lower-cost way to enhance global food availability and thus security is by reforming policies that are distorting food prices and trade.

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International trading in farm output has only been practised on a large scale since roughly 1800.
Photo: FAO/Giuseppe Bizzarri

Openness of each national economy to international trade and investment optimises the use of resources devoted to producing the world's food, it maximises real incomes globally, and it minimises fluctuations in international prices and quantities traded. It should therefore be considered among the food policy options of national governments seeking to reduce poverty and hunger, to boost diet diversity and food safety, and to raise food quality. All these dimensions contribute to national and global food security.

The evolution of food trade patterns since 1960

Developments in global agricultural trade, 'revealed' comparative advantage and net trade specialisation in farm products over the past five decades are broadly consistent with expectations from trade theory, even though trade patterns have been distorted (as well as having been shrunk) by anti-trade policies, particularly in sub-Saharan Africa but also in countries such as Argentina. Some people worry that this has led to national concentration in both the commodity and country shares of global exports of farm products: as of 2014, just eight items made up half of all international trade in agricultural products (oilseeds 12 %, meats 10 %, grains 9 %, dairy products 6 %, tree-crop beverages 5 %, grapes and wine 3 %, sugar 3 % and cotton 2 %), and two-thirds of the world's exports of farm products are accounted for by just a dozen agricultural trading economies (treating the EU28 as a single economy). However, it is a consequence of little food production being traded internationally that just a few countries dominate each product's international trade (see Table).

Gradual reform to market-distorting policies since the 1980s

Agricultural protection and subsidies in high-income countries have

Top six exporting countries for eight key traded farm products, 2013
(% by value of global exports of each product)

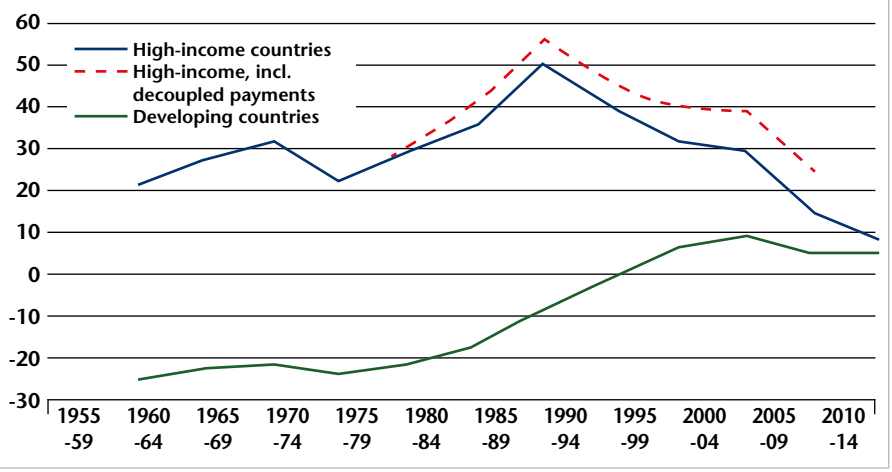
Wheat		Rice		Maize		Sugar, raw	
USA	21	India	34	USA	20	Brazil	54
Canada	13	Thailand	18	Brazil	18	Thailand	9
France	12	USA	9	Argentina	17	Australia	7
Australia	12	Pakistan	9	Ukraine	11	Guatemala	6
Russia	7	Viet Nam	7	France	7	Mexico	3
Germany	5	Italy	3	India	4	Cuba	3
TOP SIX	**71**	**TOP SIX**	**80**	**TOP SIX**	**77**	**TOP SIX**	**80**
Soybean+Oil		**Palm oil**		**Beef, boneless**		**Milk, powder**	
Brazil	36	Indonesia	47	Brazil	18	New Zealand	45
USA	33	Malaysia	36	Australia	18	Argentina	7
Argentina	12	Netherlands	5	USA	15	Netherlands	7
Paraguay	4	Papua New Guinea	1	Netherlands	7	Australia	4
Canada	3	Thailand	1	Ireland	6	France	3
Netherlands	2	Germany	1	New Zealand	5	United Arab Emirates	3
TOP SIX	**90**	**TOP SIX**	**92**	**TOP SIX**	**68**	**TOP SIX**	**69**

Source: FAOSTAT (accessed 5 April 2016).

been depressing international prices of farm products for many decades, while governments of many newly independent developing countries maintained policies that depressed the incentive to invest in farming (directly, as with export taxes, and also indirectly, as with tariffs on imports of manufactures). Since those policies had an anti-trade bias, the quantity of farm products traded internationally was less, which made international food prices 'thinner' and thus more volatile.

From the mid-1980s, however, many countries have been reforming their trade-related policies. Specifically, countries have reduced their distortions to domestic prices: high-income countries have cut import tariffs and removed export subsidies, and developing countries have phased out almost all export taxes, for example. When placed in historical perspective, the reforms since the mid-1980s have been as dramatic as the policy changes in the preceding three decades.

Nominal rate of assistance (NRA)* by governments to agriculture in high-income and developing countries, 1955 to 2014 (%)



** NRA refers to the percentage by which farm gross incomes otherwise have been altered by farm policies (five-year weighted averages, with decoupled payments included in the dashed line). The non-EU transitional economies of Central and Eastern Europe and Central Asia are included in the high-income country group.*
Source: Anderson (2017): Finishing Global Farm Trade Reform: Implications for Developing Countries.

Those developments are made clear by estimates over the past half-century of the so-called nominal rate of assistance by governments to agriculture, which is the percentage by which gross incomes of farmers have been altered by national farm policies. Weighted averages of these are shown for high-income and developing countries in the Figure.

Despite those policy reform trends over the past three decades, most countries continue to insulate their domestic food markets from the full force of short-term fluctuations in international prices. This means that, since plenty of diversity in price distortions remains across countries, and across commodities within each country, the world's resources are still far from optimally allocated towards agriculture.

Economic costs and adverse poverty effects of trade policies could be further reduced

Global economy-wide modelling results suggest that reforms over the two decades to 2004 brought the world a remarkable two-thirds of the way towards free trade when measured in terms of global economic welfare, benefiting developing countries proportionately more than high-income countries.

Had the remaining policies as of 2004 (the final year of implementing the World Trade Organization's Uruguay Round agreements) also been liberalised, developing countries would have gained nearly twice as much as high-income countries, further closing the income gap between high-income and developing countries. Of those prospective welfare gains from completing the global trade liberalisation process, two-thirds would be generated by agricultural policy changes, even though agriculture accounts for less than one-tenth of global GDP and trade. Such is the degree of distortions still remaining in agricultural markets compared with those in other sectors – and the

policies of developing countries are as responsible as those of high-income countries for those foregone gains.

Temporary trade policy responses to international food price spikes exacerbate them

Many governments continue to insulate their domestic food markets from gyrations in international prices. The collective impact of such interventions by a large number of countries is to increase the volatility of international prices, and thereby domestic price volatility in more-open countries. Yet if the world's food-exporting countries insulate to the same degree as a group of food-importing countries, each group will fully offset the other's attempt to prevent their domestic price from moving as much as the international price.

Model results suggest the world probably would see less people fall into poverty when international food prices spike if all countries agreed to abstain from altering trade restrictions in the hope of insulating their domestic markets from such spikes. For example, developing country governments prevented an estimated 82 million people from temporarily falling below the 1.25 US dollar a day poverty line in 2008 had those government responses had no impact on international food prices. However, because those actions exacerbated the international price spike, the number of people saved from falling into poverty by that insulating behaviour is estimated to be less than the number of those pushed into poverty, by 7.5 million.

Prospective effects of (or requiem for?) the WTO's Doha Development Agenda

Empirical modelling of trade reform options make clear that there is a great deal to be gained from liberalising merchandise – and especially agricultural – trade. If it were done multilaterally under the WTO's Doha round, a disproportionately high share of that potential gain could go to developing countries (relative to their share of the global economy). Moreover, the poorest people in developing countries are most likely to gain from global trade liberalisation, namely farmers and unskilled labourers in developing countries – provided developing countries did not demand Special and Differential Treatment (which gives the government of each developing country the freedom to shoot their own economy in the foot). To realise that potential gain, it is in agriculture that the greatest cuts in bound tariffs and subsidies are required. However, the political sensitivity of farm support programmes have made a Doha agreement elusive, and, unfortunately, regional and bilateral trade agreements have not been any more able to free up food trade than has the WTO.

The world has the potential to feed everyone in 2030

The world will be able to feed itself adequately in 2030, and at international food prices that in real terms are not greatly different from those just before the global financial crisis and food price spike period of 2008–12. Asia (most notably China) will continue to become more important in the global economy, and especially in markets for primary products. That opens opportunities for natural resource-rich economies in sub-Saharan Africa, South America and elsewhere to raise their own incomes by expanding their trade with Asia, and more so the faster Asia grows. But agricultural trade would grow less, as would global food security, the more agricultural protection rises in emerging economies in Asia and elsewhere. The drift in high-income countries towards protectionism in some manufacturing areas in recent years, in response to anti-globalisation lobbying, sets a bad example for developing countries to follow for their import-competing farmers.

Policy implications and prospects for boosting global food security

Open markets maximise the benefit that international trade can offer to boost global food security and ensure the world's agricultural resources are used sustainably. The decline in costs of trading internationally reinforces that benefit from reforming price-distorting policies, as does climate change. If global warming and extreme weather events are to become more damaging to food production, then all the more reason to be open to international food markets and allow trade to buffer seasonal fluctuations in domestic production. The more countries that do so, the less volatile international food prices will be. Developing countries concerned that poor households would be too vulnerable if food markets were unrestricted can now invoke generic social safety net measures such as conditional targeted income supplements, focusing them on the most vulnerable households.

For a list of references and sources for further reading, see online version of this article at ➤ www.rural21.com

Where trade and technology policies interact: what role for GMOs?

Concerns that products containing genetically modified organisms (GMOs) may be unsafe as food or animal feed, or may harm the environment, have led numerous European countries to procrastinate on approving their production or use despite no evidence of their harm. This policy stance, which has discouraged many developing countries from adopting too, is unfortunate: modelling results show that GM crops offer welfare gains that could alleviate poverty and food insecurity directly, substantially, and relatively rapidly in countries willing to allow adoption of this new biotechnology.

The stakes in this issue are very high, because the prospective gains from this new technology will increase as climate change proceeds, forcing farmers to adapt to warming and to increased weather volatility and higher costs of irrigation water.

Climate-change-induced crop losses will make many countries in the global South more dependent on food imports.
Photo: Jörg Böthling

Agriculture trade and sustainability concerns

At first glance, global commodity flows and sustainable development do not exactly seem compatible. But the following article shows that international trade can indeed contribute to addressing critical food security and sustainability concerns in agriculture, including by offsetting climate change-induced production shocks. It also argues that good-faith environmental policies in agriculture are compatible with global trade rules but cautions against the possible challenges they may pose to developing countries.

One of the greatest challenges facing the global food system is feeding nine billion people by 2050 and responding to the rapidly changing diet of a growing middle class in urban areas. Part of the solution involves improving access to food by the poor, which would however also require raising production by an estimated 50 or 70 per cent. This is likely to put significant pressure on already stretched natural resources such as land or water. Growing production could also raise greenhouse gas (GHG) emissions, which, according to the Intergovernmental Panel on Climate Change (IPCC), already represent nearly a quarter of global emissions when counting together agriculture, forestry and other land use. In short, the challenge is to improve access and productivity in a way that protects biodiversity and rationalises the use of water at a time when food systems become increasingly vulnerable to climate change.

Besides boosting productivity, especially for smallholders, international trade is likely to play a critical role in this equation. Since the turn of the century, agricultural flows have roughly tripled, reaching 1.2 trillion US dollars (USD) in 2015. Today, non-LDC developing countries account for more than 40 per cent of world imports and over 45 per cent of world exports compared to 26 and 34 per cent respectively in 2000. According to the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO), in the next decades, imports will boom in Asia and, to a lesser extent Africa, as a result of income and population growth, while exports will become more concentrated among fewer countries. Relying more on just a few countries to supply global markets for key commodities could increase risks associated with disruptive trade practices or natural disasters.

While trade has become more prevalent in recent years, the debate on agricultural liberalisation has remained highly divisive and often dominated by ideological or emotional considerations. For some, trade liberalisation guarantees an optimal allocation of resources and promotes economic growth, while others consider that it results in the overexploitation of natural resources and destroys the livelihoods of poor farmers who are unable to compete on world markets. As always, the reality is more nuanced and doesn't lend itself to simple solutions like full liberalisation or complete

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self-sufficiency. The following sections explore some of these complexities.

Trade as a climate change adaptation tool

It is widely acknowledged that the biophysical impacts of climate change, including changes in temperatures and precipitation or the increased likelihood of extreme weather events, will alter crop and animal productivity. Assessing the scope and magnitude of these changes is difficult, also given the uncertainties regarding future climatic conditions and impacts depending on agro-ecological conditions, the types of crops produced, or existing agricultural systems – rain-fed or irrigated. Most models predict that some regions, particularly in the high latitudes, may see increases in production, but that major disruptions should above all be expected in Asia and Africa, precisely where rapid population growth will be concentrated in the next decades. As comparative advantages evolve in response to changes in yields and prices, several food importers will see their food bills surge, while others may lose their ability to grow and export food. International Food Policy Research Institute (IFPRI) estimates suggest that by 2050, South Asia's imports of cereals could increase by 560 per cent from their 2000 levels, only because of climate change. In sub-Saharan Africa, this figure could reach more than 250 per cent.

Trade can help address these production shocks by enabling access to affordable food and creating jobs. From a global food security perspective, international trade will therefore play a critical adaptation role by offsetting climate-induced production shortfalls and making food available in countries that cannot produce it. This intuitively points to the importance of an open and undistorted trade system as an insurance policy against these disruptions, which is not to say that countries should rely exclusively on global markets to feed their population. For large countries such as China or India where the total volume of food traded internationally only represents a small share of domestic consumption, this is simply not an option. Second if productivity is reduced in some parts of the world but not increased elsewhere, trade won't be able to compensate fully for the global reduction in productivity. Investments to enhance productivity are therefore necessary to complement the balancing role of trade. For the above reasons, these efforts should seek to avoid trade distortions that affect food security prospects in third countries. During the 2006-08 food price spikes, for example, unilateral measures in the form of export restrictions applied by large countries to stabilise domestic prices ended up exacerbating world prices significantly. By reducing their ability to access food at affordable prices, these measures generated further food insecurity in net importing countries. In the medium term, they also undermined confidence in international markets and discouraged investments in agriculture.

Analyses have shown that the carbon footprint of flowers grown in open fields in Kenya and air-freighted to Europe was lower than that of flowers in greenhouses heated by fossil fuels in the Netherlands.
Photo: Jörg Böthling

Reducing the environmental footprint of agricultural production and trade

Looking at the other side of the coin, concerns about the environmental footprint of agricultural exports are often invoked by more advanced countries as a rationale for restricting trade (e.g. through taxes, subsidies or non-tariff measures such as labelling schemes), while most developing countries tend to see these restrictions as disguised protectionism.

A first set of concerns relates to the GHG emissions generated by the transportation of food over long distances. This preoccupation lies behind the concept of food miles developed by major retailers and the widespread notion that consumers should privilege locally produced food as it generates less emissions. The argument can however be misleading if it only takes into account emissions generated by transport without looking at the whole product life cycle. From a climate change perspective, the emissions generated by production systems, cold storage or even consumption are also significant and can exceed those generated by transport. Analyses cited in Kasterine and Vanzetti have shown e.g. that the carbon footprint of flowers grown in open fields in Kenya and air freighted to Europe was lower than that of flowers grown in greenhouses heated by fossil fuels in the Netherlands. Seasonality also matters. Emissions from products grown in the UK and placed in storage for ten months are twice as high as those of South American apples sea-freighted to the UK. Even a consumer driving more than ten miles to purchase one kg of fresh produce will generate more GHG emissions than air freighting one kg of produce from Kenya.

A second set of concerns relates to the water content of exported products, not least because of the signifi-

cant amounts of water required to produce certain agricultural goods. Early research looked at the water required to produce a particular commodity and ultimately embedded in exports as "virtual water". The approach argues that trade should result in a better allocation of resources with water-scarce economies being able to import water-intensive goods and export those that require less water. Indeed, some analysis tends to support this common-sense proposition, showing that trade liberalisation has been associated with a shift to less water-intensive activities in water-scarce countries.

Other analysis cited by the ICTSD shows a more nuanced picture. The Southern African region, for example, imports higher volumes of virtual water from the rest of the world than it exports for both irrigated and rain-fed products. Interestingly, however, trade within the region shows the opposite, with net flows of virtual water occurring from South Africa – the most water-scarce country – to neighbouring countries with considerably better per capita water endowments. This is explained by a number of factors including capital availability, technology, transport, energy and communications infrastructure. In other words, water endowment is only one of several factors playing a role in determining comparative advantages.

A third area of concern relates to the provision of environmental services. Thriving wildlife, biodiversity, beautiful landscapes, or well-functioning watersheds are all products of agriculture. Society values these services, but they have no market value. This results in a situation in which suboptimum levels of these public goods are delivered, resulting in biodiversity decline, water pollution and degraded landscapes and soils. Producers complying with more stringent environmental requirements are in turn put at a competitive disadvantage compared to foreign competitors not bound by similar requirements. This is a typical case of market failure arguably justifying some form of government intervention to ensure the delivery of such public goods, usually as state aid, including direct payments. From an environmental perspective, however, such measures should be directly targeted at measurable outcomes and be proportionate to the cost of delivering the environmental benefits or they risk being abused. Cases have been documented in the European Union, under the previous Common Agricultural Policy (CAP), for example, where a farm would receive some 27,000 euros in direct payments when the real costs of complying with EU environmental requirements were estimated at approximately 75 euros. Such practices could hardly be justified as environmental.

Implications for trade policy

Overall, the most important contribution from trade policy to address sustainability might be to remove some of the perverse economic incentives which still encourage unsustainable agricultural practices. For example, high tariff protection and subsidies in the EU but also in China, Turkey, the US, Korea or Japan continue to protect beef production, which is highly water and GHG emission intensive, while artificially bringing down world prices. Similar concerns have been raised with respect to other perverse subsidies such as fossil fuel subsidies or some irrigation subsidies. A second challenge consists in designing effective sustainability policies without unnecessarily affecting third countries' legitimate trade interests. In this respect, basing trade-related measures on good science or international standards, taking into account the complexities of agriculture production and its impacts on the environment is often a good guarantee against arbitrary discrimination or disguised protectionism. While trade agreements may impose some limitations, as a general rule, good-faith environmental measures will not conflict with trade rules of the World Trade Organization (WTO) as long as those measures are not creating unjustified discrimination. Existing jurisprudence confirms that the WTO rule-book already provides a fair amount of flexibilities, including the possibility of differentiating products on environmental grounds or providing unlimited non-trade distorting payments for environmental purposes. Such flexibilities should enable producers to improve their environmental performance without being unfairly affected by foreign competition.

From a developing country perspective, however, high environmental requirements – including stringent sanitary and phyto-sanitary measures – can sometimes act as de facto barriers to their exports by setting the bar too high for them to comply. In these cases, trade related technical assistance and capacity building have a significant role to play in helping developing country producers comply with environmental regulations. Beyond technical assistance, measures restricting imports on environmental grounds may also raise equity issues. Air-freighted exports of fruits and vegetables from Kenya may indeed generate more GHG emissions than those produced in Europe. But small Kenyan producers relying on such exports for their livelihood can hardly be held responsible for the problem of climate change. Penalising their exports on climate grounds when international agreements explicitly exempt them from GHG reduction commitments may seem unfair.

As the international community starts implementing the Sustainable Development Goals (SDGs), this points to the need for concerted solutions at international level as opposed to unilateral measures. Recent developments have shown the limits of a strategy based on bilateral or regional trade agreements as illustrated by the fate of the Transpacific Partnership (TPP). At multilateral level, the WTO ministerial conference in Argentina next December may provide an opportunity to address some of these issues, including economic incentives which still encourage unsustainable agricultural practices.

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The issue of whether trade has a positive or negative impact on food security in countries of the global South calls for a very detailed analysis.
Photo: FAO/Paballo Thekiso

Reconciling trade policies with food security objectives

Building on the findings of the Food and Agriculture Organization's flagship report 'The State of Agricultural Commodity Markets 2015-16', this article argues that a better balance between technical and strategic considerations is required when analysing and debating the links between trade, agriculture and food security.

Agenda 2030 sets out a governance framework, defined by the Sustainable Development Goals (SDGs), that affirms a new vision whereby sustainable development is no longer a question of North–South relationships, but rather a universal concern that involves developed and developing countries alike. It also underscores the importance of taking into account the different national realities, capacities and levels of development, and of respecting national policies and priorities.

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At the same time, countries now have a wider range of options for financing their development, with Official Development Assistance (ODA) representing only a small component of these options, and with the pattern of finance (the mix of national, international, public and private sources) evolving at different levels of income and development. This has contributed to a shift in attention from financing towards policy packages designed to create the enabling conditions for the effective mobilisation of different sources of finance appropriate to specific country situations.

Meanwhile, new visions have been taking shape among both donor and beneficiary countries, "inspired" by the principle of economic diplomacy (see Box on page 13, top), and placing trade at the core of international relations. Donors are increasingly transforming aid relations into trade relations. Developing countries are using trade more and more to promote structural transformation and raise their capacity to use domestic resources to support their own growth and development.

In this transition "beyond aid", trade policies play an important role in supporting the implementation and financing of agriculture strategies and investment plans. This requires an improved understanding of the links between trade, agriculture and food security, of the role that trade policies can play in creating the enabling conditions for structural transformation,

and of the improvements needed in governance and policy-making processes to enable a better balance between national interests and the collective goods provided by the global trade system.

The relationship between trade and food security

The links between trade and food security are inherently complex. As illustrated in the Figure on page 14, trade impacts all the four dimensions of food security by inducing changes in a number of economic and social variables. These impacts can be positive or negative and can evolve over time, possibly working in different directions in the short and long term. They are also influenced by the economic context and other domestic factors such as the functioning of markets, the responsiveness of producers to changing incentives and the geographical distribution of food insecurity.

The complexity of these interactions explains why the trade effects on food security are very mixed and context-specific, as empirical evidence also confirms. For example, McCorriston et al. (2013), after reviewing 34 studies on the effects of trade reforms and food security, conclude that 13 studies reported improvements in the food security indicators used, ten showed declines, and the other eleven had mixed results, "with food security metrics varying across segments of the population, regions and periods, or with alternative food security metrics indicating different outcomes for specific countries".

Therefore, "trade is neither an inherent threat to, nor a panacea for improved food security, but it poses challenges and risks that need to be considered in policy decision making." (FAO, 2015)

Long-term considerations need more attention

The challenges in generalising a relationship between trade and food security make it difficult to identify a single most "appropriate" policy instrument. The appropriateness of a trade policy is rather linked to the objectives of policy interventions, with particular attention to short- and long-term objectives. The same policy instrument can have quite different results in terms of food security under different circumstances.

The debate about trade and food security has tended to focus mainly on short-term policy interventions in response to market shocks, and on analysing and managing the resulting short-term consequences in terms of changes in trade flows and prices for consumers and producers.

When positioning the policy debate in a longer-term perspective, and considering the dynamics of structural transformation that are common to the development pathways of most countries, the determinants of trade policies supportive of improved food security change significantly.

In this perspective, the appropriateness of trade policies is determined by the stage of development of the specific country, and by the role of the agriculture sector within that country's economy. In countries in early stages of development, the provision of public goods such as market infrastructure and research and development may be paramount. As markets develop, a more interventionist approach to reduce production risks and provide incentives for productivity improvements may be required. As development proceeds and the agricultural sector becomes less important in its share of the economy, progressive withdrawal from market activities and a more liberal agricultural trade policy to allow the private sector to play an increasingly active role will be needed (Dorward and Morrison, 2000).

"Taking this longer-term perspective, the question is not whether, but when and how countries should open their agriculture sectors to greater competition." (FAO, 2015)

Improved governance for trade and food security

In addition to prioritising short-term policy considerations over long-term ones, the debate on trade and food security has also been dominated by discussions on the pros and cons of

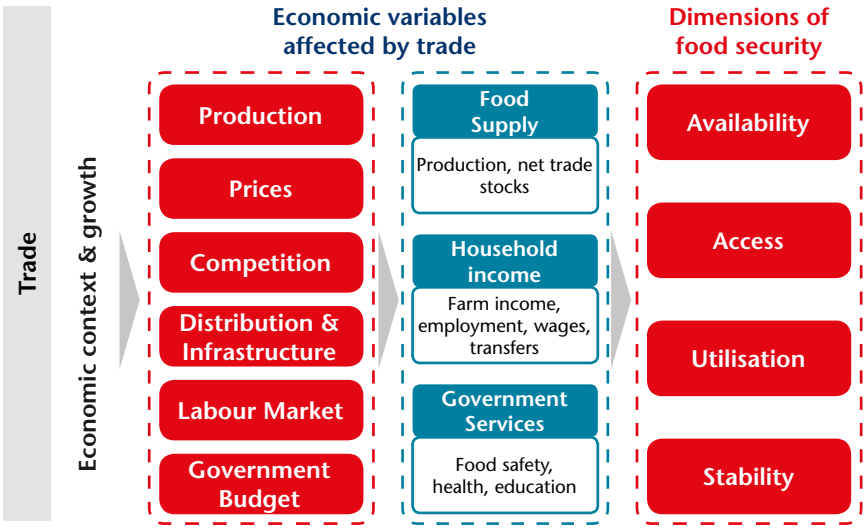
The concept of Economic diplomacy

The developments and the vision of the Agenda 2030 are underpinned by the concept of economic diplomacy, defined as "the process through which countries tackle the outside world, to maximize their national gain in all the fields of activity including trade, investment and other forms of economically beneficial exchanges where they enjoy comparative advantage. It has bilateral, regional and multilateral dimensions, each of which is important" (Rana, 2007). This concept provides the basis for a more holistic approach to international relations that is more concerned with political economy issues, connects national with international policy interests more effectively, views development policies as part of a package of policies, and prioritises long-term transformation over short-term political or commercial interests.

Trade policy responses to the food price crises and their short- and long-term impacts

In 2007–2008, in response to the rise in food prices and to increased price volatility, a number of countries put in place export restrictions (net exporting countries), or reduced import barriers (net importing countries), to stabilise supplies on domestic markets. While these policies helped to achieve the short-term national objectives of increasing food availability and lowering food prices, in the medium and long term, their negative impacts at both national level (disincentives for farmers created by an uncertain policy environment) and global level (upward pressure exerted on world prices by a tightening of the balance between demand and supply, and exacerbation of uncertainty and volatility in food markets) have become visible. The negative impacts in the long term can significantly undermine any short-term gains.

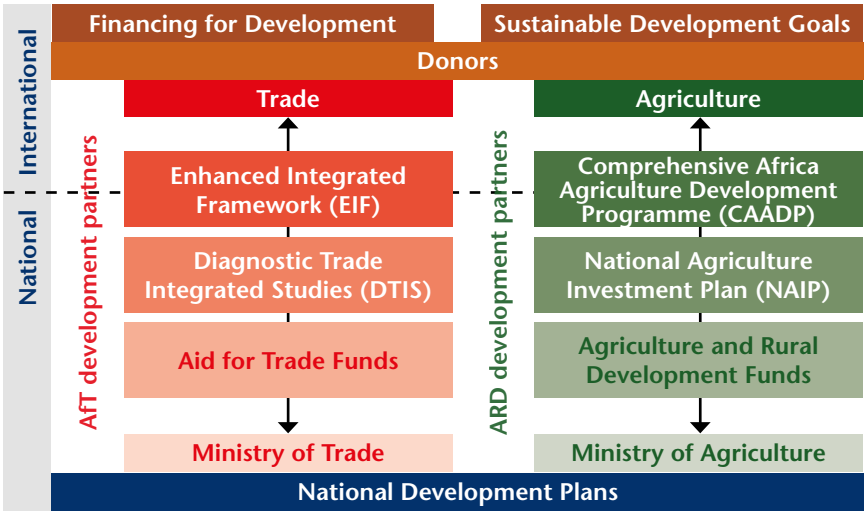
Trade and the four pillars of food security: channels of interaction



Source: FAO, 2015

different policies, and on the "policy space", or flexibilities, provided under trade agreements. This has resulted in polarised positions, making it difficult to find the right balance between ensuring that countries are not restricted in their use of policies to pursue their national food security concerns, and that, at the same time, they "do no harm" to third countries. Less attention has been given to the policy-making "processes" (the interactions and competing forces that shape policy decisions). A closer look at such processes suggests major challenges in cross-sectoral co-ordination. In most developing countries, trade and food security objectives are identified through separate prioritisation, negotiation and co-ordination processes, associated with different ministries (trade and agriculture) and involving different stakeholders, development partners and sources of financial support. This has resulted in weak strategies and has reduced the capacity of developing countries to take advantage of market opportunities. The example of least-developed countries in Africa, where processes supporting agriculture and trade development are quite separate, is emblematic.

Governance for agriculture and trade planning processes in African LDCs



Source: Adapted from FAO, 2015

"Shifting attention from the pros and cons of specific 'policies' towards addressing weaknesses in the governance of the 'processes' that guide policy decision in trade and agriculture will help to reconcile multiple views and tradeoffs, agree on common objectives, and identify the mix of policies to achieve them." (FAO, 2015)

Conclusions

Debates on the appropriate use of trade policy in support of food security have tended to focus on the short-term economic costs and benefits to economies, but have neglected both their longer-term impacts and the complex processes through which approaches to developments in the realms of trade, agricultural and food security are determined. A more pragmatic approach focused on the specificity of the country context will help to ensure greater coherence between trade policies, agriculture sector development, and the food security priorities of different countries. Focusing on policy-making processes rather than on the pros and cons of different policies will help to balance competing objectives and improve policy coherence.

To assist countries in achieving greater coherence between trade policies and food security objectives, the international community should increase its efforts to support developing countries in strengthening their capacities to analyse the implications of trade and related policies for achieving longer-term food security objectives; in facilitating policy dialogue to improve alignment and coherence between agricultural development strategies and trade-related policy frameworks; and in better engaging in the regional and global trade-related processes that shape international trade agreements, to ensure that they are coherent with and supportive of the achievement of food security in all countries.

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Photo: Bilderbox.com

European chicken drumsticks for West Africa – a threat to local markets?

Trade in agricultural products is of considerable importance to the economies of most African countries. Imports often play an important role in feeding a growing population. At the same time, they exert competitive pressure on internal production and therefore also put food security at risk. Here, it is the European Union that has above all been at the centre of criticism over many years because of its agricultural policy. Is this justified? With an account of poultry meat exports to West Africa, our authors show that there are no simple answers to this question.

Over the past ten years, poultry meat exports from the EU to West Africa more than doubled – reaching 274 million tons in 2015. Accounting for 50 per cent of all EU poultry exports to West Africa, Benin is the main target, followed by Ghana. But overall, the exports to West Africa only constitute slightly more than ten per cent of world-wide poultry meat exports from the EU. The Netherlands, Poland and France are the most important countries of origin within the EU.

The West African states themselves export only little in the poultry sector, and most of it is traded within the region itself. For example, to a small extent, Ghana above all exports live chicks to Liberia, Sierra Leone, Cameroon, Benin und Uganda.

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Often, local poultry meat production in West Africa is insufficient for protein supply to the region's constantly growing population, which, at around three per cent, is experiencing the highest population growth world-wide. While local production has doubled in Ghana since 2002, per capita consumption of poultry rose so strongly – from 9.5 kilograms per capita and year in 1995 to 10.5 kg/per capita/per year in 2005 – that imports had to be raised. According to the World Hunger Index, the national food supply situation is generally poor.

One chief obstacle to increasing local production is deficits in animal health – stocks are often threatened by animal epidemics. High energy prices are a second factor, and they impact e.g. on establishing and maintaining cold chains. And then there is the high cost of animal feed. All this results in the world market prices often being significantly lower than the local prices, which also tend to differ within a country depending on the different local markets. However, Ghana has succeeded in enhancing its competitiveness. In 2011, the import price of poultry was just shy of 50 per cent of the local price – compared to 60 per cent in 2008.

EU trade policy on West Africa

After nearly ten years of negotiating, the EU and the Economic Community of West African States (ECOWAS) concluded their Economic Partnership Agreement (EPA) in June 2014, which is one of a range of different regional EPAs with African, Caribbean and Pacific countries.

It grants the African partners completely free access to the EU market. This offers African countries new opportunities, especially in the area of further processed agricultural products whose access to the EU market was previously limited. However, the EPA does bear risks as well, for to comply with world trade regulations, the partner countries also have to open up their markets for the first time – albeit to a lesser extent. This might lead to an increase in imports that could

impair local markets. While the EPA provides a number of instruments to avoid negative impacts on African domestic production (see upper Box on page 17), particularly with regard to food, it will yet have to prove their worth in the course of implementing the agreement.

But what is now going to happen in concrete terms of border protection once the EPA enters into force? Within the EPA, tariffs on chicken parts belong to those products excluded from abolishing tariffs. So the tariff applied so far will continue to be valid vis-à-vis the EU and also all the other trade partners of the African countries. The EPA commits the EU to refrain from all agricultural export subsidies, although exports of chicken parts to West Africa have not been subsidised for a long time, so that the EPA will not result in any changes here.

EU agricultural policy

With the reform of the EU Common Agricultural Policy in 2003, the previously product-related payments to farmers were tied to the area, so that now, the farm enterprise is supported instead of individual products. While the originally volume-increasing and thus price-cutting effect of subsidies was avoided, all in all, such support also enhances the competitiveness of European producers in comparison to competitors in the developing countries.

In the past, in contrast to other agricultural sectors, poultry production in the EU enjoyed very little support via specific subsidies. On the contrary, subsidies for grain producers even led to higher animal feed costs, putting poultry producers at a disadvantage. However, animal farming was indirectly supported via investment aid e.g. for sheds and pens.

National West African policies

In addition to tariffs, developing countries can also use subsidies to protect their agricultural production,

A major share of poultry production in West African countries is consumed domestically or traded within the region itself.
Photo: FAO/Isaac Kasamani

which they do however not often resort to owing to budget limits or other political priorities. Over the last few years, only a small number of African states (such as Malawi, Ethiopia or Senegal) achieved the goal set by the African Union in its 2003 Maputo Declaration of spending ten per cent of the national budget on agriculture.

Frequently, however, the data base is poor, too. The West African countries often fail to notify the World Trade Organization (WTO) of their programmes, even though they are obliged to do so as WTO members. The WTO has defined a wide scope for subsidies that developing countries can also make use of (see Box on page 17, bottom).

Some West African countries as well as private actors have launched their own aid programmes in the poultry sector:

Ghana has already been supporting its poultry production since the 1960s in various focal areas such as combating epidemics, supporting producer associations or setting up marketing institutions. The Ghana Broiler Rehabilitation Project (GHABROP) was initiated in 2014, the notion being to couple tariff protection with infrastructure measures. It envisaged to replace imported poultry by domestic poultry in processing by 40 per cent. Owing to a lack of administrative capacities it could not be further pursued. At any rate, it is unclear whether giving domestic input preference instead of imports can be contested with WTO regulations. The general agreement on subsidies does not permit prescribing the use of domestic inputs. Other developing countries in particular could contest this regulation if they feared that this was putting their exports to Ghana at a disadvantage.

In Burkina Faso, only in September 2016, a meat processing company based in Côte d'Ivoire (Société ivoirienne de productions animales, Sipra) launched a project establishing poultry production. It remains to be seen whether this will also integrate Burkinabe producers.

Comprehensive solutions called for

Trade relations are complex. Simple solutions will not work in solving the problems emerging from them, as the following examples show.

Import protection alone is not enough. In Nigeria, import flows have been stopped completely by an

import ban since 2003, which however has not resulted in a rise in domestic production. Instead, illegal trade has developed (see also online article "The little people always suffer").

A ban on the exporting side instead would probably not solve the problem either – especially if it was only limited to European export. In the case of Ghana the EU is only the third most important supplier of chicken (50 million euros in 2015), behind the USA and Brazil. However, it would be conceivable for the G 20 to launch a joint initiative to raise the incentive for African domestic production by retaining their exports. However, also for WTO law reasons, this would have to be closely co-ordinated with the recipient countries.

African countries have to prepare comprehensive policy packages. In order to give sufficient incentives to step up domestic production, it is key for the African countries to formulate their own policies corresponding to their own interests. For example, the extent to which domestic production needs to be protected by tariffs has to be discussed in society. Import tariffs put a strain on both the importing firms and on urban consumers, particularly those with a low income who often have to depend on cheap chicken meat in order to cover their protein requirements in their diets. A trade policy measure will therefore always favour one group in society while putting others at a disadvantage. It is up to domestic politics to moderate the decision-making process and define the necessary compensatory measures with each decision taken. All interests have to be taken into consideration – not only the well formulated ones (usually those of the urban importing firms), but also those of the producers in the more remote areas who are frequently unorganised.

However, promoting domestic production also calls for measures to reduce production costs, improvements in infrastructure such as energy, communication and transport, and strengthening quality infrastructure, which has to ensure compliance with safety standards. In the past, for example, the Food and Agriculture Organization (FAO) identified bird influenza outbreaks and not continuously available animal feed as crucial problems in the case of Ghana. In these areas, development co-operation can play an important role. Ghana's GHABROP was a step in the right direction. However, its failure indicates how important strong local support by respective capacities to assist the actors involved is and what has to be improved for future projects.

Sustainability is called for in consumption and trade. It is consumer behaviour in the EU and other rich industrialised countries that enabled the rapid increase in African imports in the first place. European consumers are buying fewer and fewer whole chickens but are going more and more for chicken breast instead. However, from a business management angle, it still makes more sense to sell remnants at giveaway prices than to throw them away. Here, the United Nations Sustainable Development Goals (SDGs) point in the right direction; they demand changes in consumer behaviour in developed countries. A complete internalisation in terms of pricing of all external effects that poultry production has, including environmental pollution (e.g. through nitrates), would be desirable. This would make the meat more expensive, so that African products would then become more competitive, would reduce consumption and thus linked remnants in Europe and would have a positive impact in the environment into the bargain. The EU ought to consider appropriate measures in the forthcoming reform of the Common Agricultural Policy for the post-2020 period.

Concrete policy measures have to be defined for the respective specific situation of a country, and will always vary depending on the country and the product. As a rule, isolated (trade policy) measures will not be sufficient to secure food, income and employment in rural areas.

Scope for the protection of domestic production and food security in the ECOWAS EPA

- Exclusion of sensitive products from liberalisation, i.e. tariffs often remain for agriculture products (Art. 10)
- The safeguard clause (Art. 22) provides for the reintroduction of tariffs if local production is threatened
- Flexible tariff protection has to be an option for emerging industries (Art. 23)
- Tariff protection is possible to maintain food security (Art. 47)
- Market liberalisation can be adapted to facilitate regional integration measures (Art. 12)
- A review of the agreement's impacts is provided for (Arts. 2, 57 and 61)
- Countervailing duties can be imposed to address trade-distorting subsidies (Art. 20)

Scope for agricultural subsidies in developing countries according to the WTO Agreement on Agriculture (AoA)

- Amber Box measures: notification of future options to use respective production-increasing measures also required on signing the WTO Agreement on Agriculture in 1994, which developing countries often failed to do, reduction commitments and defined limits had to be fulfilled (Art. 6)
- "de Minimis": certain minor subsidies are possible without reduction commitments, maximally 10 per cent of the produce value (Art. 6.4)
- Blue Box measures: measures linked to production limits (Art. 6.5)
- Development measures: e.g. general investment aid, input subsidies for income-poor producers, diversification of drug cultivation in developing countries (AoA, Art. 6.2)
- Green Box measures: unlimited defined measures such as payments disaggregated from production, payments of general services such as agricultural research, for maintaining reserves for food security, for food aid, to secure income, for income compensation in the event of natural disasters, pension aid, environmental and regional programmes, investment aid (Annex 2)

The cost of high food prices in West Africa

Food prices in West African countries are significantly higher than in other areas of the world with comparable levels of development. This situation is having serious effects on the welfare of households and on food security. One more reason to unlock the trade potential of the region.

The 2007-08 world food price crisis caused political turmoil and social unrest in many West African countries. Poor urban households, in particular, were unable to afford food and demonstrated vocally in cities such as Dakar and Abidjan. Price is a key determinant of a household's access to food. As the region urbanises rapidly, more and more consumers are becoming dependent on markets for food. Yet structural changes in demand are driving food prices upward, independent of the global context. Food demand has increased fivefold over the past 60 years and dietary patterns have also transformed considerably. Consumers are increasingly looking for foods that are convenient to buy, prepare and consume; 39 per cent of all food consumed in West Africa today is processed. West African supply is adjusting to these growing and diversifying consumption patterns, but at a slower rate than demand. This is affecting market conditions and resulting in higher prices.

Getting prices right

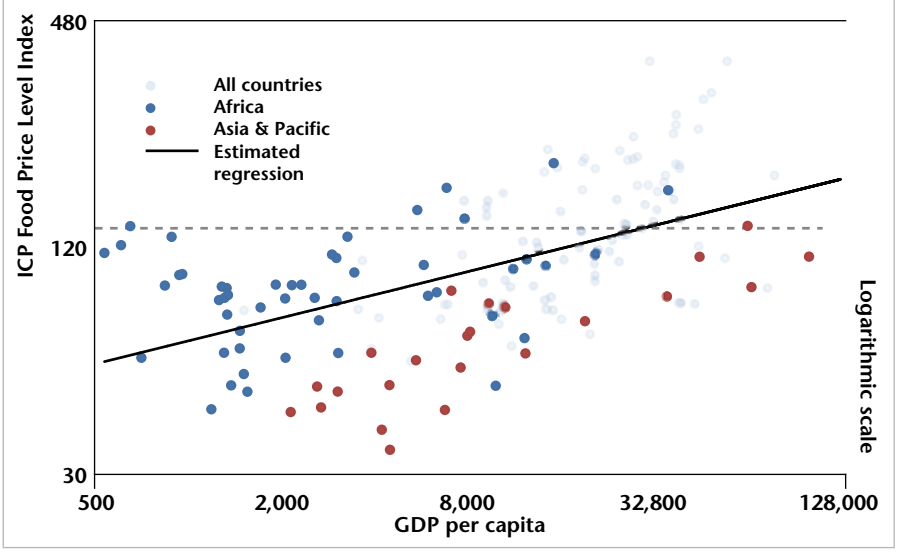
Prices have mixed effects on the welfare of households. On the one hand, increased prices mean improved incomes for producers, whilst on the other, they translate into higher food costs for consumers. The net effect depends on the structure of the economy and on the share of household food consumption that is supplied by markets. In predominantly agricultural countries, the majority of households might be better off with higher food prices. However, the rapid urbanisation taking place in West Africa calls into question certain assumptions as to what the "right" level of food prices should be.

A higher share and growing number of West African households are now dependent on non-agricultural activities for their living. This includes most urban households, which account for 45 per cent of the region's total population. It also comprises many living in rural areas where an estimated 25 per cent of households are engaged primarily in non-agricultural activities. As a result, a growing number and share of consumers rely on markets for their food supply. Overall, markets now provide at least two-thirds of household food supply as West Africans become buyers – rather than producers – of food and spend a larger share of their food budget at markets. This growing number of households would stand to lose from any increase in prices. These same households are also highly sensitive to fluctuations in prices as food represents 50 per cent of their total budget. It is therefore time for policy-makers to get food prices right, both for the welfare of households and food security.

A costly Africa

Are food prices currently too high in West Africa? Using data from the 2011 International Comparison Program (ICP), we estimate that food prices in sub-Saharan Africa are 30 to 40 per cent above prices in other areas of the world with comparable levels of development. The Figure below illustrates the relationship between food price levels and GDP per capita. It shows that the majority of African countries are above the line, indicating a higher level of food prices relative to other countries at a similar level of development. This corresponds with research by Gelb et al. (2013) who found that overall price levels in sub-Saharan African countries are 35 per cent higher when compared to their predicted values. In addition, food is particularly expensive compared to non-food products. In West Africa, food prices are 50 to 130 per cent

Relationship between food prices and GDP per capita



Sources: Author's calculations using ICP 2011/World Bank (2015)

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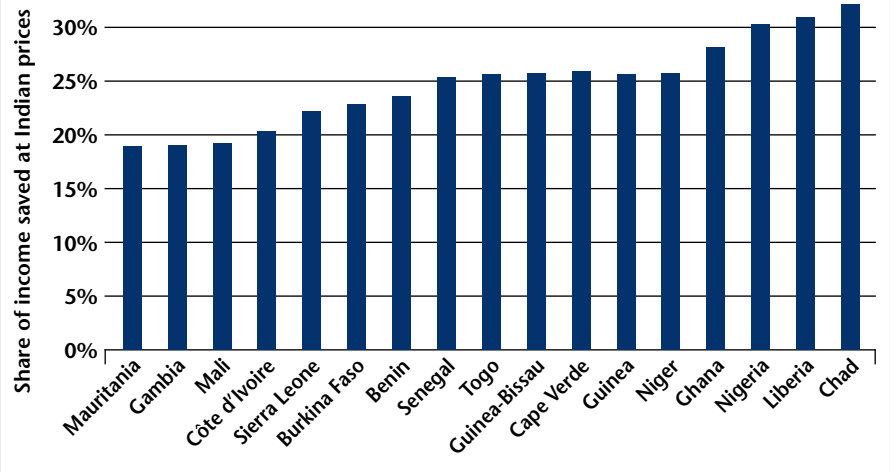
above the overall price level index, indicating that food is more expensive in real terms than non-food products. These higher food prices translate into a welfare loss for households.

A comparison with India reveals a vivid picture of how high food prices impact the purchasing power of Africans. Using food price differentials between West African countries and India, as well as looking at expenditure shares, it is possible to provide a rough estimate of how much a typical West African food basket would cost in India. The resulting comparison shows that households could save from 20 per cent of their income in countries such as Côte d'Ivoire, the Gambia and Mauritania, to approximately 30 per cent in Chad and Liberia (see Figure). These results provide an indication of the degree of household welfare loss resulting from the price gap reported between India and West Africa. It confirms that West African households are strongly impacted by the high prices stemming from the West African food system. It also provides an explanation for the trend in increased food imports.

West African households would save 20-30 per cent in income if they bought food at Indian prices



Sources: Author's calculations using ICP 2011/World Bank (2015) and Global Consumption Database/World Bank (2015)

What should policy-makers do?

Driven by population growth, urbanisation and income growth, West Africa's food system is changing. Consumers are also changing their habits, adding more variety to their diets, turning towards processed foods that are convenient to prepare and consume, and attaching greater value to other product attributes such as quality, healthfulness and packaging. This shift in consumer habits will necessarily drive the demand for increased post-harvest activities in food production. The design of food policies should take these changes into consideration as well as strive to balance the needs of consumers and producers.

A look at price levels by food group can provide interesting insight into policy options. To begin with, there is a clear hierarchy of prices across all countries in the region, in that dairy and fats/oil products are always the most expensive foods while fish, cereals, fruits and vegetables are the least expensive. Processed foods are more expensive in absolute terms than in the United States for many West African countries, yet they are increasingly in demand. Cereals remain an important contributor to a household's overall food budget, but focusing on cereals is no longer the only strategy for easing household budget constraints. For instance, countries like Côte d'Ivoire, the Gambia, Ghana, Nigeria and Togo should also be addressing the challenges and constraints that hinder the development of fruit and vegetable value chains. In Ghana, we estimate that a one per cent decrease in cereal prices would lead to a 0.19 per cent decrease in overall food prices, whilst a decrease of the same amount in the price of fruits and vegetables would have a larger impact, leading to a decrease of 0.35 per cent. These previously "forgotten" food sectors will provide local products and jobs for a growing market of domestic consumers.

Unlocking the intraregional trade potential of West Africa and expanding its food market is a priority challenge. The relatively high food price differential across the region – from -28 per cent in Mauritania to +14 per cent in Ghana relative to the regional average – indicates the relative inefficiency of the regional food market, which allows price transmission but with significant transaction costs. Public actions should focus on improving physical infrastructure, enhancing customs efficiency, and developing and enforcing necessary regulatory mechanisms. These initiatives will all contribute to lowering transport costs and ultimately food prices. A more comprehensive trade corridor approach could provide the framework to overcome the investment and institutional challenges, and to facilitate regional trade.

Increasing productivity is at the heart of the solution to limit increases in price. Long-term food supply will be determined by the amount of productive resources available for production as well as the productivity of these resources. Raising productivity will have substantial impacts on prices and on farmers' incomes, eventually decreasing rural poverty and making food more affordable for the urban poor. Many productivity-increasing solutions are within the West African farmer's reach. Yet more – and better – investments in the agro-food sector are increasingly required to respond to new and growing demand. This will happen if the business case for investing in increased productivity in the agro-food sector can be effectively demonstrated. Both public and private-sector stakeholders need to be involved in the process, while investment assistance from abroad will be instrumental.

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Pests like the Mediterranean fruit fly can spread to many parts of the world in next to no time. Surveillance, pest management, research and capacity building are critical to reduce production losses and facilitate safe trade.
Photos: STDF

Closing the standards gap

Trade in food and agricultural products offers a way for farmers, processors and traders in developing countries to increase their incomes and boost economic development. But despite the potential, they face many challenges. Limited capacity to meet food safety, animal and plant health requirements is often a major obstacle. To take full advantages of trade opportunities, developing countries receive support from the Standards and Trade Development Facility at the WTO.

Except for some agricultural products, custom tariffs in international trade are generally low. Market access for goods now largely depends on countries' ability to comply with a wide range of non-tariff measures (NTMs). Governments use NTMs, such as taxes, subsidies and regulatory measures, to attain a wide range of policy objectives including health, safety, environmental protection and other social imperatives. Among NTMs, sanitary and phytosanitary (SPS) measures are particularly relevant to international trade in food and agricultural products. Since these products are often of great importance to developing countries, much of their trade is subject to SPS rules and procedures. Surveys by international organisations have shown that NTMs can be particularly burdensome for small and medium enterprises (SMEs), because they entail fixed costs independent of the size of the exporter. When a new restrictive SPS measure is introduced in an export market, smaller exporting firms are more likely to exit that market. Large firms lose comparatively less because they are able to comply with more stringent requirements more easily and at lower costs than SMEs.

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WTO disciplines and the benefits of harmonisation

The WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) sets out the basic rules for food safety, animal and plant health requirements. It recognises the right of governments to adopt and enforce measures necessary to protect human, animal and/or plant life or health. But it also provides rules to ensure that these measures are not misused for protectionist purposes and do not result in unnecessary barriers to trade. SPS measures must be non-discriminatory, science-based, least-trade restrictive and transparent, and comply with a number of other procedural obligations. SPS measures can take many forms, such as requiring products to come from a disease-free area, inspection of products, specific treatment or processing requirements, tolerance levels for pesticide residues or limiting the permitted use of additives in food. SPS measures apply to domestically produced food or local animal and plant diseases, as well as to products coming from other countries.

The Agreement on Technical Barriers to Trade (TBT Agreement) provides related but separate disciplines that apply to all other technical regulations, voluntary product standards and the procedures to ensure that these are met (such as testing or certification). Governments use TBT measures to meet a much wider range of policy objectives such as national security or to prevent deceptive practices. TBT measures can cover any product, from car safety to energy saving-devices, but can also be relevant for the food and agriculture sector. Examples include regulations on animal welfare, food packaging, food labelling and agriculture and veterinary chemicals (unless directly related to food safety).

The SPS and TBT Agreements promote the use of international standards as the basis for regulation. The SPS Agreement is specific in encouraging governments to "harmonise" their national SPS measures with international standards developed by the Joint Codex Alimentarius Commission (CAC, food safety) of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), the World

Organisation for Animal Health (OIE, animal health) and the International Plant Protection Convention, based in FAO (IPPC, plant health). Estimates of the effect of NTMs, including SPS measures, on trade flows suggest that harmonisation can provide substantial gains in trade, particularly for SMEs, as it is more burdensome for them to comply with a plethora of different requirements. Other benefits of harmonisation are also evident. It significantly reduces the likelihood of countries being challenged by trading partners, since their measures are considered to be consistent with WTO rules. It can also be cost-effective, in particular for developing countries which often lack the human and financial resources to carry out their own risk assessments: instead, they can rely on the scientific work done in Codex, OIE and IPPC. And last but not least, implementing international standards will lead to higher production levels, reductions in crop and livestock losses, safer food in the domestic market, etc., and can have significant impacts on achieving food security and biodiversity goals.

Closing the gap

Although progress has been made, developing countries still face considerable challenges in implementing the SPS Agreement, both domestically and in terms of meeting SPS requirements of trading partners. Countries must have a proper legal and regulatory framework in place for food safety, animal and plant health and monitor their health status in these areas, operate testing laboratories, conduct risk analysis, carry out inspections, certify the safety of plant and animal products and participate in trade negotiations and international organisations. Resources, however, are limited, and hard choices will have to be made between competing investments that may all be likely to bring appreciable benefits in terms of export performance, agricultural productivity and/or health protection. Setting priorities in a coherent and transparent manner, improving transparency and economic efficiency of investment decisions and enhancing dialogue between public, private and other stakeholders will be critical for developing countries in moving forward.

In terms of market access, efforts should continue to focus on helping small growers and SMEs to meet the import requirements of trading partners and to participate in global and regional value chains, including through public-private partnerships. Such efforts should be based on international standards, where relevant and appropriate. Much could also be gained from countries checking more regularly whether their SPS measures are still fit for purpose and continue to be justified and necessary (for instance due to changes in the economic environment, new food safety, pest and disease risks, compliance with international requirements or commercial challenges). The application of good regulatory practice can provide a tool to support governments in reviewing and streamlining their SPS measures, simplifying procedures and providing services in a more user-friendly way for businesses.

Reducing trade costs and removing "red tape"

On 22 February 2017, the WTO Trade Facilitation Agreement (TFA) entered into force. The TFA contains provisions for expediting the movement, release and clearance of goods across borders, including goods in transit. It will help improve transparency and increase possibilities to participate in global value chains, in particular for SMEs. Full implementation of the TFA has the potential to reduce trade costs by an average of 14.5 per cent and increase global merchandise exports by up to a trillion US dollars per annum. In particular, developing countries are expected to benefit significantly from the agreement, capturing more than half of the available gains. Some TFA provisions (e.g. on pre-arrival processing, publication of average release times, publication of information on import/export requirements) add more specificity to the provisions of the SPS and TBT Agreements. Successful implementation of the TFA will depend on cooperation between customs and other authorities on trade facilitation, including SPS border agencies.

The Standards and Trade Development Facility

The Standards and Trade Development Facility (STDF) assists developing countries in meeting international SPS standards and gaining/maintaining market access. The STDF is a leading SPS knowledge platform, identifying and disseminating good practices, leveraging resources and working on co-ordinated, coherent solutions. It also provides seed funding for the development and implementation of collaborative and innovative SPS projects. By the end of 2016, close to 160 projects were approved for STDF funding.

Two examples are given below:

- In Thailand and Viet Nam, an STDF project catalysed an ongoing public-private partnership to strengthen food safety management systems based on Codex standards. Reduced rejections, increased sales and access to new domestic and export markets were key results. For instance, several cooperatives and SMEs were certified to international food safety schemes opening up new markets (e.g. EU, Japan, US). Women's cooperatives also reported an improvement in their status and negotiating ability. An independent evaluation found the project had "significant and lasting impact on enhancing management of food safety risks within fruit and vegetable chains."
- In Uganda, flower producers and exporters came together with the government to build capacity to improve compliance with international phytosanitary standards and EU requirements, and reduce the number of rejected consignments. The project also contributed to an improvement in the health and safety of some 8,500 workers in the greenhouses (80 % of whom are women) by reducing exposure to pesticides. The National Plant Protection Organization and the Uganda Flower Exporters Association committed to reinforce and sustain their collaboration through a new public-private partnership to expand flower production and exports. The livelihoods of the workers, chiefly women, and their families dependent on the flower industry in Uganda stand to benefit as exports continue.

For more information, see: ➤ www.standardsfacility.org

The EIF – bridging trade, development and the world's poorest countries

The Enhanced Integrated Framework (EIF) is a platform where donors and international agencies work with 51 of the world's poorest countries to promote inclusive development through increased and better trade. Rural areas, and especially the poor and marginalised groups living in them, are often focused on in particular.

The Enhanced Integrated Framework emerged from the initial desire of international agencies such as the United Nations Development Programme, the World Trade Organization, the World Bank and others to step up their co-operation, reduce the potential for duplication of efforts and achieve economies of scale in the Least-developed Countries (LDCs). It is based on the principle of partnership, where, by working through a common framework, the development initiatives can be more efficient and effective. The deepening and evolution of the programme since the original "Integrated Framework" has resulted in a country-driven approach that seeks to link trade to national and sector strategies, to establish structures in countries to better co-ordinate between different stakeholders engaged in trade and development, as well as to direct public investments in a systematic and co-ordinated manner.

Supported through a Multi-Donor Trust Fund with contributions of over 300 million US dollars from almost all major donors as well as many emerging donors, the EIF aims to be catalytic through the funding of priority projects. This includes funding common diagnostic studies (the Diagnostic Trade Integration Studies – DTISs) in all countries that are used to both inform national policy related to trade, as well as to provide a blueprint to prioritise interventions from Development Partners. Furthermore, the EIF offers support to strengthen institutions to conduct inter-ministerial cooperation on trade and increase the efficiency of engagement with the donor community through trained teams and implementation units in each Ministry of Trade (Tier 1 projects). Based on the priorities identified in the DTIS, the EIF finances catalytic investment projects focused on developing systems or specific sectors to build the country's capacity to trade (categorised as Tier 2 projects). In all of this, there is a strong emphasis on developing inclusive trade, where particular attention is given to benefiting poor and marginalised groups, often women and youth.

Inclusive trade that encompasses poor and marginalised groups in particular is the goal of EIF promotion.
Photo: SNV

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Agriculture and rural development assume a key role

The Diagnostic Trade Integration Studies almost invariably include an analysis of the agriculture sector from a trade perspective as well as, in many cases, other related issues such as those dealing with Sanitary and Phytosanitary (SPS) measures.

At the institutional and policy level, all EIF Countries establish national steering committees to bring together the key stakeholders related to trade, including agriculture ministries and private sector representative organisations. In Nepal, for instance, the Agriculture Ministry is part of the EIF National Steering Committee and was actively involved in the design

and preparation of the DTIS and its implementation, including the strong integration of trade dimensions in the country's Agriculture Development Strategy. The EIF-supported ginger project, which is aimed at enhancing the quality of ginger exports, thereby raising farmers' income, is co-financed with the Standards and Trade Development Facility Secretariat and implemented by the Food and Agriculture Organization (FAO) and the Ministry of Agriculture. Likewise, in Vanuatu, agriculture plays a key role in trade policy, and agriculture officials participate in regular coordination meetings of the National Trade Development Committee. Joint activities are now extending into more collaborative donor funding, with the European Union's National Indicative Programme specifically highlighting that the Ministries of Agriculture and of Trade are "jointly involved in achieving rural development", designing initiatives in the cocoa, coconuts and beef sectors.

Given the high importance of agriculture to many of the LDCs, agriculture and rural development issues feature prominently in the DTISs, and comprise almost two thirds of the larger investment projects (see graph). Examples include developing rice for export in Cambodia; mango production and processing in Mali; smallholder linkages to processors in Malawi and Zambia; and introducing climate smart technology to horticulture farmers in Lesotho. Many other EIF projects also have a strong impact on rural development, such as the initiatives establishing cross-border trade market centres in Rwanda; supporting standards and SPS support in Burundi and Lao PDR; and extending business support services to rural districts in Uganda.

Where to from here

While the EIF provides an effective forum to bring together trade focused development partners, the programme is increasingly working with sector specific partners including the Global Donor Platform for Rural Development. In recognition that agriculture and trade agencies and donors need to work together more effectively, the EIF is working with the FAO in selected pilot countries, including Mozambique, Rwanda, Tanzania and Zambia to promote these linkages. The work focuses on comparing the relevant agriculture and trade policies, plans and institutional frameworks with the objective of working towards increased alignment and linkages. This includes comparative analysis of National Agriculture Investment Plans (NAIPs) and DTISs to identify gaps and synergies on agricultural trade, stimulating increased policy dialogue between agriculture and trade stakeholders and joint donor engagement on priority areas.

Mangos in Mali

Photo: EIF

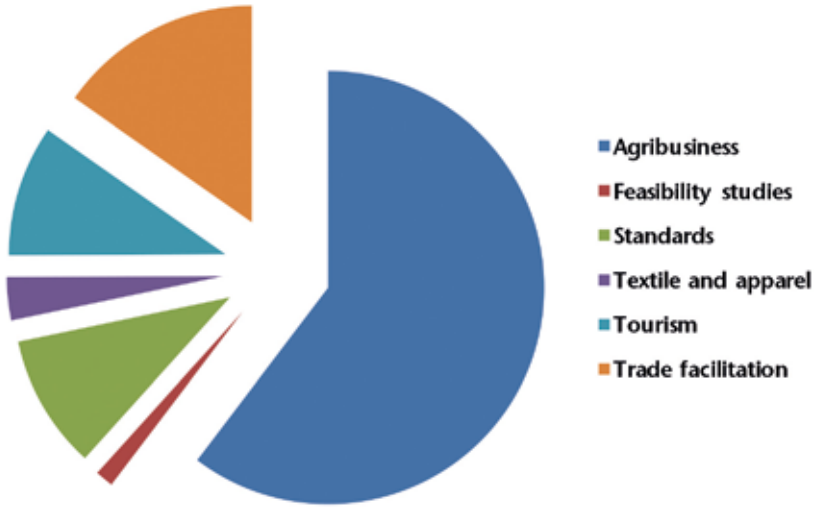
Through encouraging good agricultural practices and increased phytosanitary treatment of mango orchards, over 400 rural women have increased their earnings from mango farming and processing into jam. The EIF project has focused on building the capacity of key actors in the value chain (women farmers, producers, traders and exporters), provided guidance and support to the GlobalGAP certification for a dozen exporters, and offered marketing support at national and international trade events.

Honey in Zambia

Photo: EIF

The EIF has stimulated increased honey production in Zambia, one of Africa's largest exporters of honey to Europe. Supporting mutually beneficial linkages between national processors, extension services and beekeeping groups, the EIF project trained over 6,000 farmers, and increased production to over 2,500 metric tonnes. The initiative also stimulated additional support from the African Development Bank focusing on the SPS component.

Tier 2 projects by thematic category – share of total value



Horticultural exports – a threat or a boost to food security?

Many countries that have become important suppliers of horticulture produce to the world market – such as Kenya, Ethiopia, Peru and India – have high rates of poverty and food insecurity within their borders, and especially so in rural areas. So does this also mean that the exports have a negative impact on the population's food situation? Our authors have taken a look at how these aspects relate to one another.

Newly created employment opportunities for women in export companies lead to a higher share of income controlled by women.
Photos: Jörg Böthling

In the past two decades, exports of horticultural products (including fruits, vegetables and cut-flowers) from developing countries have increased sharply – as can be seen in the figure on page 25. Exports from Latin America more than tripled in the past 20 years, and those from Africa and Asia more than quadrupled. Horticultural products have even become the most important agri-food export category for developing countries, with export earnings having surpassed those from traditional tropical commodities, such as tea, cocoa and coffee. Horticultural produce is mostly destined for high-income countries, where consumer demand for year-round availability of fresh products and for tropical fruits is increasing.

While these horticultural exports contribute to the food intake of high-income consumers, one can wonder about their food security consequences in the countries of origin. Do horticultural exports jeopardise or improve food security in these countries? This question is not easy to answer because food security entails different components and horticultural exports may affect food security through a variety of direct and indirect effects. In this article, we discuss these different effects based on a review of the scientific literature and available scientific evidence on the implications of such exports from developing countries. We consider four different components of food security: food availability, food access, food utilisation and stability – and summarise the effects in the table on page 26.

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Food availability entails a sufficient supply of food (both in terms of quantity and quality) in a specific area. No studies are available that investigate the causal impact of horticultural exports on a country's food availability. However, national figures on these exports and food supply indicate that there is no negative correlation, suggesting that export growth in this area does not necessarily jeopardise food production for the local market and food availability within a country. Both may grow at the same time. Horticultural exports influence food availability in two ways. First, they may improve food availability because they contribute positively to foreign exchange earnings and a country's trade balance, thereby increasing a country's capacity to import food. There are nevertheless concerns that increased horticultural exports are associated with increased dependency on global markets and volatile international market prices. Second, they may reduce food availability in a country because of competition for resources between export production and food production for the domestic market. If more land, labour and water resources are allocated to export production, food production and domestic food supply may decrease. On the other hand, if profits and wages from horticultural export sectors are re-invested in food production or if technology spill-over effects exist between export sectors and food sectors, there may be complementarities between horticultural export production and food production at national level. Such an effect is observed in Senegal, where farm households use the wages they earn from working in vegetable export companies to buy inputs for their own farms, and in Madagascar, where farmers supplying vegetables to export companies under contractual agreements also use the fertilisation and composting technologies the companies teach them on their rice fields.

Food access entails the ability to obtain food and relates to available resources, markets and policies. Access to food can be direct (i.e. through own food production – determined by access to land, water and other productive resources), or indirect (i.e. through the market – determined by households' income and purchasing power). To understand how horticultural exports can influence farm

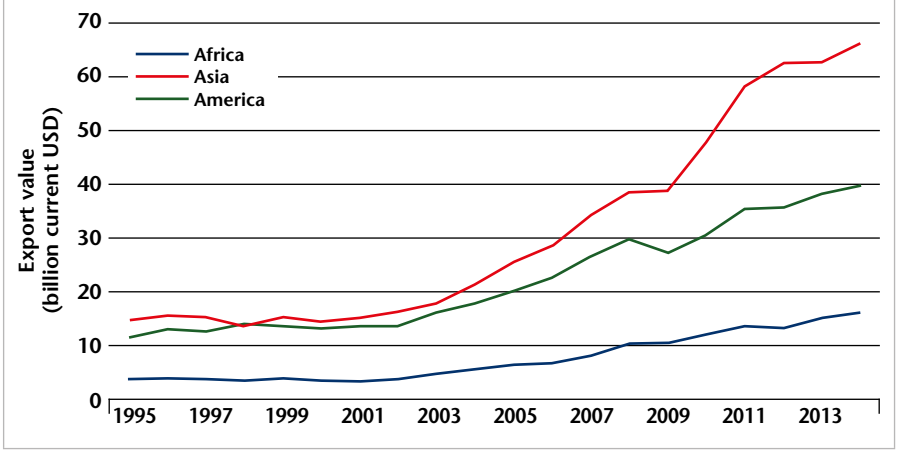
households' access to food, we need to know how they are involved in horticultural export chains. This occurs either through contract farming with export companies, or through wage employment on the fields and in the conditioning centres of export companies. Horticultural export sectors can be a very important source of rural employment with sometimes tens of thousands of employees. Contracting between horticultural export companies and smallholder farmers is becoming less important because stringent food safety and quality regulations induce companies to switch to own estate farming relying on hired labour. Employees in horticultural export companies often come from the poorest households, and a large share of workers are women (in some sectors up to 90 %), while contract farmers are most often men and are relatively better-off.

Indirect access to food may increase if contract farmers and employees in the horticultural sector benefit in terms of higher incomes and reduced poverty, and if income increases lead to increased purchasing power. Many studies have demonstrated beneficial income and poverty effects of contract farming in export chains. Some authors have shown that the adoption of private standards leads to additional benefits for smallholders *(see also article on page 27)*. However, evidence of wage employment in export chains is more contentious. While some find large poverty-alleviating effects, others point to low wages and insecure employment contracts, and expect expansion of horticultural exports to lead to increased vulnerability of poor households. The different findings are likely to relate to the specific context. Case studies from African countries tend to be more positive than those from Latin-America, which is probably due to the more recent horticultural export boom and the lack of other rural employment opportunities in African countries. In addition, the newly created employment opportunities for women in export companies lead to a higher share of income controlled by women. This might improve households' food access if women are more likely to spend money on food, and more nutritious food in particular, than men – as is observed e.g. in Kenya and Nepal. Yet, higher incomes do not automatically imply improved access to food. Food prices also importantly determine a households' capacity to buy food. If prices rise at a higher rate than income, then households' purchasing power decreases and their access to food is reduced. Horticultural exports may increase food prices if exports reduce domestic food production because of competition over resources, increase dependency on food imports at volatile prices, or create substantial environmental externalities. These effects adversely affect households' access to food – even if incomes are increasing. On the other hand, horticultural export growth is often associated with investments in infrastructure in horticultural production zones. Such investments reduce transaction costs and better link (remote) rural areas to markets, which may result in higher farm incomes, reduced local food prices, a wider diversity of food brought into rural areas, and improved access to food. However, there are no studies that have investigated whether horticultural export growth creates upward or downward pressure on domestic food prices.

Direct access to food may decline if households re-allocate land, labour and capital from food production for their own consumption to horticultural production for the export market. Still, the shift from direct to indirect access is not necessarily bad for food security of rural households. If the increase in purchasing power from participation in export chains is large enough, the increase in indirect access to food will offset the reduction in direct access. This is likely to be the case for contract-farming, given the magnitude of estimated income effects, but less likely for wage employment, given that estimated income effects are lower and real wages may increase slower than food prices.

Food utilisation entails the appropriate use of food in order to absorb nutrients and relates to nutritional quality and safety and sanitation of consumption. The development of export sectors may stimulate domestic fruit and vegetable sectors and induce a shift in the diet of people towards more fresh horticultural produce. On the other hand, employment of women in horticultural sectors may negatively affect nutrition. As women are most often responsible for food preparation, their increased workload as wage employees may reduce the time spent on food preparation. This could lead to more convenient, ready-made and less nutritious food in households' diets, but evidence is lacking here. In addition, horticultural sectors have to comply with stringent food safety and (phyto-) sanitary regulations and, increasingly, with even more stringent private standards. Good agricultural and (phyto-) sanitary practices in ex-

Export value of horticultural products in Africa, Asia and America over the period 1995–2014



Source: Van den Broeck and Maertens (2016)

port sectors may influence practices in domestic food sectors and improve safety and sanitary conditions of food production and distribution. Contract farmers who apply good agricultural practices on their contracted fields for export production may use these practices also on fields they cultivate for domestic production. For example, the use of GlobalGAP standards among Kenyan vegetable farmers has been demonstrated to lead to less hazardous pesticide use. Similarly, (female) workers in export companies who have to comply with sanitary practices at the workplace may use these practices at home, resulting in improved sanitary conditions of food preparation.

Food stability entails sustained food availability and access, and relates to food resilience and environmental sustainability. Horticultural export growth may influence stability in four ways. First, horticultural export earnings contribute to the long-term capacity of countries to import food. These earnings make countries less vulnerable to price shocks than earnings from traditional tropical commodities because prices are more stable, and produce variety is larger and includes annual crops that allow a faster reaction to shocks compared to perennial crops. In addition, horticultural chains are characterised by direct, personal and long-term commercial relations between exporters and overseas buyers, which leads to more stability in exports.

Second, the stability of farmers' and workers' participation in horticultural export chains – and how this is guaranteed in contractual agreements – matters as this determines their purchasing power and long-term access to food. There is doubt on the continued and stable involvement of smallholder contract-farmers in export chains, as companies increasingly produce on their own fields and exclude smallholders from the supply chain. For workers in export sectors, permanent and secure employment contracts are often lacking. Ensuring minimum wages and decent employment conditions in horticultural export sectors remains a point of attention in national legislation in many countries.

Third, future food production of countries and communities depends on the continued availability of natural resources. Hence, the sustainability of resources exploitation in horticultural sectors matters for stability in food security. Agricultural export production in general and large export companies in particular are often blamed for overexploitation of water and soil nutrient resources, and for soil and environmental pollution through overuse of chemical fertiliser and pesticides. While the existing evidence largely refutes the concerns related to fertiliser and pesticide use and soil nutrient overexploitation, the evidence on water overexploitation is more mixed. Studies have expressed concerns about overexploitation of water for horticultural export production in particular water-scarce production zones, e.g. in Peru and Kenya.

Fourth, besides affecting inter-annual and long-term food stability, horticultural exports influence intra-annual food security as well. If horticultural exports are realised during the low season for domestic food production, then revenues from contract-farming or wage employment in horticultural sectors highly complement farm income. If the export season coincides with the main agricultural season, horticultural production will compete with domestic production for land, water and labour resources. In this case, the seasonality of food consumption may worsen, even if the households' inter-annual access to food may be improved.

In conclusion, there is very little evidence on the impact of horticultural export growth on food security. The discussion on the various impact pathways shows that horticultural exports do not necessarily jeopardise food security and may actually contribute to improved availability, access, and utilisation of food. Especially the development of rural labour markets and participation of women in wage employment in horticultural companies may lead to improved food security. Yet, for stability in food security, important challenges remain, such as the provision of secure employment at remunerative conditions by export companies and the sustainable use of water resources.

Overview of different impact channels through which horticultural exports influence food security in developing countries.

	Opportunities	Challenges
Availability	• Contribution to foreign exchange earnings and increased capacity to import food • Technology and investment spill-overs to food production for domestic market	• Increased dependency on global food trade and volatile international market prices • Competition for resources with food production for domestic market
Access	• Contribution to foreign exchange earnings and increased capacity to import food • Technology and investment spill-overs to food production for domestic market	• Higher food prices: - Reduction of domestic food production - Increased dependency on food imports at volatile prices - Creation of environmental externalities • Reallocation of resources from food to export production
Utilisation	• Shift in diets towards more fresh horticultural produce • Stringent food safety and sanitary regulations	• Increased workload of women
Stability	• More stable earnings than traditional tropical commodities	• Continued involvement of contract farmers • Secure contracts for wage employees • Sustainable use of natural resources

For a list of references, see online version of this article at
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Do smallholder farmers benefit from sustainability standards?

Sustainability standards such as Fairtrade, Organic and Rainforest Alliance promise to improve the livelihoods of poor farmers in developing countries while protecting the environment. Development agencies often promote and facilitate farmer adoption of sustainability standards. From a development perspective, it is important to understand whether such standards actually deliver on their promise. This question is hotly debated. What does the scientific evidence say?

Millions of farmers are certified under sustainability standards such as Fairtrade (about 1.65 million), UTZ (about 1 million), Rainforest Alliance (about 1.2 million) and Organic (about 2.3 million). Sustainability standards are gaining in importance especially for higher-value foods from developing countries (also see Box on page 29). The development for certified coffee, cocoa, palm oil and tea is particularly remarkable. An estimated 30 per cent of the global coffee area, 20 per cent of the global cocoa area, 15 per cent of the global palm oil area, and 9 per cent of the global tea area are certified under different sustainability-oriented standards.

The proliferation of sustainability standards and related certification schemes in developing countries is attributable to different factors. Standards address food quality and safety, environmental and human rights, and welfare issues along agricultural value chains. An increasing number of consumers, especially in developed countries, are concerned about such issues. More importantly, many consumers are willing to pay more for certified products with a sustainability label. Further, development agencies have played a key role in facilitating farmer adoption of sustainability standards. Increasingly, private retailers and manufacturers also evolve as important players. For instance, Starbucks sell Fairtrade and Organic coffee in their stores and have developed their own sustainability standards (C.A.F.E. Practices). This boom in standards and certification will likely persist, given continued interest in sustainable approaches to global food production and trade.

In Africa, coffee is traditionally produced by very small farms with poor access to agricultural inputs and extension. In such situations, sustainability standards give reason to expect positive yield and income effects.
Photo: Eva-Marie Meemken

Can poor farmers meet sustainability standards?

Farmers who want to join a particular standard have to go through a certification process and regular audits. Certification and audits are carried out by specific agencies and serve to ensure that rules on environmental and social issues are met. This process can be bureaucratic and costly (i.e. costs can sum up to several thousand euros, depending on the sustainability standard and production volumes). These costs are

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Surveys in Uganda have shown that children in Fairtrade households attend school longer than children in non-certified households.
Photo: Eva-Marie Meemken

usually too high for individual farmers. Consequently, in the developing-country small farm sector, certification is predominantly group-based. Group certification reduces administrative and financial certification costs for individual farmers. Group structures also facilitate the implementation of training sessions and other support measures.

Without such support, farmers would find it hard to meet some of the certification requirements. Specifically, standard-compliant production can require financial investments, managerial skills and a switch to more labour-intensive farming practices. For example, if standards require farmers to use protective gear during pesticide application, such equipment may have to be purchased. Quality requirements may presuppose investments in equipment to properly dry, process and store the harvest. Training offered to farmer groups, collective use of equipment and credit schemes can help farmers to better understand and meet certification requirements. Governmental and non-governmental development agencies often help farmers to organise in groups, pay for certification costs, and implement related training sessions.

Do sustainability standards raise farmers' incomes?

Whether farmers benefit from sustainability standards is discussed controversially. Opponents of the standard boom argue that the price markup that consumers have to pay for sustainability-labelled products hardly reaches smallholders in developing countries. Proponents, on the other hand, sometimes argue that sustainability standards are the only way to increase fairness in international value chains and thus improve farmers' incomes.

None of these extreme views is compatible with the scientific evidence. A growing number of studies examine if farmers benefit from sustainability standards. Available studies differ in terms of their methods used. The most reliable ones are those that compare certified and non-certified farmers while controlling for other factors that may bias this comparison (e.g. differences in education). A comprehensive review of the evidence suggests that sustainability standards are neither a silver bullet for poverty reduction nor an empty promise. A few more insights are summarised in the following.

For farmers, the adoption of sustainability standards is associated with costs and benefits. Cost aspects were already discussed above. On the benefit side, certified farmers often receive higher output prices. Yet, in some cases, they cannot sell their entire harvest in certified value chains. This happens when too many farmers in the same region produce certified crops. Another benefit is that certified farmer organisations usually offer agricultural trainings and other services to their members. This can be important especially in areas where general access to extension is limited. Standards can also provide mechanisms for farmers to improve productivity and product quality. For instance, environmentally-friendly farming practices such as erosion measures or intercropping can improve soil fertility, and thus yields.

The overall impact of sustainability standards on farmers' income is context-specific. Many studies looking at examples in Africa conclude that standards help to raise income. For Latin America, results are sometimes less positive, especially in the coffee sector. Contrasting findings can partly be explained by regional differences. In Africa, coffee is typically produced by very small farms with poor access to agricultural inputs and extension. In such situations, sustainability standards can have positive yield and income effects. In Latin America, access to agricultural technology and services is often better, so that the additional benefit of standards is less pronounced.

Beyond geographic differences, income effects can also vary by type of standard. For instance, yields may be lower under Organic, because chemical pesticides and fertilisers are banned. Hence, a larger price premium is required in order to compensate for lower quantities.

Do sustainability standards promote development goals beyond higher incomes?

Studies typically look at the effects on farmers' income. This is not surprising, because one of the key goals of sustainability standards is to improve incomes of poor farm households. However, from a broader welfare perspective, it is important to understand whether sustainability standards can also serve to promote development goals beyond a narrow income focus. Studies have analysed the effect of sustainability standards on child education, food and nutrition security, and gender equality, with promising results.

Our own team at the University of Göttingen has analysed the impact of Fairtrade standards on child education among smallholder farmers in Uganda. We found that Fairtrade households invest 146 per cent more in child education than non-certified households. Controlling for age and other factors, we also showed that children in Fairtrade households spend on average 0.66 years longer in school than children in non-certified households. The positive effect of Fairtrade certification on child education is partly linked to higher incomes, but other mechanisms also play a role. Specifically, Fairtrade includes specific rules and activities to reduce child labour and to raise awareness on the importance of education.

In another study, we have shown that Fairtrade and UTZ standards promote women's empowerment through awareness building and special training sessions on gender equality. For example, certification does not only increase household wealth – it also alters the distribution of wealth within households. In non-certified households, male household heads own most assets. In contrast, in certified households most assets are owned jointly by couples. Further, certified farmers have better access to agricultural extension, irrespective of their gender. We have also evaluated effects of Organic certification among smallholder coffee farmers in Uganda and found positive effects on household nutrition and dietary diversity. These effects cannot be generalised, but they suggest that sustainability standards can improve various dimensions of household welfare, when properly designed and implemented.

What do farmers think about sustainability standards?

Adopting a standard and entering into a certification scheme may seem burdensome and complicated from the farmers' point of view. In a recent study, we examined farmers' subjective attitudes. We found that they have positive attitudes towards sustainability standards in general. An output price premium is a strong incentive for farmers to adopt a standard. But our study shows that they also appreciate the provision of training, credit and other services. Interestingly, farmers are willing to accept requirements on product quality, farm management and occupational safety, even without being compensated through a price premium. They are aware of the fact that such requirements can help them to increase productivity and efficiency in the longer term. However, farmers dislike bans of chemical pesticides and other productivity-enhancing inputs. Such bans are only accepted with a significant price premium as compensation.

Should development aid be spent to promote farmer adoption of sustainability standards?

Whether or not sustainability certification is a suitable and beneficial option for farmer organisations should be decided case by case. In such assessments, the following questions need to be addressed: Is the farmer organisation capable of managing a bureaucratic and costly certification process? How will the demand for the particular product develop? To what extent can certification improve farmers' access to agricultural services in the region? How strongly will ecological farming practices affect productivity in the particular context? Further, a careful assessment of the different sustainability standards is crucial, as these vary in terms of their stringency and specific requirements. A 'one-fits-all' solution does not exist.

Goals and requirements of sustainability standards

Photo: TransFair e.V.

The number of sustainability standards is constantly increasing. There are now over 200 different standards with a focus on sustainability. The first of them emerged from civil society initiatives (e.g. Fairtrade, Rainforest Alliance or Organic). In contrast, newer standards were often set by multi-stakeholder initiatives such as the Roundtable on Sustainable Palm Oil (RSPO). Sustainability standards intend to promote sustainable development and typically include rules related to environmental and socioeconomic issues. Standards vary in terms of their specific focus and requirements. For instance, Fairtrade places emphasis on social issues, promoting democratic structures of farmer organisations, prohibiting child labour, and requiring the safe handling of agrochemicals. Organic and Rainforest Alliance place greater emphasis on environmental aspects. For example, under Organic, chemical pesticides and fertilisers are prohibited and ecological farming practices are promoted. UTZ addresses both environmental and socioeconomic issues. Compared to several other standards, UTZ also has higher product quality demands, such as particular rules on post-harvest handling. Standards set by multi-stakeholder initiatives (like RSPO) often have less stringent standards in general.

More information on voluntary sustainability standards and other similar initiatives covering issues such as food quality and safety is available at: ➤ www.standardsmap.org

Big business, small farms and “no deforestation” commitments

Hundreds of the world’s largest companies have publicly committed to remove deforestation from their commodity production and supply chains, but until recently, they only disclosed progress on one out of three pledges. New findings from *Supply Change*, a Forest Trends initiative, shows a dramatic increase in disclosure and clear recognition on their part for the need to work with small farmers.

Food giants, like Danone and Mars, buy raw materials from tens of thousands of farmers around the world, and those two are also among a dozen companies investing 160 million US dollars in a programme called the Livelihoods Fund, which is designed to help 200,000 small farms across Africa, Asia, and Latin America develop sustainable land-use practices. They’re hardly alone, according to NGO Forest Trends’ *Supply Change* initiative, which has identified at least 100 companies that have committed to helping small farmers improve their practices in an effort to slow deforestation – a clear recognition of the linkages among big businesses, small farms, and deforestation.

Until recently, those linkages were hidden in traditionally complex and opaque supply chains that were only in the past handful of years exposed piecemeal by a growing trove of studies, such as the 2014 Forest Trends paper “Consumer Goods and Deforestation”. This study in particular found that commercial agriculture accounted for 71 per cent of all tropical deforestation, and that the production of four commodities – palm, soy, cattle, and timber & pulp – caused most of the destruction. What’s more, the study revealed that more than half of the forests were cleared illegally, and that at least 30 per cent of those illegally-harvested products ended up in North America or Europe – a finding that highlighted the need to purge deforestation from corporate supply chains, preferably by promoting sustainable agriculture in rural areas.

More and more companies are pledging to reduce their impacts on forests.
Photos: Jörg Böthling

More and more companies have since acknowledged this need, and Supply Change has so far identified 447 companies that have pledged to reduce their impact on forests by changing the way they produce or procure soy, palm, cattle, and timber & pulp. These 447 companies, which span across the globe and throughout all levels of the supply chain, have made a total of 764 individual pledges, and they are expected to publicly disclose frequent, standardised and relevant information to their stakeholders. Encouragingly, they’re increasingly disclosing progress, as now companies are publishing progress on just over half of the pledges. However, roughly 20 per cent of the 764 commitments have gone “dormant” – meaning the target date has passed without any progress being reported. Nevertheless, the trend is towards more disclosure as companies implement their strategies, and indeed, the current figure represents a sharp increase from years past.

A brief history of deforestation disclosure and corporate commitments

The Intergovernmental Panel on Climate Change says that deforestation accounts for roughly twelve per cent of all greenhouse-gas emissions, and that the land-use sector – which includes farming, forestry and other activities – contributes about 30 per cent. At the same time, the land-use sector is extremely vulnerable to climate change. The global rural economy is, therefore, both a leading driver of climate change and one of its most vulnerable victims – yet its own drivers are thousands of miles away, in supermarkets and retail stores across the developed world – and increasingly in emerging economies with a rising demand for the same products and goods. NGOs began highlighting these linkages in the 1990s, leading to the creation of certification standards for palm and timber & pulp in the 2000s and the launch of the Consumer Goods Forum in 2009 to promote action among consumer-facing companies.

2014 remains the seminal year in deforestation disclosure. That’s when 52 companies endorsed the New York Declaration on Forests, which is a pledge to eliminate deforestation from the production of agricultural commodities such as palm oil, soy, paper, and beef products by no later than 2020. Soon, hundreds of companies were making similar promises, and in early 2015, Forest Trends launched the Supply Change initiative to track both

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the full spectrum of commitments tied to the "big four" and – more importantly – the progress they're reporting towards achieving those commitments.

In March 2015, we conducted our first analysis of 246 companies that had made a total of 307 commitments related to the big four commodities. One third of those commitments had been made in 2014, and therefore it was understandable that progress reports were only available on a small percentage of them. However, more generally, many of the commitments were vague and overly ambitious.

Leaders and laggards and the nature of commitments

From the beginning, we found that more companies active in palm and timber & pulp were making and reporting on their commitments – largely because of the longer history and prevalence of commodity certification programmes like the Forest Stewardship Council (FSC), the Programme for the Endorsement of Forest Certification Schemes (PEFC), and the Roundtable on Sustainable Palm Oil (RSPO). Much fewer companies active in soy and cattle were making and reporting on commitments – which illuminates the inverse of science-based expectations, since cattle production causes ten times more deforestation than palm. Also, cattle supply chains lack globally or even nationally standardised certification schemes for beef and leather.

So, hundreds of companies have one or more commitments. That's a good thing, right? Problem solved, right? Ideally, but not exactly. Commitments fall into a variety of categories (see box above), from those promising a complete elimination of deforestation to net zero deforestation, to those promising to implement specific activities – such as protecting peatlands or High Conservation Value areas, or ensuring that commodities are sourced or produced sustainably (which tends to mean conformity to a certification programme).

Some elements of a typical commitment

Targets:
- Zero deforestation
- Zero net deforestation
- Zero gross deforestation
- Peatland protection
- High conservation value (HCV) area protection
- High carbon stock (HCS) management/protection
- Sustainable/Responsible
- Human rights protection

Procurement policies / Activities:
- Certification
- Transparency
- Traceability
- Legality
- Reduce use
- No burning
- Free, prior and informed consent (FPIC)
- Zero deforestation
- Biodiversity/wildlife protection
- Support smallholders
- Reduce GHG emissions from operations
- Improve water management
- Improve waste management
- Improve soil management
- Improve fertiliser management
- Reduce pesticides or toxins
- Respect animal welfare
- Improve yields

The "zero deforestation" pledges are difficult to quantify, because there is not yet an agreed-upon set of metrics by which to measure progress. Some companies, for example, are clearly engaged in activities that will reduce deforestation, such as working with smallholder farms to promote agroforestry, but progress doesn't lend itself to numerical quantification and verification in the same way that certification does. That may be one reason why annual publishing of quantitative progress is lower than one would hope. Instead, we find that companies may often use important milestones like being able to trace supplies to a specific ranch or slaughterhouse as a proxy – and in many cases, they report on those milestones if not on overall commitment. Such traceability is, as it turns out, extremely widespread in cattle, thanks to health requirements and major meatpackers like Brazil's Marfrig that are beginning to tap this to track the deforestation impacts of suppliers.

Refined criteria and small farmers

As our understanding of deforestation management plans grows, so do the criteria that Supply Change tracks, and this year we began tracking 10 new policies including those that explicitly include a complementary plan to engage with smallholders. At press time, 101 companies have made such pledges. Much of this engagement involves support for co-operatives, which is already having an impact on the number of farmers who can produce certified products. This can have a tremendous impact, because independent smallholders supply 40 per cent of the world's palm but account for less than 15 per cent of the oil certified under the RSPO – largely because the cost of getting certified is higher than smallholders can afford. That's changing as groups like Indonesia's 2,700-strong Sapta Tunggal Madiri pool their resources to certify thousands of small farmers at a time.

In addition, RSPO has also created a smallholder fund that supports roughly 11,000 smallholders controlling 55,031 hectares across six different countries. In total, RSPO has already certified 113,833 individual independent and associated smallholders with a combined land area of 264,887 hectares. This is promising because demand for sustainable commodities should translate into support for sustainable livelihoods, yet expensive certification programmes have been more feasible for larger producers than smaller ones. Only by engaging with suppliers in ways that help them can corporates across the supply chain help themselves.

On March 15, 2017, the 2017 Supply Change report is to be published via webinar, co-hosted with the Tropical Forest Alliance 2020 and Innovation Forum. The webinar contents will be archived.
For more information and download of the report, see ➤ **www.supply-change.org**

Farmers of Rice Fund Surin, Thailand, receiving the organic premium.
Photo: Helvetas

The private sector as a driver for sustainable rural development

The Swiss retailer Coop and its partners support smallholders in India and Thailand in converting their rice-based production systems to sustainable organic farming. Farmers improve and diversify their incomes while managing natural resources more sustainably. They receive fair prices for their products and invest in their future development. The initiative provides a viable business case for all value chain actors involved.

Coop, the second largest retailer in Switzerland, launched in 2011 an innovative project to support more than 4,500 smallholder rice farmers in Northern India and Eastern Thailand to convert to organic farming and to sell their produce at fair trade conditions. This initiative is part of the company's strategy to convert its rice brand to fairtrade and organic. Over the past years, Coop's rice processing and trading company Reismühle Brunnen has continuously increased the share of sustainable rice, and today, it is the largest supplier of organic and fairtrade speciality rice in the European market. Mandated by Coop, the Swiss development organisation Helvetas implements the project in collaboration with its sister organisation Intercooperation Social Development India and with local farmer organisations, processing companies and research institutions. In India, the key partner is the company Nature Bio-Foods Ltd, which buys the paddy directly from the farmers, mills it in their own premises and exports it to Reismühle Brunnen. Under its "Ecolife" brand it also sells rice and other products in the emerging domestic organic market. In Thailand, the main partner is the farmer co-operative Rice Fund Surin, which runs its own rice mill and sells the rice to various clients abroad, but also in the domestic market.

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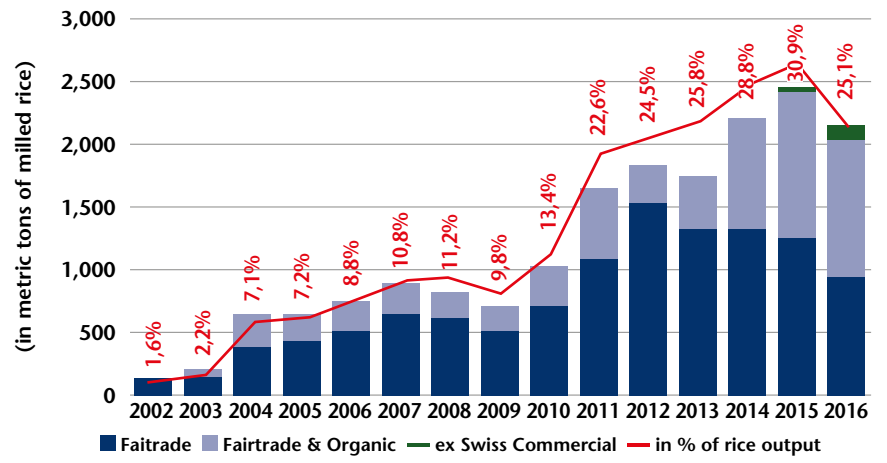
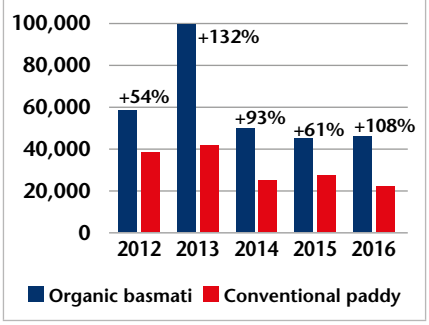
Social and environmental impact as a unique selling proposition

The purpose of the project is to improve the incomes and livelihoods of marginalised smallholders, enhance the environmental performance of the production systems and provide consumers with an attractive product of high quality. For the sustainable basmati project in India the partners therefore chose a remote region (Nainital District in Uttarakhand) located in the foothills of the Himalayan range. Start-

Sales of fairtrade rice of Reismühle Brunnen



Gross margins in organic basmati vs. conventional coarse paddy (Rs/ha)



Net profits (revenues minus input costs) in organic basmati compared to conventional hybrid paddy in Indian Rupees/ha, 2012-2016. In 2013, general market prices for basmati were extraordinarily high due to a shortage in supply.

ing with less than 200 pilot farmers in 2011, the project involved more than 4,000 households in almost 100 villages in 2016. Working with large numbers of farmers with very small holdings (average below 1 ha) involves higher transaction costs for extension and transport compared to sourcing from larger farms in the plains. However, it also allows offering consumers a product that has a clear development impact. Since the hill farms do not rely on groundwater for irrigation the selection of a remote area avoids the risk of pesticide residues that are of increasing concern in the Gangetic plain. Farmers in the hill region had traditionally grown some basmati rice, but most of them switched to coarse rice varieties due to a lack of market access. Traditional basmati – similar to jasmine rice in Thailand – has lower yields than coarse rice, but thanks to its unique features (fragrance, long grains), it achieves higher market prices and therefore is an interesting cash crop for farmers.

Further developing the production system

In close collaboration with the extension system managed by the local partners, the project helps farmers to optimise production methods in order to increase yields and profitability as well as reduce water consumption and greenhouse gas emissions. Following a Participatory Technology Development approach, farmers were supported in identifying and testing promising innovations like alternative crop nutrition and pest management practices. Variations of the System of Rice Intensification (see box on page 34) were found to be economically and environmentally viable and are increasingly being adopted by farmers. In addition, the rice farmers are encouraged to further diversify their farms by growing pulses, cereals, vegetables and spices.

Fair & good – for people, planet and business!

The project already achieved significant results at farm level. Lower production costs in organic farming and higher product prices ensure that participating farmers earn substantially more than before. Every year the project collects data from representative samples of organic and conventional farms in order to compare their economic performance. The data in India consistently show that organic farmers gain 50–100 per cent higher net incomes from rice than their conventional peers (see right-hand figure on top). Since basmati is only grown on 20 per cent of the farmland on average, the increase in overall farm income is just 20–30 per cent. However, farmers started diversifying their cropping patterns, which reduces their vulnerability to weather and market price fluctuations and contributes to a more diverse diet. The farmer organisations and local business partners are increasingly successful in developing organic market chains for alternative crops like vegetables, pulses and spices, particularly in domestic metropolitan areas. In future, this should provide farmers as well as businesses the opportunity to gradually move to higher-value crops and to earn additional income while using the extension and certification systems set up for the rice value chains.

The project enables farmers to increase yields, reduce labour requirements (through farm mechanisation) and improve water management. Capacities of the local organisations have been strengthened with regard to quality management and business planning. In addition to the fairtrade price and organic premium that are paid to the individual farmer, the farmer organisations receive a fixed fairtrade premium to be used for community development. They have invested these funds to improve irrigation infrastructure and agricultural equipment, and to develop new income opportunities like tailoring and small-scale processing. They are hence increasingly taking the role of a development actor striving to improve the livelihoods of farming communities.

An external project evaluation confirmed in 2015 that, thanks to its market-oriented approach, the project has successfully established a system of sustainable production and trade while improving the livelihoods of farmers. The innovative set-up creates a win-win-win situation for farmers, businesses and the environment. Consumers

get an attractive product with proven positive impact at production level.

Agreements provide the backbone of the value chain

In line with the fairtrade system, the farmers are organised in producer organisations that democratically elect a Board or Executive Body. In Thailand, the farmers sell their jasmine paddy to their co-operative Rice Fund Surin, of which they are a member. Rice Fund Surin takes care of input supply, certification, processing and marketing. Since the producer organisation in India is not yet in a position institutionally to manage the commercial activities, Nature Bio-Foods signs production contracts with the individual farmers. The company also provides training and technical advice to the farmers, manages the Internal Control System that guarantees the organic integrity of the production and arranges for organic and fairtrade certification by accredited agencies. All partners involved have signed Memorandums of Understanding (MoU) that define objectives, roles and responsibilities, and the pricing system (a guaranteed minimum price and defined premiums on top of the actual market price). Helvetas facilitates these arrangements and supports capacity building and monitoring. The fact that Reismühle Brunnen guarantees the partners to purchase specified minimum volumes for several years is the key reason why all of them are ready to invest in the development of the value chain. At the same time, the MoU protects the investment of the private sector parties by providing them with exclusive purchase and marketing rights for the agreed period.

A viable business model

The project took great care to limit its role to the facilitation of improving capacities and systems, and not to take up functions in the value chain that are needed in the long term. All costs for training, extension, certification, processing and marketing are borne by the local businesses and are integrated into the pricing. This ensures that the local actors will continue the value chain independently once the project ends in December 2017. Motivated by its success, many farmers are eager to join – in India, more than the extension teams are able to cover. One can already observe that conventional farmers are increasingly following the example of their neighbours and adopting organic production techniques. The approach chosen has also proved viable for the co-operatives and companies involved. Their turnovers have grown considerably, which enables them to buy more produce from more farmers. Nature Bio-Foods has become one of the largest companies in organic production in India, sourcing various products from more than 80,000 certified organic farms in 13 States. Reismühle Brunnen have substantially increased their sales of organic and fairtrade rice and continuously widened their client base (see left-hand figure on page 33). Since all involved private sector actors have a vital business interest in thriving farms and value chains, this set-up made it possible to develop viable systems in a relatively short time – and with hardly any public funding.

Challenges and constraints

Despite all these encouraging results, one needs to acknowledge that progress hasn't always been smooth. It is a tremendous challenge to build viable businesses on very small holdings that operate in a harsh and insecure environment. Agriculture is losing importance in these areas, and many young people are moving out of the sector. Producer organisations struggle to deal with a complex set of tasks because their Boards and executives have limited experience in managing an agribusiness of this size. Since margins in staple food processing and trade are very small, it is difficult to recruit and maintain qualified staff even for the local companies involved. Managerial capacity has therefore often been the most limiting factor for using opportunities to their full potential. Nevertheless, the initiative shows that private sector engagement can be an important driver for sustainable rural development. If set up well, thriving agribusinesses can help smallholders to improve their livelihoods, and offer a perspective for rural youth.

For a list of references, see online version of this article at
➤ www.rural21.com

The System of Rice Intensification (SRI)

A women transplanting basmati rice seedlings in Uttarakhand, India. Photo: Helvetas

- Single seedlings are transplanted with wider spacing at an early stage
- Alternate wetting and drying instead of continuous flooding
- Mechanic weeding with simple tool

Results

- More sturdy plants with more tillers, higher yield
- Less damage by pests and diseases, less lodging
- Less costs for seeds and weeding
- Reduced water input and greenhouse gas emissions
- Better grain quality, higher milling turnout

“We give farmers planning certainty”

Rural 21: Ms Wolff, why did Reismühle Brunnen start the ‘fair & good’ project six years ago?

Anja Wolff: We have already been working in the Fairtrade sector for more than 15 years. The ‘fair & good’ project was launched to ensure a steady supply of sustainably grown rice and promote environmentally friendly organic cultivation, which improves the living standards of the farmers.

You are the market leader for bio-Fairtrade rice in Europe – and in this market segment, you work exclusively with smallholders. How can you assure the quality level of your product in this context?

Our local partners work according to clearly defined specifications that we set together with them. Furthermore, the entire production process is controlled. During the growing period, agricultural extension specialists pay regular visits to the farmers and also supervise the entire post-harvest process with them. The farmers dry the rice locally, in the sun. With paddy, the right degree of drying is crucial to prevent mildew infestation. Quality is tested at purchase, and farmers charge a better price for higher quality. In addition, the co-operative works in accordance with a clearly defined Hazard Analysis and Critical Control Point concept that was defined together with us.

Doesn’t side selling worry you?

Side selling accounts for perhaps one to two per cent. But as a rule, that doesn’t bother us because we simply pay better than other purchasers. After all, the System of Rice Intensification Premium, the Bio Premium and the FairTrade Premium ensure higher prices. And the farmers are contractually bound, for they have had their land entered for rice cultivation in a farm register via the co-operative. Of course there will always be the odd black sheep, but the farmers sort this out themselves. Anyone who doesn’t play the game is kicked out.

So the good prices are the chief advantage for the farmers?

What counts is that we offer the farmers planning certainty. Many smallholders used to be heavily indebted, and the project has helped them reduce their debts. We see to it that the money arrives at the right time so that they can meet their expenses. We guarantee that we will purchase a certain amount of rice that has been set in advance. The supply contracts with the partners cover a period of three years. We pre-finance the contracts 80 to 100 per cent so that the farmers can also rely on being paid at harvest.

***Anja Wolff** is Head of Sales and Marketing at Reismühle Brunnen, an integrated Division of Coop.*

Does ‘fair and good’ also count in marketing?

The project is a good opportunity to get in touch with customers, for example when we are asked at trade fairs why we all of a sudden start selling rice mixtures with pulses. Then we can explain that we are encouraging the farmers to grow chickpeas or lentils – to promote soil health and, of course, to improve their nutritional and income status.

The farmers demonstrate a considerable interest. Do you want to extend the project?

It is already quite big – after all, in India, we are now working with 3,500 farmers. If we want to grow there, it will tend to be more in terms of quality, for instance through raising area yield or through the already registered farmers providing more area for rice cultivation. Of course we want to continue to grow and expand our role in the market – but not more than demand will take in the long run.

How do you assess demand?

2016 was a difficult year. At the moment, as far as basmati is concerned, we have observed a slight stagnation, and demand is dropping somewhat because the market demands lower prices. If Fairtrade is too expensive and conventional rice is too cheap, things will no longer add up, and we won’t be able to grow. This is why we are now also seeking to secure other already certified projects. In Uttar Pradesh, for instance, we are supporting farmers producing long grain rice, which we can also offer to customers who are unwilling to buy the expensive basmati rice.

What is important for the success of a project like ‘fair & good’?

What above all counts is to have reliable partners in the country you’re working with who have already attained a certain size in order to reliably manage the processes as a whole. You need locals who speak the farmers’ lingo. This is particularly important in agricultural extension. The farmers need to understand the system of cultivation and be able to apply it. And what is more, everyone involved in the value chain has to be taken seriously and lent an ear.

And on the company side?

The company’s strategy has to have a clear focus on sustainability. This first of all requires a lot of persuading in order to gain the full backing of all staff. And perseverance is called for as well as being prepared to cope with difficult moments. We have set ourselves the goal of providing healthy food from sustainable production and simultaneously ensuring that local people can really live on what they earn with their products. This is also appreciated by our customers. Many of them value the personal aspect too. New business relations often start with a trip together to the project area. And we pay a visit to the projects at least twice a year, also together with our regular customers. Credibility is a very important factor in steady customer relations.

Sustainable Land management – restoring degraded lands for a better future

"The nation that destroys its soil destroys itself"
Franklin D. Roosevelt, 1937

Throughout the world, demand for finite land resources is ever increasing, and can lead to irreversible land degradation, as land is used beyond its "bio-capacity". Against this background, sustainable land management has become extremely important. The benefits are well-known, as are measures and best practices. But implementation is still lagging behind. A plea for more efforts in bringing together the world of conservation with the financial and development sectors.

Globally, there is an increasing demand for goods and services derived from finite land resources. Land available to feed one person decreased from 0.45 hectares in 1961 to just 0.20 hectares in 2005. Climate change, population growth, globalisation and poor land management practices have resulted in a loss of provisioning and ecosystem services (e.g. carbon sequestration and nutrient cycling) maintained by land. Some degradations are natural, like those caused by earthquakes and landslides, while in most cases they are human-induced. Factors influencing them include deforestation, over-grazing and urban sprawl. Declining soil quality results in low crop productivity, prompting farmers to make greater use of fertilisers and chemicals, putting the population into a vicious cycle of land degradation, food shortage and poverty. Degradation also causes loss of forest, biodiversity and vegetative cover, inducing climate change. According to the United Nations Food and Agriculture Organization, one out of every three people on Earth is in some way affected by land degradation. Further, a recent study puts the annual global cost of land degradation at approximately 300 billion US dollars (USD).

The global community has reacted with a goal to achieve a state of 'Land Degradation Neutrality' along with the fulfilment of other ambitious climate and biodiversity commitments. To help achieve these commitments sustainable land management (SLM) can play an important role. SLM is a set of implementable practices, technologies and approaches geared to maintaining indefinite ecological resilience and stability of the ecosystem services, while providing sustenance and livelihood diversity for humans. Rehabilitating degraded land by ecosystem restoration and sustainable neighbourhood designs can protect vital ecosystems and empower businesses. SLM can reverse the current trend of degradation, but large-scale interventions need to be based on an assessment of their total value (ecological, societal, economic benefits).

Investing in restoration can bring multiple benefits

The United Nations Convention to Combat Desertification (UNCCD) recognises that preventing and reversing land degradation is one of the key priorities for most of the 168 affected countries. Increasing soil carbon storage through land restoration and sustainable land management represents a significant opportunity to mitigate climate change, particularly at a time when the global community is falling short of the Paris Agreement. Many studies indicate that there are strong incentives for taking action against land degradation. According to an Economics of Land Degradation (ELD) Initiative study, on average, every USD investment into land restoration can give a five USD return. According to the World Resources Institute (WRI), restoring 20 million hectares of degraded lands in Latin America and the Caribbean would yield 23 billion USD in net benefits over 50 years. Restoring high-value forests in Nicaragua around coffee plantations generated an average additional 415 USD per hectare from forest products and an additional 161 USD per hectare from ecotourism. A study on large-scale restoration of rangeland in Jordan indicates that the benefits of sustainable land management practices dwarfed their implementation costs.

A number of initiatives are at work at regional and global levels that are helping strengthen the global political momentum in the battle against land degradation. Globally, efforts have been made to achieve land degradation neutrality by 2030 (Target 15.3 of the Sustainable Development Goals [SDGs]), restoring 150 million hectares by 2020 under the Bonn Challenge and 350 million hectares

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A restored environmentally degraded site in the desert converted into a beautiful oasis with proper watershed management and rehabilitations to encourage growth of desert plants, animals and arrival of migratory birds.
Photos: Bedanga Bordoloi

by 2030 under the New York Declaration on Forests. Regional initiatives include 20x20 (a country-led initiative on land restoration) in Latin America and the Caribbean and the African Forest Landscape Restoration Initiative (AFR100). Such initiatives follow existing international pledges, including the Convention on Biological Diversity (CBD) Aichi Target 15 and the United Nations Framework Convention on Climate Change (UNFCCC) REDD+ goal. Most recently, the UN Forum on Forests (UNFF) has set a target that would expand the world's forests by 120 million hectares by 2030. The International Standards for the practice of Ecological Restoration, released by the Society for Ecological Restoration, will further support sustainable land management initiatives.

Approaches to management of degraded lands

Sustainable land management comprises a variety of agronomic, vegetative, physical and management measures. These include green cover, mulching, use of manure, conservation tillage, plantation of trees and shrubs, crop-rotation, integration of different agro systems like agro-silvi-pastoral integration and building agri-engineering structures like terraces, dams, etc.

Numerous tools and methods exist that can assist private sector players in assessing the value of SLM and implementing it. The land materiality risk assessment tool, which has been developed by the ELD Initiative and the World Business Council for Sustainable Development (WBCSD), provides insight into a business's impact and dependence on land, as well as into related risks and opportunities. This tool enables companies to assess the significance of land for their business. The World Resources Institute's restoration diagnostic method identifies the success factors for forest restoration, and it has an atlas of restoration opportunities to identify opportunities for restoration across the globe.

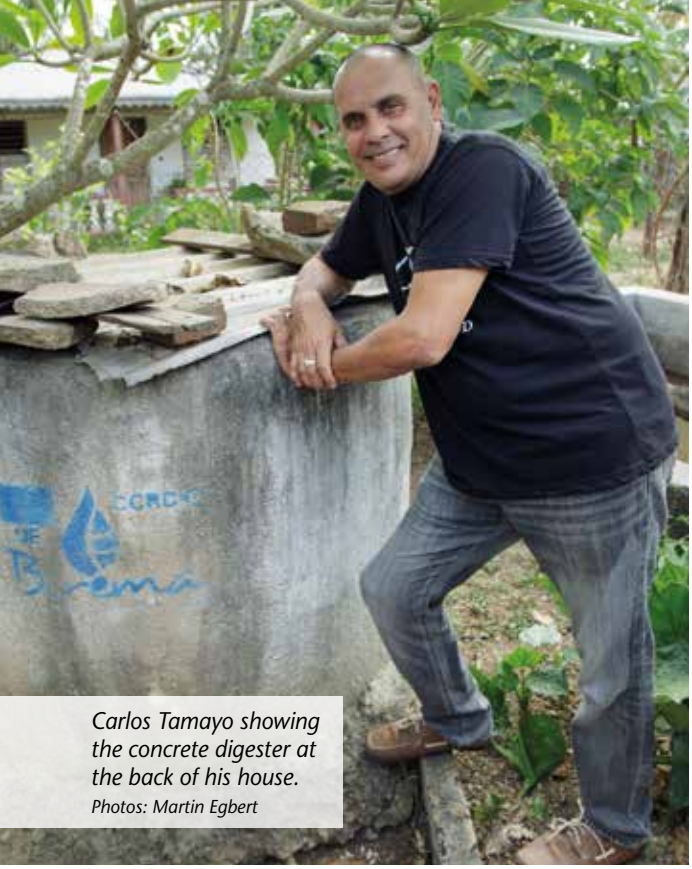
Right investments and policies can halt and reverse land degradation

Incentives to manage land better and reward those who practice sustainable land management need further impetus. Some good examples already exist. Costa Rica provided tax deductions, initiated a Payment for Ecosystem Services (PES) scheme and later introduced a mandatory conservation fee. Over five million hectares of degraded land in the Sahel has been restored through farmer-managed natural regeneration. In Ethiopia, SLM like terracing, crop rotation, pastureland improvement and green cover has restored around 390,000 hectares of degraded land. From 1991 to 2004, Brazil's grain production more than doubled thanks to the adoption of conservation agriculture and the introduction of improved crop varieties. Further, Brazil has recently committed to restore around 22 million hectares of degraded land. This commitment will help in Brazil's Nationally Determined Contribution (NDC) to the Paris Climate Agreement while supporting farmers, ranchers and conservationists. However, the implementation of actions towards prevention and restoration of land degradation faces numerous challenges. Many countries lack the necessary methods, data and expertise to monitor and report land degradation. Unclear tenure rights, continued incentives for unsustainable land uses, lack of implementation capacity, insufficient awareness of financing opportunities and investors' lack of understanding are other barriers.

But in many places, numerous measures have already been adapted to local contexts, which can be replicated across wider landscapes. Providing tangible local incentives for taking action against land degradation can include provision of securing land rights, enhancement of education and extension services, and empowerment of local communities. The use of the farmer field school or agro-pastoral field school approach has emerged as a core tool for building capacity of farmers and agro-pastoralists. There is also a need to improve access to financial and social capital to enhance SLM uptake. Local institutions providing credit services or inputs such as seed and fertilisers must not be ignored in the development policies. Today, more than ten private equity impact funds (already operational or in design) seek to invest in landscape restoration projects. Green bonds have the potential to finance a broad range of sustainable land use and conservation efforts.

Transforming the way we think, value, use and manage our land resources can help build a more resilient and sustainable future. SLM practices protect our natural capital and help populations adapt to climate change and build resilience. They can reduce the risk of migration and conflict while achieving food and energy security. SLM holds promise to be the accelerator in achieving commitments set in the national and global sustainability agendas.

The views expressed herein are the personal views of the authors and do not reflect the views of any organisation.



Carlos Tamayo showing the concrete digester at the back of his house.
Photos: Martin Egbert

Relieving (energy) poverty with biogas

Biogas plants are much in demand in Cuba: they ensure that waste from pig-farming is disposed of in an environmentally friendly manner, and help rural families to cut energy costs and earn additional income. However, there are many hurdles still to be overcome before this "green" fuel can supply the country's energy on a large scale.

When Carlos Tamayo goes out collecting in his neighbourhood of the village of Quatro Caminos, he probably won't be rattling his collecting tin. "I collect dung for my biogas digester", explains the pastor of La Trinidad episcopal church and laughs. The grey concrete digester is no bigger than a refuse bin and stands under a guava tree behind his house, covered by a tin sheet and a few stones. Inside, pig manure ferments to produce methane, which is forced through a narrow pipe directly into the kitchen, where it supplies a two-burner stove. Here the pastor's wife cooks for at least five people every day. She used to use an electric hotplate. "The biogas cuts our electricity bill by half, that's to say roughly the equivalent of five euros." That is a quarter of what a doctor or a teacher earns in a month.

Profiting financially and environmentally

Wages are low and prices high on the Caribbean island, which is why hardly any Cubans can live on their official salary. Carlos Tamayo also needs to supplement his pastor's salary, so has other jobs besides the profession he was called into. For a while, for example, he kept ten to fifteen pigs, to sell and for his own consumption, and their waste ran the digester. "But I'm out and about too often to keep pigs." So now he collects pig manure three times a week from members of his "flock".

With Tamayo's help, fifteen smallholders in the village have been able to install small digesters as well. They took courses to learn about building and operating the plants, and the church gave them small loans to enable them to pay for building materials and labour. In the mainly agricultural province of Matanzas there are a large number of small-scale pig breeders. "That is an environmental problem too, as most of them dispose of the untreated waste in ditches", explains Pastor Carlos Tamayo. That pollutes the soil and groundwater – and is unpleasant for people.

The church-based aid organisation Centro Cristiano de Reflexión y Diálogo-Cuba (CCRD-C) has been promoting biogas since the start of the economic crisis in the early 1990s. This period, known as the Período especial, was triggered by the collapse of the Soviet Union. Cuba lost its market for the sugar produced on most of its arable land – as well as its supplier of subsidised manufactured goods, oil and fertiliser. To make matters worse, America expanded its economic embargo. The island suffered acute shortages, especially of energy. Oil deliveries from Venezuela, drilling for Cuban crude oil and national energy-saving programmes have now alleviated the extreme supply problems. For example, nine million low-energy light bulbs have been distributed to Cuban households and low-interest loans made available for purchasing energy-efficient refrigerators, hobs and electric fans. Furthermore, the government has decentralised supply in order to relieve the strain on the dilapidated old power stations. Power cuts and blackouts do still occur, admittedly, but to a far lesser extent than in the 1990s, when outages lasted up to sixteen hours a day.

Demand can scarcely be met

"We can kill two birds with one stone with biogas", says Rita Morris, director of CCRD-C. "We can improve the lives of rural people and reduce the environmental damage caused by pig manure." The organisation receives support from Berlin Mission and the European Union, amongst others. There are 300 digesters in the mainly agricultural province of Matanzas

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alone that have been installed with the aid of CCRD-C. "Each digester is used by three families on average", explains Rita Morris. There is a great deal of interest among farmers in the province, she says, because they see how much their lives will improve if they can produce their own methane. "At the moment we have around a hundred people on the waiting list for a micro-digester." However, the organisation has neither the money nor the capacity to fulfil all these requests.

The versatility of biogas

The CCRD-C also operates two biogas plants of its own. This saves the organisation around sixty euros a month, which it previously had to spend on propane gas. On the aid organisation's 36-hectare fruit and vegetable farm close to the small coastal town of Cárdenas, methane is used not only to prepare meals for the twenty or so employees: in a kitchen on the outskirts of the farm two women preserve cabbage, mangoes, papaya, cucumbers and green tomatoes to sell. In this way they keep the farm's wide range of produce in supply even out of season, providing local people with affordable healthy food. Used plastic bottles are collected from hotels, restaurants and private houses for this. The women cut them open and then wash them in hot water to sterilise them. Then they fill them with cooked food in vinegar, hold them in a clamp and seal them using a metal rod, which they have first heated on the stove. Methane is used in almost all stages of the work.

A growing number of independent farmers in Cuba are also investing in biogas plants – without the aid of organisations like the CCRD-C. Joel Matienso has been operating his, which ferments manure from 300 pigs, since 2012. The waste flows straight from the sties along concrete channels into the 42-cubic metre fermentation tank at the edge of his farm in Sancti Spíritus province. "I built the digester myself", his voice hoarse as he shouts above the noise of his pigs and the chaff cutter, which his two employees are using to chop cassava. He had help from other farmers with previous experience. Four families live and cook at the farm, making sixteen people altogether. Besides Joel Matienso and his wife and two children, this includes one of his three brothers, who helps him in the business, and the brother's family. "We use methane to cook broken rice to feed the piglets, too."

In this way Matienso saves the equivalent of 240 euros a year. In Cuba that is more than the annual salary of a university professor, a doctor or a construction engineer – Joel Matienso's actual profession. Thanks to his pig-breeding he was able to give up his job five years ago. Since then the family has prospered. There is a new air-conditioning system and a new television set in the house, and a red motorbike is parked outside – a 1989 MZ that, despite its ripe old age, costs the equivalent of 8,000 euros. Private transport is a luxury in Cuba. The investment of the equivalent of 1,700 euros for materials and labour to build the biogas plant was modest by comparison. "I shall have recouped that in no time", says the 49-year-old farmer, and trudges off in his white wellingtons towards the cropland to show how effective the digester residues are as fertiliser. Sugar cane and cassava for the pigs flourish over an area of half a hectare, as do guavas, avocados, bananas, limes, coconuts and a host of other crops for the family growing in another field. This self-sufficiency farming is extremely important in Cuba, owing to continuing supply shortages. Private farmers often have virtually no access to expensive fertiliser and pesticides; both are sold almost exclusively through state-owned businesses. That is why many farmers effectively farm organically, without necessarily being certified.

Requirements for pig-fattening units

A lot of Cuba's pig farmers work closely with the state-owned Empresa porcina, from whom they buy piglets, feedstuffs and veterinary services and to whom in return they sell their pigs. Since 2015 these farms have had to

The digester residues are often used as fertilisers.
Photos: Martin Egbert

A worker feeding the pigs on Joel Matienso's pig farm. The farmer also uses methane to cook broken rice to feed the piglets.

provide evidence of a biogas plant when signing their contracts, which always last for six months. Moreover, since the beginning of 2016 all units keeping twenty or more pigs have had to ferment their dung in digesters. That is why, of the 1,200 pig-fattening units in Sancti Spíritus province, almost four hundred have their own biogas plants.

However, the boom also owes much to the expertise at the University of Sancti Spíritus. Research into this fuel has been taking place in this small town in central Cuba for many years. "There is great potential in Cuba", says Osvaldo Romero Romero of the University of Sancti Spíritus, currently visiting professor at the Technische Universität Berlin. To date 1,818 digesters altogether are in operation across the island, according to the energy ministry's official figures. Volumes range from ten to more than two hundred cubic metres. As well as these there is a not inconsiderable number of unrecorded digesters. However, there is potential for many more yet, Osvaldo Romero Romero believes. "Seven thousand plants could be run just on pig manure, and another 1,700 if cow dung is used as well." Five hundred plants could ferment the residues from sugar refineries, jam factories, distilleries, abattoirs and coffee processors.

Renewables must be expanded

Cuba produces only 4.3 per cent of its electricity from renewable sources, of which by far the greatest proportion comes from biomass. Almost half of Cuba's power stations burn crude oil, over sixty per cent of which has to be imported, as do the other fossil fuels, diesel and gas, that are used to generate electricity. This is to change under proposals from the national commission for the development of renewable energies set up by Raúl Castro. The proportion of biomass, hydropower, and solar and wind energy is to rise to 24 per cent by 2020. Biogas generation is not included in this plan as a source of electricity, but as a source of fuel and organic fertiliser. However,

On CCRD-C's fruit and vegetable farm, women preserve cabbage, mangoes, papaya, cucumber and green tomatoes, providing local people with affordable food out of season.

a national programme for the development of biogas, which envisages electricity generation from methane, is currently being drafted at the University of Sancti Spíritus on behalf of the commission. "Biogas could provide seven to ten per cent of the electricity used in Cuba, and in Sancti Spíritus province it could even be more than twenty per cent", estimates Osvaldo Romero Romero. As yet, however, there are neither the technical skills nor the funds needed to import foreign biogas systems to realise this potential.

Cooperation with German plant construction companies

Archea New Energy from Oldendorf in Hesse wants to change that through a collaboration with the University of Sancti Spíritus. "Cuba is very interested in green energy", says Saskia Louwen, a project engineer for biogas plant construction with the company. She sees the potential for electric capacity from biogas plants as at least 500 megawatts. The company initially plans to build a pilot plant generating 250 kilowatts at a rice farm, to promote the use of biogas in this way. At the same time the highly qualified scientists at the university could gain practical experience in the field.

The question of a suitable substrate is as yet unresolved, as Cuba lacks the resources for growing energy crops. Of the more than six million hectares of arable land, almost one million are lying fallow. However, this Caribbean island must prioritise growth in food production and feedstuffs in order to reduce imports. On the basis of a doctoral thesis there, Archea worked at the University of Sancti Spíritus to develop the idea of using the waste from rice-drying. The husks, broken grains and stalk residues can be mixed with manure from a neighbouring pig farm, and the methane from the digester used to drive a combined heat and power plant. The rice farmer could use the heat and electricity generated himself, for example for drying the rice. That is important, because feed-in is difficult in Cuba's overloaded grid. However, there are many other stumbling blocks: "Every bag of cement that you need has to be planned for a year in advance", is how Saskia Louwen describes the shortages and problems of a centrally controlled economy. Then there is the bureaucracy. And which business model is suitable? In a recent development foreign companies have been able to set up their own subsidiaries outside joint ventures, although they are not for instance allowed to recruit their own staff, but must select them from the skilled workers referred by the state. "Nevertheless, we are determined to be involved in biogas in Cuba", says Saskia Louwen.

Photos: Institute of Agricultural Engineering/University of Hohenheim

Solar powered cooling for enhancing milk value chains

Insufficient cooling systems are among the chief constraints many small-scale dairy farmers in the Global South are faced with. Quite frequently, milk is rejected by collecting centres or processing plants. Germany's University of Hohenheim is testing the efficacy of an environmentally friendly cooling system in Tunisia and Kenya.

In many African countries, milk is produced mostly by small and medium-sized dairy farms. These groups are mostly constrained by a lack of cooling systems and inadequate or reduced hygiene standards, which often leads to high microbial contamination of the milk. Under warm climatic conditions, raw milk can exceed the maximum bacterial count prescribed by food safety laws after only two to five hours. During the hottest periods of the year, a lack of quality can lead to high rates of rejected milk at collection centres or dairy processing plants. Milk cooling is essential to inhibit bacterial growth and stabilise milk until processing. In this context, an innovative agricultural solar-powered milk cooling system was developed to refrigerate and store milk on the farm and cool it during transportation. Since 2015, the system has been undergoing tests in two projects in Tunisia and Kenya (see Box on page 42).

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Easy to handle and resource-friendly

The system consists of PV panels, a commercially available DC freezer equipped with a smart control unit (adaptive control unit, charge controller, data-logger and batteries), and two insulated milk cans with a 30-litre capacity each. The milk cans were designed with an integrated ice compartment which replaces the conventional lid and an external removable insulation. Twenty-five plastic containers of 2 litres volume each are filled with water and placed inside the freezer, which is 100 per cent solar-powered, to form ice blocks. When solar energy is available, the freezer works at maximal power, while it goes into a "sleep mode" at night to conserve the ice produced. The freezer is able to store 50 kg of ice, assuring 4 days of autonomy. Thus, a single smart freezer allows the production between 12 kg and 16 kg of ice a day, cooling around 60 litres of milk a day all year round.

The insulated milk cans that have been developed are filled with a maximum of 30 litres of milk, after which the ice compartment is placed inside the can. Up to four ice blocks fit into the compartment. The use of a removable insulation for the milk cans offers a flexible handling of the system. In the case of the morning milk, 30 litres of milk can be cooled down with 6 kg of ice (3 ice blocks) and preserved up to six hours. In the same milk-can model, 20 litres of the evening milk can be stored for up to twelve hours with the help of 8 kg of ice (4 ice blocks). Furthermore, it is possible to fill a clean insulated milk can with ice the night before and give it to the farmer to cool the morning milk. This also allows more farms to use the insulated milk cans without owning the solar cooling system.

The system consists of PV panels, a commercially available DC freezer equipped with a smart control unit and two insulated milk cans with a 30-litre capacity each.

Tunisia – more flexibility for the milk collector

The Tunisian dairy sector is relatively advanced. Usually, someone assigned as "The collector" is in charge of a number of farms in the region and follows a route to collect the milk from the farms and bring it to the collecting centre. The milk is collected twice daily, in the morning and in the evening. As yet, with no cooling system in the car, the collector has to reckon with the milk being rejected, and if he wants to arrive at the collecting centre with milk of good quality, he usually tries to speed up the collection and transport. Therefore, the cooling system offers the collectors more flexibility in transporting the milk without the current pressure they are under to avoid spoilage.

The first evaluation of the solar milk cooling system was performed in Sidi Bouzid in central Tunisia. Ten systems were assessed at seven farms. The farmers were eager to co-operate and engaged in testing the technology. They monitored the pH and temperature levels of the milk from the milking to the collecting centre.The assessments of the system in Sidi Bouzid show the system's potential to provide fast cooling of raw milk from 35°C to less than 15°C within the first hour after milking and then maintain this temperature during transport until arrival at the collecting centre. This hampers bacterial growth during transportation. The farms testing the system are located up to 40 km away from the collecting centres, which means that the milk transport can take up to five hours. The cooling system is currently showing its ability to limit bacteria growth, preserve milk quality up to four times compared to un-cooled milk and ensure payment to the farmers.

The original milk-can prototypes introduced in the field had an incorporated insulation fixed to the milk-can walls. The farmers criticised this approach because of the increased weight and volume, which lowered handling comfort. Therefore, a new model was developed and introduced to the field in October 2016. Since the insulation is removable, this model can accommodate conventional milk cans. It allows better handling during milking and cleaning, which is often done by women in the region.

Background

The solar-powered milk-cooling system was conceptualised by the University of Hohenheim, Germany, with funding support from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

Implementation in Tunisia was embedded in the GIZ programmes 'Innovation Transfer into Agriculture – Adaptation to Climate Change' (ITAACC) and 'Sustainable Energy for Food – Powering Agriculture'. The International Center for Agricultural Research in the Dry Areas (ICARDA) and the National Agricultural Research Institute of Tunisia (INRAT) coordinate the project at national level.

The pilot testing in Kenya is funded by the Programme of Accompanying Research for Agricultural Innovation (PARI) while the coordination is carried out by the GIZ programmes 'Green Innovation Center for the Agriculture and Food Sector' and 'Sustainable Energy for Food – Powering Agriculture'.

Besides the aim to assess the potential and acceptance of the system under real conditions, business models are studied which would allow the introduction of the technology with locally produced components.

For detailed information on the project, see online version of this article at:
➤ www.rural21.com

The system was adapted to facilitate transportation by bike and motorcycle.

Kenya: adapted to small farmers' needs

In rural areas in western Kenya, milk production per farm usually ranges between one and ten litres. Owing to this low level of production, milk is handled by small farmers that organised themselves in co-operatives. Bikes and motorbikes are used to transport the milk from the farm to the co-operative, which is used as a collecting centre, but when the farms are located 7 to 12 km away from the centre, intermediate collection points (satellites) are established. At the satellites, milk is bulked until it reaches 50-60 litres and then is transported to the collecting centre on a motorbike. Thus, the first modification of the system was to use specially designed plastic milk cans in order to facilitate transportation by bike and motorcycle.

A pilot system was installed at the SAM Malanga dairy co-operative located in Siaya County. The group of farmers showed an interest in the system and participated in the project right from the start. They responded very quickly to individual issues such as the transportation of the milk cans, and were willing to adopt the technology. For example, they built an adaptor to carry two milk cans on the motorbike. In 2017, two more systems will be installed and evaluated in a selected farm and satellite respectively, covering all stages of the milk value chain before processing. The installed cooling system is already showing great potential to significantly reduce bacterial growth during transport and ensure the payment to the farmer. The activities planned are based on different business models that will focus on the overnight storage of evening milk and the evaluation of the system in the early stages of milk handling (satellites and farms). Private sector involvement in the country- and region-wide upscaling of the system is a long-term goal of the project.

A potential to boost market access

The solar milk cooling system is showing a great potential to overcome the challenges posed by short-term on-farm storage of milk and cooling during transportation. In addition, the pilot testing in Tunisia and Kenya has shown that this technology is a user- and environmentally-friendly solution for remote regions not connected to the grid. The scheme offers the opportunity to support the milk value chain at any stage by increasing productivity and giving access to premium prices or opening additional markets.

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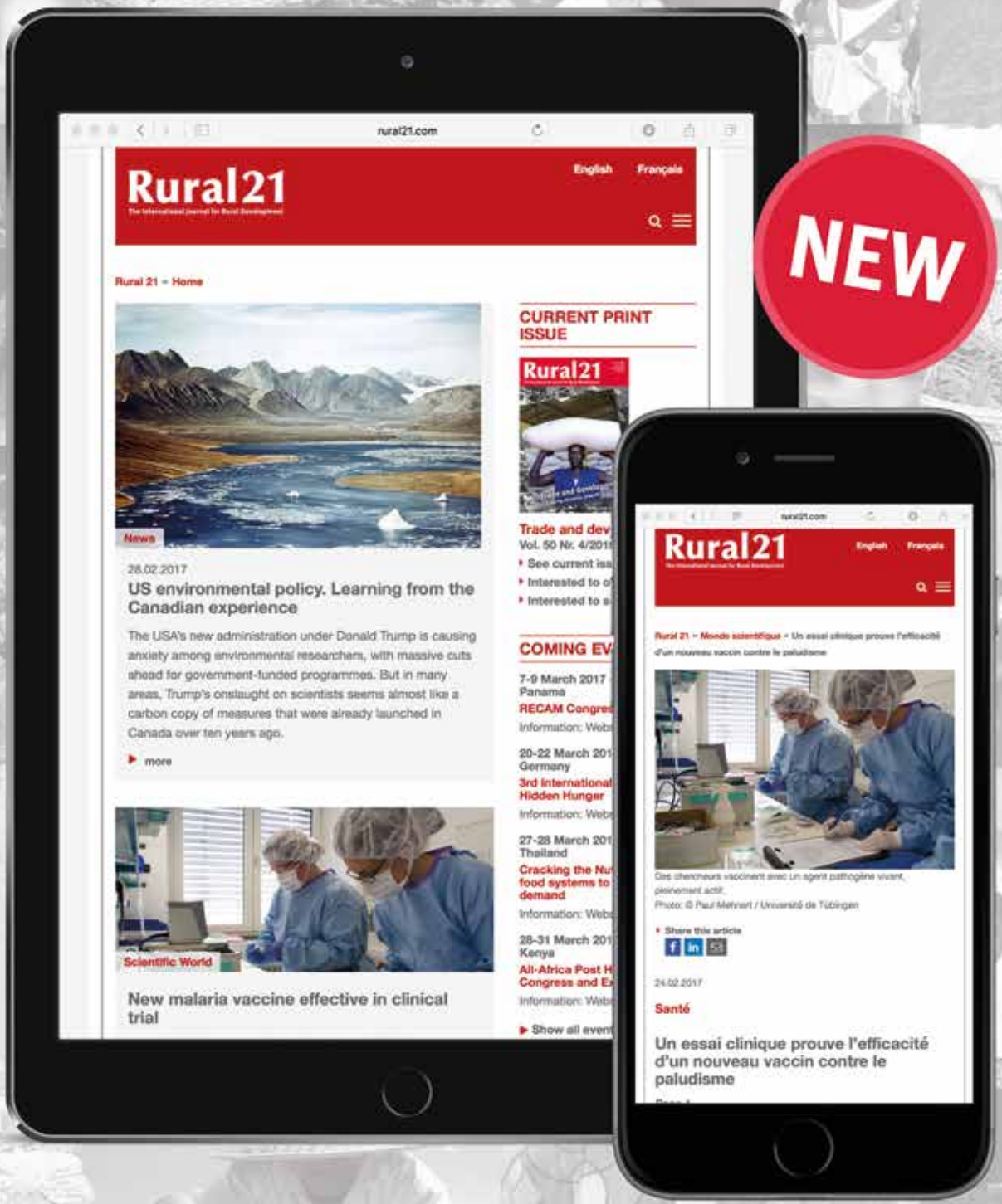

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