



## Special Issue on Innovation in Agriculture

### *Edition # Innovations to Feed the World*

Research and technological innovation have been instrumental during the past centuries to transform our agriculture and create the conditions to feed a growing world population. As a result, today, more people than ever before in history have access to food, in quantity and quality. At the same time, food production systems today are criticized for their environmental footprint and role they play in the emergence of chronic diseases such as diabetes and obesity. The number of people suffering from hunger remains unacceptably high, while at the same time the prevalence of obesity is on the rise worldwide.

Our food systems are at a crossroad. The recipes from yesterday might not work to feed the population of tomorrow. We need to rethink our approach to food production that addresses these new challenges, considering we don't have any alternative than producing more with less, including less social and environmental impact. Innovation in Agriculture can hold the key as long time bring value to the society in a sustainable and equitable way. As a matter of fact, new forms of innovation that bring together purpose and profit have been emerging during the past decade to address these issues, as reflected in the growing number of companies developing their own corporate social responsibility strategies and the emergence of small to medium enterprises with a strong social and environmental focus.

In FAO China, we have embraced innovation which has been placed at the heart of our country programme. Using design thinking

and the expertise of a wide range of experts and partners from academia, NGOs, private sector and government institutions, innovations are transformed from ideas and concepts into products with a special focus on finding solutions for improving the livelihood of smallholder farmers. Through its innovation Lab, FAO provides a platform for all interested stakeholders – government, private sector, technicians, youth as well as civil society – to engage and explore options for experimentation, prototyping, funding arrangement and project development. It is a space dedicated to test ideas for the development of food for the future, where we already tested some ideas in the area of food waste and loss or the use of new technologies to better connect smallholder farmers to markets and advice services.

In implementing our activities in 2018, we have learned that engaging end-users such as smallholder farmers and the poorest, in identifying the problems and elaborating the solutions with them, is essential and must take place at each stage of the process. It is also clear that while innovation in agriculture can improve the quality of life of people, they are often not adopted by smallholder farmers and the poorest, who have to overcome different types of barriers (institutional, financial, economic or cultural).

Hence, empowering rural farmers to co-develop innovative agriculture solutions becoming is deemed essential.

2018 has been a fulfilling year for FAO's innovation exploration journey. As we are approaching the traditional Chinese New year, we would like to take this opportunity to express our profound gratitude to all our friends, colleagues and partners. Thank you for entrusting us with your most ambitious ideas and most valuable support, time and contributions. We are grateful for the value you have added to our programmes and look forward to a mutually beneficial value exchange in the coming year of the pig, symbol of both prosperity and new opportunities!

On behalf of our staff, we thank you for your continued partnership and support and wish you and your family a very safe, healthy, and happy holidays!



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Vincent Martin  
FAO Representative  
in China and DPR Korea

## Connecting farmers: FAO Innovation Lab – AgLabCx – gives Youth in China the opportunity to address smallholder farmers' connectivity gap with urban markets

Opportunities are opening up for city dwellers to buy fresh wholesome food directly from rural producers. There is no other intermediary in reaching the food from the field to the table. One example of how to do this comes from China. Once a month, Xu Xinquan, a farmer from Sanggang Village of Hebei Province, gets up early in the morning and gathers his fellows for a trip to the capital city Beijing. They load their vehicles with supplies of fresh vegetables, meat and some seasonal agricultural products and hit the road. Travelling four hours his team reaches Beijing before noon and delivers their prideful products to the customers in several selected communities who have pre-ordered and pre-paid online.

This innovative model of monthly exchange between Sanggang Village and Beijing City, named as Nested Market, is facilitated by a group of researchers from China Agricultural University. It is a well-organized structure that tightly link smallholder farmers with individual customers. With rapid social and economic development, Chinese pay more and more attention to consuming high quality agricultural products. Nested Market has emerged as a suitable alternative to address this concern, which allows Sanggang farmers sell their products directly to urban customers in Beijing. They have now more confidence in the quality and safety of the food they buy from the farmers. This model, as well as many other similar ones in China, creates the necessary bridge between smallholder farmers and markets.

However, behind one success story lurk stories of many farmers in remote areas struggling to connect to more sustainable markets and improve their livelihoods. Many other challenges need to be overcome in order for connectivity to improve. One is building trust between farmers and consumers. For instance, at the beginning of establishing the Nested Market, customers in Beijing shoot tons of questions to Sanggang farmers, especially concerning the quality of products. "Why are your chickens so big?" In fact the local chicken species in Sanggang is a bit larger than normal ones. Yet the buyers worry that farmers must have used chemical products to feed their animals. Gradually, the Sanggang farmers had to abandon the local species and raise the normal-size chickens to win over the customers.



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An 8-week postgraduate service design course co-organized by FAO and Tsinghua University under the umbrella of the Innovation Lab.

To address this and other gaps in connecting the smallholder farmers to urban markets in China, the Food and Agriculture Organization (FAO) and the World Food Programme (WFP) partnered with Tsinghua University in an innovative project with the support of the "Delivering Together for Sustainable Development Fund" of the United Nations Development Operations Coordination Office. The project mobilized talented young students through the FAO-Tsinghua established Innovation Lab, AgLabCx to address these connectivity gaps through design thinking methods and co-creation workshops. The project was implemented in three phases. In the first phase, researchers, tech-companies and e-commerce practitioners, as well as smallholder farmers were brought together to brainstorm problems that need to be solved in tackling the following three main connectivity issues:

- a) Trust-building between producers and customers;
- b) Capacity development of smallholder farmers; and
- c) Market information sharing.



Co-creation workshop to identify smallholder farmers connectivity gaps

Based on this preliminary analysis and on these three main gaps identified, an 8-week postgraduate service design course was organized under the umbrella of the Innovation Lab. The aim was for Tsinghua students to develop practical solutions that could address these connectivity gaps. At the end of the course a co-creation workshop was organized on 22 December 2018 to discuss, analyse and validate the potential four solutions the students came up with: 1) Dingguagua, an online unmarketable/ugly fruits application; 2) Nonghu, a farmer-consumer exchange platform based on participatory guarantee system; 3) Yunduan, a farmer-technical expert instant communication app for Farmers Field School (FFS); 4) Agriculture heritage, a comprehensive promotion packaging for local agricultural products.

During the co-creation workshop and after three hours of brainstorming reviewing the solutions generated by the students, four teams presented the improved versions 2.0 of the solutions, which not only better reflects the actual needs of both farmers and consumers, →

but also focuses on how ICT can provide better service for both end users. The improvement of four Apps includes: 1) Dingguagua: gaming for fruits and entertainment elements are included to attract young consumers; 2) Nonghu: focused on the Yao Ethnicity Mom's Guesthouse at Hebian Village, an eco-tourism case in Yunnan Province, and stressed the importance of evaluation on the services; 3) Yunduan include the tutors' management and incentives through crowd fundraising and paying for knowledge; 4) Agriculture heritage: the group selected a local camellia oil from a Dong Ethnicity village in Hunan Province, and proposed to establish a free platform and a set of toolkit for farmers' easier selection of package elements and materials for their products.

## What does the future hold for AgLabCX?

It is full of promises opening up new frontiers of application. This type of innovative approaches has already attracted the attention of private sector companies willing to help reduce poverty in rural areas.

As an example, it enabled FAO to receive one million USD from the GF Securities Social Charity Foundation of Guangdong Province (GFS) to implement a Sustainable Development Goals (SDG) Pilot project in poverty stricken villages of South China, with the objective of assisting China to meet its poverty eradication goal by 2020.

The project plans to implement Farmer Field Schools (FFS) trainings to increase the productivity and income through capacity building while connecting farmers to e-commerce platforms, and use participatory guarantee system to provide quality assurance of the products.



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Postgraduate students of Tsinghua University visited Farmer Field School in Shunyi District, Beijing.

In 2019, AgLabCx looks forward with more confidence in using Tsinghua postgraduate service design course, together with China Foundation for Poverty Alleviation to harness the innovative thinking of young talents in solving some of the key agricultural challenges in China. More importantly, activities in 2019 will see a broader engagement of young farmer entrepreneurs to generate more sparkling thoughts and innovative solutions. Therefore, in 2019, AgLabCx will work together with partners to harness the creativity and talents of the youth while targeting young farmer entrepreneurs.

Xu Xinquan, the Sanggang villager, said he is becoming too old to drive to Beijing monthly, and would be willing to explore new solutions that would also solve his mobility problem. Such solutions with support from young farmer entrepreneurs might soon be within reach of farmers like him. They can expect to continue selling their products in the city while spending less time on the road and increasing incomes.

## Digital innovation and E-agriculture in support of the Belt and Road Initiative

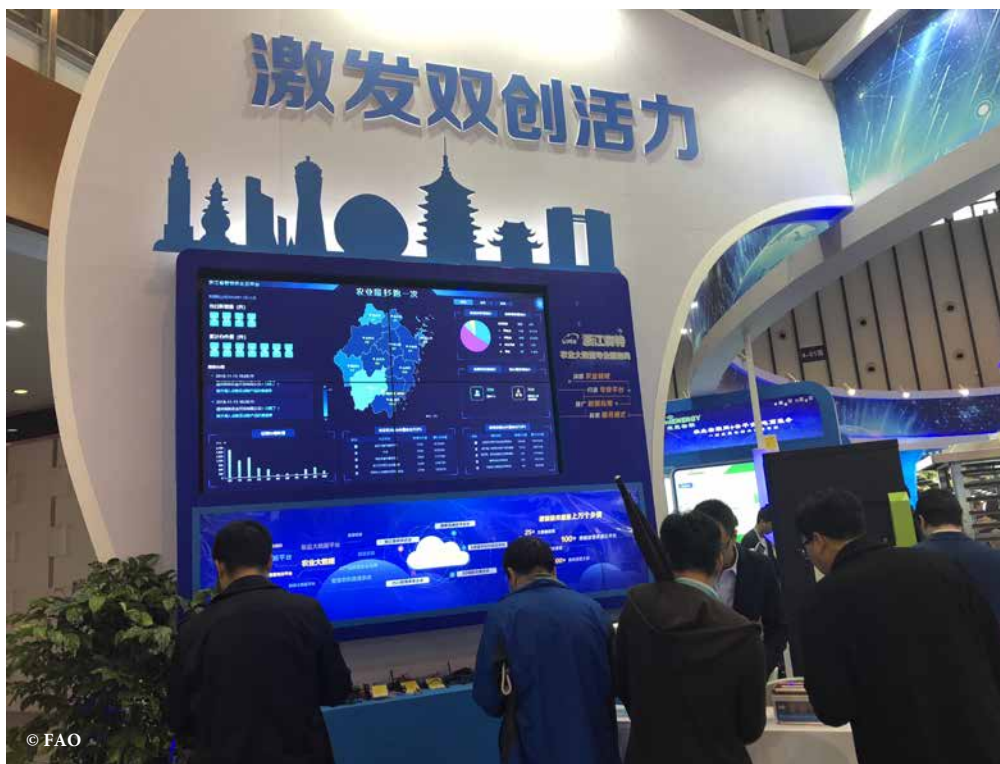
In a globalized world, cooperation between countries is becoming increasingly important to deliver international public goods and turning into an SDG mindset. As such, the Belt and Road Initiative (BRI) launched by China in 2013, and its agriculture development component, has the potential to influence the food systems locally, regionally or globally and bring development and market opportunities to remote areas which have largely failed to benefit from the expansion of global trade for the last four decades.

However, to achieve effective rural development and alleviate poverty, BRI infrastructure investments are a “necessary but insufficient” condition. The impact of infrastructure investments on rural poverty and food security will depend on many different factors. Well-designed measures, that benefit both women and men, and complement infrastructure investments, are necessary to ensure that poverty alleviation, food security and pro-poor outcomes can be achieved. Private sector investment in activities such as agricultural production, logistics, storage and processing, are also encouraged and will be key to achieving the above-mentioned goals. To ensure that private agricultural investments benefit local communities and promote rural development, efforts should be made to ensure the investments and business models adopted use an inclusive and sustainable framework.

Just as with transportation infrastructure, enhanced information and communications technology (ICT) capabilities has the potential to bring great benefits to previously remote and inaccessible areas through e-agriculture innovations. E-agriculture innovations create possibilities of leap-frogging stages of development for poor rural areas.

Improved access to information can provide immediate benefits to small farmers. E-commerce, or buying and selling online, is in fact only one of many potentially powerful applications of ICT in agriculture. The coverage can range from increasing agricultural productivity, establishing knowledge and information systems, accessing financial services, the use of ICT in farmer organizations, improved risk management, improving food safety, strengthening rural governance, remote sensing applications to supply chain management.

Digital agriculture could hold the key in addressing local, regional and global food security challenges. However, to be a potent technology, it has to be tailored to working for more social justice and preventing the digital divide that widen inequalities and further marginalizes the poor. It also needs to be brought at the service of more sustainable and responsible market chains that have a social impact and leaves no one behind.



In this context, FAO together with the International Telecommunication Union (ITU) and the Ministry of Agriculture and Rural Affairs of China organized the E-agriculture Solutions Forum from 15 to 17 November 2018 in Nanjing, China. The forum was attended by more than 200 guests and participants from over 30 countries all over the world attended the Forum. It represented a unique opportunity to: 1) bring together proven e-agriculture solutions that will benefit agriculture stakeholders; 2) share knowledge on successful e-agriculture solutions and identifying ways of scaling up implementations; 3) strengthen the Community-of-Practice (CoP) among e-agriculture solution providers; and 4) share experiences in implementing ICT solutions for agriculture.

## The Community Supported Agriculture model in China



*The CSA conference held in December 2018. From left to right: Judith Hitchman, President of Urgenci; Dr Shi Yan from Shared Harvest Farm and Dr. Vincent Martin, FAO China Representative.*

Greening the future is about mainstreaming green development into policy and development agenda. As the single largest sector using 60 percent of world's ecosystems and providing livelihoods for 40 percent of today's global population, the food and agriculture sector is critical to green development. Although there is no internationally agreed definition of green development, there is a consensus that it implies sustainable and inclusive growth that incorporates environmental and social issues, and allow to "do better and more...with less". It also resonates with the principles of the sustainable development agenda set by the United Nations.

This particularly applies to meeting the global challenge of producing more food for a growing population in the 21st century without further degrading the environment. The challenge is also about producing food that is healthy and wholesome and building sustainable food and agriculture systems from farm to fork. To achieve this, some countries or farmer communities have started moving away from high-input and resource-intensive farming systems that while substantially increasing food production also

exacted a high price on the environment. The focus is now on reducing pesticide and chemical use, supporting smallholders and family farmers, improving land conservation practices and embracing new digital technologies that offer some exciting opportunities in this endeavor.

In making transition to green agricultural development, China has taken some interesting steps. While the perception from outside is that there is only one type of agriculture in China, highly intensive and heavily dependent on pesticides and fertilizers – hence a major source of contamination of soils and water sources, a new era of farming practices has been emerging during the last decade. It is based on:

- A bottom-up demand driven approach: In the aftermath of large-scale food scandals, food safety has become a major concern for the population and consumers who are driving a shift to more sustainable and healthier consumption modes.
- A top-down policy change: with the Rural revitalization strategy and green ecological agriculture development concept. The Rural Vitalization Development Plan (2018-2022) further specified the focuses of green agriculture development interventions through reducing agricultural inputs, managing waste and pollution and promoting ecological production.

One of the approaches advanced by Chinese food producers and consumers to promote green ecological agriculture is based on Community Supported Agriculture (CSA). The annual China CSA conference is the highest policymaking platform of CSA in China. The 10th annual conference of the platform was held in December 2018 at "Mother Farm" located in Sichuan province, Zhanqi Village. It attracted more than 300 researchers and practitioners, supportive of this new type of small scale family-based agriculture production systems. In China such an approach has also the potential to close the urban-rural gap and revitalize rural areas that have suffered from migration to cities. It can also create job opportunities for young people in search of their roots and a simpler way of life.

## What is Community Supported Agriculture (CSA)?

CSA is a relatively recent movement and a way of producing sustainable food and close the urban-rural gap by connecting consumers to farmers. The CSA model emerged in the 1960s in Japan (and more or less at the same time in Europe) at a time of the Minimata disaster due to mercury contamination of seafood that entered the food chain. As a result, a network was developed in which housewives would source their food directly from organic farmers.

The movement progressively went global, with Urgenci (<http://urgenci.net/>), a network of national networks uniting over a million of producers and consumers. In this network, consumers commit themselves to buy from a producer on a regular basis, thus sharing the risks (difficult season for instance) and benefits of the production.

As Judith Hitchman, President of Urgenci International Community Supported Agriculture Network, reminded us during her speech at the conference, →

the food produced through CSA is nutritious (you can get your “full vitamin shot” because it is based on short and local market chains), healthy and safe (being produced using agro-ecological or organic practices), while it preserves the environment, and maintain the biodiversity.

The CSA model is not only about sharing costs and risks of the production or consuming healthy food, it is also about building a link between farmers and consumers, restoring mutual trust and exchanging knowledge. In addition, it strengthens rural-urban linkages in the context of rural exodus and the development of urban areas where inhabitants are disconnected from the agricultural and rural world.

In China, the movement has been spearheaded by Dr Shi Yan, a graduate from Renmin University, who set up one of China’s first CSA farms called ‘Little Donkey’.

Following Shi Yan's path, an increasing number of young, qualified graduates are eager to experience a more simple way of living outside of the city which provides an opportunity to educate and train them in farming techniques. While CSA is a relatively new phenomenon in China, introduced about a decade ago, the movement is spreading fast. In 2015 there were already about 800 CSA farms with 100,000 consumers-members. The theme of the 10th session of the CSA Conference was “Rural regeneration: green agriculture development”.

As the new middle class keeps growing in China, the food habits of its population are evolving simultaneously. Consumers have not only diversified their sources of food, adding more animal’s proteins and vegetables to their diet, but they are also expecting food that is better in terms of quality and nutrient content. Food safety has indeed become a top priority for all. In this context, Community Supported Agriculture is progressively seen as an alternative to the current system in which they have lost trust.

At the same time, the CSA model can also play an important role in poverty alleviation and rural revitalization, which will directly bring more profits to the producers and raise farmers' income effectively. Compared with traditional agriculture, this model is more likely to attract young people back to the countryside, and achieve rural revitalization.

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## A Leap of Faith

If countries make specific policy commitments to green agriculture, CSA has the potential for outgrowing from a movement into a robust approach to turn green agriculture into a new global paradigm of agriculture development and revitalization of rural areas. It is also encouraging to see that what seemed impossible ten years ago is becoming a reality now – organic food is becoming widely available in supermarkets in many countries, at cheaper prices, with neo-farmers and educated young people returning to parent’s land and taking pride in farming.

In today’s world, food and agriculture systems vital for human progress are beset with multiple challenges – climate change threatening agriculture production and livelihoods, rise in hunger and obesity driven by growing inequalities and access to income, widening rural-urban gap leading to social exclusion, to name a few.

The world indeed needs a new paradigm to make rapid transition to sustainable food and agriculture systems to address the challenge of Zero Hunger spelled in the Sustainable Development Goal (SDG) 2 of UN's 2030 agenda for sustainable development.

As the advantages of CSA are in display, there is reason to be optimistic that it could become part of the solution to global food and nutrition insecurity, and contribute to build more resilient, inclusive and sustainable food systems.

## Moving towards Farming 5.0

Is humanity up to the challenge of addressing global food production within this broad context? If the past is any guide, the answer is yes. The best hope comes from research and technological innovations that transformed agriculture during the past centuries and created conditions to feed a growing world population. If we look at how agriculture revolution followed the industrial revolution and advanced with each wave of technological revolution, four stages are distinct: Farming 1.0 (mechanization in the 1900), Farming 2.0 (the Green revolution), Farming 3.0 (Precision agriculture); and finally Farming 4.0 in the early 2000s with digital farming becoming the key in real time farm management systems. How can we move up along this trajectory to solve what seems to be an impossible equation of producing more food with less, and addressing crucial issues such as climate change and demographic challenges? The reality is that Farming 5.0 is already on its way with the increasing role of Artificial intelligence that is going to revolutionize the way food will be produced in a future nearer than we think.

## Artificial Intelligence, the remedy to tomorrow's agricultural challenges?



More and more Ag-tech start-ups are designing deep learning models. It is indeed considered to be a powerful tool to answer today and tomorrow's global challenges in agriculture such as how to feed a growing global population (9 billion people by 2050) while taking into consideration the limited availability of arable land and climate change issues.

For example, a new cloud-based AI app named Plantix has been launched in India to help farmers detect diseases in crops. This app does not require high skills in technology and farmers only need to be in possession of a smartphone to use it: after taking pictures of the crop, they upload them into Plantix with GPS locations, which will then provide a diagnosis to the farmer (disease, pest or nutrient deficiency). It also provides technical advice such as using the proper amount of herbicide that will be efficient to grow the plant while avoiding overuse or incorrect application. Before making digital tools applied to agriculture truly efficient, critical issues need to be addressed (e.g. outdoors' factors can rapidly change and lead to an incorrect diagnosis for instance), but it is a promising initiative.

Deep learning, a sophisticated form of Artificial Intelligence (AI), is exploring new approaches to boost productivity while being environmentally friendly and it has become one of the most effective AI tools. It involves 'neural networks'- digital imitations of the human brain's system of neurons and synapses- that are able to detect patterns and make predictions and recommendations (outputs) based on the data injected in it (inputs).

*Source: From identifying plant pests to picking fruit, AI is reinventing how farmers produce your food.*

## Blockchain: a new paradigm for increasing trust and transparency in agricultural supply chains

Almost everybody today has heard about blockchain technology, the new buzz word in the tech innovation circles. But what does it mean exactly and how can it apply to agriculture development and solving global food security challenges?

In January 2019, FAO has just released a publication, together with ITU that answers these questions and gives multiple examples of blockchain technology application in the agricultural sector.

Also refers to "internet of Value", a blockchain consists of a linked chain that stores auditable data in units called blocks, each block containing the data (anything of value), its own hash value (a unique cryptographic value containing characters and numbers generated through a complex computational algorithm) and a pointer to the hash of the previous block. Bitcoin was one of the first and most popular implementations of blockchain technology.

In this publication, you will learn how it can be used in agricultural insurance systems, land registration, fisheries, and in which country it has been piloted.

In the agricultural supply chains, a blockchain can assist in providing an immutable record from the provenance to the retail store of a product, thereby increasing consumers' trust in the products (who can get access to the product details by scanning a QR code) and reward producers using sustainable farming practices. More to learn from the link below....

*Source: E-agriculture in action: Blockchain for agriculture opportunities and challenges.*

## When art meets agriculture: the zero hunger art exhibition



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As a vehicle of education and values, Art contributes to build a better world and as such can help eradicate all forms of poverty and hunger.

On 27 November in Beijing, in FAO China, we launched our first Art exhibition entirely dedicated to Agriculture and food reflecting on this year's World Food Day theme: "Our Actions are Our Future - A Zero Hunger world by 2030 is possible".

The exhibition, created in collaboration with the Institute for Culture Creativity of Tsinghua University aims to engage and inspire the youth and demonstrate that Art and creativity can serve as an electroshock, inspire possible futures and bring disruptive innovation needed to transform our food systems and achieve a brighter food future.

Designed to engage and inspire the public with the fight for a "Zero Hunger" World, the two-week exhibition displays a series of paintings, movie, photography, and installations created by renowned artists from China, America, France, Japan, Thailand and the Netherlands.



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The exhibition is divided into three parts:

- The Living Past, which demonstrates the wisdom of our ancestors in farming techniques;
- The Present, which focuses on a series of current problems arising from the crisis caused by industrialized agriculture; and
- Breeding the Future, with actions oriented towards the future.

Based on the recent alarming trend seeing a rise of undernourishment for the third year in a row, it is clear that fighting against hunger and malnutrition worldwide remain a long and difficult journey, intimately linked to other key challenges of the 21st century such as climate change, conflicts, economic slowdown and migrations.

But we know can make it and become the first Zero Hunger generation, if we work across a wide range of disciplines, unite our efforts and build on the genius and creativity of Artists around the world that can bring innovation and foresight into the scientific world and help sensitize the young generation to such global issues.

Increasing awareness and engaging governments, the private sector as well as the public to participate in this global fight against hunger is a crucial step to achieve a Zero Hunger world by 2030.

Collective actions, wisdom and more solidarity can indeed invert this trend and help achieve our commitments, if we align our actions to our commitment for a better and more sustainable world, because "our Actions are our future".

FAO is committed to working with all stakeholders and actors including artists and the public to raise awareness and make a zero hunger world a reality.

In addition, during the past 4 months, over a thousand of Chinese students aged from 6 to 16 participated in FAO's online art contest and shared their artwork. Around 800 artworks from the contest have been selected to be displayed at the exhibition in Enjoy gallery of Beijing at 798 art zone.

At the opening ceremony, the organizers awarded the winners of the online art contest. 30 students received prizes for their creative works. The art exhibition will be open to visitors until December 9, 2018.



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