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Lecture in Honour of Frank L. McDougall

Delivered by

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**The Agricultural Economy of Tomorrow:
Opportunities for Transforming our World**

I am honored to deliver this year's McDougall Memorial Lecture. I feel some affinity with Frank McDougal who, like I, spent part of his life on a farm. He was an advocate of using science and analysis to inform policy decisions. And he was a forceful believer that better policies could improve both food production and distribution. He inspired the conference convened by US President Roosevelt in early 1943 that laid the foundations for the establishment of FAO after World War II. I am also humbled to deliver this lecture, given the stature and knowledge of so many who preceded me, starting with President Lula two years ago, and including two UN Secretary-Generals (Kofi Annan in 2011 and Boutros Boutros-Ghali in 1999), Indira Gandhi, and the "father" of the green revolution, Norman Borlaug. I was also preceded, in 2013, by Nobel Laureate in Economics Amartya Sen, arguably the most influential voice in the definition of UNDP's Human Development concept and practice - I will have more to say about Prof. Sen's lecture here later in my remarks. But let me tie my lecture, Amartya's teachings and Frank McDougall's legacy with the thread that has, in the near and recent past, allowed us to understand – and fight – hunger and poverty with renewed energy and ideas. That is what I intend to do, again, today with these remarks.

Taken at face value, agriculture may not appear central to today's global development and sustainability challenges. How relevant is agriculture, a sector which accounts for less than 4 percent of global GDP?ⁱ

Yet, today I will argue that agriculture represents much more than what is measured as a sectoral contribution to GDP— first, because we all depend on the availability of and access to food, and second, because it represents one-third of global employment.ⁱⁱ Most importantly, it is on farms, big and small, around the world that the interaction between people, planet, prosperity and peace can unfold in ways that will either take us to sustainable development or will make our task virtually impossible.

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It was the first agricultural revolution, more than 10,000 years ago, that enabled the emergence of civilization. As humans domesticated plants and animals, they built settlements and accumulated surpluses that advanced progress. Greater food production has arguably been the driving motivation for farmers for millennia and may be seen, by some, as the solution to feeding a growing global population. Seen from this perspective, all we should expect from agriculture is to continue to produce more.

I think the challenge, however, is more complex. The world's population is expected to grow to almost 10 billion by 2050, with two-thirds living in cities. This will boost and change agricultural demand, with some estimating that the world will need to close a 70 percent food gap by 2050. With further income growth and urbanization in low- and middle-income countries, a dietary transition will happen towards higher consumption of meat, fruits and vegetables, relative to that of cereals, requiring commensurate shifts in output and adding pressure on natural resources. Within the complexity of this challenge we can unlock opportunities to advance sustainable development by transforming agriculture.ⁱⁱⁱ

The “Agriculture Economy” that we inherited from the 20th Century

The decisions made by a farmer anywhere around the world may appear to her as voluntary or under her control. Her decisions are, in fact, influenced – even determined – by a vast array of factors beyond her control. There is no question that her motivation is to provide for the livelihoods of those that live off the land, be it a small farmer or those that depend on a major agricultural corporation. But past practices, existing incentives and regulatory frameworks, some global in nature, are leading to behavior that is resulting in the following central challenge: the need to feed more people and to end hunger against agricultural practices that deplete the natural resource base on which the future of agriculture itself depends upon.

Agriculture was transformed over the last century, leading to greater production and distribution of food and other agricultural products for a rapidly growing population with ever higher incomes and more diversified tastes. Agricultural research, both public and private, became a major enterprise, leading to more efficient production, greater mechanization, and better resistance to pests and environmental stresses. Complex economic and social interlinkages developed, downstream and upstream – downstream in industries linked to seeds, fertilizer, irrigation, and mechanization, and upstream in activities such as food distribution, packaging, cold-chains, retail, food and beverage hospitality, and tourism. Many of these industries are global in nature, with sourcing and distribution of agricultural produce crossing countries and continents. Container ships, trucks, trains and airplanes move around the world enough maize, wheat, rice, and soybeans (the largest source of animal protein feed) to feed 40 percent of today's population.^{iv} Sophisticated regulatory systems were developed, including those aimed at ensuring food safety. This is the “agriculture economy” under which farmers operate, where economic incentives and a regulatory context, for the most part, are pushing inexorably towards more production.

I will argue that the dominant practices that emerged over the course of the 20th century will need to change on at least three dimensions: improving sustainability, ending hunger, and enhancing peace and stability. I will illustrate linkages across economic, environmental, and social issues and conclude by suggesting possible pathways for transforming agriculture.

Transforming agriculture to transition towards sustainability

The animals and plants upon which agricultural output depends use land and water and are at the mercy of weather conditions. Through human ingenuity, agriculture has evolved to make better use of these resources and to make production less vulnerable to climate conditions. While technological change and innovation will continue to enable progress, we are confronting a more fundamental challenge: an “agriculture economy” that leads to choices that are “mining” unsustainably the very natural resources upon which agricultural output depends.

Agricultural investments and technological innovations have boosted agricultural productivity, and there is more room to grow, both by continuing to raise the frontier of productivity and by helping farmers achieve higher standards of efficiency. The needed acceleration in productivity growth, however, is hampered by the degradation of natural resources and the loss of biodiversity. The risk goes beyond using natural resources in a way that harms agricultural production in the future. It is about us not being able to maintain the ecological infrastructure that underpins our economies and societies.

Agriculture today accounts for 70 percent of fresh water use^v at a time when one third of the world's population lives under water stress^{vi}, with this percentage set to increase to two-thirds by 2025.^{vii} Over the last century, three-quarters of the genetic diversity in agricultural crops has been lost, and we depend on only 15 plant and 8 animal species for 90 percent of our caloric and protein intake.^{viii} Agriculture continues to claim more land, including forested land, at a time when a quarter of existing agricultural land is already highly degraded.^{ix} one-third of the world's arable land has been lost to erosion or pollution over the last four decades.^x

Another “self-defeating” dynamic has to do with agriculture and climate change, the well-chosen topic for the latest State of Food and Agriculture Report published by FAO. More than one-fifth of greenhouse gases emissions can be linked to agriculture, including changes in land use and deforestation. While higher latitudes may see net increases in yields in the short run, the overwhelming impact of climate change on agricultural production – especially in regions where local production is already under stress and over the longer run – is negative. Climate change disproportionately affects food-insecure regions, jeopardizing crop and livestock production, fish stocks and fisheries. And given that soil is a major repository and storage for carbon, soil erosion and changes in land use linked to agriculture can further undermine efforts to reduce greenhouse gases concentrations in the atmosphere.^{xi}

But the challenges of sustainability extend beyond natural resource use and climate change. For instance, in the US, 80 percent of the antibiotics consumed are used in agriculture.^{xii} Some of the major global health concerns at present have to do both with the transmission of infectious agents from animals to humans, as well as the threat of anti-microbial resistance. This has been recognized not only as a major threat to our wellbeing, but also as a potential major economic challenge in the future. Widespread, often unregulated, use of antibiotics in agriculture compounds these challenges.^{xiii}

Transforming agriculture to end hunger and reduce poverty

For all its achievements during the 20th century, agriculture and the “agriculture economy” of the 21st century have failed to eliminate hunger. Even though the prevalence of undernourishment dropped from 19 percent in 1990 to 11 percent today, close to 800 million remain undernourished.^{xiv}

Again, this is a case in which the “agriculture economy” is, at times, signaling to farmers to produce more when the challenge is elsewhere. The challenge is that local production is not taking place where it needs to happen to feed currently hungry people, and the globalized “agriculture economy” is not making food accessible everywhere and at all times. As Amartya Sen argued so forcefully in an earlier McDougall Lecture (in 2013), the main reason why there is so much hunger in the world is that a focus on “food production” detracts from considering the manifold challenges that preclude people from having access to the calories and nutrients they need. Ultimately, in Sen's assessment, lack of access to food can be explained by what he calls a loss of “entitlements,” either because food prices are too high, income is not enough, or a combination of both. What Sen's analysis clearly demonstrates – even if it may not be a complete or exhaustive diagnostic of the problem – is that many of the challenges that need to be addressed to end hunger lie beyond agriculture as such, and are much more within the realm of the “agricultural economy.”

A bitter irony is that many of the people living in hunger or that are food insecure are themselves engaged in agriculture, either farming or livestock. In many African countries, where there is high prevalence of hunger, up to 80 percent of poor Africans depend on agriculture for income.^{xv} There is a dual challenge in many of these settings.

The first is that agricultural productivity is typically extremely low, with yields having been stagnant for many years, trapping people in low value-added, family farming. Here agriculture needs to be assisted to transform itself in a similar way to what happened in much of South and East Asia. During the second half of the 20th century, sustained increases in agricultural productivity were the engine that reduced massive extreme poverty, generated income for the development of rural non-farm activities, and ultimately enabled the structural transformation towards manufacturing and higher value-added services. Of course, while technological change and innovation will need to play a role, charting this pathway will require more than a mere replication of these “green revolutions.” Agriculture has to be transformed so that the massive sustainability challenges now faced by Asian countries are not replicated elsewhere.

The second is the confluence of rapid population growth in environmental stressed areas, as in the Sahel or in the Horn of Africa, and its interaction with natural hazards and conflict that leads to recurrent acute food security crises. In 2016 more than 100 million people globally were facing crisis-levels of food insecurity, 35 percent more than in 2015. Areas harvested for cereals, as in parts of the Sahel, have grown, because gains in agricultural productivity have not kept pace with increases in populations. This has resulted in encroachment on traditionally grazing lands, with detrimental effects on land quality and social and political tensions. Higher weather volatility and environmental shocks also generate acute food crises, as illustrated by the impact of El Niño last year in Eastern and Southern Africa. And conflict was, and remains, a main cause of food insecurity in many parts of the world. There is a need to enhance the management of transitory food production shocks. The recurrent inability to access food relates to the reduction in purchasing power, either due to drops in income or increases in food prices, or both. Often, these come together and are self-reinforcing, taking us back to Sen’s loss of entitlements.^{xvi}

To address recurrent inability to access food, we need risk management options that help buffer farmers against production variability (e.g., through weather-based insurance), as well as social protection mechanisms (e.g., cash for work, food for work) or other cash-transfer mechanisms. Greater efforts are needed to develop and expand social protection. The income provided by social protection can be instrumental not only in maintaining “food entitlements,” but more broadly in improving livelihoods and the resilience of the poor to shocks.

Transforming agriculture to enhance peace and stability

Political and social instability, which can result in violent conflict, is the result of complex interactions among people, ecosystems, and economic and political factors. Environmental shocks and/or other factors that lead to sharp increases in food prices or loss of income have triggered social and political instability. This is exacerbated when there is competition over water or land, between competing claims over the use of these resources for agriculture, especially in environmentally-stressed areas.

While this is a contentious field, evidence suggests at least an association between deviations from expected weather patterns (including rainfall, but especially temperature) and an increase in the risk of an outbreak of violence, especially when these environmental shocks interact with economic exclusion and horizontal inequalities.^{xvii} For instance, research found that while only 9 percent of armed conflict outbreaks between 1980 and 2010 coincided with disasters linked to droughts or heatwaves, this percentage increases to 23 – almost one quarter – in ethnically fractionalized settings.^{xviii}

The interaction between conflict, environmental shocks, political exclusion, and livelihoods has been shown to depend highly on agricultural practices. A recent study found that droughts significantly increase the likelihood of sustained violent conflict in low-income settings where ethnically/politically excluded groups are dependent on agriculture.^{xix} Another study traced the effect of the worst drought in recorded history in the Fertile Crescent, which started in 2005, on events that unfolded in Syria just prior to the 2011 uprisings. Both the drought and longer-term trends towards warming, reductions in soil moisture, and decreases in precipitation are shown in the study to be linked to climate change. In 2008, during the driest winter in Syria's recorded history, wheat production failed and almost all livestock was lost. As a result, 1.5 million people were internally displaced, moving – along with as many Iraqi refugees – to peripheral urban areas. Facing overcrowding and lack of basic services, with unemployment rampant, these areas faced civil unrest that intensified in March 2011. This does not imply causality between the drought and the conflict in Syria, but illustrates how events and dynamics related to how agriculture is managed can contribute to violent conflict or political instability.^{xx}

The interaction between environmental stressors, conflict, displacement, and competition over scarce natural resources calls for strengthened joint work in bridging the large-scale immediate humanitarian needs with interventions to build the recovery and longer-term resilience of vulnerable populations. Take for instance, the case of Somalia, where meeting food security needs call for hundreds of millions of dollars in food assistance, when rehabilitating the major irrigation systems in Somalia leading to a more productive agriculture would much less. The current humanitarian aid to guarantee food security could be rendered unnecessary if at some point we manage to break the vicious circle of need and instead invest to repair the five main irrigation systems of the country. The difficulty is to combine the life-saving assistance needed when the crisis hits with the structural investments in development so that it does not hit again. The UN is already leading joint efforts by humanitarian, development and peace partners to deliver urgent humanitarian assistance and build resilience, in line with the agreements reached at the World Humanitarian Summit.

Pathways to transform our world through the transformation of agriculture

For agriculture to survive on the right amount of water and land, for the planet to survive on the right temperature and use of resources, and for humankind to survive on the right amount of food, new pathways have to be charted towards agricultural transformation. Let me suggest three elements to consider as we reflect on what it will take to chart those pathways.

First, and perhaps the most important point, is that seeking to transform agriculture in a silo is not going to work. I would argue that this is valid beyond the discussion on agriculture. It illustrates the integrated approaches and the identification of interlinkages across sectors that we will need to consider as we advance towards the achievement of the Sustainable Development Goals (SDGs) and the implementation of the 2030 Agenda. Agriculture has to be understood as part of the “agriculture economy,” with all its upstream and downstream linkages, and this “agriculture economy” is, in itself, part of a broader economic, social, and political system.

Let me illustrate what I mean with an example. Food consumption preferences, as I argued above, will have a major impact on the future evolution of agriculture. What people choose to eat will have a bearing on the impact of agriculture on the environment, but also on our individual and public health. In fact, increasingly, non-communicable diseases, many linked to dietary habits, are already a major cause of premature death and disability, in both developed and developing countries. So how much of a difference on future pathways for agriculture, the environment, and our health would a change in diets make? One recent study found that shifts in current dietary patterns towards more plant- and less meat-based diets, in line with current health guidelines, could reduce global mortality by 6-10% and greenhouse gases emissions by 29-70% by 2050 compared to a reference scenario. Monetizing these benefits, the improvements in health and environment outcomes could be valued by as much as \$30 trillion dollars by 2050.^{xxi} Yet, acting to unleash these benefits through changes in diets lies largely beyond the purview of authorities with direct responsibility for agriculture, or even

with influence on the broader “agriculture economy.” Encouraging healthier diets that are more plant-based and shrinking excessive consumption of animal products calls for action in sectors such as public health.

Second, we have to shift market incentives and regulations away from maximizing production, and towards optimizing agricultural production systems to enable an “agriculture economy” that invests, maintains, and sustains the foundations on which not only agricultural but ultimately all livelihoods depend. Clearly, farmers and those working in the “agriculture economy” downstream and upstream are not taking these actions deliberately as an act of self-defeat – for them and, ultimately, for the planet. It only so happens that current regulatory systems and economic incentives are not fully capturing the total costs, including to future generations, of these unsustainable agricultural practices.

The challenge here is to ensure that the future of agriculture reflects true costs and true benefits, and that through both the market system and regulatory frameworks, prices are aligned to make agriculture sustainable, both to farmers, and to all of us. And while all natural resources matter, land has a central place in the future of agriculture, but also on how we manage challenges ranging from climate change to urbanization. After all, it was US President Roosevelt that, in the midst of the “dust bowl” – itself the result of unsustainable and destructive agricultural practices – said that it was critical “to conserve the soil as our basic asset. The Nation that destroys its soil destroys itself.”^{xxii}

A reflection of how much room there is to improve within the “agriculture economy” is reflected in that one-third of all the food produced in the world is lost or wasted.^{xxiii} Food losses reflect failures in the agricultural process or downstream to it (for example, in storage or marketing) that impede food to get to consumers, while food waste does reach consumers but is ultimately discarded. This is even more troubling when the economic, and business case is clear: a recent study showed that for every dollar invested by firms in reducing food loss and waste would generate 14 dollars in return.^{xxiv} And, similarly, the public initiatives are both effective and cost efficient. An initiative in the UK reduced household food waste by more than 20 percent between 2007 and 2012, with a 250:1 return on investment. These high rates of return should not be surprising, given the inefficiency of a system in which one in three of everything that is put into it – inputs, resources, human ingenuity and labor – vanishes. Something that would be unacceptable in most settings, but it is tolerated by today’s “agriculture economy.”

Third, we need to leverage agriculture to further enhance livelihoods, in and off the farm, in rural areas. Of the 570 million farms around the world, 90 percent – producing 80 percent of the world’s food - are managed by one person or a family. And 84 percent of family farms are small (occupying less than 2 hectares), with many small family farmers being both poor and food insecure.^{xxv} They are vulnerable to shocks, often hesitant to use new and better crops or methods, in the absence of risk management tools, with intensive resource use threatening the viability of their farms. Yet, this is not the reality everywhere, and we know that farmers can be empowered if they are better connected to markets (for both inputs and outputs), have means to manage risks (including by diversifying their income, having access to insurance, and being provided social protection), and are given access, and a stake in developing, new technologies and farming innovations, including those that can lead to more sustainable use of resources.

With farmers more connected to markets, to information, and to knowledge, lives on the farm can make agriculture more attractive to youth, including young people with skills. Lives on the farm are not condemned to be seen as low-status livelihoods, if through the use of agricultural science, through the deployment of innovative ICTs, and through the development of financial products (from credit to insurance), opportunities are seized to both increase yields sustainable and raise farmers’ incomes, including by adding value to primary products (for example, producing jams out of fruits).^{xxvi} Higher purchasing power on the farm will also spur non-farm economic activities in rural areas, as lower food prices and higher incomes combine to increase demand for non-agricultural goods and services that can be produced in rural areas.

Conclusion

The subtitle of the 2030 Agenda for Sustainable Development is: “transforming our world.” I would argue that through the three elements that I have just outlined, the transformation of agriculture can be a fundamental enabler for the achievement of the SDGs. My main message today is that to transform our world, as called for in the 2030 Agenda for Sustainable Development, we need to transform agriculture. Doing so cannot be seen as a technical challenge to be addressed within the agricultural sector, but rather as a complex undertaking that calls for integrated approaches considering economic, environmental, and social aspects. It is in many ways a profound political reforms agenda. And an agenda that needs to recognize farmers as agents of change, operating within a larger “agriculture economy,” that with the right incentives and enablers, can leverage agriculture to enhance livelihoods and sustainability.

The agricultural transformation has to happen with the same speed, if not more rapidly, than the changes that we saw over the course of the 20th century. The shifts need to be enabled by an “agriculture economy” that makes the enterprise much more than being about producing crops, moving agriculture towards enabling the management of ecological assets, from which we derive ecosystem services for agriculture and beyond. Agriculture has to be transformed to benefit those that have “been left behind,” amidst a world of excessive food production that coexists with the immoral paradox of widespread hunger. And, finally, agriculture has to be transformed to enable risk management, including conflict risk, rather than being a multiplier of cascading threats.

It might be appropriate to end by quoting Amartya Sen, to whom I referred to earlier, and the conclusion of his McDougal lecture. He said that “Doing one thing at a time is never particularly good advice when it comes to economic and social policy.” He went on to say that this is particularly misleading in tackling massive challenges like the prevalence of hunger in the modern world. He called, therefore, for all of us to do many different things – together. It is the same appeal that I leave you with today, so that we can transform agriculture to transform our world.

ⁱ <http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS>

ⁱⁱ <http://data.worldbank.org/indicator/SL.AGR.EMPL.ZS>

ⁱⁱⁱ All data in this para:

http://www.wri.org/sites/default/files/Shifting_Diets_for_a_Sustainable_Food_Future_1.pdf

^{iv} <https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-06-27-chokepoints-vulnerabilities-global-food-trade-bailey-wellesley.pdf>

^v Foley, J. A., R. DeFries, G. P. Asner, C. Barford, G. Bonan, S. R. Carpenter, F. S. Chapin, M. T. Coe, G. C. Daily, H. K. Gibbs, J. H. Helkowski, T. Holloway, E. A. Howard, C. J. Kucharik, C. Monfreda, J. A. Patz, I. C. Prentice, N. Ramankutty, and P. K. Snyder. 2005. “Global Consequences of Land Use.” *Science*. 309: 570–574.

^{vi} Defined as living under water scarcity conditions for at least one month of the year.

<http://advances.sciencemag.org/content/2/2/e1500323>

^{vii} <http://www.un.org/waterforlifedecade/scarcity.shtml>

^{viii} <https://www.cbd.int/agro/whatstheproblem.shtml>

^{ix} www.mdpi.com/2071-1050/7/1/866/pdf

^x <https://www.theguardian.com/environment/2015/dec/02/arable-land-soil-food-security-shortage>

^{xi} <http://www.fao.org/3/a-i6030e.pdf>

^{xii} <http://www.nejm.org/doi/10.1056/NEJMp1311479>

^{xiii} <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4380918/#b26>

^{xiv} <http://www.fao.org/3/a-i4646e.pdf>

^{xv} <http://www.sciencedirect.com/science/article/pii/S030691921600021X>

^{xvi} All data in this para: <http://www.fao.org/3/a-br323e.pdf>

^{xvii} Marshall Burke, Solomon M. Hsiang, and Edward Miguel, 2015. “Climate and Conflict.” *Annual Review of Economics*. 7(1): 577-617.

^{xviii} Carl-Friedrich Schleussner, Jonathan F. Donges, Reik V. Donnera, and Hans Joachim Schellnhuber. 2016. “Armed-conflict risks enhanced by climate-related disasters in ethnically fractionalized countries.” *Proceedings of the National Academies of Sciences*. 113 (33): 9216–9221.

^{xix} Nina von Uexkulla, Mihai Croicua, Hanne Fjelde, and Halvard Buhaug. 2016. "Civil conflict sensitivity to growing-season drought." *Proceedings of the National Academies of Sciences*. 113 (44): 12391–12396.

^{xx} Colin P. Kelleya, Shahrzad Mohtadib, Mark A. Canec, Richard Seagerc, and Yochanan Kushnirc. 2015. "Climate change in the Fertile Crescent and implications of the recent Syrian drought." *Proceedings of the National Academies of Sciences*. 112(11): 3241–3246.

^{xxi} <http://www.pnas.org/content/113/15/4146.full>

^{xxii} <http://www.presidency.ucsb.edu/ws/?pid=15373>

^{xxiii} http://www.wri.org/sites/default/files/reducing_food_loss_and_waste.pdf

^{xxiv} <http://www.wri.org/blog/2017/03/numbers-business-case-reducing-food-loss-and-waste>

^{xxv} <http://www.fao.org/3/a-i4646e.pdf>

^{xxvi} <http://www.undp.org/content/undp/en/home/librarypage/hdr/africa-human-development-report-2012.html>