World Federation of Engineering Organisations

The Committee on Engineering and the Environment

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Engineers and agriculture – contributing sustainable solutions towards the world's food and water security.

Engineering and Agriculture – Finding a Balance With the Environment

By Darrel Danyluk, P.Eng. FEC, FCAE, FEIC, FCSCE

Darrel Danyluk chairs the WFEO Standing Committee on Engineering and the Environment (CEE).

The WFEO Standing Committee on Engineering and the Environment (CEE) Strategic Plan for the 2011–2015 term has selected key industrial sectors where the environment and engineering ingenuity are vital to providing, protecting and enhancing societies' quality of life.

This newsletter focuses on the agricultural sector and elements where engineering plays a role in finding a balance between the environment and the delivery of sustainable food. Fertilizer, irrigation, transport, storage, waste management and telecommunications are examples where engineers' ability to innovate is needed. This innovation goes beyond the traditional view of engineering, where built infrastructures are provided. By recognizing the necessity for interrelationships with the actors in the sector and for building technical capacity at local levels, engineers are broadening their reach and influence, and contributing by increasing the efficiencies within the agricultural sector. From improving transport

facilities, to irrigation technologies; and from enabling market-access through wireless-communication to protecting surface water through adequate waste and fertilizer systems, engineers are important contributors of the food supply chain that society depends upon.

The CEE Agricultural Task Group is tasked with the following objectives:

- To develop an understanding, knowledge and capacity to address selected key problems within the agricultural supply chain at a regional or country level that would benefit from engineering;
- To foster co-operation between the engineering and agricultural communities;
- To provide on-going engineering advice to the Farming First organization; and
- To provide the engineering perspective on agricultural supply issues internationally at the United Nations Framework Convention on Climate Change (UNFCCC) and the UN Conference on Sustainable Development (UN-CSD).

The work will extend over the next few years and members with relevant experience are being sought to broaden the skill base of the task group. If you are interested, please contact the CEE secretariat at: david.lapp@engineerscanada.ca

Of particular importance is the WFEO contribution to the on-going work of Farming First. Through WFEO involvement at the United Nations Commission on Sustainable Development as co-chair of the Scientific and Technological Community, WFEO and our co-chair, the International Science Council, joined two other major groups to create Farming First. The Farming First coalition exists to articulate, endorse and promote practical, actionable programs and activities to further sustainable agricultural development worldwide. Farming First has no secretariat and it is not intended that one will be created. The WFEO-CEE contribution is to provide engineering and technical input into documentation produced by Farming First. This newsletter offers further insight on these initiatives.

Farming amounts to a most fundamental and essential human activity. Even in highly urbanized and industrialized countries, sizable sectors of the population are only a generation or two "off the land."

Whether or not we are farmers, we are close to the land and closely reliant upon it for our very survival.

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Farming and Engineering Walk Hand-in-Hand

By Robynne Anderson

Robynne Anderson is a consultant to the World Farmers Organisation and a member of Farming First.

Farming First promotes practical, actionable programmes and activities to further sustainable agricultural development worldwide.

Food prices are rising and demand for cereals has outstripped production seven of the past ten years. Just watching the news each night, the need to link engineering, technologies, and capacity building to agriculture is clearer now than it has been in the last half century.

That is why World Federation of Engineering Organisations (WFEO) was a founding member of the Farming First coalition. Farming First promotes practical, actionable programmes and activities to further sustainable agricultural development worldwide. With this in mind, its web site is a bountiful resource of information on farming and sustainable development (www.farmingfirst.org). Over 131 organisations representing the world's farmers, scientists, engineers and industry as well as agricultural development organisations, are supporters.

Improving Farmers' Livelihoods

With one shared voice, Farming First highlights the importance of improving farmers' livelihoods and agriculture's potential contribution to global issues such as food security, climate change, and biodiversity. It also aims to build synergies amongst its supporters in promoting Farming First's mission.

"We have a strong communications team that has won awards for our efforts to highlight sustainable agricultural development," explains Morgane Danielou, Co-chair of Farming First. "WFEO has brought a focus on capacity-building and interdependency to the coalition. Working together with a group like WFEO has helped us expand our expertise and get meaningful policy outcomes focused on what farmers and all agricultural actors will need to grow."

Agriculture Top Rio+20 Priority

From the perspective of WFEO, engagement has encouraged a focus on capacity-building in the context of these challenges. An example is the recent engagement at Rio+20, which saw agriculture become a top priority issue in the final outcome.

Where engineers can help includes:

- Focusing investment on sustainable agriculture practices, rural infrastructure, storage capacities and related technologies, co-operatives and value chains;
- Enhancing agricultural research extension services and training to improving agricultural productivity and sustainability;
- Empowering farmers, fishers and foresters to choose among diverse methods of achieving sustainable agricultural production;
- Significantly reducing post-harvest and other food losses and waste throughout the food supply chain; and
- Enhancing resilience to climate change and natural disasters.

A few examples of relevant language directly from the Rio+20 text include:

109. *We recognize that a significant portion of the world's poor live in rural areas, and that rural communities play an important role in the economic development of many countries. We emphasize the need to revitalize the agricultural and rural development sectors, notably in developing countries, in an economically, socially and environmentally sustainable manner. We recognize the importance to take the necessary actions to better address the needs of rural communities through, inter alia, enhancing access by agricultural producers, in particular small producers, women, indigenous peoples and people living in vulnerable situations, to credit and other financial services, markets, secure land tenure, health care and social services, education and training, knowledge, and appropriate and affordable technologies, including for efficient irrigation, reuse of treated waste water, water harvesting and storage….*

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207. ….We note the importance of mitigating the effects of desertification, land degradation and drought, including by preserving and developing oases, restoring degraded lands, improving soil quality and improving water management, in order to contribute to sustainable development and poverty eradication... *We also encourage capacity building, extension training programmes, and scientific studies and initiatives aimed at deepening understanding and raising awareness of the economic, social and environmental benefits of sustainable land management policies and practices.*

Zero Hunger Challenge

Rio+20 culminated in the launch of the UN Secretary General's new Zero Hunger Challenge, which caps a long effort to get a focus on food and nutritional security. Ban Ki-moon said: "Zero hunger would boost economic growth, reduce poverty and safeguard the environment. It would foster peace and stability."

The Zero Hunger Challenge has five main objectives: to achieve 100 per cent access to adequate food all year round; to end malnutrition in pregnancy and early childhood; to make all food systems sustainable; to increase growth in the productivity and income of smallholders, particularly women; and to achieve a zero rate of food waste.

Graphic shows poster created in connection with three side-events that Farming First hosted during the recent Rio+20 gathering in Rio de Janeiro.

Sustainable Development Goals

Following Rio+20, the UN is embarking on a process to establish Sustainable Development Goals (SDG). There is already a process underway to establish the post-2015 development framework to replace the Millennium Development Goals (MDG). Certainly hunger and food are high on both the MDG and SDG agendas. For WFEO and our Farming First partners, it is a chance to highlight the impact of good engineering as a solution to improve food production, and to enhance reliability of the distribution chain.

"Farming First has been a dynamic partner coalition for WFEO," says Darrel Danyluk, P. Eng., a member of the WFEO Rio+20 coalition. "It has been a symbiotic relationship that has provided another forum to talk about science and engineering while intersecting with one of the most pressing issues facing the world today."

Engineering and Sustainable Agriculture – Transforming Words Into Action

By Fethi Thabet

Fethi Thabet, a Tunisian engineer, is co-ordinating the work of the WFEO-CEE Engineering and Agriculture Task Group. He is a founding member of the Tunisian Order of Engineers. He is a long-serving (20 years) CEE member and for four years served on WFEO's Executive Committee. He is a graduate of the Ecole nationale superieure des télécommunications de Paris and holds a master's degree in transportation planning and management from the Central London Polytechnic. Mr. Thabet has spent much of his career in transportation policy development and currently is an Advisor to the Chief Executive Officer of Tunisair, Tunisia's flag carrier.

> *"There is still enough water for all of us. But only as long as we keep it clean, use it more wisely and share it fairly" UN Secretary General Ban Ki-moon*

Overview

The world community of engineers is engaged more than ever in backing the United Nations in its effort to put the planet on the path of inclusive and environmentally sustainable growth. Engineers are committed to identifying, developing and implementing innovative and sustainable solutions that allow for an efficient use of world resources. The profession is ready to provide thought, leadership and appropriate technology-led solutions in all sectors of the economy and particularly in agriculture.

Why is agriculture so important for the future? The main reason is that there is a widespread recognition of the growing role of agriculture in building a global green economy. This sector is regarded as an engine suited to eradicate poverty, to reduce inequality, to ensure food and nutrition security worldwide, and to improve the standard of living of those living in rural areas. Millions of small farmers represent 50% of the poorest population.

Engineers play an increasingly important role in the agricultural field.

The world population will increase from seven billion today to more than nine billion by the year 2050; of those, more than 70% will live in urban areas. Despite the effort undertaken over the last 20 years, more than one billion are hungry.

For many countries, agriculture's share of the GDP exceeds 50%. Most of these countries are in Africa and Asia (for example, Chad, Comoros, Guinea-Bissau, Liberia, Sierra Leone). So, any growth in agriculture has direct impact on poverty reduction.

Agriculture and the Green Economy

The drive toward a green economy goes through agriculture, which worldwide accounts for:

- 70% of water consumption;
- 34.3% of land area;
- 30% of greenhouse gas emissions (deforestation 13%); and
- 37.3% of total labour forces.

In contrast to sectors like industry or transport, agriculture has a huge potential to reduce carbon emissions. Because of improvements in crop yield, a saving of more than 34% of total carbon emissions has been achieved over the last decade.

Climate Change

Climate change is among the factors causing serious problems.

The warming of the climate will affect many African countries as yields from rain-dependent agriculture (important to the poorest farmers) could be reduced by up to 50% by the year 2020. Furthermore, any warming above three degrees Celsius will have negative impact on productivity. This will increase food prices, which already are high in many low and middle-income countries. This, in turn, will increase the risk of hunger.

At the same time, agriculture is still an important contributor to the climate problem as the industrial agriculture system depends on synthetic fertilizers and intensive use of inputs like fossil fuel and water.

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FOCUS AREAS FOR FUTURE ACTIONS

Facing Land Degradations

It is estimated that every year 80,000km^2 are degraded (more than 24% of the soil used by agriculture). The most vulnerable areas are Sub-Saharan Africa, where recent figures show 65% of the land is degraded. As a result, land restoration and regeneration are urgently needed to reduce the scope of migration.

In addition, Africa is suffering from severe climate conditions, civil conflicts, low productivity and insufficient use of technological innovation. Many farmers told us during the June Rio+20 convention that they need knowledge and not money. So engineers are in the front line to review the management of land and regenerate soils and improve rural infrastructure.

Deforestation

Every year, thousands of square kilometres catch fire (this summer, for example, in Algeria 21,000km^2). If we lose the forests, we lose the fight against climate change. In Kuwait, 75% of the land is prone to overgrazing and this causes degradation of vegetation cover and loss of biodiversity.

The contribution of engineers can be in drafting guidelines and disseminating successful examples of reforestation in different physical areas. The guidelines should also cover methods used to reduce the pollution resulting from the processing of forest production.

Desertification

Desertification affects more than one third of the world landmass, resulting in more than 1.5 billion persons facing the threat of hunger and migration (70 million persons leave rural areas every year) especially in Africa, Asia and Middle East.

Facing Hunger and Food Insecurity

The big challenges for engineers now are:

- To build a sustainable world supply chain and reduce food losses and waste during harvest, storage, distribution, transportation or during processing or packaging as many countries set up quantitative objectives for loss and waste reduction.
- To increase agricultural yields: engineers can foster applied research and share and disseminate knowledge to identify adequate solutions as the demand for food will double by 2050. In many areas, like Middle East and North Africa, more than 40% of crop productions are at risk by 2025 because of water availability and yields may decrease by 20% because of climate change.

Water, whether too much or too little, is vital to the success of agriculture and the well-being of this African farmer and millions of others.

Water Security

The global water system is changing without adequate knowledge of those changes. How is this evolving and how can we respond?

During the past century, population has tripled and the use of water increased six times. Nowadays, more than 2.7 billion people face water shortage and the situation is likely to worsen.

The quality of water has been degraded because of climate change; the precipitation patterns increase the risk of floods and change the seasonal run-off. Practices like pumping water faster than it is replenished are unsustainable.

Another issue is related to water pollution. Livestock is among the largest sectoral sources of water pollution and is responsible for 64% of ammonia emissions, which contribute to acid rain.

The WFEO-CEE Draft Strategic Plan (2011–2015), in the field of sustainable agriculture, emphasizes the urgent need for new innovative solutions for better use and management of the water resource system to adapt to climate change. Control of water pollution is also needed. This is especially the case in Africa where precipitation is expected to decrease by 33% in some regions and increase by 22% in others.

Footnote: Statistics cited in this article were taken from two documents on the Farming First website. (www.farmingfirst.org)

Role of the Agriculture Engineer in Achieving Food Security

By Boubaker Thabet

The author is Professor of Agricultural Economics at the National Institute of Agriculture in Tunisia.

"Providing assistance to building capacities of agriculture engineers should be a top priority."

The engineer is viewed as a skilled, generally educated person capable of calling on science and technology to find operational solutions for real world problems by taking into consideration effective constraints limiting decision-making and progress. The agriculture engineer does this in domains related to agriculture and food.

Food security is taken to mean a state in which a person, a region or a country is confronted with as little uncertainty as possible in finding and accessing to food.

From this point of view, requirements for successful agricultural engineering in augmenting food security, which is equivalent to reducing food insecurity, are:

(i) skills to adequately address and identify food security or insecurity problems (This depends upon the nature and quality of the engineer's training.);

(ii) knowledge about the food insecurity particularly in terms of causality;

(iii) neutrality in addressing food security complexities so as not to bias the analysis and treatment of food insecurity issues and problems.

In this context, food security treatment and analysis are viewed as the end objective and the engineer's know-how is one of the possible tools that could contribute to achieving such an objective.

Food security involves two aspects: the demand side of the seeker of food and the supply side that provides the food.

Supply and Demand Variables

Elementary economics tells us that the demand side is heavily determined by the consumer's absolute income; among other things, the cost of food items; its fluctuation through time and space; and the socioeconomic characteristics of the consumer etc. The more these variables favor the consumer, the more secure he would be.

The supply of food items also plays a very important role in providing security to the consumer. Typically, food supply has two origins – national and international. The national component is a function of the internal resource potential, plus the technical know-how provided to farmers by research and extension facilities. It is also affected by climatic and natural resource variability and the quality of the national and international market functioning and performance.

Food security is also quite relative depending on the commodities, consumers, regions and countries. Food security or insecurity are dynamic and evolving in that food demand and, particularly supply, are never stable.

Perceptions by Public Authorities of Food Security Are Sometimes Misleading

The public perception of food security as one-view-of-the-consumer-fits-all can be quite misleading. One important segment of the population can face severe food insecurity while most of the population is quite secure. The accounting macroeconomic view of food security, measured in terms of how close or how far from a balanced food trade situation a given country is, while apparently reassuring when it is favorable, can hide very destabilizing factors, which can become very socially explosive.

Ultimately, food security or insecurity is a household concern. It can be a public concern in view of the diverse and sporadic use and misuse of public policy instruments, which no doubt distort an otherwise spontaneous economic and social behavior. Distortions obviously have advantages to those who benefit and disadvantages to those who are penalized.

Policies May Overshadow Debate

To cover up and justify public-policy errors, officials often use the concept of staple, strategic, basic, sensitive and/or sovereign commodities to argue for what could otherwise be ill-advised food policies. While important considerations to study in depth and with skills, these commodity qualifiers have publicly been used in many counties to overshadow adequate public debates about food policies issues.

Importantly, while it can be a cause for social and economic stability or instability, food policy security or insecurity are in themselves endogenous (i.e., result from the interaction of many determining variables). One can notice that in a number of countries significant food deficits have emerged as a result of public policies promoting inexpensive basic food items. This has resulted in large imports from world markets where prices

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have recently been quite volatile, thus making domestic economies increasingly and heavily dependent on international supply, and thereby necessitating public budget outlays that these countries cannot afford.

"Strategic" Commodities Prompt Interventions

Food insecurity questions correspond nowadays to the so-called strategic commodities, which almost everywhere are the subject of policy interventions. It is argued that they are commodities that are heavily consumed by all population segments. Rarely considered, however, is what the level of consumption of those commodities would have been with no or less policy encouragements.

It is believed that new and alternative ways of looking at a number of not only food-security but also more generally true and lasting development issues are needed. It is also hypothesized that agriculture engineers with adequate and comprehensive training programs could contribute to better formulating development questions and issues. In our view, the role of the operational engineer is first in helping diagnose situations and problems; it is not in inculcating learned recipes in classrooms.

Hence providing assistance to building capacities of agriculture engineers should be a top priority. This could involve primarily long-term, but also on-the-job training at relevant scientific and research centers.

Quality applied research dealing with resource limitations to promote food security on the supply side is also of utmost importance. Adequate resource utilization and preservation are also of great need to many countries with limited natural resources.

In some countries, natural biological diversity has been declining due to intensive use of resources promoted by public policies and subsidies. This has sometimes resulted in excessive use of fertilizers and pest-control chemicals, and contributed to pollution of soils and irrigation waters. Similarly, public subsidies for pasture and grazing have resulted in over-investments in animal stocks.

These are typical areas where well-trained engineers could contribute to minimizing or, at least, reducing the risks of food insecurities.

Call for abstracts due November 15, 2012. See website for details and scope of topics.

WFEO-CEE and Related Upcoming Events

- Sept. 16, 2012 Ljubljana, Slovenia – WFEO-CEE Face-to-Face Meeting #5
- Sept. 20, 2012 Ljubljana, Slovenia – WFEO Executive Council Meeting
- Nov. 26 – Dec. 7, 2012 Doha, Qatar – United Nations Framework Convention on Climate Change – Conference of the Parties - Meeting No 18 www.unfccc.int
- June 3 – 14, 2013 Bonn, Germany – UNFCCC Subsidiary Body Climate Talks www.unfccc.int

Meetings Relating to WFEO-CEE Themes

Themes 1 and 2 – Climate Change Adaptation and Mitigation

- May 27 – 29, 2013 Montréal, Quebec, Canada – 3rd Climate Change Technology Conference 2013 www.cctc2013.ca
- Sept. 11 – 13, 2013 Singapore – World Engineers Summit 2013 – Innovative and Sustainable Solutions to Climate Change www.wes2013.org

Theme 3 – Engineering and Agriculture

- July 6 – 7, 2013 Hong Kong – 2013 3rd International Conference on Environmental and Agriculture Engineering – ICEAE 2013 www.iceae.org

Theme 4 – Engineering and Mining

- Feb. 24 – 27, 2013 Denver, Colorado, USA – 2013 SME Annual Meeting and Exhibit – "Mining - It's About the People" www.smenet.org
- May 22 – 23, 2013 Aachen, Germany – 4th International Symposium on Mineral Resources and Mine Development www.aims.rwth-aachen.de
- June 30 – July 3, 2013 Milos Island, Greece – 6th International Conference – Sustainable Development in the Minerals Industry (SDIMI 2013) www.sdimi2013.conferences.gr

Theme 5 – Sustainable Development and Environmental Stewardship

- Oct. 23 – 25, 2012 Addis-Ababa, Ethiopia – Eight Annual African Development Forum – "Governing and Harnessing Natural Resources for Africa's Development" www.uneca.org
- Nov. 6 – 8, 2012 Manila, Philippines – Third Asian Development Bank Transport Forum – "Inclusive and Sustainable Transport" www.adb.org/transportforum2012

Report on the United Nations Rio+20 Summit

The WFEO, through the UN Relations Committee, chaired by Engineer J. Spitalnik of Brazil, was involved in the organization and execution of two important events prior to the United Nations Rio+20 Summit held in Rio de Janeiro, Brazil, June 20 – 22. (www.uncsd2012.org) These events served to increase awareness of the important role of engineering and science in addressing world sustainability issues such as food security, sanitation and potable water supply.

Members of the Organizing Committee of the WFEO Sustainable Communities Day held in conjunction with the United Nations Rio+20 Summit: (left to right) Victoria Rockewell, Dan Hoornweg, Jorge Spitalnik, Darrel Danyluk, Jose Tadeu de Silva, Deborah Shields, Michael Michaud, David Lapp and Fethi Thabet.

Rio+20 Science and Technology Forum – June 10–15, 2012

The five-day Forum was held at the Rio Catholic University in Rio de Janeiro and attracted nearly 1,000 participants. WFEO participated throughout the sessions, presented a keynote statement and the CEE Chair and Secretary had many opportunities with delegates to explain an engineering perspective on sustainability issues, as well as the importance of engineering and science working together towards resolving sustainability issues.

The sessions focused on human well-being and population trends, climate and other environmental changes, food security, water security, urban well-being, ecosystem services and biodiversity, indigenous knowledge, disasters, energy, green economy and rethinking social and economic models. Chair summaries of these sessions and further results of the Forum can be found at www.icsu.org.

WFEO Sustainable Communities Day – June 16, 2012

This event consisted of a seminar on sustainable communities with high-quality speakers and excellent presentations. Two sessions covered achieving sustainable communities in large urban settings, as well as small and rural communities. The third session focused on risk assessment and sustainable engineering solutions for communities. This was followed by the adoption of a declaration on sustainable communities that was submitted to the United Nations Secretariat for Rio+20. The Declaration is posted on the World Federation of Engineering Organizations website and was communicated to all national members with an encouragement to use it to engage with their national governments on sustainable development and sustainability issues.

UN Rio+20 Summit Preliminary Meetings and Preparations

The World Federation of Engineering Organizations (WFEO) together with the International Science Council (ICSU) serve as co-chairs of the United Nations Major Group on Science and Technology. The WFEO Co-Chair is Engineer J. Spitalnik and members of the CEE, including Chair D. Danyluk, FEC, P.Eng., are significant contributors.

WFEO and ICSU together participated vigorously in the development of contributing text as stakeholder input to the development of the final declaration of the Summit. Numerous interventions and presentation of views were tabled at the preparatory sessions to explain the engineering perspective and the role of engineering in sustainable development and sustainability. These are available on the WFEO website.

Finding a Balance (continued from page 1)

Just because farming has a long tradition, doesn't mean there is no room to improve agricultural techniques and technologies. The UN estimates up to 50% of all food produced is lost to pests, spoilage or waste. In fact, for the very reason that farming's roots run so deep, there is added and continuing need to improve the methods used. Engineers have a vital role in enabling such advances.