Notes from July 22, 2013 Global Forum at ASABE AIM, Kansas City, Missouri
Notes by Sonia Maassel Jacobsen

Introduction –

President Bob Easter, University of Illinois-19th president of the University who began this role in 2012:

Both ASABE and the University of Illinois Agricultural & Biosystems Engineering Department experienced a name change which acknowledged that they are confronting the challenges that involve animal and plant biology. Easter stated that he hoped this forum and subsequent collaboration would link discoveries and set the stage for the future. Dr. Easter stated that he would "Help you think and give some insights as an outsider to the discussion." Today's challenges are food, water, energy, people. We are challenged to raise, produce, and distribute food to the world. Water resources are increasingly needed by many and costly. How can we prepare the next generation to pick up these challenges?

Discovery science and education are critical to solving these issues. What will your role be? Looking forward… We remember the Green Revolution with the thought that we did it once, we can do it again. However, the landscape has changed. The Green Revolution heavily involved America. The world now is very different. Successful and competent engineers and scientists in many countries around the globe are contributing their studies to the body of knowledge. The role of the private sector for technology transfer and applying and innovating with basic concepts is greater. The focus could be fundamental discovery but we also need to take fundamental discovery into application. Population growth and rising incomes are factors. The world needs to develop supply chains. The arable land remaining is limited. Food security is of wide interest. The safety of the food supply is a common concern among urban dwellers. Youth explosion and a growing senior population are concerns. Who will replace those leaving the farm?

Growing up, most food came from within 200 miles of Easter's residence. Now it comes from around the world. How can we increase the efficiency of the supply chain for food to reach cities? Governance issues are key to solving food supply issues. Countries are dysfunctional because governance has failed. How can we organize ourselves around the challenges? (Refers to graphic) Examples. What is the system that will orchestrate accomplishments such as these? (Photos: Pyramids, Roman aqueducts, Great Wall of China.) The approach to this issue must include strategic intent. What is the strategic intent of ASABE? UI ACES has set its focus as: ***Globally preeminent and locally relevant.*** When Dr. Easter started as chancellor in 2009, economic challenges dominated and focus was on maintaining institutional quality at UIUC. Now the Striving for Excellence goal focuses on strategic intent. Easter referred to a document by the American Society of Animal Sciences - Farm Animal Integrated Research (FAIR) 2012 Summary.

We constantly seek Insights: What worked? What doesn't work? Why or why not? What criteria should be applied? We analyze and evaluate Alignment, Commitment, Leadership, Mission, Goals. Those involved need to know why they're doing something. What is the scope of the mission? The management challenge is to get the right people with sufficient resources, and reasonable costs in the right places.

Each of our eleven panelists has been asked to speak from their experience. What are the 2-3 most critical challenges in your region? What approaches are being employed to solve these challenges? What barriers to success have you encountered? What opportunities exist for collaborating? Each panelist will speak for 3 to 5 minutes after which the audience is invited to submit questions to the moderator for panelists to answer. Cards were made available on each chair in the room.

Remarks from Panelists:

1. Jong Hoon Chung – Korean Society of Agricultural Machinery

Korea has two challenges: food and energy. The Korean dietary life and food policy are changing due to 1) rapid economic growth, 2) new substitute foods, 3) new food processing technology, 4) income level, and 5) change in foreign policy such as the FTA. The 2011 levels in Korea for self-support are 45% for food and 24% for grain. This ratio is low compared to other OECD countries. If North and South Korea reunite, the current level of food security is very low. Therefore, a stable food self-support policy is very important for Korea.

Korea's current food policies are: 1) National investment to increase the self-support of food and grain, 2) Establishing environmentally friendly stockbreeding, 3) Prudent opening of the Korean agricultural market, 4) Establishing the national food management system, 5) Expanding R&D in agriculture, 6) Preparing for climate change, 7) International cooperation in agriculture.
Among these food policies Korea is focusing on investment in the industrial agriculture R&D to develop practical technology.

Energy is the second major problem for Korea. Korea is a resource poor country. Korea imports 97% of energy resources from overseas. Energy consumption is ranked 10^{th} in the world. In 2011, Korea's energy consumption was 39% oil, 29% coal, 17% natural gas, 12% nuclear energy and 3% renewable energy. However, Korea is striving to increase renewable energy to 5% by 2015.

Korea's current energy policies are focused on: 1) Increasing national R&D investigation of renewable energy, 2) Concentrating to secure optimum level of backup power by increasing power plants, 3) Developing the technology to reduce the greenhouse gases, 4) Introducing a policy to stabilize the price of energy. Korea's current focused research areas of energy are 1) renewable energy, 2) thermal energy network, 3) CO_2-free, 4) clean fuel, 5) next-generation battery, 6) energy convergence material. Korea is investing in the energy convergence materials research such as biofuel, biogas, biomass and also investing in developing technology to produce high-efficiency hydrogen energy.

Summary: Korea is exposed to various food and energy issues, and national R&D is working actively to solve them. Particularly, development of high value food and new renewable energy is required. Also, as there are national concerns and active investments for global challenge issues, Korea needs to discuss global collaboration in the agricultural and biological engineering field.

2. Daniella Jorge de Moura, Brazilian Society of Agricultural Engineering and Latin American and Caribbean Association of Agricultural Engineering (ALIA)

Good morning everyone, and thank you for this opportunity to speak briefly about the issues facing Central and South America. But first of all, I would like to thank the American Association of Agricultural and Biological Engineers for the opportunity to represent Alia (The Latin American and Caribbean Association of Agricultural Engineers) and SBEA (The Brazilian Association of Agricultural Engineering) for whom I am currently the president. I also thank the CONFEA – Brazilian Federal Council of Engineering and Agronomy for funding my participation in this ASABE meeting.

ALIA was founded in 1994, with the objective to join all the Agricultural Engineering Associations from Latin America and the Caribbean.
SBEA was founded in 1965, and like ASABE, has the main objective of creating opportunities to discuss and disseminate scientific knowledge applied to Agricultural Engineering. Today, we have more than 1,000 members, and our next Brazilian Agricultural Engineering meeting will be held in the city of Fortaleza, from August 4th to 8th, and we are expecting more the 1,000 to attend.
Talking about the top 3 challenges that our organization are facing, we can list:

- The challenge to develop technology and new methodologies to:
    - Produce more food and fiber to feed the growing population, adopting more efficient and sustainable production methods and adapting to climate change.
    - Produce the next-generation biofuels with less direct impact on food crops than first-generation biofuels;
    - Reduce greenhouse gas emissions in livestock and the rest of agriculture.

To meet these critical challenges we promote Scientific and Technical meetings, technical Courses and a Journal named the Agricultural Engineering Journal that has an Impact Factor of 0,353. This has been increasing since we started to publish the articles in the English language.
Perhaps you are aware of the Brazilian initiative, the so-called Science Without Borders program. Brazil has committed to sending more than 100,000 students and faculty abroad, with the purpose of increasing scientific training and promoting the establishment of new initiatives. I would like to thank the many ASABE members that are contributing by hosting our students, and encourage your continued participation. We also need more involvement by key agribusiness sectors to provide unique internships.
Finally, I would like to finish by providing a few key statistics for you to consider:

- SBEA has over 1,000 members. Each meeting includes approximately 500 students, mostly graduate students, as well as faculty and industry representation.
- Brazil's rapidly expanding food and fiber production means we need to continue to enhance our methods for training future engineers in this sector.
- In the past 5 years, Brazil has initiated new courses in Biosystems Engineering, further enhanced its fundamental training in Agricultural and Environmental Engineering, and developed several important undergraduate exchange programs with US partners such as Illinois, Iowa State, Purdue, and Kentucky.
- As a professor and administrator at UNICAMP, the State University of Campinas, I can assure you that we are actively seeking new collaborations and partnerships among industry and

faculty in Agricultural Engineering. We know that students are our future, and your continued efforts and involvement are appreciated.

Thank you for this opportunity. Please feel free to contact me if you would like further information regarding the Brazilian and Latin American scene in Agricultural Engineering.

3. Richard (Dick) Godwin, European Society of Agricultural Engineers (EurAg Eng) and the UK organization IAgrE

1. Thank you for that warm introduction; it is an honor to be here.
2. Firstly I would like to extend the apologies of Florentino Juste who for family reasons cannot attend today. As a result the Secretary General of EurAgEng (David Tinker) - has asked me to speak on their behalf. As this request was at very short notice I am not aware of the formal position of the European Society – but I will, however, give a view from my recent perspective, albeit with a UK bias, but hopefully not too dissimilar to continental Europe, to where I make 6-7 trips per year.

3. In the UK the issues were brought to a head by the publication in 2011 of the Foresight Report – "The Future of Food and Agriculture" commissioned by the then UK Government Chief Scientist, Sir John Beddington. He referred to it as the "The Perfect Storm". These are not dissimilar to the points made by our plenary speaker this morning and Robert Easter a few moments ago.
It highlighted 6 major concerns:-

- Global population increase
- Changes in size and nature of per capita demand
- National and international governance of the food system
- Climate change
- Competition for key resources
- Changes in values and ethical stances of consumers.

And set 5 challenges:-

- Balancing future demand and supply sustainably - ensuring affordability
- Ensuring stability in supply - protecting the most vulnerable from volatility
- Achieving global access to food and ending hunger
- Managing the contribution of the food system to the mitigation of climate change
- Maintaining biodiversity and ecosystem services while feeding the world.

4. My colleagues and I read the report with much enthusiasm - only to be disappointed it made no mention of engineering! So we made an appointment to see Sir John – who agreed with us, and asked us to prepare a response, which we did: "Agricultural Engineering: a key discipline enabling agriculture to deliver global food security". It is available on the website at www. iagre.org

5. Thankfully - "the UK Agricultural Industry" has risen to the challenge and a report - "Feeding the Future" has just been published, picking up on some of the issues raised in the IAgrE Report. This list includes the following topics, among others:

- 1. Use of modern technologies to improve the precision and efficiency of management practices
- 3. Use of systems-based approaches to better understand and manage interactions between soil, water and crop/animal processes
- 4. Develop integrated approaches to the effective management of weeds, pests and diseases

- 7. Extend training, professional development of researchers, practitioners and advisors to promote delivery of the above.

6. Thankfully the politicians did listen and today, at 4.30 am Kansas City time, the UK Government launched its Agricultural Strategy. I'm still not sure how engineering will be represented in this, but I'm told it will reflect the issues raised by "Feeding the Future". Precision Agriculture, Soil and Water Management, and Weed and Pest Control cannot be achieved without engineering inputs.

7. This then brings us to what I call "The Hungry Skills Gap" – the void produced by the 20 years of decline in agricultural research & development and extension which saw many mid - career agricultural engineers leaving the profession to follow other career paths as extension services, research stations and university departments were closed. Making it more difficult for the 60+ engineers to retire because of the skill gap needed to mentor the up and coming graduates and post doctorates (of which I am happy to say are relatively plentiful). My major concern is the lack of firsthand experience of practical agriculture of some of the post-doctoral graduates. Whilst I fully support the need to publish – the focus on "publish or perish" in our universities/research stations can "distort the mission" and should be treated with care as we will not feed the world on scientific publications alone.

8. In Europe the new "Common Agricultural Policy" (CAP) framework was outlined on 26th June 2013 which according to the European Commissioner for Agriculture and Rural Development (Dacian Ciolos) – ".... will lead to far-reaching changes: making direct payments fairer and greener, strengthening the position of farmers within the food production chain and making CAP more efficient and more transparent. These decisions represent the EU's strong response to the challenges of food safety, climate change, growth and jobs in rural areas. ..."

9. I will leave you with a demonstration which shows that we grow our food on less than 3% of the world's surface – so that managing our soil & water resource is crucial, which is reinforced by 2 classic statements:-
The first by - F D Roosevelt "The nation that destroys its soils destroys itself!" and the second by the great philosopher "Anonymous" - "Man has only a thin layer of soil between him and starvation".
Thank you – I hope this has been a useful addition to the discussion. From which there are plenty of opportunities to work with other societies the only barriers are time, money and above all else good leadership and governance at all levels within agriculture. In conclusion I would like to stress that the challenges and opportunities are enormous, and because there are so few of us – we all need to work together using our complimentary skills to feed the world in a sustainable manner. Personally I believe working together we shall achieve this goal – remember that "Engineering" can deliver many of the short term benefits that we need - allowing time for the pioneering research to come to fruition.

4. Klein Ileleji, African Network Group

Hunger, malnutrition, and poverty remain in evidence in much of Africa. Often all of Africa is boxed together but based on diversity this is not true. Africa has a diverse climate from north to south. It also has diverse people groups, diverse history, diverse economic structures. Problems in Africa can only be solved by understanding the diversity. Resources must be distributed where they are needed. No one agricultural society represents the continent. Opportunities for agricultural and

biological engineers are as follows: #1 - Reduce extreme poverty and hunger is main goal in Africa. #2 – Foster strategic partnerships to address needs. #3 - Empower women. 70% of the farming population is women. We need global partnerships for development. Another challenge is how to deliver solutions to those that need them, for example, how do we deliver technology to low-income women farmers owning 2 acres. Africa would like to create jobs for engineers to deliver these solutions to small landowners. This is different from the Green Revolution. We must link agricultural production to markets. We need to be able to sell goods to make money so that subsistence agriculture is not just practiced by farmers but as a source of livelihood by generating income that would help educate their children, pay the bills, grow their business, etc. We seek to link aid to local solutions – we are not trying to feed people but to teach Africans to feed themselves.

5. Anthony Kajewski, ASABE President 2012-2013

We don't have enough agricultural and biological engineers to deal with the current problems. The image of agricultural and biological engineers fell in public opinion. In seeking to interest students in the major, departments changed their name and added biological to the program name. The problems we face all have biological aspects. We need to promote our expertise in these areas. Agricultural engineering is one of the top 10 disciplines needed in the near future per a Forbes magazine article. Enrollment has increased at many universities in recent years. ASABE's name change was made in 2005. Everything we do has a biological aspect. We need to continue to promote what we do. We need to work with high school students to get them to pick Ag & Bio Engineering as a major. ASABE is to be a cosponsor of EWeek in 2015. We need enough engineers to solve the challenges of not enough food, fiber, renewable energy, clean water.

6. Toshinori Kimura, International Commission of Agricultural and Biosystems Engineering (CIGR) Secretary General

CIGR is an international organization, comprised of many regional and national societies. It has no individual members, only societies. Our presence is not widely known but there are challenges in international cooperation. We need to improve our activity to harmonize international activity in this field.

7. Yoshisuke Kishida, Science Council of Japan

Shin-Norinsha Co., Ltd. was established by Kishida's father in 1933 to promote mechanization in Japan. The senior Kishida was the first member of ASABE from Japan. He established the Kishida International Award in 1978. The company is now 80 years old. The Shin-Norinsha continues to promote mechanization in developed and developing countries. Many gaps exist between small farmers and urban dwellers. As the gap increases, the stress on the world increases. As the population grows, technology is needed to increase land productivity. Timely and accurate operation and better mechanization are needed. The Agricultural machinery industry is trying to fill the gaps. The power of our science and technology is increasing rapidly. The Internet lets us share information quickly. Will human beings handle the power of the technology well or not? We need a

good way of thinking to control the power. The world needs harmonization with life systems. Human beings can't survive without harmonization between human beings and other life systems. Food, fiber, forest products, medical products, water, flowers, good environment – all need better harmonization to be adequate in the future. Agriculture's most important function is to change human beings for the better.

8. Ta-Te Lin, Taiwan Institute of Biomechatronics

Taiwan is a small island with less area than New York State, but supports 23 million people. Taiwan has a high population density and small scale agriculture. The large urban population has transformed agriculture in Taiwan two ways/times; first, to agricultural mechanization from hand labor, and second from mechanization to automation. Taiwan has more concerns on food safety and sustainability and environmental concerns now than ever before. Food safety is the #1 concern. #2 concern is feeding people in highly populated areas, trying urban agriculture, and vertical farming. #3 concern is the aging society – a high proportion of farmers are over age 65. How can we introduce young people to agriculture and change the structure of agricultural industry will be a great challenge. Taiwan needs to apply new technology to agriculture. Politicians need to be encouraged to support for agriculture. Taiwan needs to reorganize people and industry to be involved in agriculture. Lin witnessed agricultural mechanization as it happened and saw the change from manual labor. Rice production is now very mechanized in Taiwan. Formerly, grain was dried with solar energy but now large drying systems dominate. The future will be good – as Helmi Ansari said: Live well, forever.

9. Bernardo Predicala, Canadian Society for Bioengineering (CSBE)

Previous speakers already described some of the challenges in North America in general, and for the most part Canada faces a similar situation. The top challenges unique to the Canadian setting include: 1. growing the expertise required to drive and sustain the bioeconomy (agriculture and forestry) in a cold-climate production environment within the context of globalized agribusiness; 2. building value-added bio-industries in an economy that is historically founded on commodity export, and 3. developing technologies in biomass concentration and transportation to achieve economies of scale in a geographically-extensive domain. At present, CSBE collaborates closely with ASABE, CIGR and other global societies in co-hosting international conferences and related events, while individual CSBE members or clusters of members are engaged in professional activities with international collaborators. The current CSBE structure, size, and resources preclude the Society from pursuing many initiatives on its own to address these challenges on a global scale. However, CSBE is open to participating in future opportunities to collaborate with other societies to address these global challenges.

10. Ying Yibin, Chinese Society of Agricultural Engineering (CSAE) and Chinese Society for Agricultural Machinery (CSAM)

China's economy has developed fast in the past 34 years. In 2011, China became the 2nd largest economic entity in the world. Meanwhile, China has also made great achievements in agricultural development, and has successfully solved the problem of food self-sufficiency for the 22% of the

world population with 7% of world farmland. However, China is still a developing country. Even if the proportion of agriculture in GDP falls down to 1%, it is still 100% important. The two most important challenges our profession are facing are #1 Agricultural modernization/mechanization and #2 Food security. The per capital water resources in China is less than 1/4 of the global average, about 50% of the farmland without irrigation. The per capital farmland in China is less than 1/3 of the global average, and 2/3 of total is medium & low yield farmland. With the development of urbanization, the average annual reduction of cultivated land was about 0.7 million hectare per year. More agricultural equipment and mechanization are needed to replace laborers going to cities. Agriculture is the strategic industry of ensuring the social stability and economic development. Though our profession in China facing lots of challenges, I am very optimistic with our profession. Let's work together globally to move our profession forward!

11. Fedro Zazueta, International Commission of Agricultural and Biosystems Engineering (CIGR)

Never in human history have we seen the levels of wealth, health, scientific understanding of the world around us, and the technological achievements that we experience today. However, never in human history have we been faced with the absolute numbers of people without adequate food, medical attention, housing, education, and the threats to our planet that we are faced with today. In this contemporary context, the profession of agricultural and biosystems engineering can make great contributions to improve the quality of life of all, and ensure a sustainable future for generations to come. As professionals, we need to insure that agricultural and biosystems engineering plays an influential and contributing role in finding solutions to the problems facing us. As engineers, we often tend to focus and define ourselves by the body of knowledge and technologies used by our profession –what we do. We must shift the focus from what we do, to the relevant outcomes our profession generates in the resolution of the challenges that currently face us. We need to ensure our profession addresses relevant issues and is nimble enough in defining itself to proactively address problems in a timely manner.

Over the past few decades we have seen our profession evolve. The discovery of the double helix, the development of computer and networking technologies profoundly affected and transformed our profession. The full impact of developments in biological science and computing technology on our profession took decades to be fully recognized. With the enabling tools that this science and technology brought to the profession, we created tools that allow us to address old and new problems in innovative and more effective ways. But neither the problems facing us, nor science and technology remain static. Thus, it becomes important to our profession to anticipate future problems and pay careful attention to developments in basic science and technologies that when brought to bear over problems result in favorable outcomes. What will be the next scientific or technological development that will transform our profession? Is our profession sufficiently nimble to adapt to them? Are we ready to capitalize on the opportunities this will bring?
To be effective, our profession must position itself to realize the potential contributions it can make. As engineers, this requires that we move beyond being "problem solvers" and raise our participation to "strategic partners" at the highest levels of policy creation and resource allocation. For this purpose CIGR has created a strategic taskforce. A second component towards this is YOU, as an ambassador for our profession. Also, we must accelerate our efforts to disseminate information on what we do and achieve. Related to this is making knowledge available globally, most importantly for countries or regions of the world that lack out expertize, and increase collaboration at a world

scale. Current mechanisms being developed by CIGR towards this include multilingual eTexts to be made available at no cost to end stakeholders and massive open online courses (MOOCs) prepared by top experts in the field.

Our profession, through our societies and each of us must be present. We can become strategic partners that help bring solutions to the complex problems we are facing today for the benefit of all.

Questions from the Audience with Response(s):

1 – Water use in places like Yemen and Qatar may be focused on drug production, like a mild narcotic chew. High energy and water uses for desert lawns and golf courses vs. food production in the US raise questions about our priorities. (Rod Nohr r.nohr@nohrengineering.com) (one response from panel) Dick Godwin (UK) – I went to a copy of Resource magazine, the issue edited by Tony Grift, looking at the article by Buffet. That article encouraged replacement of 20 year old systems in use in the US which would result in much increase in efficiency.

2 – I have no real disagreement with presentations & points. However, one area not mentioned that engineers can address is reducing food waste (report of Institution of Mech Engineers (UK) suggests 40-50% less). Do you see this being recognized in the future? (Norm Scott nrs5@cornell.edu) (one response from panel) Klein Ilelji - US initiatives and similar efforts in the UK and other nations are giving high priority to reducing post-harvest losses. 4 billion US dollars equivalent is lost in grain post-harvest losses annually.

3 – A lot of students who graduated with an agricultural engineering degree pursue their career in other areas. Why? Is it due to a small job market, low salary, challenging work environment? (ileleji@purdue.edu) (response – not sure by whom) Many positions are dependent on government policy to pay their salary. Governments have cut funds for research. More graduates go into business. The trend is to a significant disinvestment in things like experiment stations. What are areas where the government needs to continue to make investments? The private sector is not in some of these areas for good business reasons.

4 – How do the social sciences (i.e. sociology, anthropology, etc.) fit with solutions to global challenges? Is there value to transdisciplinary collaboration to solve these problems? (Michael Sheehan mrsheeha@purdue.edu) (response) Fedro Zazueta - Problems are not purely scientific or technical when they are applied to a community. We need to understand the cultural context. Better solutions are reached when the final decision maker is the one involved. People that make decisions for themselves will carry them into the future because they've chosen them. We must teach so knowledge is in a grower's hands. Peer to peer is best model. One grower can teach another because they know the same background and challenges. Solutions must emerge from the community itself.

5 – Almost all the panellists discussed "new generations", concerns, and how young people/students are needed. The buzzword in the USA is "STEM". How do we make "STEAM" and add agriculture to the picture? (Mark DeKleine m.dekleine@wsu.edu) (Response #1) Fedro Zazueta – We have a deficit of scientists and technologists in the U.S.A. Our profession is not vertical with science. Chemical engineers are aligned with chemistry. Mechanical engineers are aligned with physics. Agricultural engineers are very diverse and not linearly aligned with a single body of knowledge. We

are unique in that sense. We need to sell our profession well. We need to do better at selling it with students (some use the curriculum to go into some other field). What drives us is our human nature. We need to get to the heart of the student, appealing to their compassion to make the world a better place. (Response #2) Bob Easter – The next generation will come predominantly from the city. We need to find how to attract those bright young people from urban areas into agriculture. It's hard to recruit those.

6 – Most discussions focused on more production of food and fiber. What about creating an environment to limit population growth? (Anonymous) (Response) Bob Easter – Education results in people choosing to limit population growth. The Korean and Taiwanese panellists commented on the challenges of urban needs with high population density.

7 – There are two critical elements in determining "Governance": Population growth and limited resources. How will "governance" in the future balance these two elements? How do we avoid the potential conflict – even war? (Yuanhui Zhang) (Response – not sure from whom) Problems cross domains and involve more than engineers. Conversations need to include more people and be functional. Those making policy need to understand the broader picture.

8 – What can ASABE do to work with you (the panellists) to address the challenges you face? Some specific steps to be taken and opportunities to leverage? Also INTL-601 International Affairs Committee invites you all to the committee meeting at 6:30 p.m. tomorrow in Signboard 1 at the Westin to discuss how we can work well together as a group. (S.G. Bajwa sreekala.bajwa@ndsu.edu) (Response) Fedro Zazueta – I encourage all attendees to come to the business meeting as well as technical meetings. When people work for the Society, the Society can grow and have a bigger impact.

9 – Large farms, large food companies, consolidation of agribusiness into fewer "hands", small farming vs. big farming, small processing & delivery vs. big companies. Crime and corruption's influence causes research to become proprietary, seeking profit. This restricts knowledge. (Rod Nohr r.nohr@nohrengineering.com) (Response #1 – not sure from whom – Easter?) University research in the 1980's did not become source of income but was shared broadly. Now we protect all work as intellectual property. (Response #2) Klein Ileleji – Technology can address corruption. In Nigeria, technology was applied to addressing corruption for fertilizer being bought by middle men. The government now has system so farmers receive fertilizer through a cell phone ID card. This eliminated the middle man and farmers get their products at a fair price. Apps are a life-changing technology because so many rural people have cell phones. (Response #3) Bob Easter – In the matter of food safety related to meat, it was important to establish a credible inspection service after harvesting using a supply chain. Can technology take this out of the hands of potentially corrupt officials? This profession can make great contributions in this area. (Response #2) Dick Godwin - Traceability for grains has improved even with a central silo. Even if an animal is cut in pieces, an RFID tag can be used to link the animal parts. (Response #3) Bob Easter – We have ways to know the genetic source now. We can follow it and do a gene map. This protects the consumer.

10 – How do greenhouse gas emissions challenge today's agricultural engineering industry? (Liangcheng Yang, University of Illinois) (Response #1) Daniella Jorge de Moura – These gasses affect livestock production all over the world. We need to mitigate with technology. (Response #2) Bernardo Predicala – We need to optimize production systems to reduce greenhouse emissions. (Response #3) Bob Easter – Is it all the nutritionists' fault? (Response #4) Fedro Zazueta – We need

to not only describe what we are doing but actually do something. (Response #5) Bob Easter – We need to develop concrete solutions.

11 – Please describe the challenges and benefits due to more and more of the agricultural industry's power and influence being in the hands of a few big corporations (e.g. Monsanto & others) that are driven by short term profit vs. long term sustainability. (Helmi Ansari, Pepsico) (Response) Fedro Zazueta –Governance involves where do we want to be and who do we trust for handling these issues? We do not have good mechanisms to assess and control and trust when executing new developments. Technology is neutral. The way we use it removes neutrality. What do we want for us and for future generations? The short term profit motive is never simple. Long term benefits involve more balancing of influencing agents.

12 – From the audience verbally: In the matter of population growth, if young girls are educated, the size of family is smaller. Statistical information shows that the uneducated have 9 children and those with at least a 4th grade education have only 3 children. We need to think outside engineering box.

13 – Genetic modification (GMO) is controversial. Comments? (Response #1) Dick Godwin – In the UK, scientists have new super wheat likely to increase yields by 30%. This was reported in the national press. 3 weeks later, the national press listed new developments in beans, maize, etc. None had come from genetic modification. Much can be achieved by adapting a few genes. Old fashioned plant genetics were what was causing increases to feed the world, not just changing a single trait like resistance to Round Up. (Response #2) Bob Easter – The cultivator is not used in recent times. (Response #3) Fedro Zazueta– Technology ethics are applied to grains, material science, energy science, etc. This has impacts at a social level. Governance is key. (Response #4) Klein Ileleji – We in the developed world must correctly educate the public about whether technology is good or bad for society. Adaptations will not be accepted in developing countries without this education. I have a Zimbabwe example. Maize was refused because it was genetically modified and its reputation was not favourable. We need to train students to understand the impacts of adaptations and modifications. (Response #5) Bob Easter – Science as a basis for making decisions was more accepted in previous times than today. Science facts are less accepted. The World Food Prize, often referred to as the "Nobel Prize of Agriculture" was started by Norman Borlaug. The three winners being recognized now are workers with GMO. Will this validate the GMO technology?

Concluding Remarks: Bob Easter – Our challenge is how to bring technology to small scale producers who contribute to the world food supply. This is significantly critical to feeding the world.

GLOBAL CHALLENGES FORUM 2013 AIM, Monday, July 22nd, 9:30-noon, Chicago C – Sheraton
Robert Easter, Session moderator

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Summary (from KC Ting's notes) July 22, 2013:

Challenges (Issues, Barriers)

1. Low Food security
2. Self sufficiency
3. Energy sufficient for production of food and fiber
4. Human capital development
5. Reduce greenhouse gases
6. New technology for producing food, fiber and fuel
7. Balance future supply and demand
8. Critical nurturing of the new generation
9. Soil – a limited resource
10. Hunger, malnutrition, poverty
11. Diversity such that solutions are not universal
12. Gender equality – empower women
13. Create jobs
14. Not enough agricultural and biological engineers
15. International collaboration needs to be stronger
16. Decrease the economic gap between small farmers and higher income population
17. Increase land productivity (mechanization)
18. Ethics for engineers – human handling of power
19. Deliver solutions to the people that need them
20. Environmental sustainability
21. Strategic partnerships
22. High population density and small agricultural presence
23. Aging Society
24. Need for urban agriculture
25. Building value-added industry
26. Biomass logistic (efficiency)
27. Small percentage of land is available to solve problems
28. Continued agricultural mechanization, notably for small producers
29. Urbanization – farmland reduction
30. Bioproduction in a cold climate and within a global economy
31. Student numbers decreasing in ag/bio engineering
32. Food, health, education
33. Influential ag/bio engineers
34. Use a problem solving approach, not just the tools themselves
35. Need 21st century technology applied in many ways
36. Be at the table for strategic decisions
37. What science and technology will transform our profession even more?

Opportunities (Approaches, Collaboration)

1. National food management system
2. Renewable energy and reducing greenhouse gases
3. Science without borders program
4. Training new human capital

5. Systems approach to feeding the world
6. New technology
7. Professional development
8. Practical skill sets
9. Global collaboration
10. Linking agricultural production to markets
11. Use local institutions as part of the solutions
12. Vertical farming
13. Attract younger generation to agriculture and its challenges
14. Influence policy making
15. Reorganize (people?) in the entire value chain
16. Share examples of success
17. Collaboration with international societies
18. Everyone should be an ambassador for ag/bio engineering
19. Be the society that is an agent for infusion of knowledge
20. Open access to research and educational materials
21. E-textbooks and online courses

Summary:

Two topics emerged as widely shared by the panel of speakers: food and energy.

The need for enough high quality food to feed the growing world population is universal. This is best approached by a diversity of skills and abilities addressing such issues as production efficiency, mechanization, food distribution, reducing post-harvest losses, soil health, environmental sustainability, urban and vertical farming, and new technologies as yet undiscovered.

Energy for food production and to support life is a world-wide concern also. The move toward more renewable energy must happen to be sustainable.

International collaboration is critical to achieving goals for both food and energy. This includes exchange of information and people to disseminate knowledge into the hands of many who can make a difference. Politicians must be fully informed on issues of food and energy so that governance supports a sustainable world.