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THE AMAZONS OF FOOD OR FOOD FOR ALL: EMERGING ISSUES AND SCENARIOS

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Harnessing science, technology, and innovation (STI) is key to meeting the aspiration of efficient, inclusive, resilient, and sustainable, agrifood systems and leveraging emerging opportunities for achieving the Sustainable Development Goals (SDGs). Advances in STI have left no aspect of life untouched, and agrifood systems are no exception.

For example, the promising future of digital technologies is foreseen to multiply with increasing breakthroughs in blockchain, Artificial Intelligence (AI), the Internet of Things (IoT), and others, fueled by lower costs and increasing capacity in data applications.

Numerous foresight studies that have been conducted see technologies and innovations across the entire agrifood system as a key part of the solution for transformative change and emphasize the need for them to be accessible and affordable, signaling equity concerns.



Image source: Canva

The promise is immense, but there are also risks, as rapid developments can outpace the ability of societies to adapt, and existing socioeconomic disparities and negative environmental effects can be exacerbated.

Therefore, to reap the benefits, it is imperative to evaluate (and anticipate) the context-specific needs of small-scale producers as well as the differential impacts of current and emerging technologies and innovations, including the potential benefits, risks, and unintended consequences as well as the barriers for adoption and diffusion. The commensurate regulatory, ethical, gender, social, environmental and policy issues must be addressed, including at regional and global levels.

Here we articulate emerging technologies and innovations in food and agrifood systems going to the year 2052. This includes 18 emerging issues – relatively unknown in international policy meetings that could have great impacts in the decades to come.

The purpose of identifying these issues is to alert policymakers of warnings and opportunities so that they can more effectively act now and in the foreseeable future. Some of these issues require immediate policy discussions, while others require longer-term strategic debates, and some will require a watchful policy/strategy eye to see in which direction they will develop.

EMERGING ISSUES

Emerging issues analysis (EIA) seeks to identify threats and opportunities – issues – before they become unwieldy and expensive to act upon. The method also seeks to identify bellwether localities where new social innovation starts (the future in the present). EIA is used to scan the environment, to discover issues that lie beyond the horizon. These issues tend to have low evidence – marginal support in the literature – but with a potential impact if they move from being a seed of change to a full-fledged tree or forest.

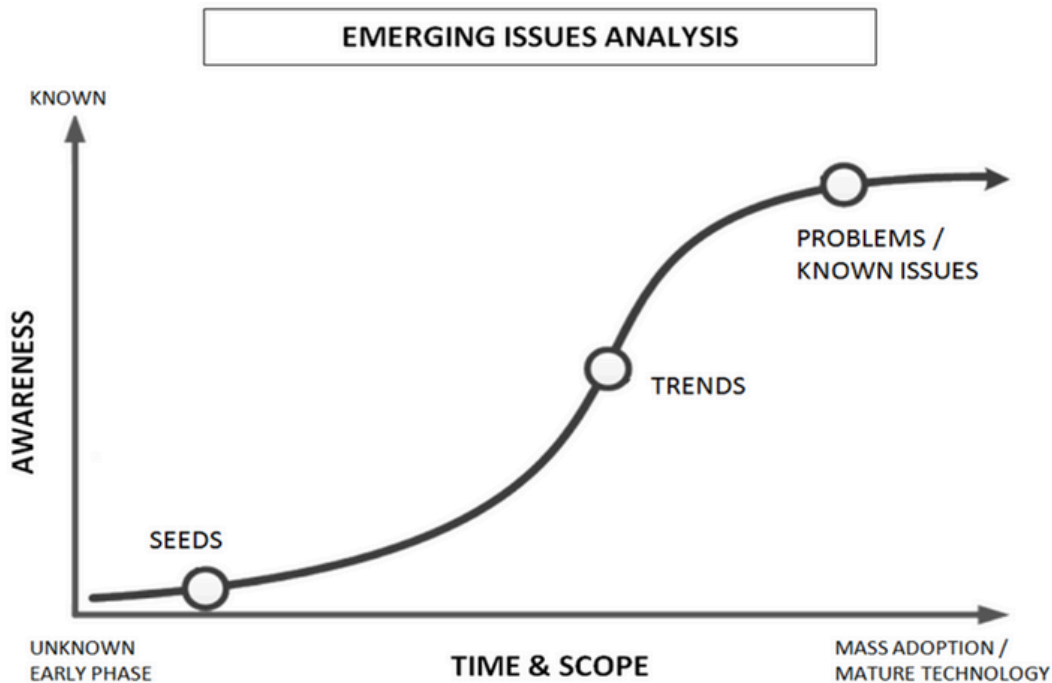
They are anomalous issues, which some commentators have called black swans (Talib, 2008). Seongwon Park of the Korean National Parliament Assembly calls these cracks in the wall (2021, December 16, personal email). They could bring the house down or could, if acted upon early enough, buttress the safety of the home. Staying with this analogy, cognizance of the emerging issue could lead to a redesign of the home.

Emerging issues analysis was first developed by Graham Molitor in the late 1950s, published in a seminar research paper in 1977, and championed by James Dator (1980), one of the pioneers of the field of Futures Studies in his work for the U.S. legal system in the 1980s and 1990s.

Using the S-curve, Molitor identified three phases of an issue. The first, at the bottom left of the s-curve, is generally unknown. Over time, if it has traction the issue (citations, articles, comments, laws, conferences,) moves up the s-curve becoming a trend. It then attracts attention from leading think-tanks.

Finally, it moves from nascent possibility to reality, becoming an issue that is debated in public media and legislatures with decisions needing to be taken. For example, thirty or so years ago there were discussions on cellular agriculture — as a solution to climate change, as part of the rise of the vegetarian movement, as a more efficient way to produce protein.

aspects of the disruption of the cow remain beyond the horizon. A particular emerging issue, even if it does not come to fruition, can for the researcher spark discussions that lead to novel and different emerging issues. One can thus track organizations, as well as nations, on the S-Curve in terms of their adoption of a particular issue. While those ahead lead, those behind can watch,



Today, numerous corporations have developed products for sale globally. Some nations are ahead in developing policy, in seeding funding for this innovation (some are even developing the "Internet of Food", food as software), while others are dealing with the immediate issues of hunger and food justice.

While aspects of cellular agriculture are now a trend – initial products and articles, books, conferences, businesses having sprouted up – in some areas of the world, other

learn and make decisions based on more data. But which issues are useful or relevant?

Based on extensive research on the futures of food and agri-systems, we've identified 18 specific issues. We have created a longer text which presents each issue with a general description, a concrete what-if hypothetical, likelihood estimate, keywords, and sources. Here we briefly outline these emerging issues as they are linked to particular domain areas.

The domain areas (emerging technologies and innovations) and emerging issues are:

- 1. DOMAIN AREA: PERSONALIZED NUTRITION** – Personalized nutrition becomes the norm in wealthy nations by 2041.
- 2. DOMAIN AREA: FOOD WASTE** – Dramatic reduction in food waste/loss because of tech innovations.
- 3. DOMAIN AREA: CELLULAR AGRICULTURE** – 40-50% of all protein comes from in-vitro meat especially in the Asia-Pacific region.
- 4. DOMAIN AREA: INTERNET OF THINGS AND FOOD** – Full planetary internet of food and systems by 2071, in connected wealthy regions by 2050.
- 5. DOMAIN AREA: ADDITIVE MANUFACTURING (3D PRINTING OF FOOD)** – 3D food printers become the norm in wealthy households by 2041 and the norm in communities in less developed nations.
- 6. DOMAIN AREA: GENE EDITING** – Gene editing is used all over the world – become the new norm in many places by 2042.
- 7. DOMAIN AREA: BIG DATA – FOOD AS SOFTWARE** – By 2041, food as software competes with other agri-food systems, becoming dominant in advanced economies.
- 8. DOMAIN AREA: BLOCKCHAIN** – All food will be required to be on the Blockchain by 2041.
- 9. DOMAIN AREA: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING** – Agri-tech funding leads all startups in Africa by 2041.
- 10. DOMAIN AREA: ECOLOGICAL MODELING** – The creation of eco-digital twins. Biological Sense platforms help shape public agricultural policy.
- 11. DOMAIN AREA: MAPPING UNDERGROUND FUNGI NETWORK FOR SOIL PRODUCTIVITY** – Global Fungi network fully mapped with productivity increases resulting.
- 12. DOMAIN AREA: ALTERNATIVE PROTEIN SOURCES AND PRODUCTION** – New protein sources make major inroads into traditional protein areas by 2042.
- 13. DOMAIN AREA: CARBON CREDITS IN AGRICULTURE** – A Full Agricultural Carbon Credit Scheme by 2042.
- 14. DOMAIN AREA: CARBON CREDITS FOR AQUACULTURE** – THE RISE OF BLUE CARBON CREDITS – Full carbon credit scheme for aquaculture by 2042.

15. DOMAIN AREA: REGENERATIVE AGRICULTURE – Regenerative Agriculture becomes the new paradigm by 2042.

16. DOMAIN AREA: CLIMATE CHANGE AND INNOVATION – BIOCHAR – By 2041, biochar is widely used to mitigate carbon dioxide, build soil quality, help plants resist disease, retain moisture and ameliorate water pollution.

17. DOMAIN AREA: URBAN AGRICULTURE AND TECHNOLOGY – 30-40% of all food required by an urban population is produced in an urban environment.

18. DOMAIN AREA: NEW FINANCING – Expansion of platform to finance farmers in Africa in the coming decade.

These emerging issues were then used as a cornerstone for articulating 4 distinct scenarios on the futures of Agrifood Systems.

SCENARIOS

Using the futures wheel through the input of experts we articulated the first and second-order implications of each emerging issue. Then, based on these implications we developed recommendations for the next steps and strategies. Finally, to manage the information, the uncertainties we articulated four scenarios.

Tentative scenarios include:

Image source: Canva

THE FOUR SCENARIOS

1

THE AMAZONS OF FOOD

This is a future of full integration of the supply chain. Drones, sensors, big data, and AI are all used to meet changing consumer needs and predict evolving needs. Large corporations own this food data and develop a global internet of food – food as software. Small scale farmers and other producers are either purchased or go bankrupt. As in the tech industry, those who own the food tech and those who manufacture will maximize profits. While the claims will be for efficiency, the likely outcome will be great inequity. Instead of better production, nutrition, environment and life, given the consolidation of economic and political power, we will likely see a worsening of conditions in the long run.

2

FOOD FOR ALL

In this future, technological developments in agri-systems create food abundance. Soleil, protein from thin air, the internet of Food, Big Data, lower energy costs because of renewables and even fusion, as well as reduced prices because of gene editing and cellular agriculture as well as localized food products through 3D printers create a world where there is food abundance. In this future, given the decentralization of power and great access to technologies we will likely see better production, better nutrition and a better environment.

3

FOOD TECH FOR THE POOR

In the future, the global food commons helps create a revolution in decentralized and appropriate food technologies. New technologies are used by the poor, the vulnerable, small farmers to empower and increase wealth. International organizations and nation-states use AI systems to help the poor better anticipate weather, prices, and create a peer to peer platform cooperatives. In this future, no one is left behind.

4

THE GREAT IMBALANCE CONTINUES

New technologies in the food and agri-systems do not challenge power paradigms, nor can they mitigate the impacts of climate change. The internet of food is used in wealthy regions for food integration but poorer areas with lower connectivity find themselves becoming worse off. Like the green revolution, the food tech revolution creates new winners and losers. For parts of the world improvements in food production and accessibility are achieved, but for other parts, life on the ground worsens.

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CONCLUSION

The recommendations for policy makers in the area of agrifood systems were as follows:

1. In Scenario One – The Amazons of Food, they carry the banner of food justice. They are also concerned about food resilience and dependence on tech systems.
2. In Scenario Two – Food for All, they ensure food safety, are focused on enabling all so they can self-regulate.
3. In Scenario Three – Food Tech for the Poor, they lead in creating a world of food justice.
4. In Scenario Four – The Great Imbalance Continues, they champion the poor, focusing on rebalancing food technologies and wealth.

REFERENCES

- Asian Development Bank (2022). *Reimagining the Future of Transport Across Asia and the Pacific*. www.adb.org
- Asian Development Bank (2020). *Futures Thinking in Asia and the Pacific*. <https://www.adb.org/publications/futures-thinking-asia-pacific-policy-makers>.
- Behar, A., and Hlatshwayo, S. (2021). *How to Implement Strategic Foresight (and Why)*. International Monetary Fund. <https://www.imf.org/en/Publications/analytical-notes/Issues/2021/12/22/Strategic-Foresight-at-the-International-Monetary-Fund-463660>.
- Dator, J. (1980). *Emerging issues Analysis in the Hawaii Judiciary*. The Hawaii Judiciary.
- Dator, J. (2018). *Emerging Issues Analysis: Because of Graham Molitor*. *World Futures Review*. 10(1): 5-10.
- Deloitte (2015). *Healthcare in 2065*. www2.deloitte.com.
- FAO (2017). *The Future of Food and Agriculture: Trends and Challenges*. <https://www.fao.org/3/i6583e/i6583e.pdf>
- Glenn, J. (1972). *Futurizing Teaching vs. Futures Courses*. *Social Science Record*. 9(3): 26-29.
- Henley, J. (2020, September 9). *Climate Crisis Could Displace 1.2 bn People by 2050, report warns*. <https://www.theguardian.com/environment/2020/sep/09/climate-crisis-could-displace-12bn-people-by-2050-report-warns>.
- Inayatullah, S. (2008). *Six Pillars: Futures Thinking for Transforming*. *Foresight* 10(1): 4-21.
- Inayatullah, S. (2004). *The Causal Layered Analysis Reader*. Tamkang University.
- Inayatullah, S. (2020). *Scenarios for Teaching and Learning*. *CSPS Strategy and Policy Journal*. 8, 31-48.
- Inayatullah, S. and Na L., (2018). *Asia 2038*. Tamkang University.
- Investopedia (2020). *The Top 20 Economies in the World*. [https://www.investopedia.com/insights/worlds-top-economies/#:~:text=In%202018%2C%20the%20China%20GDP,\(PPP\)%20of%20%2425.27%20trillion](https://www.investopedia.com/insights/worlds-top-economies/#:~:text=In%202018%2C%20the%20China%20GDP,(PPP)%20of%20%2425.27%20trillion)
- Kassam, A. (2014). *For sale: one Spanish village, free to the right owner*. *The Guardian*. <http://www.theguardian.com/world/shortcuts/2014/mar/10/for-sale-spanish-village-free-right-owner>.
- Milojević, I. (2021). *Futures Fallacies*. 25(4): 1-16.
- Molitor, G. (1977). *How to Anticipate Public Policy Changes*. *SAM Advanced Management Journal* 42 (Summer): 4-13.
- Molitor, G. (2003). *The Power to Change the World*. *Public Policy Forecasting*.

National Intelligence Council (2021). *Global Trends 2040: A More Contested World*. Government of the United States. www.dni.gov/nic/globaltrends.

National Public Radio. (2015). *In Spain, Entire Villages Are Up for Sale — And They're Going Cheap*. NPR.org. <http://www.npr.org/sections/parallels/2015/08/23/433228503/in-spain-entire-villages-are-up-for-sale-and-theyre-going-cheap>.

Paice, E. (2022, January 20). *By 2050, A Quarter of the World's People Will be African – this will shape our future*. <https://www.theguardian.com/global-development/2022/jan/20/by-2050-a-quarter-of-the-worlds-people-will-be-african-this-will-shape-our-future>.

Pershad, V. (2022, February 2). *Will Asia's Investors Pounce on the Farm Tech Revolution in the Year of the Tiger*. <https://www.scmp.com/comment/opinion/article/3165180/will-asias-investors-pounce-farm-tech-revolution-year-tiger?module=opinion&pgtype=homepage>

PWC (2015). *The World in 2050*. www.pwc.co.uk/economics.

Rand Europe (2022). *Address Societal Challenges in Norway*. https://www.rand.org/pubs/research_reports/RRA966-1.html.

Rupasinghe, R., Chomel, B., Martinez-Lopez, B. (2022). *Climate Change and Zoonoses: A Review of the Current Status, Knowledge Gaps, and Future Trends*. *Acta Tropica*. (226), 106225.

Silver, N. (2012). *The Signal and the Noise*. Penguin.

Talib, N. (2008). *The Black Swan*. Random House.

Wells, H. (1938). *World brain (1st ed.)*. Doubleday, Doran & Co.

Yasutomi, W. (1981). *Emerging Issues Analysis*. Honolulu: The Hawaii Judiciary.



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