2018 Transformation World Capital Report:
Sustainable Food for a Growing Population:
The Future of Agriculture
Table of Contents

2. Table of Contents
3. Foreward
4. Population Growth & World Food Output
5. Agricultures & Climate Change
6. Food Waste
7. Nutrition, Starvation, and Obesity
8. 21st Century Technology Solutions
9. The Transformation World Capital Mission
10. Closing Statements
11. Appendix
This presentation serves to illustrate the importance of Transformation World Capital’s mission to organize global capital from the world’s leading investors of at least $1 billion to address the largest problems and challenges in the world of agriculture, food, water, and climate change.

With the aid of the published research and works of various organizations such as the Rockefeller Foundation, the World Economic Forum, the United Nation’s Food and Agriculture Organization (FAO), and others, we have been able to extract and organize helpful data for the following discussions, analysis, and conclusions.

The goal of this white paper is to clearly address the status of the current and future problems the growing human population faces, specifically in the agricultural sector and its related industries. Feeding the estimated 10 billion population in 2050 is something we believe should be addressed now to avoid major food and water crisis for our future generations. Meanwhile, we must do so using innovative technological strategies in order to preserve our limited natural resources and arable land.

Victoria Sophia Brodsky  
Director of Projects  
Transformation, LLC

Walter Leo Schindler  
Chairman & CEO  
Transformation, LLC
“The population is steadily climbing towards 10 billion by 2050, potentially increasing demand for food between 60-100%”

- Roy Steiner Managing Director, Food The Rockefeller Foundation

The growing world population has been a topic of discussion for centuries. As our developments in science and technology allow for increased longevity, our hope has always been that the natural resource output from the earth will match the demand of the fast growing human population. It is estimated that by 2050, nearly 10 billion people will inhabit planet earth. It took nearly 200,000 years for the human population to reach 1 billion, but only 200 more years to reach 7 billion people.\(^2\) We have created a “Catch 22” situation in which innovations in science and technology have allowed the human population to flourish, yet to house, feed, and support this population sustainably requires more aggressive and smarter solutions.

The United Nations estimates that the population is growing by roughly 80 million people per year, and much of this growth is expected from regions like Sub-Saharan Africa, India, and the U.S.\(^3\) However, the combination of population growth and the increasing numbers and consumption of food and goods in the middle class are causing an exponential increase in demand for food and housing.

Global economic growth of over 2.9% annually is allowing citizens of developing countries to escape poverty (less than $1.25 per day) faster than ever.\(^4\) This, of course, should be considered a great achievement for the global society, but the increase of global middle class citizens leads to increase of consumption and higher demand for more expensive food like meat products, dairy, and vegetable oils. To feed 10 billion people in 2050, global cereals production (wheat, barley, hay) for both human and livestock consumption would have to increase to 3 billion tons, nearly a 1 billion ton increase from today’s production of 2.1 billion tons.\(^4\)
Since the green revolution of the 20th century, output per acre, and thus available calories per capita has increased in an effort to feed a growing population, reducing starvation. Genetically modified seeds, and technological advances in agriculture, production, and distribution have allowed us to produce nearly 4,000 calories per person, per day, around the world today. So why are we worried?
What It Will Take to Feed 10 Billion

Feeding 10 billion people in 2050 in order to avoid a global hunger epidemic and related issues is something we need to think about now. What will it take to feed 10 billion? Research by the Rockefeller Foundation and World Economic Forum estimates that despite our over-production of food today, we will need to increase food production by over 60%. Our current use of the world’s arable land must be doubled, so sustainable intensification of agriculture is crucial in meeting goals of feeding a population of over 10 million people.

The areas of greatest concern are developing nations whose infrastructure and governments currently face the challenge of feeding their population, and thus inevitably have issues scaling alongside their population growth. These include Sub-Saharan African countries, South America, India, China, and countries in South East Asia, and most of their food comes from small family farms. In order to improve the efficiency and output of the land in these areas, there must be a global initiative to implement smart solutions.

The issue at hand, how to feed 10 billion, is not the only issue. At its core, this problem is intricate, and complicated, because while we attempt to feed a growing population, we must also address the concern of the limited resources of the earth, and how our practices impact the earth and its struggles with pollution and climate change.

The question of human consumption of food, water, materials, oil, gas, and other natural resources has switched from how will we produce more food, to how do we produce more food, more efficiently?
“Today’s food and agricultural systems are accountable for 1/4 of greenhouse gas emissions and 70% of fresh water use.”

- Roy Steiner Managing Director, Food The Rockefeller Foundation

Global Food Production is a Leading Cause of Climate Change

As the world faces a growing number of environmental and social challenges, including combating climate change, we need to take a look at the largest contributors of greenhouse emissions.

Agriculture is a top contributor to climate change, and the largest consumer of fresh water. It takes up 50% of the globe's vegetated land. Methane from livestock digestive fumes, nitrogen fixing crops, synthetic and organic nitrous oxide pesticide use in soils, and the millions of gallons of fuel burned everyday to distribute food all over the world by trucks and ships contribute greatly to the amount of CO2 in the atmosphere.

Feeding 10 billion people, and the animals they consume, is the biggest opportunity to make sustainable changes.
Climate Change Adversely Impacts Food Production Processes

Despite our adaptive strategies to date, downstream effects of climate change like weather patterns, biodiversity, drought, and rain patterns continue to have proven negative effects on our food systems, including crop yield, and the nutrient density of our food. This in turn affects the price, availability, and quality of crops, making climate change a cause of net negative impact on international social and economic welfare of both the producers and the consumers of agriculture.

According to the Agronomy study from the University of California, Davis, the highest impacts of crop diversity occur across hydrologic cycles (droughts and floods), averaging rising temperatures of at least 1 degree Celsius, rising atmospheric CO2 levels, and reduction of wild crops leading to a reduction in biodiversity.\(^8\)

In a meta-analysis of over 1,000 published reviews of the effect of climate change on crop yields, the evidence is that rising temperatures have a negative effect on nearly all crops in all regions.\(^9\) Negative crop yields are having an increasingly damaging economic impact due to changes in import/export prices, trade patterns, and market distortion, all of which adversely affect the welfare of regional producers.\(^9\)

Changes in production, price, and availability of feed-grain greatly affects the economics and efficiency of the livestock industry as well. In addition to grain production, animal growth and reproductive health, disease and pests risks, and health of forage and feed are all impacted. Exposure to higher temperatures in livestock increases their metabolic rate, reducing their overall size and thus meat production; heat-related production losses recorded in 2011 were over $1 billion for livestock producers.\(^{10}\)
The Amount of Food Produced is Not the Issue, Waste is Where We Fail

We have an imbalanced global food system that is contributing to a destructive cycle of climate change and agricultural inefficiencies. A growing population requires greater agriculture output, yet agriculture output contributes greatly to climate change, and climate change negatively impacts agricultural output. This system puts stress on our ability as global citizens to produce enough nutritious, affordable food to avoid worsening food insecurity across the globe. \(^\text{11,12,13}\)

Since we are currently living in a world greatly effected by inefficient processes of the human race, it is important that we not only look to reduce our impact on the environment, but also to implement strategic adaptive strategies to lessen the negative effects of climate change on agriculture. To do this requires capital-intensive solutions to act swiftly in the time of natural disasters like wild fires and floods, taking preventative measures seriously both by private industries and by the public sector, and developing “efficiency first” technologies in water, energy, and agricultural infrastructure.

---

“Food is not lacking, it’s just poorly managed.”

- Irene Banos Ruiz, Deutsche Welle

“Sustainable food for everyone? The challenge of our century”
Inefficiencies in Agriculture Technology and Infrastructure

Big data, field sensors, drones, and GPS units are just some examples new technology that must be applied to global agricultural systems in order to meet the food and water demands of a rapidly growing population.\(^\text{14}\)

Although we currently over-produce food, we waste 30-40\% of it, either out on the field, during distribution, or down the garbage disposal.\(^\text{15}\) Technological solutions have the ability to improve water efficiency in fields and throughout the supply chain, down to the harvest times for farms and nutrient composition for consumers.

The more data and knowledge farmers, producers, and distributors have at every step of the process, the more they are empowered to run their operations more efficiently, reducing waste, optimizing inputs and outputs, and providing better, healthier, safer food products to consumers. On the other hand, food sensing technologies and mobile apps that teach consumers about what’s in their food allows them to make more informed purchasing decisions when it comes to food, reducing household waste and improving dietary habits.

However, for most farmers, utilizing all of the latest agriculture technologies is not always easily available or economical. That has to change.
Of all global food grown that ends up in landfills or rotten in fields.

Of economic loss every year around the world due to food waste.

Is the daily average of food waste per capita in the US.
The Waste, Hunger, and Obesity Paradox

Our global food system is unbalanced for three main reasons:

1. **We produce enough calories to feed everyone in the world 4,000 calories per day, yet we waste nearly 40% of it.**

2. **The global demand (as well as economic need) for fast and convenient food has increased dramatically over the last century, leading to a global obesity epidemic and “hungry-overweight” paradox.**

3. **Climate changes is putting both micro and macronutrients quality of food at risk.**

While over 800 million people around the world go hungry, 2.1 billion people are overweight or obese. Both sets of people are dying because they’re not well-nourished— a paradox referred to as the hungry-overweight paradox. Those literally going hungry every night due to lack of access to food (due to poverty, or other reasons) lack both calories and nutrients for a healthy life. Those who either choose, or do not have access to nutritious food are sick from over-eating a caloric, yet low-nutrient diet, dying early from heart disease, diabetes, and other overweight/obesity-related diseases.
Food waste is not just the amount you leave on your plate at a restaurant; the impact of food waste come from every step of agriculture process - from the food left unharvested in fields, to the food improperly stored or over-served at restaurants and grocery stores, and all of the water, cropland, fertilizers and pesticides that was required to grow that food that was ultimately wasted. These aspects combined make food waste a large contributor to green house gas emissions. The 30% of food that is wasted around the world takes up 18% of the arable crop land, and 21% all fresh water.\(^9\)

The largest energy consumption in the agriculture process is Nitrogen fertilizer, which has been shown to have negative effects on atmospheric conditions, terrestrial ecosystems, and human health. The second largest mineral used in fertilizer is Phosphorous, a limited and mined natural resource whose fertilizers can fuel harmful algae blooms if leaked into oceans and rivers.
“A key strategy is investing in food that is healthy for people and planet.”

- Tilman and Clark 2014; IFPRI 2015
The Effects of Climate Change on Nutritional Value

Climate change not only has a negative impact on the crop output, but also the quality of the crop and its macro and micro nutrient contents and ratios.

“Though changes in temperature, CO2 concentrations, and solar radiation may benefit plant growth rates, this does not equate to increased production. Increasing temperatures cause cultivated plants to grow and mature more quickly. But because the soil may not be able to supply nutrients at required rates for faster growing plants, plants may be smaller, reducing grain, forage, fruit, or fiber production.”

- National Climate Assessment, Climate Change Impacts in the U.S. (Report)

Increased CO2 concentrations have also shown to have negative impact on the nutritional value of some crops. Soybean and alfalfa are in danger of having a reduced nitrogen and protein content, which not only influences the food products they end up in and the consumers who are eating them, but also the food quality for livestock.¹⁷

By mid century, estimates have predicted that chilling requirements for fruit and nut trees, specifically in California, will not be met, leading to reduced crop output per acre.¹⁷ This would leave California farms falling short of the growth that industry would require in order to keep up with rising demands.
Lack of Nutrition and Food Education Makes Fruit and Vegetable Waste the Worst Culprit

Nutritional education early on is an important topic that is unfortunately widely misunderstood and clouded by media, big pharmacy, and various industries leveraging the confusion around nutritional science.

A culture diseased by the western diet of refined carbohydrates, sugar, excess fat and salt has not only led to a world where nearly 1/4 of the global population is overweight or obese, but also normalized a culture where food waste, especially of fruits and vegetables, is the norm.

Of the 150,000 tons of food wasted in American every day, the food products wasted the most are fruits and vegetables. Although fruits and vegetables require a lot of agricultural inputs, they require less cropland and promote a healthy lifestyle for consumers. However, due to lack of understanding in how to properly prepare, cook, store, and use fruits and vegetables, nearly 40% of food waste in America happens in the home.²¹

Additionally, the consumers’ preference of cosmetically perfect fruits and vegetables requires farmers to throw out produce that looks or feels unworthy of a grocery store aisle (bruised, misshapen, too small or too large). Over 1/3 of fruits and vegetables are left in the field, fed to livestock, or hauled straight to the landfill due to their imperfections.²¹

Proper nutritional education about the importance of fruits and vegetables for health, and the best practices to use them.
“A global food revolution based on the paradigm for agriculture is urgently required.”

- Johan Rockstrom et. al.
The Royal Swedish Academy of Sciences
“Big data in conjunction with the Internet of Things can revolutionize farming, reduce scarcity and increase our nation’s food supply in a dramatic fashion; we just have to institute policies that support farming modernization.”

- Lloyd Marino of Avetta Global, big-data expert

Only a minority of agricultural output in the next 50 years can come from the expansion of arable land. Increases in crop yield and more efficient water use is our only option, which requires innovation.

Luckily, the software market for precision farming tools is expected to increase 14% by 2022 in the US. Venture Capital investing in the Agriculture Tech space has increased 80% since 2012. We’re at a point where we understand there are a lot of problems to be solved in the agriculture industry, but we’re still early-on in making these new technologies ready and cost-efficient for farmers worldwide.
Waste Management Solutions are Essential to Meeting Current & Future Food Requirements for a Growing Population

The growing population not only demands more food, water and resources, but also increases the need for better waste management solutions. According to the World Energy Council, we’re heading towards waste generation of 6 million tonnes per day by 2025. Increasing amounts of municipal waste, especially in developing countries puts pressure on local governments to move, sort, and find land for all of this waste. Waste, especially when not treated, sorted, and disposed of properly ends up in oceans, rivers, city streets and of course, landfills where carbon-producing byproducts like methane make waste on of the largest culprits of climate change. With that said, waste related social and environmental is half the battle in sustainably feeding and supporting a growing population.

Although consumer education, laws, and regulations are required to reduce waste globally, it is unlikely we’ll ever live in a zero-waste world. The second best practice would then be to utilize waste as a resource.

Segregation and organization of waste to be used as a renewable energy source can be looked at in three categories: organic waste, recyclables, and waste for energy.

Organic waste, including food waste, makes up 60-80% of municipal waste in developing countries. Luckily, this waste can be converted into compost and then used for fertilizer. Recovery of recyclable materials like plastic and paper products will also assist in recovery residual waste products. For these practices to be sufficient, proper waste segregation practice must be in place, ideally at the source of the waste. Waste to energy technologies is a third pillar of waste-to-resource solution that converts chemicals from waste into heat, steam, or electrical energy. Combustion and gasification are the two most common forms of waste to energy technology used. However, operating time to break down these waste chemicals is long, creating a demand for faster, and more commercially feasible waste to energy technologies.


“Investing in agriculture is one of the most effective strategies for reducing poverty and hunger and promoting sustainability.”

- Food and Agriculture Organization of the United Nations
Our Proposed Solution: Transformation World Capital Fund

Transformation World Capital (TWC) is a new sustainable impact investment syndicate of large global capital investors, guided by multiple national governments, for the progress of global agriculture, energy, water, and affordable housing infrastructure and development.

The inspiration for Transformation World Capital comes out of the 18 years of venture capital experience from SAIL Capital Partners LLC and the history of sustainability and the challenges of the early phase of cleantech investing. Our experience has demonstrated that sustainability investment reflects the highest degree of complexity arising from the interdisciplinary synthesis of our deepest knowledge of the world’s three largest and most essential industries: energy, water and food.

Transformation World Capital therefore is dedicated to bringing together like-minded global investors and advisors from Canada, The Netherlands, Sweden, the Middle East, the United Kingdom, Switzerland and the USA to form an investment syndicate with a minimum of $1 billion dollars of dedicated investment capital. Our plan is that Transformation, LLC will play a co-partner role alongside the syndicate investors in managing the capital and providing strategic advisory services as well as investing in project development and management. Our plan is part of the total solution, but it is a part because capital is essential and deficient to date in the context of the magnitude of the challenge.
Why We Are Positioned to Lead a Global Food Revolution

As one of the world’s first sustainable and clean tech venture capital firms, SAIL Capital Partners LLC took a path never before taken for the future of sustainability investing. What we discovered was that meaningful changes towards sustainability in global energy, water, and agriculture require a much larger capital base than is typical in a venture capital fund and a much greater effort at system change in the direction of total system impact than a typical venture fund of private investors can deliver, even with the dedication of an experienced team. Making a significant difference in the world’s most important industries and markets, while also producing large and lasting financial returns, requires a global effort from the world’s largest investors dedicated to making a difference for future generations.

Agriculture is the highest priority of Transformation World Capital because of the impending crises in food. Therefore, our first projects will be focused on transforming agricultural infrastructure in Brazil, Mexico, and the Philippines. We estimate that 60% of the capital will be invested in agriculture, and the balance in energy, water, housing and healthcare.
Current Status

Starting the Syndicate
The intention is for the Syndicate to be offered first to 12 identified investors, with the top 7 to be represented on the Board of Directors. The current plan is for Transformation, LLC to be the partner of or strategic advisor to the Manager in a joint venture with the investor who invests the development capital described below.

Development Capital
There is a unique opportunity for one of the founding investors to invest an initial $5 million in development capital in exchange for a 20% fully vested equity interest in the Manager joint venture entity. All development capital may be reimbursed at closing from the initial fund expense closing fee of 1% of all capital closed.

Board of Directors
The Board of Directors of the Manager will consist of seven members selected by the Investors. The Board of Directors should approve the Manager, which will be organized as a joint venture.
Closing Statements

Transformation World Capital
As a closing statement, we look forward to engaging the syndicate for Transformation World Capital. We wish to acknowledge and thank the valuable insights from all resources mentioned and cited in this document, including but not limited to the Rockefeller Foundation and their related research, the works and related research of the World Economic Forum, and the Food and Agriculture Organization of the United Nations.
Appendix

Transformation World Capital
Sources


- How Will Climate Change Affect Agriculture?[PDF]. (n.d.). University of California, Davis.


Sources


Contact Information

vbrodsky@transformationholdings.com
www.transformationholdings.com