



Building Sustainable Triple Bottom Line Indoor Farms

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Acknowledgements



Outline

- Introductions
- Defining Sustainability and the Triple Bottom Line
- B-Certification
- About the Farms
- Discussion
- Summary and Conclusions



About the Panelists: Dave Nichols

- **Affiliations**

- Director of Strategy, AppHarvest
- Managing Director, Pangea Capital Partners

- **Background**

- 15 years working with venture start-ups
- Socially responsible investing
- Carbon credit projects
- Clean energy and clean-tech finance

- **Education**

- Columbia Business School (MBA)
- University of Delaware (BS)



About the Panelists: Alexander Rudnicki

- **Affiliation**

- Head of Farm Design, AeroFarms
- Leads daily operations for vertical farm capable of growing 1.5M lbs of produce annually

- **Background**

- Project estimation
- Market research and business development
- Renewable energy

- **Education**

- Columbia University, Environmental Science & Policy (MPA)
- Columbia University (BS)



About the Panelists: Grant Vandenbussche

- **Affiliation**

- Chief Category Officer at Fifth Season
- Strategy, Finance, Product, Business Development, Marketing, and Sales

- **Background**

- Product and Business Development
- International Operations

- **Education**

- Carnegie Mellon University – Tepper School of Business (MBA)
- Michigan State University (BS)



About the Moderator

- **Affiliations**

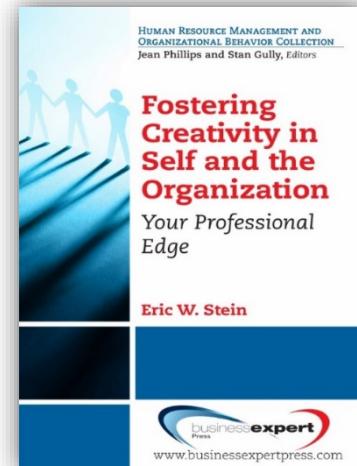
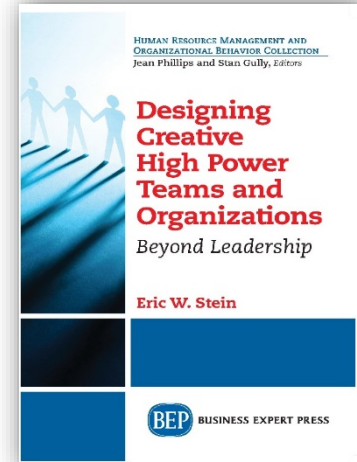
- Tenured Associate Professor of Management Science and Information Systems at Penn State Great Valley School of Graduate Professional Studies
- Executive Director of the Center of Excellence for Indoor Agriculture

- **Background**

- Business school professor
- Consultant to business and industry
- Author of two books on creativity, innovation and strategy
- Run a small R&D indoor vertical farm

- **Education**

- The Wharton School at the University of Pennsylvania, Ph.D. (Managerial Science)
- Amherst College (BA) Physics



About the Center of Excellence

- Our mission is to accelerate the global transition to indoor farming production methods that are safe and sustainable and to empower indoor and vertical farmers with the knowledge, tools and resources to build profitable businesses.
- “Indoor Ag Center Best-in-Class Awards”™ for Growers and Equipment Manufacturers





What is Sustainable Development and the Triple Bottom Line?

Sustainable Development Defined

- Sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity.
- Companies aiming for sustainability need to perform not against a single, financial bottom line but against this triple bottom line.



The Triple Bottom Line (TBL)

- **People**
 - Community impact
 - Fair wages
 - Transparency and Accountability
 - Governance
 - Working conditions
- **Planet**
 - Product and service value
 - Land use
 - Inputs – water, energy, raw materials
 - Outputs – e.g., solid waste, water, air
 - Transportation and distribution
 - End of life for products
- **Profit**
 - All business must derive a profit from venture otherwise it is not economically sustainable



Farm-Centric View of Sustainability

-Value Chain-



5. Social
Impacts

2. Environment:

- Water
- Air
- Land
- Energy

Suppliers

- Raw Materials

1. Farm

- Production

Distributor

- Packaging
- Transport

Consumer

- Products

3. Waste

- Packaging
- End of Life Products

Sustainable Practices

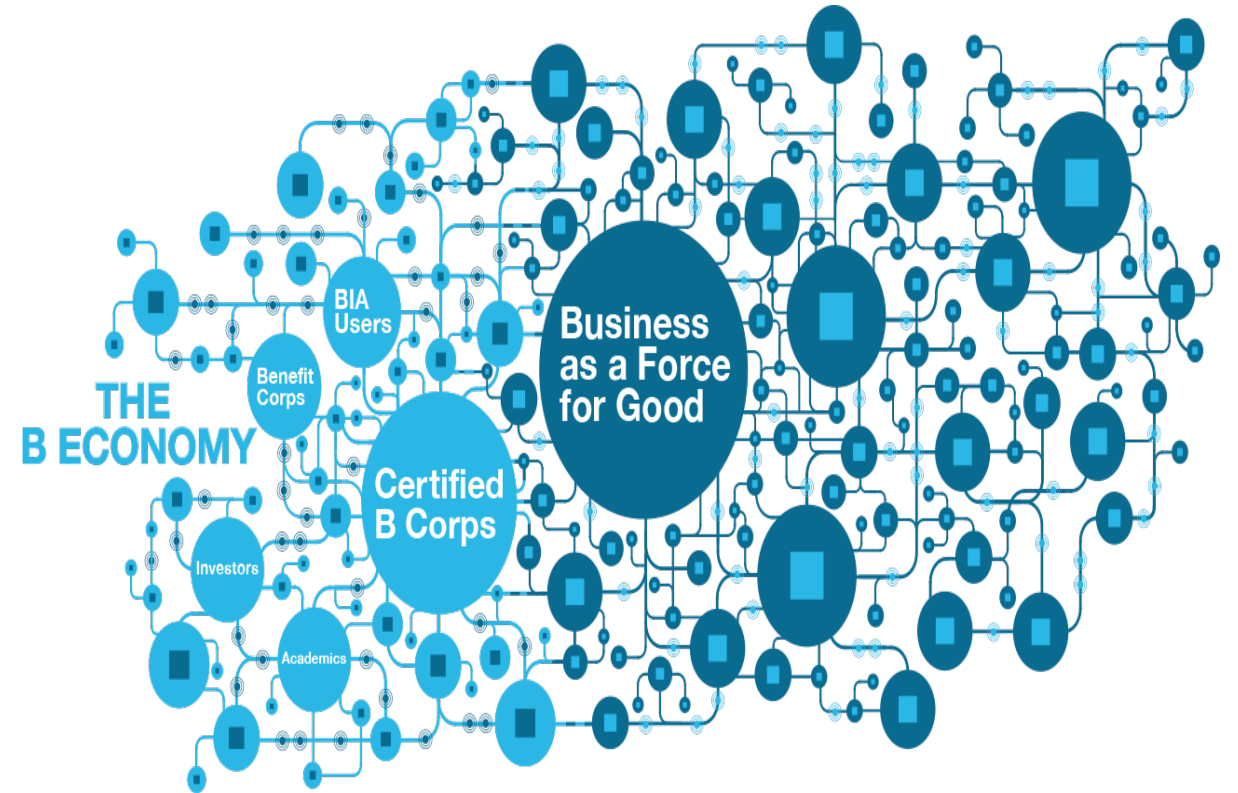
4. Impacts

- Human Health
- Water, Air, Land
- Solid Waste
- Bio-diversity
- CO2 and Heat

“Externalities”

Recognition for TBL Companies: B-Certification

- B-Certification by B-Lab
 - Demonstrates commitment to TBL principles and measures them
- Open to any company that is chartered as a Benefit (B) Corporation
- It begins with a B Impact Assessment (BIA)
 - Includes workers, community, environment, and customers



B Impact Scoring: Criteria for Evaluation

- People
 - Governance
 - Workers
 - Community
 - Customers
- Planet
 - Environment
- Profits
 - Required to stay in business
- Scoring
 - 0 to 200
 - Must be 80 or better for cert



See how they compare

King Arthur Flour Company B Impact Report		
Impact Area	Average score of other businesses*	King Arthur Flour Company
Governance	10	14
Transparency	6	10
Accountability	3	4
Workers	22	61
Compensation, Benefits & Training	15	18
Worker Ownership	2	37
Work Environment	4	6
Community	32	16
Community Products & Services	15	0
Suppliers & Distributors	4	2
Local Involvement	5	4
Job Creation	2	1
Diversity	2	3
Civic Engagement & Giving	4	5
Environment	9	12
Environmental Products & Services	4	1
Land, Office, Plant	4	5
Inputs	2	2
Outputs	1	1
Transportation, Distribution & Suppliers	1	2
Overall B Impact Score	80	103

103
B IMPACT SCORE

*Of all businesses that have completed the B Impact Assessment.



About the Indoor Farms of the Panelists

Aerofarms

- About
 - Founded 2004
 - \$196M in funding
 - 125 employees
 - B-Certified
- Global Headquarters (Rome Street-2016)
 - Size: 70,000 sq. ft.
 - Harvest: Up to 2 million pounds per year
- R&D Farm (Market Street-2013)
 - Size: 5500 sq. ft.
 - Harvest: R&D
- Newark Farm (Ferry Street-2015)
 - Size: 30,000 sq. ft.
- R&D Farm - Abu Dhabi (Future)
 - Size: 90,000 sq. ft.



B Impact Report: AeroFarms

B Impact Report



AeroFarms

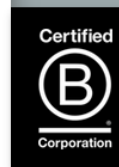
Leafy Green Vegetables

Certified Since: February, 2017

Location: Newark, New Jersey, United States

Sector: Manufacturing

Overall B Impact Score ⓘ



WWW.AEROFARMS.COM

An environmental champion, AeroFarms is leading the way to address our global food crisis by building, owning, and operating indoor vertical farms that grow safe, healthy, and flavorful food in a sustainable and socially responsible way. Setting a new standard for totally protected agriculture from seed to package, they have been fundamentally transforming agriculture by disintermediating the supply chain by bringing local commercial farming to where the consumer is. All of their technology is proprietary, and they are vertically integrated with expertise and capabilities all in house. Horticulture intersects with Engineering, Food Safety, Data Science, and Nutrition, giving AeroFarms the capability to understand plant biology in a way that has never been understood. And they grow using 95% less water, a fraction of the land and resources, and with yields 390 times higher per square foot annually vs. traditional field farming.

Their passion and expertise honed over the last 13 years is growing delicious food with uncompromising quality that has been optimized for taste, texture, color, nutrition, and yield. They have grown over 250 varieties of leafy green vegetables and have grown other types of crops as well.

Best for the World Honoree ⓘ

Best for Customers 2018



Impact Area Scores ⓘ

	Governance	8.9
	Workers	14.1
	Community	16.9
	Environment	12.9
	Customers	36.4

B Impact Report: AeroFarms



Governance

8.9

Mission & Engagement	1.1
Corporate Accountability	1.3
Ethics	0.9
Transparency	3.1
+ Mission Locked	2.5



Community

16.9

Job Creation	5.2
Diversity & Inclusion	2.3
Civic Engagement & Giving	6.0
Local Involvement	2.0
Suppliers, Distributors & Product	1.1



Environment

12.9

Land, Office, Plant	3.2
Inputs	5.7
Outputs	1.0
Transportation, Distribution & Suppliers	2.2
N/A Points	0.4



Workers

14.1

Compensation & Wages	2.3
Benefits	4.0
Training & Education	1.3
Worker Ownership	2.2
Management & Worker Communication	1.3
Job Flexibility/Corporate Culture	1.3
Occupational Health & Safety	1.1



Customers

36.4

+ Health & Wellness Improvement	6.2
+ Serving in Need Populations	30.1

AppHarvest

- About
 - Founded in 2017
 - Morehead, KY
 - 47 employees
 - B-Certified
- Total Funding
 - Initial-\$150M
 - 3-4Q 2020-Novus-\$475M IPO
- Farm
 - 60 acre greenhouse complex
 - Crops: Tomatoes
 - Water retention system
 - First Harvest: 2021



B Impact Report: AppHarvest

B Impact Report



AppHarvest

Large-scale controlled environment agriculture

Certified Since: December, 2019

Location: Morehead, Kentucky, United States

Sector: Manufacturing

Overall B Impact Score ⓘ



The B Impact Scores are being compared against all businesses that have completed the B Impact Assessment

[APPHARVEST.COM](https://appharvest.com)

AppHarvest is building some of America's largest indoor farms, combining conventional agriculture techniques with today's technology to grow non-GMO, chemical-free produce. Their first greenhouse in Morehead, Kentucky, will span 60 acres and use 90% less water than a typical farm because of a sophisticated circular irrigation system and 10-acre rainwater retention pond. Their central location in Appalachia is within a day's drive of 70% of the U.S. population, allowing them to reduce the amount of diesel used in transportation by 80%. This is Farming Now

Impact Area Scores ⓘ



Governance

14.4



Workers

19.1



Community

15.7



Environment

33.5

B Impact Report: AppHarvest



Governance

14.4

Mission & Engagement

1.5

Ethics & Transparency

2.8

+ Mission Locked

10.0



Environment

33.5

Environmental Management

2.7

Air & Climate

1.3

Water

3.4

Land & Life

1.9

+ Environmentally Innovative Manufacturing Process

23.9

+ Toxin Reduction / Remediation

N/A



Workers

19.1

Financial Security

10.1

Health, Wellness, & Safety

3.0

Career Development

2.9

Engagement & Satisfaction

3.0



Community

15.7

Diversity, Equity, & Inclusion

2.5

Economic Impact

4.3

Civic Engagement & Giving

6.3

Supply Chain Management

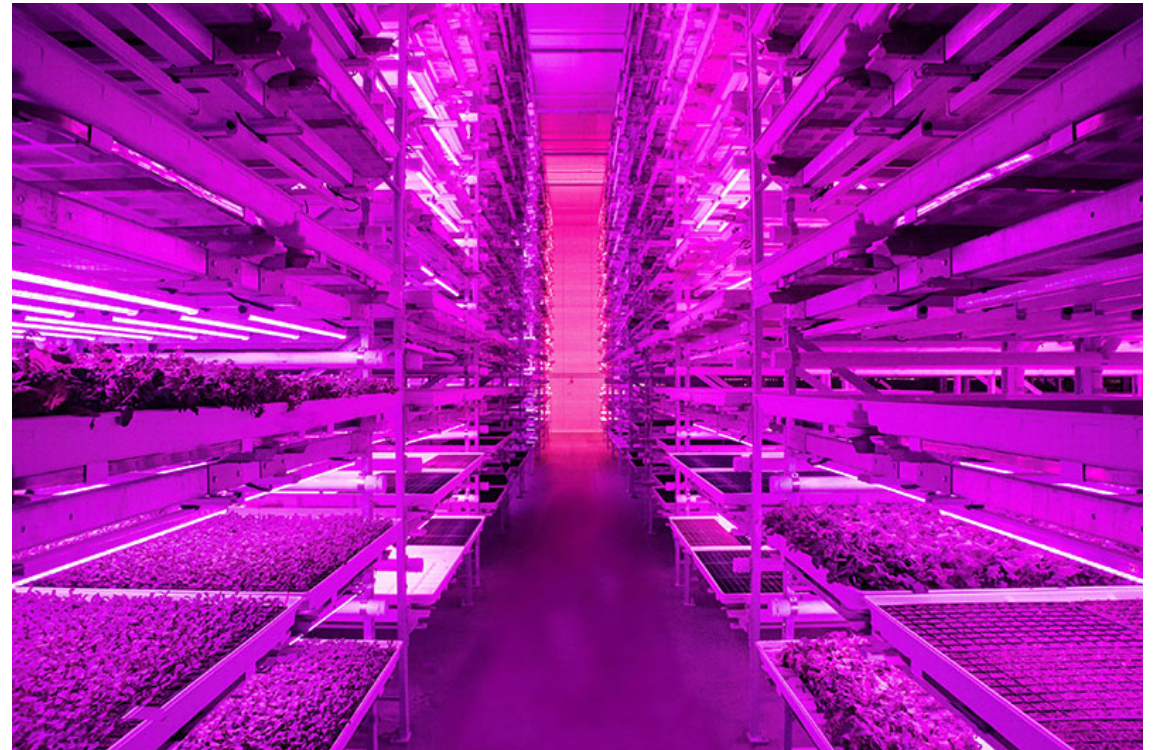
0.0

N/A Points

2.5

Fifth Season

- About
 - Braddock, PA
 - Founded 2015
 - Funding \$40M
 - Originally RoBotany
 - Ties to Carnegie Mellon
 - Not B-certified but committed to many of the same TBL principles
- Farm
 - 60,000 ft² farm
 - Crops: leafy greens
 - Intensive applications of robotics and automation in farm
 - Reduced labor and operating costs





Panel Discussion

Panel Topics

- Discussion (30 mins)
 - Moderator will interview panelists for their insights and thought leadership on topic.
- Panelists will discuss ways indoor farms can:
 - (i) contribute to people through mission, jobs and beneficiaries;
 - (ii) contribute to the planet through operations, methods of production and distribution channels;
 - (iii) build indoor farms that can achieve long-term sustainable economic results while supporting contributions to people and the planet.
- Q&A (10 mins)
 - Panelists will field questions from the audience supplied through the chat feature
- Summary and Conclusions (5 mins)
 - Moderator and panelists make closing comments





Conclusions

Summary and Conclusions

- Sustainable development and the Triple Bottom Line are important ways to frame the impact of indoor farms
 - People
 - Planet
 - Profits
- TBL indoor farms provide significant opportunities for social investing



To Learn More and Next Steps

- Go to: **indooragcenter.org**
 - View Presentation
 - Find other related information
- **Benchmarking**
 - We are conducting a benchmarking study
 - Open to all indoor farms, grow system manufacturers, and lighting manufacturers
 - We will offer awards and recognition for best-in-class finalists
 - Go to indooragcenter.org for more info



Contact Info

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 - Skype: [cire3500](https://www.skype.com/people/cire3500)
 - Google: 484-727-8874





Q & A

References & Additional Reading

1. *<https://www.iisd.org/topic/sustainable-development>
2. Adapted from Marshall, J. D., & Toffel, M. W. (2005). "Framing the elusive concept of sustainability: a sustainability hierarchy." *Environmental science & technology*, 39(3), 673-682.
3. Excerpts from *Blessed Unrest* (2007) by Paul Hawken. Viking Press
4. The World Business Council for Sustainable Development .
<https://www.sustainabilityambassadors.org/sustainability-defined>
5. <http://sustainability.psu.edu/sustainability-institute>
6. John Bellamy Foster, *Ecology Against Capitalism*, 2002. Monthly Review Press
7. Is 'Conscious Capitalism' an Oxymoron? (video)
<http://www.treehugger.com/files/2010/08/conscious-capitalism-oxymoron-video.php>
8. *Environmental Skill: Motivation, Knowledge, and the Possibility of a Non-Romantic Environmental Ethics* (2015) by Mark Coeckelbergh. Routledge