Annotated Bibliography

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The potential of Vertical Urban Farming using Aquaponics and Hydroponics

Paul Mon-Kau 93740918

VCC Bachelor of Hospitality Management Degree

Research Methods in Business

Introduction

I have chosen the concept of Vertical Farming using Aquaponics as my subject for the Idea Paper and it's subsequent Capstone projects. This Annotated Bibliography assignment relates directly to the articles found to research the subject. This paper will try to explain the technology; it's use and limitations as well as the possible future applications of using non-soil based agriculture techniques. I would further like to show the other aspects that affect the growth or restriction of this concept, including real estate values and public health issues.

Steve Diver (2006) Aquaponics: Integration of Hydroponics with Aquaculture. National Sustainable Agriculture Information Service

This is a technical paper intended to be an introduction to aquaponics. It gives extensive details on both hydroponics and the choice of fish species used in aquaponics. The paper also touches on the benefits of aquaculture, and highlights the first well-known modern system designed by Tom and Paula Speraneo. While the authors do not go into extensive detail about technical requirements, they do offer many resources for people interested in entering the field.

Rakocy, J., Masser, M. & Losordo, T. (2006) Recirculating Aquaculture Tank Production Systems: Aquaponics—Integrating Fish and Plant Culture. *Southern Regional Aquaculture Center* United States Department of Agriculture

Building on the previous paper detailing the general concept of aquaponics, this paper delves deeper into the technical specifications and requirements of aquaponics. As it is a

technical paper published with the support of the US Department of Agriculture, the authors do not seek to answer any specific research questions, but rather have published a fairly definitive treatise on the subject, covering all related aspects of the industry. Although the paper is supported by and published for the US government, much of the research data was sourced from Calgary, Alberta.

Shrestha, A.& Dunn, B. (ND) Hydroponics *Division of Agricultural Sciences and Natural Resources.* Oklahoma State University

This is a white paper published by Oklahoma State University. It clearly defines both the history and the technical requirements to effectively set up and operate a hydroponic system. The authors also give some thought to the potential of a modified soil based system, as well as offer some contemplating on its global use is underdeveloped countries.

Nickerson, C., Morehart, M., Kuethe, T., Beckman, J., Ifft, J., & Williams, R. (2012) Trends in U.S. Farmland Values and Ownership Economic Research Service. United States Department of Agriculture

This report was written to examine both macroeconomic and parcel-specific factors affecting farmland values. The authors found that historically low interest rates have likely been a major contributing factor to the farms abilities to support current land values. They suggest that a increase in current interest rates could potential have a strong negative affect on current farmers ability to support the land they own. They further note that Government crop subsidies have also played a significant factor in artificially supporting the farms.

Raquel Moreno-Peñaranda (2011) Japan's Urban Agriculture: Cultivating Sustainability and Well-Being. United Nations University Tokyo.

Published by the United Nations University Tokyo campus, this paper is a big proponent of urban agriculture and its broad benefits to society. The author discusses a range of challenges and opportunities presented to the regional and national governments of Japan. The author further documents some interesting findings that may be unique to Japan and its agricultural industry.

Banerjee, C., Adenaeuer, L. (2013) Up, Up and Away! The Economics of Vertical Farming. Institute for Food and Resource Economics. University of Bonn.

This German paper focuses directly on the physical and economic requirements of building and operating Vertical Farms. It examines a real world engineering study undertaken to calculate the cost and yields of a VF and asses its market viability, and also gives stark warnings about the potential of food scarcity and agriculture land loss. The authors also conduct a thorough SWOT analysis of the concept, and focus much of their concept on Mega-cities and the worlds Desert regions as viable location choices.

Mougeot, L. Ph.D. (2000) Urban Agriculture: Definition, Presence, Potentials and Risks, and Policy Challenges. *Cities Feeding People Series Report 31* International Development Research Centre (IDRC).

As this paper was published 16 years ago, some of the findings are now out of date, but it's overall purpose is to define and help support the growth and support of Urban Agriculture. It discusses a broad range of aspects relating to the field. I found it to be most helpful in actually

helping to define the actual description of Urban Agriculture.

Goddek, S., Delaide, B., Mankasingh, U., Ragnarsdottir, K., Thorarinsdottir, H. (2015) Challenges of Sustainable and Commercial Aquaponics. MDPI

This relatively recent paper addresses the other aspect of building and operating a viable Vertical Farm using Aquaponics, which is to ask if it is actually commercially realistic or sustainable. While the authors accept that food security and scarcity are a real and growing concern, they seem to have reservations in recommending aquaponics as a solution. While they spend a great amount of time discussing the benefits of the concept, they seem to shy away from any strong conclusions and instead recommended more research. Although the authors declare no conflict of interest, I found the message of the paper to read as a bit conflicted.

Smit, J., Nasr, J., Ratta, A. (2001) Chapter 8 Problems Related to Urban Agriculture Urban Agriculture. *Food, Jobs and Sustainable Cities.* The Urban Agriculture Network, Inc. United Nations Development Programme (UNDP)

This paper was also published during the early stages of the modern Urban Agriculture industry, and it discusses issues mainly encountered in African nations. The authors do offer some examples of solutions to Health hazards, but these are based on standards set in Western nations, Canada included. I found this paper to be very insightful in helping to identify health and safety issues that may need to be addressed in the further development of the industry.

Cofie, O. (ND) Emerging Issues in Urban and peri-urban agriculture (UPA) in West Africa. International Water Management Institute

This paper was written to help address how policy makers can help rewrite zoning and public policy guidelines to support the further development of Urban Agriculture in African Nations. The author addresses both benefits and challenges of UA using studies based in Ghana, Sierra Leone and Nigeria. The author does cover many aspects of the challenges facing this process of food production, but most of the findings seem to be brief and somewhat elementary.

Olima, W. (ND) Urban Agriculture in Kenya – Experience and Challenges. Department of Land Development. University of Nairobi, Kenya.

Urban Agriculture in Kenya - Experience and Challenges is focused almost exclusively on Nairobi. Although the author does address some basic issues, the coverage is almost all in bullet point format and does not seem to sufficiently address the stated goal of optimizing land use in city areas. Although the author recommends that urban agriculture ought to be improved, they offer no recommendations or insights in how to do so.

Conclusion

From the basic aspects of how to build and operate an aquaponic system, to information on how to plan and cost the construction of a vertical farm, these articles seem to provide enough information to move forward with my research. Further to that I have sourced articles that address land values across North America and the challenges faced both in rural and urban centers. Lastly there are several articles addressing issues and opportunities on how to address them, faced in the development, operation and viability of Vertical Farming and aquaponics. In conclusion I believe that across these eleven articles I have sufficient information to successfully move forward with my Capstone paper.