Sustainability Through Extension Services

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Table of Contents

Acknowledgments

Deserving my utmost, sincere respect, I must first express my appreciation to The World Food Prize Foundation, the soul-sponsor, in my mind, of a "Food Secure" future. The late Dr. Norman Borlaug, and the exceptional staff that carries on his legacy of a hunger-free world from day to day, are ultimately responsible for not only my interest in fighting for Dr. Borlaug's humanitarian vision, but also the peers of my generation. Being selected to represent a man of immense vision, and an organization of great compassion and momentum, in the summer of 2014, will forever be an experience of a lifetime. For this I am eternally grateful. As a major investor in the lives of youth all across the nation, and our world, I would like to thank the John Ruan Family for their continued support of the Borlaug-Ruan International Internship program. Ambassador Kenneth Quinn deserves special recognition for his ability to represent our country, instill a vision for human rights and advocacy in the lives of millions, and to my direct benefit, lead a staff with great devotion, success, and integrity. Along with this great staff, I want to recognize Ms. Lisa Fleming, the true leader and backbone of this influential program. Ms. Lisa has shown her dedication to carrying out Dr. Borlaug's legacy through the countless hours spent coordinating visas, staying up late to take international phone calls from us interns, and never ceasing to inspire us to "go get" all the opportunities for innovation and development that were waiting for us to assist in feeding the world. Dr. Borlaug and The World Food Prize Foundation is lucky to have an asset such as Ms. Fleming to carry out their operations and recruit "hunger fighters" in the years to come! Along with Ms. Fleming, I would like to thank Mr. Keegan Kautzky for his continued support throughout my participation with The World Food Prize, and his ability to pass on the realization of the issues facing our generation, just as Dr. Norman Borlaug once conveyed to him. In addition to those who helped me along the way, I would like to congratulate my fellow 2014 Borlaug-Ruan Interns, and thank them for their inspiring Facebook posts, their blog entries, and overall tireless devotion that we share for building a sustainable, food-secure world. You ALL are agents of change and I could not feel any safer with the future of our generation in your hands.

To the Kishor Pande family: Kishor, Teju, Aditya, and Swastik. I cannot thank you all enough for bringing me into your home for my stay here in India. Without a doubt, my relationship with your family and the days that I spent with you all have forever molded my life and changed my heart for the better. This summer you shared your home, you shared your culture, you shared your religion, and most importantly, I know that you shared your love for people with me. I truly feel like a part of your family and I will be forever thankful that God blessed me with a host family that is as generous and genuine as you. Your outpouring of hospitality reinstated just what Maya Angelou once said, "Perhaps travel cannot prevent bigotry, but by demonstrating that all peoples cry, laugh, eat, worry, and die, it can introduce the idea that if we try and understand each other, we may even become friends." For impacting my life, I can NEVER thank you enough.

I would like to specifically thank my host institution, Mahyco, and the mentors there that made my research possible. Dr. Bharat Char, Sheetal Sethi, and Amrita Ingole worked closely throughout the summer to ensure I had the best experience possible while learning about the true components that make up India's agricultural industry. Individually, I would like to thank Mrs. Sethi for assisting in the development of my thesis and communicating closely with me all

summer from her Hyderabad office. Day after day, she provided me with valuable input and guided me through the obstacles I encountered while organizing my research project. To Amrita: thank you so much for putting your official job aside, and taking me in this summer while you served as my unofficial, official mentor. Without your help arranging my field visits, and interpreting FGD responses, none of this would have been possible. Amrita's background with Indian agriculture and market relations proved invaluable throughout my research and without a doubt, guided my analysis of possible barriers and cultural differences I experienced throughout the course of my internship.

Back home, I would like to thank Ms. Casey Epler for inviting me to participate in The World Food Prize Youth Institute, and for believing in my passion and intent to better the world. Without you, this opportunity would have never come my way! I cannot forget my other two Agriculture teachers, Mr. Rodney Wiedower and Mr. Jason Davis for instilling in me the values of our industry and what it means to "believe in hard work." You two are an inspiration to my fellow classmates and FFA members, and I will never forget the legacy that you will both one day leave behind. I especially want to thank my friends and the staff at Greenbrier High School, or as I like to believe- my family. You have provided the basis for a first-class education and continue to inspire my fellow students and I to uphold our core values: Perseverance, Integrity, Excellence, and Respect. Thank you for working with me as I miss countless days of school, and for always giving me the resources necessary to carry out my dreams and to be successful.

I cannot forget to express my gratitude to the over-13, 000 members of the Arkansas FFA Association. Each and every member of this great organization has inspired me to fight for our future, and share the passion and vision that I have for the agriculture industry and the goal of birthing a food-secure future. Mr. Chris Bacchus deserves special recognition pertaining to the Arkansas FFA Association for his unending support in my relations with the WFP Foundation. He transported me to my first Global Youth Institute in Des Moines, and he continues to inspire youth all across our state to get involved with the work of The World Food Prize and take responsibility during a timet of uncertainty and developing despair as our world population continues to grow. I feel confident that with your continued support of our Association, Arkansas FFA members will play a vital role in developing crucial ideas on how we, the American agriculturalists, can feed the world in the years to come!

Thank you to my dear friends and family, who sacrificed time spent with me during such a special year of my life. The time that I spent away was tiring at times, but I promise that whatever tears were shed, or whatever 2:00 AM phone calls were made, will all be worth it! Having such a strong support system back home that always kept up with my blog posts, and sent me encouraging messages along the way was very inspirational, and undoubtedly made my journey away from home much easier. I hope that my experience here inspired you, and opened your eyes to the critical issues that our future world is facing. To my phenomenal parents: Tim Harris and Kelly Tapley. THANK YOU for always believing in me and empowering me to make a difference in the world. Although at times I know it's hard for you both to grasp, you raised me to be a strong, independent person who was able to handle an experience like this. From the surprise letters I found packed away in my suitcase, to the countless "I love you" and "I miss you" text messages, I cannot thank you both enough for loving me and pushing me to be who I am today. As my mother has always encouraged me to do, I must thank God for ultimately

making this experience possible and for blessing me with the skills and passion I have for helping others and serving my world.

About Me

I grew up unlike you probably would picture a 'traditional agriculturalist'. I didn't grow up on a large farm, although agriculture has forever been a part of my life. Growing up in rural Arkansas, in the outskirts of a town whose population staggers below 4,000, I was born to an Agriculture teacher and a traditional classroom educator. Although I don't remember the years my father spent as an agriculture educator, I'm sure his involvement and belief in the National FFA Organization has played a key role in my passion for the industry that feeds the world. Growing up, I heard my sister and brother talk of their experiences with the FFA and I saw how it molded their lives. I knew from an early age that I wanted to be involved with agriculture and this organization, but it wasn't until I became a member myself that I realized I wanted to devote my life to these things. As I advanced through school I thought maybe I wanted to be a doctor, a lawyer, a scientist, or maybe even a teacher like my parents, but thankfully I found my niche somewhere that I believe will allow me to make the biggest impact: human development and agriculture.

Growing up in rural America, I unquestionably was aware of how huge the agriculture industry was, and what Arkansas' contributions to it were with its investments in Tyson Foods Inc., Wal-Mart…etc. However, with the wool over my eyes, as many well-off American's still live, I didn't fully comprehend where our future was headed, and what my role in it was. In high school I got involved with a community food drive, Step Up to The Plate, that sparked my interest regarding the effects of hunger and it's relevance to my neighbors, the city that I loved. As I continued to investigate opportunities that would allow me to help the less fortunate, I stumbled across the National FFA Organization's initiative for feeding the world: Food for All. With this grant opportunity, I was awarded $2,500 to start a food service program within my local FFA chapter. With the help of my advisors, and fellow FFA members, we successfully designed and carried out a workshop on container gardening that provided insight about the skills of urban agriculture and how ANYONE could produce their own food, thus taking a grass roots approach as promoting a food-secure populace. It's undeniable that the skills and statistics that I uncovered while working with this project, spurred the future endeavors that led me to apply for the Borlaug-Ruan International Internship, an opportunity that I only remember dreaming of.

The World Food Prize and How It Captured Me

How appropriate, since food has always been one of my favorites, that I attend a conference with an organization entitled "The World Food Prize!" Although the titled served enough as an appropriate reason to attend, I never imagined how much it would actually allow me to thrive. "Hey Sam, would you be interested in attending a conference in Iowa that involves world-renowned scientists and agriculturalists to discuss solutions for ending hunger?" I believe that was how the conversation went with Ms. Epler in the summer of 2012. Clearly, I wasn't going to pass up this opportunity to meet some influential people and travel to a new city! Little did I know, my participation in this Global Youth Institute would take me to Jalna, India and repave the pathways of my life. I was already interested in hunger relief and agriculture, and I

knew that this would be the perfect opportunity for me to develop my passions and bring back what I had learned to my hometown and to my home state.

After attending the GYI in October of 2012, I returned home fired up and read to fight: ready to fight hunger. Among the time I spent in Iowa, I had became aware of our unsure future, and I knew that I had to do something to help! I had sat through hunger banquets, talked to rural African farmers, and observed first-hand the gut-wrenching realities of hunger and what it meant for our neighbors across the world, and as importantly, my neighbors next door. I returned back to Arkansas with a sense of humility and responsibility to serve.

For many teenagers, spending their last years of high school fighting hunger and identifying their social responsibilities is the last thing on their minds. I don't count my passion as a loss, however. I see it as an opportunity to better my future. I believe it to be the gateway that led me to apply for such a prestigious internship. The summer of 2014 portrayed it to be the reason I traveled over 8,000 miles across the ocean, flew over the Himalayas, and landed in Jalna, Maharashtra, India for a life-changing eight weeks.

Jalna, Maharashtra, India

A city of about 240,000, Jalna was my first taste of the Indian culture. It lies only miles away from Maharashtra's economic center, Aurangabad, where the airport is located. As I hopped off the plane, scrounged for my luggage amongst flowing languages I did not know, I realized that I was really there. I was really 8,000 miles from home, embarking on a journey of independence, knowledge-seeking, and most importantly- hope. Even from hour one, I was greeted with the upmost sincere interest, and hospitality. As my host father, Kishor, and the driver loaded my bags, I took a look around at a landscape that appeared vastly different from any that I had ever seen. I got in the car and we rolled away; my body absorbing every speed bump as a change in heart. I was ready to conform, learn, and soak up every moment.

Mahyco Hybrid Seed Company (Limited)

"Mahyco was founded on the foresight of a man who dared to venture beyond visible possibilities and showed immense confidence in his vision. Post independence, when India was still in the process of fortifying her weak economic strength, Badrinarayan Ramulal Barwale sowed the first seeds of economic development. Breaking free from the stronghold of Nizam conservatism in the Marathwada region of Maharashtra where his family owned land, he chose to take risks and develop the immense potential that lay latent in hybrid seeds at a time when the seed industry was small. His major breakthrough came from the Pusa Saoni bhendi (lady's finger), a hybrid resistant to a widely prevalent virus developed by the Indian Agricultural Research Institute (IARI). Dr. Barwale began producing and marketing this variety, which set an example of how technology can help fulfill the promise of a bigger harvest at a lesser cost," according to the company website. The planting of this "first seed" proved to open the door to an expansion of the Green Revolution and the beginnings of a food-secure Indian nation.

Since 1964, Mahyco has established over 15 production centres, 23 sales offices and about 2,500 dealers located across India. Currently, over 10,000,000 cultivators are growing seeds for Mahyco. With such an elaborate business design, and the perseverance to prevail, even in a sometimes-strained Indian economy, Mahyco has exceeded its vision of success, and continues to provide an avenue for food security across one of the World's fastest-growing nations. Mahyco continues to work under science-oriented projects, and uses the practical skills that Dr. Borlaug talked about in his book, *Norman Borlaug on World Hunger,* which he deemed as the "most vital tool" young scientists have to combat population growth and resource scarcity. Found online at Mahyco.com, the company's frameworks of success are as follows:

Vision: *'To feed the world with India's Agriculture'*

- To bring the best of science into the Indian fields, it is the socio-economic vision of the company to empower the farmers with the best of seeds and to enhance the agricultural productivity of our country.

Mission: *'Enhance cultivation with art of science'*

- Protect the present agricultural face of India from the challenges of the future by strengthening our farmers with the best of technology and innovation. We believe in being static in values but dynamic in learning and adapting the best of the world to create a green India.

Over the years, Mahyco has continued to display its commitment to success through partnerships with companies such as Monsanto and Dow AgriSciences. Its most recent collaboration with Monsanto, to implement the use of Bt Cotton across India, is just one excellent example of Mahyco's determination, and ability to advance India's Agriculture.

Despite the company's profound economic and scientific successes, the website points out that "The centre of this growing company still remains the same: the ability to dream big and the courage to follow those dreams. It's not surprising though. With a visionary like Badrinarayan Ramulal Barwale to emulate, it cannot be anything else."

As a young researcher, and modern-day hunger fighter, I am convinced that it is organizations, with values such as these, Dr. Norman Borlaug was speaking of when he said this about **change**: "In the developing countries it is not the number of profound scientific treatises or publications that appear in scientific journals that will help to make changes. Change must be measured by the increase in tons of grain be it wheat, rice, corn, sorghum, or millet; this must be your criterion of change, not the over-sophisticated approach, which we, the developed nations, have unfortunately sponsored in our university staff advancement philosophy of "publish or perish"." Mahyco strives day-to-day to measure change in growth, both agricultural and economic, by developing new seed varieties and technologies that increase production. This ceaseless dedication to global food security was recognized, in 1998, when Dr. B.R. Barwale, Founder and Chairman of Mahyco, was awarded The World Food Prize for his strong influence among private sector contributions for the enhancement of Indian agriculture.

Why Farm Extension Services?

Since the beginning of time, countries have raced to secure one title of supremacy that could set them a part from the rest of the developing world: education. In the age of the "Knowledge Revolution," it is undeniable that obtaining a secondary education, and furthermore a post-secondary education, is of utter importance to all of humanity. Often times it set you a part from others in society, in the professional workforce realm, and sometimes it even influences our personal relationships throughout our lives. It's something that most of us take for granted from the day we begin kindergarten, and when we register for our first college classes. For most developing nations, education is available at any place and at anytime- simply for our taking and for our development. But across the world, in one of the most populated countries, India, getting a secondary education is often a task in itself. When many students aren't granted the luxury of even attending school for a basic education, we can't expect there to be professional development opportunities available for those that already have established careers. However, amidst the aftermath of the Green Revolution, the Indian Government is providing just that. As India's nation flourished economically due to advancements in the agricultural industry, the Ministry of Agriculture concurred that it was time to establish a means of technology and information dissemination for farmers all across the country. Since agricultural occupations make up about 50% of the total workforce, it is undeniably necessary that farmers, those ultimately responsible for feeding the world, are up to date on the latest and most sustainable technologies and cultivation practices of our age. To accomplish this, the government's agricultural officials worked closely with the Education Committee of 1964-1966, to establish the first Farm Science Centre (Krishi Vigyan Kendra or KVK). This initiative would serve as India's first attempt at educating farmers and providing out-reach opportunities to those struggling with their operations. Since conception, there has been over 570 KVKs established throughout the country to work with rural villages and in farmer-majority districts. The program closely mirrors the United States system of Agriculture Education and Extension Services set into place by the USDA. With major, proven success, and concrete guidelines in place for instruction, it would appear that every farmer across rural India is being informed on the newest industry information, thus adopting the most productive and profitable farming practices. However, during the age of innovation and groundbreaking agriculture research, the rates of productivity suggest otherwise. If new seed varieties, that offer protection against destructive pests and increases in yields, are available to farmers for purchase, and government subsidy programs are established that allow farmers to invest in much-needed drip irrigation systems, why is India still home to over a quarter of the world's undernourished people? Could it be that the delicately designed extension programs aren't as effective as planned, or does this deficit simply suggest that the lack in productivity lies elsewhere? Farmers are truly resilient entrepreneurs, and without a doubt, they should be the first to adopt a new technology that could assist them in overcoming the strife of an ever-changing world. So, to assess this problem, and gain insight into India's possibly faulty method of disseminating information to farmers, I chose to survey the recipients of the Krishi Vigyan Kendra services and other smallholder farmers in the state of Maharashtra, and use their stories of success and failure to pinpoint the weaknesses in the KVK's efforts.

Abstract

Extension services are community, government, or private initiatives set into place to assist farmers and agricultural producers in maintaining and managing their farms in a productive, expedient manner. In India, most farmers depend on the rainfall of the Monsoon to supply their fields with the necessary water supplies. Furthermore, due to unpredictable climate variations, farmers must be equipped with relevant information on how to sustain their farms even during times of extreme drought, soil degradation, and regulatory instability. Often, due to poor infrastructure or uncommitted program establishments in the Maharashtra area, existing extension services are not carried out to their fullest capacities. This creates a potential block in the dissemination of information and farm resources.

To better identify the gaps and loopholes regarding this topic, the following were investigated:

1. **The possible fault in quality or quantity of extension services in rural India is impacting on-farm practices**

2. **The lack of access to relevant information and vital resources influences farmer's awareness and perception of new technologies, thus affecting the adoption of new technologies.**

In a rural-based, agrarian scenario as in India, smallholder farmer operations are strongly influenced by local extension services. It is possible that due to their inaccessibility to crucial resources and information, some farmers may be forced into making ill-advised decisions regarding their farms and crop production methods. Because of not only India's rapidly growing population, but also the World's, it is important that ALL farmers are adapting and advancing together in order to meet consumer demands. The use of traditional farming practices over more advanced technologies is limiting smallholder farmer's income and productivity growth, and at the same time is also reducing the ability to ensure communities are food secure in future. In realization of this developing problem, the chosen topics focused on the practices related to dissemination of information, identify gaps if any, and determining how these divides are affecting farmer productivity levels. This topic was chosen to also focus on farmer awareness and perception pertaining to new farming practices and technologies and how it also affects the adoption of productivity-boosting methods.

To better get a first-hand perspective on farmer's perceptions and informational deficiencies, local villages in the Jalna, Maharashtra area were chosen as the study group, where the seed company, Mahyco is located. The farmers of Jalna are certainly dependent on agriculture to ensure their livelihood and ability to thrive. Farm owners and/or operators were chosen as the target group of respondents. These respondents were selected based on accessibility and connections already existing between rural farmers and Mahyco's outreach team. In order to observe a proper representation of farmers, three focus-study groups were organized, each consisting of about 10 smallholder farmers to ensure a representation of respondents across crops, landholding size, dependence on rainfall, farm management practices, and other relevant aspects. The specifics selected allowed us to better understand the role of extension services in the area.

Although quantitative methods were used as necessary, for the purpose of this study, qualitative methodology were mainly be utilized to conduct the primary research. In addition, secondary investigations into existing databases were executed. This data was organized, compiled, and analyzed using statistical tools and methods. With the use of graphing utilities such as Microsoft Excel, we were able to visually represent our finding for further investigation, evaluation, and proposals.

Upon completion of our study, the outcomes were as follows:

1. **Farmers of all ages, and in various sectors of production have differing views regarding new technologies being developed in agriculture. These differing perspectives often became hindrances in farmer exploitation of new technologies, keeping the rural farmers from furthering their productivity potentials.**
2. **There is an obvious gap between the potential impact of existing extension services and their actual impacts on the targeted farmers- differing from village to village. Villages with larger-scale, more productive farmers seemed to benefit more from these services.**
3. **Farmers who have accessed efficient extension services within the past decade have better acclimated to climatic changes, consumer demands, and environmental changes compared to those who have not had the opportunity to utilized farm extension initiatives.**
4. **Factors such as education, religion, cultural beliefs…etc. heavily influence how farmers view scientific advancements and emerging technologies, thus often affecting their adoption thereof.**

This study and its focus group discussions revealed that farmers continue to adopt new skills and technologies taught by extension workers, based on socio-economic feasibility, because they see the obvious benefits of innovation such as increased crop yields and boosting monetary profits. Younger farmers are becoming increasingly open-minded and innovative compared to past generations, but the extension staff concurs that this “knowledge revolution” has outreached the immediate generation and is improving the productivity of farmers in every age group. Although a majority of farmers are willing to adapt to the changing world- barriers still exist. Factors such as socio-economic status and cultural beliefs still heavily influence Indian agriculture.

Objectives of The Study

To better understand the relationship between India’s extension services, and the productivity of smallholder farmers, the first objective of this study was to better identify the gaps and loopholes regarding current governmental, private company, and NGO extension programs. To do so, a questionnaire was designed to assess the possible fault in quality or quantity of extension services in rural India and it’s affects on farm practices. Additionally, the questionnaire for farmer focus-group discussions identified the lack of access to relevant information and vital resources that may influence a farmer’s awareness and perception of new technologies, thus affecting the adoption of progressive agricultural practices.

Personal Contributions

Since Mahyco focuses on hard sciences to create revolutionary seed varieties, rather than community outreach and development, my research focus was originally mine in its entirety. Upon arrival at Mahyco, I expressed my interests in farmer knowledge and education, and how I wanted to focus my research around those areas to better understand how they affected food security across the world. Thankfully, my mentors, despite their unfamiliarity with this type of research project, accepted my interests and worked diligently to coordinate my internship to fit my research goals. My mentors, and other Mahyco staff provided all the resources and opportunities that I needed to "hit the ground running," but with that freedom came more responsibility, and an increased need for self-directed work and learning. With the assistance of co-workers, I decided on what hypotheses would need to be tested, and how I would do so. By creating the questionnaires designed to reveal local, smallholder farmer's perceptions and operational concerns, I successfully collected the responses from farmers through assistance of a translator. Following the conclusion of the last focus group discussion, the responses were organized, and response-based themes that best represented our discussions and accurately portrayed the thoughts of local farmers were generated. In addition to the collection of primary data through focus-group discussions and interviews with extension professionals, secondary research was conducted in order to better understand the scope of extension services, and how India's compare to those in other parts of the world.

Methodology

Due to resource and time constraints, qualitative methods were chosen in order to make inferences, rather than unfair statistical assumptions that could've arisen from small sampling sizes or response bias. To assess the perceptions of local farmers about emerging agriculture technologies, an open-ended questionnaire was created. With the use of open-ended questions, I hoped to get a truer depiction of the impacts of farm extension services, while also detecting any ambiguity regarding our purpose or the farmer's knowledge about local government extension services.

The study was played out through four different focus group discussions: one discussion with local extension agents and KVK program, and three separate groups of local, smallholder farmers. In order to understand how the KVK program was designed to work, we initially met with the KVK program coordinator and held focus group discussions with the team's scientists who serve as farm extension workers. Beginning with the KVK program discussions allowed for a comparison between what the desired KVK impacts are, and what the program actually accomplishes as reported by local farmer recipients. The KVK meeting took place in the Jalna District of Maharashtra, where two of our farmer focus group discussions were also held. This was intentionally planned in order to make accurate comparisons. In the Jalna District, a focus group discussion was held in the Siraswadi village with 10 farmers. In the Badnapur district, a focus group discussion was held in the village of Dhoksal with 13 farmers. Although Dhoksal was outside of the district of Jalna, the KVK still provided services to this area. In addition to local farmers, another group of farmers were interviewed in the Nashik district, which is relatively far away from the Jalna area, and from Mahyco's influence. In the village of Thangaon, 23 farmers attended focus group discussions to provide their input about the seemingly non-existent extension services in their area.

The focus group discussions took place in the heart of the villages that we individually visited. Sometimes this meant meeting in a small, window-lit classroom, or other times it meant we were gathered on floor of a local farmer's home. Each location allowed us to connect with the community's farmers and accomplish our purposes. Each discussion lasted approximately one hour, but was often followed by extra time as requested by farmers, in order for them to also ask questions. Overall, 50 farmers were interview and/or participated in our focus group discussions, in addition to the KVK director and staff members who represented their program through a separate FGD discussion.

Krishi Vigyan Kendra, MSSM, Jalna

The Krishi Vigyan Kendra, or KVK, is an institutional project of Agricultural Extension that works under the control of MSSM, and is officially sponsored by the Indian Council of Agriculture Research (ICAR). MSSM is a voluntary organization of which, for the last four decades, has been dedicated to Watershed Developments and Agricultural Extension and Education. Currently, there are over 650 KVKs in rural villages across India. As designed by the MSSM, KVKs are active in almost every rural district country-wide. Although the mandates of the KVK program are managed by ICAR, each KVK location varies in management. While a majority of KVK programs are solely maintained by ICAR, some are under the supervision of State Agriculture Universities (SAUs) or Non-Governmental Organizations (NGOs). Each location's operation is comprised of a team of multidisciplinary scientists who are trained in education, agriculture, and life sciences. KVK programs receive all agriculture-related education materials from accredited, academic or government research institutions. Furthermore, extension programs work closely with private companies, government ministries, and private dealers to acquire the latest information and technology.

During focus-group discussions with these scientists, and the local KVK director, various aspects were investigated ranging from personal background and education to crop specific knowledge and skill dissemination. To understand the extension staff's qualifications and training, each participant's educational background was recorded. Out of the 10 scientists interviewed, all had a Master's Degree in an agriculture-related area. Since extension workers are required to provide assistance to farmers in the local area regarding crop specifics, it was important to understand the extent of their background with the area's geographical and biological make-up. After further discussion, it was discovered that each technical workers had either lived in the immediate area since birth, or were at least native citizens of the State of Maharashtra. The scientists claimed that this association with the Jalna area gave them expertise about local cultivation practices, language differentiations, and cultural restraints. In addition to the extension staff's formal education backgrounds, they reported that professional development opportunities were regularly available to them, making them even more efficient extension workers. Discussions held with the Jalna KVK clearly suggested that the institution showed strong organization and strategy as outlined by their official mandates. Each worker appeared to be committed to educating farmers through various seminars, events, and demonstrations. Their facilities were of descent quality, and proved sufficient in hosting farmer training events and hands-on dissemination opportunities.

When asked what motivated farmers to utilize extension services, the extension staff conclusively suggested that almost all farmers are primarily motivated by success. Consequently,

farmers mainly reach out for extension intervention on a needs-basis. When farmers see the successes of other farmers using newer technologies and/or crop varieties, they likewise choose to adopt. The local KVK often elects "trial farmers" to demonstrate the newest pipelined technology, in order to show success and motivate surrounding farmers to adopt the modification. Monthly seminars and additional events attract further farmer participation. With events such as "Women's Day" and "Soil Day", the local farming community is encouraged to attend events that further their agricultural knowledge, and boost their partnerships with local farmers/dealers. These complex interactions not only promote farming success, but they improve the profitability and continuation of smallholder farming throughout rural Indian areas. Since the conception of the KVK initiative, progress has prevailed throughout the developing country of India. It's undeniable that the resources they have, and the skills that they teach are vital to the sustainability of Indian agriculture.

Nasik Fruit and Vegetable Farmers

In the Nasik district of Maharashtra, focus-group discussions were held with local, smallholder fruit and vegetable farmers in the village of Thangaon. Thangaon is located among 106 other villages, in the city of Sinnar, which is found on the rural outskirts of Maharashtra's 3rd largest district, Nashik. Being the fastest growing city in the Nashik area, Sinnar has seen many developments throughout the past decades in infrastructure, agriculture, and education. This immense growth has trickled into the village levels of Nashik, including the area of Thangaon, which is currently one of the largest villages in the district. With a population of 6,213 people, 3,113 being males and 3,100 being females, Thangaon is almost completely agrarian based. Fortunately, due to recent government outreach, around 68% of the population is literate. Although the majority of households hold a basic education, almost 78% of the working population is still involved with production agriculture, while 48% of the population remains unemployed. With the majority of the total population not currently working, that leaves more hungry mouths to feed, with fewer resources. Active farmers in the Thangaon area mainly cultivate exotic fruits and vegetables such as: cabbage, onion, lettuce, and sweet limes. Due to a rapidly increasing amount of land fragmentation, the majority of the farmers in this area farm on less than 2 acres of land. Most farmers in the Sinnar area rely on irrigation systems, and long water pipeline systems installed by farmers. In a rain-fed region, agriculture here often suffers from climatic changes, as many places do across India. This resource restriction further increases the farmer's lot to maintain wholesome and profitable farm operations.

With constraints such as water scarcity and land fragmentation, it is important that farmers are equipped with the latest information and farm technologies that allow them to hedge against calamities. However, in secluded villages that lack communication infrastructure, often the transmission of such vital knowledge doesn't take place. Ideally, KVK programs are implemented in such areas to overcome these communication barriers, but as the study revealed in Thangaon, these collaborations are often faulty and/or lacking the desired impacts mandated through the host institutions. When asked how familiar the farmers were with extension services, the response was a resounding "not at all." Each of the 23 farmers surveyed expressed deep unfamiliarity with government, private company,

and NGO farm extension and education services. Although the Nasik area currently hosts two KVK programs, the farmers in Thangaon, one of the most resource-stricken villages in the state, aren't reaping the benefits.

Throughout the past decade, countless technologies have been developed such as improved seed varieties and drip irrigation; however, the smallholder farmers in Thangaon rely only on information transferred to them from the local agricultural supply dealer. Although local dealers often provide the necessary products to operate a small farm, they don't always relay to farmers the latest information or cultivation practices that are being developed in the industrial realm. Whether it be a sense of greed restricting this dissemination, or a simple lack of knowledge, the farmers who need these adapted technologies the most, aren't learning about them, which is necessary if they are to adopt. To assess the need for farming education, basic knowledge questions were considered through a focus-group discussion. In addition, the attendees were asked, "If you had opportunities to attend training events on new farm technologies, would you?" Each of the 23 farmers in attendance not only answered "absolutely," but they pleaded for more government interaction. Even these rural farmers understood their lack of knowledge, and realized their need for new practices and better defenses to face our changing world.

The farmers of Thangaon expressed that they needed so much more. Not only was crop management an area they lacked education about, but also simple practices and concepts that farmers in developed countries take for granted were simply vague realities. Farmers discussed the absence of marketing support and post-harvest intervention from the government, or any third-party. They were often aware of mechanized technologies such as tractors, plows, greenhouses…etc. However, due to economic constraints, they hoped for more information regarding subsidy options to fulfill these needs. These illiterate farmers relied on local brokers and dealers to transport their product to the market, and sell it for the best price. Being forced to use a "middle man" often reduced their profits, and caused unfair market involvement for the farmers; but regularly, this was their only option. Due to the lack of proper storage facilities or access thereof, smallholder farmers reported being forced to sell the products of their toil for minimal prices, simply to avoid spoilage and waste. Even if a rural farmer took the initiative to seek out market information in order to sell his product at the maximum price, in the optimal location, resource deprivation restricted them from successfully utilizing intuition and increasing their profits. Factors such as these demonstrate the additional hardships that farmers face each day, in developing agricultural societies.

One shocking observation that arose from FGDs in Nasik was the volatile future of Indian Agriculture. Various respondents willingly expressed their fears about their occupation, and their negative perceptions regarding the future of their vital work. Farmers in Thangaon felt that with the increasing complexities of farming such as government regulations, unstable markets, and unpredictable climatic changes, their often-inherited occupation would not longer be a sustainable source of income in the near future. As a result, the farmers admitted that they encourage their children to seek education and livelihood elsewhere. They feel that being born a farmer is a "bad destiny" and that they have no other choice for themselves, or their families. Farmers in rural societies, such as Sinnar, don't feel respected in public, or at home. Such change

in perception of our industry is making it harder for farming men to find wives and families that accept their devotion to agriculture- simply because of bad experiences, and a mostly misinformed public and inefficient government. These threats of discontinuity are alarming and real. The stronghold in food security has been breached, and thoroughly needs revision to ensure a protected future of self-sustaining farmers, and enough food being produced to feed not only India, but also the growing world.

Jalna Cotton Farmers

In a larger, more populated area, I visited the village of Dhoksal to discuss extension, adoption, and development with regional cotton farmers. As was investigated in the village of Thangaon, I inquired about the local farmer's knowledge of extension support and what their current position was on new, pipelined technologies. Farmers here appeared to have more awareness of the existence of extension services. They reported that the majority of new information comes to their village through government agencies. For about seven years, the farmers here claim that the government has assumed a heightened roll in supplying them with farm manuals, booklets, and essential supplies. Almost all of the farmers in attendance were educated to the tenth standard, which they also believed contributed to their adaptability and receptiveness to the changing industry. The government agencies were seen as vital to the continuation of their educational capacities, and because of this the farmers vehemently yearned for new skills by attending workshops hosted by the Jalna-area KVK program. Not only do the farmers in Dhoksal attend monthly seminars, they also are very active in the cellular communication programs offered through the National Institute of Agriculture. Through television programming and periodical newspapers, around 13 "highly active farmers" in the village reported obtaining new information about market information that was very helpful before selling their products. In a rural village such as this, the amount of information dissemination taking place was surprising and hopeful for the future of agriculture. Although much was taking place in regard to educating farmers, there still seemed to be constraints on productivity. These progressive farmers had readily adopted Bt Cotton varieties, and were experiencing exponential yield increases as a result. As stated by a local farmer, "our lives have been transformed because of the two letters B-t." So why is Dhoksal still experiencing hunger on a daily basis? The problem with increasing food productivity to a sustainable amount seems to be rooted elsewhere. Since genetic engineering displayed its self at the forefront of global food productivity, India has rejected its life-saving potentials. The country's legislative institutions have contemplated the idea for almost a decade, never really basing their abstentions on scientific proof. Although the United States and similar countries have been able to increase the livelihoods of farmers across their country, India remains stalemated on the idea of accepting genetically modified consumable produce. Whether the issues of GMOs are rooted in political disagreements, or cultural misunderstandings, almost all of the farmers that I met with over the course of the focus group discussions stressed their desires for the government to ease regulatory policies and allow them to quite-frankly save themselves. Within the last ten years, farmers in Dhoksal report that their yields have increased from five quintals (100kg) per acre to over 25 quintals per acre because of their implementation of biotech varieties that were obtained through "black markets." The increases in productivity are viable and obtainable for these farmers, and as a suggestion to the governing bodies of India, it is time to release certain varieties that have been proven safe and are backed by scientific evidence proving that they, in no way, pose health concerns to consumers. This release would not only generate a stronger economy by preventing

black market-retail, but it would sustain the continuation of farming for generations to come-providing India with hope for a food-secure nation.

Jalna Field-Crop Farmers

Much like the cotton farmers in the Jalna district, farmers in Siraswadi seemed to be familiar with extension services and its benefits. Siraswadi has a population of 3,000 people, 50% of which currently operate small farms on six or less acres. The average age of farmers in this area ranges between 30 and 40 years old, accumulating an average literacy rate of 71%. Similar to what was asked in the other group interviews, the Siraswadi farmers were assessed on their involvement with local extension programs and their receptiveness to the information that was being transferred. As usual in this region, the farmers were actively involved with the Krishi Vigyan Kendra agency, which has undeniably changed their lives. With the new skills they have learned from attending monthly seminar trainings and from the educational materials provided to them, their yields have more than doubled within the last five years. The farmers in Siraswadi have adopted new practices and technologies that have allowed them to grow more food per acre, with less external nutrient inputs, thus reducing their costs and increasing their profits. They feel satisfied with current governmental intervention, but they realize the inefficiency of extension services when compared to the materials provided through the private sector. Not only does the private sector supply them with informational guides, but also they are willing to periodically demonstrate how to effectively use their products. However, most of the information that is received from the private sector companies such as Mahyco are very product specific, and usually pertain to costly hybrid seed varieties. Since most of the farmers in rural villages are not financially capable of investing in the latest hybrid, they usually rely on local seed suppliers. This restricts the applicability of private sector education, and doesn't allow the farmers to thrive from this third-party information. All in all, the right information isn't getting passed on to the farmer who needs it the most. In addition to these barriers, farmers in this specific area showed to be skeptical of the government and the technologies that they are promoting. Farmers are using new seed varieties and chemical applications, but only for commercial use because they do not trust them for their own consumption. Although this does benefit them from a market perspective, they are not able to produce surplus foods to sustain their families throughout the year. The farmers admit that they remain skeptical of these new technologies because of the government's own apprehensions. Even though they are aware of several disease resistant varieties that they desperately need, they do not utilize them due to a simple lack of education.

The farmers of Siraswadi are unusually receptive and overall increasingly innovative. Their adoption of systems such as drip irrigation and mechanical plowing show their willingness to change and excel. It is vital that the government and surrounding agencies focus on farmer education in order for their productions to remain sustainable in the future as the need for food drastically increases. The farmers here are willing to use greenhouses and like infrastructure because they understand the potential they hold for their farms, but they still lack the credit resources needed to invest in such technology. If the government were to reallocate funds to increase farm credit entities in India, I believe that farmers would be ready to participate and better equipped to support not only the district of Jalna and the state of Maharashtra, but also India as a whole.

Other Limiting Factors

Although there are obvious faults in the dissemination of information from established extension education programs, it isn't fair to place the blame for low-productivity on such institutions. Initiatives such as the KVK have undeniably transformed the lives of many rural, smallholder farmers across India; however, much insecurity still plagues our industry.

Education

It was conclusive across all villages visited and surveyed, that a lack of formal education plays a major role in the unwillingness or inability to adopt emerging agricultural technologies. Time and time again, farmers revealed through FGDs that they didn't understand biotechnology, they weren't well trained on chemical application methods, and consumer demands were one of their greatest mysteries. With the majority of the 46 farmers interviewed only receiving, at most, a 10^{th} standard education, they lacked the ability to understand biotic and abiotic factor effects, alike. This inability to strategize and deflect production risks, caused further problems in yield, not to mention environmental degradation and pollution. Often, farmers were taught about new seed varieties or chemical applications, but due to their skepticism and misunderstandings, they sometimes refused to adopt such practices in the name of illiteracy.

From Applicant to Advocate

As 2013 came to an end, I had just applied for a new beginning: to be a Borlaug-Ruan International Intern. I had fought with the decision for weeks, and after deciding that it was in fact what I wanted to do, I spent weeks perfecting my application and resume, and collecting recommendations from superiors who believed I could handle the summer abroad. When I sent in that application, I did so without hesitation. But when I received the email stating that I had been selected, through the excitement, I felt hesitation creeping its way into my mind. Today, having spent two months across the world in India, I am thankful that I didn't let my reserves keep me from this experience of a lifetime.

In the United States we grow up without appreciating the basic things in life. We expect education, we expect safety, and we expect three full-course meals everyday. Before I started this journey I didn't realize just how much we in the developing world expect. But now, I realize that I don't simply deserve these things; rather, I am simply lucky. I am lucky that I can concentrate my daily focus on following my dreams and being successful, rather than finding food and nourishing my body.

Jumping back to my first day here in India, I can vividly remember leaving the airport to see makeshift huts with mothers, fathers, grandmothers, and newborn babies lying on the barren ground- surviving. Throughout my two-month journey in India, I saw a lot of surviving, rather than thriving. I saw people working day in and day out to feed their families, rather than pay for their children's education. When I visited rural villages, I heard cries for help and messages of distress. I saw farmers encouraging their children to flee from agriculture, and make for themselves a better life. Why was there such distress in the heart of the world's largest industry? I may not every fully understand the lifestyle of misfortune that was prevalent throughout this

country, but that won't stop me from searching for an explanation.

Fortunately, I saw another thing while living in India: hope. Despite the hardships many of these impoverished people endured, they remained hopeful and overall, diligent in labor. They remained strong and motivated to grow and produce food for their families and for their world- for our world. Seeing this dedication left me with one question: "if these underprivileged human beings are working to feed me everyday, what can I do in return?" After all, we know that feeding the growing population will take an army- it will take us all applying our skills, our passions, and our abilities to sustain the future. Many believe that these smallholder farmers don't hold a significant place in this fight for political and humanitarian peace because they either refuse, or don't have the resources available to change their ways and to cultivate a "modern-day" crop. But Dr. Borlaug left us a quote of opposition to this lethal assumption:

"The most significant thing of all, as far as I'm concerned, has been to disprove that the small farmers, these small, peasant farmers, would not change. He'll change if you help him change. [We] have to help him out at all levels; not only at the scientific but at the top government levels with proper government economic policy." Furthermore, Dr. Norman Borlaug concluded his remarks by saying, perhaps the most important phrase in this fight, *"**this is not an easy task**."*

This blunt reality leaves me with focus and determination; it answers the question I've asked myself relentlessly: "…what can I do in return?" After this summer, I am convinced that it's my duty, as a privileged American, to fight for the smallholder farmers, and to help them secure the future of our industry. It is important that I see India as my home, too. It's significant to understand that we are all just pieces of this vast world- and that it doesn't owe us anything, but that we owe it everything.

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