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International and Local Collaboration in the Social Design of the Harvester in Argentina during the Long Twentieth Century (1900-2010)

Yovanna Pineda

Yovanna Pineda [https://orcid.org/0000-0001-8520-7964], Associate Professor, Department of History, University of Central Florida. E-mail: Yovanna.Pineda@ucf.edu

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Abstract

This article examines the local and international collaboration of farm machine-making between Argentines and Americans. These collaborative interactions provide insight into the multiplicity of design, invention and innovation at the local and international level. Drawing on nearly 100 oral histories, collective memory, more than 60,000 invention patents in a newly created data set, and visual and material culture, the collaborative approach of designer-users and manufacturers/makers demonstrate that the long, arduous task of tinkering and collaborating required participants to believe that building machinery was meaningful, important work. Second, it shows that local oral tradition and community culture mattered to the making of local technology and taking it to the international stage.

Keywords: harvester combine, international collaboration, farm machinery, technological innovation, agriculture

Colaboración internacional y local en el diseño social de la cosechadora en Argentina durante el siglo veinte largo (1900-2010)

Resumen

Este artículo examina la colaboración local e internacional entre fabricantes de maquinaria agrícola argentinos y estadounidenses. Estas interacciones colaborativas proporcionan información sobre la pluralidad existente en el diseño, invención e innovación en ambos niveles, local e internacional. Con base en casi cien historias orales, la memoria colectiva, más de 60,000 patentes de invención provenientes de una base de datos de reciente creación, así como la cultura visual y material, el enfoque colaborativo de los diseñadores-usuarios y fabricantes/manufactureros demuestra que la ardua y larga tarea de trabajar juntos para mejorar el producto requería que los participantes estuvieran convencidos de que la construcción de maquinaria era un trabajo importante y significativo. Además, muestra que la tradición oral y la cultura comunitaria eran relevantes para la fabricación de tecnología local y para llevarla a la escena internacional.

Palabras clave: cosechadora, colaboración internacional, maquinaria agrícola, innovación tecnológica, agricultura.

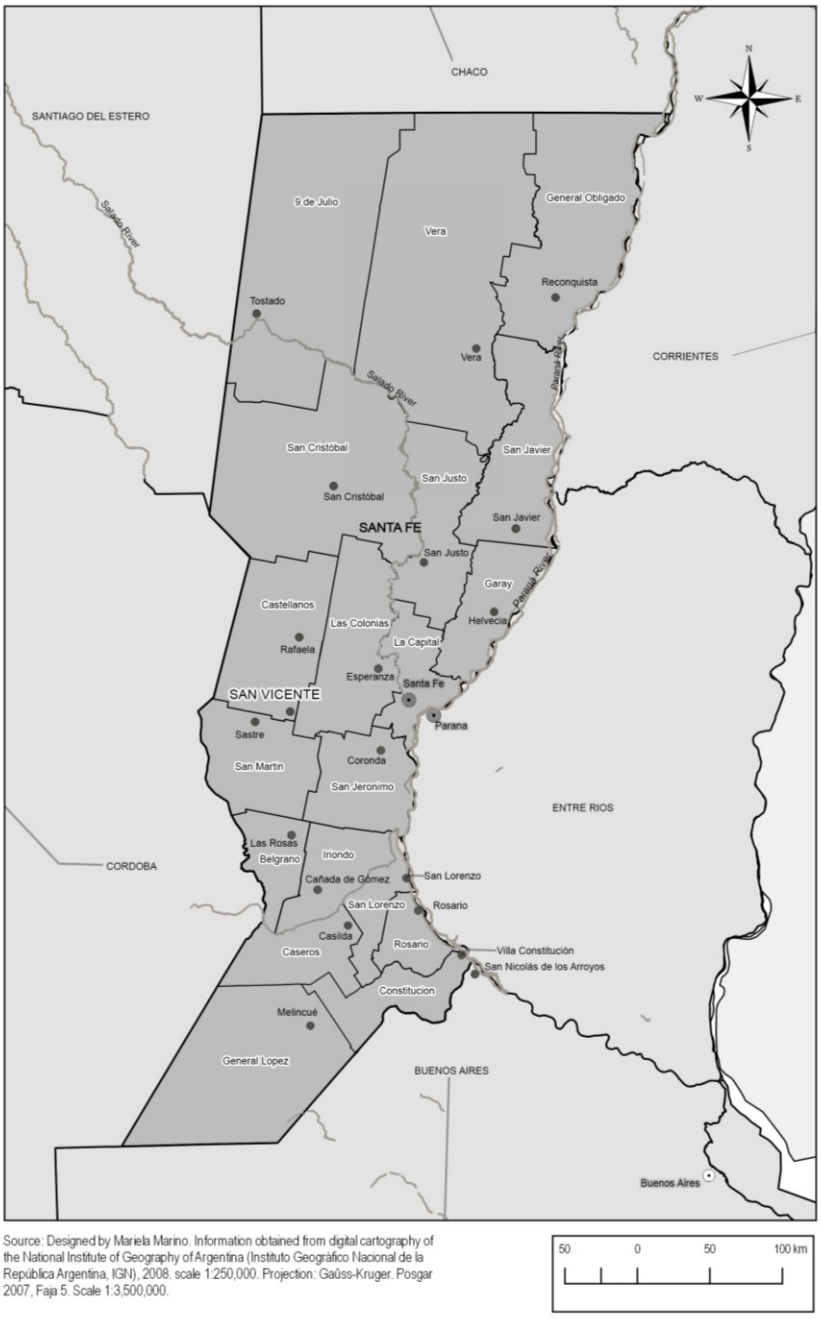
Introduction

As a child, Juan Bergero's favorite bedtime story was of how his grandfather Juan Senor built his first harvester design in San Vicente, Santa Fe. Senor had cleared space to etch a harvester design in his family's backyard. Using nails and thread, he shaped a 3D design of his harvester combine, which eventually became his first patented harvester improvement in 1917.[1] Nearly a century later, in 2016, Bergero retold the story of how his grandfather "…[estuvo] *maquinando* la forma de construir esa máquina cosechadora."[2] Different members of the San Vicente community and Senor family recounted their forebear's story, focusing on his practical intelligence and determination to design a machine. In the 1890s, the brothers Juan and Emilio Senor had moved to San Vicente and operated a blacksmith shop to repair foreign farm machinery and implements. Their shop's business boomed as imported, foreign and mostly North American, machinery had a tendency to break down often and spare/replacement parts were not always easily available. In their successful shop, they made spare/replacement parts for foreign machinery as well as sulkies, designed improvements to harvesters, and eventually, developed a Senor line of harvesters. Using their practical experience repairing hundreds of foreign machines (or machinery items) and implements, they developed their own original farm machinery designs and transformed their shop into the Senor Family Harvester factory.

These brothers were among many machine designers-users in Argentina's pampas region that made a living supporting the livelihood of farmers. In the rural towns of Santa Fe province, local people have attached deep meaning to the farm technology they created, developing a language about farm machinery that became their own (image 1. Map). Individuals and groups in the region collaborated to adapt and design foreign and domestically made tractors and combine harvesters for their effective use in the pampas. Before 1960, most designers-users were self-trained, learning from Spanish-language machine manuals, integrating craft-based approaches, and passing on intergenerational traditions and skills from old to young men in a shop or factory. They also collaborated with foreign or state-trained engineers and with each other to create and disseminate new designs that improved the efficacy of crop farming.

[1] Juan Bergero (Grandson of Juan Senor), In-person interview by author, 2 July 2016, San Vicente, Santa Fe.
[2] Bergero, Interview, 2 July 2016.

Image 1: *Map of Santa Fe Province, Its Departments and Towns*



Source: Designed by Mariela Marino. Information obtained from digital cartography of the National Institute of Geography of Argentina (Instituto Geográfico Nacional de la República Argentina, IGN), 2008. scale 1:250,000. Projection: Gaûss-Kruger. Posgar 2007, Faja 5. Scale 1:3,500,000.

Agricultural studies of the Latin American countryside are abundant, but are largely focused on labor relations, policy, or their approach of analysis is narrow. As historian Claudio Robles-Ortiz (2018, p. 195) has argued, the literature is largely haunted by the "…decades-old interpretations emphasizing the backwardness of both the agricultural sector and the large estate." Past approaches to analyzing the successful development of local technical expertise and mechanization of farming in Latin America have been limited and authors have often compared

Argentina with canon studies, hence, reiterating old interpretations of under-development and "backwardness" (Fienup et al, 1969; Adelman, 1992; 1994). New research shows how foreign trade exchanges or local repair work led to local development of machinery. Robles-Ortiz (2018), for instance, demonstrates the technical exchanges between experts, local landowners, and foreign companies to mechanize the rural sector in Chile. Damián Bil (2009) and Pablo Volkind (2017) investigate how local-level repair work of foreign machinery in shops and forges led to adaptation and invention of farm machinery, including the development of harvesters and tractors in Argentina. Both Bil and Volkind relied on local interviews, material culture, and archives to examine local farm machinery. Nevertheless, Bil compares local machine-making with foreign machinery, which places the former in the role of "backward" in relation to North American or European farm machinists. Yovanna Pineda (2018) contributes to this literature through the study of users. Employing a use-centered approach based on David Edgerton's *Shock of the Old* (2008), she shows how local machine makers focused on what their local market needed and in several cases, designers made machines (i.e., harvesters) that were intentionally less technologically complex than the imported foreign farm machines in order to best serve local consumers.

These studies also reveal that the development of heavy farm machinery required collaboration and an entrepreneurial spirit. Lilly Irani (2019) offers an approach of analysis for better understanding the essence of the entrepreneurial spirit. In her work, she demonstrates features of the "entrepreneurial citizen" that led to collaboration and "people articulat[ing] desires to work for change as demos and deliverables" in the face of innumerable obstacles and shortcomings among the Indian middle classes and subaltern (Irani 2019, p. 2).

This article examines the collaborative approach of machine making by designer-users in the Argentine pampas, specifically in Santa Fe province.[3] It draws on nearly 100 oral histories that form a collective memory, invention patents in a newly created data set, and visual and material culture. In this exploratory research, I conducted field research across urban and rural regions in Argentina, England, and the United States from 2014-2019.[4] I conducted and recorded interviews (in-person, phone, messaging apps, and email) with the men and women who used

[3] In 2016, my interviews with historians Damián Bil and Juan Luis Martirén led me to the central pampas regions. Bil shared his 27 interviews that turn out to be one to six-hour ethnographies of repair work and peoples' perceptions of their work and lifeworld. He shared his contacts in San Vicente, Santa Fe province. (His 27 interviews are not part of my database of 100 interviewees). Martirén introduced me to the local historian and museum curator Raúl Kröhling in Humboldt, Santa Fe province. Also, I created a database of more than 60,000 invention patents from 1866 to 1943. To filter this large data set, I analyzed the data with specialized visual and spatial tools: Palladio https://hdlab.stanford.edu/palladio/ and Gephi, the Open Graph Viz Platform https://gephi.org/ Dr. Amy Giroux assisted me with Gephi.

[4] I have interviewed or received written correspondence or audio recordings, and conversed with nearly 100 respondents for this study.

and related to heavy machinery, especially combine harvesters.[5] Their repair work, designs and collaborations became a part of local oral tradition and community culture.[6]

The structure, application, and sustainability of some designs were the result of years, even decades, of technological exchanges between engineers and mechanics in Argentina and abroad. During the twentieth century, American, Russian, German, and Belarusian engineers and mechanics visited the pampas to exchange ideas on diverse components of these machines, including rotating balls and bearings, transmissions, tires, and platform designs. Similarly, Argentines traveled abroad to agricultural expositions across Europe, Brazil, Chile, and the United States to learn from others' designs and ideas. The process of design went beyond a practical function: in general, "people in different situations interpret[ed] the meaning of a particular machine or design of an instrument in different ways" (Winner, 1993, p. 366). The local communities of the pampas attached cultural, social, and aesthetic meaning to the design of the harvester. Their work to "get it right" required collaboration with others.

Through several case studies, this article demonstrates the process of farm machinery design and collaboration in Argentina during the long twentieth century (1900-2010). One of the principal findings of this qualitative research is that the long, arduous task of tinkering and collaborating required participants to believe that building and working with machinery transformed them in meaningful ways. In the sections 2 and 3, I elaborate on these findings to analyze the history of technology literature and popular meaning of farm machine culture and design. Section 4 discusses collaboration in the important Santa Fe province of the Pampas. The fifth section then examines the international collaboration drawing on research in material and visual culture, oral tradition, and interviews with machine makers/designers/users from Argentina and the United States. The final section discusses future research topics.

Culture of Collaboration, Design and Machine

The process of collaboration had several stages beginning with checking self interest in favor of community interest. Ezio Manzini (2015) argues that collaborative work involved breaking routine and "experimenting with more collaborative ways of living and producing." Social innovation is integral to collaboration, producing "concrete, practical answers to difficult problems" (p. 4). Though social innovation could be defined as "new ideas, products, services, and models," it should not be presumed to be a smooth, linear process (Manzini, 2015, p. 11). On the contrary, the collaboration taking place in the pampas could be viewed from what Deleuze and Guattari conceptualize as "rhizome" in *A Thousand Plateaus* (1987). That is, the pampas contained rich, open complex systems; before forming habits or hierarchies, people re-invented

[5] Interviews took place in person, by email, video conferencing, and/or by social media in multiple locations across the pampas region and in the United States, and at the Museum of English Rural Life, Reading, England.
[6] University of Central Florida Institutional Review Board has reviewed the interview questions and procedures of this research (Exempt number IRB ID: SBE-16-12483).

themselves, choosing to break routines or habits to find innovation.[7] Within the space of creation and design, there were multiple, non-hierarchal points situated in timeless place that invited diverse interpretations of the work people were doing together. Respondents in my study recalled their pasts full of persistent determination and patience to overcome many bumps on the way to developing creative and innovative designs and methods. They considered this process of design as meaningful, impactful work. The community promoted collaborative work regardless of class, gender, position, and so on.

Heavy farm machinery (i.e., harvesters and tractors) transformed the performance of work wherever they were introduced across the globe. The original combine harvester and tractor were designed during the nineteenth century, which enabled the exponential expansion of global food production. In 1834, Hiram Moore invented the first mechanical combine harvester pulled by draft animals, and John Froelich invented the gas-powered engine and a simple transmission for the tractor in 1892.[8] In the pampas, relatively high labor costs due to a low or sporadic supply of mostly unskilled workers, known as *brazos* (literally, "arms") o *changarines* (colloquial term), was common. As a result, local farmers preferred the use of heavy farm machinery to farm efficiently. Such machinery made it possible for Argentine farmers to be major global producers of wheat, corn, linseed, soy, and sorghum during the twentieth century. Despite the revolutionary nature of the invention of heavy farm machinery, the latter had multiple flaws in design, craftsmanship, and ability to work effectively to replace human and animal labor across different natural environments. They also lacked aesthetic details such as a pleasant or distinguishable color. For these reasons, local designer-users developed their own machinery. As David Edgerton (2007) has argued for other regions, users' creole technologies were distinguishable from transferred technologies, designed and used in original ways.[9]

The ethnography of the process of the local use, repair and maintenance of technology is still in its infancy, and seldom viewed from a long term historical perspective. The pioneering work *Repair Work Ethnographies* (2018) demonstrates how, why, and when machinery is repaired and maintained (Strebel et al, 2018).[10] In the pampas, local residents discuss, reenact, and reminisce about how they improved their technological competencies by adapting, repairing, and designing their own machinery while at the same time engaging in collaborative work to expand innovative ideas and methods.

Another characteristic of amateur or professional designers was that designers felt an ethical responsibility to improve human lives through each design change. Verbeek in *Moralizing*

[7] Deleuze used the sciences to explain his philosophical ideas. In botany and dendrology, a rhizome is a "rootstock," a modified subterranean plant stem that sends out roots and shoots from its nodes. In Deleuze and Guattari (1987), they are referring to the rhizome as an "open system."

[8] The Froelich Foundation, a nonprofit organization, "The Froelich Tractor," http://www.froelichtractor.com/index.html Accessed on 21 October 2019.

[9] "… in relation to technology, the poor world is especially invisible," essentially, the "poor world lacks modern technology" or there is a "focus on (some) technologies brought from the rich world." David Edgerton, "Creole technologies and global histories: rethinking how things travel in space and time," *Journal of History of Science and Technology*, Vol. 1 (Summer 2007): 3-31, 11 and 23.

[10] Ignaz Strebel, Alain Bovet, Phillippe Sormani, editors. *Repair Work Ethnographies: Revisting Breakdown, Relocating Materiality* (New York: Palgrave Macmillan, 2018).

Technology examines the complicated relationship between ethics and technology. Essentially, "the moral relevance of technology is closely related to this active contribution of technologies to human practices and experiences" (Verbeek, 2011, p. 5). The farming experience was harsh for most farmers. Hence, designers viewed each new technological function or added feature of the combine harvester as a social technology. They had the moral duty to effectively replace units of animal or human labor and reduce human misery. Machine designers took into account mechanical and non-mechanical issues, including the harvesters' smooth driving ability, aesthetics (i.e., color), and seat comfort as ways to do more for the local community and humanity.[11] For example, at least half of the respondents in this study mentioned that a major design improvement was the addition of a "*cabina*" (essentially a sunshade or cover) sitting atop the driver's seat of the combine harvester. Thanks to the cabina, the driver could work and sit for long hours protected from the sun.

Within a generation (1911-1929), designer-users developed a fully automated combine harvester often described locally as the first of its kind in the world.[12] The designers/manufacturers, Rotania Brothers, were particularly successful in realizing the creation of the once "imagined" auto-mobile, sensory-enabled, and intuitive combine harvester. This nearly perfect "bodymachine" expanded human capabilities to do the arduous tasks of harvesting with a professional driver as the brain of this machine.[13] During the twentieth century, designs included Senor's versatile B3 model (1936), B-series model, modern V60 (1960), and many others. Local respondents recalled that the failure of the V60 harvester combine was because it was too advanced for its time—a time when local people wanted simpler ("fixable") machinery.

Beyond the practical value of designing a machine to do farm work, the development of machinery had cultural significance for the people. In the pampas region, invention seemed conceptually synonymous with community development through the creation and application of *new ways of doing things*. Tangible design or intangible creativity relied on practical intelligence, crafting traditions, and the perception that the designer-producer was building the nearly perfect "bodymachine" mentioned above with input from engineers, local mechanics, and users; hence, helping the larger community. As early as the mid-1920s, domestic farm machinery had unique technological adaptations featuring narrow platforms, unique drums for harvesters, and better filtering and cleaning systems for the commonly found untilled and weedy fields of Argentina (Bil, 2009). During the course of the twentieth century, these systems became more sophisticated with collaboration.

When asked about local machine-making, the respondents across gender and class revealed their feelings about how creating models of farm machinery, regardless of time and

[11] Before the Second World War, drivers of combines or tractors had minimal training. By the 1950s, a driver was typically a professional, certified and licensed driver of combines and/or tractors.

[12] Regarding the formal education level of these designer-users in Argentina, annual data of the literacy of specific groups is not available, but it is known through national and provincial census data that Argentina had one of the highest rates of adult literacy and child enrollment in co-educational primary school relative to its Latin American neighbors. See Reimers (2006), Newland (1991), Engerman et al (2002).

[13] Cassandra Hartblay, "Cyborg," *Society for Cultural Anthropology*, 29 March 2018, https://culanth.org/fieldsights/cyborg. Accessed on October 21, 2019.

effort, was important and meaningful work. They perceived their work as community-driven and often spoke of their past and present collaborations within the context of machine-making with affection and pride. Some respondents noted that more advanced designs of machinery and technology often excluded *changarines* and others, thereby increasing unemployment. For instance, before 1930, drivers of combines or tractors received minimal training. As early as the mid-1940s, a pampas driver was typically a professional, certified and licensed driver of combines and/or tractors. Additional drawbacks to the machines (*las máquinas* refers to heavy machinery, especially tractors and combines) were the cost to make or purchase them, the risk to creating new designs that may or may not appeal to consumers, and the need to relearn about maintenance, repair, and improvements of new designs. However, the overall feelings of most respondents across gender, class, and age regarding the machines and their companies was positive. Indeed, they often expressed words of endearment, such as referring to the factory or shop as "like a first girlfriend" (*primera novia*) or to a harvester as their toy (*chiche*).[14]

"*Volver a probar*": Ethnography of Local Collaboration and Meaningful Work

People involved in the making of local farm machinery or redesigning foreign machinery often collaborated to improve the work they considered meaningful and impactful to the community. The harvester designs were a product of collaboration and the outcomes were meant to be good for the community. As Verbeek argues, users and designers could assess the quality of a technology in moral terms (Verbeek, 2011). A good design had to be practical, functional, aesthetically pleasing, and took into account the fragility of the human body. Along with morality, community members had affection for the technology or for the factories that made them. Each developed their own story connecting them to the machines and to the collaborations with people who also enjoyed the process of restoring, repairing, modifying, or reassembling a harvester.

In the pampas, there were many reasons for how and why people collaborated to make the things they valued. In the case of rehabilitating vintage farm machinery, collaborations were common. Participants considered their restoration work important for preserving community history. For example, since 2003 the author and aficionado of combine harvesters, José María Barrale has regularly shared his collection of rehabilitated domestic farm machine brands in his warehouse in San Vicente, Santa Fe. From his collection he proudly showed his "chiche", the Argentine harvester Vassalli's "la mosquita" (*the little fly*) that he exhibited, along with others, at local farm machinery expositions, especially the annual Harvester Festival (Fiesta de la Cosechadora) in San Vicente, Santa Fe.[15] He also enthusiastically shared his knowledge (he is an

[14] Mary Habeck (2000: 100) found a similar affection in letters written by First World War soldiers to their families. Though often overwhelmed by "the monstrous technology" of this war, "…a few even learned to deal with the material character of modern war with a modicum of affection, even, at times, of love."

[15] iEco Clarín, "El autor de 'Reinas mecánicas,' cuenta su relación con los fierros del campo," March 4, 2010, video, https://www.youtube.com/watch?v=MIcC6VqvUEQ (Accessed on 11/26/2019); Interview by author,

author of three books) and his collection of harvesters to communities by posting his YouTube videos and historical pictures on social media.[16] He believed it was "selfless of him" to share.[17] As a collector of vintage machinery, he collaborates with fellow aficionado Gabriel Ardusso who is a licensed combine driver, harvester mechanic and builder, and contractor. Ardusso is interested in re-building the machines with teams and views it as a labor of love. He spoke fondly of the process of restoring machinery that would be presented in agricultural expositions as "vedettes."[18]

Collaboration for modifying domestic or foreign machinery was vital to understanding problems and finding solutions because it required diverse "bochos" (brainpower) and skills. In one case, former harvester repairperson Daniel Oitana, who had worked in the former Bernardín Harvester factory during the 1980s, recounted how finding solutions to everyday problems was normal. One of his tender memories of repair and maintenance was modifying a locally produced Bernardin M21 Harvester to harvest "*falaris*," (phalaris) a very fine seed crop. A Danish client Pedersen had purchased the M21 model to harvest falaris as the machine was proven versatile for harvesting linseed, corn, wheat, rye, and other crops. They needed a modification for a crop (falaris) that they had never encountered. After a few weeks of collaboration, driving to the nearest town (about an hour away) to their repair shop, they solved the issue with a modification "para poder cubrir medio ventilador."[19] He described the process as "volver, instalarla y volver a probar…volver…"[20] He remembered the experience to be personally fulfilling as he enjoyed the hard work and collaboration to find a solution.

Creatively assembling old parts together or resurrecting a tractor or combine was also accomplished in a collaborative way. In the town of Humboldt, respondents from the agricultural museum preserved examples of local *genio*, or machinery that were "inventions-out-of-necessity." Their heavy machinery was produced during periods of national isolation, such as during the Great Depression and the Second World War, when access to scrap iron, machinery, and other vital resources was restricted. Respondents referred to the inventors of these farm machine creations as *genio criollo* since the machines were deemed to possess practical intelligence and resourcefulness of "doing more with very little."[21] In image 2 Tractor Genio, this no-brand name tractor harvester is an example of using whatever different working parts are available from a tractor, harvester, or commercial vehicle to create something new, original and useful.

José María Barrale, Interview by author, 18 June 2017, San Vicente, Santa Fe; Barrale, *Reinas mecánicas* (Cordoba: Advocatus, 2007).

[16] Inalta Ing. De Software "Agroactualidad, 10/06/2017 Parte 1 José María Barrale" https://www.youtube.com/watch?v=k7aJyayh8r0 and "Agroactualidad, 10/06/2017 Parte 2 José María Barrale" https://www.youtube.com/watch?v=_X1u4B-ndUs (Accessed on 30 November 2019).

[17] José María Barrale, Interview by author, 18 June 2017, San Vicente, Santa Fe, Argentina.

[18] Gabriel Ardusso, Interview by author, 17-18 June 2017, San Vicente, Santa Fe, Argentina.

[19] Daniel Oitana, Interview by author, 18 June 2017, San Vicente, Santa Fe, Argentina.

[20] Daniel Oitana, Interview, 18 June 2017.

[21] Interviews by author, curator, mayor, etc., at the Museo Histórico de la Colonia Humboldt, 16 June 2017, Humboldt, Santa Fe Province.

Image 2: Tractor Genio, Humboldt, Santa Fe

Source: Photo by author, Museo historico de la Colonia Humboldt, Humboldt, Santa Fe Province, 2017

People attached significant meaning and affection to their machinery, to the point that humans became machines to continue making machines. Anthropologist Cassandra Hartblay argued that humans could view machines as an embodiment in which biological, technological, material and digital qualities blurred "boundaries like human/tool, human/animal, animal/machine, body/mind, and physical/nonphysical."[22] In a similar sense, respondents who had worked at the domestic harvester factories also regarded the human body as a machine. In a conversation about the process of making machines, Edgardo Botta, who had been a factory worker in the Senor Harvester Factory during the 1950s-1970s, described the work as manual, with no physical technology despite the use of hand tools (i.e. hammer). He placed more significance on the human power of the lungs ("*a pulmón*") to make machines: "…los trabajos en la planta era todo manual, no había tecnología de ninguna manera, nada, tecnología cero; era todo a martillo y a martillo y pulmón como se decía en la empresa, esto es todo a pulmón…"[23] Botta repeated himself as he described the machine-making process as "…era cortar, desarrollar, probar, volver a hacer, era una cosa que a nosotros o sea era todo mano de obra, todo mano de obra, era mucha mano de obra, mucho esfuerzo físico, todo, no, no había de ninguna manera había nada que pudiera ayudarnos, era todo manual."[24] His repetition of "mano de obra" referred to factory workers who

[22] Cassandra Hartblay, "Cyborg," *Society for Cultural Anthropology*, 29 March 2018, https://culanth.org/fieldsights/cyborg. Accessed on October 21, 2019.
[23] Interview by author, Edgardo Botta, 3 July 2016, Santo Tomé, Santa Fe.
[24] Interview by author, Edgardo Botta, via emails October-December 2015. Interview by author, Edgardo Botta, in-person, 3 July 2016, Santo Tomé, Santa Fe.

saw their mission as envisioning and realizing the machine design through their raw human strength.

Image 3: Escudo de San Vicente, Santa Fe

Source: "San Vicente," Gobierno de Santa Fe, https://www.santafe.gov.ar/index.php/rmyc/content/view/full/172159. Last accessed 1 dic. 2019.

The machine and the process of making the machine can be a circular process that improved people's lifeworld because they believed they had a mission to do meaningful work, and vice versa. The work gave owners, administrators, engineers and workers in factories or shops a purpose and meaning through the innovative development of discipline, routine, and traditions through materials, ideas, and collaboration. Not surprisingly, it was clear that respondents felt nostalgia about their past work in making or repairing machinery and in building its administration. Though they differed in their specific experiences according to their job positions or gender, a revelation was that across regions (urban and rural), class, and gender, they developed a positive collective awareness about work and machine. They believed that only by working together the machine could exist—in other words, their imaginations and aspirations had built the machine. In turn, this machine kept them grounded, giving them a sense of ownership, control, and romance as an effect of layered and shared memory. For instance, residents in San Vicente call their town the "la cuna de la cosechadora," as this is where the Senor Brothers created their first, original design in 1917. Also, the First Festival of the Harvester (1960) began in San Vicente and two presidents (Arturo Frondizi and Arturo Illia) had attended during the 1960s. Though the town has not had a harvester company since the late 1980s, the festival has taken place every year since 2003. In the mid 1990s, the town included on all official letterhead, "San Vicente, La Cuna de la Cosechadora." In the 2000s, the townspeople also changed its coat of arms (*escudo*) and included a harvester to demonstrate the town prideful legacy (image 3). In this town, local culture is identified with the harvester and thus gives it meaning.

International Collaboration

These innovative designer-users created a local, popular culture of technological ethos in their communities. They made it their own, determined to share it across cultures, class, and gender in their communities. The farm machinery culture was preserved in collective memory and could be characterized as a culture of ingenuity, independence, and hard work. This type of culture-creation surrounding technology is not unique to Argentina. In the United States, Leo Marx described how Americans maintained the vision of ephemeral rural landscapes "…in this sentimental guise the pastoral ideal remained of service longer than the machine's appearance in the landscape…" The imagination was the "pursuit of rural happiness while devoted to the ideals of productivity, wealth, and power" (Marx, 1964: 226). In different places across the globe, people created their own innovative technological cultures to fit their own experience.[25]

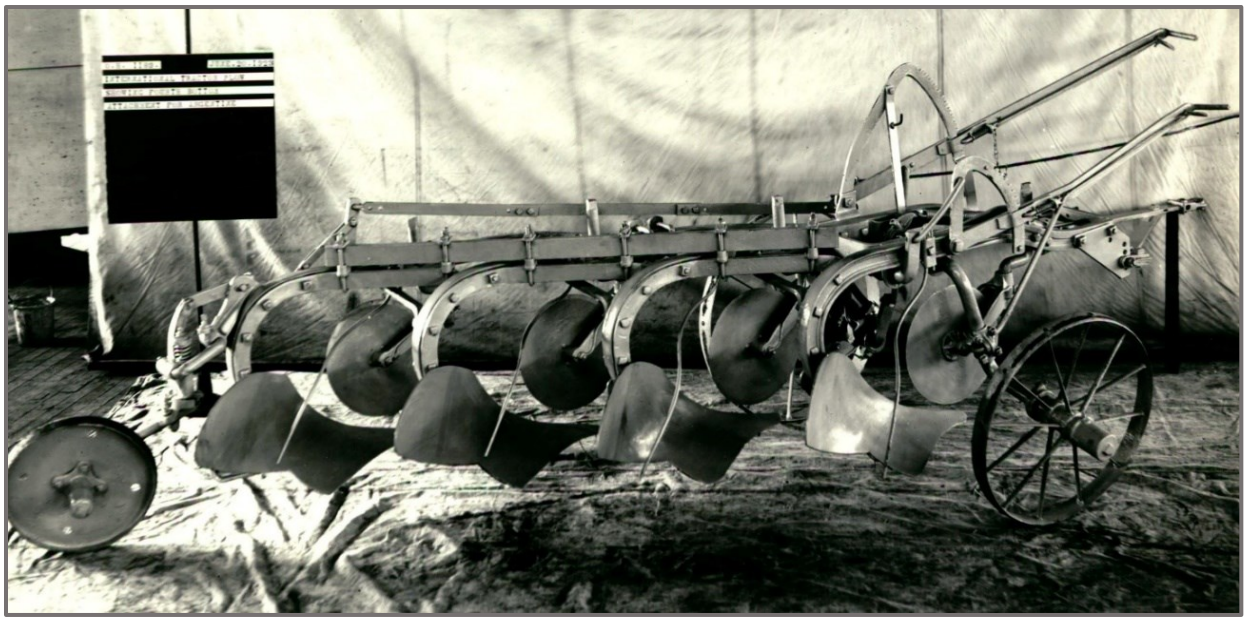
During the twentieth century, farming and especially the process of repairing and making farm machinery connected local people's worlds to the international community. The collaborative global interactions could be viewed as local communities expanding their outreach in order to improve local human conditions. The process of collaboration was multidirectional, slow, intentional, and had diverse stages of trial and error testing of designs of tractors and combines (Hartblay, 2018).[26] These bodymachines needed to technologically extend human and animal capacities, yet, the machines still needed humans to operate the machine from the inside. The human became the brain of a machine, a primary internal component of a cybernetic combine harvester. Together, the human and machine efficiently cultivated, harvested, and transformed farmland to produce food.

Collaborative work and international exchanges between Americans and Argentines began as early as the 1900s. The International Harvester Company (IHC), a conglomerate of several U.S. companies, expanded production in South America as it had become an important market for them. They established their headquarters in Buenos Aires City, and in order to expand markets in Santa Fe province, the IHC sent agents to work with local producers to exchange ideas and experiment with different styles of cultivation, harvesting and seeding machinery. Images 4 and 5 show the tractor plow that IHC had created for the Argentine market. Its practical and aesthetic value belies the complexity in the design of the tractor plow with four blades so that the Argentine farmer could achieve more work with one machine. Foreign companies like the IHC learned from local machine designer-users equally as much as local producers learned from foreign machine makers. Foreign and local producers of machinery exchanged ideas and expertise in part to create machinery that could be use on varied terrains, soil conditions, and climate.

[25] As it had in Zimbabwe, for instance. Clapperton Chakanetsa Mavhunga, *Transient Workspaces: Technologies of Everyday Innovation in Zimbabwe* (Cambridge: MIT Press, 2014).

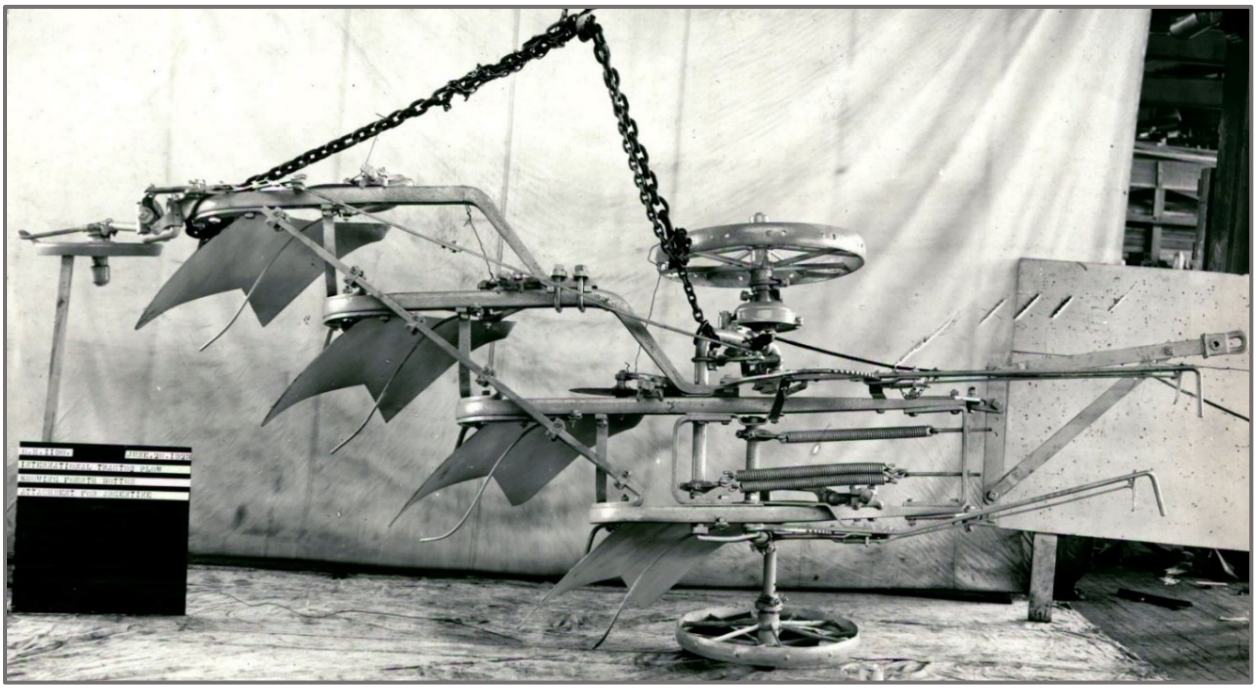
[26] Cassandra Hartblay, "Cyborg," Society for Cultural Anthropology, 29 March 2018, https://culanth.org/fieldsights/cyborg. Accessed on October 21, 2019.

Image 4: International Tractor Plow, Attachment for Argentine (June 20, 1923)



Source: IHC McCormick Archive, Wisconsin Historical Society, Madison, Wisconsin

Image 5: International Tractor Plow, Attachment for Argentine, on its side (June 20, 1923)



Source: IHC McCormick Archive, Wisconsin Historical Society, Madison, Wisconsin

Between 1914 and 1945, the IHC expanded its stores and relationship with local designer-users. In the late 1940s, sociologist Carl Taylor had expected to find rural isolation, but instead he found an International Harvester store in Santa Fe province, and was impressed upon seeing in it "every

type of farm machinery used in cereal and dairy farming and be impressed with the fact that nearly all the machinery is excessively large—70 horse-power tractors, giant drills, 4-bottom gang plows, medium-sized and large combines, 3-row planters" (Taylor, 1948: 13). Ethno-historian Kristine Jones argues that these foreign travel accounts are valuable as a "documentation of a developing frontier society in articulation with expanding western capitalism" (Jones, 1986: 195).

In another instance before the Second World War, Felipe Reinhardt, a German immigrant and farmhand resided in the town of Humboldt, Santa Fe and invented a tractor design. The collective memory is that one day an agent from the American farm machinery and tractor company, Case IH, appeared in Humboldt and reviewed Reinhardt's design. According to local Humboldt residents, the agent invited Reinhardt to Racine, Wisconsin for dinner and tractor pull shows. The Case IH company purchased and compensated him for the design. In 2017, several townspeople, including the mayor and a local historian, recounted the story of how Mr. Case benefited from Reinhardt's innovative design and how unfortunate it was that Reinhardt had not patented his design.[27] Reinhardt's legacy confirms how local townspeople understood international power relations in technology and the importance of patenting an invention. The story also shows a multi-directional relationship between a local town in Argentina and a multinational corporation. In this case, the representative of Case IH discovered that Reinhardt's invention was useful to his company and he paid Reinhardt for knowledge to improve Case IH's machines.[28]

Between 1930 and 1955, Argentine designer-users were relatively isolated from international markets and discovered ways to build and design despite the lack of material and financial resources. In San Vicente, Santa Fe, most residents called the period from roughly 1918-1960 as the "Golden Age of Machinery" because of the four harvester companies that operated in their town. Historically, the "golden age" coincides with periods of *de facto* and actual import substitution industrialization policies at the national level. By November 1940, the Argentine Finance Minister Federico Pinedo, for instance, proposed explicit import substitution programs, especially state support of so-called natural, or agroindustry, to sustain employment and economic self-sufficiency (Llach, 1984; Cramer, 1998). Pinedo's original bill proposal, known as the Economic Reactivation Plan, or Pinedo Plan, died in the Congressional House of Deputies that same year. Regardless of the bill's demise, by the mid-1940s, the military (1930-1946), and Peronist (1946-1955) governments had passed the majority of his policies, especially those related to raising productivity in traditional agricultural sectors through the use of technology (Llach, 1984; Cramer, 1998). Beginning in the 1950s, the structuralist economists working in the United Nations Economic Commission of Latin America (ECLA) promoted strong state intervention in all Latin American economies. Argentine economist and ECLA Director Raúl Prebisch argued that core countries developed at the expense of peripheral nations because of unfair international

[27] In Humboldt, Santa Fe, Interviews by author with the mayor, museum curator, president of the museum, and aficionados of local technology.

[28] Author has contacted the historian, Juliann Ulbrich, at Case IH and is waiting to confirm the possibility of this story with Case IH. Ulbrich has reached out to its South American agents.

terms of trade between the two regions, thereby leaving the peripheral nations perpetually underdeveloped.[29] Prebisch and structuralist theorists called for the development of peripheral governments through the promotion of inward-oriented growth and national growth strategies with technocrats capable of implementing policies that expressly supported domestic manufacturing. Consequently, most Latin American nations, including Argentina, followed a model of heavy state intervention in the national economy to support industry.[30]

Hence, for nearly a generation, *de facto* and explicit import substitution policies helped Argentina's industrial production grow during the interwar, war, and postwar periods. At the local level, the domestic combine-harvester sector had grown from approximately three companies in the 1930s with a production of 2-20 machines per year to 23 factories producing 100-360 harvesters each per year by the mid-1960s (Bil, 2011).[31] It was during this period that the Senor Harvester Factory developed new models of harvesters. By 1936, they had invented the unpatented model B3, which was their best-selling machine in the region; according to former worker Botta, "se vendió como pan caliente!"[32] Under the brand name Industrias Urvig, the Senor company developed a transmission (powertrain) model specific for harvesters.[33] This was a breakthrough, as previous transmissions had come from tractors and were less efficient in a harvester combine.

By 1958, the newly elected Intransigent Radical Party (UCRI) President Arturo Frondizi (1958-62) unveiled a national development plan inspired by Pinedo's, the structuralists' recommendations, and Rogelio Frigerio (1962). At his inauguration speech in May 1958, Frondizi called for a broad plan to support "national development," especially the expansion of oil production and select heavy machinery industries through foreign direct investment (FDI) (Szusterman, 1993). Some groups viewed FDI in key economic sectors as a betrayal of the principles of economic nationalism, such as self-sufficiency. Nevertheless, several domestic company owners benefited from new credit lines offered through the Argentine Industrial Bank and the National Bank as part of an Inter-American Development Bank initiative for the

[29] After the Second World War, Prebisch was a significant figure head for economic planning in Latin America. He headed the United Nations Economic Commission on Latin America (ECLA, 1948-1962), created and mentored the Latin American Institute of Economic and Social Planning (ILPES), and played an international role as head of the United Nations Conference on Trade and Development (UNCTAD). See Love (1996), Dosman (2008).

[30] It should be noted that beginning in the 1980s, scholars critiqued the structuralists for conceptualizing development within a limited framework of industrialization and for viewing it solely as a technocratic process. See Cyper (1990), Escobar (1995).

[31] These number of machines are estimates. Juan Bergero Senor, interview, 2 July 2016; Botta, In-person interview by author, Santo Tome, 3 July 2016; Osvaldo Savore, interview by Luciano Prosperi, San Vicente, Santa Fe, 26 December 2016. The author and aficionado, José María Barrale, has claimed that he found 49 different harvester producers across time in Argentina. José María Barrale, In-person interview by author, San Vicente, Santa Fe, 18 June 2017.

[32] Jorge Senor (padre), In-person interview by author, Roldán, Sante Fe, 20 June 2017; Edgardo Botta, In-person interview by author, Santo Tomé, 3 July 2016.

[33] Typically, harvesters had utilized tractor transmissions. Jorge Senor Sr., email interview, 29 May 2017.

promotion of industrial development during Frondizi's administration (Szusterman, 1993).[34] This access to credit helped small-scale producers expand production. In the case of the Senor Harvester Factory, the owners used the credit to help them build a new factory and patent farm machinery during the 1950s and 1960s, including patenting a domestic tractor.[35] They also designed and built unpatented combine models, including the V60 and JE50.

By 1959, new foreign farm machinery companies entered Argentine markets, such as John Deere (known as John Deere Argentina, JDA). According to former manager Hector Sendoya, in 1959, the John Deere Company established a factory with headquarters in Granadero Baigorria, Santa Fe, Argentina. It introduced one model that had been discontinued in the United States, the JD 730 with manual transmission and two horizontal cylinders. Though JDA produced 10,000 units of the model JD 730 in the factory in Baigorria, Santa Fe from 1959-1969, most local users sought more advanced tractors. Consumers and users dictated to JDA what they should be selling to them—they sought a more advanced and "user-friendly" machine. By 1970, JDA finally introduced the "modern line 20" for the Argentine market—these tractors had synchronized transmissions and advanced hydraulic systems that helped JDA beat local competitors.[36] Over time JDA became more in tune with local users' desires. They hired local people to manage operations and began to address non-mechanical issues, such as the use of the drivers' sunshade (*cabina*), seat comfort, and toning the green color of the machine to a more pleasing shade as opposed to the bright "cartoonish" green of the JD730 (image 6). In some ways, JDA had successfully "argentinized" to the point that in one interview, a farmer could say with confidence that JDA was Argentine. [37] Former manager Sendoya was proud to work for JDA, recalling this time with the Argentine-based company with fondness.

[34] Banco de la Provincia de Buenos Aires, *Reseña Anual Informativa,* (Buenos Aires: Banco de la Provincia de Buenos Aires, 1960). Frondizi Archive, Box 03.4.1.8.17, Santa Fe, Special Collections, Biblioteca Nacional, Buenos Aires, Argentina; Danilo Senor, email interview, 21 September 2015; Jorge Senor Sr., In-person interview by author, Roldán, Santa Fe province, 20 June 2017.

[35] "Mejoras en plataformas recolectoras de maíz," Patente de invención 98.117, Juan y Emilio Senor e hijos, Sociedad Anónima, Industrial y Comercial de San Vicente, Provincia de Santa Fe, 18 July 1955; "Mejoras en máquinas cosechadoras-trilladoras de cereales," Patente de invención 126.380, Juan y Emilio Senor e hijos, Sociedad Anónima, Industrial y Comercial de San Vicente, Provincia de Santa Fe, 7 July 1961. "Un nuevo tractor de aplicaciones multiples," Patente de invención no. 130.492, Juan y Emilio Senor e Hijos, Sociedad Anónima, Industrial y Comercial de San Vicente, Provincia de Santa Fe, 8 October 1962. The tractor patent was taken out, but the Senor factory never manufactured it for commercial purposes.

[36] Hector Sendoya, Interview by author by phone and email, Orlando, Florida, 8 November 2019.

[37] Jorge Peluzzi, In-person interview by author, 4 July 2016, San Vicente, Santa Fe.

Image 6: JD 730 Tractor for Argentina, 1959

Source: "1959 John Deere 730 Hi-Crop Argentina," Mecum Auctons, https://www.mecum.com/lots/GN1118-345087/1959-john-deere-730-hi-crop-argentina/ Last Accessed 1 Dec. 2019.

Another example of international collaboration over a century was the making and resurrection of the Rotania auto-propelled harvester discussed in the introduction. In the 1910s, the Rotania brothers opened a farm machinery shop in Sunchales, Santa Fe province to repair and design farm machinery. Between 1915 and 1926, they developed a series of unpatented improvements, modifications and new designs. By 1926, Alfredo and his three brothers (Miguel, Enrique, and Fernando) conceived of the idea to create an auto-propelled global combine developed with local materials and foreign motors, namely, the Hercules 13/4hp gas engine and the transmission from a Chevy'27 truck. In the collective memory of the region, residents recalled that Rotania created the first motorized combine harvester, and it became legend to the restorers of antique farm machinery.[38] Some remembered that the Canadian company Massey collaborated with the Rotania brothers to create it. Others, however, insisted that Alfredo Rotania was the sole *genio* who sought a mechanized, gas-powered combine for local Santa Fe farmers who needed it. Despite the slightly different versions of the story, this patented invention was among the first

[38] "Rotania: La cosechadora argentina que trilló 90 años después," http://supercampo.perfil.com/2019/01/rotania-la-cosechadora-argentina-que-trillo-90-anos-despues/ Super Campo de la Huerta a la Estancia, 27 enero 2019. Last accessed 7 october 2019.

of its kind that received international recognition in 1929.[39] The subsequent global crisis of the 1930s interrupted its mass production and use.

Rotania the machine is not forgotten, however. Collaborative work is meaningful and fulfilling to a subculture of people connected by farm machinery that transcends class, cultural lines, and time. During the early twenty-first century, the German Helmut Class, president of the international farm machine company CLAAS discovered a display of the Rotania model in a store window in Sunchales, Santa Fé. He immediately decided to fund the rehabilitation of the Rotania combine, using the original patent design. Once completed, CLAAS filmed the operation of the Rotania combine harvesting alongside a twenty-first century CLAAS combine (Video 1).[40]

Americans and foreigners quickly learned as much about the Argentine technologies as much as Argentines learned from foreigners. In other words, it was multi-directional learning process to discover designs that users sought. In the United States and Argentina, interviewees mentioned Germany as "the place" to learn more about farm technology. Agronomer Juan Giordano was adamant that only three nations on the planet had original designs for combine harvesters and had learned from each other: "Yo creo que hay tres lugares donde se han hecho máquinas: Estados Unidos, Alemania y Argentina; yo creo que esos son los tres lugares donde el bocho nos funcionó a todos para hacer las máquinas. Y siempre nos estamos mirando."[41] Many conversations later, respondents named Germany as number one in agricultural innovation—they referred with pride their attendance at the annual meeting of AgriTechnica, which is held each year in Hanover, Germany.[42] Though more ethnography and interviews are needed to understand the clusters of networks, indeed, learning from each other and international collaboration was important among respondents.

[39] The patent says, "espigadoratrilladora con adaptabilidad de un tren automotriz en el rodado delantero."
[40] For videos, see "La primera cosechadora autopropulsada del mundo: Rotania historia sunchales Santa Fe Argentina," https://www.youtube.com/watch?v=WPjd7SS_Kic, Accessed on 6 October 2019; "Restauracion dela Rotania," https://www.youtube.com/watch?v=te5rGI2KSVg, Accessed on 6 October 2019.
[41] Juan Marcos Giordano works for the Instituto Nacional de Tecnología Agropecuario, In-person interview by author, 3-4 July 2016, San Vicente, Santa Fe.
[42] AgriTechnica https://www.agritechnica.com/en/ Accessed 9 December 2019.

Video 1: *"La primera cosechadora autopropulsada del mundo: Rotania historia sunchales Santa Fe Argentina"*

Source: https://www.youtube.com/watch?v=WPjd7SS_Kic

Future Research

Future research includes understanding how deep the relationships are across nations and elaborate on the importance of global collaboration. Research, thus far, shows that respondents held similar feelings about the importance of global collaboration and doing meaningful work. Some international relationships have been going on for nearly twenty years or more, such as the case between the Kansas-based company Roto-Mix and the Senor brothers in Santa Fe Province. Rodolfo and Gustavo Senor are descendants of Juan Senor and understood the importance of international collaboration. In an interview, Kelly Wittman, vice president of operations at Roto-Mix in Dodge City, Kansas, talked about their mutually beneficial relationship. He discussed how they learned from each other about the organization and design of feed yards, feed mixers, and natural environmental factors (climate and water). Wittman recalled that in summer 2018, "they [Rodolfo and Gustavo] came and visited. They brought a couple of customers with them. We took to them to three U.S. feed yards… showed them the stationary applications that we do in the U.S.… And they wanted to see some of our setups in

America to see what differences there were."[43] These exchanges were multidirectional; in another instance, Ryan Bivens, Kentucky farmer and member of the Kentucky State Fairboard, visited Argentina in February 2013 to understand their farming techniques. He was impressed with the massive land tracts in Argentina: "I've always been concerned as a farmer, how are we going to feed an ever-growing population in this world? But I think we're seeing new ground come into production in countries like Argentina."[44] He ended his interview with appreciation: "it was very eye-opening, have a great appreciation, built a lot of friendships." [45]

Another topic of future research is how collaboration across time and space transcended gender and class. This is unclear in old photographs, which tended to demonstrate hierarchy rather than collaboration because of social norms of the time. For instance, I have found no women in the pictures thus far though from personal interviews and antique film footage they are important to the community. Male respondents often named a woman who was crucial to the making and use of farm machinery (and vice versa women named men who I should speak to). Also, in the old photographs, there exists a hierarchy among males with owners on the machine, engineers in front of it, and workers on the far side and near the animals. In interviews, however, the discussion was always about how everyone worked, collaborated, and socialized together, regardless of class and gender.

Finally, farm machinery culture and international collaboration is a very rich, complex topic. There exist many examples of international collaboration that led to innovative designs and improved peoples' lifeworlds. The designs had practical, social and cultural meanings to the people who made and used them, resulting in hundreds of thousands of stories about the harvester.

[43] Kelly Wittman, In-person interview by author, National Farm Machinery Show, Louisville, Kentucky, 15-16 February 2019.

[44] Ryan Bivens, In-person interview by author, National Farm Machinery Show, Louisville, Kentucky, 15 February 2019.

[45] Bivens, interview, 15 February 2019.

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