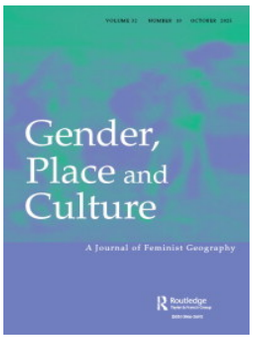

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Agricultural technologies and the emergence of cyborg assemblage: rethinking the relationships between young women farmers and agricultural machines in Taiwan

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ABSTRACT

This paper aims to study the relationships between young women farmers and agricultural technologies by proposing the emergence of cyborg assemblage to indicate more fluid and flexible ways of doing gender, thereby being able to negotiate the rural gender script. While agricultural technologies, especially tractors, have been identified as the cultural symbol of hegemonic masculinity, smaller agricultural machines are often neglected despite their frequent use in farming practices. The predominance of small-scale farming in Taiwan means that machines such as mowers and cultivators also play a crucial role comparing with tractors, which dominate in large-scale agricultural economies. Drawing on Haraway and Lupton's work, this paper proposes the concept of the emergence of cyborg assemblage, emphasising that various contextual factors, individual characteristics, and the material attributes of different types of machines contribute to the dynamic experiences of young women farmers. Through the operation of agricultural machines, young women farmers are practicing established perceptions that differ from inherited gender scripts. Overall, the interactions between different young women farmers and various agricultural technologies give rise to new dynamics and unforeseen outcomes.

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Cyborg assemblage; materiality; agricultural technologies; rural gender scripts; young women farmers

Introduction

Modern agriculture relies heavily on well-developed technologies—by technologies I mean not only the actual machines used in agricultural production but also the knowledge and skills involved in the practice. However, the division of labour remains highly gendered, with men typically dominating machine operation and on-farm physical work, and women being relegated to less technical tasks, such as off-farm housework, marketing, or organising activities related to food and agricultural education (Alesina, Giuliano, and Nunn 2013; Brandth 2002; Feldman and Welsh 1995;

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Heggem 2014). As Haugen and Brandth (1994) noted several decades ago, much of the existing scholarship has focused on farm women or farmers' wives, with insufficient attention given to women farmers themselves—particularly young newcomers with less experience or financial support.

In recent years, interest in gender and farming has grown, with studies exploring a variety of perspectives, including environmental concerns among young farmers (Unay-Gailhard and Bojnec 2021), challenges to hegemonic femininity (Annes, Wright, and Larkins 2021) and the intersections of gender, sexuality, and farming (Leslie, Wypler, and Bell 2019). In this article, I concentrate on the relationships between young women farmers and agricultural technologies, to 'read and deconstruct how gender identities and performances are constructed, contested and sometimes reinvented' (Little and Panelli 2003).

Many studies have linked agriculture technologies to masculine power. For example, Saugeres (2002) argues that tractors symbolise masculinity and reinforce patriarchal ideologies by asserting domination over women. This view has shaped the perception that mechanisation—particularly its technical aspects—belongs to the men's domain. However, this binary thinking oversimplifies the realities of agricultural practices, especially in the context of Taiwan's smallholder farming system. According to the 2020 Census of Agriculture, Forestry, Fishery, and Animal Husbandry (Directorate General of Budget, Accounting and Statistics, and Executive Yuan 2023), tractors are the most common machine in Taiwan, with 42% of people owning at least one. Due to the practical needs of small-scale farms, where the cultivated land is mostly under one hectare, power tillers and rice transplanters are also widely used. While mechanisation plays a crucial role in improving productivity, smaller machines have received far less attention in research compared to tractors.

Drawing on Haraway's (1991) concept of the 'cyborg' and Lupton's (2013) idea of 'cyborg assemblage', this paper argues that the relationships between young women farmers and agricultural technologies are complex—messy, fluid, and continuously negotiated, aiming to broaden the discussion of gendered practices in agriculture. This study asks: How do young women farmers in Taiwan use agricultural technologies to (re)shape their gendered identities, particularly in smallholder farming? How do agricultural technologies, as part of a cyborg assemblage, influence the interactions between young women farmers and their work?

The paper is structured as follows. The first section reviews theoretical framework. The second introduces the methodology. The findings are divided into two parts: the first explores how young women farmers (un)do gender through their use of agricultural technologies, and the second considers how these technologies extend and transform their identities. The conclusion reflects on the fluid, dynamic, and continually evolving relationships between gender and agricultural technologies.

Theoretical framework

Researching women farmers and agricultural technologies

According to the Employment Indicators 2000–2022 (FAO October 2024 update), the agricultural sector employed 892 million people globally in 2022, with women

comprising 28.5% of this workforce. Despite their significant presence, systemic gender inequalities and discriminatory norms continue to shape women's participation, limiting their opportunities and reinforcing marginalisation within the sector.

One important reason for this is the strong cultural image of farmers as men—especially white, heterosexual men. This idea, based on traditional views of strength, control, and bravery, reinforces farming as a male-dominated field (Kroma 2002). Such gendered associations influence the social and spatial organisation of agricultural labour, excluding women from roles thought to require physical strength or technical expertise. However, this narrative is neither static nor uncontested. In addition to employing agricultural technologies as labor tools, women farmers actively challenge these norms by renegotiating gender identities and disrupting power structures in rural spaces.

The FAO (2022) explains three ways mechanisation can benefit women in farming. First, it gives women more flexibility for other activities, readjusting their time management. Second, working in mechanisation-related jobs allows women to gain technical skills, earn money, and challenge gender norms. Third, as entrepreneurs, women can take on leadership roles. However, in reality, mechanisation often deepens gender inequality because women struggle to access resources, training, and decision-making power, while men typically own and control agricultural machines.

In rural areas, agricultural machines—especially tractors—have long been symbols of masculinity (Saugeres 2002). These machines are linked to physical strength, technical skills, and control, traits traditionally seen as male. Carter and Lopez (2019) explain that in modern U.S. agriculture, technology and expertise shape ideas of masculinity, reinforcing the image of the 'successful' farmer. This excludes women, people from diverse racial or sexual backgrounds, and those who challenge industrial farming practices. Similarly, Kaur's (2024) study of rural Punjab demonstrates how ownership of land and mechanisation further entrench farming as a masculinised domain, excluding women from spaces of power and decision-making, aligning with Agarwal's (1994) assertion that access to agricultural resources is essential for enhancing women's autonomy and economic empowerment.

The gendered dynamics of agricultural technologies are both a symbolic representation and everyday practices. On one hand, physical strength and mechanical skills are often framed as inherently masculine, justifying the exclusion of women from certain agricultural roles. For example, Shattuck's (2021) study on pesticide use among agricultural workers in Laos reveals stark gendered divisions of labour. Men typically perform physically intensive tasks, while women are relegated to planting seeds treated with toxic chemicals, which stain their hands for days. Prevailing narratives portray women as unsuited for physically demanding work, reinforcing their marginalisation within agricultural hierarchies. On the other hand, women can challenge these norms by appropriating agricultural technologies in ways that disrupt men's dominance and present alternative forms of rural femininity. Shattuck (2021) provides the example of Joy, a woman farmer in Laos who defies conventional gender roles. Her ability to perform traditionally men's tasks with skill and independence earned her respect within her community and a leadership role in the Women's Union, typically reserved for village elites. This shows how women can challenge hegemonic masculinity by using their skills and effort to change social views and enter positions

of power. However, it also raises the question of whether gender can be redefined in ways other than simply taking on traditional men's roles.

Empirical studies further show strategies women adopt to navigate and contest gendered norms. Drawing from Australian cane farms, Pini (2005) identifies five such strategies. Some women minimise or hide their involvement with machines to prevent their husbands from appearing lazy or inadequate. Others emphasise their domestic roles to maintain clear boundaries between masculine on-farm work and feminine off-farm duties. A third approach involves distancing themselves from men farmers and avoiding behaviours such as swearing or boasting about physical strength. Alternatively, some women reinforce their femininity by dressing in a 'ladylike' manner and speaking in more traditionally feminine ways in public spaces. Finally, a 'new' strategy involves adopting a business-oriented discourse, framing the farm as a partnership between husband and wife.

These examples highlight the dual potential of agricultural technologies: they can reinforce gendered exclusions or serve as tools for renegotiating power dynamics and creating new rural subjectivities. Concurrently, the meanings attached to machines shift through everyday performances (Bear and Holloway 2015). Building on Bear and Holloway's work, I argue that the relationships between agricultural practices and gender identities is messy, fluid, and continuously evolving. Symbols, discourses, and ideologies linking gender performances to agricultural technologies are not fixed but multiple and dynamic.

Agricultural technologies do more than improve productivity—they shape rural life and influence how gender is performed. However, discussions often focus only on large machines like tractors since most studies are based in Western contexts. Studying women farmers and agricultural technologies in Taiwan with attention to material aspects could identify the variety of agricultural tools and the experiences they create. This means considering how non-human elements play a role in farming life. Factors like size, weight, and function, along with sensory experiences such as sounds, smells, and touch, affect how farmers interact with technology. Encounters between women farmers and various technologies generate new dynamics, producing emergent forms of identity and practice. As Anderson and Wylie (2009) suggest, 'The principle is one of multiplication: materiality is never apprehensible in just one state, nor is it static or inert'.

Cyborg assemblages, concepts and discussions

As Haraway (1991) said, 'The machine is us, our processes, an aspect of our embodiment'. Rooted in the interaction between individuals and technology in Western societies, Haraway introduced the conception of the 'cyborg', a hybrid of machines and organisms. This concept dismantles, blurs, and redefines conventional boundaries between human and non-human, machine and organism, and matter and non-matter. Originally developed in dialogue with feminism, Haraway's framework has been assimilated into broader research, leading to diverse manifestations of the cyborg. By continuously reconstructing bodily boundaries, the cyborg opens new possibilities for interpreting power relations.

Contrary to the cyborg concept, Dant (2004) advocated for assemblage as a more fitting framework, arguing that the term 'hybrid' overly emphasises unity, simplifying the interaction of entities into formulas like A + B = C. Dant exemplifies with a car driver to show that the person and vehicle assemble temporarily rather than hybridise. The car extends the driver's abilities while driving, creating a 'driver-car' assemblage where both are essential. This assemblage remains open to influences from other actors, such as passenger movements or weather conditions that might in turn change the speed. In this sense, an assemblage is a flexible and shifting relationships rather than a fixed or completed one. Similarly, a cyborg can also be seen as a kind of assemblage.

My perspective aligns more closely with Lupton (2013, 2015), who, inspired by Haraway, introduced the concept of the 'cyborg assemblage'. This term refers to a more intricately woven assemblage of technology and the body, grounded in social materialism and constantly changing. Lupton, focusing on digital health technologies, argued that when individuals use smartphones, access the internet, or have implants, these technologies shape multiple embodiments and self-identities. Technological artefacts thus become extensions of the body and self. Mitchell (2004) shared a similar view, describing the 'cyborg self' as 'Me ++', composed of a biological core and its extended boundaries and network systems. Technological advancements push the corporeal boundaries of the cyborg self outwardly, connecting with surrounding objects to form a dynamic network system that continuously reconfigures the body and self.

From Haraway's (1991) *Cyborg Manifesto* to Lupton's (2013) proposition of the cyborg assemblage, it is clear that when bodies and objects connect, new identities and ways of being emerge. Garoian and Gaudelius (2001) think that cyborg identity can be performed as dominant narratives of information technologies are revealed, analysed, and critiqued through subjective performance. This process involves an interplay of personal memory, cultural history, and desire. Wilson (2009) extends cyborg discussions within geography and offers a methodological framework for understanding hybridity on Haraway's cyborg figuration. Wilson proposes four interconnected strategies—witnessing, situating, diffracting, and acquiring—to engage with the cyborg identity in geographic research. Witnessing involves observing and documenting the emergence of cyborgs, while situating knowledges emphasises the contextualisation of assemblages. Diffracting allows for alternative interpretations, and acquiring engages with contradictory discourses, thereby hybridising knowledge and unsettling traditional inquiring methods. By interrogating the knowledges produced through human-technology assemblages, new insights can be gained into the evolving nature of cyborg identities.

Inspired by Lupton's concept of 'cyborg assemblage' and recent debates (Puar 2020; Wilson 2009), I aim to rethink the relationships between young women farmers and agricultural technologies in Taiwan. There is a notable lack of understanding regarding the complexities of contemporary agricultural practices, particularly in the context of young women farmers' engagement with agricultural technologies. Moving away from the conventional view of agricultural machines as symbols of patriarchal dominance, I propose a relational lens to examine these interactions. The following section adopts an assemblage-thinking approach to explore the

interconnectedness of bodies, technologies, and identities within the agricultural sphere.

Towards an assemblage thinking approach

In this research, I hope to move beyond masculinity-femininity binary to explore the relationships between young women farmers and agricultural technologies. I adopt assemblage thinking as a guiding framework because I agree that gender identities are context-dependent, shaped by region, social class, and specific socio-spatial arrangements (Bell, Hullinger, and Brislen 2015). By tracing these dynamic and situated identities, I hope to identify the multiplicity and fluidity of human and non-human interactions in agricultural contexts.

Anderson and McFarlane (2011) define assemblages as socio-spatial formations of diverse, heterogeneous elements that are constantly evolving through emergent processes. These formations are contingent yet open to transformation, as new elements and relations constantly forming and dissolving. Building on this, Baker and McGuirk (2017) emphasise the importance of following actors, focusing on lived bodies and situated knowledge, and tracing the labour of assembling through ethnographic sensibility. It aligns closely with Savage's (2020) three core principles s: (1) recognising relations of exteriority to understand social formations better; (2) embracing heterogeneity, relationality, and flux as defining features of assemblages; and (3) attending to power, politics, and agency.

However, assemblage thinking is not without its critiques. Kinkaid (2020) argues that assemblage geographies often neglect social categories like race, gender, and sexuality, treating them as abstractions rather than relational processes. This comment is crucial to my work, as it suggests the need to view gender as an event that emerges from specific socio-spatial configurations. Gender identities, including masculinity and femininity, are inherently context-based, varying across regions, social classes, and cultural settings (Bell, Hullinger, and Brislen 2015). Moreover, Puar's (2020) work draws on Donna Haraway's famous declaration, 'I would rather be a cyborg than a goddess', to challenge binary oppositions with intersectionality. While intersectionality emphasises the co-construction of race, class, sex, gender, and nation, assemblage thinking highlights the fluidity and multiplicity of bodies, forces, and matter, resisting fixed categorie. Puar critiques the tendency to dismiss assemblages in favour of intersectionality, arguing that assemblages offer insights into how control operates not only through identity but also through affective capacities and tendencies. Gender identities, in this view, are shaped by both discipline and affect, stabilising and destabilising identities within socio-spatial contexts.

Extending assemblage thinking into gender studies, McCann's (2018) application of affective theory to queer femme identities provides an insightful lens. By conceptualising queer femme as an assemblage, McCann avoids framing femininity as either disempowering or empowering and instead focuses on how materiality, affect, and connectivity shape identity and belonging.

Rather than viewing femininity or technology as pre-existed categories, I explore how they are co-constituted in dynamic, context-specific assemblages. Agricultural technologies, whether tractors or small-scale tools, are not just objects but active

participants in shaping gendered identities. The size, weight, and function of a machine, along with the affective experiences they produce influence how women engage with and reinterpret traditional gender norms in agricultural spaces.

Methodology

Locating the research

Agriculture in Taiwan is characterised by small-scale farming, shaped by the country's dense population of approximately 23 million people, of which 11,526,193 are men (49%) and 11,874,027 are women (51%) and its limited land area of 36,197 square kilometers (Ministry of Foreign Affairs 2025). This unique context has led to a prevalence of fragmented farms, with most cultivated lands being less than one hectare in size. According to the 2020 Census of Agriculture, Forestry, Fishery, and Animal Husbandry (Directorate General of Budget, Accounting and Statistics, and Executive Yuan 2023), 56% of farms are smaller than 0.5 hectares, while 21% range between 0.5 and 1.0 hectares. These small-scale farms are well-suited for cultivating diverse crops (Galli et al. 2020), a strategy encouraged by both the government and non-governmental organisations to enhance biodiversity and reduce reliance on monoculture systems (Isbell, Tobin, and Reynolds 2021).

Taiwan's agricultural sector also faces demographic and gender-related challenges. Women account for only 21.3% of farm managers, reflecting gradual but slow progress in gender representation, as the proportion has grown marginally from 17% in 2010. As for the number of men and women farmers, it is 359,000 (70.5%) and 150,000 (29.5%), respectively, with the proportion of women has increased year by year (Ministry of Agriculture 2024). Meanwhile, the sector is increasingly dominated by older farmers, with individuals under 45—classified as 'young farmers'—constituting just 5% of farm managers (Directorate General of Budget, Accounting and Statistics, and Executive Yuan 2023). This aging demographic highlights the pressing issue of generational renewal and the need to attract younger participants into the sector.

Mechanisation plays a critical role in improving productivity, even on Taiwan's small-scale farms. Tractors, power tillers, and rice transplanters are among the most widely used agricultural machines (Directorate General of Budget, Accounting and Statistics, and Executive Yuan 2023), emphasising the importance of small machines in enhancing efficiency. Compact equipment, such as two-wheel and four-wheel tractors, is particularly advantageous for navigating fragmented plots and preserving biodiversity (FAO 2022). These machines also reduce labour demands, making them especially beneficial for empowering women farmers.

This research is situated within the broader context of Taiwan's small-scale agricultural practices, exploring how agricultural technologies intersects with gender. It seeks to study how agricultural technologies influence farming practices, labour dynamics and gender roles. In doing so, this research contributes to broader discussions on the evolving nature of small-scale farming in response to technological, environmental and social transformations.

Methods

This research adopts a qualitative methodology, drawing upon semi-structured interviews, documentary analyses, and participant observation. Inspired by theoretical approaches emphasising relationality and socio-technical dynamics, I adopt a strategy of 'tracing' (Baker and McGuirk 2017) which involved following the movements and practices of young women farmers who engage with agricultural machines and actively share their activities online. This approach allowed me to explore the interplay between agricultural technologies, gender identity, and farming practices in diverse rural contexts across Taiwan.

Between April 2019 and June 2021, I conducted semi-structured interviews with seven primary participants. These participants were identified using a snowball sampling technique, beginning with women recognised as 'Top Hundred Young Farmers in Taiwan'. I examined their websites, social media pages, and advertisements to identify women who explicitly engaged with agricultural technologies. The selection criteria focused on their active use of machines and the diversity of their farming practices rather than specific crop types or scales of production. Recruitment was limited to self-identifying 'women farmers' who emphasised an engagement with agricultural technologies in their social media and media interviews. In addition to these primary participants, I interviewed eight additional informants, including family members, friends, neighbors, and work partners, resulting in a total of 15 informants.

The semi-structured interviews were conducted in various rural areas across Taiwan, covering the northern, central, and eastern regions. Three primary participants were from northern Taiwan, two from the east, and two from central Taiwan. Interviews were designed to address two primary themes: the participants' personal experiences as young women farmers and their interactions with agricultural technologies. Open-ended questions encouraged participants to share their life stories, learning processes, and perceptions of themselves in relation to these technologies, allowing for the emergence of diverse, situated narratives.

The interviews were conducted primarily in Mandarin, with occasional use of Taiwanese when participants expressed themselves more comfortably in the latter. As the researcher, I translated all interview data into English.

While this study did not undergo formal ethical review—as it was conducted as part of a master's thesis—ethical considerations were central to the research process. In Taiwan, it is not standard practice for master's theses to undergo formal institutional ethical review. However, ethical protocols such as informed consent and confidentiality are still expected and supervised at the departmental level. Participants were fully informed about the purpose of the research, and their consent was obtained before conducting interviews. This consent process was reviewed by my thesis supervisor to ensure its rigor and clarity. Participants were assigned code names, which are used throughout this paper to protect their identities. Participants were invited to nominate their own pseudonym, recognising the pseudonyms allow participants to have a voice within this research instead of participant codes or numbers.

As a woman researcher, my gender identity had an important but subtle impact on how I interacted with my participants. Having a similar identity helped me connect with them, making our conversations feel less hierarchical. This connection encouraged

Table 1. Data of the research participants.

Code Name	Age Range	Crops	Common Use of Agricultural Technologies	Farm Size
Chen	40-45	Rice, Sweet Potatoes and A Variety of Vegetables	Cultivator, Mower, Tiller, Farm Wagon, Tractor, Truck and Fertiliser Distributor	3 hectares
Gong	30-35	Tangerines, Persimmons and A Variety of Fruits	Cultivator, Mower, Tiller, Farm Wagon, Sprayer, Pump, Sorting Machine, Auger, Fruit Washing Machines and Chainsaw	1.5 hectares
Weng	30-35	Tangerines, Persimmons and A Variety of Fruits	Cultivator, Mower, Tiller, Farm Wagon, Sprayer, Pump, Sorting Machine, Auger, Fruit Washing Machines and Chainsaw	1.5 hectares
Yeh	30-35	Traditional Medicine Materials	Cultivator, Mower, Tiller, Farm Wagon, Tractor and Fertiliser Distributor	0.5 hectares
Liao	35-40	Grapes, Peaches and High-Priced Fruits in Taiwan	Cultivator, Mower, Tiller, Farm Wagon, Excavator and Shredder	2.5 hectares
Hu	40-45	Rice	Cultivator, Mower and Farm Wagon	20 hectares
Wang	35-40	Oldham bamboo shoots, Cabbages and Raising Chicken	Cultivator and Mower	4 hectares

participants to share their experiences and thoughts openly and clearly. Being a student also affected the dynamics, as some participants saw me more as a learner than an authority figure, which created a more relaxed atmosphere during the interviews. These dynamics contributed to a richer, more nuanced understanding of their socio-technical practices and personal narratives.

The qualitative data gathered through interviews, participant observation, and documentary analyses were analysed thematically. This process involved coding transcripts and field notes to identify patterns and themes related to the participants' socio-technical contexts. Particular attention was paid to the relational, material, and gendered dimensions of agricultural technologies, as well as the ways participants negotiated these dynamics in their daily practices (Table 1).

Findings

This section examines how young women farmers in Taiwan engage with agricultural technologies to (re)shape their gendered identities within the context of smallholder farming. The first part explores the types of agricultural machines they use, the processes through which they acquire and learn to operate them, and the gendered barriers they encounter. It highlights how machine ownership and technical skills provide autonomy while also exposing persistent inequalities in access to knowledge, resources, and recognition. The second part applies the concept of cyborg assemblage to analyse how agricultural technologies become integral to women's farming practices, reshaping their bodily capacities, work routines, and interactions with the land. By centring their embodied experiences, this section illustrates how young women farmers navigate and negotiate their relationships with machines—adapting, modifying, and resisting conventional gender norms—while forging new forms of agency, expertise, and labour identities.

Doing and undoing gender with agricultural technologies

In this section, I address two central questions: What agricultural technologies do the participants use in their farming, and how do they learn to operate them? Through the analysis of interviews, I aim to study the relationships between these young women farmers and their machines. Moreover, these narratives identify how they both do and undo gender in the rural context.

The participants in this study exhibit considerable heterogeneity regarding crop types. Their agricultural endeavours encompass a range of practices, including rice farming, vegetable cultivation, herbal production, and fruit farming. While their production scale and farming styles differ, they share a commitment in small-scale, eco-friendly farming. Their agricultural practices generally follow a similar pattern: soil preparation (using tractors and cultivators), mowing (with mowers), transportation (*via* trucks, stackers, and other vehicles), fertilisation (using fertiliser spreaders), and for fruit growers, additional tools like chainsaws, electric shears, shredders for pruning, sprayers, fruit washing machines, and classifiers for post-harvest processing. In greenhouses, their choice of support structures, plastic sheets, wiring, and environmental control equipment varies based on specific needs.

This seemingly straightforward classification list conceals numerous considerations that cater to the diverse needs of users in various situations. For example, large tractors are suited for efficient soil preparation in vast, flat fields, while more mobile cultivators are better for traversing rugged, small fields. Mowers come in different models—hand-pushed, self-propelled, riding, or backpack mowers—selected based on factors like terrain and grass growth. Power source decisions, such as diesel, gasoline, hybrid, or electric engines, are also influenced by user preferences and habits. Additionally, various accessories, such as gloves, washbasins, and nylon ropes, are used to tailor agricultural machine operations to the needs of the users.

The acquisition of agricultural machines among the participants varied widely. Some shared equipment with the community, while others inherited machines from previous generations. A few started from scratch, gradually accumulating capital and experience, while taking a cautious approach towards acquiring agricultural machines. A unique case involved two informants, Weng and Gong, who are apprentices of the farm and receive equipment rent-free by the owner for a four-year period. Here, the informants invested in machines according to their capabilities and needs. Beyond financial considerations, the purchase of machines also involves additional costs, such as land and time. While owning their own machines may require more effort and resources compared to sharing with others, many participants felt a strong need for ownership. As Chen expressed:

> In the past, farmland planning was focused on maximising crop production. I wanted to incorporate leisure agriculture and create spaces for food and agriculture education. When I asked a contract farmer who owned a tractor to help, he dismissed my ideas as 'unrealistic' and 'unprofessional'. That's when I decided to buy my own tractor. (Chen, 17/04/2019)

Conflicts, like those between Chen and the contract farmers, arise due to differing visions of farmland use. This echoes Stock and Forney's (2014) findings that 'being one's own boss' is crucial to farmer identity, and parallels Tuitjer's (2018) analysis of

rural gendered identities being materialised through property ownership. For young women farmers, autonomy is particularly empowering, challenging traditional gender hierarchies in agriculture. By gaining control over their farming operations, they carve out independent spaces in a male-dominated industry.

Most informants are more familiar with smaller agricultural machines like mowers and cultivators, and only three know how to operate larger machines like tractors and trucks. For many, learning began in childhood, though gendered divisions of labour often meant that brothers were trained to drive tractors while sisters assisted in less mechanical tasks. For those without a farming background, they typically sought advice from vendors or attended government or university courses.

The gendered nature of machine use is clear in the participants' experiences. Hu, who was raised in a traditional farming family, stated:

> My brothers usually drive the harvester, and my sisters and I are in charge of loading grain bags on the machine. This arrangement was 'by nature' since the division of labour was the same as my parents and grandparents. (Hu, 01/11/2020)

Similarly, Chen described her experience of being teased for wanting to operate machines:

> I once joined the exhibition of agricultural machines and asked a businessman for guidance to operate the machines, but later I was questioned 'But you're a woman. Are you sure you want to learn?' (Chen, 17/04/2019)

Beyond learning from others, many of the participants described having to self-educate through observation and hands-on practice. Once they mastered machine operation, they had to adapt to machines designed for men's bodies. Several participants noted the lack of consideration for women users in machine design. For example, gloves used for operating machines were often too large, and tools were not adapted to their body size. Weng and Gong dealt with this by modifying gloves with cloth scraps, while Wang, a bamboo farmer, adjusted the length of a hoe handle to suit her needs.

In response to these challenges, women farmers developed strategies to navigate the physical demands of machine operation. Chen, for instance, preferred wheeled cultivators for ease of movement, noting that non-wheeled machines required greater physical strength to pivot. Others employed collaborative techniques, like Weng and Gong's division of labour when using a spraying machine, with one person pulling pipes and another managing the machine.

Despite acknowledging physical differences, these women did not shy away from operating machines traditionally associated with masculinity (Trauger 2004). They resisted gender norms by engaging in 'dirty' work and taking pride in their mechanical skills, without reinforcing feminine stereotypes (Shisler and Sbicca 2019). Even those who found machine operation challenging insisted on learning basic skills, proactively seeking out training programs and collaborating with experts to improve their performance. As expressed by Chen, '*You rarely see independent women like me*'. In this ongoing process of learning and adaptation, these young women farmers continually affirm their identities as autonomous professionals, challenging the traditional masculine/feminine binary within rural agricultural spaces.

Assembling agricultural machines as the prostheses of women farmers

When I began conversation about agricultural technologies, many of my informants quickly emphasised the necessity of machines in farming. For them, operating agricultural technologies was part of their daily routine; some even described these machines as their 'working partners'. From this perspective, agricultural machines are not merely inanimate tools but could be considered a 'prosthesis' for these women farmers, as suggested by Callon (1998). This leads to an intriguing question: What if agricultural machines are not just tools, but extensions of the body itself? How do individuals come to understand their bodies and selves through technologies?

Drawing from Haraway's (1991) *Cyborg Manifesto* and Lupton's (2013) work on cyborg assemblage, it becomes clear that when objects and bodies intertwine in complex assemblages, new forms of embodiments and identities emerge. The interactions between young women farmers and agricultural technologies have reshaped their work routines and ways of lives, creating fresh understandings of both self and the environment. Inspired by these scholars and grounded in my empirical data, I propose the concept of the emergence of cyborg assemblage, emphasising three key points.

First, the assemblage of young women farmers and agricultural technologies is body-centric. Among the four cyborg technologies mentioned by Lupton (2013, 2015), this assemblage not only establishes new combinations of humans and technologies but also extends human bodily capabilities. For instance, a tiller allows users to cultivate land more quickly, while a mower enables the effortless removal of weeds. These changes in bodily capabilities also influence psychological aspects such as labour tasks, daily life, mental states, and social interactions. Liao proudly showed off her biceps during our conversation:

> Carrying a mower on your back is like carrying a lot of bricks on your body. It makes your hands go numb, but it also makes us strong. (Liao, 25/05/2019)

This highlights how the body serves as a crucial medium through which young women farmers observe and evaluate their work. Muscle soreness, trembling hands, and being startled by noise and odour are all manifestations of being a 'novice'. Over time, the body develops new contours, postures become firmer, arms stronger, and familiarity with the sounds and smells of machines marks the proficiency of young women farmers. However, the body also connects shared experiences among these women. Conversation like '*My hands can't lift anymore today*' or '*Do you have any muscle pain patches?*' reflect an understanding of the toil of farming and a spirit of mutual encouragement. Through these exchanges, the cyborg assemblage finds companions and builds new networks.

Second, the assemblage expands Bear and Holloway (2015) concern with the materiality of technology by incorporating considerations of social context. The assemblage involves not only women farmers and agricultural machines but also the interactions of various actors—people, land, crops, weather, and more. The relationships between women farmers and machines is dynamic rather than static. They feel the condition of the soil (dry/hard, wet/soft, sandy/rocky) and adapt their machines based

on crop growth (dense grass, thin branches, etc.). They experience both domesticating technologies and being domesticated by them. Similar to Lupton's (2013, 2015) notion of digital cyborg assemblages, they may become aware of overreliance on machines or a lack of proficiency, leading them to adjust bodily movements, daily practices, or social interactions accordingly. These relationships are not linear but networked, akin to Mitchell's (2004) 'Me ++' concept of the 'cyborg self', continually self-assembling inwardly and extending connections outwardly. As young women farmers become aware of the conflict between their embodied practices and gendered discourses, they question the design, marketing tactics and inherited division of labour, as Weng and Gong remarked during our interview:

> Why are the machines so heavy and big? And why are recent lightweight agricultural technologies marketed as 'for women use' when they would benefit all farmers? (Weng and Gong, 20/04/2019)

Lastly, the assemblage of young women farmers and agricultural technologies emphasises relationality, fluidity, and assembling. The cyborg assemblage is not an inherent existence; women farmers do not automatically integrate with machines by entering the field and using them. Instead, they undergo a learning process involving encounters, assemblage, and reflection. During this process, encounters between different women farmers and different agricultural machines will generate distinct daily routines. These routines may stem from environmental assessments (e.g. realising that working together in an orchard is easier than working alone), bodily self-awareness (e.g. recognising the need for arm and waist strength when using a tiller), and familiarity with the machines (e.g. learning that different muscle groups are used for backpack versus handheld mowers). In short, different assemblages of young women farmers and agricultural technologies emerge under different circumstances. The same body acquires different identities in different contexts with different tools. For example, when first operating machines, a lack of proficiency and discomfort may cause insecurity. But with practice, machine operation becomes routine, and confidence grows. Liao explained:

> I feel fortunate to know how to use these machines. If I didn't, I'd have to rely on my husband, and I could only work after he finished. (Liao, 25/05/2019).

The fluid nature of the assemblage allows it to respond to Haraway's (1991) concern of 'pleasure in the confusion of boundaries and for responsibility in their construction'. Through the operation of agricultural machines, young women farmers resist gender scripts that position the farmer's body, rural spaces, and operational tools as men's domains. While machines extend the user's capabilities, bodily autonomy enables women farmers to negotiate and engage in dialogue with these scripts. The selection and use of machines reflect their responses to the demands of fieldwork and diverse conditions. The assemblage of young women farmers and agricultural technologies continually self-adjusts, shaping the landscape through shared experiences.

Conclusions

In this paper, I have examined how young women farmers negotiate rural gender scripts through their relationships with agricultural technologies, arguing that the relationships

are messy, fluid, and continuously evolving. In Taiwanese agriculture, rural gender scripts have long positioned men as the primary landowners and machine operators because the resources such as lands, technologies and farming knowledge are mostly passed patrilineally, while women were expected to support in less mechanical or more domestic tasks. The participants' experiences reflect how rural gender scripts are internalised through generational labour divisions, where machine is coded as male and mechanical skills are seen as unnatural for women. However, the results suggest that these young women farmers have paved their way through their bodied experience.

Despite variation in crop types and farming practices, a common theme emerges: these young women farmers adapt machine usage to suit their specific needs. They employ collaborative strategies and modify their approaches to overcome gender-specific challenges. While most interviewees acknowledge differences in physical attributes such as strength and body size, they actively engage in farm work, avoiding the emphasis on traditional feminine roles. Instead, they focus on acquiring skills and knowledge, believing that continuous learning can mitigate any perceived physical limitations.

For many of these young women farmers, operating agricultural technologies has become integral to their daily work. Thus, rather than viewing agricultural machines as mere tools, they function as a 'prosthesis' for these young women farmers. Drawing on Haraway's (1991) cyborg concept and Dant's (2004) notion of assemblage, this work explores the idea of a cyborg assemblage (Lupton 2013, 2015), emphasising three key aspects. First, the body-centric nature of the assemblage highlights how machines extend bodily capabilities and influence psychological aspects, fostering mutual understanding and support among farmers. Second, the dynamic and networked relationships between farmers, machines, and various actors within the agricultural context shapes daily practices and social interactions. Third, the fluidity and relationality of the assemblage allow for diverse responses to different circumstances, enabling young women farmers to renegotiate inherited gender scripts. The assemblage of young women farmers and agricultural technologies thus serves as a dynamic platform for challenging traditional gender norms and constructing new identities within rural environments.

These findings contribute to literatures on gender and agricultural technologies. Rather than framing agricultural machines solely as instruments of patriarchal dominance, this paper adopts a relational perspective, examining the complex interplay between young women farmers and agricultural technologies. Embracing the concept of the cyborg assemblage provides a nuanced exploration of the diverse experiences of young women farmers—both in their involvement in agriculture and in their operation of agricultural machines—without being constrained by stereotypical gender roles or pressured to perform exaggerated notions of masculinity. In reality, various contextual factors (such as environmental conditions, access to capital, and scale of operation), individual characteristics (including future vision, self-perception, and emotional state), and the material attributes of different machines shape the dynamic experiences of young women farmers. Despite sharing a common identity, their experiences are fluid and heterogeneous, reflecting the intricate interplay between humans and machines. This recognition of multiple, coexisting realities underscores the significance of the assemblage of young women farmers and agricultural technologies in understanding the complexities of contemporary agricultural practices.

Furthermore, this study highlights how agricultural technology use in Taiwan differs from that in Western Europe, the United States and Australia. The predominance of small-scale farming in Taiwan means that machines such as mowers and cultivators also play a crucial role comparing with tractors, which dominate in large-scale agricultural economies. This finding suggests that it is important to situate discussions of gendered technology use within specific agricultural economies and geographies.

Results also extend current knowledge about the materiality of agricultural technologies. While substantial attention has been given to large-scale equipment like tractors, it is equally important to consider other types of agricultural technologies. Previous discussions have largely focused on the static attributes of machines, such as size, technical requirements, and noise levels, while overlooking the experiential aspect of operating these technologies. This paper addresses these gaps by exploring not only the physical features of machines—size, weight, shape, and functionality—but also the embodied experiences associated with their operation, including sensory perceptions (sounds, smells) and emotional responses (frustration, transformative moments). Ultimately, the interactions between different young women farmers and various agricultural technologies generate new dynamics and unexpected outcomes.

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