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Department of Social Anthropology and Cultural Studies

Working Paper №

ZANTHRO

Zurich Anthropology Working Papers

Staying Behind, Moving On – Women, Technology and Migration in Contemporary Rural China

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ZANTHRO - Zurich Anthropology Working Papers

Published by
ISEK – Ethnologie
Andreasstrasse 15
CH 8050 Zurich

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Graphic Design:
University of Zurich, Information Technology, MELS/SIVIC, Sarah Steinbacher

Cover Photo:
Zhou Yuemei

ISSN: 2571-6190

Staying behind, moving on – Women, technology and migration in contemporary rural China

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Introduction: A gynotechnic perspective on agriculture and migration

In the People's Republic of China (PRC), more than one sixth of the population is currently on the move (NBSC 2019, sec. 2–3). This corresponds to one third of Chinese farmers, most of whom migrate to major cities on China's east coast. Thus, already by the early 2000s, at least one member of every rural household on average was working away from their farm (Huang and Rozelle 2009, 22). In most of these households the middle generation has left. Meanwhile, the grandparents – notably elderly women – remain in the countryside caring for both the grandchildren and the fields.

This situation of heavy rural outmigration has contributed to what is commonly called the 'feminisation of agriculture' in China (see e.g. Meng 2014). Notably, farming is an activity that has long been perceived as archetypically androcentric in China. In imperial China, the occupation of the farmer and the bureaucrat characterised what was considered essentially male and men's knowledge. Women, in turn, were associated with textile production. This general ideal of a gendered division of labour normatively differentiated between male/heavy/outside and female/manual/inside tasks (Bray 2013; Jacka 1997).

Today, these gendered associations are still alive in the Chinese countryside. However, a look at actual farming practices tells a somewhat different story, i.e. one of a more flexible assemblage. In the context of the rural exodus, women have jumped in to sustain the androcentric farming system. They do so with the help of particular farming technologies. As China historian Jacob Eyferth has shown with regard to the craft of papermaking, such processes can actually be seen as systemic in China. They follow a pattern in which one group of people steps out and specialises while another group adapts to changing specialisations in skill and fills the emerging gaps. The latter are often women. Their contribution to maintaining a certain stability while enabling new dynamics usually remains invisible, however (Eyferth 2009).

Mrs Luo and Granny Li are two of these women who have stayed on their farms and contribute to upholding social and economic stability while encouraging the mobility of others. Both of them have figured out specific ways for coping with their double burden of caring for fields and grandchildren while the rest of their household works far away from home. Exploring the socio-technical choices of so-called 'left-behind'[1] elderly women such

[1] 'Left behind' is the common translation of *liushou* 留守, which literarily translates as 'stay to take care of', implying that those left behind hold the fort for migrants to return.

as Mrs Luo and Granny Li[2], my overall aim is to contribute to the underdeveloped field 'materialities of migration'.

This article is located at the intersection of migration studies, agro-anthropology and the anthropology of skilled practice. Migration scholars have only recently turned to investigating and theorising about the material side of migration (see, particularly, Basu and Coleman 2008; Wang 2016). In doing so, they have mainly focused on commodities that can be carried along or sent, such as food or remittances (see, e.g. Crenn, Hassoun and Medina 2010; Cohen 2011). With the exception of houses (e.g. Pauli 2008; Dalakoglou 2010), they have not looked much at people and things that stay behind. The people left behind by their migrant family members have commonly been portrayed as victims, although there are a few studies that highlight their agency (Toyata, Yeoh, and Nguyen 2007; Jacka 2014). Still, these remain exceptional and the agency of those staying – let alone the skilled practices from which much of their agency stems – is rarely taken into account. Agro-anthropological studies that have dealt expansively with migrants' places of origin and farmers' techniques and knowledge (e.g. Richards 1985; Sillitoe, Bicker, and Pottier 2002) usually do not, however, focus on migration.

Meanwhile, except for the French agricultural technology anthropologists (notably Haudricourt and Delamarre 1955; Leroi-Gourhan 1964; Sigaut 1994), the anthropology of skilled practice has generally looked in detail at craft techniques, technology and skill, its transmission and transformation (e.g. Ingold 2000). It has also broadly overlooked questions of migration, however. Nevertheless, drawn together, these bodies of literature doubtlessly allow for a more holistic investigation into the formation of the everyday skill repertoires that are acquired, practised and developed by farmers between rural work and migration exigencies and their gendered dynamics.

This article addresses this gap in investigating farmers' socio-technical land-use practices in a context of migration. It does so from an actor-centred, knowledge-strategic perspective. Methodologically, it is based on the analysis of local gazetteers, proverb collections and ethnographic data collected in the 2010s in Green Water Village, Anren County, Hunan Province, PRC plus follow-up video interviews and text messages with migrants and left-behind farmers.

Hunan Province holds one of the world's longest histories of rice production and still maintains a local economy that is based mainly on rice. Today, Hunan produces 6 percent of the PRC's entire rice on only 3 percent of the country's arable land (World Bank 2015, 2). This facilitates surplus grain production and export to other provinces. However, Hunan Province is also among China's major sending provinces of internal migrants. Most of Hunan's migrants move to the Pearl River Delta in nearby Guangdong Province. This has been attributed to economic regional disparities and inequalities (Naughton 2007, 26; Fan 2008). The province is thus particularly apt for investigating questions at the nexus of agriculture and migration.

This article focuses on the materialities of migration-affected rural households in Hunan, with special attention to women. I examine their agro-technological choices through the lens of gynocentric technologies. This notion draws on the historian and anthropologist of science and technology Francesca Bray's concept of 'gynotechnics': 'sets of technologies

[2] The names of the village and the people mentioned are all pseudonyms.

that produce ideas about women and about gender, as a creative [...] way of looking at how societies give material form to their ideas' (Bray 1997, 380). As Jacob Eyferth, Suzanne Z. Gottschang, and Gonçalo D. Santos have highlighted in a workshop on gynocentric technologies held in October 2018, the concept is essentially related to the work of 'people-making', including everyday tasks such as childbirth, childrearing or care, i.e. efforts commonly undertaken by women with or without the help of artefacts and machines. The term is useful because, on the one hand, it gives credit to the role of women in creating, fashioning and sustaining people and societies. On the other hand, it draws attention to the fact that for understanding how this work is done and perceived, we need to look closely at both the social and the technical-material spheres of women's labour and work.

I take up the term 'gynocentric technologies' here to argue that what is considered to be a gynocentric technology is shifting in the context of rural-urban migration. This allows questioning the common-sense assumptions about what constitutes typical technologies used by women in China, namely technologies used for cooking or weaving. Moreover, it permits rethinking the binary of productive and reproductive work. While women are commonly associated with reproduction in rural China as well as in many other places, agriculture and men are seen as belonging to the sphere of production. I challenge this normative assumption throughout the article, adding socio-technical insights to earlier studies on the dynamics of migration and women's work in rural China (notably Jacka 1997).

I argue that through their technological choices, left-behind women contribute significantly to finding and implementing solutions with regard to a basic predicament of contemporary rural Chinese rice farming households: having to migrate on the one hand, and having to preserve home resources (paddy fields) through constant cultivation, on the other. By focusing on rural women's use of farming technology, I not only highlight women's particular agency and role in the current transformations in post-reform China, but I also invite further reflections regarding our perception of technology and modernity in general-

The paddy field predicament

Rice fields are crucial to migration, as they shape migrants and migration and are shaped by it. Apart from emotional, imagined and administrative ties to the land (and the fact that rice is the staple food in southern China), rice fields are a central economic factor and safety net for rural households. They provide subsistence for old people left behind and the grandchildren they care for. The latter are expected to continue the family's lineage and will look after returning migrants in years to come. For migrants, this farmland is an asset that provides seed capital and an important economic safety net for their, often highly precarious, city life.

The Chinese system of household registration (*hukou zhidu* 户口制度) continues to prevent rural Chinese from gaining permanent settlement rights or any entitlement to the welfare, pension and education system available to registered urban-dwellers. Although this system is currently being abolished step by step, it remains valid in major cities. It strictly divided the country's population into rural and urban, agricultural and non-agricultural, binding the rural population to their fields (Cheng and Selden 1994). These rural households were allocated land use rights rather than welfare services during the 1980s de-collectivisation period. Migrants therefore rely on their resources at home. Indeed, the fields owned

by some of the migrants I interviewed were so central to their economic security that they specifically left close family members behind to look after them.

Preserving wet rice fields is a socio-technical challenge, especially when skilled people have migrated and are unavailable to cultivate them. First, each step of wet rice cultivation requires considerable skill, and many cannot be mechanised (Bray 1994). Wet rice cultivation is thus more labour- and skill-intensive than most other crops. Even where it is possible to mechanise certain stages, not many farmers can afford to do so. Second, in order to retain their worth and yield, wet rice fields need to be cultivated with rice continuously, which increases their value over time (Bray 1984; 1994). Not cultivating the fields or transforming them into dry fields therefore significantly decreases their value.[3] Mechanisation, fallowing fields or switching to less labour-intensive crops might seem to be easy ways to compensate for the missing skilled labour due to off-farm migration. However, the constraints described above show that none of these are straightforward possibilities.

Chinese rice farmers are in a tricky situation. Staying at home to ensure constant rice cultivation is not an appealing option, because rice farming barely provides subsistence-level incomes. In 2011, one migrant construction worker could earn up to three times as much as an entire rice farming household. The socio-economic pressure to migrate is also enormous. As Mrs Luo's elder daughter Yuemei explained:

> There are three of us children, two sisters and one younger brother. When I went to primary school [in the late 1980s and early 1990s], school fees were still very high. Therefore, ever since then my dad had to work outside the village. Now my siblings and I have also left, only my mother remains. My brother is 22 now and will have to marry soon. But he works in mining, so it is difficult for him to get to know a woman there. He needs a piece of land and to build a house [here], otherwise it will be hard to find a wife.[4]

To build a suitable new house requires incomes that can be achieved only through migration. Regarding her own decision to go to Beijing, where she had recently graduated from university, she stated: 'I have always liked studying. I studied hard, because I wanted to get out of this cycle [of hardship and of being bound to the countryside].'[5] Even though Yuemei clearly did not see her future in farming, she was nevertheless sending money to her mother, which ensured that rice cultivation could continue. As these accounts reveal, the pressure to migrate is strong due to both economic and social factors.

In fact, all of the households I encountered in the field had migrant members, most of them at least two. Drawing on Tom Shakespeare (2006, 63), I term this situation of simultaneous cultivation and migration pressures a 'predicament'—a situation that is indeed difficult, but that is nevertheless solution- and future-oriented, evoking active subjects rather than victimhood. Rural households therefore have to find solutions that allow them to simultaneously migrate and cultivate their fields to preserve them. They follow household patterns that allow them to do so, usually leaving women, elderly people and small children behind, while the middle generation and especially men migrate to the cities for work.

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[3] This is related to the particular soil characteristics and the requirements of the rice plant on the one hand, and to tenacious weeds that quickly populate fallow fields, such as barnyard grass (*Echinochloa crus-galli* Beauv.), on the other hand. For details see e.g. Bray (2004); Kleinhenz, Schnitzler and Midmore (1996); McKay (2005).

[4] Interview with Yuemei, 04/02/2011, reconstructed from fieldnotes.

[5] Interview with Yuemei, 19/01/2011, reconstructed from fieldnotes.

Gynocentric technical and technological choices

I argue that to find solutions to the paddy field predicament, rural households draw on a repertoire of knowledge. Agro-anthropologist Thomas K. Schippers's (2014) notion of 'repertoire' is particularly inspiring here. By understanding it as a repertoire of farmers' capacities to deal with varying, sometimes unforeseen circumstances, it transcends a narrow understanding of the notion of technology as merely a technical set of knowledge and skills. The repertoire of the Chinese farmers studied consists of corpora of knowledge about different aspects of farming such as soil or water, farming technologies, embodied techniques, and the knowledge of how to organise farm work efficiently, e.g. along gendered lines. It also includes climate and time knowledge, represented and transmitted in the Chinese agricultural calendar and in proverbs.

This repertoire has been transformed greatly with the national and local implementation of the Chinese Green Revolution (1964–1967) (see Stavis 1974; ACGCC 1996; 2011). The Chinese Green Revolution meant a rapid popularisation of the first generation of modern, agricultural technologies developed in China. These included mechanised irrigation, farm chemicals, mechanisation and rural electrification, along with newly bred high-yielding varieties of crops. It was deeply intertwined with wider socio-political ambitions and larger development schemes, which occurred – not coincidentally – at the same time as the Cultural Revolution (see Schmalzer 2016). Yet, even though many manual techniques have been replaced by mechanisation and farm chemicals, as the China historian Sigrid Schmalzer (2016, 7) has noted, there has still been a lot of creative hybridity in implementing this shift in practice, for both practical and political reasons. In fact, in Green Water Village, people made use of a whole potpourri of 'non-synchronous'[6] techniques and technologies simultaneously, ranging from stone mills to combine harvesters.

Indeed, to deal with their predicament of simultaneous field preservation and migration strategically, farmers can now draw on an extended repertoire of knowledge, including pre-industrial, manual techniques, mechanisation, chemicalisation and hybrid seeds. Similar to the archaeologist Knutsson's (2014) idea of using farm tools as a 'farming manual', i.e. as a way to store and transmit farming knowledge, I see the practice of keeping pre-industrial implements, despite central and local governments' rigorous push for modernisation, as a way to store and preserve a large repertoire of knowledge. An expansive repertoire of knowledge can provide solutions to a whole range of different socio-technical problems that have occurred before and may potentially reoccur today, e.g. in the form of a shortage of fuel, electricity or cash, or a wave of return migration due to an economic crisis.

Taken together, these agro-technological transformations have fuelled the farmers' dilemma, especially by setting free large numbers of rural labourers for migration through labour-saving technologies. But they have also provided new options of dealing with the conflicting pressures of farming and migration. In this context, women left behind by their migrant family members face particular challenges, not least because of the double burden many of them experience, i.e. having to take care of the grandchildren and the fields while being confronted by their ageing bodies and porous support networks, due to migration. Next, I provide three examples of technical and technological choices from the farmers' repertoire that reveal how these women cope with their households' predicament.

[6] The concept of non-synchronicity goes back to the German Marxist philosopher Ernst Bloch (1885–1977). For more about its origin and more recent adoptions, see Flitsch (2008, 270).

The example of harvesting

The first example of a strategic socio-technical choice relates to harvesting technology. In Green Water Village, the use of harvesting technology is, at first sight, not related to specific gendered norms. However, in the absence of many men due to migration,[7] the choice and its practical implementation has *de facto* become a mainly female issue. Along with transplanting, harvesting is the busiest time in the agricultural year, especially during the time of *shuangqiang* 双枪, i.e. the 'double rush' of simultaneously harvesting the first crop and transplanting the second crop of rice. It is an instance where lacking labour due to migration becomes particularly challenging for those left behind. In order not to lose any of the harvest, both activities have to be carried out quickly, i.e. within a time frame of just ten days. In this context, the combine harvester is especially appealing to households who lack labour. However, the sickle also retains some advantages and – as the following case of Mrs Luo shows – it is not a simple choice of either using the combine or the sickle. Rather, the two technologies are part of a whole repertoire of pre-industrial and post-Green Revolution technologies from which farmers can choose according to varying household circumstances.

When I met her in 2011, the middle-aged Mrs Luo was the only person in her household who had stayed in the village. The slim and short suntanned woman with a large smile and a loose ponytail tucked under her hat hosted me during my stay in the village. Her husband and three grown-up children had all migrated to various cities throughout China. The two daughters Yuemei and Linjie were working in administrative and service jobs respectively in Beijing. I had gotten to know Yuemei, who introduced me to the village, in Beijing. The son Pengyu followed the cohort of the young village men to operate excavators in Guangdong. Mrs Luo's husband, Mr Zhou, was a construction worker who moved to various places along with his company's assignments. Mr Zhou was the first to leave around the beginning of the reform period in the late 1980s and early 1990s, when the three children started primary school. Later, he needed money to build a new house for Pengyu in order to attract a suitable marriage partner who would care for Mr Zhou and Mrs Luo in their old age. Mrs Luo was therefore the only one who stayed at home, taking care of the fields and, more recently also of her son's two daughters. Only after Yuemei and her sister consecutively married other migrant workers and each gave birth to a baby in Beijing did Mrs Luo leave the countryside for the first time, visiting her daughters in order to help them out. She soon returned to Green Water, however, because she felt ill, which the family attributed to her body not being used to city life. Thus, Mrs Luo continued to stay at home, waiting for the Spring Festival until she would finally see her husband and children again. During the rest of the year she usually lived on her own, taking care of the household's fields and trying her best to maintain the rice cultivation.[8]

During the busy harvesting period, Mrs Luo chose to strategically use two competing harvesting technologies simultaneously: the manual sickle and the mechanic combine harvester. Both affect or are affected by gendered dynamics. The first technology, the sickle, is

[7] Until the new millennium, migrants were mainly men. Thereafter, women also began to migrate (Bossen 2011, 98; Jacka 2006). Elderly men and women commonly stay at home, both facing considerable challenges (see e.g. He and Ye 2014). However, in Green Water, elderly men also seem to migrate for longer periods of time. Elderly women in particular are faced with the double burden of taking care of the household and the fields.

[8] Based on personal observations and multiple conversations with Mrs Luo's family, 2010–2016.

the conventional harvesting implement in Green Water Village (see Figures 1 and 2). Previously, harvesting with a sickle used to be performed across age and gender boundaries, and Mrs Luo's daughter Yuemei recalls from her school years in the 1990s that nobody was spared from the hectic job of cutting the grain, with children even officially excused from school to help with the harvest.[9] With the outmigration of many men, sickles are now mainly used by women who stay behind and they have somewhat shifted towards becoming a more gynocentric technology. This example from southern Chinese Green Water Village complements François Sigaut's observations. He asserts that harvesting with a sickle was already typically a woman's task in non-Mediterranean Europe and India, but a man's task in the semi-arid areas of Morocco, Spain, central Asia and northern China (Sigaut 1991, 41–42).

Figure 1: A hand-made sickle (above) and an industrially-produced sickle (below). They are now part of the collection of the Ethnographic Museum of the University of Zurich (Photo: Lena Kaufmann, 2011)

Figure 2: Sickles with plastic handles. Today's sickles are industrial products, which may be purchased for under five Yuan (less than 1 USD) at the local market (Photo: Lena Kaufmann, 2011)

Combine harvesters have only recently been introduced to Anren County through a county government initiative. According to the *Anren County Gazetteer*, rice was harvested mechanically in Anren for the first time in October 1998. At that time, the County Department of Agriculture had invested more than 100,000 Yuan (about 15,000 USD) to purchase a combine harvester from Zhejiang Province. More than 3,000 people are reported to have watched the demonstration of this exciting new vehicle (ACGCC 2011, 300, 302).

Some of the richest farmers can afford to buy privately-owned machines. In 2011, there was just one in Green Water Village, which Hugen's family – the richest family in the village and the only one that resided in a walled compound – had purchased in 2007 (see Figures 3 and 4). Hugen stated that the combine harvester had cost 50,000 Yuan (about 7,500 USD). His family had saved up for eight years to buy it. The villagers paid Hugen up to 100 Yuan (about 15 USD) per *mu*[10] for his mechanic harvesting service, a considerable cost that not everybody was willing or able to afford.[11] Hiring manual harvesting services to replace the missing labour would be even more expensive (see Chen 2016), which is why some farmers continued to rely on the household labour they had available.

[9] Text conversation with Yuemei, 24/11/2016.
[10] *Mu* is a Chinese measure for land, equalling one fifteenth of a hectare, or about 667 square metres.
[11] Interviews with Hugen and various villagers, 01/02/2011.

Figure 3: The only combine harvester in Green Water (Photo: Lena Kaufmann, 2011)

Figure 4: Hugen's mother and her grandson lock up the combine harvester (Photo: Lena Kaufmann, 2011)

Despite its high cost, the combine harvester saved considerable time and labour, which was important when faced with labour constraints. Hugen explained that it took about ten minutes for him to harvest one *mu*. Only one person was needed to run the machine, with a second one walking behind it to put the rice into bags.[12] In contrast, four people would take about one day to harvest one *mu* manually (Chen 2016). This is an important factor when it comes to taking technological choices when faced with off-farm migration. Renting the services of a combine harvester means that migrant workers do not need to return for the busy harvesting season. Besides, it has enabled villagers such as left-behind women to pay somebody else for the task of harvesting, rather than performing it themselves or engaging in tiring labour exchange.[13]

Notably, the operation of the combine harvester undoubtedly belongs to the androcentric realm. Its introduction contributes to new dynamics in the gendered division of harvesting labour and knowledge. Combine harvesters in Hunan are operated exclusively by men, sparing women, children and migrants from much of the harvesting work. The machines are also perceived as predominantly male. Mrs Luo's husband Mr Zhou sees this in relation to the complex and uneven physical features of the terrain, which render it difficult to operate the machine – thus requiring a man to do so. In contrast, he states that it is easier to drive a combine harvester in the flat terrain of northern China, which is why women there can also drive a combine harvester.[14] Here it is worth noting that certain new skills are needed to drive a combine harvester and that the new technology and the skills to operate it are attributed only to men. This points towards the transformation of the knowledge system, including the issue of deskilling (see Braverman 1974; Stone 2007).

Both technologies – sickles and combine harvesters – ensure the cultivation and, hence, the protection of the rice field that requires constant cultivation to retain its soil quality and value. At the same time, they each have certain advantages and disadvantages that farmers weigh against one another. My aim here is not to provide an exhaustive list of factors around deciding which to use, but rather to suggest that the choice is indeed complex and goes beyond simple economic reasoning. As suggested above, labour and costs are the

[12] Interviews with Hugen, 01/02/2011, and Zhou Wenxiang, 21/01/2011.
[13] Interview with Zhou Wenxiang, 21/01/2011, text communication with Yuemei, 24/11/2016.
[14] Text communication with Zhou Wenlu and Yuemei, 29/04/2017.

two central factors Green Water villagers take into account. These are also interconnected when it comes to opting for mechanisation in the context of migration. On the one hand, migrant remittances enable those remaining in the village, such as Mrs Luo, to afford harvesting services, or as in the case of machine owner Hugen, to invest by purchasing machines. On the other hand, the need to counteract labour loss through labour-saving technology is obvious.[15]

The reality is more complex than only considering the financial and human capital available for making technological choices, however. When it comes to harvesting, according to Anderson and Sigaut (2014, 92), the choice of harvesting method is generally related to the following factors: the desired part of the plant, including the possible use of the stems; plant morphology (sometimes); field density; and soil type. This is the case in Green Water, too.

Moreover, different techniques and technologies affect each other because farming is a system (Sigaut 1991). In this system, according to ethno-archaeologist Whittaker (2014, 355), '[a] technology [here the sickle] survives as long as it maintains a competitive edge – technical, economic, or even social – over technologies with similar functions [here the combine harvester]'. The combine harvester's main competitive edge, in view of the missing emigrated labour, is certainly its labour-saving capacity. In contrast, sickles are not only a low-cost implement, but they also cut the plants closely to the ground and therefore have the competitive advantage of producing rice straw (see Sigaut 1991). This is in contrast to the long, standing rice straw that the combine harvester always leaves behind on the fields in Green Water (see Figure 5). That straw is lost and cannot be used for other purposes.

Figure 5: Fields harvested with a combine harvester (left) and a sickle (right) (Photo: Lena Kaufmann, 2011)

Rice straw has many uses, from housing to cooking to sleeping. Within the sphere of farming, one of rice straw's main purposes is to provide fodder for the oxen. Accordingly,

[15] Social scientists from various disciplines examining the impact of migration on agricultural production have widely documented this double effect (see e.g. Davis, Carletto and Winters 2010).

the lack of straw influences various spheres of everyday life. Nowadays, numerous straw products are being replaced by industrial products and affected by commoditisation. In view of the rice field resource, this means that – similar to the realm of rice consumption – commoditisation, along with increased cash incomes through migration, has given farmers the possibility of eliminating their dependence on rice straw.

Because oxen are first and foremost kept as ploughing animals, a change in harvesting technology directly affects the choice of ploughing technology. Whereas oxen ploughs used to be the conventional technology and their operation was attributed to men, nowadays some farmers have replaced them with walking tractors, machines that are lighter to handle. According to Mrs Luo's daughter Yuemei, tractors have rendered ploughing less physically demanding, making it possible for women to carry it out.[16] This is just one example of how different technologies are linked within the whole *chaîne opératoire* (Leroi-Gourhan 1964) or 'operational sequence' of the entire agricultural process, which complicates decision making, especially when interlinked with a shift in the gendered division of labour.

In addition to these complex considerations of farming technologies that left-behind women have to evaluate, there is a whole range of further practical factors that come into play when choosing between a sickle and a combine harvester: the amount of rice planted (sickle harvesting is suitable for smaller amounts); the size of the field (if a field is too small, the combine harvester cannot manoeuvre well on it); the shape of a field; and the characteristics of the soil. For instance, Mrs Luo used a sickle in some parts of her field and a combine harvester in other parts of the same field because the machine would get stuck in the mud in certain places.[17] Finally, available skills also play a role, not only since their lack affects the organisation of labour, but also because migrants need to have the right skills to earn enough money in the city to afford mechanical harvesting or other services back home.

Overall, the complexity of factors that come into play outlined here – which provide merely a glimpse into the issue of technology choice – contribute to explaining why scholars have not yet been able to clearly determine the relationship between migration and the adoption of agricultural mechanisation, despite numerous efforts to do so (see e.g. Rigg, Salamanca, and Thompson 2016, 125). Other factors not mentioned here may involve further practical issues, such as the way a crop is sown (i.e. broadcast or transplanted) and the way it ripens (evenly or at different stages) (Bray 1984, 322, 335), or the availability of subsidies for machinery and extension services.

Moreover, there are also socio-cultural factors. For example, mechanisation frees up fragile, left-behind elderly people from having to offer their labour as exchange in mutual help arrangements. This eases the double burden of elderly women in view of their aged bodies, allowing them to cope with the farming-migration predicament, or it gives other households which have several members the possibility of offering their labour in return for cash or other favours. Other examples include the association of certain techniques and technologies with 'backward' or 'modern' farming practices (see Santos 2011; Oshiro 1985), or other influences based on gender and age (see Song 1998; Yuan and Niehof 2011). Here, further research is needed with regard to Chinese combine harvesters, which have only recently begun to change Chinese rice farming landscapes and knowledge repertoires.

[16] Email exchanges with Yuemei, 24/11/2016 and 13/03/2017.
[17] Interview with Mrs Luo, 24/01/2011.

If we shift the focus away from these distinguishing decision-making factors, towards highlighting the repertoire character of the knowledge and skills inscribed in these technologies that underlie technological choice – and away from discourse towards practice – it becomes clear that women like Mrs Luo are not simply passively adopting new technology. Instead, whether manually or by paying someone for the service, they use pre-industrial and mechanic technologies strategically. They do so in a way that best fits their current circumstances and constraints in order to achieve their own 'projects' (Ortner 2006). For Mrs Luo, one important long-term project is certainly to preserve the family's paddy fields, while allowing the household as a whole to profit from migration. In addition, for her personally, she makes specific choices in view of her own frail health and to provide for her own subsistence. After she had grandchildren, her technological choices also implied having sufficient time to look after them. This meant paving not only the road to her own old-age care, but also ensuring the continuity of the patriline. In other words, Mrs Luo's technological harvesting choices enabled her to do both reproductive and productive labour, which points towards the complexity of the technologies that seem to escape a clear-cut binary division in this regard.

The example of direct seeding

A second example of technological choice is switching from transplanting to direct seeding, here referring to broadcasting pregerminated seeds. In the current context of rural exodus, direct seeding is undergoing a revival in Hunan and elsewhere (see, e.g. Pandey et al. 2002). This once again demonstrates the close link between social and technological changes in the 'socio-technical system' (Pfaffenberger 1992) of rice cultivation. Although transplanting has also been practiced by men in Green Water Village as elsewhere, transplanting is typically a women's job, with the knowledge of this technique literarily lying in the hands of women with their (attributed) nimble fingers (e.g. Kyaddondo 2010; Bergstedt 2016). Moreover, as many people left behind are women, the switch to direct seeding can be seen as mainly a female choice and a way of coping with the rice paddy predicament.

In addition to rejecting a technique typically performed by women, using direct seeding instead of transplanting means substituting an older technique for a newer one. The technique of direct seeding was the earliest method of rice cultivation. The shift to transplanting only occurred in the late Han Dynasty (23–270 B.C.E.).[18] It is remarkable that the social and technical knowledge about this more than two-millennia-old technique has been retained, even though transplanting has long been the dominant practice and farmers today do not seem to have ever personally practiced direct seeding. Still, in a way, knowledge about the practice has been remembered collectively. Following Schippers (2014), I suggest that proverbs may have played a role here. These sayings can transmit knowledge that is not required in certain situations, but may be crucial in others.[19] Moreover, farmers seem to

[18] See Chang (2000, 140–41) and Bray (1984, 285–86). Unfortunately, I lack information regarding the gendered division of labour in direct seeding in the past.

[19] For example, the following three proverbs on the explicit advantages of careful transplanting and careful intensive farming simultaneously convey implicit information about the disadvantages of direct seeding and, more generally, sloppy rice cultivation:

(1) 宁可过坏一个年，不可插坏一丘田。

Rather spend one bad year, than to transplant one field badly. (XT 1988, 232)

(2) 插得正，等于上次粪；插得匀，抽穗一齐平；插得浅，有利分蘖与生长。

have retained 'tactile memory' (Harries 2017), which allows left-behind women to now rediscover certain logics inherent in the seeds.

While the strategy of direct seeding was not practiced in Green Water Village in 2011, and the villagers only mentioned it with regard to other places in Hunan Province, Mrs Luo stated that, by early 2016, 'a lot of people' in the village had switched to direct seeding. She claimed that they did this because the work is 'not so bitter, but relaxed' and because 'households don't have time'.[20] They directly seeded the early-season, usually hybrid, rice (the main rice people grow) since they had further de-intensified farming by switching from two rice harvests per year to one.

While the lack of labour due to migration is one important decision-making factor with regard to this technological choice, there is a whole range of other points that also needs to be taken into consideration. First, according to Hugen, who owned the combine harvester and whose sister had resorted to this technique, the field must be properly levelled beforehand. In conditions that lack male labour, this usually requires a tractor – another instance of how 'technical linkage' (Oshiro 1985) influences decision making. Second, Hugen said, using pesticides is problematic: because the plants are not evenly distributed, it is not possible to apply pesticides evenly. Third, there are more weeds in direct-seeded fields. Fourth, the yields of directly seeded rice fields differ.[21] Finally, direct seeding requires more financial capital because of the relatively high quantities of costly hybrid seeds needed, in addition to requiring twice as many seeds as needed in transplanting (Van den Berg et al. 2007, 846; IRRI 2016).

The decision for or against direct seeding is therefore highly complex, especially when taking into account the many advantages of transplanting: making optimal use of scarce land, water, and fertiliser; controlling weeds effectively; and gaining higher yields. In addition, more labour input is required for transplanting, which may also be an advantage in times of high population pressure and few other options. For example, Mrs Luo continued transplanting (see cover photo) when her husband Mr Zhou returned home temporarily, making use of the skills he had acquired as a construction worker when building a house for his son Pengyu. When I talked to Mrs Luo in 2016, she had weighed all these factors against each other. As a woman left behind by her other household members, her planting choice, just like her choice of harvesting technologies, allowed her to compensate for the lack of labour, to act in consideration of her own frail health, and still continue to plant rice and thereby protect the land for the family, while enabling the other members to migrate, be productive and reproductive.

The example of lamp rush as a cash crop

The third example of a strategic socio-technical choice involves cultivating less labour-intensive cash crops in the paddy fields. Cash crops are not gynocentric technologies *per se*.

Transplanting straight is equivalent to applying manure once; transplanting the ears evenly will be produced simultaneously and evenly; transplanting flat is better for tillering and growing. (XT 1988, 232; see also CZ 1988, 163)

(3) 田间管理如绣花，工夫越细越到家。

To care about the fields is like embroidery, the more thorough the effort, the more perfect it is. (XT 1988, 243)

[20] Video interview with Mrs Luo, 08/02/2016.

[21] Interview with Hugen, 01/02/2011, video interview with Mrs Luo, 08/02/2016.

Yet, as the case below shows, cash crop decisions may be deeply gendered. In fact, as ethnographically-oriented archaeobotanists assert, plant choice is a complex issue. It relates to an interplay of numerous natural, technical and, especially, socio-cultural factors (Chevalier, Marinova and Peña-Chocarro 2014, 4). In Green Water Village, too, these factors are complex, with the social context being particularly influential.

Local statistics indicate that cash crops are of growing importance. Common cash crops in Anren are rape seed, tea, fruit, tobacco, cotton and groundnuts. Between 1989 and 2003, the proportion of cash crops (mostly rape seed) in relation to the total cultivated area in Anren County grew from 11.6 to 19.3 percent.[22] The income obtained from these crops is higher than that generated from rice. Therefore, cash cropping even seems to be a good alternative to migration.[23]

One particular local cash crop is lamp rush (*Juncus effusus*, 灯芯草 *dengxin cao*, see Figure 7). It grows in bundles, with characteristic stems that stick out from the wet ground like long green needles. The spongy cores can be sold as cushioning material. The crop is also sold to Japan for *tatami* mat production, as well as to other Asian countries (Zhi 2010; ACGCC 2011, 291). Lamp rush grows throughout the winter and spring, so it replaces the early rice crop. Cultivating lamp rush is mainly undertaken by older women and their husbands, who have been left behind by their migrated family members. Important factors that influence their crop choice are the short-term objective of earning extra income to secure the immediate subsistence of those left behind while, at the same time, compensating for the lacking household labour and preserving the paddy fields in the long term. Lamp rush is an optimal crop in this regard because, like rice and unlike most other crops, it grows in a wet field.

This crop already has a certain history in the area, which is closely tied to the socio-technical and political contexts of previous eras. According to the *Anren County Gazetteer*, between the mid-seventeenth and mid-twentieth centuries in Qing and Republican China, lamp rush used to be a major local cash crop. As its name suggests, the rush was previously used for lighting. Due to its perceived superstitious usage, which was condemned by the Chinese Communist Party, and the increasing replacement of candles and oil lamps by other lighting technology, its cultivation decreased in the 1950s (ACGCC 1996, 295).

At the end of the 1980s, with de-collectivisation, it regained importance and Longshi Township, where Green Water Village is located, became one of the three cultivation centres in Anren County. In 2002, its extensive promotion was part of an ambitious local government project and one of the first rural commercialisation projects in the prefectural-level city of Chenzhou. By 2003, 7,100 *mu* of lamp rush had been planted across the entire county, 5,100 *mu* of which was in Longshi Township (ACGCC 2011, 291).

Lamp rush cultivation is fairly profitable, the output value of the crop more than double that of rice: up to about 4,000 Yuan (about 600 USD) per *mu*, compared to up to 1,200 Yuan (about 180 USD) per *mu* for one season of rice (Zhi 2010; ACGCC 2011, 291). Seventy-year-old Granny Li from neighbouring Paishan Township, the mother-in-law of Mr Zhou's sister, sold a bundle of peeled rush for 3 Yuan, which was used to line coffins.[24] Furthermore, the profitability and popularity of lamp rush is connected to the comparatively low input of farm

[22] See ACGCC (2011, 287–88). More recent local statistics are not available.
[23] Interviews with the Zhao couple, 13/02/2011.
[24] Interview with Granny Li, 25/01/2011.

chemicals and labour it needs, which makes it an important crop for old people, who are often frail and lack support from others.

In contrast to lamp rush cultivation, lamp rush processing is highly demanding. Processing the rush involves carefully and quickly peeling off the inner part of the plant with a small knife without breaking the long core (see Figure 8). Not everybody is skilled at this. Out of several grandchildren gathered around Granny Li while she demonstrated her skills to me, only one ten-year-old girl was able to imitate her movement successfully.

Figure 6: Lamp rush growing in a wet field (Photo: Lena Kaufmann, 2011)

Figure 7: Granny Li peels the dried lamp rush (Photo: Lena Kaufmann, 2011)

Overall, for migration-affected households, cultivating lamp rush implies a shift in labour in terms of time, space and degree: from the labour-intensive rice farming peak seasons to a more balanced need for labour throughout the year for lamp rush cultivation; from outdoor rice farming, to indoor lamp rush processing; and from heavy labour needed for rice to light labour for lamp rush. Hence, the potential of senior female family members' labour can be fully tapped in lamp rush cultivation and processing.

Here, technological choices in the context of migration clearly take old women's manual skills into consideration. Lamp rush cultivation seems to match the ideal gendered division of labour of male/heavy/outside and female/manual/inside tasks. This may also be one reason why the crop is generally accepted among the old villagers. Thus, the lamp rush example clearly demonstrates that skill is an important factor in agricultural decision making, and that a focus on skill provides valuable insights into farmers' decision-making strategies.

While the move from rice to cash crops may appear at first sight to be a post-reform period phenomenon, Francesca Bray states that farmers were already abandoning paddy fields in favour of cash crops in China as early as the seventeenth century (Bray 2013, 80, 82). Around that same time, Jiangxi immigrants led a flourishing cash crop trade with new food produce such as sweet potatoes, tobacco and sorghum in Hunan (Perdue 1987, 97). Therefore, even though the particular cash crops may have changed, switching from rice to cash crops is another example that contradicts the narrative of technological development. Hence, with regard to a repertoire of farmers' knowledge about different ways to manage paddy fields, it is evident that this switch is, in fact, one proven option available to farmers that has regained its appeal in the current context of rural emigration and overall rural policy.

Moreover, since the Chinese grain market is less liberal than that of other crops, the decision to change to cash crops is often viewed in the framework of market liberalisation. Scholars perceive it as a rational move by farmers to gain more income. Due to the increased tax revenues it offers, this may even enjoy the support of local governments (Tilt 2008, 197). However, my findings show that, while profit is certainly a concern for farmers, it is not the only consideration. They also make decisions based on the social organisation of farming and the related knowledge and skills in a migration context.

Conclusion: More than technical

These three examples of technical and technological choices taken by women left behind in the countryside suggest that they contribute significantly to finding and implementing practical solutions to the basic predicament of contemporary rural Chinese rice farming households – having to migrate on the one hand, and to preserve home resources (paddy fields) through constant cultivation on the other. In taking these decisions, it has become clear that technological choices are, in fact, much more than mere technical decisions. Rather, they involve a multitude of factors, as the women pursue various short and long-term personal and family endeavours.

With regard to the topic of gynocentric technologies, the three examples presented in this paper question assumptions about what constitute the typical technologies used by, and made for, women in China and beyond. In China, agricultural work and related technologies have long been considered the archetypical male realm, while rural women have been assigned to the inside sphere of weaving, despite their continuous engagement in farming (Bray 1997; Bossen 2002). In the interrelation with migration, my examples display interesting dynamics with regard to the gendered spheres of these technologies. Moreover, the technologies employed by women in Green Water dissolve the gendered binary of technologies used for productive and reproductive labour, the latter commonly being ascribed to women. By staying behind and carrying out technological choices in practice, left-behind women operate on many different levels. Green Water women have not only successfully reproduced by having had children. They also contribute substantially to the continuity of the family and the family's resources: they are productive in agriculture by working in the fields, protecting this crucial resource and safety net that guarantees the economic basis for the family's continued reproduction. While taking care of the farm, women like Mrs Luo or Granny Li are also caring for their grandchildren. Therefore, they enable the migration of others through their staying, also allowing their offspring to be productive and reproductive. In sum, through the help of particular techniques and technologies (farm implements, seeding techniques, crops), left-behind women not only successfully uphold the whole productive and reproductive system at home. Through staying they support the outmigration of other household members to cities – emblems of modernity that are literally constructed by migrant workers. In doing so, these staying women also contribute considerably, although rather invisibly, to building up an (imagined) modern and urbanised Chinese state.

The three examples clearly deconstruct the narrative of almost-linear progress and social and technological development that pervades not only the agricultural sections of the county gazetteers on which I have drawn, but also much of our common-sense

understanding of technology and modernity more generally.[25] In this regard, it is fruitful to look at peasant women's strategies of technology adoption by approaching technology beyond iPhones and combine harvesters as 'ways of *making* and *doing*' (see Bray 2017, 97; original italics). Such a perspective shows that Chinese farmers are neither 'backward' (*luohou* 落后), as they are commonly portrayed in public discourse. In this discourse, '[k]nowledge and technology were (and remain) understood to be by definition the antithesis of the traditional and the peasant' (Schmalzer 2016, 108). Nor are they simply passive adopters of new technologies, blindly reproducing the state narrative of technological innovations and progress. Instead, they strategically draw on a whole repertoire of solutions to deal with their households' paddy field predicament.

These findings resonate with David Edgerton's (2007) 'history of technology-in-use', i.e. a history of technology that focuses on actual practices rather than mere inventions. This challenges our perceptions of technological time as being innovation-based, of the importance of certain technologies, and ultimately also of modernity (Edgerton 2007, xi). Applying a perspective of skilful *making* and *doing* makes it possible to grasp the particular, often tacit, agency of rural Chinese women who actually choose and use these technologies. It enables us to grasp and describe a Chinese modernity that is grounded in practices of 'non-synchronicities', where stone mills, oxen-pulled ploughs, combine harvesters and hybrid rice coexist. This modernity is clearly distinct from a notion of modernity as mere technological advancement. Looking at the (gendered) materialities of translocal households therefore provides crucial insights into the transformation that is currently occurring in and beyond the Chinese countryside.

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Acknowledgements: An earlier version of this article was presented in the workshop 'Reproductive Labour and Gynocentric Technologies in East Asia, 1800s-2000s', Northhampton 2018, organised by Jacob Eyferth, Suzanne Z. Gottschang, and Gonçalo D. Santos. I am grateful to the workshop organisers and participants for their valuable comments. I am indebted to my colleagues Rehema Bavuma, Francesca Rickli and Maria-Theres Schuler for their insightful suggestions on the first draft. Moreover, I am grateful to Mareile Flitsch and Annuska Derks, who supervised the dissertation on which this article draws. I would like to thank the people of Green Water Village who hosted and shared their lives with me. Thanks also to Helen Rana and Jennifer Bartmess for copy editing and to the anonymous reviewers for their helpful remarks.

[25] For valuable critiques of this common-sense notion, see Pfaffenberger (1992) and Edgerton (2007) in general, as well as Bray (1994) and Sigaut (1994) on farming technology in particular.

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