

Farm Intensification and Milk Market Expansion in Meru, Tanzania

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Abstract: In Meru, Tanzania, technological and institutional change has turned milk into one of the most reliable and important sources of income for smallholder households. Decades of increased population density have caused land scarcity, leading smallholders to intensify their farming methods and land use, including introducing stall-fed exotic breeds of dairy cows. Meanwhile, a growing urban and rural demand has resulted in a significant market expansion for milk and increasing cash incomes for smallholders. Both farm intensification and market expansion are bottom-up processes of change driven primarily by smallholders. These factors make the livestock sector in Meru an interesting example of broad-based agricultural development.

Résumé: Dans la région du Meru, en Tanzanie, les changements technologiques et institutionnels ont transformé le lait en l'une des sources les plus fiables de subsistance pour les foyers des petits exploitants. L'accroissement de la population depuis des décennies a causé une pénurie de terres, obligeant les fermiers à intensifier leurs cultures et leur utilisation de la terre, introduisant des races de vaches laitières exotiques nourries en boxes. Entre-temps, l'accroissement de la demande urbaine et rurale a contribué à une expansion significative du marché du lait et à un revenu grandissant pour les petits exploitants. L'intensification des cultures et l'expansion du marché sont des transformations vers le haut générées principalement par les petits exploitants. Ceci fait que la gestion du cheptel dans la région du Meru est un bon exemple de développement agricole à grande échelle.

In this article I analyze a case of farm intensification and market expansion among the Meru in northeastern Tanzania. Focus is on changes in animal husbandry during the last half century and smallholders' increasing reliance on incomes from the sale of milk since the 1980s. My first aim is to

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demonstrate how farm intensification in local systems of production has fundamentally been driven by changes in relative price between local factor endowments as population increase has led to land scarcity. The change in land–labor relations has induced a change in the animal husbandry system from one characterized by low labor intensity and low land productivity based on free-grazing Zebu cattle to one with high labor intensity and high land productivity with stall-fed exotic breeds of dairy cattle. My second aim is to map how an exogenous rising urban demand for dairy products has created new market opportunities and provided incentives for smallholders to further increase their milk production. As a result, milk incomes have become imperative for a large number of smallholder households. I also make the claim that farm intensification, including both technological and institutional change, as well as the development of well-functioning informal markets, has been driven primarily by endogenous processes and initiatives from local smallholders.

Smallholders in Agricultural Development

Research on African agricultural development from a long-term perspective can be classified, in the broadest terms, as being guided by either institutional analysis or factor endowment analysis. The point of departure for the factor endowment school is that sub-Saharan Africa, in general, has been characterized by an abundance of land relative to labor and capital. Over time labor scarcity has been regarded as the most important constraining factor for growth of agricultural output and the key explanation for persistence of prevailing agricultural methods. Until today, agricultural intensification has been the dominant means of feeding a growing population, and intensification has usually been limited in time and space to what Widgren and Sutton (2004) call “islands of intensification.” Yet the situation might be about to change, since the claim has been made that in most countries, the land frontier has been reached or is about to be reached (see Djurfeldt et al. 2005). Therefore, in a critical revision of the factor endowment perspective, Austin (2008) and others now argue that Africa increasingly is moving toward intensive agriculture due to shifts in factor ratios—that land is becoming increasingly scarce and thereby valuable in comparison to labor.

These developments imply that Africa currently is in the middle of a major transition phase whereby the inner logic of a land-abundant and labor-scarce rural economy is slowly eroding. Following the factor endowment logic, we could speculate that the alterations of the factor ratios will lead to local institutional and technological change. Recent literature suggests that to learn more about the driving forces in these processes of long-term change and the interaction among changes in factor endowments, institutions, and technology, there is need for more in-depth region-specific studies of local systems of production. The overriding goal is to capture

more precisely the mechanisms driving processes of agricultural development (see Nunn 2009; Schirmer et al. 2010). This article is a contribution to the writing of what Hopkins calls the “new economic history of Africa” (2009:155).

Although factor endowment analyses for explaining agricultural development have recently become popular, they do not constitute a new school of thought. In 1965 Ester Boserup presented her thesis on population increase as the exogenous force causing changes in farming systems and agricultural growth. Through the study of stages within an evolutionary scheme, she demonstrated how increasing land scarcity causes changes in fallow systems and how intensification is associated with an increased frequency of cropping. The increased land productivity is accompanied by decreasing labor productivity. Because intensification of farming systems requires added labor, smallholders will avoid intensification until an increasing need for food makes it necessary. The general hypothesis—that population increase and consequent land scarcity induce technological change that is labor intensive—is highly relevant for the present study.

Building on Boserup’s assumptions, Hayami and Ruttan (1971, 1984) introduced their model of “induced innovation.” They hypothesized that changes in factor endowments, particularly the relative price of land and/or labor, cause farmers to participate in processes of technological and institutional change. These processes of farm intensification are defined as endogenous rather than exogenous to the economic system, and they are typically the result of long-term incremental change rather than of radical shifts. Further, according to this model, markets are the necessary intermediates between demand and agricultural production, and if they are well functioning they can provide the incentives for productivity increase and technological change. One of the most important processes of change on the road to agricultural development is the reform of existing markets and the expansion of new markets. Just as in the case of farm intensification, market expansion can be successful as an endogenous, bottom-up process (also see, e.g., Barrett 2008). I consider the induced innovation model to be of great relevance for the present study.

The economy in Meru is agriculture-based, meaning that agriculture is the major contributor to growth. Further, the agricultural sector in Meru is completely dominated by smallholders, and therefore any agricultural transformation in the area has to be broad based—that is, inclusive and based on smallholders’ productivity increase—in order to be successful. As demonstrated by previous research, African smallholders are not just passive participants in the transformation process. On the contrary, they have the potential of being dynamic actors in processes of change, contributing to successful agricultural growth through technological change and market expansion (see, e.g., Haggblade & Hazell 2010; Hazell 2005), which include a shift from extensive grazing to intensive livestock keeping with stall-fed cows (see World Bank 2007). Throughout this article I will dem-

onstrate how dynamic processes of change have been driven primarily by smallholders with a limited involvement by the state or NGOs. This study will emphasize the significant of bottom-up processes and the potential role of smallholders in agricultural development in local systems of production.

Most African smallholders today pair subsistence farming with the production and marketing of a small surplus. If these smallholders are to improve their incomes, they need opportunities to increase market-oriented surplus production for domestic, national, and international markets (see Barrett 2008; World Bank 2007). However, in most developing countries, including Africa, market systems are technologically and institutionally underdeveloped. This poor state of markets hinders an accurate reflection of both the relative price between factor endowments (i.e., the relative value of factors of production) and the production relationship between supply and demand. One of the most important processes of change on the road to agricultural development, therefore, is the reform of existing markets and the expansion of new markets. Such a reform would also cohere with the arguments of the induced innovation model.

A mere increase in existing agricultural production is one way of enhancing smallholders' market integration, but it is not enough. Increased incomes derived from agricultural development will be substantial only if smallholders also make the transition from growing low-value staple crops to producing high-value agricultural products such as dairy products. Mixed farming systems combining crop farming and cattle raising, however, show great variation in the ways in which they have responded to new market conditions. The great variety in extensive and intensive traditional dairy systems, for example, has been mapped by Ndambi et al. (2008) in the context of Uganda. Despite discrepancies among the various local systems of production, what they have in common is that they interact with the market in some form. A changeover in production could be a way of tapping into an increasing urban demand stemming from the growth in urban population and wealth on the continent. If markets are well functioning, then urbanization can be a positive force. In particular, mixed farming has a lot to gain, since the demand for meat and dairy products is the greatest in the urban areas where general income levels are the highest (see, e.g., Jayne et al. 2006; Tiffen 2006). I argue that the expansion of the milk market in Meru is driven primarily by urban demand from Arusha and thereby is an example of such positive rural–urban exchange.

Unfortunately, market integration and expansion seem to have encountered a number of difficulties and hindrances in sub-Saharan Africa, and it is often argued that market failure is cementing low productivity in the agricultural sector (see, e.g., Shiferaw et al. 2008.) The concern is an old one, and the call for market reform has been heard before. Market liberalization and reform were central to the Structural Adjustment Programs in the 1980s–'90s, and pathways and outcomes have since been varying. For example, Owango et al. (1998) demonstrated that milk market liberaliza-

tion policies in Kenya had unintended outcomes as it resulted in an expansion of the unregulated raw milk market and boosted the milk cooperatives as competitors to private actors. Some politicians and academics claim that reforms have contributed to the present agricultural crisis and urge the state to resume activities directing farm inputs and commodities. Others claim that market reform has fundamentally been beneficial for smallholders and that present market failure can be explained by poor market institutions and insufficient infrastructure, and even by insufficient liberalization.¹

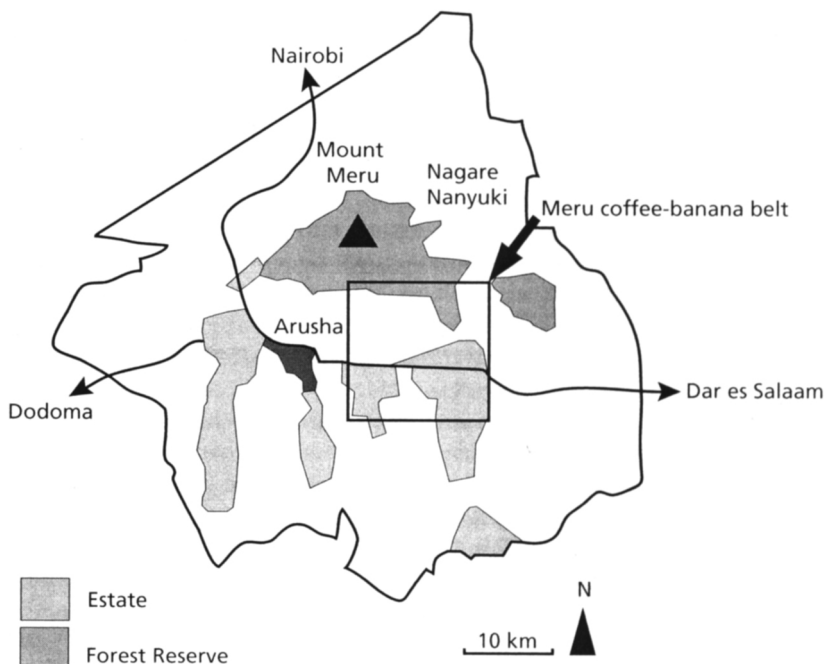
Whatever the causes, agricultural marketing systems in sub-Saharan Africa in general suffer from a number of problems such as imperfect information, contract enforcement problems, high risks, and poor finance institutions, which in turn result in high marketing and transaction costs.² With studies in Ethiopia, Halloway et al. (2000) demonstrated that cooperatives could stimulate market entry by acting as a bridge between smallholders and markets, thereby reducing transaction costs for producers. There is a pressing need for good market institutions that reduce transaction costs to enable smallholders to participate in the market. Such institutions can be created and developed from above via government policies.³ However, we cannot rely on the state only to “liberate the market” and create “good institutions.” Successful institution-building should also be a process started from below by the producers and consumers themselves. The development of the milk market in Meru exemplifies such a bottom-up process.

Area Background and Empirical Data

The Meru area is located 5 kilometers east of Arusha town in northeastern Tanzania. It covers roughly 50 square kilometers on the southeastern slopes of Mount Meru, an extinct volcano rising 4,565 meters above sea level. The soils are of volcanic origin and soil fertility is considered to be medium to high. It has a tropical climate moderated by altitude and a bimodal rainfall pattern with an average precipitation of more than 1,200 mm per annum. Climatic conditions paired with technical advances such as gravity irrigation guarantee a fair access to water for agricultural purposes. Due to coffee–banana intercropping, the heartland is termed the “coffee–banana belt,” but several other crops such as fodder grass, maize, beans, and a great variety of vegetables are also grown. The favorable agricultural conditions have been a precondition for the development of intensive farming methods.

This is an area with high population density. While the national average in Tanzania is forty-six persons per square kilometer, the density in the coffee–banana belt is on average above one thousand persons per square kilometer. The area was never included in the villagization program in the 1970s, mainly because of the dense population and the presence of coffee, which is a perennial crop. Consequently, there is no concentrated village settlement in the coffee–banana belt. The villages function as administra-

Figure 1. The Arumeru District with Meru Coffee–Banana Belt



Source: Modified from Larsson (2001:29).

tive divisions and the dwellings are spread out, with each household cultivating primarily the plots surrounding the homestead.

The heavily trafficked Dar es Salaam–Nairobi road cuts through the coffee–banana belt and from there dirt roads venture up the mountain slopes and to the plains in the south. The relatively well-functioning transport infrastructure facilitates farmers' access to markets, both in Meru itself and in Arusha town. Arusha has a population of more than 270,000 (National Bureau of Statistics Tanzania 2005), and its economy is centered on tourism, mining, and a large service sector. Size and economic dynamics make it one of the biggest and most important towns in Tanzania.

My first investigation into the sale of milk in Meru took place in January to March 1996. With the purpose of collecting general information on contemporary dairy farming and in order to map a historical background, I conducted interviews with key informants in government administration and in NGOs at the district level, as well as with individuals involved in different capacities in the production and marketing of milk. I also conducted in-depth household-level interviews in the subvillage of Nkoambiaa, located in the coffee–banana belt. Fifteen households were chosen for the

study, representing a mix of gender, marital status, age, wealth, and cattle ownership. This first study focused mainly on population growth and consequent farm intensification strategies. Interviews were semi-structured and included questions on acquisition of exotic breeds, costs for veterinary services and supplementary food, incomes from milk, access to milk markets, and so on.

In November 2007 I conducted a follow-up study during which I revisited the households and repeated the original interview procedures. The purpose of the follow-up study was to determine if incentives and strategies of dairy farmers had changed in any way. As all households except for one (whose members had moved from Meru) were the same in the first and the second round, there have been ample opportunities to make comparisons between the two studies. I also undertook a new set of interviews with actors involved in the milk market. In the second study the focus changed from inquiring into the milk production as part of farmers' new livelihood strategies to investigating the mechanisms driving the milk market expansion.

In 2008 I started a new project dealing with income strategies for smallholders in six villages in Meru. As milk continues to be an important source of income for many, information about the role of milk incomes, among other incomes in the households, was gathered through questionnaires in 2008–2010. This is an ongoing project, and at the moment 240 smallholders have been interviewed, representing villages with variations in climate, population density, agricultural production, and distance to the main road and markets. I consider this more quantitative study to be a good complement to the semistructured interviews done with a smaller sample in 1996 and 2007. In 2009 I also investigated the general market expansion in the area in a qualitative study. The study included a variety of agricultural products and sales, and the processing of milk was mapped using in-depth interviews with traders and dairymen and women.

Farm Intensification

Population Increase and Land Scarcity

Following their arrival at Mount Meru some three hundred years ago, the Meru started to establish permanent settlements surrounded by fields for bananas, maize, beans, and millet. Farther away from the homesteads they also cleared land for grazing cattle and small livestock. At the time of the initial arrival of Europeans, an extensive mixed farming system had been established, and as population increased new land was cleared. In the late nineteenth and early twentieth centuries the German colonial administration granted primary agricultural land in Meru to German and Boer estates, while the reigning Meru chief also sold off land to European settlers. Simultaneously, the colonial administration established a forest reserve above 1,600 meters on Mount Meru. The First World War and the introduction of

British rule brought only a modest expansion up the mountain slopes (see Spear 1996:16; Larsson 2001:31–32) Since the early colonial-era opportunities for territorial expansion for smallholders were therefore limited, land scarcity became a major concern from the 1930s onward, for the native authorities and the colonial administration alike. Grazing areas in the coffee–banana belt were increasingly converted to crop farming, and Meru started grazing their animals on the plains to the east and south. This forced them to herd their animals across the settler estates, which caused conflicts between Meru and the settlers. Tension over the livestock escalated, and it became increasingly clear to the colonial administration that the land issue had to be solved

A one-man inquiry was established to consider the land matter, and in 1947 the Wilson Report was released. The report suggested that the Meru were to be granted both cash compensation and more land and in return they would surrender land in Ngare Nanyuki (see figure 1). The colonial intention was to establish modern dairy farms in Ngare Nanyuki, but the plan met with fierce resistance from the Meru as the area represented valuable grazing range, something that was becoming increasingly scarce. Although the Meru contested the reallocation of land all the way to the United Nations, they lost what has become known as the Meru Land Case. The period of European dairy farming in Meru turned out to be brief. In little over a decade most Europeans had left Ngare Nanyuki as they could not generate sufficient profit. Meru smallholders again took over the land, and in the early 1960s they reestablished their farms. What nobody knew at the time of the Meru Land Case was that the short period of European dairy farming would later play an important role for the introduction of exotic breeds in Meru.

Meanwhile, population increase on the mountain was radical in the decades that followed land alienation. Between 1928 and 1948 the population increased from approximately twelve thousand to nineteen thousand and during the next two decades almost doubled again. The average population density on the mountain grew from thirty-seven individuals per square kilometer in the 1930s to 114 in the 1960s. Eventually, social tensions caused by land shortage drove many to abandon the coffee–banana belt in the 1950s and to migrate to the northern highlands and the lowland to the east and south. Outmigration has continued to be a strategy for dealing with high population density and the imbalance in supply and demand for land. Currently there is both seasonal and permanent migration, within and outside the district, rural to rural as well as rural to urban. When it comes to permanent migration, outmigration exceeds immigration, but it is still small in view of the acute shortage of land in some localities.⁴

Consequently, population density in the coffee–banana belt has remained extremely high. Villages experience a population density of one thousand persons per square kilometer on average, while those located along the Dar es Salaam–Nairobi road can reach two thousand persons per

Table 1: Percentage of Smallholders in Meru Producing Various Agricultural Crops, 2008–2010

Crops	Percentage of smallholders
Maize	92
Beans	65
Bananas	82
Vegetables	55
Rice	8
Coffee	42

Source: Questionnaire 2008–2010

square kilometer. In these villages farming is no longer an option for many people as the plots of land that they control are often small. There are no official estimates at the regional, district, or village levels regarding the exact average size of the plots. However, academic studies show that the average size of a land holding can be as low as 0.3 hectares per household in some villages close to the Arusha–Nairobi road and that a large and increasing section of villagers are landless (see, e.g., Larsson 2001:35,39). In my own questionnaire sample (2008–2010), households on average had access to 1 hectare, including land that was rented on the less populated outskirts of the Meru area.

Still, the questionnaire sample indicated that the main economic activity for the population in the Meru coffee–banana belt is agriculture, although off-farm incomes are becoming increasingly common and important to household economies. Most of the land is under smallholder cultivation where the overriding strategy is risk spreading through diversification within farming activities as well as within the household, rather than specialization. Table 1 summarizes the extent to which the most common crops are being cultivated by Meru smallholders. For nearly 80 years coffee–banana cultivation was the most important farming system and coffee has been farmers' primary cash-earning source, but for the last decade or so other crops such as maize, beans, vegetables, and rice have become increasingly important. Growing land scarcity has promoted the development of complex cultivation systems and intercropping is now commonplace.

Generally, intensification processes in mixed farming systems result in greater interaction between crop farming and livestock rearing. The advantages of integration become increasingly evident as it leads to increased production in both systems. Animals provide manure and draft power for crop farming, while crop residues offer feed (see McIntire et al. 1992). Such increased interaction has also been an important trend in Meru. According to the questionnaire responses, 87 percent of households have access to livestock and 8 percent substitute livestock for smallstock such as goats and sheep. Only 5 percent of households own neither livestock nor smallstock.

Introduction of Exotic Breeds

Keeping livestock is not a new phenomenon; it has been an essential aspect of Meru farming for centuries. Cows of the Zebu breed originating in South Asia provided milk and meat for household consumption and soil fertility was regenerated with the use of manure. The potential milk production of the Zebu cows, however, was modest in comparison to that of the present exotic breeds. The first cattle of exotic breeds to arrive in the Meru area were brought by white settlers to estate farms in the lowlands in the first half of the twentieth century. Later, in the early 1950s, the settler dairy farmers in Ngare Nanyuk imported exotic breeds from Europe and North America, and from their farms knowledge about the advantages of the cows of exotic breeds spread via the Meru employed on these estates. The Meru learned how to care for the improved cows, which were more sensitive to disease than the Zebus, and sometimes workers could buy exotic breeds themselves.

The first exotic breeds appeared in the coffee–banana belt in the mid-1950s, the result of both individual initiatives and changes in government policy. In the late colonial era, the administrations in sub-Saharan Africa generally were concerned with the need to improve agricultural productivity and to conserve natural resources. This perceived need to develop and promote new farming methods can be traced back to the first decades of the twentieth century. African farming was deemed unable to provide enough food for the growing population, destructive to the environment, and noncompatible with economic and social development. The preferred colonial solution to the African problem of low agricultural productivity was to advocate for mixed farming systems, and Tanganyika (present-day Tanzania, excluding Zanzibar) was one of the colonies where mixed farming was promoted at an early stage. It was argued that the main advantage to mixing livestock keeping and crop farming was the use of manure as fertilizers. There was also an understanding that stall-fed cattle would be given better nourishment through cut-and-carry feeding than was the case with grazing animals (see Sumberg 1998). For the first half of the twentieth century the Meru area had been improving productivity mainly through the construction and use of irrigation furrows, intercropping, and the introduction of more labor-intensive farming methods. While the coffee–banana belt was not considered to have low productivity, land scarcity motivated the colonial administration to support further intensification strategies.

The colonial administration considered the existing African animal husbandry effort with herded Zebu cattle to be underutilizing the food value of livestock. Keeping large numbers of animals under poor conditions was seen as a serious waste. Instead, the desirable goal was increased productivity within the livestock sector through technical improvements as well as market expansion. The colonial administration had a general interest in modernizing the livestock sector and replacing the traditional

Zebu cattle with exotic breeds, and there was also a decades-long ongoing colonial interest in promoting the privatization of communally held grazing range (Sumberg 1998:296). In the 1950s the two trends in colonial development policy interacted with the factors of increasing land scarcity and changes in the relative prices between factor endowments in Meru. While the administration was interested in providing exotic breeds to be kept as domesticated animals on the farms and dividing up the commons, the Meru were already losing their old grazing range and had to improve land and labor productivity due to decreasing access to natural resources. While mixed farming in itself was nothing new to Meru, the introduction of new breeds of stall-fed cattle and new land-tenure regimes signified, respectively, technological and institutional change in farming methods.

To further promote the introduction of exotic breeds among the Meru smallholders, various projects to spread the Holstein and Friesian breeds, first involving local extension officers and later involving NGOs, were initiated by the government. Certain branches within the powerful coffee cooperatives in Meru also decided to focus on dairy farming, and they bought, or were given, dairy cattle by the government, which they later distributed among the farmers. Instead of charging money, both cooperatives and NGOs invented a "pass-on-the-gift" system, whereby female calves had to be given back to the project as payment and would later be distributed to other farmers.

The gradual introduction of improved dairy cows continued for more than a decade from the mid-1960s. At that time the new postindependence government had also recognized the increasing problem with land availability in the coffee–banana belt and had developed an interest in promoting and improving the mixed farming systems. Today government officials and researchers, just like the colonial administrators before them, are promoting mixed farming in a search for increased productivity and particularly sustainable farming methods (see, e.g., Ngambeki et al. 1992; Smith et al. 1997).

Starting in the 1950s the Zebus were gradually moved to the lowlands, which allowed for the grazing land to be used for cultivation instead. Progressively the newly introduced exotic breeds took over the role of providing milk for domestic consumption in the coffee–banana belt. The change meant that farmers only needed to keep a single cow to meet domestic needs and these new cows were all stall-fed zero-grazers. Today there are basically no Zebu cattle to be found in the Meru coffee–banana belt, only exotic breeds of dairy cattle and a small number of cross-breeds. The whole livestock sector has moved from an extensive to an intensive rearing system.

Similar projects for improving milk production by introducing Holstein and Friesian varieties in both medium- to large-scale dairy farms and in smallholder mixed farming have taken place in other areas in East Africa (see, e.g., Menjo et al. 2009). Generally, the efforts to improve the African stock using semen from North America, Europe, and Israel and creating an

exchange within East Africa have been successful, but they are not without concerns. Studies show that these breeds adapt to tropical and subtropical environments, but productivity is lower compared to productivity in their original environments. The main explanations for lower productivity in developing countries are low quality and quantity of feed, heat stress, exposure to diseases and parasites, poor breeding, and generally inadequate husbandry.⁵ Due to local climate conditions, Meru has been spared some of these problems. The area is not plagued with the tsetse fly, and higher up on the mountain slopes heat stress is of minor concern. Still, animals need to be treated against ticks and generally low income levels hinder farmers from using veterinary services or acquiring the supplementary food that would optimize animal husbandry and dairy production. The experience from Meru therefore supports the conclusions from other studies, although the challenges to exotic breeds have limited milk production rather than hindering it.

Although great economic benefits have resulted from the introduction of the exotic breeds and milk production has soared, there is room for further production improvements in the livestock sector. Farmers experience a lowering of milk production during the dry season, as few can afford to buy the extra fodder needed. Also, during the rest of the year many testify that if they could afford to give their cows extra fodder together with the regular banana leaves and stems, their cows would give more milk. Veterinary fees are expensive, and farmers to a large extent continue to rely on NGOs to help them with breeding. Poverty clearly sets limits to investments that could improve milk production and augment milk incomes. The highest costs are associated with keeping the heifers until they calf and start producing milk for the first time. According to studies carried out in environmental conditions similar to those of Meru, it can take up to four years before the animals calve for the first time.

According to the responses to the 2008–10 questionnaire, 85 percent of the households in the coffee–banana belt today have milking cows of exotic breeds. Those households that do not own cows generally claim that they are too poor to acquire any. Very few households decide against having cows on grounds other than lack of economic resources. It should be pointed out that actual ownership of animals is sometimes unclear. While most farmers are the owners of the livestock that they care for, it is also the case that on occasion wealthier relatives will lend out cows to the less fortunate. This strategy allows for the owner to spread the risks while the relatives are given an opportunity to produce milk as well as offspring without needing to lay out the initial costs. In the study, however, no distinction has been made between owning and borrowing a cow.

The average number of cows kept by the farmers in the coffee–banana belt is one to two (see table 2). Calculating the average number of liters produced per day per cow is difficult, and no reliable statistics are available. The production depends mostly on the quality of fodder, the breed-

Table 2: Number of Cows of Exotic Breeds Owned by Meru Smallholders

Number of cows	Percentage of smallholders
0	15
1	32
2	33
3	8
4	3
5	2
6	1
7	1
8	2
9	1
10	2

Source: Questionnaire 2008–2010

ing regime, and calving cycles. Due to land shortage, many cattle holders do not have sufficient land to grow enough fodder grass, mill products, and banana stems for their animals, and they need to supplement their supply by buying fodder from others. Collecting food for the cows and feeding them is one of the most time-consuming tasks of the smallholders. Land shortage together with constraints on time, labor, and financial assets put a limit to how many improved dairy cows a farmers can keep.

The Milk Market

Expansion of the Milk Market

In the 1960s, when the exotic breeds were introduced in the coffee–banana belt on a larger scale, the market for selling milk was negligible. Until then only a small surplus production of milk from the Zebu cattle had been marketed on an irregular basis. Farmers who produced a surplus sold milk to neighbors in the village, or even gave it away to prevent it from going to waste. For the first two decades after the introduction of the exotic breeds, the greatest benefit for the smallholders was the securing of home consumption needs in spite of land scarcity and a shrinking number of cows. Milk was, and still is, an important source of nourishment for all members of the household, but especially for children. Only the very poorest households do not consume milk at all, and for households that do not own a milking cow, buying milk is a substantial expense. It was in the mid-1980s that a market for milk started to grow, with demand coming primarily from Arusha town. Over the last two to three decades the attitude toward dairy cows and milk production has changed, such that the emphasis now is not just on home consumption but also on dairy as an important and dependable source of income. In the questionnaire sample, 65 percent of small-

holders keeping dairy cows get an income from the sale of milk, and of those selling milk, 42 percent state that milk is the primary income earner for the household.

Meru is located in Arumeru District, which surrounds Arusha town, and the economic success and continuous expansion of Arusha in particular has meant a growing number of consumers in general and of consumers with improved levels of income specifically. Arusha is a town of great national importance in Tanzania. With its proximity to Serengeti National Park and Mount Kilimanjaro, it is a center for a booming tourist industry. To the south there are tanzanite mines unique to the country, and the trading in gemstones is another important economic activity. Due to its relatively cool and pleasant climate, it is also a favored site for NGOs, government employees, and international organizations attempting to flee the humidity of Dar es Salaam. The urbanization process does not entail the growth of Arusha town alone, but has also brought about an increase in population numbers in the urban and semi-urban settlements in Meru itself, such as Tengeru, Usa River, and Magia Chai.

The case study shows that urban demand influences rural production and that rural–urban exchange is dynamic and positive for smallholders. This conclusion fits well with other studies. Cour (2001) argues that for safety reasons, subsistence farmers generally aim at producing 20 percent above what is required for their own immediate needs. The surplus production is primarily a safety buffer. However, smallholders are simultaneously interested in selling their excess production in order to meet income needs that cannot be met by subsistence agriculture. An increasing urban demand would therefore give farmers further incentives to alter their farming methods to increase production and productivity. According to Cour, a critical point is reached when urban dwellers make up 30 percent of the area's population; in other words, this is the point at which urban demand becomes significant enough to function as an incentive for subsistence farmers in the surrounding rural areas to move away from subsistence farming and produce specifically for the market. If the population of Arumeru District and Arusha town are considered together, the area's urban dwellers make up roughly 35 percent of the total population, and there are also growing semi-urban settlements in Meru. These figures together with Cour's assumptions support the conclusion that there should be a sufficient urban demand for increased market-oriented agricultural production in Meru.

An increasing demand for agricultural products does not come only from the urban areas, however. In the coffee–banana belt more smallholders are left with less land and plots become too small to feed the household and provide an income. Farmers have to turn to off-farm incomes and they become permanent net buyers of agricultural products as they try simultaneously to profit from the rural and the urban, alternating between occupations. In the questionnaire sample, 33 percent of smallholders claim to be net buyers of agricultural products.

Actors on the Market

Some smallholders still sell their milk within the village, either to neighbors or to the village shops, which are numerous. Twenty percent of dairy farmers in the questionnaire sample adhered to one of these strategies. Those who sell to shops may have a contract according to which they are expected to deliver a certain amount of milk every morning and they are paid weekly or monthly. They may also run a credit in the shop for the purchase of animal feed and other necessities, which is later deducted from the value of the milk. In 2009 farmers received US \$0.25 per liter of milk, with the shops adding 10–15 percent as their profit margin. There are plenty of smallholders interested in selling, and they deliver milk directly to the shops. There is no shortage of local customers, as there are many households without cows or with insufficient milk production for their home needs. There is no significant differential in the price between villages. Although this is puzzling, I have not been able to find a convincing explanation for this.

One alternative to selling within the village is to sell milk in one of the semi-urban or urban areas nearby, either in the small town of Tengeru in Meru or in Arusha. Despite the fact that many people in Arusha town and the smaller urban settlements keep their own dairy cows, interviews indicate that there are plenty of opportunities for the Meru smallholders to off-load their product. Milk is sold fresh in the marketplace, to hotels and restaurants, or to dairies. Nevertheless, few farmers actually market their own milk themselves. Only 4 percent of those in the questionnaire sample used this strategy. The opportunity costs for smallholders to invest labor and financial resources in transporting their own milk to town are too high, especially for small-scale producers. Some producers who have dairy cows as their main source of income may choose, however, to combine the sale of their own milk with collecting additional milk from their neighbors.

Instead, the main trading is conducted by a group of so-called milkboys and milkgirls, who have specialized in the milk market. One hundred percent of smallholders who responded to the questionnaire had at one time or another sold milk to milkboys/girls. As smallholders have multiple strategies when trading, they may very well be selling to more than one trader at the same time. These boys and girls, or men and women, usually work independently, although there are also a few who are employed by others. The milkboys/girls generally secure agreements of delivery with a number of producers in the villages to protect the rights to buy their milk, transport it to town, and then sell it. They contact the producers by asking around in the villages. If a milkboy turns out to be reliable he may collect from the same smallholder for years. Agreements between producers and traders are in the form of social contracts. Payments to producers are made monthly, and if there is a breach of contract from one of the parties there are alternative partners to be found. Agreements are not legally binding and not enforced by a judicial authority, but with the exception of

occasional accusations of late payment, they appear to be functioning well. When milkboys/girls find it hard to secure enough milk directly from producers, they buy milk from the village shop and take it to town. When selling in Arusha the profit margin of one liter of milk can be up to 60 percent. The amount of milk handled by each milkboy/girl varies, but to be able to make a reasonable profit they need to move at least twenty liters per day, which translates to a daily income of US\$3.00. Some may transport up to 100 liters, although that is most unusual. The main concern for these milk traders is not the profit margin, but consistency in delivery. The general explanation for the success of these market institutions is probably to be found in the fact that exchange continues over the long term, so incentives are in place for the nurturing of relationships between trading partners.

The milkboys/girls use bicycles or wheelbarrows, or they carry the milk on their heads along the dirt roads leading up the mountain slopes and down to the plain. Once they reach the main Dar es Salaam–Nairobi road that cuts through the coffee–banana belt, they continue on their bikes or take a bus to Arusha. Transport costs for one individual with a twenty-liter container is roughly US\$0.50. Government investments in infrastructure have not been directed toward the expansion of the milk market, but producers, traders, and consumers have all benefited from existing infrastructure. The fact that fresh milk, like many other high value agricultural products, spoils quickly means that it requires rapid delivery to customers. Despite the fragility of the product, no producer or trader in either sample stated market access as a concern and existing infrastructure appears to be sufficient to meet present demand for transportation.

The price paid to households by milkboys/girls in the villages is fairly constant, with differences at the most of 20 percent. There does not appear to be a connection between the differences in price and the distance between the village and the market in Arusha. This would mean that those milkboys/girls who come from villages higher up on the mountain slopes have to put in more time and labor in bringing the milk to town than those who come from villages close by the main road, without making a higher profit. Again, the negligible impact that distance has on price is at this stage unexplainable.

In town, traders have two basic options. Many have contracts to deliver a certain amount of milk to the same sorts of buyers who sometimes deal with dairy farmers directly: shops, restaurants, and hotels. Milk that is not contracted is sold on street corners to regular or short-term private customers. The going milk price for customers in Arusha is roughly US \$0.40 per liter depending on negotiations and contracts.

It is surprising that in spite of a growing market for milk in Arusha in recent decades, there have been few functioning dairies in town. In the 1980–1990s there were attempts from cooperatives and other parastatal organizations to run dairies, but they failed due to corruption and inefficiency. Since then there have been a number of more or less successful

private initiatives on the part of both small-scale entrepreneurs from Arusha and large-scale international companies from the East African region. In general, the Arusha dairies have had little impact on milk production in Meru as few smallholders sell to them. One exception is a dairy cooperative in the coffee–banana belt where milk is collected and transported in larger quantities to a dairy in town. Mostly, however, the dairies situated in town collect milk from farmers within or just outside Arusha.

Private and cooperative initiatives to start up processing plants in Meru itself appear to be more successful. Producers bring small quantities each day to these local dairies and they are paid per week or per month. The contracts set up between producers and processors resemble those that are found between producers and village shops or milkboys/girls. They are social and not judicial contracts and are part of an already functional social structure. The dairies' main constraint is lack of capital for necessary investments in machinery, cool rooms, and so on. Without the right equipment they are not able to produce or store long-lasting products such as yogurt, butter, and cheese. This, in turn, makes them unable to counter seasonal supply and demand.

Although most fresh milk is sold directly to institutional consumers in Arusha and to individuals on the street, the dairies sell to supermarkets, which are well established there. Indeed, urban supermarkets for high-value agricultural products for domestic consumption are the fastest-growing purveyors of agricultural products in most developing countries today (Delgado et al. 1999; World Bank 2007:12), and Arusha is no exception. It is a dynamic town with a growing economy and increasing levels of income, and supermarkets are well established there. Supermarkets in general are most interested in an upper-income customer base and in processed milk products such as cheese from the dairies (World Bank 2007:126). Therefore, with the small local Meru dairies as middlemen, milk from smallholders does make its way to the supermarkets in Arusha town. The customers are mostly businessmen within the tourist industry, foreigners who work temporarily in Arusha, and tourists. Because the dairies and supermarkets lack extensive storage capacity, the tourist seasons dictate the activities of the processing plants. Clearly, a better functioning processing industry would improve the opportunities for meeting urban demand while also stimulating increased rural production.

Concluding Remarks

In this article I have demonstrated how the process of farm intensification in Meru has been initiated and driven primarily by changes in factor endowments. Population increase combined with geographic limitations have led to a more efficient use of a scarce and valuable resource (land) through a more intense use of an abundant and cheap resource (labor). A mediator in this process has been technological change. With the introduction

and spread of exotic breeds of dairy cattle and the shift to a system of zero grazing, smallholders began to invest more labor as a substitution for land. Changes in factor endowments also set in motion processes of institutional change, such as the division of the commons. Farm intensification has been primarily an endogenous process with smallholders in local systems of production as the primary actors.

Further, I have mapped the origin of the present milk market and shown how it is interlinked with the technological and institutional change taking place in the farm intensification process. Without the introduction of stall-fed exotic breeds, Meru smallholders would not have been able to increase milk production. Meanwhile, an expanding market has conveyed increasing urban demand of dairy products to agricultural producers and has thereby had a significant impact on further efficient use of production resources. Market institutions have developed without the involvement of the state, and thus represent a case of a successful bottom-up process. All in all, the processes of intensification in husbandry systems in Meru fit well with Hyami and Ruttan's model (1971, 1984) of induced innovation, while milk market expansion resonates with their expectations of markets as intermediates between demand and agricultural production.

Looking ahead, the study indicates that the full potential of milk production and sales has not yet been reached in Meru. The dairy processing industry in the area is still at an early stage, and smallholders claim that if they could afford proper inputs they could increase their production. I claim that one reason that the development up until now has been successful is that it is based on endogenous processes of change in local systems of production instead of being a top-down government project. Still, there is room for the government to play an important role in the future in regard to offering agricultural extension and veterinary services, subsidizing inputs, developing infrastructure for transport and communication, and investing in dairies. With a combination of private and state initiatives, the livestock sector could play a significant role in future agricultural development in Meru.

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Notes

1. See, e.g., Barrett (2008); Jayne and Jones (1997); Jayne et al. (2002); Poulton et al. (1998); Poulton et al. (2006).
2. See Barrett (2008); Jayne et al. (2002:1968); Shiferaw et al. (2008:26).
3. On the role of smallholders, see Kherralah (2000); Kydd and Dorward (2001). On the role of government policies, see, e.g., Barrett (2008); North (1987); Poulton et al. (2006).
4. For demographic data see Kivelia (1995); Larsson (2001); Spear (1997).
5. See Bondoc et al. (1989); Ansell (1985); Ghaffar et al. (2007).