JAPAN–ETHIOPIA COOPERATION ON RURAL ROAD PROJECT: UNDERSTANDING ROAD USAGE, ROAD DISASTERS, AND LOCAL RESPONSES

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Introduction

This paper is based on a study conducted in Baytsimal and Kaysa Kebeles (local administrative units) of Baka Dawla Woreda (District), South Omo Zone, Southern Nations, Nationalities and People's Region (SNNPR), Ethiopia. The study was carried out in the context of the SATREPS-MNGD project, which was undertaken by four Japanese universities (Kyoto University, University of Miyazaki, Nagoya Institute of Technology, and Ehime University) in collaboration with three partners in Ethiopia (Addis Ababa Science and Technology University—AASTU, Jinka University—JKU, and the Ethiopian Roads Authority—ERA).(1)

The Science and Technology Research Partnership for Sustainable Development (SATREPS) is the Japanese government's program for international joint research on global issues by researchers in Japan and developing countries. The title of the SATREPS project in Ethiopia is "Project for Development and Operation Model of Plant-Derived Soil Additives for Road Disaster Reduction on Problematic Soil." Because this title is so long, the name "Making Network for Global Development" (MNGD) was adopted and it is pronounced "Menged," which means "road" in Amharic, the Ethiopian lingua franca.

The SATREPS-MNGD project in Ethiopia focuses on addressing technical constraints of road infrastructure, especially the difficulties of rural road construction and maintenance on expansive soil. Depending on moisture content, expansive soil changes its volume: it swells when it absorbs water during the rainy season and shrinks when it loses moisture during the dry season. While the swelling pressure causes roads to heave, lift, and/or become muddy, the shrinkage pressure causes cracks and subsidence on the roads. Therefore, it is apparent

that expansive soil can cause severe and regular road disasters and makes road construction and maintenance rather difficult. These circumstances constrain the mobility of people, economic activities, and service provisions.

The conventional solution to mitigate the conditions that cause road disasters is mixing cement with the expansive soil or replacing the soil with other weightier soils. However, this approach requires the allocation of significant budget funds, which is not suitable and realistic for developing countries like Ethiopia. Therefore, the SATREPS-MNGD project aims at developing mechanisms that will improve the stability of unpaved roads by applying soil additives from local plants. In other words, the goal of the project is to find simple and convenient methods to construct and maintain roads without relying on expensive machinery or materials, and to develop an operational model through collaboration between researchers from Japan and Ethiopia. Thus, the overall aim of the SATREPS-MNGD project is to contribute to the mission of the Universal Rural Road Access Program (URRAP), which connects all *kebeles* by all-weather roads, thereby providing people with year-round access to markets and services.

The research has two components: (1) a laboratory analysis of the capacity of different plant additives to stabilize the expansive soil and (2) a social science study, which is the focus of the present exercise, to generate local knowledge about road construction and maintenance, road disasters, the purpose of road use, and the involvement of community as well as government actors in road construction and maintenance. While the laboratory-based investigations are conducted in Japan and at Addis Ababa Science and Technology University, the fieldwork for the social science research is undertaken near Jinka Town at two sites (Baytsimal and Kaysa) in collaboration with researchers from JKU. Professor Gebre Yntiso Deko, a senior academic in Ethiopia who has decades of experience conducting research in South Omo Zone and beyond, and who recently served as president of JKU, coordinated and supervised the fieldwork.

The study explored the history and current state of road construction, disasters, and maintenance; the history, frequency, and purpose of road use; and knowledge about and interest of local people in the SATREPS-MNGD project. After identifying the research assistant and researchers from JKU, an intensive training was given for the researchers focusing on the objectives of the study and the research design (including the data collection and analysis methods).

The present study has not been completed without any challenges. First, the JKU researchers operated under an extremely busy schedule of teaching, preparation of exams, and correction of exam papers during the summer

vacation. Second, the funding for this research (a generous donation[2] from The Growth Partners, Co. Ltd., a company based in Tokyo, Japan), which was transferred to JKU in May 2020, was not readily available for disbursement to the researchers because the Ministry of Finance of Ethiopia reportedly blocked it, as a routine practice, at the end of the fiscal year. Third, the JKU researchers felt uncomfortable by the reference made to them by JKU as data collectors rather than researchers. Finally, although the JKU researchers are highly motivated recent graduates, most of them lacked adequate experience in research and report writing.

The study investigated the experiences and knowledge of informants about road construction, usage, disasters, and maintenance in Baytsimal and Kaysa Kebeles of Baka Dawla Woreda. The nature of the research required an examination of people's lived experiences, knowledge, and perspectives about roads in their respective communities. Hence, a qualitative research approach was employed to allow for the active participation of informants and cross-examination of facts during the fieldwork. The study employed two data collection methods: interviews and observation. In addition, the maps of the Baytsimal and Kaysa area were drawn, GPS information (latitude, longitude, and altitude) of the research sites was collected, and attempts were made to review relevant documents on road infrastructure in Ethiopia, including the project area.

During the inception of the project two years ago, the researchers from Japan, in collaboration with government authorities, selected Baytsimal as a study site. With support from the SATREPS-MNGD project and the community's labor contribution, a 150-m road from Boyka (village center) to Baytsimal Primary School was repaired. Hence, the study in this village was a continuation of the same project. Kaysa was selected as the second research site in consultation with Baka Dawla Woreda officials.

Data were collected from a total of 20 purposely selected households (10 households from each research site). The criteria used for the selection of households include: use of roads by family members; depth of knowledge about road construction, disasters, and maintenance; involvement in road construction/maintenance; and willingness to cooperate with the researchers. Data were gathered through in-depth interviews with different family members who use roads for different purposes: traveling to the farm, forest, school, marketplace, place of worship, and so forth. Data obtained through the interviews and observation, and information gathered through other means were systematically organized to ensure thematic and contextual analysis.

The ethics of social science research were strictly followed. Research participants were informed about the precise purpose of the study and were asked if they agreed to take part in the study. In this paper, everything possible was done to respect the rights and dignity of all participants and refrain from disclosing confidential information obtained from them.

The Contexts of Road Infrastructure in Ethiopia

1. Perspectives on the link between roads and development

The scholarly perspective on the relationship between rural road infrastructure and rural development seems to have changed. In the 1970s, some studies revealed that rural road investments had a limited impact on the lives of rural residents because the major part of rural travel and transport is bound up in domestic tasks such as water and firewood collection, which generally involve walking on off-road paths (Fernando & Porter, 2002). More recent studies, however, have pointed out that the causes of poverty, isolation, powerlessness, vulnerability, unemployment, and income inequality are related to inadequate and unequal access to roads and other public infrastructures (Escobal, 2001; Wondemu & Weiss, 2012). In other words, lack of adequate road infrastructure coupled with other impediments hamper socioeconomic development in rural areas.

According to Fan & Rao (2003), public spending on rural infrastructure such as the road sector is one of the most powerful instruments that governments can use to promote economic growth. Some of the specific benefits of rural road construction and maintenance include reduction of the physical costs of access to resources and markets (Arethun & Bhatta, 2012; Terefe, 2012); expansion of agricultural production (Tegebu & Seid, 2016); improvements in the provision of social services (Norman, 2013); reduction of poverty (Shiferaw et al., 2015); and general enhancement of socioeconomic development (Bogale, 2016).

Studies in Ethiopia have established the link between road networks, on the one hand, and economic development in general and impact on rural residents in particular, on the other hand. After the completion of the Road Sector Development Program, the ERA investigated the existence of a well-established link between the country's development plan and the road sector policy (ERA, 2008; Worku, 2010). Arethun & Bhatta (2012), who studied the contribution of rural roads in northern Ethiopia, have argued that roads increase job opportunities, open up new sources of revenue, and lead to a more diversified income structure.

Terefe's (2012) economic analysis in rural Ethiopia also showed a strong association between road infrastructure and rural well-being.

2. Road development program in Ethiopia

Since 1997, the Ethiopian government has been engaged in massive road construction through a program known as the RSDP.[3] This ten-year program (1997–2007) was conducted to address the limited road coverage and low standards by increasing the quality and quantity of road network (Emmenegger, 2012; ERA, 2011; 2012). The country hoped that the development of an effective road network would be instrumental in terms of fighting poverty and improving access to basic services and markets.

The government later, after 2010, launched a subprogram called URRAP to address road accessibility and connectivity in rural areas (ERA, 2012). There were four phases of RSDP and URRAP is part of RSDP IV. It emphasized the construction of low-volume roads with a major investment in *woreda* and *kebele* access roads. The main objective of URRAP was to connect all *kebeles*, thereby improving rural livelihoods through upgrading rural people's access to market and social services. URRAP is an ambitious program that targets the construction of 71,523 km of gravel roads with a low-cost mechanism by using local materials and labor force—the least expensive and most abundant resources (Demeke & Gebissa, 2016). Many of these low-budget and low-quality URRAP roads are reportedly susceptible to disasters and little is known about the frequent causes of and the strategies to address these problems.

The road network increased from 6,400 km in 1951 to 19,017 km in 1991, and from to 46,812 km in 2009 (Worku, 2010: 107) to more than 144,000 km in 2020.[4] However, the increase in road density clearly has been concentrated in Addis Ababa (the capital), the Tigray Region in the north, and in central parts of the Oromia Region (Kanth & Geiger, 2017). The lack of uniformity in infrastructure development across regions means that road connectivity in some regions such as the SNNPR has been poor. This has hindered agricultural productivity, the transportation of goods and services, and labor mobility in these regions, especially in remote locations such as South Omo Zone in the SNNPR. Despite considerable effort to expand the road infrastructure in the country, rural road accessibility remains low. In areas where road infrastructure has expanded, little is known about the sociocultural implications of roads. This warrants the need to undertake social sciences research on the impact of rural road development on culture as well as social relations and interactions.

3. Road development in the SNNPR

In addition to the community-based road construction/maintenance systems, there exist three entities responsible for the development of road infrastructure in the SNNPR. These include URRAP (managed by South Omo Zone), the Road Authority of SNNPR (RA-SNNPR), and the ERA. As stated earlier, the URRAP subprogram was launched to connect rural *kebeles*. The RA-SNNPR constructs and maintains roads that link *kebeles* and *woredas*, different *woredas*, and *woredas* and zones. The ERA is mandated to construct/maintain road networks that connect regions as well as regions and zones. The ERA also constructs roads that link *kebeles*, *kebeles*, and *woredas*, and different *woredas*. For instance, the ERA recently announced a bid for construction of the Shishir–Wobamer road that connects many *kebeles* in South Ari and Woba Ari Woreda.(5)

URRAP was meant to serve two purposes: connecting remote rural *kebeles* by access roads and creating jobs for university graduates(6) and other job seekers. In 2017, the SNNPR was reported to have created 600,000 permanent and temporary jobs through URRAP, which by then linked 746 *kebeles* out of the total 3,724 *kebeles* in the region (Walta Information Centre, 2017). The region further noted that 254 local construction enterprises and 106 consultants were involved in the construction of 6,520 km of road in the region. In South Omo Zone, according to an informant, two local enterprises called Hamar Nasa and Siket participated in URRAP, while other enterprises such as Tsinat, Arsonia, Soliana, and Subgrade also came from other places and benefited from URRAP. The report of the SNNPR also revealed that the implementation of URRAP faced such challenges as limited execution capacity of the contractors, financial shortages, and difficult mountainous terrain that required heavy machinery.

The other characteristic feature of URRAP is the community participation requirement that amounts to 50% of the work. During the earthwork of road construction, community members are expected to participate in land clearing and management of run-off water. Indeed, people often volunteer to provide labor contribution as the roads are meant to bring greater benefits to people. However, the community involvement in road construction rarely reached 50% because the earthwork often required machinery, which was provided by the *woredas*. The span and quality of roads constructed through URRAP are less than those constructed by the RA-SNNPR and the ERA.

The RA-SNNPR is mandated to construct and maintain gravel roads (not asphalt) through its district offices located throughout the region. The current SNNPR has eight district offices, and one of them (the Jinka District Office)

is located in Jinka Town, and covers South Omo Zone and the neighboring Basketo Special Woreda. The RA-SNNPR, which receives funds from the federal government, has two budget lines: Projects (for new and ongoing construction of roads) and Road Fund (for the maintenance of old and new roads). The ERA constructs both gravel and asphalt roads, focusing mainly on those that are costly due to their length or other factors such as difficult terrain, number and size of bridges, and so on. As indicated in the Table 1 below, in South Omo Zone, there exist 59 roads with a total length of 1,867.45 km that have been and that are being constructed by URRAP, RA-SNNPR and ERA.

4. The South Omo Zone contexts

South Omo is one of the zones in the SNNPR created by the Ethiopian People's Revolutionary Democratic Front following its victory against the military regime known as the Derg in 1991. Over the years, the number of zones in the region has increased based on local requests for autonomous administration. The region has also witnessed in recent years multiple demands for self-governance as regions. This led to the separation of Sidama Zone to form an autonomous region, which was followed by another separation of five zones and one special woreda to form

Table 1. Road Networks in the South Omo Zone by Constructing Agents and Woredas[(i)]

	Woreda	URRAP[(ii)]		RA-SNNPR		ERA[(iii)]		Total	
		Number	KM	Number	KM	Number	KM	Number	KM
1	Semen Ari	3	27.64	3	52.8			6	80.44
2	Woba Ari	1	18.84	1	19			2	37.84
3	Debub Ari	4	45.48	5	107			9	152.48
4	Baka Dawla	4	41.24	2	47			6	88.24
5	Maale	5	66.75	2	56			7	122.75
6	Bena-Tsemay	5	78.27	0	0			5	78.27
7	Hamar	4	57.41	1	17			5	74.41
8	Dassanech	0	0	2	44.9			2	44.9
9	Nyangatom	0	0	1	15.6			1	15.6
10	Sala Mago	2	22.52	0	0			2	22.52
	Sub Total	28	358.15	17	359.3	14	1150	45	717.45
	Grand Total (URRAP + RE-SNNPR + ERA)							59	1,867.45

(i) Roads that have been completed and those that are still under construction.
(ii) The construction of 17 roads with a total length of 232.8 km has been completed, while 11 roads (121.35 km) are still under construction.
(iii) As they connect woredas, only the total values of the ERA roads are indicated.

the Southwest Ethiopia Region.(7) In mid-2022, further division of the SNNPR is expected to lead to the formation of at least two more new regions.

South Omo Zone is situated in the southwestern corner of Ethiopia, bordered on the south by Kenya, on the southwest by South Sudan, on the west by West Omo Zone, on the northwest by Keffa Zone, on the north by Konta Special Woreda, Gofa Zone and Basketo Special Woreda, on the northeast by Ale Woreda and Konso Zone, and on the east by Oromia region. South Omo Zone got its name from the Omo River that runs through the zone to Lake Turkana (see Figure 1). South Omo Zone has 16 indigenous ethnic groups: Ari, Bacha, Banna, Brayle, Bodi, Dassanech, Dime, Erbore (Arbore), Hamar, Koegu, Maale, Murle, Mursi, Nyangatom, Tsemay, and pockets of Ethiopians from other parts of the country, living particularly in towns. The land area of the zone is 22,361 km^2.

Compared to most other zones in Ethiopia, South Omo Zone has a large area of land. The highlands are inhabited by densely populated agriculturalists, while

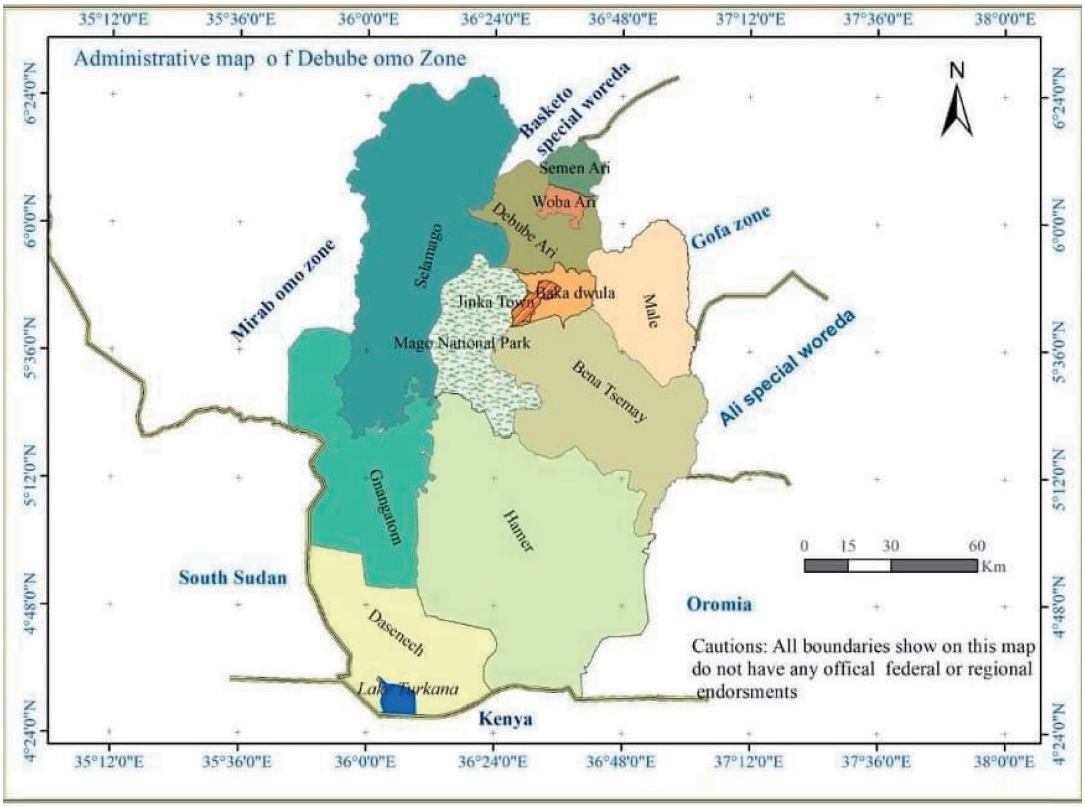

Figure 1. Map of South Omo Zone
(Source: Prosperity Party, South Omo Zone, 2020)

sparsely distributed agro-pastoral communities are located in the lowlands. The zone has 10 *woredas* and three town administrations, which are listed below (see Table 2) together with their population.

South Omo Zone is widely known as one of the least developed areas in Ethiopia as evidenced by poor economic development, limited provision of social services, low business opportunities, and poor infrastructural facilities. Despite the host of challenges, the zone failed until recently, to attract the attention of nongovernmental organizations that overcrowded major cities and accessible areas in central Ethiopia. Two decades ago, the Japanese embassy's grassroots projects in Jinka Town and South Ari Woreda represented two of the very few development interventions with foreign funds. In recent years, especially in the last two decades, however, the zone has witnessed promising development initiatives such the construction of the Arba Minch–Jinka asphalt road, the launching of the Omo-Kuraz sugar project, the construction of Jinka International Airport, the establishment of JKU, and the mushrooming of numerous private investments in the different *woredas*. The impact of these rather new developments on the lives of the people is yet to be seen.

Table 2. Population Size, Administrative Centers, and Ethnic Groups by Woreda

	Woreda	Population	Capital	Major Ethnic Groups
1	Debub Ari	238,991	Gazer	Ari
2	Semen Ari	95,840	Gelila	Ari
3	Woba Ari	74,211	Boyka	Ari
4	Baka Dawla Ari	55,211	Arksha-Kaysa	Ari
5	Hamar	79,374	Dimeka	Hamar, Erbore, and Kara
6	Benna Tsemay	102,234	Keyafer	Benna, Tsemay, and Brayle
7	Dassanech	101,961	Omorate	Dassanech
8	Maale	160,803	Lemo Gento	Maale
9	Nyangatom	33,292	Kangaten	Nyangatom, Koegu, and Murle
10	Selamago	53,889	Hana	Bodi, Dime, Mursi, and Bacha
11	Gelila Town	31,517	Gelila	Ari and migrants
12	Jinka Town	78,663	Jinka	Ari and migrants
13	Turmi Town	12,400	Turmi	Hamar and migrants
	Total	1,118,386		

(Source: Office of Prosperity Party, South Omo Zone, SNNPR, 2021)

In South Omo Zone, road transport is the only means of movement for freight and passengers. The overwhelming majority of residents rely on pack animals and on carrying loads on their own heads, shoulders, and backs to transport goods from place to place. The zone is one of the remote areas in Ethiopia with poor road infrastructure. According to the Road Transport Department of South Omo Zone, there exist 598,129 km of all-weather road, and a plan is underway to construct 1,200 km of road. A total of 40 *kebeles* have been connected and 173 *kebeles* are not connected through road networks. A number of constraints have prevented the construction and maintenance of roads in South Omo Zone, which include, according to zonal officials, lack of finance, lack of machinery, lack of experts in the field, and failure to maintain roads regularly.

Most people in South Omo Zone have low income and reside in rural areas without or with poor road access. Consequently, rural people are subjected to high cost of transportation; farmers and agro-pastoralists cannot sell their products for reasonable prices; people pay high prices for industrial products and other goods from towns; and their access to social services such as education and health is limited. Poor rural accessibility and poverty are closely associated because people cannot harness economic and social opportunities that would otherwise be within their reach. Therefore, in South Omo Zone, it is necessary to improve rural road, to pull millions of people out of poverty and ensure development.

5. The Baka Dawla Ari Woreda contexts

Baka Dawla Woreda, the research area, is one of the two structures that were recently formed after Debub Ari Woreda was split for administrative convenience into three parts: Debub Ari, Woba Ari, and Baka Dawla Ari. The total population of Baka Dawla Woreda is estimated at 50,310 and the land area is 314 km^2. The *woreda*, which has 18,642 households (14,202 male headed + 4,440 female headed), is divided into 13 *kebeles* (11 rural and two urban). Baka Dawla is bordered by South Ari Woreda to the north, by Mago National Park to the west, by Benna Tsemay Woreda to the south, and by Maale Woreda to the east.

Like most other *woredas* in the zone, Baka Dawla has poor road infrastructure. People rely on pack animals and human labor to transport agricultural products from their farms to their homes. and from their homes to marketplaces. There are three types of roads in this *woreda*: one asphalt road that crosses Jinka, a few unpaved earthen roads that link *kebeles* and *woredas*, and narrow rural paths that lead to different destinations such as villages, farms, pastures, schools, health centers, places of worship, and so forth. Different government entities are

responsible for the construction of both the asphalt roads and the unpaved earthen roads, while the local people construct the narrow paths through community labor.

The settlement pattern in Ari is largely scattered; therefore, many small roads are required to connect communities with neighboring villages, farmlands (often far from residential areas), grazing areas (often far away), schools, places of worship, and so forth. Seasonal road disasters are common in the research area. The road problems get worse during the rainy season due to soil erosion, landslide, water logging, and muddiness. Road disasters have an impact on all three types of roads listed above.

Hence, road maintenance is of paramount importance in order for communities to function. The community-constructed paths are maintained whenever the need arises. However, according to informants, roads constructed by community labor using hand tools reportedly lack the structural strength to bear erosion, landslides, and water logging. The maintenance of government-constructed earthen roads requires machinery, selected materials, and fuel, among other expenses. In most cases, the relevant government agencies lack the financial resources to maintain such roads. An official of Baka Dawla Woreda said the following about road maintenance challenges:

> "The road from Kaysa to Ally must have been maintained last year. It will not be maintained even in this budget year … Now, you cannot drive to Ally. The poor people travel on foot and the rich take motorbikes … The woreda does not have (a) budget for road maintenance. We have asked the Zone for help. They said that they did not allocate (a) budget to maintain the Kaysa–Ally … We do not know what to do."

6. Community-level contexts

Baytsimal and Kaysa, which are located close to Jinka Town, are two of the 13 *kebeles* of Baka Dawala Woreda considered for the present study. Despite their proximity to Jinka, the capital of South Omo Zone, these two farm communities have limited road access for vehicles. Therefore, the residents heavily rely on human labor and donkeys to transport agricultural harvests and other goods to different locations such as home and market. Informants reported they have been waiting for the government to construct roads. However, it is unlikely that road networks will connect most *kebeles* in the near future.

The news about the SATREPS-MNGD project in the study area, therefore,

created intense excitement. The residents of Baytsimal are not only familiar with the project but also hold positive views that the SATREPS-MNGD project may address the road problems facing communities today. Knowledge about the project has been enhanced by the involvement of the Japanese partners in the building of 150 m of road to Baytsimal Primary School using earth-bag construction, or the technique called *do-nou* technology.[8] The Baystsimal residents are asking for more such interventions, while the Kaysa people are demanding attention to their road problems.

Informants in Baytsimal and Kaysa Kebeles expressed interest in the SATREPS-MNGD project and offered to participate through contributing labor apparently for the following reasons. First, people have long realized the limitations of the government as far as investing in road infrastructure (the construction of new roads or maintenance of the old). Second, because the existing community-built dirt roads, which are vulnerable to seasonal erosion and water logging, are not meant for motor vehicles and carts, transporting harvests from farms to home remains a critical challenge. Third, given the growing demand for maize in Jinka market, it is widely believed that improvement in road access will contribute to increased family income. Fourth, the absence of roads or the occurrence of road disasters forces people to travel long distances and pay an exorbitant amount of money for risky motorbike rides on rough and rugged roads. As these two *kebeles* have certain peculiar features that differentiate them, the next two sections (one for each) are devoted to discussing the research findings.

The Road Situation in Baytsimal Kebele

1. Background information

Baytsimal Kebele is situated between latitude and longitude values of 5°44′43″N to 36°34′47″E with an elevation of 647 m above sea level (Figure 2). The population of the *kebele* is estimated at 3,845 (4,190 males and 2,405 females). It is bordered by Alga and Jinka Town in the west and north, Goldya Kebele in the south, Kaysa Kebele in the southeast, and Sanmamer Kebele in the east.

1–1. Details about informants

Ten households participated in the study, and different family members were interviewed. The majority of the households are male headed, and the youngest

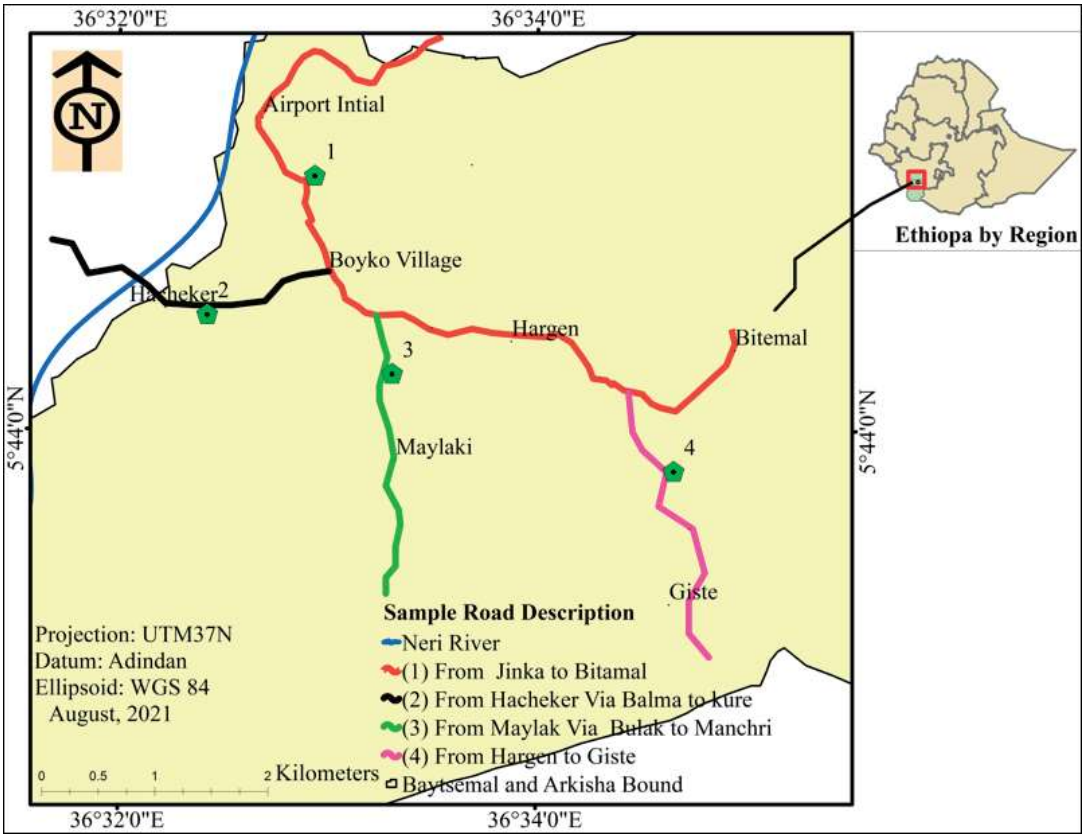

Figure 2. Map of Baytsimal

and oldest household heads are reported to be 35 and 42 years old respectively. Although most households seem to have a large family size, there exist significant variations: the largest family has 12 members and the smallest has three members. The overwhelming majority of the informants are followers of various denominations of Protestant Christianity: Kale Hiwot, Mulu Wongel, and Mekane Eyesus. A few followers of the Orthodox Christian Church also reside in Baytsimal Kebele. With the exception of one household (headed by a man from the Maale ethnic group), all others belong to the Aari ethnic group. Based on the above variables, it can be argued that the Baytsimal community is almost homogeneous.

The educational background of the households reveals that women (especially the wives) have little or no formal education compared to the male members (especially the husbands). An informant explained the poor educational attainment of women in terms of household chores that prevented them from enrolling in school or regularly attending classes. Although the adult (especially the elderly)

members of households have low educational attainment, many households have many students at different grade levels. From this it is apparent that future households will have more educated members.

1–2. Economic activities

In Baytsimal, the main source of income for all informants is crop production, which is supplemented by other activities such as animal husbandry and apiculture. While maize is used both for subsistence and cash income, coffee is grown primarily as a cash crop, which is sold to retailers and wholesalers in Jinka Town. The other cereals grown in Baytsimal include teff and sorghum. The common root crops are potato, sweet potato, yam, and taro. The major fruit trees are banana, mango, and avocado. The green leaves of *aleko* or *qalingi* (a tree believed to have medicinal value) are used as vegetables, and different types of beans are grown and consumed to provide protein supplement.

While root crops, vegetables, and fruit trees are planted around homesteads, cereals are grown alongside the Neri River and in remote locations called Manchri to the south and Balma to the west. Depending on the types of crops, farmers use both organic and chemical fertilizers to grow crops and help them become productive. Chemical fertilizers are often used for maize. In the various production activities, all able-bodied and adult household members often participate, with men playing the dominant role in the production of cereals, fruits, and vegetables. During agricultural production season, neighbors help each other through the traditional labor organization called an *aldi*.

The residents of Baytsimal raise cattle, goats, sheep, donkeys, and chickens. Except for the cattle that are raised in the bush close to the farmlands, all other animals are kept in and around homes. Some oxen are raised for plowing and others are fattened for sale. Goats and sheep are raised for domestic use as well as marketing. Donkeys are kept as pack animals for transporting harvests from the farm to home, and from home to the marketplace. Generally, animals are considered vital household insurance against bad times or unexpected disasters (harvest failure, sickness, etc.). It is often men who look after the animals, although women and children generally participate in animal husbandry. Apiculture (honey production) is also part of the economic activities that focus on cash generation. Most heads of households have several beehives in the forest.

Although Baytsimal residents are known for producing maize in large quantity and a significant portion of their harvests are meant for selling, they lack road infrastructure to transport their products from the farm to home and then to the marketplace.

Besides crop production and livestock production, some farmers in Baytsimal engage in off-farm activities such as trading. For example, a few farmers have minishops by the roadside and some farmers provide motorbikes and donkey carts for rent. There are also households that cater food and drink in the *kebele*.

1–3. Social organizations

There exist different community-based organizations (CBOs) in Baytsimal Kebele. These include the traditional work party called *aldi* or *haila*, women's and men's cells, and a faith-based reconciliation committee called a *galta*. *Aldi* and *haila* refer to labor organized when a farmer or a household needs the collective efforts of different individuals during the farming season. In other words, people work in each other's fields in rotation following an invitation from a household seeking the support of neighbors. This is because certain agricultural activities such as clearing, weeding, and harvesting cannot be done by family members alone.

As part of the government direction for the mobilization of local people for different purposes (e.g., sharing or communicating information, holding meetings, etc.), both men and women are organized into cells, and the cells are divided into small teams of six individuals (called the 1 to 5 team). The cells engage in community work such as school maintenance and road construction and maintenance. The cells also act as consumer cooperatives responsible for acquiring and distributing sugar, edible oil, and wheat flour to its members.

The church-based reconciliation committee, consisting of church leaders, senior members, and elders, is responsible for addressing conflicts or grievances within the community. The church reconciliation committee is responsible for collecting different information from the disputants or conflicting parties and help them reach consensus and a binding agreement. The church is responsible for forming the committee from among its members, and this is particularly the case for Protestant members. The Orthodox Church also has religious-based organizations called *mahber* and *senbete*, which are organized primarily for religious functions. However, members of these organizations have the opportunity to create bonds or establish strong friendships as they meet regularly on certain holidays.

The *idir* is another traditional or local type of social organization formed by both adult men and women to support each other in times of grief associated with the loss of a loved one. Besides organizing funerals, *idir* members comfort the grieving through visiting their home and providing other forms of support. The *equb* is a local rotating savings and credit association to which members regularly

contribute a fixed amount of money, which is then awarded to the winner of a lottery draw system.

An individual can be a member of different organizations. A female informant in Hacheker village reported that she belongs to the female committee of the Kalehiwot Church, the Hacheker village *idir*, the Hacheker cell, and one of the 1 to 5 teams of the cell in the village. Different family members may belong to different local organizations.

1–4. Means of transportation frequently used by the households

Baytsimal residents use different means of transportation from their home to various destinations. For example, they travel on foot from their home to their farm and to their church. While primary school students always walk, those in secondary schools located in Jinka Town use motorbikes or reside in town. When their destination is Jinka Town or another distant location, people take motorbikes or a donkey cart. When the road is maintained, people use three-wheeled bikes called *bajaj*. Those who cannot afford any of these transportation means take a long walk to their destination. Also, when the road becomes inaccessible to all forms of transportation, people have no choice but to travel by foot. Many households use pack animals (donkeys) to transport harvests from their farm to their home and/or from their home to the marketplace.

Informants reported that the major transportation challenges for people in Baytsimal include lack of roads to the farms to convey harvests by vehicle, lack of bus or minibus transport to go to Jinka, frequent road disasters and failure to maintain the Jinka road, and high transport costs for motorbikes due to road disasters. Motorbike owners charge more than the regular rate, arguing that they bear the risks of damage and/or injury.

2. Road usage

2–1. Frequency of road use

There is one unpaved earthen road that connects Baytsimal Kebele to Jinka Town. Initially, the cost of the road construction was covered by the Ethiopian Airport Enterprise when the formerly community-built road was closed due to the construction of Jinka International Airport in 2015/16 on land that belonged to the Baytsimal people. The replacement road had to be substantially repaired using rental machinery with financial and labor contributions from the community because the quality was poor. Other roads constructed by the community connect Baytsimal with multiple destinations: villages in the *kebele* and farms. The roads

(excluding the internal roads) that are identified as critical for the community include the following (also see Figure 2):

1) from Baytsimal to Jinka Town Administration
2) from Hargen (Baytsimal) to Bitemal (Arkisha Kebele)
3) from Hacheker (Baytsimal) to Balma agricultural field, crossing the Neri River
4) from Maylak (Baytsimal) to Manchir agricultural field via the Bulak area
5) from Hargen (Baytsimal) to Gista Kebele

Note: Hargen, Hacheker, Maylack, and Bulak are villages within Baytsimal Kebele

2–2. Purpose of road usage

The unpaved earthen road from Jinka to Baytsimal is one of the most important roads used by many people on a regular basis. The residents of Baytsimal take this road to travel to Jinka Town by three-wheeled bike, motorbike, donkey cart, and/or on foot. Some people travel to Jinka to sell agricultural products and buy different things. Others have houses, relatives, family members, and businesses in Jinka Town. Secondary school students travel to Jinka to attend classes. This road branches at the Hargen area, within Baytsimal, into two roads: one heads to Bitemal toward Arkisha and Kaysa, and the other goes to Gista, farther south.

The distance between Hargen and Bitemal is estimated at 1.87 km. The narrow dirt road across a swampy terrain is accessible only during the dry season on foot, by motorbike, and by pack animals. This road is extremely important for two reasons. First, the nearest health service is located at Bitemal, and road is intended to facilitate access to health services for pregnant women, children, and others. Second, this road should significantly reduce the time and resources needed to travel to Arksha-Kaysa, the center of Baka Dawla Woreda. Unfortunately, people are forced to journey a long distance or spend more money on transportation to go to Bitemal in Arksha and Kaysa, through Jinka. The Hargen–Gista dirt road is used by people traveling to visit their relatives. Baytsimal and Gista are not yet connected by an unpaved earthen road, and the government is now expected to construct one.

The road from Hacheker to Balma, which is located on the western side of the Neri River is estimated at 3.71 km. Balma is the second important agricultural site, after Manchri. The residents of Baytsimal travel to Balma on foot, obviously to engage in agricultural activities. According to informants, farmers experience

two major challenges: lack of road access to Balma and lack of a bridge over the Neri River. While the lack of road access hinders the highly needed transportation of harvests from fields to homes, the absence of a bridge crossing poses challenges during the rainy season to the use of pack animals and human labor for transportation.

The road from Maylak via Bulak to Manchri (estimated 4.10 km) is reportedly used by most residents of Baytsimal because they have farms, livestock, and even family members staying there for weeks and months. Hence, it can be said that Manchri represents the most important agricultural area with the potential to expand even further (as can be seen from satellite images). Farmers produce beyond their subsistence needs. However, they have been experiencing tremendous challenges to transporting their surplus production to the market due to lack of road infrastructure. An informant stated, "In Manchri, we produce not only more than what we can consume but also more than we can carry home."

On the whole, the five different roads identified in Baytsimal are considered important based on different interests. Informants interested in promoting agricultural activities emphasized the Manchri and Balma roads, while those who care more about health services and access to the administrative center, felt that the Bitemal road deserves priority. The majority of people obviously want the Jinka road to stay functional year round.

2–3. Road disasters and current condition of roads

According to informants, all the roads in Baytsimal, including the one constructed by the government, have been experiencing disasters during the rainy season. The common problems that affect roads are soil erosion that creates cracks, and water lodging that makes the road muddy. The current conditions of all roads are described as poor, although some are worse than others. For example, the Baytsimal–Jinka earthen road has been repaired only partially and needs proper maintenance (see Figure 3). The roads to Manchri and Balma are in terrible condition and cannot be accessed by motor vehicles, while the Hargen–Bitemal and Hargen–Gista roads are described as inaccessible during the rainy season.

3. Knowledge about and interest in the SATREPS-MNGD project

3–1. Reflections on road maintenance by the SATREPS-MNGD project

In addition to presenting the historical background of roads in Baytsimal, the paper also discusses the results of the assessment of the knowledge and

Figure 3. Partial View of the Baytsimal-Jinka Unpaved Road

perspectives of the community about the SATREPS-MNGD project, their interest in the project, and their preferences regarding road construction and maintenance. Baytsimal has already been selected as one of the research sites by the team of the SATREPS-MNGD project. The villagers of Baytsimal witnessed and participated in the maintenance (rather, renewal) of the 150-m road to Baytsimal Elementary School. This experimental road was maintained using *do-nou* technology. What knowledge and perspectives do people possess about this road and other roads in Baytsimal?

Except for a very few, most informants reported having participated in or known about the road maintained by the SATREPS-MNGD project. Informants were asked the following questions: What do you know about the SATREPS-MNGD project undertaken with financial support from the government of Japan and in collaboration with JKU and other partners? Who are your sources of information? What did you expect when you heard about the project? The interviewees included different members of households.

It appears that the Baytsimal community acquired information from

two sources: the facilitators of the SATREPS-MNGD project and the chief administrator of Baytsimal Kebele. According to most informants, people expected that the project would solve all the road problems in their villages and that the road would be a paved asphalt road. However, later, they understood how the project works, and the experimental road maintained near the school was presented as an example. The informants further noted they had participated in road maintenance on a voluntary basis, in any case. People volunteered to take part in the project primarily because it was being done for them. Moreover, they hoped that the project would construct and/or maintain roads to solve the major problems of farmers: lack of road to transport harvests from the field to home, and from home to the marketplace.

The families of students and teachers at Baytsimal Primary School, the beneficiaries of the 150-m road, explained how important the road has become for the school community. According to most informants, today, the residents of Baytsimal greatly appreciate the Japanese team for maintaining the 150-m experimental road and strongly recommend the continuation of the SATREPS-MNGD project in the *kebele*. One informant stated, "we will be happy if all roads in and around Baytsimal can be repaired in the same way."

3–2. Interest in SATREPS-MNGD project

All informants expressed their willingness to participate in the SATREPS-MNGD project. Some informants suggested the use of machinery for some of the activities that are difficult to perform by human labor. However, they are deeply interested in the project and expressed readiness to support it by any means without expecting any reward for their labor and participation. A few individuals did not know anything about the SATREPS-MNGD project. Yet after learning the objectives of the project from the research team, they displayed a strong interest in supporting the project. An informant (a woman who learned about the project) explained the importance of maintaining problematic roads in terms addressing the challenges facing women, who are responsible for fetching water, collecting firewood, and carrying harvests on their backs. In short, interest in SATREPS-MNGD project emanates from the hope that the local road infrastructure problems might be resolved.

3–3. Road construction/maintenance preference

In addition to the five major roads, there are many other roads within Baytsimal. The five roads that link Baytsimal and other locations include (1) the Maylak–Bulak–Manchri road, (2) the Hacheker–Balma road, (3) the Hargen–

Bitemal road, (4) the Baytsimal–Gista road, and (5) the Baytsimal–Jinka road. Informants were asked their preference regarding road construction and/or maintenance in order of importance. People believe that all the roads are important for different purposes and should be repaired.

Although there is no clear consensus on the prioritization of roads in order of importance, many people believe that the Baytsimal–Jinka road should be maintained to provide transport services to sick people seeking emergency medical attention, to farmers transporting their products to marketplaces, to students attending secondary school, and to other people with different businesses in Jinka. This road is expected to be maintained by the government. The Hacheker–Balma road receives people's attention because they cannot cross the Neri River during the rainy season. In this case, the demand is for both road maintenance and building a bridge on the river.

Many people underlined the great importance of properly constructing the Hargen–Bitemal road, especially the short way that crosses through a swampy area. The significance of this road is explained in terms of accessing the Bitemal

Figure 4. Partial View of Road Cracks/Small Gully

health center and the Kaysa *woreda* center, without having to travel via Jinka, which is too far and too expensive. Finally, the Maylak–Bulak–Manchri road is important for the people of Baytsimal because they have farms, animals, and family members living in temporary camps.

The current SATREPS-MNGD project cannot be expected to maintain the Hacheker–Balma road (see Figure 4) and build a bridge on the Neri River. Due to its long distance, the Maylak–Manchri road may not be considered in this project. The government has no plan to construct the Hargen–Bitemal road. The local community could not maintain this road during the rainy season. Therefore, the SATREPS-MNGD project could apply *do-nou* technology to respond to the demands of the Baytsimal people for the Argen–Bitemal road.

The Road Situation in Kaysa Kebele

1. Background information

Kaysa is situated between latitude and longitude values of 5°44′56″N to 36°38′10″E (Figure 5). The total population of Kaysa is estimated at 7,163 (3,495 males and 3,668 females). It is bordered by Ally Kebele on the east, Chali Mountain in the southeast, Kako Kebele in the south, Goldya in the southwest, Baytsimal and Jinka in the west, Sanmamer Kebele in the north, and Senegal Kebele in the northeast. Like Baytsimal, Kaysa Kebele is predominantly agricultural and many residents engage in raising animals, trade, and so forth. The majority of residents are Ari, who are engaged in the production of maize largely for cash income, as they interact with multiple groups: highland agriculturalists, urban residents, and lowland agro-pastoralists.

1–1. Details about informants

The 10 households contacted as key informants for this phase of the socioeconomic study for the SATREPS-MNGD project were selected using purposive sampling in consultation with officials. They were chosen because all 10 households are located near and around the five major roads considered essential in Kaysa Kebele. The informants are frequent users of some of these roads. Moreover, the elders of these households have knowledge about the history of road construction and maintenance, a crucial necessity in achieving one of the objectives of the study.

The households have commonalities in terms of certain demographic

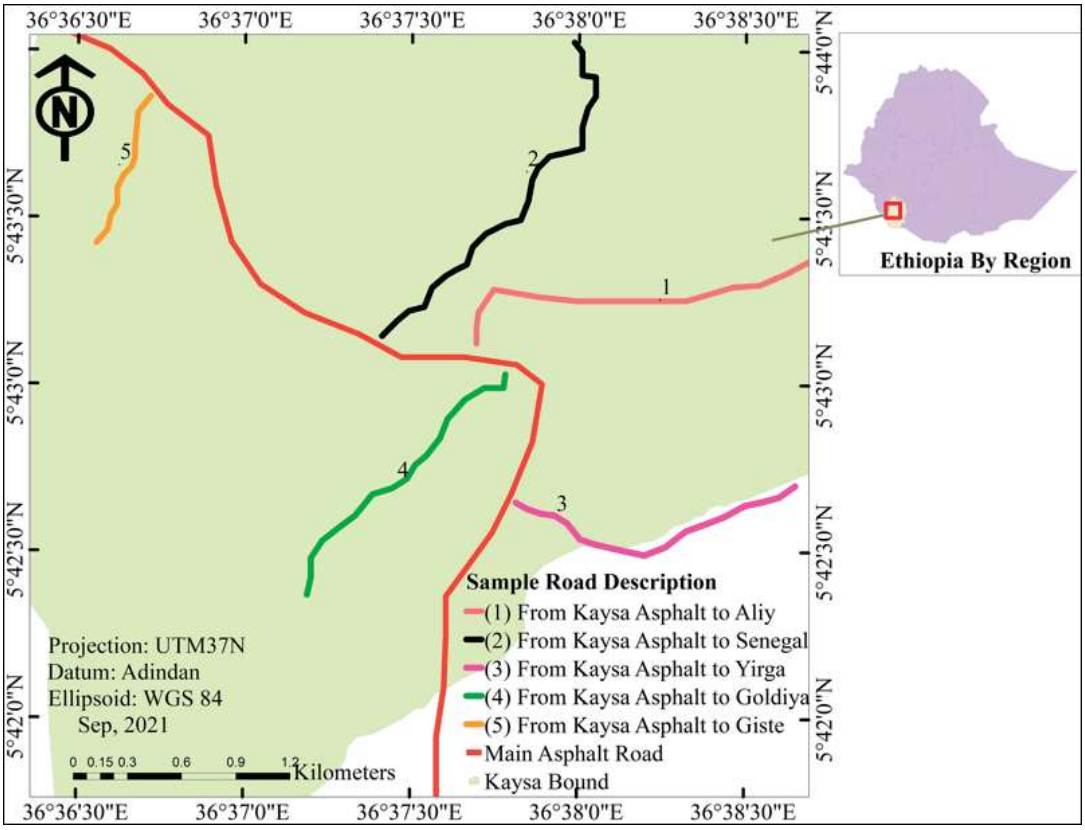

Figure 5. Map of Kaysa

characteristics: all are male headed, all are Protestant Christian, and all belong to the Aari ethnic group. Another commonality among these households is that most of them have larger family sizes with an average household size of 14 members. The largest family has 27 members and the smallest has six members. In terms of age, the oldest household head is reported to be 60 years old and the youngest household head is 39 years of age. Based on their self-reported age, the median age for the heads of the 10 households is 45.

The educational background of the households reveals that none of the household heads ever attended secondary school. The highest level of education was fifth grade and some received only two to three years of formal education. Two of the respondents do not have any formal education, while one household head had a chance to get some basic literacy and numeracy skills during the adult education campaign of the Derg regime. However, members of many households are students in different grades. For example, an informant who is head of a certain household, received only a fourth-grade education. His wife and his mother, who resides with them, had no formal education. The family has five

school-age children and the parents are determined to support their children to succeed in formal education.

1–2. Economic activities

Agriculture has remained the mainstay economy of all the households studied in Kaysa. The major cereals crops grown by almost all households include maize, sorghum, teff, and finger millet. Cereals are produced for both domestic consumption and to generate cash income. In recent decades, the production of maize has substantially increased due to the unprecedented demand at both the local and the central market. In addition to cereals, yam, taro, bananas, coffee, onions, and *aleko* are also grown on a limited scale, at a subsistence level. Some farmers with more acres of land, however, seem to be producing coffee and bananas to diversify their production and generate cash income for their families.

The households that participated in the study also raise herds of cattle, sheep, and goats. While oxen are kept as draft animals (used for plow agriculture), others are fattened for market, and still others are kept as family insurance and a status symbol. The value of cows is associated with production of milk and calves, especially the she-calves that are in high demand among the agro-pastoralist groups in South Omo Zone. Goats and sheep are raised for domestic consumption as well as marketing. However, the stock of animals owned differs from one household to another. Only a few of them have donkeys as pack animals to transport their crops from the farm to home, and from home to the market. The donkeys are also used to fetch water and firewood for the households.

In addition to their main income from crop production and animal husbandry, only one of the households supplements its income with wages earned by (1) the head of household, who works as a security guard at a local Ethio-Telecom office and (2) a son who supports himself by working as broker in different local business transactions. It is important to note that participation in off-farm activities by members of households is common in Kaysa as one can observe different economic activities: catering food and drink, running small shops, providing Bajaj bike and motorbike services, and so on.

1–3. Social organizations

The people of Kaysa are involved in different CBOs of various sizes and purposes. Almost every adult in Kaysa, with the exception of the elderly who stay at home, is a member of a cell, which is divided into many six-member teams called 1 to 5. These groups are set up by the government for administrative and community mobilization purposes. In the case of meeting community needs, the

group is also used by its members to share labor during harvest seasons and help each other out during times grief as well as share their happy times. A member of 1 to 5 may call upon his teammates to lend a hand if he is facing difficulties in managing his farm errands with just his family and is also wholeheartedly willing to extend a helping hand in their times of need.

Even though CBOs have lost significance in recent years, in the opinion of the respondents, there are still some other traditional CBOs with indigenous names and arrangements. One such traditional CBO is an *aldi*, which consists of 15–20 members and is formed for sharing labor during farming activities. The second type, which has the same structure and purpose as an *aldi* but with a higher number of members involved and that covers a relatively larger area, is called a *molaa*.

There is also another form of CBO called a *sawi*, which is the same as an *aldi* but with financial aspects in addition to the labor-sharing functions. Members of a *sawi* are required to make labor and regular financial contributions, and failure to comply with these requirements is punishable by the rules that govern the *sawi*, which also stipulate what will happen if one fails to meet this or other obligations. The financial contributions are used to create a common pool of funds to finance emergency needs, for matters like funerals and weddings, of each member of that CBO. The fund is also usually used to purchase an ox to slaughter and share the meat during holiday celebrations. These and some other characteristics of a *sawi* give it the appearance of a hybrid form of an *aldi* and an *equb*, the widely practiced traditional saving and credit association in Ethiopia.

Another social organization, but one with exclusive membership, is a farmers' union, which operates under the legal name of *gapinti*. This is a farmers' union established by the government as a social business enterprise. For the last 10 years, this organization has played a significant role in the collection and distribution of agricultural inputs and outputs as well as functioned as a retail agent for basic consumer goods (such as table sugar and edible oil) supplied by the government.

In contrast to what is happening to *aldi* and *molaa*, faith-based community organizations are gaining momentum. Pastors and fathers of churches are grouping their laity, based on their relative location, into groups of five or 10 members to study the Bible and also mobilize resources for the church and among themselves.

1–4. Means of transportation frequently used by the households

The means of transportation used by the sample households depend on multiple

factors, which include the purpose of the travel, the distance to be covered, the presence or absence of a load to move around, the availability of transport services (e.g., bus, minibus, three-wheeled bikes, and motorbikes), and the capacity to afford. In most cases, the movement of family members often takes the following form: elders travel to the farm; children go to school and sometimes to the farm; and family members travel to the church, market, or other locations as deemed necessary. Most of the time, all of them go on foot due to lack of roads and means of transportation. Taking three-wheeled bikes and motorbikes to farms and schools is either unsuitable or unaffordable.

However, the residents of Kaysa use buses, minibuses, three-wheeled vehicles, or motorbikes to travel to the nearby markets in Kako Town, to the new *woreda* administrative center at Kaysa, and to the zonal capital, Jinka. In other words, people pay fees to be transported. The transportation costs to these places are considered fair. However, The young people (riders) who provide motorbike service reportedly ask for higher payment, arguing that the bad condition of the roads damages their property and sometimes they slip on the road and sustain serious physical injuries.

2. Road usage

Maintaining and constructing a stable rural road infrastructure network by using local materials (inputs), without having to rely on expensive machinery, is critical for the economic development of developing countries because such techniques reduce the costs of rural road construction. Such roads provide safe and efficient human mobility, access to any destination (markets, educational center, asking relatives), and enhance socioeconomic development. This section of the SATREPS-MNGD project research attempts to understand from informants in Kaysa Kebele the nature of the roads, the frequency of road usage, the purpose of the use, road disasters, and the current conditions of roads. In Kaysa, the five major roads that connect the *kebele* with other areas are the following (also see Figure 5):

1) from Kaysa asphalt to Ally Kebele
2) from Kaysa asphalt to Yirga Kebele
3) from Kaysa asphalt to Goldya Kebele
4) from Kaysa asphalt Senegal Kebele
5) from Kaysa asphalt to Gista Kebele

2–1. Frequency and purpose of road use

The frequency of road usage can be measured in terms of circulation or movement of the individual household members for a specific purpose on each road network at every time of the year. According to informants, they use each road for different purposes during various times of the day, weeks of the month, and months of the year. Informants were asked to recall the frequency of trips on the major roads, for what purpose they often travel, and how many times they travel in a day, week, and month to a destination. Generally, the average number of trips per month per person is nearly 12. The data gathered on all five roads are discussed below.

The Kaysa–Ally road is the most frequently used rural road network. People from Kaysa, Ally, and other *kebeles* frequently use this road to go to the weekly Kaysa market on Tuesday. The Ally people often use this road also to travel to Jinka Town for medical attention and to buy/sell goods in the bigger Jinka market held on Tuesdays and Saturdays.(9) Many people also frequently use this road to go to the church, which is located on the road. Students from three primary schools on this road are reported to use the road five times a week. People residing close to the center of Kaysa Kebele said that they use the Kaysa–Ally road twice weekly, on average, to go shopping and for drinks.

The Kaysa–Senegal road is not used more frequently. The highlanders (Senegal) and lowlanders (Kaysa) travel on this road on market days and on social occasions such as visiting, attending funerals, and so on. The residents of Kaysa living in the hills in the direction of Senegal frequently use this road to go to the farm, town, church, health center, and school. The Senegal people take different roads to go to Jinka. However, one cannot underestimate the economic relationship between Kaysa and Senegal. The Senegal people bring to the Kaysa market peas, beans, cabbage, onions, groundnuts, animals, and animal products.

The Kaysa–Yirga road is considered busy as different people use it for different purposes. The Yirga farmers transport their agricultural products (teff, sorghum, maize, etc.) to the weekly market. Students from Kaysa frequently take this road to attend Yirga Primary School. Households with domestic animals (cattle, goats, sheep, and donkeys) walk on this road daily when they travel to and from grazing areas. Likewise, during the agricultural season, farmers go to their farms using the Kaysa–Yirga road. This is the same road that people use to travel to the church or to visit their relatives.

The Kaysa–Goldya and the Kaysa–Gista roads are also considered important in the context of crop production and livestock grazing. During the agricultural

season, the people of Kaysa regularly use both roads, although more people reportedly use the Gista. Animals are taken to grazing areas on a daily basis by these two roads. People of Kaysa and Gista often take the Kaysa–Gista road to visit friends and relatives and go to the market.

As indicated above, people use the various roads to go to different destinations: farms, marketplaces, schools, health centers, places of worship, towns, shops, grazing areas, friends' and relatives' homes, water points, and so on. Based on these purposes, it can be argued that the roads in the Kaysa area are used for undertaking economic activities, accessing social services, maintaining social interaction, fulfilling social commitments, attending religious functions, and acquiring goods and services for individuals and/or family members.

In terms of the average distance for market travel, in Aliy it is more than 12 km, which is two times that of the market distance travel in Senegal, Goldiya, and Yerga, whereas such markets are absent in Gista Kebele. Another possible reason could be differences in community engagement in commercial agriculture production. Orderly the agricultural crops produce and widely practiced in Alley, Goldiya, and Gista than in Senegal Kebele. Households that produce agricultural output mainly sell it at the market. Moreover, they travel too long a distance to find a better market center for selling or to exchange agricultural products.

2–2. Road disasters

Road disasters are common in Kaysa Kebele, and during the rainy season (June to August), multiple disasters occur on multiple roads. The major causes of road disasters are erosion, landslide, and water lodging. Based on information gathered from 10 respondents, Table 3 shows the different impacts of disaster agents on different roads. For example, erosion and landslides affect the roads to Ally and Senegal due to the mountainous nature of the terrain. In contrast, water lodging has an impact on the roads to Goldya and Gista that cross a low-lying valley which gets saturated by groundwater. The Yirga road, which passes through hills and low-lying land, is minimally affected by these three causes.

The zonal government is expected to maintain the Kaysa–Ally road (see Figure 6), and it is not clear when this will happen. It is beyond the capacity and mandate of the *kebele* and the *woreda* administration because the maintenance of such roads requires finance, machinery, and expertise. Given the economic and social importance of this specific road, as discussed earlier, the relevant government authority should address road disasters as soon as possible. The Kaysa–Senegal road has been repaired every year through community labor. However, disasters recur every summer, to the disappointment of the local people. It appears that

they need technical support in identifying new methods of erosion control and landslide prevention. Water logging that also occurs in the summer on the Gista and Goldya roads has become beyond the capacity of the local communities to manage (see Figure 7). Therefore, the SATREPS-MNGD project could help in developing surface drainage mechanisms to build roads that last in seasonally swampy areas.

Table 3. Current Status and Gradient of Each Road

	Roads	Current Condition	The Nature of Terrain
1	Kaysa to Ally	Very bad	Hill, up-and-down slope land
2	Kaysa to Yirga	Bad	Undulating hill with flat areas
3	Kaysa to Goldiya	Bad	Low-lying land, seasonally swampy
4	Kaysa to Senegal	Very bad	Steep-sloped land
5	Kaysa to Gista	Very bad	Low-lying land, seasonally swampy

Figure 6. Partial View of Kaysa–Ally Road

Figure 7. Example of Roads Vulnerable to Water Logging

2–3. Current condition of roads

The current conditions of the five roads originating from Kaysa are summarized below.

During the research period, Ally Kebele was no longer accessible by motor vehicles, and even taking motorbike rides on this badly damaged mountainous road is considered risky. However, some people still travel by motorbike out of desperation. Most of the Kaysa–Yirga narrow road is extremely damaged by erosion. However, people continue to use it. The Kaysa–Goldya and Kaysa–Gista roads are inaccessible as they are completely covered by stagnant water. The Kaysa–Senegal road was badly eroded during the last rainy season and currently is difficult for human movement.

3. Knowledge about and interest in SATREPS-MNGD project

3–1. Knowledge about SATREPS-MNGD project

Prior to the arrival of the research team, according to the informants, the Kaysa community did not have any information about the SATREPS-MNGD project

and the cooperating partners. Therefore, the researchers created awareness about the project, which is sponsored by the government of Japan and implemented in collaboration with JKU. People were informed that the project seeks to explore mechanisms to improve the stability of unpaved roads constructed on expansive soil. The team also emphasized that the project involves field studies, laboratory experiments, and, later, trial road construction.

It is hoped that people in the community do not confuse the SATREPS-MNGD project with regular road construction projects managed by contractors. The informants and *kebele* officials are expected to convey the same message to the rest of the community members. Yet, the project created excitement and hope on the part of informants, who think that the kind of trial road built by the project in Baytsimal Kebele will be replicated in Kaysa.

In Kaysa Kebele, all informants expressed interest in the SATREPS-MNGD project. The people of Kaysa have faced road construction and maintenance problems time and again for decades. The SATREPS-MNGD project is viewed as presenting an opportunity for road construction and maintenance in the area. Many informants promised to participate in the project on a voluntary basis, without payment for their labor. The Kaysa people have local organizations responsible for mobilizing community labor for road construction and maintenance, and other community works. The research participants suggested the possibility of mobilizing the community for the implementation of the SATREPS-MNGD project. It is important to underline that people communicated interest with enthusiasm in the hope that the project would eventually address the problem of road disasters.

3–2. Road construction and maintenance preferences

It is in the best interests of the community members to maintain all roads. Nevertheless, people do realize that all problems cannot be resolved at the same time. With this in mind, informants in Kaysa Kebele expressed their preferences for road maintenance in accordance with the purpose of the road, the frequency of use, and the nature of road disasters. In others words, people want the most commonly used roads and the most badly damaged roads to receive priority. Accordingly, the roads are ranked in order of importance as follows: the Kaysa–Ally, the Kaysa–Gista, the Kaysa–Senegal, the Kaysa–Goldya, and the Kaysa–Yirga.

As indicated earlier, the Kaysa–Ally unpaved earthen road requires machinery and other important inputs. Hence, the relevant government authorities should address the potential for road disasters that could affect the economic and social

well-being of the people in Kaysa and Ally Kebeles. There is no government plan to construct the Kaysa–Gista road and this has been left to the community. However, the community lacks the capacity to drain the surface water and stop the road from becoming swampy and muddy. Therefore, external support is needed. Community members have tirelessly maintained the Kaysa–Senegal road multiple times, yet disasters recur due to the geographical nature of the terrain, which is mountainous. Disasters on this road may be minimized through better erosion control methods. The Kaysa–Goldya road is similar to the Kaysa–Gista road except that more people use the latter for many more purposes. The maintenance of the Kaysa–Yirga road can be managed locally.

Conclusion

The benefits of rural roads are widely recognized and explained in terms of creating market opportunities for agricultural products; expanding social services such as for education and health; providing public and private services such as banking and insurance; and establishing linkages to other modes of transportation like railways and airways. With this in mind, the Ethiopian government has taken a policy direction aimed at achieving road networks that connect all *kebeles* in the country. Yet despite the considerable efforts to expand the road infrastructure throughout the country, rural road accessibility remains generally low, partly because the development of road infrastructure has not been uniform across regions. The poor road connectivity in some regions such as the SNNPR hinders agricultural productivity, the transportation of goods and services, and labor mobility. This problem gets even worse in the far remote locations such as Baka Dawla Woreda, South Omo Zone, and the SNNPR.

In the research area, Baytsimal and Kaysa Kebeles of Baka Dawla Woreda, most people reside in rural villages without or with poor road access. Seasonal road disasters due to soil erosion, landslides, and water logging are prevalent, especially during the rainy season. The local people are forced to accept high transportation costs, low prices for agricultural products, high prices for industrial products, and poor access to social services such as education and health. Despite the availability of natural resources and great economic potential, poverty is widespread in these rural areas with poor road accessibility. Therefore, the construction of new roads and the maintenance old ones are of paramount importance for communities to function and to pull millions of people out of

poverty.

In this regard, the implementation of the SATREPS-MNGD project would be timely and appropriate in that the project intends to develop mechanisms that would improve the stability of unpaved roads by applying soil additives from local plants. As stated in the introduction, the expectation is to find simple and convenient methods to construct and maintain roads without relying on expensive machinery or materials. During the fieldwork, many informants inquired whether the project would help the people of Baytsimal and Kaysa in constructing and/or maintaining roads using *do-nou* technology. The experimental road maintenance launched by the project at Baytsimal proved successful and won the trust of people, who are now demanding more similar interventions. The people of Kaysa have requested comparable support. While working on the core project agenda (research on how to improve road stability by applying soil additives from plants), it is important to employ the proven *do-nou* technology side by side for three reasons.(10)

First, a side intervention would allow the SATRPES-MNGD project to address the current practical road problems of the people, which, in turn, would help maintain the commitment of the local people to participate in the project. Second, in case the research fails to produce the expected results for different reasons (e.g., lack of plant cellulose that can stabilize unpaved roads, shortage of plant supply, and road durability problems), *do-nou* technology can be promoted as a backup option until a better solution is identified. Third, even if laboratory experiments lead to promising breakthroughs, translating the scientific knowledge into practical application is likely to take several years depending on the maturity period of the plants and the regularity of the supply, among other issues. Promoting *do-nou* technology on the side would require a budget for inputs and other related costs. The partners of the SATRPES-MNGD project may have to consider utilizing part of the existing budget or secure funds from other sources for a side intervention.

Notes

(1) Constructing passable, maintainable, and affordable roads in rural Ethiopia. www.jst.go.jp/global/english/kadai/h3007_ethiopia.html (Accessed March 3, 2022).

(2) The purpose of the donation, as stipulated in the donation agreement, is to allow JKU to achieve its objectives with regard to contributing to the Japanese Technical Cooperation for the MNGD project that is implemented under SATREPS.

(3) The major activities of the RSDP included the following: 17projects to rehabilitate major trunk roads, 26 upgrading projects of trunk roads, the upgrading of 32 link roads, and the construction of 73 link roads.

(4) https://www.trade.gov/country-commercial-guides/ethiopia-roads-railways-and-logistics#:~:text=As%20of%20the%20end%20of,1.13%20billion)%20in%20road%20construction (Accessed March 3, 2022).

(5) It is to be recalled that the first Shishir–Wobamer dry-season road and the bridge on Sala River near Boyka Town in Wobamer area were built with financial assistance from the grassroots project of the Embassy of Japan to Ethiopia.

(6) The Ethiopian government once introduced the 70:30 quota system (now revised to become 55:45), according to which higher education institutions were forced to enroll 70% of their students in the natural science fields and the remaining 30% in the social sciences. Because the 70:30 enrollment increased unemployment, URRAP was meant to absorb some of the unemployed university graduates.

(7) The five *zones* that voted in a referendum to form the Southwest Region are Bench Sheko, Dawro, Kaffa, Mierab Omo, and Sheka and Konta Special Woreda also joined the group, for a total of six.

(8) *Do-nou* technology is a Japanese technique of soil reinforcement that involves the use of gunny bags/sacks filled with sand, soil, or gravel. It is an inexpensive method for rural road construction or maintenance.

(9) The Ally people are known for the production and supply of maize, sorghum, teff, cabbage, onions, and groundnuts, among others. Moreover, they supply animals and animal products and buy finished industrial products from Kaysa and Jinka.

(10) One potential site for possible *do-nou* technology intervention is the shortcut, south of the Jinka International Airport runway, between the Hargen village in Baytsimal Kebele and the Bitemal village in Arksha Kebele. The importance of maintaining the two km Hargen–Bitemal road through marshland is discussed in the report. Further south of this location, a similar stretch of marshland between Kaysa and Gista Kebeles represents the second option for applying *do-nou* technology.

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