



CHARCOAL SUPPLY IN DAR ES SALAAM CITY, TANZANIA

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ABSTRACT

In Tanzania, charcoal is the primary source of energy particularly in urban areas. Dar es Salaam, being the largest urban center in the country, is also the largest consumer of charcoal. Assuming that all charcoal transported in the city is consumed, an investigation to estimate the amount of charcoal supplied daily was undertaken through monitoring at checkpoints the amount of charcoal transported daily to the city of Dar es Salaam. The study reveals that on average about 6,000 bags of charcoal are transported daily to the city. The figure may be an underestimation by four fold as most charcoal enters the city unrecorded. The highest amount of charcoal comes from North-West (34 %) and South (31 %) of Dar es Salaam. Open trucks transport the highest amount of charcoal (88 %) into the city. However, bicycles are the most frequent means of charcoal transportation constituting on average about 64 % of all individuals engaged daily in charcoal transportation. Though there are some new vehicles, the greatest percentage of vehicles involved in charcoal transportation are old (mainly registered in the 1980's). Most of the charcoal is transported during morning hours (56 %). Most of the charcoal transported to the city is for commercial use. The revenues from charcoal transportation taxes contribute a significant amount of money to both Local and Central Governments. If properly collected and used, they can effectively contribute to the development of the country and sustainable management of the catchment areas for charcoal.

INTRODUCTION

In Tanzania, firewood and charcoal constitute the primary source of energy for both rural and urban populations. Woodfuels which are firewood and charcoal account for about 92 % of primary energy consumed, while petroleum and

electricity supply about 7 % and 1 % respectively (Kaale 1998). Nevertheless, charcoal is by far the most preferred source of energy in urban areas. In a recent study, MNRT (2001) found that about 86 % of residents in Dar es Salaam use charcoal and only 27 % use firewood. In Zambia, Chidumayo (1997) reported that urban households consume 85 % of charcoal.

Urban population growth rate has been extremely high especially after independence. The World Bank (1992) reports that between 1980 and 1990, the urban population growth rate were about 10.5 % in Tanzania. As a result of this high rate of urban growth, the environment in urban and surrounding areas has suffered because of the increasing demand for woodfuels.

In order to get an insight into the supply of charcoal to the city of Dar es Salaam and to evaluate its eventual impact on the economy and the environment, an investigation on the amount of charcoal transported to the city per day was carried out at different checkpoints along the main access roads to the city. The study also aimed to investigate the principal catchment (sources) of charcoal commercialized in Dar es Salaam, the means of transport used and other factors related to charcoal dynamics in the city.



METHODOLOGY

Study area

The Dar es Salaam region is located between latitudes 6° and 7° South, and longitudes 39° and 40° East. It borders the Indian Ocean in the East and the Coast region in South, West and North (Figure 1). The total area of the region is 1,392 km² out of which 945 km² have been reserved for the city expansion (City Commission 1997). The boundary of the city corresponds to the boundaries of the region. The city of Dar es Salaam is divided into three municipalities, namely Kinondoni, Temeke and Ilala.

The population of Dar es Salaam region was estimated to be 1,360,850 during the 1988 population census. The current projections suggest that the population has tripled to 3,152,000 at a rate of 7 % annual growth rate since 1988 (MNRT 2001).

Dar es Salaam is the largest city in Tanzania and is the commercial capital of

the country. The largest percentage of industries, commercial and trade activities, service and tourism sectors and multitude of small businesses in the informal sector are found in Dar es Salaam. The GDP was estimated to be Tshs 316,541 million with an annual per capita GDP of Tshs 197,107 (City Commission 1997).

The infrastructure network is well developed than elsewhere in the country. Dar es Salaam is well linked to different parts of the country by roads, railways, airline and other communication systems which makes it to be economically very active. Even though, the largest part of the city is residential and industrial, there is small area at the periphery that is covered by woodlands. However, most of these woodlands, being under the open access regime, have been highly encroached for agriculture, timber, building poles, and charcoal production (City Commission 1997). Both primary and secondary data were collected at different forest produce checkpoints before entering the city.

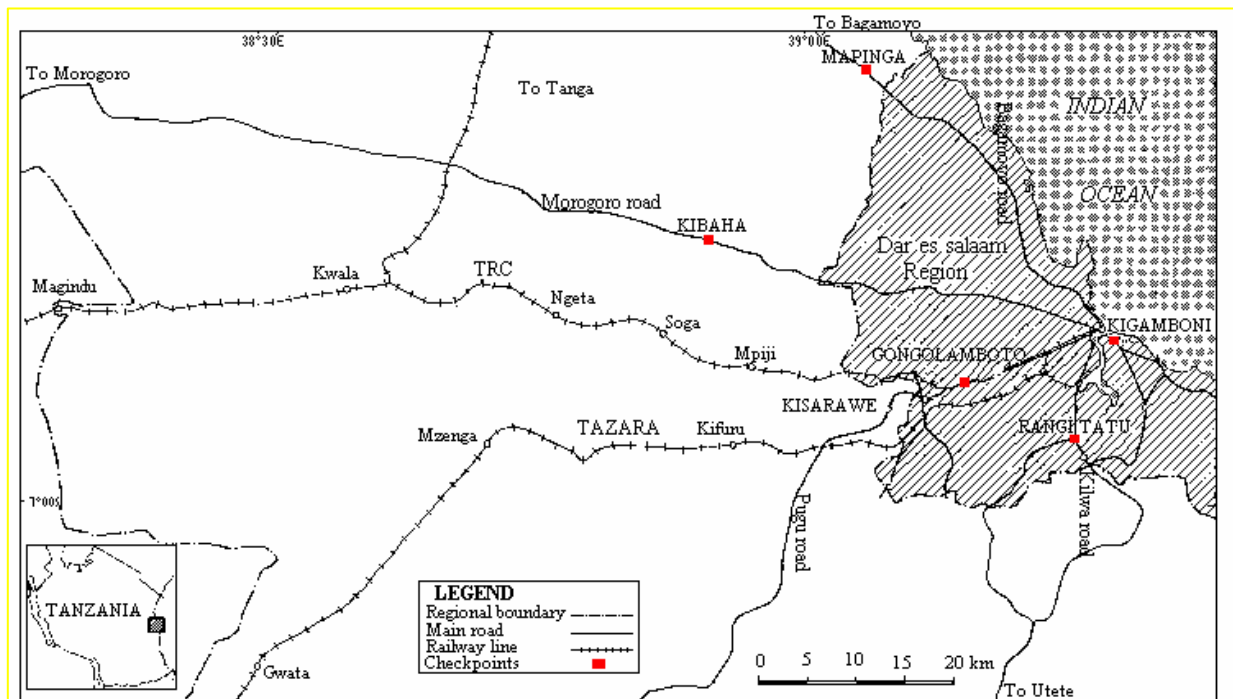


Figure 1: Dar es Salaam Region: Charcoal transportation routes and location of checkpoints and visited stations



Data collection and analysis

The data related to the number of charcoal bags were recorded at a checkpoint per day. Secondary data were obtained from register books and forms specially prepared for collection of taxes and payments (such as licenses and fines) from various forest products.

Primary data were collected through direct informal talks with monitoring officers at the checkpoints and direct counts of charcoal loads passing at the checkpoints during a few successive days. The counts at different checkpoints along the main entrances to the city of Dar es Salaam were conducted thrice. The first round was carried out in December 2000-January 2001. The second survey took place in March 2001 while the third survey took place in August 2001. The counts were made especially during daytime from 6 a.m. to 6 p.m. beyond which it was assumed no more charcoal was passing because the law does not permit transportation of natural resources at night (between 6 p.m. and 6 a.m.). Otherwise, the enumerators recorded reports from officers who stay overnight at the checkpoints. At the beginning the counts were made by actual counting of charcoal bags for each vehicle passing. With such an experience the subsequent loads were estimated without actual count.

The checkpoints involved in the study include (Figure 1): *Morogoro route*: Kibaha Maili Moja and Ubungo Kibo checkpoints; *Bagamoyo route*: Boko and Mapinga Mpinji checkpoints; *Pugu route*: Gongo la Mboto and Dondwe checkpoints; *Kilwa route*: Vikindu and Mbagala rangi tatu checkpoints; *Kigamboni route*: Kibugumo and Kibada checkpoints.

During the surveys, vehicles and other means of transport carrying charcoal to the city were enumerated at the checkpoints. The means of transporting charcoal were grouped into five categories: as follows:

- (1) *Open trucks "I"*: all types of vehicles with a carrying capacity of 1 – 2 tons;
- (2) *Open trucks "II"*: all types of vehicles with a carrying capacity greater than 2 tons;
- (3) *Buses and Minibuses*;
- (4) *Bicycles*;
- (5) *Others*: motorcycles, head loads, unrecorded vehicles, tankers.

Two assumptions were made with regard to intended use of the charcoal load. First assumption was unless specified, bicycle loads and larger loads of charcoal (> 10 bags) were considered to be commercial. The second assumption was Private uses were all other uses other than commercial ones.

RESULTS AND DISCUSSION

Sources of charcoal for Dar es Salaam City

Much of the charcoal consignments are from the Coast, Morogoro and Tanga Regions. The main entry points are the Kilwa, Pugu, Morogoro and Bagamoyo routes (Figure 1). However, the Tanzania-Zambia Railway (TAZARA), the Tanzania Railway Corporation (TRC) and the Kigamboni area constitute minor entry points.

Amount of charcoal transported daily to Dar es Salaam

The overall average amount of charcoal (Table 1) that is transported to Dar es Salaam City is estimated to be about 6000 bags per day. This value may be an underestimation of the real figure due to diversions and night evasions particularly in recent times following increased monitoring for tax/levy collection. In fact, in a recent consumption survey, the total daily consumption in the city was estimated to about 24,000 bags of charcoal. That is,



Table 1. Daily (gunny bags) amount of charcoal hauled to Dar es Salaam

| Routes | Average load per day (bags)* | | | Average | (%) |
|-----------|--|--|------|---------|-----|
| | Wet season (1 st & 2 nd survey) | Dry season (3 rd survey) | | | |
| Kilwa | 1870 | 1847 | 1859 | 31 | |
| Morogoro | 1848 | 2315 | 2082 | 34 | |
| Pugu | 742 | 1199 | 971 | 16 | |
| Bagamoyo | 357 | 610 | 484 | 8 | |
| Kigamboni | - | - | 68 | 1 | |
| TAZARA | - | - | 450 | 7 | |
| TRC | - | - | 150 | 2 | |
| Total | 4817 | 5971 | 6062 | 100 | |

Notes on estimating the overall average charcoal amount (gunny bags) entering the city per day

Kilwa, Pugu, Morogoro & Bagamoyo routes: simple arithmetic average for both seasons was taken.

Kigamboni area: no primary data were collected, thus secondary data from the Local Government checkpoints were used. It is reported that charcoal business fluctuates with season, most charcoal businessmen (who mainly use bicycles) turn to the fruit business during fruit seasons.

Railway lines (TAZARA & TRC): the estimates for charcoal hauled daily through these routes were made through interviews with a number of key informants including the Village Government Officials, Station masters and charcoal dealers.

about four times higher than the amount passing daily through surveyed checkpoints (INCO-DEV 2002). It would appear that most charcoal passes the checkpoints unnoticed probably in closed vehicles.

The average amount of charcoal bags that enters Dar es Salaam City daily (Table 1) tends to be slightly higher in the dry season than in the wet (rainy) season. The highest amount of charcoal (34 %) enters the city daily through the Morogoro road route, followed by the Kilwa road route (31 %).

Means of charcoal of transport

The means of transporting charcoal to Dar es Salaam and the corresponding amount of charcoal transported during the period of the surveys (Figure 2) show that *Open trucks "II"* (Plate 1) account for the highest daily load. In general, the study shows that this means of transport carry about 88 % of the charcoal to Dar es Salaam City.

A survey of ten prominent and long-term charcoal truckers who had been in business from between 1987 and 1999 (though most of them had been in business from around 1997) revealed that the majority of the charcoal businesspersons reside in Dar es Salaam and operate their businesses from the city. None of the businesspersons own their own trucks, they hire trucks on a need basis, though they frequently tend to hire from the same individuals. There are various reasons as to why the respondents went into the charcoal transportation business. It is a good income generating activity, given that there is a very good market in the city for charcoal. Secondly, it requires low starting and operating capital. Thirdly it does not require specialised skills to operate.

Although bicycles haul quite a small percentage of charcoal to the city, they are the most frequent means of transporting charcoal. Bicyclists account for about 63 % and 70 % of the daily means of charcoal

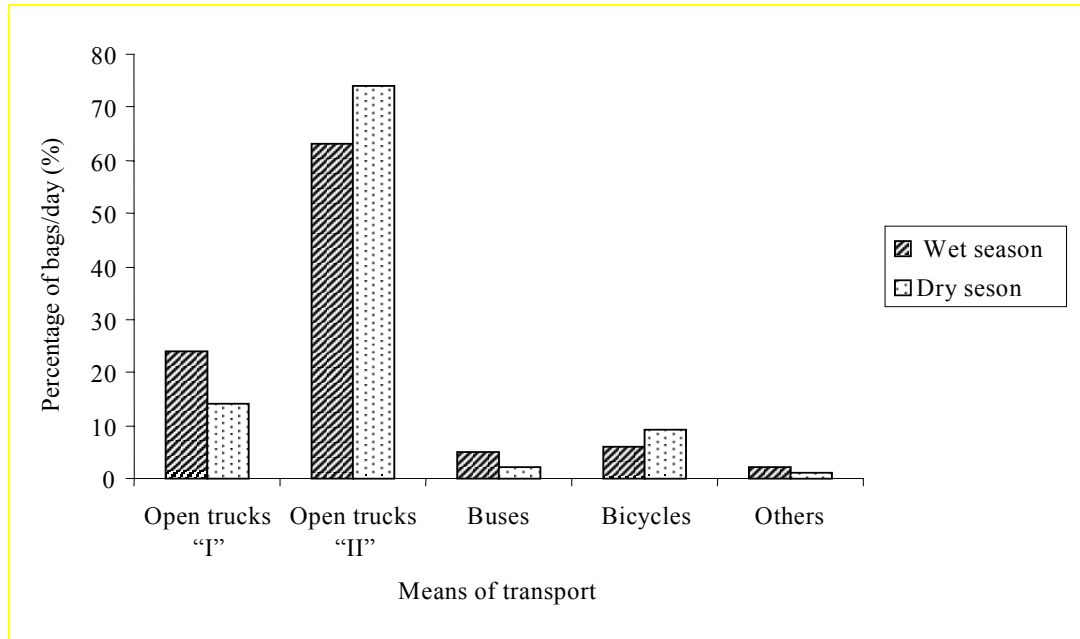


Figure 2. Means of charcoal transportation to Dar es Salaam during the wet and dry season



Plate 1. Medium sized trucks transport the highest amount of charcoal to the city

transport in the wet and dry seasons, respectively. This may be an indication that many people involved in charcoal business are poor people who can't afford to pay for better means of transport, but are engaged in this business to earn their living.

The bicycle is a highly important asset for many peri-urban households (Box 1). In a survey of some 10 villages in the peri-urban and rural areas adjacent to Dar es Salaam, around the Pugu, Kazimzumbwi and the

Ruvu South Forest Reserves, in Coast Region, more than 80 % of households owned bicycles. In these areas, bicycles are considered to be not only important for local transport, but also even more important for ferrying charcoal on a daily basis into the city. The bicycle can carry the equivalent of two very large gunny bags (gunia) of charcoal, weighing from 50 – 70 kg each. In selling sites, however, the bag weighs about 30 kg which may indicate that it was divided into two.

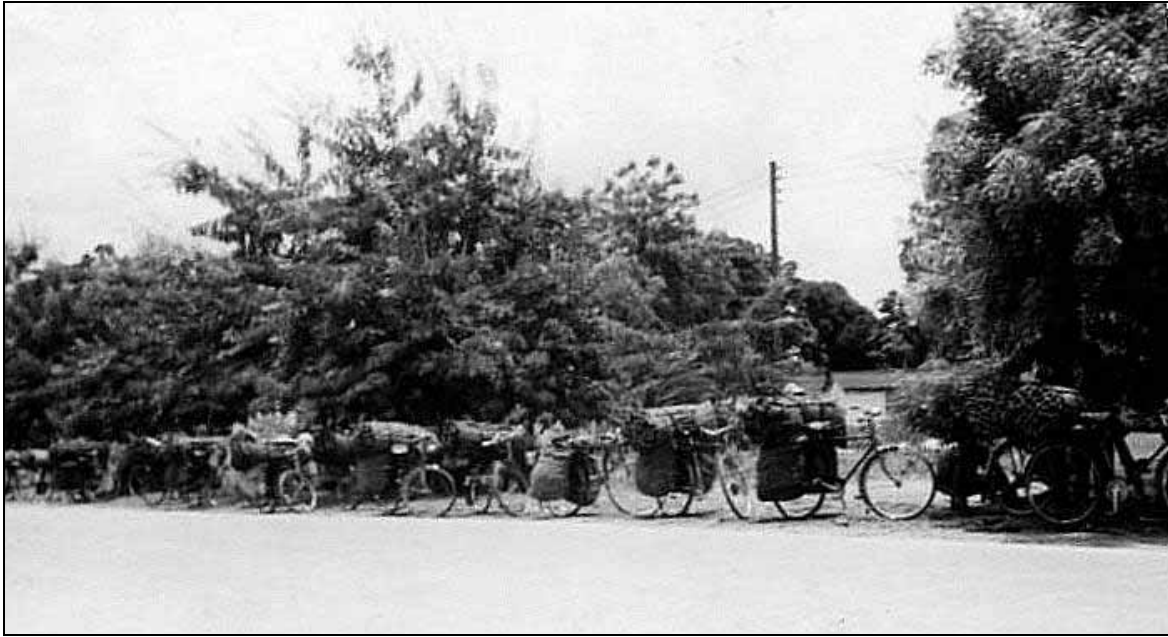


Plate 2. Charcoal loaded bicycles with charcoal waiting for customers at Kilwa Road.

Box 1. A profile of a typical charcoal cyclist along Pugu Road

Charcoal cyclist is male whose age is between the mid 20's and mid 30's. Transporting and selling charcoal at the periphery of the city is his job and the bicycle is the main asset. He either owns the bicycle or rents it at Tshs 500/= a day. He has to service it twice or thrice a week. He is often resident in the peri-urban or rural areas adjacent to the city and he finds this job much more beneficial than cultivating. If he has a family some members of his household will be engaged in subsistence agriculture. He can make between Tshs 1,300/= to Tshs 5,200/= per day. Income is not constant, on a good day when his cycle is in order and he is in good health, and the market prices are good, he makes the maximum. On a bad day, he will just make between Tshs 800/= and Tshs 1,300/=. On a very bad day he will not make a sale, but will leave the bag to middlemen and return the next day to fetch a minimum of Tshs 800/=.

He works for six days a week, with a typical workday beginning at 5:00 am and ending at 10:00 pm. This time includes transporting charcoal twice a day to town and returning late at night. The distance to charcoal source being 7 – 15 km, the bicycle transporter covers as much as between 30–60 kilometres per day. He tries hard not to take meals in town so as to keep costs low. When he is ill, income is affected drastically, so cooperation, in the form of social and capital sharing with other cyclists and middlemen is important in the event that he needs to borrow cash to start over. His major concern about deforestation is the fact that distances to charcoal sources are getting longer and that one day there may be no charcoal to transport!

The cyclists come in from the peri-urban and rural areas and deliver the charcoal to specific points just at the periphery of the

city and wait for city-based consumers to come and buy the charcoal (Plate 2). The buyers are small charcoal traders, people



with small businesses that use charcoal and even some of the wealthier households. A few of the cyclists go to deliver to specific customers further into the city. The cyclist transporters may either just deliver charcoal and get paid for it, or are sometimes actually involved in its production and sale.

Service life of vehicles involved in charcoal transportation

The registration numbers of vehicles were recorded in an attempt to estimate the service life of vehicles involved in charcoal transportation. The results of the study show that even though there are a number of newly registered vehicles that transport charcoal to the city, old vehicles are the most dominant. These vehicles were registered in the 1980's and accounted for 27 % and 17 % of the total charcoal hauled to the city for the wet and dry seasons, respectively. Many researchers (TISCO 1988, Sawe 1993, Serenje *et al.* 1994 and Brigham *et al.* 1996) also reported the dominance of old vehicles in charcoal transportation. The reason for using old vehicles in charcoal transportation is probably that charcoal trade does not generate enough profit to pay for the upkeep and capital of new vehicles. However, new vehicles occasionally transport charcoal for private use.

Time of the day for charcoal transportation

The quantity of charcoal that entered the city of Dar es Salaam daily during the period of the surveys and time of the day is presented in Table 2.

It appears that the highest amount of charcoal is transported during morning hours. The trend shows that, the amount of charcoal slightly declines in the afternoon, and considerably at night. This trend has also been noted by the officers at the checkpoints with the following explanations:

Firstly, vehicles carrying natural resources products including forest products are theoretically not allowed to travel after 6:00 p.m. Therefore, it is assumed that once vehicles reach the checkpoint after this hour they should stay until the next morning. In this regard, most of the enumerators did not stay overnight at the checkpoints.

Secondly, most of the vehicles used in charcoal transportation are old with several mechanical problems. In order to avoid coming across Traffic Police, the charcoal transporters prefer traveling very early in the morning before Traffic Police start their patrols or very late evening/nights when the Traffic Police have reduced routine patrols.

Table 2. Amount of charcoal transported to Dar es Salaam and time of the day

| Time of the day | Hours range | Average load per day (bags) | | | |
|--------------------|-------------|-----------------------------|-----|------------|-----|
| | | Wet season | % | Dry season | % |
| Morning | 6:00-12:00 | 2073 | 43 | 3321 | 56 |
| Afternoon | 12:00-18:00 | 1677 | 35 | 2033 | 34 |
| ¹ Night | 18:00-6:00 | 1067 | 22 | 617 | 11 |
| Total | | 4817 | 100 | 5971 | 100 |

¹The counts were taken between 6:00 and 18:00 hours beyond which the enumerators recorded reports from officers who stay overnight at the checkpoints.

Intended use of charcoal load

The use of charcoal transported to the city of Dar es Salaam by the different means of transport has been grouped into two

categories, "private" and "commercial" uses (Table 3). Any charcoal load that is greater than 10 bags and that is transported by bicycles was assumed to be for commercial use. Military vehicles



transporting charcoal were put in their own category even though their loads are often for commercial use. As illustrated in Table 3, commercial use accounts for most of charcoal transported to the city. About 1 % of the charcoal entering the city is by military vehicles, which normally goes unrecorded by the government.

Revenues accruing from charcoal transportation

Revenues to the Government

Charcoal production contributes remarkably to the economy of the country in terms of individuals’ income (producers and traders) and in terms of taxes. The average revenue expected to come from charcoal transportation to Dar es Salaam. (Table 4) Shows that despite variation in levy taxes per bag vary from one district to another, most of the District Councils apply the same levy as that by the Ministry of Natural Resources and Tourism, which is Tshs. 400 per bag. The City Council taxes Tshs. 100 per bag of charcoal. Assuming that all the money collected through charcoal taxation is properly managed, these revenues are quite substantial. If properly planned, they can effectively contribute to the management of the catchment areas.

It is worth mentioning that not all charcoal loads passing through the control points are registered and therefore officially taxed.

Even though some loads, such as small loads (less than 10 bags) for private uses and military loads, are deliberately unrecorded, others are simply not recorded as a cheating mechanism about the real revenues collected from charcoal transportation. At one of the check points, it was noted during the period of the survey (five days) that on average, for every five bags passing, only three were recorded and officially taxed with a cheating of about 4 bags in 10.

The daily government revenues supposed to be accruing from charcoal transportation are Tshs 4.4 million. This figure, however, is an underestimate considering that most charcoal entering the city is unrecorded.

Revenues to charcoal transporters

Table 5 provides estimates of costs and relative profit to the charcoal transporter in wet or dry season. Assuming that cyclists do not pay the Central Government Levy, their levy cost has been estimated to only Tshs 500 per bag while the truckers pay Tshs 900 per bag. The lower levy per bag of charcoal transported by bicycles may be an incentive to use bicycle transport. If the bicycle or the truck belongs to the charcoal dealer then there is no hire costs and the profit margin becomes higher. Figure 3 gives relative profits accruing through the cost and income structure (Table 5).

Table 3. Intended use of charcoal loads entering Dar es Salaam

| Charcoal bags transported | Private (bags/day) | | Commercial (bags/day) | | Military (bags/day) | |
|---------------------------|--------------------|------------|-----------------------|------------|---------------------|------------|
| | Wet season | Dry season | Wet season | Dry season | Wet season | Dry season |
| Total | 241 | 242 | 4509 | 5700 | 68 | 29 |
| Percentage (%) | 5.0 | 4.0 | 93.6 | 95.5 | 1.4 | 0.5 |



Table 4. Daily Government revenues accrued from charcoal sales in Dar es Salaam

| Seasons | Average commercial charcoal (bags/day) | | Daily revenues (Tshs/day) | | | |
|------------|--|----------|---------------------------------|---------------------------------|-----------------------------|-----------|
| | Trucks | Bicycles | District Council (400 Tshs/bag) | Central Treasury (400 Tshs/bag) | City Council (100 Tshs/bag) | Total |
| Wet season | 4227 | 282 | 1,803,600 | 1,690,800 | 450,900 | 3,945,300 |
| Dry season | 5173 | 527 | 2,280,000 | 2,069,200 | 570,000 | 4,919,200 |
| Average | 5105 | 405 | - | - | - | 4,432,250 |

Notes: It is assumed that checkpoint Officers tax only commercial load. Private and military loads are usually neither checked nor taxed. Some checkpoints, particularly those instituted by the Ministry of Natural Resources and Tourism for the Central Treasury, do not even tax bicycle loads. As such the revenues under Central Treasury do exclude charcoal transported by bicycles. This also explains the difference between the average number of bags shown in Table 1 and those in Table 4.

Table 5. Costs and income from legal charcoal transportation to Dar es Salaam

| Means of transport | Costs (Tshs) | | | Selling price (Tshs) | |
|--------------------|-----------------------------|--------------|---------------|----------------------|-------------|
| | Unit price at roadside site | Hire per bag | Levy per unit | Wet season | Dry season |
| Bicycle | 1100-1500 | 500 | 500 | 4000 – 4500 | 3200 – 3500 |
| Trucks | 1100-1500 | 1170 | 900 | 4000 – 4500 | 3500 – 4000 |

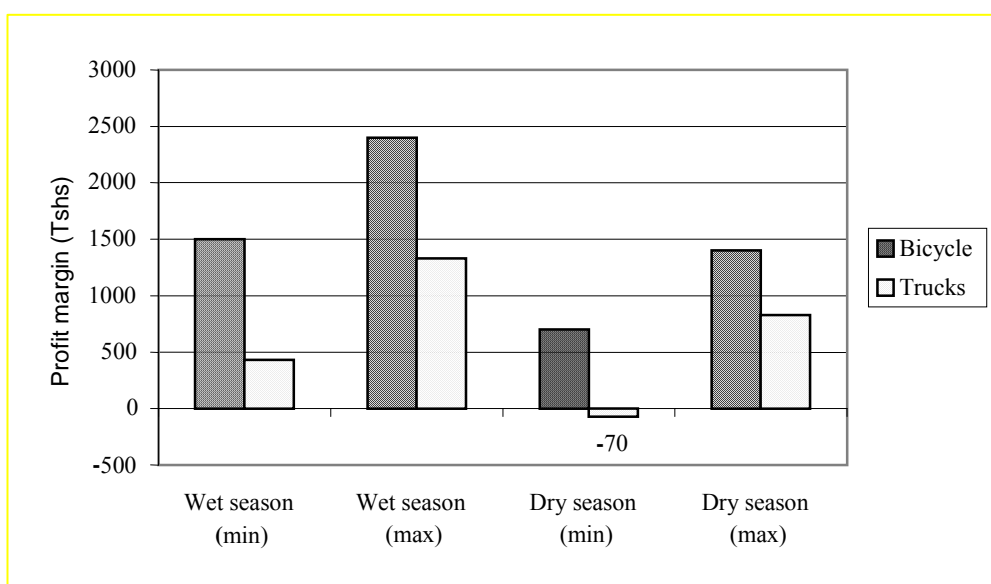


Figure 3. Relative profit margin of charcoal transportation to Dar es Salaam.

The profit margins (Figure 3) are relatively slim in the charcoal transportation business, and that bicycle transporters have a higher profit margin per bag than those who transport by truck. Obviously, however, the total profit in transportation by truck is higher, since more bags are handled. It also shows that there is a strong incentive to evade the government levies. These levies can virtually wipe out the whole profit

under certain circumstances, such as truck transport of a load of charcoal that has been purchased at high production costs in the dry season. The low profit margins are also an explanation to the observation that mostly old trucks are used in charcoal transportation. The profit margins are not enough to pay for the costs of new vehicles.



CONCLUSION AND RECOMMENDATIONS

Large quantities of charcoal flow in to the city of Dar es Salaam daily. Study surveys at check points gave an estimate of about 6,000 bags of charcoal. All this charcoal, and effectively more (INCO-DEV 2002), is consumed by the city dwellers. The highest amount of charcoal comes from Morogoro and Kilwa directions.

According to the survey, most of the charcoal is transported during morning hours (6:00 a.m. to 12:00 p.m.). Open trucks with carrying capacity greater than 2 tons transport into the city the highest amount of charcoal. However, bicycles haul in an important amount of charcoal as well, not in terms of quantity but in frequency terms. Bicycles are the most frequent means of charcoal transportation indicating that the charcoal business is attractive to mostly low income class. Though there are some vehicles with new registration numbers, the greatest percentage of vehicles involved in charcoal transportation are old. Although there is a small amount of charcoal for private and military use flowing in the city, most of the charcoal transported to the city is for commercial use.

Charcoal business generates an important income to a range of charcoal dealers from the producer to the ultimate secondary seller. The revenues from charcoal transportation taxes contribute also a significant amount of money to both local and central governments. If properly collected and used, they can effectively contribute to the development of the country and the management of the catchment areas for charcoal.

The profit margin in charcoal transportation and trade is relatively low, especially for transportation by truck in the dry season. This gives a strong incentive to evade paying taxes and levies. Evasion is apparently through many means, including

nighttime transportation which is forbidden for biomass resources, and various forms of collusion and payments to guards at the check points.

Given considerable amount of charcoal flowing in and consumed by the ever-growing city dwellers, in order to ensure sustainable supply of charcoal it is pertinent to recommend the following:

To continue the current sensitization of charcoal users for use of energy efficient technologies e.g. improved energy efficient stoves; To strengthen the checkpoints and ensure proper follow up of revenues from tax collections. However, this will immediately have an effect on urban charcoal price, if successful. Hence will hurt the poorer people in town, and; To ensure that a certain amount of money collected from charcoal transportation business is allocated for the rehabilitation of charcoal catchment areas and the training of charcoal producers on efficient charcoal making methods.

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