

Transport and Employment in International Development

John Hine

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Abbreviations

DFID	Department for International Development of the UK
GDP	Gross Domestic Product
HIV/AIDS	Human Immune Deficiency Virus/ Acquired Immune Deficiency Syndrome
HVT	High Volume Transport
ILO	International Labour Organisation
IRF	International Road federation
Kw	Kilowatt
OECD	Organisation for Economic Co-operation and Development
UITP	International Association of Public Transport
TANROADS	Tanzania National Roads Authority
TARURA	Tanzania Rural-Urban Roads Agency
UK	United Kingdom
US	United States of America

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1. Introduction

The purpose of this note is to provide information and guidance on issues and trends relating to employment within the transport sector and how employment is affected by transport investment. The main focus of attention is on low and middle income countries in Asia and Africa, however when necessary, to illustrate key points, data is drawn from the UK and elsewhere.

2. Transport's contribution to the economy

Transport is, of course, an important part of the national economy. Direct transport operations typically contribute around 5% to 10% of GDP. However this omits transport based construction and the supply of vehicles and fuel. In UK direct transport employment accounts for 5% of total employment however transport accounts for around 14% of total consumer's expenditure. Expenditure on private transport is an important part of the difference.

Within the transport sector road transport is by far the biggest sub sector, accounting for most the greatest contribution to GDP and employment. In India direct transport operations contribute 5% of GDP, with road transport at 3.6%, rail 0.9% and water 0.08% and air 0.07%¹. In India rail transport contribution is particularly high, in most other developing countries the contribution is far lower.

Transport investment is crucial to the wider development of the economy and this is further discussed below.

3. Transport services employment

It is well recognised that as incomes rise, an urbanisation takes place, there is a movement of labour out agriculture towards industry and services (including transport). Currently agriculture accounts for 53% of employment in Africa and 29% in Asia. Worldwide services now account for with just over half of all employment, with industry and agriculture accounting equally for the rest. The Global trend of a rising share of employment in services and high skilled employment is projected to continue. (ILO, 2018).

Data on transport employment appears to be very unreliable, in part because a lot of transport employment is informally provided, and therefore omitted from statistics, and also transport employment may be classified under other headings when transport workers are employed by firms working predominantly in other sectors. As an example, for China it is quoted that just 2.8 million (0.36% of workforce) were employed in road transport in 2013 (ILO, 2015). When in fact it was also reported that there were 22.5 million goods vehicles and buses in China at the same time (IRF 2017).

Vehicle fleet numbers can provide a guide to trends in transport employment. The Table below provides vehicle fleet data for five countries for 2002 and 2013 together with growth rates and the growth in GDP. Two Asian countries (China and India) are selected along with two Africa countries (Kenya and South Africa) along with the UK to provide a high income country comparison. Vehicle fleet data is drawn from the International Road Federation (IRF) that is perhaps one of the most reliable sources, however up-to-date data from many developing countries are missing from the IRF statistics.

The data shows that car populations tend to grow faster than GDP and that there is a reasonably close correspondence between goods vehicle population growth and the growth in GDP, while bus populations tend to grow at a slower rate. South Africa appears to be an exception. The fast rate of

¹ <http://statisticstimes.com/economy/sectorwise-gdp-contribution-of-india.php>

growth in motorcycles appears to be very common now in the rest of Africa. Buses and goods vehicles generate the most employment per vehicle. However employment is also generated by garage services, fuel distribution for private vehicles. Cars and motor cycles also provide formal and informal taxi services.

Table 1. Vehicle Population and Growth rates for Five Countries

Country	Vehicle Population in 2002		Vehicle Population in 2013		Growth rate % per year
	No. in 1000s	No. per 1000 people	No. in 1000's	No. per 1000 people	
China					
Cars	10,220	8.0	103,133	76.0	23 %
Motorcycles	51,028	39.9	95,211	70.2	6 %
Buses	1,803	1.4	2,484	1.8	3 %
Goods vehicles	8,122	6.3	20,106	14.8	9 %
<i>GDP</i>	-	-	-	-	10 %
India					
Cars	7,613	7.0	24,806	19.4	11%
Motorcycles	41,581	38.1	132,605	103.7	11%
Buses	635	0.6	1,824	1.4	10%
Goods vehicles	2,974	2.7	8,573	6.7	10%
<i>GDP</i>	-	-	-	-	8%
Kenya					
Cars	270	8.2	710	15.8	9%
Motorcycles	48	1.5	738	16.4	28%
Buses	47	1.4	96	2.1	7%
Goods vehicles	227	6.9	370	8.2	5%
<i>GDP</i>	-	-	-	-	5%
South Africa					
Cars	4,163	88.6	6,377	118.1	4%
Motorcycles	60	1.3	367	6.8	18%
Buses	165	3.5	344	6.4	7%
Goods vehicles	2,222	47.3	2,579	47.8	1%
<i>GDP</i>	-	-	-	-	3%
UK					
Cars	25,782	437.0	29,141	455.3	1%
Motorcycles	1,070	18.1	1,220	19.1	1%
Buses	173	2.9	165	2.6	0%
Goods vehicles	3,027	51.3	3,823	59.7	2%
<i>GDP</i>	-	-	-	-	1%

Sources IRF Statistics, 2017 and World Bank

As economies grow so the demand for transport increases and nature of transport jobs will change. At high levels of income, particularly for countries with a high service content, such as the UK, there can be a 'decoupling' between GDP growth and growth of the transport sector. For example it was reported that between 1997 and 2004, GDP in the UK rose by 21% in real terms while total ton-km grew by only 8% (McKinnon, 2006). However for the most part this does not appear to be an issue in low and middle income countries, as is borne out by Table 1. An increase in private car use may lead to some reductions in in the demand for public transport. But parking difficulties, and measures to prevent congestion, in the centre of the larger cities, are important drivers for the demand of both

bus and rail public transport. After years of decline the demand for interurban rail services has also substantially increased, during the last few years, in the UK. Obviously with an expansion of private car fleet so there will be an increase in the need for garage services.

The nature of freight transport services also changes with income growth. In low income countries there are often strong demands for the movement of bulk agricultural and mineral commodities. And in both high and low income countries there has been a relative switch away from medium trucks towards heavier vehicles. However in high income countries there has been a substantial increase in the use of light goods transport, perhaps partly reflecting the increased use of small parcel deliveries resulting from internet shopping. For example between 1994 and 2017, heavy goods vehicles in the UK increased by 19% while in the same period light goods vehicles increased by 82%.

Currently Indian Railways is estimated to be the World's eighth largest employer with 1.3 million employees. Employment peaked in 1990/91 with 1.6 million, and since then there has been a gradual decline. In Sub-Saharan Africa, South Africa has the largest rail network. Transnet Freight Rail reports 38,000 employees while the Passenger Rail Agency of South Africa had 17,000 employees. Although there are some notable exceptions, particularly new railways financed by China (discussed below), in most of Sub-Saharan Africa rail operations have been in long term decline.

In some countries, particularly in Asia, informal transport services can provide a great deal of employment to the poor, but almost exclusively for men. For example, in the 1980's it was estimated that there were around 2 million cycle rickshaw drivers in Bangladesh, with 280,000-400,000 operating in Dhaka. It has been estimated that there are 10 million rickshaw drivers in India, as part of the 400-million informal sector labour force. Cycle rickshaws have, of course, given way to auto rickshaws.

Formal urban public transport is estimated to employ 7.3 million worldwide. The Asia Pacific region employs 2.8 million, Eurasia 1.2 million, Latin America 1.2 million, Middle East/North Africa 200,000 and Sub-Saharan Africa just 70,000 (UITP, 2011). Informal motorised public transport can also be an important employer. For example there are various estimates of between 5000 and 6500 matatu minibuses in Nairobi, employing in the region of 15,000 to 20,000 people for an urban population of about 4.4 million.

However the nature of the transport labour market is now changing significantly particularly with the huge growth in motorcycles. Following the growth in Asia, Africa is now seeing an explosion in the growth of motorcycles with Tanzania reporting a recent growth rate of 60% growth per year. Although little data has been collected, from common observation, motorcycle taxis have, in the last 10 years, become a new major source of employment in rural Africa. Uganda was been reported to have 200,000 bicycle and 90,000 motorcycle 'boda-boda' drivers operating for hire.

4. Occupational safety and health in transport services

Road traffic injuries are a leading cause of death and disability in. Of the 1.25 million people that die each year as a result of road crashes it is reported that 90% occur in low and middle income countries. Between 20 and 50 million people also suffer non-fatal injuries. Road safety is clearly a major issue for the employment of drivers and conductors.²

² <http://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>

Long distance truck drivers have been particularly at risk of getting HIV/Aids in Africa. It was reported that in 2003 AIDs infection rates was as high as 30% in certain countries because of high risk sexual behaviour. (World Bank, 2006)

A recent ILO report identified safety and health concerns in the sector including a risk of road accidents, physical hazards, violence, dangerous operational situations and exposure to harmful substances. Long-haul road transport drivers can find it challenging to combine their work and family life because of the irregular and split shifts involved in transport service provision. Competitive pressures can lead to over-speeding, overloading, working without proper sleep and rest. This in turn can have a negative impact on other road users and overall public safety. Transport workers were also found to be susceptible to a range of work-related disorders, including fatigue, stress, sleep deprivation, kidney disorders, obesity and substance abuse. The transport sector in developing countries has a large number of informal workers and these will be particularly vulnerable because of a lack of social protection measures and they have to work low levels of income, productivity, skills, technology and capital. (ILO, 2015).

5. Transport construction and employment

With regard to larger scale initiatives, there appears to be very little information, or research, on direct employment opportunities in transport construction or maintenance. The construction industry is a major employer in virtually all countries, and major transport investment should provide significant opportunities. Data from UK and USA show the total construction industry for these countries accounts for around 5 to 6.5% of total employment and a similar contribution to GDP. Inland transport infrastructure accounts for around 0.8% of GDP for the OECD. For transition and developing countries the percentage appears to be higher, so that for the Central and Eastern European Countries the figure was 1.7% of GDP in 2010 (OECD, 2013).

An analysis of transport investment in Middle East and North Africa by the World Bank suggested that in oil-importing countries, for every USD billion spent around 110,000 infrastructure-related jobs were created. The opportunities for non-qualified workers were much less for rail transport accounting for just 1% of expenditure, in comparison with road and port investment expenditure on non-qualified labour accounted for 6-10% of the total expenditure (lanchovichina et al, 2012).

China has recently helped to finance a number of railways in Africa, most notably:

- a) the Mombasa-Nairobi Standard Gauge Railway, which employed 25,000 Kenyans in construction
- b) The Addis Ababa-Djibouti Railway, which employed 20,000 workers in Ethiopia and 5,000 in Djibouti.
- c) Abjua-Kaduna rail line, in Nigeria, which employed 4,000 workers in construction and is estimated to create an additional 5,000 jobs during operations.

It is planned that the Addis Ababa-Djibouti railway will initially be managed by Chinese staff for five years while local employees are given specialist training in operations. A railways training academy is being set up that will employ 250 teachers and administrative staff. This will train 100 students at a time in seven different railway related disciplines.³

An analysis relating to the USA suggested that, per dollar spent, investment in public transport generated 31% more jobs than new construction of roads or bridges. Similarly maintenance and repair of roads and bridges generated 16% more jobs than new construction per dollar spent. It was

³<https://www.smartrailworld.com/five-major-african-projects-supported-by-china>

also found that putting or keeping public transport in communities with high unemployment produced up to 2.5 times more new jobs than that of putting public transport into communities with low unemployment (Smart Growth America, 2011). As an example of urban transport investments and potential benefits, there are reported plans to construct 1000 km of Bus Rapid Transit corridors in 20 cities across India in the coming 6-12 years, at a cost of USD 3-4 billion. Over the next 20 years this should save more than 27,000 lives and create 128,000 jobs, as well as reduce greenhouse gas emissions by 42 million tons.⁴

6. Trends in the financing, organisation road construction and maintenance

Over the last twenty five years there have been a number of trends in the financing and organisation of road construction and maintenance, which inevitably impacts on employment. Following extremely poor performance of road networks in much of the developing world in the 1970s and 1980s new “Second Generation” Road Funds were set up around the world in the 1990’s to increase the funding of road maintenance through collecting and distribution of a fuel levy. These had a major impact in improving road standards, particularly in Africa, through ensuring that basic maintenance was carried out. At the same time the direct responsibility for organising road construction and maintenance of main roads has moved away from ministries towards separate road authorities such as TANROADS, the Tanzanian Road Authority. For rural roads there were movements towards decentralisation by increasing the responsibility of local authorities, as has recently happened in Nepal. Nevertheless the latter trend towards decentralisation has not been entirely successful and has been modified in several countries by setting up new national agencies to coordinate rural roads, such as TARURA, the recently established Tanzania Rural-Urban Roads Agency.

Along with the changes in responsibility there have been major moves towards commercialisation, whereby maintenance is undertaken through letting commercial contracts rather than by government force account. Various different type of maintenance contracts are let to local companies to undertake specific works, or to look after roads on a longer term basis through ‘term contracts’ or through ‘performance based contracts’ whereby the company agrees to keep the road at given level of service. Inevitably there will be a major change in employment terms and conditions if former government employees are re-employed by commercial contractors. Other approaches have been successfully tried, particularly in South America, whereby local communities are given contracts to maintain roads, with extra help and supervision from the road authorities (Zietlow, 2002).

7. Labour based road construction and maintenance

Labour intensive road construction has been very common in India and other Asian countries for many years, however it was far less common in Africa. To help increase construction employment in Africa, and elsewhere, specific programmes were developed during the 1980s and 1990s, with support from the ILO, donors and governments. Training was provided for contractors, supervisors, technicians, labourers, engineers and road authority officials on how this can be achieved. Training centres were set up for this purpose. The labour / equipment share in construction may vary between labour intensive construction (little equipment), labour based construction (in which tractors and small equipment may be used), and conventional construction (where large machine are used).

⁴ http://article.wn.com/view/2014/06/24/BRT_system_will_save_27000_lives_in_India_World_Bank/

Successful programmes were implemented in a wide range of countries including Kenya, Ethiopia, South Africa, Cambodia, Ghana and Zimbabwe. It is important that contracts are specifically designed for labour based work and that payments are made strictly on time. Contractors are reluctant to get involved with labour based work if payments are delayed.

There are reported to be numerous benefits from the approach. Up to five times more direct employment may be achieved. Less scarce foreign exchange is used to pay for imported equipment. Because the workforce spend money locally this can have local multiplier effects creating additional employment. The local workforce will also gain useful skills they can use elsewhere and local communities can take pride and sense of ownership of local infrastructure.

In a study of labour based road works in Uganda it was found that labour based work could achieve the same quality and the conventional machine based approach. For full rehabilitation, using financial prices the work was 18% cheaper and 38% cheaper, with economic prices. Three times as much direct employment was created and 1.6 indirect jobs were created for each directly employed person and twice the amount was spent in procuring local goods and services. Overall it was estimated that labour based methods would be economically competitive up to daily wage rates of \$US 4 per day (Taylor and Bekabye, 1999).

Although with increasing incomes interest in the approach has declined it is still actively undertaken in a number of countries, including Kenya. DFID is currently supporting labour based construction and maintenance in Nepal under the Rural Accessibility Programme (RAP). Since 2001 over 18 million person-days of work have been provided for poor people, and deliberate efforts have been made to employ both women and disadvantaged groups such as Dalits (low caste untouchable people) and Janajatis (ethnic indigenous people), (DFID, 2017).

8. Gender and employment in the transport sector

In rural areas of developing countries women undertake a vast amount of work carrying and transporting firewood, water and agricultural produce. Although most of this is for purely domestic purposes a significant component is for informal employment. Recent studies in Kenya and Tanzania have found that 'first mile' commercial movement of agricultural produce, by head and backload, from farm to the first collection point or market is undertaken by overwhelmingly by women (Hine et al. 2018) It is also reported that women are extensively involved in informal employment carrying goods in urban markets in Africa (Grieco et. al. 1996).

At the early stages of crop transport men will also be employed but they will make much greater use of technology including bicycles, motorcycles, hand carts and animal transport. The differential access to technology is not fully understood but probably relates to women having less access to financial resources. Women are also much more involved in multitasking such as looking after children, the sick and elderly and undertaking domestic chores so that they may have less opportunity to employ technology on a full time basis.

Women are far less likely to be in formal employment in the transport sector than men. Although women are much more likely to be employed in the transport sector in middle and higher income countries however the proportion declines with low income countries. In an analysis of data from 12 low income countries in Asia and Africa women made up 28% of the formal labour market but accounted for just 7% of formal employment in the transport, storage and telecommunications sector (Turnbull, 2013). Although even here women are far more likely to be involved in static office jobs. Conventional transport jobs (such as working on trains, trucks, buses, in water transport or physical port operations) the proportion of women will be much lower. However, various efforts have been

made by city authorities and donors to increase women's employment in new ventures such as bus rapid transit systems.

In Kenya, in the informal transport sector, men dominate. Women comprise 13.6% of transport operators and only 5% workers, of these the majority, 62%, are employed as conductors, office and route managers (Mwangi, 2014).

The reason for the low rates of employment relates to the unsocial nature of much of the work (with long hours, working away from home, often after dark, and sometimes in unsafe environments) and to gender stereo-typing (Turnbull, 2013). Discrimination against women and the enforcement of morality can also have a strong negative impact on women's employment (Adamu, 2008)

In high income countries there has been a substantial improvement in women's participation certain professions that were previously thought of as the preserve of men. Women bus, taxi and delivery drivers, are now commonplace in the UK. Women are now trained and can take senior roles in the shipping industry, a long term exclusive preserve of men. There has also been encouragement for women to enter engineering professions in both high income and developing countries. Although there is still 'a long way to go' in developing countries it is possible to find women airline pilots in countries as diverse as India, Morocco and Tanzania. In fact it is reported that 12.4% of pilots in India are women, compared with the world average of 5.4%.⁵ Women taxi drivers can also be found in South Africa, Sierra Leone, Kenya, Botswana, Namibia and Ghana.



Fig 1. Women employed in labour-intensive road construction in Kenya, 2016

A number of countries, and donor funded programmes, have made deliberate efforts to employ women in road construction, as part of labour based construction, both as contractors and as labourers. In the French Aid (AfD) financed Roads 2000 programme, to construct rural roads, approximately 35% of the million person-days of work undertaken by 2016 went to women. (Hine and Bradbury, 2016) In DFID's Rural Access Programme in Nepal approximately 40% of the road building and maintenance groups are women. (DFID, 2017)

There is increasing awareness of developing country governments to address gender issues at a national level, in line with the Sustainable Development Goals. However, in Kenya, although the

⁵ <https://teamtroubleshooters.com/2018/11/07/women-pilots-percentage-in-india-is-twice-that-of-global-average-data/>

national policy is progressive on this score the transport sector has been slow to implement the Government's policy on gender equality. (Tanzarn, 2017)

9. Transport and induced economic growth and employment.

There is an extensive literature on the macro relationship between transport investment and economic growth. Although there is general consensus on the direction and pathways between infrastructure investment and growth there is disagreement about the economic models used and widely varying estimates of the effect.

Most major road investment is planned using conventional transport cost savings approaches, however researchers have tried to explore whether this approach is too limited and that 'wider economic benefits' occur. Earlier authors related infrastructure investment to changes in national economy. Using data from US states, Aschauer (1989), produced very large estimates for the elasticity of infrastructure to productivity of between 0.20 and 0.40. However other authors point out that 'reverse causality' could be present (i.e. richer locations may spend more on infrastructure) which may not have been taken into account. Romp and de Haan (2005) found that when reverse causation considerations were taken into account, the magnitude of estimates was approximately reduced to one third of Aschauer's initial estimates (Straub 2008).

Canning and Bennathan (2001) did a multi-country analysis and derived output elasticities with respect to paved roads. Relatively high elasticities (0.09) were found for middle income developing countries with lower returns in both high income countries (0.04) and low income developing countries (0.05).

Perrault et.al (2008) modelled the effects of increasing infrastructure spending in six African countries, (Benin, Mali, Senegal, Tanzania, Uganda and Cameroon) under different scenarios, and they found that a 20% increase in road expenditure, funded by foreign aid, will lead to a rise in GDP of between 0.7 to 1.03 % with a rise in wages of between 0.82% and 4.9%.

In recent years a number of authors have explored the effects of transport investment on the benefits of agglomeration. In this case transport investment permits towns and cities to grow larger and thus enables the economies of agglomeration to occur, whereby workers become more productive and wages rise as they gain benefits from working in a larger market (Lakshmanan, 2011)

Common sense suggests that the wider economic benefits of transport infrastructure investment will vary significantly from country to country, and investment to investment, depending upon:

- a) the likely change in transport costs that will result from the investment, in part relating to the current availability of infrastructure (- i.e. diminishing returns must set in),
- b) the economic opportunities to exploit, including the connectivity of the existing network and the availability of natural resources, markets, local skills etc.
- c) the responsiveness of business, including their ability to raise finance and the ease of recruiting necessary staff
- d) the institutional and regulatory structure of the economy.

In a systematic review of the effects of rural road investment in developing countries, it was found that there were significant increases in income, poverty reduction and agricultural output. (For example, studies carried out by Fan and colleagues (2004, 2005) in Tanzania and Uganda found benefit-cost ratios for rural road investment of 9.1 and 7.2) One of the most widespread findings

from the review, was that non-farm employment significantly increased, following rural road investment (Hine et. al. 2016).

A recent study of the effects of major highways in India has also found that while in some circumstances farm employment declined there was significant increase in non-farm employment and regular wage employment (Asian Development Bank et. al., 2018).

10. The effects on employment with changes in technology

There is currently a debate in the media as to whether new technology (including computers, the internet and robots) will have a long term negative effect on jobs. Since the days of the Luddites in the 19th Century, who destroyed industrial weaving machinery to protect their craft based jobs, there have been concerns about how technology will impact on jobs. However employment in the UK is currently at a record high. In the US the employment rate reached a record of 64.7% in 2000, however the current rate at 60.4% is above the long term average (from 1950 to 2018) of 59.3 %. Hence the evidence suggests that although technology may destroy specific jobs, new opportunities arise that will create new jobs in different areas. Common sense suggests that a flexible work force, with a diverse skill set, is most likely to take on new job opportunities as they arise.

10.1 Autonomous-driving technology

A number of firms have proved that it is possible for a car to drive itself safely between an origin and destination with the intervention of a driver. However completely autonomous taxi operations are still to be implemented in city streets, anywhere in the world. Once the legal and insurance issues are sorted out this is likely to happen in high income countries with say the next five to ten years. However there are reasons to believe that there will be many years before such services are introduced in low income countries. This is for the following reasons:

- Most of Africa and much of Middle East and Central America rely on second hand vehicles hence the new technologies will take extra time to become common in these countries.
- The economic benefits of doing without a driver are directly dependent on driver wages. Hence there is likely to be less incentive in low wage developing countries.
- Even if person doesn't drive they can still be useful to find destinations, act as caretaker, deliver goods and ensure the vehicle is properly fuelled and behaving normally. The role of a caretaker is important. In many city areas a new high value unattended car (moving or not) will inevitably attract unwarranted attention.
- There is a major issue over addresses in most developing countries. In many countries, because post is rarely delivered to houses, there is often no uniform system of street addresses and post codes. Most people would be hard pressed to provide a correct address in a standard format. Inevitably when travelling people must personally direct a taxi driver to their doorstep. If they don't know the area they will have to stop ask the assistance of local people. Although this can be overcome, it will take time and there needs to be an incentive.
- Even in city areas there are large networks of unclassified unpaved roads and tracks. These routes are not clearly defined. There are often large potholes, puddles, hidden obstacles, and occasionally building materials on the side of the road that may be a challenge for autonomous driving.

10.2 New Vehicle Power Technology

With current plans to reduce the use of carbon based fuels around the world there is likely to be a very substantial reduction in petrol and diesel vehicles. And at the moment there is significant growth in electric battery vehicles, but other technologies, for example based on hydrogen or 'electric road ways' may become popular. However major uncertainties remain over the extent to which different vehicle types will be adopted in the developing world.

The effects on employment relate to manufacturing, vehicle maintenance and infrastructure for fuelling (or charging) vehicles. It is generally recognized that electric vehicles, because of their far fewer moving parts, require far less maintenance than those with internal combustion engines. Nevertheless short courses are available for training mechanics in electric vehicle maintenance. However new maintenance opportunities will develop in looking after older electric vehicles. There are companies that will reprocess, or 'repurpose', electric batteries. One can easily envisage reprocessing plants developing across the world as electric vehicles become more common. Furthermore local mechanics will acquire equipment and develop skills to replace individual battery cells that need attention.

Currently China holds the lead with nearly 50% of the global electric vehicle market. Small numbers of electric cars are constructed in South Africa and Ethiopia, although there are complaints in South Africa that they are 'expensive' compared with traditional vehicles, and take a long time to charge.⁶

Currently India also produces a range of electric cars, however light electric vehicles (e.g. electric cycles, electric motor cycles, and electric rickshaws) are likely to gain the most traction in the near term. The Delhi government is offering a subsidy scheme for electric rickshaws and there are proposals to set up charging stations in Delhi, Jaipur and Chandigarh.⁷ India also currently produces a number of solar powered light vehicles. It seems most likely that light electric vehicles will also catch on in Africa quite soon. Coupled with solar charging stations these could be very attractive to people living in rural areas.

However with regard to the take up of new cars and heavier vehicles it seems certain that the richer Far East, Europe and rest of Asia will take the lead. It is most likely that Africa, the poorer parts of Asia and the Middle East and Central America will lag far behind in electric vehicle use. This is for a range of reasons:

- These countries rely on the import of large numbers of second hand vehicles (cars, trucks, buses and motorcycles). These vehicles will largely remain petrol and diesel for the next ten years.
- Older electric vehicles will have less range capacity (a five year old Nissan Leaf has a 130 mile -and diminishing -range) making them less attractive
- Compared with high income countries, in low income countries there is much less use of car parks (both for public and for companies) and in city centres there is lots of indiscriminate parking on streets and pavements, which will make it difficult to install suitable electric charging stations. Hence day-time charging is likely to be a major issue.
- There are huge electric grid capacity problems. It is reported that 30 of 48 countries in Sub Saharan Africa suffer blackouts on a daily basis. Although Nigeria has an installed capacity of 12 Gigawatts it is reported that on most days they are only able to generate 4 Gigawatts.⁸ The

⁶ <http://www.itnewsafrika.com/2015/02/has-load-shedding-killed-off-the-electric-car-in-africa/>

⁷ <https://enincon.com/report/electric-vehicles-market-in-india-2017/>

⁸ <https://www.usaid.gov/powerafrica/nigeria>

strong economic case for greater, more reliable capacity, has been present for many decades - yet the poor situation remains. Half of Nigeria's population is still not connected to the grid. A substantial electric car fleet would add a major extra burden. For example if half of Nigeria's 16 million car fleet were electric, and plugged into the grid (on a slow 3 kw -12 hour charge) this would draw 24 Gigawatts.

Currently a number of firms are experimenting with the production of electrically powered trucks and buses. The heavy weight of batteries to power heavy vehicles has been a constraint up until now. Electrically driven trams and trolley buses have, of course, a long history, and similar public transport vehicles are likely to be the most promising candidates for the new 'electric road ways'. However the relative demise of trams and trolleybuses over the last seventy years is a lesson that the trend towards electric vehicles can be reversed, particularly if proposed innovations are not fully self-financing. An example of what can happen, is the trolley bus system that was opened in 1975 in Kathmandu, Nepal, however because of a lack of maintenance and a lack of political and financial support, operations were finally closed in 2009.⁹

In the long term alternative power sources for trucks and buses may also become common. And for the reasons outlined above, they are most likely to first catch on in richer parts of the world. Because of the need for robust higher capacity charging systems for heavier vehicles, their introduction is likely to be heavily dependent on the installation of heavy duty charging infrastructure.

10.3 Internet Booking Systems

With the advent of smart phones a range of new internet booking services have been introduced that have had a major effect on taxi services as well as on deliveries of fast foods, groceries and general merchandise. Companies such as Uber and Amazon now have a huge global reach. Uber taxi services now operates in 720 cities in 84 countries including Ghana, Nigeria, South Africa, Kenya, Malaysia and Tanzania. In India the online transport company Ola Cabs is reported to have a network of more than a million vehicles across 169 cities, and a formal employment of 6,000 in 2017.¹⁰ Similarly Didi in China is now reported to be the World's leading ride sharing service carrying 30 million customers per day. It is reported to have 10,000 employees.¹¹ In general the prices of internet booking companies are lower than conventional taxis and appear to have created many additional jobs in taxi services.

The rise in light van delivery services is in part due to internet booking systems. There appears no clear answer as to whether internet companies such as Amazon have reduced or increased overall employment. The rise in jobs in delivery and warehousing appears to have been offset by a decline in retail jobs.

11. Suggestions for further research

The note has raised a number of related issues that warrant further investigation. Key issues identified are as follows:

- The composition and trends in transport employment. Because of the informal nature of much of the sector, and limitations of industrial classification, employment in the transport sector can be grossly under-recorded, as for example the quoted miss-match between commercial vehicle numbers and employment in road transport in China. A number of

⁹ https://en.wikipedia.org/wiki/Trolleybuses_in_Kathmandu

¹⁰ https://en.wikipedia.org/wiki/Ola_Cabs

¹¹ <https://en.wikipedia.org/wiki/DiDi>.

detailed country case studies that provided more reliable estimates, would significantly improve our understanding.

- Skill gaps and training in the transport sector. Training is critical both for a country's economic growth and to develop a high paid and flexible workforce. Country case studies could look into where the gaps are and identify what types of training is required.
- How do different types of transport infrastructure impact on employment, and what are the economic consequences? Some work has been done comparing the employment consequences of conventional with labour intensive approaches in Sub-Saharan Africa. And in the US, and the Middle East/North Africa comparisons have been made between investment in roads, rail and public transport. This work could be up-dated and broadened covering case studies in a range of wider countries.
- Changes in transport technology and implications for employment. Significant changes in the patterns of employment, because of new technology are now taking place in high and middle income countries. Furthermore the advent of driverless vehicles is likely to take place within a decade. There will clearly be differences in the speed of implementation in different countries. How will these trends playout across the developing world?

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