DISRUPTIVE TRANSPORT TECHNOLOGIES: IS SOUTH AND SOUTHERN AFRICA READY?

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ABSTRACT

E-hailing services have been arguably labelled as a disruptive transport technology, if assessed relative to certain role-players and aspects in the transport sector. Compared to private vehicle use and ownership, it has gained a foothold in the low-end market and established a completely new market of previous non-public transport users, which might encourage current and potential vehicle owners to sell or halt a purchase of a vehicle. This paper examines the extent to which e-hailing services may reduce vehicle ownership in South Africa. The analysis indicated that for each road user, using a specific vehicle travelling a predefined distance per year, there is a travelling distance threshold which if exceeded makes financially more sense to keep using their vehicle or sell and make use of e-hailing services if this threshold kilometres is not achieved. The paper finds that South African cities are spatially challenged, and it is not envisaged that e-hailing services will have a profound impact on vehicle ownership in South Africa in the short to medium term.

1. INTRODUCTION

For centuries, technological innovation has had many impacts on the development and interaction between human and machine. More specifically, technological innovation has been a contributing factor to the efficiency and effectiveness of applications, providing numerous benefits to its users. However, technology has the power to be disruptive. The term disruptive technology was first mentioned by Clayton M. Christensen and his collaborators in 1995 (Bower & Christensen, 1995). Disruptive technology or disruptive innovation refers to an enhancement in product or service offerings, bringing forward a new value network and market, at the displacement of inferior established technology. Uber and Lyft are examples of Transportation Networking Companies (TNC's) or commonly known in South Africa as e-hailing service providers. Uber and Lyft are have become internationally infamous and are commonly referred to as disruptive technologies. Uber has the dominant market share for e-hailing services in South Africa and therefore chosen for a brief analysis. Uber provides mobility as a service via the use of smart devices, connecting the supply of drivers seeking fares and the demand of commuters seeking lifts. These companies act as a technology platform between the parties, using application software to map and connect users of their applications, facilitating the trade as a third-party administrator.

Transport mode decisions for commuters are subject to both monetary and non-monetary factors, and with a change in value network and new entrants, we are likely to see differences in the value commuters place on transport. Travel time was the most influential factor regarding South African commuters' choice of transport, according to the findings of

the National Household Travel Survey. Nationally, 32.6% of households stated that travel time was the primary determinant, this was followed by travel cost at 26.1% and flexibility at 9.2%. Looking at the relationship between e-hailing services and potential impact on vehicle ownership, Lyft data from American and Canadian users accounted for approximately 375.5 million rides in 2017, and that 250 000 American and Canadian commuters chose to sell their vehicles that year as a result of their services (Iqbal, 2019). Although a bold statement, other studies hint that this may not be as farfetched internationally. In North America, surveys have found that on average, 41% of car sharing users chose to halt the purchase of a light motor vehicle as a result of using the services provided by the new mobility platforms offered today (Martin et al., 2010). It is, however, unknown to what extent e-hailing services may reduce vehicle ownership in South Africa.

The paper is structured in five sections. Following the introduction, Section 2 provides a brief review of the implications that e-hailing services have had in the transport sector. Section 3 describes the methodology of using travel diaries and cost analysis to assess if e-hailing services may reduce vehicle ownership in South Africa. This is followed by the cost analysis of forecast annual travel of participants making use of travel through private vehicles and Uber. The paper concludes with a recommendation regarding the potential e-hailing services may have on vehicle owners and potential vehicle owners.

2. IMPLICATIONS OF E-HAILING SERVICES ON THE TRANSPORT SECTOR

Since the implementation of e-hailing services, especially Uber, there have been various responses regarding the operations and legalities across countries, with some countries banning the application entirely (Dickinson, 2019). E-hailing services have been argued to be disruptors to the meter taxi market, by creating additional value to its commuters at the displacement of existing alternatives. The value creation favoured by commuters consists of both monetary and non-monetary benefits like convenience, safety, availability and reliability. However, there have been violent advances against Uber and Taxify drivers by other taxi operators in South Africa, claiming unfair competition, with calls for government to regulate the service and make amendments to the National Land Transport Act (Ritchie, 2019).

A study conducted in Austin, Texas, by Clewlow and Mishra (2017) concluded, that apart from the abovementioned societal and policy issues, e-hailing services may result in the reduction in private vehicle usage and possibly ownership. In this study, e-hailing services were paused due to local ordinance, and the results found that 41% of respondents reverted to their automobiles to fill the gap left by e-hailing services. Furthermore, 9% of respondents indicated that they bought an additional vehicle to meet their travel needs. A study done by the American Public Transportation Association (2016), which compared the car ownership for households who use e-hailing services and those who do not, found that those who do not use e-hailing services own on average 1.5 cars per household. When compared to those that do make use of the service, commuters owned 1.05 cars per household. This indicates that on average, e-hailing users own less vehicles. A further study by Stanley (2016) confirmed this relationship between vehicle ownership and e-hailing services, indicated that 10% of millennial Uber riders within the United States halted the purchase of a private vehicle since the introduction of e-hailing services.

Furthermore, looking at other implications, e-hailing services have the potential to reduce parking demand and congestion, but they also have the potential to reduce government revenue generation. A study done by Henao and Marshall (2019) suggested that 26.4% of e-hailing users would have driven and required a parking space if e-hailing was

unavailable. The study found that e-hailing has the potential to reduce parking demand, especially near recreational land use areas like airports, events and restaurants. Governments can potentially lose out on revenue generated by driver's license registrations, vehicle registrations and traffic violations. However, these studies have been undertaken within first world countries, with greater utilisation of public transport and less dispersed land use patterns.

3. METHODOLOGY

In order to assess to what extent e-hailing services may influence vehicle ownership in South Africa, an analysis was undertaken to assess the differences in commuting costs and travel times when comparing private vehicle usage and Uber usage. Information of daily commuting trips undertaken by nine participants using their personal vehicles was collected through a travel diary during the week 11th to the 16th March 2019. This period represents a normal work week for the participants and does not include weekend trips. The total vehicle operating cost for each trip was calculated by using a rate per kilometre derived from the Automobile Association of South Africa's vehicle rate calculator for each participant. The road users were also asked to note the cost and travel time for each trip they undertook through the Uber application. These two cost and time calculations were then compared to assess if it is financially better for the road users to keep on using their own personal vehicle or alternatively sell their vehicle and only make use of e-hailing services for their normal weekly commute. The travel dairy logged each trips' start time, origin, destination, distance and end time. Each participant also provided details of the characteristics and annual usage of their vehicle that was used during the week's commuting trips, which was recorded into the Automobile Association of South Africa's website (AASA, 2019). The fuel price was R14.23 per litre of petrol during the period of analysis. The AASA site provided the average running costs, average fixed costs and total transport costs of each participant's vehicle on a per kilometre basis. This per kilometre cost rates was then multiplied by the distance of each trip travelled during the week to assess the full transport cost of each trip.

Table 1: Participant vehicle characteristics

	Participant 1	**Participant 2**	**Participant 3**	**Participant 4**	**Participant 5**	**Participant 6**	**Participant 7**	**Participant 8**	**Participant 9**
Vehicle	**Ford**	**Ford**	**Mercedes**	**Chevrolet**	**VW**	**Chevrolet**	**Hyundai**	**Kia**	**Hyundai**
Model	Fiesta	Figo	C180	Utility	Polo	Cruz	Atos	Rio	Getz
Engine (L)	1.4	1.4	2	1.4	1.6	1.6	1.1	1.2	1.5
Purchase price	R120 000	R120 000	R550 000	R125 000	R150 000	R220 000	R60 000	R180 000	R120 000
Year of registration	2011	2011	2011	2012	2007	2014	2010	2014	2009
Fuel price	R14.23	R14.23	R14.23	R14.23	R14.23	R14.23	R14.23	R14.23	R14.23
Estimated distance vehicle travel per annum (km)	10 000	10 000	15 000	15 000	10 000	10 000	10 000	15 000	15 000
Average running cost per kilometre	R1.37	R1.37	R1.52	R1.37	R1.52	R1.52	R1.2	R1.2	R1.37
Average fixed cost per kilometre	R2.75	R2.28	R5.9	R2.75	R2.43	3.51	R2.35	R3.71	R2.28
Total transport cost per kilometre	R4.12	R3.65	R7.42	R4.12	R3.95	R5.03	R3.55	R4.91	R3.65
Average Uber cost per kilometre	R10.45	R9.345	R9.309	R9.908	11.29	R12.00	R11.56	R8.84	R8.43

Sources: (Automobile Association of South Africa, 2019) and (Uber, 2019)

Additionally, the road users were asked to report their wait time, travel cost and travel time of each trip by using the Uber application. An average cost per kilometre for all Uber trips

was then calculated. It is notable that the calculations are based on vehicles operating costs and non-inclusive of parking fees. Table 1 above shows the characteristics of the vehicle that each participant used, and the calculated transport costs per kilometre for travel with the participants' private vehicle and Uber.

These two cost and time calculations were then compared, on a weekly and annual basis, to assess if it's more economical for the participants to keep on using their own personal vehicle or alternatively sell their vehicle and only make use of e-hailing services for their normal weekly commute. This was done to determine at which point or number of kilometres per week/annum of travel is it more economically viable for the participants to make use of Ubers' services and sell their vehicle, or to keep on using their personal vehicles.

4. FINDINGS

The participants' weekly travel ranged between 45-277 kilometres (See Table 2). The difference in price ranged between 1.25 to 3.26 times more expensive per kilometre to use Uber when compared to the participants' private vehicle costs, with the variance caused mainly by the total fixed cost of each vehicle. Travel time data indicated that on average, an Uber would take 5.6 minutes longer from origin to destination.

Table 2: Travel diary calculations and comparisons

Participant	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Participant 7	Participant 8	Participant 9
Weekly distance (km)	85,4	116	257	214	44,5	53,2	106	222	277
Projected annual distance (km)	4440,8	6052,8	13358,8	11117,6	2314	2766,4	5506,8	11518	14378
Average running cost per annum	R6 083	R8 292	R20 305	R15 231	R3 517	R4 204	R6 606	R13 821	R19 697
Average fixed cost per annum	R12 212	R13 800	R78 816	R30 573	R5 623	R9 710	R12 940	R42 731	R32 781
Total transport cost per annum	R18 296	R22 092	R99 122	R45 804	R9 140	R13 914	R19 549	R56 553	R52 479
Uber total transport cost per annum	R46 450	R56 565	R124 359	R110 154	R26 141	R33 205	R63 667	R101 818	R121 333
Difference	R28 153	R34 472	R25 237	R64 349	R17 001	R19 290	R44 118	R45 265	R68 853
Weekly threshold kilometres	33,6	45,5	204,8	88,9	15,6	22,3	32,5	123,0	119,6
Annual threshold kilometres	1749,3	2365,4	10647,8	4623,0	809,1	1159,3	1690,9	6397,5	6219,4
Weekly travel time private (minutes)	169	224	488	348	171	126	222	322	341
Weekly travel time UBER (minutes)	287	314	576	457	234	179	315	347	376
Time Difference (minutes)	118	90	88	109	63	53	93	25	35

The findings indicated that there is a point in each vehicles weekly or annual usage where it will be more economical for a road user to sell their vehicle and make use of Uber. Commuters driving below this threshold level will experience cost savings if they sell their vehicle in favour of e-hailing services, especially in terms of the vehicles total fixed cost per kilometre. All participants in this analysis experience cost savings using their own vehicle and due to the difference in weekly travel time, it is unlikely that the participants will substitute their weekly travel with Uber's mobility services.

5. CONCLUSION

This paper set out to examine if e-hailing services, with specific reference to Uber, may reduce vehicle ownership in South Africa. The analysis indicated that for each road user, using a specific vehicle travelling a predefined distance per year, there is a travelling distance threshold which if exceeded makes more financial sense to keep using set vehicle or sell and make use of e-hailing services if this threshold kilometres is not achieved.

South African cities are spatially challenged, accredited to urban sprawl and former apartheid policies that have created large spatial disparities which pose challenges to the lower income populations. E-hailing services may encourage reduced vehicle ownership to a niche population, its net effect will likely contribute to traffic growth, as the availability of automobiles becomes greater, the network is likely to obtain additional kilometres travelled created by deadhead kilometres. Majority of commuters have considerable travel for daily employment, with high income commuters heavily reliant on low occupancy private automobiles and low-income commuters heavily reliant on mass public transport for mobility. In the short term, South Africa will see rising usage of e-hailing services, however, the scale of this usage will be catered mainly by the middle to high income population and due to the large spatial disparities experienced in the country, it is unlikely commuters will reduce their vehicle ownership. As travel time and travel cost are the primary two determinants in South African commuter choice, along with the above analysis, it is unlikely commuters' will reduce their vehicle ownership. Commuters who live nearby their frequent destinations, below their threshold travel will experience reduced transport costs by trading their vehicle in and switching to e-hailing services as their primary mode of transport.

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