

# **The Improvement of the Operational efficiencies in the Minibus Taxis Industry :A Work in Progress System Dynamics Approach.**

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## **Abstract**

The Minibus Taxi Industry is plagued with violence, un-roadworthy and unsafe vehicles. Although the government has made numerous efforts to formalize and regulate the sector, the industry remains unregulated and unofficial. As the industry is not properly integrated into South Africa's public transportation infrastructure, this impacts the operational performance of minibus taxis.

Nowadays, there is intense competition between those with operating licenses and those without. To ensure that the industry functions in accordance with South African law and to prevent organized violence within the industry that endangers commuters, substantial police action is required. This paper presents the work-in-progress of a study that aims to use Systems Dynamics as a tool to advise on what can be done to formalise and regulate the minibus taxi industry in order for it to participate fully and formally in the country's public transport system in order to improve the operational performance of the industry.

## **1.Introduction**

### **The History of the Minibus Taxi Industry**

The minibus taxis could only operate lawfully due to a loophole in the Road Transport Act of South Africa's passenger transport from 1977. The National Transport Commission (NTC) and eleven local road transportation boards were opposed to the industry, making it difficult to secure road carrier permits. The majority of operators are now operating illegally (Colleen, 1990).

Those with operating licences competed fiercely against those without them in a market that was flourishing and expanding rapidly. The entry of minibus taxis into the market had a profound effect on the bus and rail industries (Colleen, 1990). This was due to a decline in ridership. Initially, the bus industry responded to taxi competition by rejecting taxi permit applications and producing midibuses ( 24-34 seater).

The minibus taxi sector has also been stigmatised, and the negative connotations have always eclipsed the positive contributions of the industry to the South African economy (Mashamaite, 2013) .This is due to violence and hazardous and unroadworthy automobiles. Nonetheless, this is not surprising considering the violence the sector encountered at its inception and its lack of formal integration into the South African Transport System.

In 1983, a government commission advocated removing all taxis from the road, but the minibus taxis' competitors soon recognised that this would not occur and adapted their operations (Colleen, 1990).

### **The Taxi Recapitalisation Policy (TRP)**

1999 saw the formulation of the TRP with the purpose of formalising and regulating the minibus taxi business. The government implemented the TRP in 2005, bringing a ray of hope to taxi passengers who had been victims of taxi violence and traffic accidents. (Mashamaite, 2013)

The TRP aims to introduce safety regulations for New Taxi Vehicles, eliminate existing vehicles, regulate the minibus cab business effectively, strengthen public transport law enforcement, and empower the taxi industry. (Mashamaite, 2013) Years after the program's inception, however, practically little progress was observed. The taxi sector was still plagued by violence, and some taxis were not roadworthy. Nevertheless, the industry is mostly unregulated and informal. Although making significant changes, the TRP was unable to accomplish all of its objectives (Mashamaite, 2013).

The purpose of this paper is to utilise Systems Dynamics as a tool to provide recommendations on what can be done to formalise and regulate the minibus taxi business so that it can participate completely and formally in the country's public transport system and so improve its operational performance.

## 2. Methodology

The methodology employed in this work is the high-level modelling procedure typically employed when developing a model of system dynamics. The table below details the modelling process at a high level, as documented by the Eskom Research, Testing, and Development Centre.

### High Level Modelling Process

Problem Articulation	<ul style="list-style-type: none"> <li>• Focusing Question</li> <li>• Modelling time frame</li> <li>• Reference Modes</li> <li>• Literature Review</li> </ul>
Problem Contextualisation	<ul style="list-style-type: none"> <li>• Causal Loop Diagram</li> <li>• Model boundary chart</li> <li>• Behaviour over time</li> </ul>
Systems Analysis	<ul style="list-style-type: none"> <li>• Data mining</li> <li>• Preliminary calculations</li> </ul>
Model Development	<ul style="list-style-type: none"> <li>• Model Structure</li> </ul>
Validation	<ul style="list-style-type: none"> <li>• Scenario and sensitivity analysis</li> <li>• Work group meetings with subject matter experts</li> </ul>

	<ul style="list-style-type: none"> <li>• Theoretical and empirical consistency</li> </ul>
Insights	<ul style="list-style-type: none"> <li>• Policy design and evaluation</li> <li>• Recommendations</li> </ul>

Source : Eskom Research, Testing and Development (2019)

## 2.1 Problem Articulation

The Gauteng White Paper on Transport Policy from 1997 includes LOS monitoring as one of its core policy areas (Cloete, 2006). In light of the actual level of service supply in Gauteng Province, the objective of this study was to establish minimum and target public transit LOS. (Cloete, 2006) ' The introduction of public transportation services was prioritised in locations with the highest need and the greatest potential for system improvement.

### Current Performance of Minibus Taxis

The Key performance indicators regarding public transportation internationally have been recorded as:

- Availability and accessibility of public transport services;
- Service capacity
- Frequency of services
- Cost of public transportation ; and
- Safety and security issues.

The above indicators provide a mechanism to evaluate and screen the performance of the public transport system.

### Ideal Minimum target level of Service

Parameter	KPI	Level of Service
Availability	Hours of service	18
Accessibility	Walking distance to public transport	750 mm
Service capacity	%Capacity utilisation ( Volume to capacity ratio)	1.00
Frequency	I. Number of departures per hour in peal period. ii. Number of departures per hour off peak. iii. Average waiting time in peak period	i.12 ii. 4 iii. 5 min
Cost of public transportation	Percentage of income spent on public transport	10%
Safety	Maximum age of vehicles in fleet	10 years
Security	Number of security officers per 1000 peak hour passengers	1

Regularly, provisional and national travel surveys are conducted to monitor passenger satisfaction. The following tables displays the Satisfaction with Service Attributes of Minibus Taxis. Gauteng Household Travel Survey 2019/20 (GDPTRW 2019/20) was the source of the data.

Table 2 below shows the reasons that respondents disclosed for not using minibus taxis. The dominant reasons related to a) taxis are too expensive (30%) and b) overcrowding (15%).

Attributes of taxi service	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied
Behaviour of the taxi drivers to passengers	17.4	19.8	35.9	21.6	5.4
Distance of the taxi stop from home	11.2	22.6	25.1	30.5	10.7
Distance of the taxi stop from work	17.2	16.6	31.7	24.1	10.3
Facilities at the taxi ranks or stops	15.8	11.7	35.8	30.8	5.8
Level of crowding in the taxi	18.2	18.2	54.5	9.1	0.0
Off-peak frequency of taxis	40.0	0.0	20.0	40.0	0.0
Peak-period frequency of taxis	27.6	15.8	34.2	19.7	2.6
Perceived accidents of the taxi	0.0	100.0	0.0	0.0	0.0
Punctuality of taxis	0.0	0.0	0.0	0.0	100.0
Security in the taxi	100.0	0.0	0.0	0.0	0.0
Security on walk to taxi	38.5	23.1	30.8	7.7	0.0
Waiting time for taxis	0.0	50.0	50.0	0.0	0.0
% Total	16.6	20.0	34.2	23.0	6.3

Table 2: Attributes of taxi service Source (GDPTRW , 2020)

The majority of taxi consumers were dissatisfied with taxi services, while some were unable to choose between good and bad features. 37% of unsatisfied users are unhappy with the conduct of taxi drivers, compared to 27% of those who have no issues with taxi driver conduct. Over 35% of respondents, however, were comfortable with the distance between their homes and the taxi stop (Gauteng Province , 2020).

Table 3 below shows the reasons given by public transport users for not using the taxis.

Reasons for not using taxis	Number people	Weighted population size	% of population
Taxi too expensive	61	12 045	37.2%
Taxis are crowded	23	4 541	14.0%
Taxi stop too far from home	11	2 172	6.7%
Taxis don't go where needed	11	2 172	6.7%
Taxi not available at the right time	10	1 975	6.1%
Taxi not available often enough	10	1 975	6.1%
Taxis always late	10	1 975	6.1%
Taxis not roadworthy	8	1 580	4.9%
No taxi available	6	1 185	3.7%
Taxi stop too far from destination	6	1 185	3.7%
Prefer train	4	790	2.4%
Prefer private transport	2	395	1.2%
Too much crime or dangerous	1	197	0.6%
Travel time too long or too slow	1	197	0.6%
Total	164	32 384	100.0%

Table 3 : Reasons for not using taxi Source (GDPTRW , 2020)

### Summary of results from The Gauteng Household Travel Survey 2019/20 ( GDPTRW 2019/20)

The Household Travel survey research covers household and demographic characteristics, travel patterns, trip features, and user opinions and attitudes towards various transport modes. The full datasets for third-party access will be made accessible to enable planners and academics to use them.

#### Notable findings:

Three-person homes have become two-person households on average. Increased single-person homes. Non-car households rose. Commuting consumes much of household income. Minibus taxi and private car demand keeps rising. Private cars split motorised share. Employed households have fewer trips (Gauteng Province , 2020). Minibus taxis dominate public transport. Over 20 years, average travel time has quadrupled and rose 17% from 2014. Walking dominates commuting. Increased public transport access time. 30% of workers work less than five days a week (Gauteng Province , 2020). Most households thought higher-capacity public transport was inaccessible and unavailable, creating latent demand. Reduced trips, employed households, and their morning peak departure times show that travel demand is sensitive to travel time and cost. In contrast to 2014, the West Rand-CoJ corridor had the greatest travel demand density of all inter-municipal corridors (Gauteng Province , 2020).

The systems dynamics model is aimed at analysing the whole minibus taxi system and advising on what needs to be done to :

- To promote integration the Mini-Bus Taxi Industry into the mainstream public transport System
- To promote the speedy regulation of the mini-bus taxi industry in the province.
- To promote modernization of the mini-bus taxi industry
- To promote road safety rule of law and reduce fatalities in the province.
- To promote the formalization, transformation and economic empowerment of the mini-bus taxi industry in the province
- To promote the fight against fraud and corruption between and amongst the government officials and the mini-bus taxi industry

## **2.2 Problem Contextualisation**

### **Causal Loop Diagram (CLD)**

The Growth and Underinvestment and Tragedy of the common are the ones that commonly describe the minibus taxi transport system.

#### **The Growth and Underinvestment System Archetype**

The Growth and Underinvestment archetype links performance and growth with investment. The archetype demonstrates that low performance standards can lead to a decrease in organisational resource investment. Less performance equals less growth (Kim, 2008).

It is also possible to lower performance standards to justify underinvestment. In general, lowering performance standards will result in decreased performance (Kim, 2008).

Managers must focus on growth potential and foster that growth by funding resources related to performance. Focus on long-term expansion and ensure that the performance standards are adequate to accommodate this expansion. If not, procure the necessary investment in resources to meet the increased demand (Kim, 2008).

#### **The Tragedy of the Commons System Archetype**

The Tragedy of the Commons archetype describes a situation in which several individuals, groups, or organisations utilise a finite set of resources in an unsystematic manner (Kim, 2008).

Individuals frequently use the resources for their own purposes, resulting in short-term profits or success. In the long run, there are decreasing returns and resource depletion (Kim, 2008).

Managers must address this issue by instituting a systematic strategy to resource allocation and distribution. To avoid a dictatorial appearance, it is best to include others in the rule-making process. Also, it aids in educating people about the administration and handling of the resources (Kim, 2008).

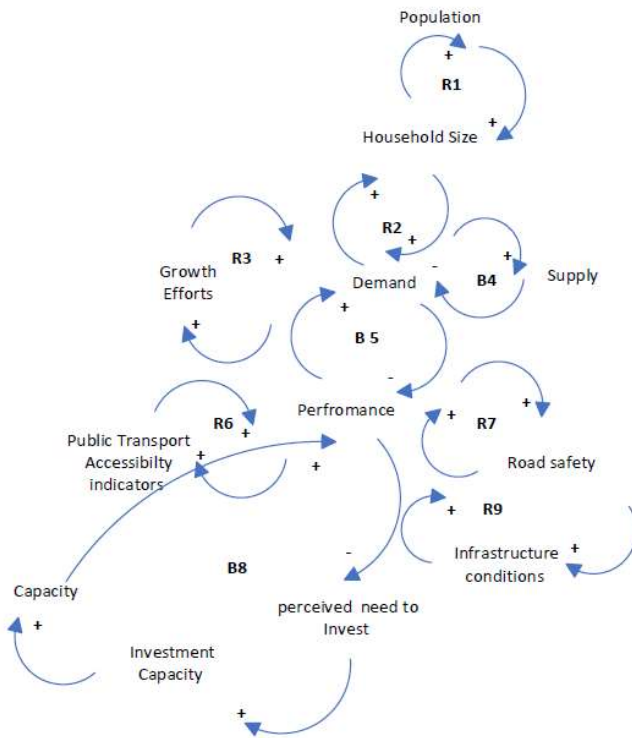
#### **The archetypes were utilised so as to:**

Identify interlocking behaviour patterns

Identify perceptual delays

Determine and reduce acquisition delays

- Predict associated capability gaps
- Prevent the occurrence of self-fulfilling prophecies
- Examine for diminishing performance standards
- Explore different inputs



**Figure 1: Minibus Taxi Industry Network Specific Variables CLD**





Development Areas xiii. Other major strategic development initiatives for instance Tambo Springs, Lanseria, etc.

### **3. Conclusion**

The application of the system dynamics methodology in conjunction with the utilisation of iSee STELLA will be used to develop a model that is able to provide insightful forecasts regarding the future of the mini-bus taxi industry in South Africa. As the work continues, the other components of the high-level modelling process will eventually result in a model. This model will be used to inform on what strategies should be put into place in order to successfully bring the industry formally into the mainstream transportation sector alongside bus and rail.

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