

## Modernisation in Automotive Technology and Performance of Informal Sector Mechanics in Kenya

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### Abstract

In Kenya, repairs to motor vehicles are undertaken in either of two places: dealer (formal) garages and *Jua Kali* (informal) garages. Mechanics in the informal sector perform the bulk of the repairs yet most of them do not have the right equipment and many have had no formal education in repairs of motor vehicles. With changes in motor vehicle technology, the mechanics have not kept up with the changes and this has had a negative impact on the quality of the repairs they undertake on motor vehicles. This calls for development of new policies and incentives for the informal sector that can take care of and respond to technological changes.

**Keywords:** automotive, informal sector, mechanics, modernisation, technology.

## 1 Introduction

Due to the rapid population growth and lack of an equivalent growth in the formal industrial, commercial and public sectors, many youth in Kenya have had to look for employment in the informal (popularly known as *Jua Kali*) sector (Republic of Kenya, 1994; King, 1996). The *Jua Kali* sector is characterised by it being labour intensive, requiring very little capital and mostly in the open air (and hence the name *Jua Kali* which is 'hot sun' in Kiswahili). However, the quality of services and goods produced in the *Jua Kali* sector are usually much less than the equivalent from the formal sector and the charges (cost) for the same are correspondingly less. Despite this, the Kenya government has noted that the *Jua Kali* sector has the potential of being a major contributor to the economic development and technological advancement of the country (Republic of Kenya, 1989).

In the automotive industry, the repair of motor vehicles is one activity that the *Jua Kali* sector has come up as an alternative to the formal (dealer) sector. With the rapid changes in automotive technology, there is concern as to how the informal sector has coped especially in the quality of work considering the unique characteristics of the sector. Though the basic design of motor vehicles has remained the same for many years, there is now greater use of electrical and electronic controls of automotive engines and systems (Probst, 1989; King, 1993; Hillier, 1997). The increased use of electrical and electronic systems means two things for the automotive mechanic; first, all service mechanics need skills in electrical diagnosis and repair if they are going to be effective regardless of their service speciality. Second, mechanics with such greater skills will command greater financial rewards (King, 1993).

The changes in automotive technology have been so rapid that mechanics need training every few years yet many mechanics never go for on-the-job training after they have started working. Moreover, many training institutions (especially government-funded ones) have not modernised their curricula and facilities so there have been a lot of complaints about mismatch between the products of the education systems and the labour market demands (Kerre, 2000). A study was therefore undertaken to investigate the extent to which modern

automotive technology is affecting the operation and management of the automotive industry within the informal sector.

The objectives of the study were:

- To find out if there is any significant difference between the frequency of the services done by *Jua Kali* mechanics on modern vehicles and those done by the dealers' garages.
- To find out if there is any significant difference between the tools available in the *Jua Kali* garages and those recommended by the vehicle manufacturers
- To find out if there is any correlation between the professional qualifications of the workshop owners/managers and those of the *Jua Kali* mechanics.

## 2 Methodology

The study was conducted in Eldoret, a fast-growing town in Rift Valley Province of Kenya. Most formal industries in the town collapsed in the 1990s and it is believed that people who lost their jobs in formal industries went to the informal sector (including repair of motor vehicles). Also with a state university, international airport, military barracks, and middle-level training institutions located within and around, the town has attracted people from all over Kenya who come looking for employment. In the event that formal employment is not forthcoming, there are high chances that some of them end up in the *Jua Kali* sector.

The population studied consisted of all garages owners/managers and mechanics that deal with repairs and servicing of petrol engines. A sample was chosen by use of systematic sampling methods from a population of registered garages. In addition, some garages from the same sample were sampled for interviews and participatory observations. The research instruments used in the study included a validated self-administered questionnaire, interviews and direct observation/participation from day to day contacts with the mechanics, customers and the public.

Descriptive statistics, chi-square, and Spearman rank correlation procedures of the SPSS® computer package were used to analyse the quantifiable answers obtained from the questionnaires. Qualitative analysis of the open-ended questions was also used in the discussion of the results and in drawing the concluding remarks of the study since statistical analysis alone may not always answer the question 'why' (Otieno, 1995).

## 3 Results and Discussion

The subjects were 73 garages with a total of 73 garage owners/managers and 402 mechanics; 20 of these garages were used for interviews and participatory sampling.

### 3.1 Descriptive analysis

It was found that all garage owners/managers have had some form of formal education (Table 3.1.1). This is because the nature of activities in garages requires some technical understanding and so it is imperative that the owners/managers have some basic education.

Table 3.1.1: Highest level of education of garage owners/managers

<i>Level</i>	<i>Number</i>	<i>%</i>
Primary school	36	49.3
Secondary school	33	45.2
University	3	4.1
Total	72	100.0

In contrast, the majority of the garage owners/managers do not have professional qualifications (Table 3.1.2). This seems to be because those with formal training normally secure jobs in the formal sector and it is only after retirement from the formal sector that some venture into the *Jua Kali* sector. Also there was perception by some of the owners/managers (and even some members of the public) that the curricula in technical training institutions are outdated, and hence not relevant to the job market.

Table 3.1.2: Highest professional qualification of garage owners/managers

<i>Level</i>	<i>Number</i>	<i>%</i>
Trained on-the-job	44	60.2
Trade test certificate	13	17.8
Craft certificate	8	11.0
Diploma	4	5.5
Degree	3	4.1
Total	72	100.0

A majority of the *Jua Kali* garages were located in temporary workshops (Table 3.1.3). This could be attributed to the ownership of the plots within town in that most *Jua Kali* garages rent the places they are using and therefore cannot make permanent improvements on the plots.

Table 3.1.3: Nature of workshops

<i>Nature</i>	<i>Number</i>	<i>%</i>
Temporary	52	70.0
Permanent	19	26.0
Total	71	100.0

Majority of the *Jua Kali* garages were found in town (Table 3.1.4). This is because inside the town is where most customers are found and also where supporting businesses (spare part shops, petrol stations, etc.) are found. Those garages located in the outskirts of town are to be found in the densely populated estates and this is because the high rate of unemployment in such estates forces many people to start *Jua Kali* businesses including garages.

Table 3.1.4: Location of workshops

<i>Location</i>	<i>Number</i>	<i>%</i>
In-town	62	84.9
In outskirts	11	15.1
Total	73	100.0

Many *Jua Kali* garages have been in place for less than five years (Table 3.1.5). There are three possible reasons for this. One is that the economy of Kenya in general has not been doing well in the last decade and many businesses in the formal sector have been shutting down forcing many people to venture into the *Jua Kali* sector. Secondly, most *Jua Kali* garages rent the premises they are in and once the plot-owner develops the plot, the garages have to be relocated because most buildings being put up have no provision for garages (they are mainly shops and offices). Thirdly, because of the unfavourable economic condition in the country, many people keep on changing business as they look for something that they hope will give better income.

On the other hand, there were also many garages that have been in existence for over 20 years (Table 3.1.5). Majority of these businesses were in permanent premises and had tools and equipment which they had acquired over the years in order to maintain or increase the number of their customers.

Table 3.1.5: Age of business

<i>Time</i>	<i>Number</i>	<i>%</i>
Less than 5 years	22	30.1
6 – 10 years	14	19.2
11 – 15 years	11	15.1
16 – 20 years	7	9.6
More than 20 years	19	26.0
Total	73	100.0

Most garages handled less than five cars a day (Table 3.1.6). This is due to their capacity in manpower and space. It was found that plot owners don't restrict the numbers or kinds of tenants in their plots so long as one can find space and is ready to pay rent. This makes most garages to be congested and restricts the number of cars at any given time and also the number of mechanics (Table 3.1.7).

Table 3.1.6: Number of cars handed per day

<i>Number per day</i>	<i>Number</i>	<i>%</i>
1 – 2 cars	10	13.7
3 – 4 cars	32	43.8
Over 4 cars	22	30.1
Total	64	100.0

Table 3.1.7: Number of mechanics in garages

<i>No. of Mechanics</i>	<i>No. of garages</i>	<i>%</i>
Below 6	31	42.5
6 – 10	36	49.3
11 – 15	2	2.7
Over 15	1	1.4
Total	71	100.0

It was found that the majority of the *Jua Kali* garages does both minor services and major services (Table 3.1.8). This is because the services involve routine maintenance and schedule services which in most cases are done upon the requests of customers. There is nothing much that requires specialised personnel and equipment and anybody with basic automotive knowledge can do. It involves visual checks, adjustments and component replacement (i.e. changing oil, fuel and oil filter, spark plugs, brake pads and shoes).

Table 3.1.8: Services offered by garages

<i>Type of service</i>	<i>Number</i>	<i>%*</i>
Minor	57	78.1
Major	55	75.3
Engine overhaul	44	60.3
Auto-electrical	36	49.3

\* These are percentages of all the garages sampled.

Majority of the mechanics in *Jua Kali* garages are male (Table 3.1.9). This is due to the public perception of automotive industry in general and the nature of working environment in the *Jua Kali* garages in particular. Lack of tools and equipment means that one uses a lot of extra energy and spends long hours in scorching sun and women may not like this. Lack of role models for women in the automotive industry has also led to many girls and women shunning it (Kerre, 1999).

Table 3.1.9: Gender of mechanics

<i>Nature</i>	<i>Number</i>	<i>%</i>
Male	366	91.0
Female	36	9.0
Total	402	100.0

### 3.2 Statistical analysis

Chi-square analysis was used as the general frame work for evaluating whether there were significant differences between the services offered, and tools and equipment of the *Jua Kali* garages and dealer garages recognised by the manufacturers of the vehicles. The expected conditions are the activities done in dealer garages and the observed are those recorded in the questionnaire (i.e. from *Jua Kali* garages).

Spearman rank correlation was used to determine whether there is degree of correlation between the professional qualifications of workshop owners/managers and those of their mechanics. This method is useful because the quantitative measure of professional qualifications cannot be fixed but individuals in the groups can be arranged in order thereby obtaining for each group individual number indicating rank.

Table 3.2.1 shows the typical observed frequencies ( $f_o$ ) and expected frequencies ( $f_e$ ) for services of the fuel and ignition system for 'regular' and 'not regular' service. ['Regular' means that the service is done routinely when a vehicle is brought to the garage and 'Not regular' means it is not done as a routine service. It is assumed that statistically these two events are equally likely.]. It is seen from Table 3.2.1 that except for ignition timing and firing order, there is significant difference between the frequencies at which *Jua Kali* mechanics and dealer garages do services of fuel and ignition systems of modern cars.

Table 3.2.1: Chi-square analysis of services of modern cars

System	Regular		Not regular		d.f.	$\chi^2_{ob}$	Significance
	$f_o$	$f_e$	$f_o$	$f_e$			
Fuel pump operation	6	33.5	61	33.5	1	45.149	0.000
Fuel pressure measurement	8	33.0	58	33.5	1	37.879	0.000
Electronic control unit	7	33.5	60	33.5	1	41.925	0.000
Ignition timing & firing order	32	33.5	35	33.5	1	0.134	0.714
Ignition coil supply voltage	13	33.5	54	33.5	1	25.090	0.000
Distributor sensor	16	33.5	51	33.5	1	18.284	0.000
Distributor amplifier	11	33.0	55	33.0	1	29.333	0.000

Table 3.2.2 shows the typical observed frequencies ( $f_o$ ) and expected frequencies ( $f_e$ ) for presence of hand tools. ['Yes' means that the hand tool is present and 'No' means it is not available. It is assumed that statistically these two events are equally likely.] Table 3.2.2 shows that, except for piston ring compressor, *Jua Kali* mechanics do not have the hand tools recommended by vehicle manufacturers. The lack of these tools is due to their prices because they are relatively expensive compared to most common hand tools. This lack of proper tools indicates that the quality of work done by the *Jua Kali* mechanics in the areas where these tools are supposed to be used is below standard.

Table 3.2.2: Chi-square analysis of special hand tools

Hand tool	Yes		No		Total	d.f.	$\chi^2_{ob}$	Significance
	$f_o$	$f_e$	$f_o$	$f_e$				
Torque wrench	7	36.0	65	36.0	72	1	46.722	0.0000
Valve spring compressor	11	36.0	61	36.0	72	1	34.722	0.0000
Piston ring compressor	31	36.0	41	36.0	72	1	13.890	0.2370
Piston ring expander	15	36.0	57	36.0	72	1	24.500	0.0000
Bearing puller	10	36.0	62	36.0	72	1	37.556	0.0000
Clutch plate alignment set	12	36.0	60	36.0	72	1	32.000	0.0000
Bush and bearing removal set	10	36.0	62	36.0	72	1	37.556	0.0000
Stud extractor	18	35.5	53	35.5	71	1	17.254	0.0000
Tap and die set	20	35.5	51	35.5	71	1	13.535	0.0000
Set of Allen keys	16	35.5	55	35.5	71	1	21.423	0.0000
Soft face hammer	27	35.5	44	35.5	71	1	4.070	0.0440
Straight edge	20	35.5	51	35.5	71	1	13.535	0.0000

Table 3.2.3 shows that, except for feeler gauge, *Jua Kali* mechanics do not have the measuring tools recommended by vehicle manufacturers. Just like for hand tools, the lack of the right measuring tools indicates that the quality of work done by the *Jua Kali* mechanics that requires the use of these tools is below standards. There are high chances that the diagnosis made by *Jua Kali* mechanics is wrong and may cause more problems to the vehicle in the long run.

Table 3.2.3: Chi-square analysis of measuring tools

Measuring tool	Yes		No		Total	d.f.	$\chi^2_{ob}$	Significance
	f <sub>o</sub>	f <sub>e</sub>	f <sub>o</sub>	f <sub>e</sub>				
Vernier caliper	10	36.5	63	36.5	73	1	38.479	0.0000
Micrometer screw gauge	7	36.0	65	36.0	72	1	46.722	0.0000
Dial gauge indicator	5	36.0	67	36.0	72	1	53.389	0.2370
Engineers square (Tri-square)	8	36.0	64	36.0	72	1	43.556	0.0000
Feeler gauge	31	36.0	41	36.0	72	1	3.890	0.2370
Steel rule	8	36.0	64	36.0	72	1	43.556	0.0000
Thermometer	5	36.0	67	36.0	72	1	53.389	0.0000
Plastic gauge	5	36.0	67	36.0	72	1	53.389	0.0000

Table 3.2.4 shows that *Jua Kali* mechanics do not have the garage equipment recommended by vehicle manufacturers for repairs and maintenance of engine and engine systems. Apart from trolley jack and electric soldering gun, the rest of the equipment were each available in less than 10 of the sampled garages. This lack of equipment puts in to doubt the quality of work done by the concerned *Jua Kali* garages.

Modern vehicles have been developed through a long time of research and their systems are so complex that one needs to go for formal training in order to understand them. Formal training would also enable one to appreciate the need to use manufacturer's manuals when servicing vehicles. However, the *Jua Kali* garages do not have service manuals (Table 3.2.5). This puts in to more doubt the quality of work done in the *Jua Kali* garages especially during system overhauls.

Table 3.2.4: Chi-square analysis of garage equipment

Equipment	Yes		No		Total	d.f.	$\chi^2_{ob}$	Significance
	f <sub>o</sub>	f <sub>e</sub>	f <sub>o</sub>	f <sub>e</sub>				
Trolley jack	18	36.0	54	36.0	72	1	18.000	0.0000
Air compressor	11	36.0	61	36.0	72	1	34.722	0.0000
Engine compressor tester	8	36.0	64	36.0	72	1	43.556	0.0000
Timing light	10	36.0	62	36.0	72	1	37.556	0.0000
Cooling system analyser	7	36.0	65	36.0	72	1	46.722	0.0000
Digital multimeter	6	36.0	66	36.0	72	1	50.000	0.0000
Dwell tachometer	6	36.0	66	36.0	72	1	50.000	0.0000
Fuel pump gauge	10	36.0	62	36.0	72	1	37.556	0.0000
Oil pressure gauge	10	36.0	62	36.0	72	1	37.556	0.0000
Electric soldering gun	14	36.0	58	36.0	72	1	26.889	0.0000
Set of fire extinguishers	7	36.0	65	36.0	72	1	46.722	0.0000
First aid kit	8	36.0	64	36.0	72	1	43.556	0.0000

Table 3.2.5: Chi-square analysis of manuals

Manual	Yes		No		Total	d.f.	$\chi^2_{ob}$	Significance
	$f_o$	$f_e$	$f_o$	$f_e$				
Service/repair manual	12	35.5	59	35.5	71	1	31.113	0.0000
Auto data general	8	35.5	63	35.5	71	1	46.606	0.0000
Auto data E.F.I	8	35.5	63	35.5	71	1	46.606	0.0000
Auto data E.I.	8	35.5	63	35.5	71	1	46.606	0.0000
Training manuals	10	35.5	61	35.5	71	1	36.634	0.0000
Spare part catalogues	10	35.5	61	35.5	71	1	36.634	0.0000
Spark plug catalogues	12	35.5	59	35.5	71	1	31.113	0.0000

Table 3.2.6 shows the ranks of the professional qualifications of workshop managers and mechanics. The Spearman rank order correlation was found to be 0.83 and the t-test of this correlation (2.98) was found to be significant. These show that there is a high degree of positive correlation between the qualifications of the workshop owners/managers and those of their mechanics.

Table 3.2.6: Spearman Rank order correlation

Qualification	No. of workshop managers	Rank	No. of mechanics	Rank	d	d <sup>2</sup>
Degree	3	5	3	6	-1	1
Diploma	4	5	4	5	-1	1
Craft	8	3	19	3	0	0
Artisan	0	6	12	4	2	4
Trade test	13	2	77	2	0	0
On-job training	44	1	287	1	0	0
Total						6

$$R_s = 0.83$$

### 3.3 Interviews and observations

Among those interviewed, 87% cited the major challenges as rapid changes in technology which may end up removing them from business as they cannot perform as expected. Quite a number of them even confessed to having repaired unfamiliar systems through trial and error.

Another problem facing the *Jua Kali* garages is the fact that most of them operate from rented premises and so they cannot invest heavily in the business and, moreover, have no collateral if they wanted to take a loan to improve their businesses.

## 4 Conclusions

The study showed that *Jua Kali* mechanics have problems in handling modern vehicles and in view of this, it is necessary for policy makers to come up with policies that can modernise the *Jua Kali* garages. Also, there should be periodic assessment of the mechanics and the garages to see what kind of equipment/tools they have and then come up with a grading method that shows the kind of repairs that can be undertaken at various types of *Jua Kali* garages.

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