AN EXPLORATORY STUDY ON FACTORS THAT INFLUENCE THE ADOPTION OF SELF-SERVICE FUEL STATIONS IN JOHANNESBURG: MOTORISTS’ PERSPECTIVE

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Abstract
The main objective of this study is to determine motorists’ perspectives on the adoption of self-service fuel stations (SSFS) in Johannesburg. The present research was quantitative in nature and a five point likert scale questionnaire, based on the motor-vehicle type used was distributed to potential respondents who were Johannesburg motorists above the age of 18. The research focused on the adoption of these self-service fuel stations by assessing the general attitudes and perceptions of motorists on the innovation. Data was analysed using SPSS 22 and AMOS 22. Findings have revealed that motorists generally accept the adoption of such innovations provided that they understand the benefit from the functionality of adopting such innovations should they be introduced. Results from the study also revealed that motorists are more likely to consider adoption of Self-Service Fuel Stations provided they perceive such facilities to be useful and enhance their service experience at service-stations.

Key terms: Self-service, motorists, innovation, adoption
INTRODUCTION

Over the years, many service providers have used technological service innovations in their operations and business models, especially self-service technologies that enable customers to produce and consume services electronically without direct contact from firm employees (Meuter, Ostrom, Bitner and Roundtree 2003; Nijssen, Schepers and Belanche, 2016). Furthermore, Nijssen et al. (2016) have confirmed that they have gained considerable market share, especially in Western retailing settings. The petroleum industry is an important industry for South Africa as it makes a significant contribution towards the country’s GDP (Matsho, 2010). However, like many other industries in the country, the petroleum industry is not immune to strikes and go-slow which have become more pronounced over recent years (The Economist, 2012). This situation has consequently caused a number of problems for service stations as most do not have complete control of the environment that their businesses operate in, making it difficult for them to meet set targets and ensure that greater profit margins are realised over time. The adoption of SSFS may help to reduce the inconvenience that motorists often face when industrial action occurs.

The concept of adopting self-service fuel stations was first introduced to the United States market in the early 1930s, although it became increasingly popular in the 1960s (Jakle and Sculle, 2002). The initial adoption of these stations was relatively limited due to the fact that, in most cases, petrol attendants were the only people who were legally sanctioned to make use of the petrol machines at service-stations due to fears that adopting the new system would create fire hazards in neighbouring communities (Jakle and Sculle, 2002). However, the American market continued to adopt self-service fuel stations, with 40 percent of gasoline sold under the Citco-Brand being sold at such outlets by 1977 (Jakle and Sculle, 2002). Over the years, countries such as the United Arab Emirates have also begun to adopt these self-service fuel stations, with 15 service stations introduced by the Emirates Petroleum Product Company on the 12th of December 2013 in an effort to increase convenience for motorists (Sambidge, 2013).

PROBLEM INVESTIGATED

Due to the need for an increased service level, service providers have moved to the adoption of the self-service culture to provide services to their customers (Zain and Idris, 2015). The adoption of self-service fuel-stations in South Africa is a fairly new research topic as a result there is a dearth of knowledge surrounding this research area within a local context. Prior research on the use of self-service fuel stations has been done within an American and Asian (Malaysia) context (Johnson and Romeo, 2000; Zain and Idris, 2015). Authors such as Molefe (2006) merely highlighted the potential problems associated with entering the highly saturated but potentially lucrative market, particularly the costs associated with setting up and tapping into existing distribution channels. Furthermore, Molefe (2006) had mainly looked at consumer motivations towards the use of self-service fuel stations but the present goes further in assessing their viability research. Abdelaziz, Hegazy and Elabbassy (2010) concentrated
on the adoption of self service centres in retail outlets and international airports for the convenience of travellers without specifically considering the adoption of self-service fuel stations. Consequently, not much research has been made to establish the feasibility of creating self-service fuel-stations in emerging economies such as South Africa in order to ensure a more reliable, convenient and cost-effective service is made available for Johannesburg motorists.

RESEARCH OBJECTIVES

Primary objective
The study aims to determine the factors that influence the adoption self-service fuel stations by focusing on motorists’ perspectives on the adoption of these facilities in an effort to increase motorists’ intrinsic satisfaction and foster consumer loyalty.

Empirical objectives
The current study has the following empirical objectives.
1. To conduct a quantitative study on motorists in Johannesburg in order to determine their perception on the adoption of self-service stations in South Africa.
2. To review literature on the successful adoption of self-service stations in countries such as the United Arab Emirates and United States of America.
3. The research also evaluated some of the various elements that may affect the adoption of self-service stations by motorists such as Do-it-Yourself tasks and activities.
4. To analyse data collected from the questionnaires distributed to motorists in the Johannesburg region by using the SPSS 22 and AMOS 22 statistical software.
5. To draw up conclusions on motorists’ perception of self-service fuel stations based on the output from the SPSS statistical software.

Literature review
The fuel industry is largely regarded as competitive which is why the fuel-pricing is closely monitored in order to retain customers who have become more price sensitive recently (Litman, 2011). It has been noted that an estimated 30% of motorists are price-sensitive and often willing to travel an extra 10 minutes to save on the price they have to pay for fuel (Grogan, 2012). Moreover, service stations are largely characterised by low profit-margins Grogan (2012), which limits opportunities for growth and presents a number of challenges for fuel station owners who would be looking to make their businesses more sustainable.

Oil prices have unfortunately continued to increase over the years and may continue to do so due to the general global economic growth which has consequently led to an increase in fuel demand (Fournier, Koske, Wanner and Zipperer, 2013). In South Africa, oil prices tend to fluctuate depending on a number of factors that include the levels of demand and supply (which have recently been perpetuated by economic growth in many emerging economies such as China and India) as well as the Dollar-Rand
Exchange rate which would mean that a weaker rand increases the general price of fuel in the country. Political unrest in some of the oil producing countries particularly the Middle-East region as well as weak protection of investors rights in oil producing companies has also lowered the amount of potential investments in the oil industries, resulting in the lower supply of oil in relation to demand and this has consequently led to the increase in price of fuel (Ratner and Nerurkar, 2011).

The fuel industry is one of the most important industries in South Africa as it largely contributes towards the GDP of the country’s economy, with an estimated contribution of over 2% of the GDP (Swart, 2010). The fuel industry in South Africa has grown tremendously since 1954, when it was fairly underdeveloped, to a point where it became the second largest oil refiner on the continent, after Egypt (Wakeford, 2013). The country has also continued to develop significantly since 1994 and has grown to become one of the most developed African countries and Africa’s second largest economy, after Nigeria (Hinshaw and McGroarty, 2014). In light of these rapid changes and developments, there has also been a shift in demand for products and services within the South African consumer product and services market which has increased the energy consumption in most sectors of the economy. The three largest consumers of energy in the country are Industry, which accounts for 41% of the energy consumption, Transport, which accounts for 28% of the energy consumption in the country and Residential areas which accounts for 17% of the energy consumption and it has been noted that crude oil accounts for 10% of all the energy sources (Department of Minerals and Energy, 2005).

SSTs create unique value propositions for the consumers which are largely centred on convenience and creating new experiences that arouse consumers’ cognitive senses, yet at the same time, helping to cut down operating costs for firms and the final consumer (Castro, Atkinson and Ezell, 2010). Like many Self-service technologies (SSTs) that have directly affected consumer behaviour and the way in which a number of service and product companies interact with the 21st century consumer (Wang, Harris and Patterson, 2012), Self-service technological innovation has continued to grow tremendously within the fuel industry in most developed countries. This has largely been due to the need for fuel stations to cut down costs and increase capacity to generate more revenue. The self-service fuel stations have been widely adopted by a number of developed countries such as U.A.E, USA and most European countries over the years. A number of self-service fuel stations are available in various markets, with most located in public places for the convenience of consumers. The concept of vending machines basically applies to the self-service-fuel stations, which may make it fairly easy for South African motorists to adopt as it involves consumers transacting with machines to obtain a particular product.
HYPOTHESES

Proposed Model for Johannesburg motorists to adopt self-service stations

Elements of TAM by Davis (1989), are particularly essential in helping to determine the Motorists Self-Service Technology Acceptances (MSSTA) as factors such as Perceived Ease of Use (PEOU) are common predictors that can be used to determine the intention to use technological innovations. Other elements that have been used in the modified version of the TAM have been adapted from innovation factors by Rodgers (1995) who argued that elements such as Complexity and Relative Advantage (RA) are critical in determining the potential adoption of a given innovation. For the purposes of this study, the researcher decided to introduce the safety and security variable as it may also influence behavioural intent of customers to make use of new innovations.

The researchers created a modified version of the Technological Acceptance Model by Davis (1989) in order to determine the motorists’ perceptions on adopting SSFS. The key constructs of the model were adapted from the TAM by Davis (1989) and Rogers’ Diffusion of Innovation Theory (1995). The modified version of the TAM model is therefore illustrated on the following page:

Figure 1: Research Conceptual Model: A Modified Technology Acceptance Model
Adapted from TAM Model by (Davis 1989)

Table 1: KEY

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorists Perceived Usefulness</td>
<td>MPU</td>
</tr>
<tr>
<td>Motorists Perceived Safety</td>
<td>MPS</td>
</tr>
<tr>
<td>Motorists Attitude</td>
<td>MA</td>
</tr>
<tr>
<td>Motorists Perceived Ease of Use</td>
<td>MPEOU</td>
</tr>
<tr>
<td>Innovation: Relative advantage</td>
<td>INNRA</td>
</tr>
<tr>
<td>Innovation: Complexity</td>
<td>INNCOM</td>
</tr>
<tr>
<td>Motorists Self-Service Stations Satisfaction</td>
<td>MSSS</td>
</tr>
<tr>
<td>Motorists Self-Service Technology Acceptance</td>
<td>SSTA</td>
</tr>
</tbody>
</table>

**Proposed Hypotheses**

Based on the constructs that have been included in the theoretical model adopted for the study, the researchers therefore formulated the following hypotheses in order to test the various elements which are likely to influence the potential adoption of SSFS by Johannesburg motorists:

**H1**: Motorists’ perceptions of safety of self-service fuel stations (SSFS) determines overall motorists’ attitude towards self-service fuel stations.

**H2**: Motorists Perceptions of Safety (MPS) of SSFSs determine Motorists’ Self-Service Technology Acceptance (MSSTA).

**H3**: Motorists’ Attitudes towards SSFSs influences Motorists’ Self-Service Technology Acceptance of self-service fuel stations

**H4**: Motorists’ Perceived Usefulness (MPU) of self-service fuel stations influences Motorists’ Attitude (MA) towards the adoption of self-service fuel stations.

**H5**: Motorists’ Perceived Ease of Use (MPEOU) of SSFS determine Motorists’ Attitude towards adopting SSFSs.

**H6**: Motorists’ Perceived Ease of Use (MPEOU) of SSFSs determines Motorists Self-Service Technology Acceptance (MSSTA)

**H7**: Relative advantage of self-service fuel-stations (SSFS) determines Motorists’ Perceived Ease of Use MPEOU of SSFSs.

**H8**: Relative advantage of SSFS determines Motorists’ Self-Service Technology Acceptance (MSSTA)
H9: Motorists’ Perceptions on Complexity of SSFSs determines their overall acceptance of self-service fuel stations.

H10: Motorist’s Self-Service Technology Acceptance (MSSTA) of SSFS determines Motorists Self-Service Stations Satisfaction (MSSS).

RESEARCH METHODOLOGY
The following section will explore the research methodology adopted for the present study.

Research Design
The research was grounded in the positivist paradigm and quantitative in nature. Primary and secondary sources of data were utilised. Questionnaires were therefore distributed to Johannesburg motorists in order to assess their perceptions and attitude towards the adoption of SSFS and technological innovation in general. Both primary and secondary research method were adopted. In order to have a better understanding of the perceptions of motorists, the researchers created a 5 Point-Likert scale questionnaire that essentially tests the perceptions of motorists regarding the usage of SSFS. The sample size of potential respondents was based on the average total number of cars that travel to and from Johannesburg on a normal working day and it was established that an estimated 300000 motor vehicles travel to and from Johannesburg everyday (Gautrain, 2013).

Sample Selection
Probability sampling was adopted in selecting participants with the sole purpose of providing every unit within the population an equal chance to be sampled as suggested by (Galpin, 2011).

In order to obtain a valid sample for the study, the researchers made use of Raosoft to come up with a sample size estimate that would determine the number of potential respondents required to answer the questionnaire. At 5% level of significance, it was established that an approximate sample size of 390 respondents would be required to participate in the study given that a total number of 300000 cars travel between the Johannesburg-Pretoria corridors daily (Gautrain, 2013).

A pilot study was conducted with 30 respondents in order to determine the level of reliability and validity of the self-administered questionnaire that was used as the research instrument for the quantitative study. The target respondents were active motorists above the age of 18 who drive within and around Johannesburg. Potential respondents were invited to participate voluntarily and the researcher also took note of any questions that respondents found ambiguous in order to edit the questionnaire and make it more understandable. To analyse the data the structural equation modeling approach was adopted.
RESULTS/FINDINGS

Demographic Statistics of motorists by motor vehicle type and age groups

Most of the data was sourced from light-motor vehicle motorists and taxi drivers as they were relatively more available in the city as compared to large heavy-motor vehicle motorists and motorcyclists. 72% of the respondents of the questionnaire were light motor-vehicle motorists as well as taxi-drivers. The table below seeks to illustrate the distribution of the motor-vehicle types based on the age-groups of the motorists.

Table 1: Distribution of Johannesburg motorist by Motor-vehicle-type and Age-group

<table>
<thead>
<tr>
<th>Age-group</th>
<th>Motor-Cycles</th>
<th>Light-Passenger Vehicles</th>
<th>Heavy-Motor Vehicles</th>
<th>Taxis</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>27</td>
<td>85</td>
<td>24</td>
<td>89</td>
<td>225</td>
</tr>
<tr>
<td>25-34</td>
<td>14</td>
<td>28</td>
<td>23</td>
<td>34</td>
<td>99</td>
</tr>
<tr>
<td>35-44</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>45-54</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>55-64</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>121</td>
<td>52</td>
<td>124</td>
<td>339</td>
</tr>
</tbody>
</table>

It can be observed that participants were light motor cycle drivers, light vehicle drivers, heavy motor views and lastly taxi drivers. It can also be observed in the table above that most of the respondents where in the 18 to 24 age group and these were represented by 225 out of the total 339 participants. The least represented group was the 55 to 64 age group and was represented by only one participant.

Table 2: Hypothesis tested by the theoretical model

<table>
<thead>
<tr>
<th>Proposed relationship hypothesis</th>
<th>Hypothesis</th>
<th>Factor Loading</th>
<th>P Value P&lt;0.01</th>
<th>Supported/Rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPS→MA</td>
<td>H&lt;sub&gt;1&lt;/sub&gt;</td>
<td>0.08&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
</tr>
<tr>
<td>MPS→MSSTA</td>
<td>H&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0.47&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
</tr>
<tr>
<td>MA→MSSTA</td>
<td>H&lt;sub&gt;3&lt;/sub&gt;</td>
<td>0.22&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>Factor Loading</td>
<td>Significance</td>
<td>Support and Significance</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----------------</td>
<td>--------------</td>
<td>--------------------------</td>
<td></td>
</tr>
<tr>
<td>MPU → MA</td>
<td>0.94&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
<tr>
<td>MPEOU → MA</td>
<td>0.79&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
<tr>
<td>MPEOU → MSSTA</td>
<td>-0.1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
<tr>
<td>RA → MPEOU</td>
<td>-0.05&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
<tr>
<td>RA → MSSTA</td>
<td>0.43&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
<tr>
<td>INN → MSSTA</td>
<td>0.32&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
<tr>
<td>MSSTA → MSSS</td>
<td>0.73&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.01</td>
<td>Supported and significant</td>
<td></td>
</tr>
</tbody>
</table>

NB: self-service fuel stations (SSFS), Motorists Perceptions of Safety (MPS), Motorists’ Self-Service Technology Acceptance (MSSTA), Motorists’ Perceived Usefulness (MPU), Motorists’ Perceived Ease of Use (MPEOU), Motorists Self-Service Technology Acceptance (MSSTA), Motorists Self-Service Stations Satisfaction (MSSS). Relative advantage of innovation (RA)

### Discussion of hypotheses

It can be observed that all the above tested hypotheses were all significant and supported. It also important to note that of all the relationships, Motorists Perceived Usefulness (MPU) and Motorists’ Attitude) had the strongest relationship as indicated by a factor loading of 0.94. The weakest relationship was that of relative advantage of innovation (RA) and Motorists’ Perceived Ease of Use (MPEOU) indicated by a factor loading of -0.05.

### CONCLUSIONS

Based on the inferential and descriptive statistics adopted, the quantitative study revealed that there is generally a positive attitude towards the adoption of SSFS by Johannesburg motorists. It was also noted that constructs from the theoretical model such as MSSTA, MPU, MPEOU, Relative Advantage and Attitude were key drivers that are likely to influence the potential adoption of these SSFS overtime as they would ultimately influence MSSS and repeat-usage.

The ANOVA tests revealed that there was no significant difference in motorists’ attitudes towards the usage of SSFS based on age-group and this may greatly help to reduce the need for stakeholders, particularly fuel station owners, to customize fuel stations substantially in order to meet the homogeneous needs of the potential market for such facilities based on age-group as it would prove to be too costly to implement and may also be potentially difficult to manage. Having a more uniform
SSFS implementation will go a long way in helping to reduce unnecessary implementation costs. It was also noted that there was no variation in Motorists Attitude towards SSFS based on the motor-vehicle type that they made use of.

Another important discovery was the fact that Relative Advantage associated with the adoption of SSFS is likely to significantly influence MSSTA which may then be imperative for fuel-station owners and other stakeholders to establish and highlight the advantages associated with the usage of SSFS to Johannesburg motorists as it will go a long way in helping to increase the potential adoption of such facilities in the long-run. It was also discovered that a high relative advantage associated with the usage of SSFS is also likely to positively influence the perception that motorists have of the usefulness of these facilities. As MPU has a positive influence on the acceptance of such an innovation, it will therefore be beneficial for SSFS owners to highly consider the benefits or relative advantage that the service brings to the consumer as it will affect the consumers perceived usefulness of the facility. The researchers also discovered that the MPU is highly likely to influence motorists’ attitudes (MA) towards SSFS significantly as the relationship between the two constructs had a high factor-loading of 0.94. It will therefore become imperative for firms to consider the functionality and practicality of SSFS to the motorists as it has high implications on the Motorists’ Attitude towards the innovation since it ultimately influences the acceptance of such innovations by Johannesburg motorists.

**MANAGERIAL IMPLICATIONS**

A number of managerial implications and recommendations have been formulated based on the findings of the study. Firstly, management of fuel service stations should identify effective ways of helping to enhance motorists’ attitudes (MA) towards the adoption of SSFS in order to ensure that these SSFS may be widely accepted by the potential market they intend to serve. In order to effectively create a positive attitude amongst the potential users of these facilities, management may focus on the MPU as it has a significant impact on MA and may ultimately influence motorists’ self-service technology acceptance overtime. Management would therefore need to highlight and emphasize on the functionality of SSFS and how that can be of benefit to the potential users to entice them to consider making use of these services.

In order to help increase MPU of SSFS, management and marketers may consider educating motorists on the value-proposition of convenience and service experience that is brought by the adoption of SSFSs to motorists which can go a long way in increasing the wide adoption of these facilities should they be introduced for Johannesburg motorists. Based on the questionnaire distributed to motorists around Johannesburg, Safety and security were a concern for most respondents who participated in the study as they feared for their safety and security should the SSFSs be introduced in Johannesburg as the city is well known for its high crime rates (Fonio and Pisapia, 2014). The study revealed a factor loading of 0.47 on the effect of MPS on MA which suggests that it is important for management to help increase...
motorists’ perceived safety as it can go a long way in influencing their attitude towards the usage and adoption of SSFS. Motorists Perceived Safety may be enhanced by ensuring that the SSFS are kept safe and secure and that security officers constantly monitor the activities around these facilities.

Results from the study also suggest that there seems to be a need for potential adopters of SSFS to consider the relative advantage that comes with the adoption of such facilities as they can go a long way in influencing motorists’ self-service technology acceptance and ultimately lead to the wide adoption of such services by Johannesburg motorists. The stakeholders should therefore focus on the benefits associated with the usage of SSFS facilities, particularly convenience to motorists when there is industrial action. Furthermore, fuel prices are likely to decline as operation costs in service stations are likely to be reduced.

REFERENCES


