

- \* 15. Technology, Innovation and Supply Chain Management
- \* Competitive

## ABSTRACT

*This paper explores the key factors that characterise Saudi Arabian petrol stations supply chain integration. We developed a conceptual model incorporating eight factors based on the technology-organisation-environment (TOE) framework (Tornatzky & Fleischer, 1990). This study employed a qualitative research methodology and hermeneutics to analyse the data. We conducted a case study of rural and metropolitan petrol stations in Saudi Arabia. Our findings confirmed that the Saudi Arabian petrol stations supply chain is influenced by the technological (i.e. relative advantage and IT infrastructure), organisational (i.e. culture, firm size and firm resources), and environmental (i.e. geographic location, competition intensity and government regulation) factors. In the findings, we identified several practical implications in terms of petrol stations supply chain and operations management enhancement.*

## Keywords

Supply chain management, operations management, integration, quality management, technology.

## Saudi Arabian Petrol Stations Supply Chain Integration

Ibrahim Alhawas

School of Business IT and Logistics  
RMIT University  
Melbourne, Australia  
Email: [ibrahim.alhawas@rmit.edu.au](mailto:ibrahim.alhawas@rmit.edu.au)

Konrad Peszynski

School of Business IT and Logistics  
RMIT University  
Melbourne, Australia  
Email: [konrad.peszynski@rmit.edu.au](mailto:konrad.peszynski@rmit.edu.au)

Leslie Young

School of Business IT and Logistics  
RMIT University  
Melbourne, Australia  
Email: [leslie.young@rmit.edu.au](mailto:leslie.young@rmit.edu.au)

\* Stream: 15. Technology,  
Innovation and Supply Chain  
Management

\* Competitive

## **Saudi Arabian Petrol Stations Supply Chain Integration**

### **ABSTRACT**

*This paper explores the key factors that characterise Saudi Arabian petrol stations supply chain. We developed a conceptual model incorporating eight factors based on the technology-organisation-environment (TOE) framework (Tornatzky & Fleischer, 1990). This study employed a qualitative research methodology and hermeneutics to analyse the data. We conducted a case study of rural and metropolitan petrol stations in Saudi Arabia. Our findings confirmed that the Saudi Arabian petrol stations supply chain is influenced by the technological (i.e. relative advantage and IT infrastructure), organisational (i.e. culture, firm size and firm resources), and environmental (i.e. geographic location, competition intensity and government regulation) factors. In the findings, we identified several practical implications in terms of petrol stations supply chain and operations management enhancement.*

### **Keywords**

Operations management, supply chain management, integration, quality management, technology.

### **INTRODUCTION**

Saudi Arabia possesses the largest oil reserves in the world standing at 262 billion barrels (Jhaveri, 2004). Furthermore, Saudi Arabia is the largest exporter and producer of oil in the world where the oil sector accounts for over 90% of total export earnings and over 75% of the country's total revenue (Squalli, 2007). Moreover, petrol stations in Saudi Arabia are considered the lifeline of transportation in Saudi Arabia because the only means of transportation in Saudi Arabia is either cars or buses. The major petroleum products to refuel vehicles in Saudi Arabia are petrol and diesel, pinpointing the importance of petrol stations in Saudi Arabia.

According to the Council of Saudi Chambers, there are approximately seventy thousand petrol stations in the country with only seven companies registered to manage and operate ten percent of these stations (Abdullah 2012). Approximately 90% of Saudi Arabian petrol stations are operated and managed by individuals, either locals or expats (who rent petrol stations from Saudis and lease the station's utilities (e.g., groceries, car service utilities, ... etc.) to other expats through subcontracts) (Alsaied, 2011; Matar & Al-Zahrani, 2011a). When interviewed on the *8.00 report with Dawood* (2012) the undersecretary of Riyadh region municipalities stated, in Riyadh region along the national highways, there are approximately 1000 petrol stations, 400 petrol stations among these 1000 petrol stations were not built in compliance with pre-construction regulations of the Ministry of Municipalities and Rural Affairs.

Additionally, Saudi Arabian petrol stations utilise traditional petrol operational management processes, which include manually measuring petrol levels in tanks, testing for leaks and book-based accounting processes to minimise cost and increase profit (Grozniak & Trkman, 2006). However, these processes increase

the uncertainties in the petrol stations supply chain. Increased uncertainties would contribute to the petrol stations supply chain complexity and hence increase the chance on budget and schedule overruns (IEA, 2006).

This study aims to explore the factors that characterise Saudi Arabian petrol stations supply chain integration based on the technology-organisation-environment (TOE) framework (Tornatzky & Fleischer 1990). Specifically, the research question for this study is: *what are the elements that influence in Saudi Arabian petrol stations' supply chain and operations management?* By studying the elements that characterise the Saudi Arabian petrol stations supply chain and operations management, we hope to identify the ways these stations can integrate their supply chains to enhance the operational performance by offering good service and a competitive advantage whilst keeping cost and lead-times low. The term of lead-time in this study means the time between the measurement of the stock level and the arrival of fuel (Grozniak & Trkman, 2006).

This paper is organised as follows. First, a review of prior literature is provided, which incorporates the TOE framework into this study. Second, the research methodology of the study incorporating research sites and data collection and analysis is provided. This is followed by the study's discussion of findings based on the TOE context. This paper then concludes with the study's implication and limitations.

### LITERATURE REVIEW

Literature was identified that focused on the role of the supply chain in the Saudi Arabian manufacturing industry (Al Falah, Zairi, & Ahmed, 2003), as well as barriers to the adoption of online supply chains (Archer, Wang, & Kang, 2008). Among these, only one study was identified that focused on the petrol station supply chain, in which the researchers showed how the performance of the supply chain could be improved with the integration of various tiers in the chain of procurement in a Croatian petrol company via a simulation-based methodology (Grozniak & Trkman, 2006). Given this, it was then decided that our study would focus on key factors that influence in the petrol station supply chain in Saudi Arabia employing the TOE framework. Julka, Karimi and Srinivasan (2002) state that today's business environment needs integrated supply chain management to evaluate business processes and policies with consideration of their impact on overall business performance. In addition, Julka, Karimi and Srinivasan (2002) and Grozniak and Trkman (2006) come to an understanding that the usual supply chain goal is to offer good service to the final customer and keep costs and lead-times low. Furthermore, Bolumole (2001) states, within petrol retailers the success of logistics is critical due to issues of service delivery and just-in-time (JIT) product availability. Therefore our study aims to identify the elements that characterise the Saudi Arabian petrol stations supply chain and

operations management to identify the ways these stations can offer good service and a competitive advantage whilst keeping lead-times low.

Looking at various literature, it was noted that there is a lack of literature written about the adoption and use of IT in Saudi Arabia (Al-Jabri & Roztock, 2011; Al-Somali, Gholami, & Clegg, 2009). The acceptance of IT in Saudi Arabia addressed in the available literature typically applies the Unified Theory of Acceptance Use of Technology (UTAUT) (Al-Gahtani, et al., 2007) where researchers tried to determine the intention to use, and usage behaviour. Given that we found that the literature addressing the impact of culture as a significant factor that influences the acceptance of IT employing the Technology Acceptance Model (TAM) (Rose & Straub, 1998), to be the most relevant to our study towards the utilisation of technology in Saudi Arabia because the technology is one of the important aspects towards supply chain integration. However, according to Davis, Bagozzi and Warshaw (1989), the general goal of TAM is to provide an explanation of the determinants of computer acceptance and to determine why a system is unacceptable through explaining user behaviour, which helps to examine appropriate corrective steps to accept a system by determining the external factors on internal beliefs, attitudes and intentions. This differs from our study, which describes both existing and new technologies relevant to the firm, such as prior technology usage, and the number of computers in the firm based on the TOE framework (Salwani, et al., 2009), thus helping the determine the extent of technology utilisation in Saudi Arabian petrol stations in terms of the integration of Saudi Arabian petrol stations supply chain.

Several researchers have employed the TOE framework in the adoption of information technology or systems in organizations in terms of supply chain integration and enhancement (Angeles, 2012; Chau & Tam, 1997; Kuan & Chau, 2001; Lee & Shim, 2007; Thong, 1999; Zhu, Kraemer, & Xu, 2003). There is also evidence in many studies that the TOE framework is an appropriate theoretical framework to support empirical studies (Zhu, et al., 2003). For example, Chang, Liao and Hsiao (2005) highlighted the factors that impact new technology adoption. Teo et al. (2009) employed TOE on the adopters and non-adopters of e-procurement. Salwani et al. (2009) state in their study that TOE is a popular foundational model to study the drivers contributing to successful e-commerce from the three characteristics of TOE, particularly examining adoption, implementation, and usage (of e-commerce in their study). Table 1 addresses the literature that has employed the TOE framework and why the framework was employed.

To identify the factors that influence the extent of technology utilisation in Saudi Arabian petrol stations supply chain and operations management we have reviewed several sources of literature to provide an

insight into the three contexts of TOE: Technological, Organisational and Environmental. Under the technological context, we investigated texts that showed how relevant IT infrastructure is in evaluating petrol stations, both internally and externally. Tornatzky and Fleischer (1990) stated that the technological context is relevant to the organisation. Zhu and Kraemer (2005) refer to technology infrastructure or technological resources as hardware and software that enable Internet-related business (e.g., EDI, EFT, intranet and extranet). In addition, Al-Somali et al. (2010) highlighted that countries adopting new technologies must have the right basic infrastructure. Hence IT infrastructure is considered as one of the technological factors that impacts the adoption of e-business in Saudi Arabia. It is with this background that IT infrastructure is premised within our study.

Another technological factor mentioned in our study is relative advantage. Relative advantage refers to “the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 1995, p. 213). Several studies found that relative advantage was a significant variable in the adoption of IS innovations in electronic supply chain management (Ramdani, Kawalek, & Lorenzo, 2009) and has positively influenced electronic commerce adoption decisions based on the theoretical significance (Al-Qirim, 2007). Tornatzky and Klein (1982) has also mentioned that “relative advantage is the only variable that has been consistently identified as a critical adoption factor and as the most important factor for IT growth in small firms” (Kuan & Chau, 2001, p. 511). In our study, relative advantage refers to the perceived benefits from technology with both direct and indirect benefits such as minimising cost, reducing lead time and increasing competitive advantage to enhance the operational performance in Saudi Arabian petrol stations supply chain (Jeffcoate, Chappell, & Feindt, 2002).

The second context is the organisational context. Different organisational factors introduced in various studies include size of the organisation (Lai, Li, Wang, & Zhao, 2008; Ramdani & Kawalek, 2007; Zhu, et al., 2003), age of the business (Kamal, 2006), resources (Grozniak & Trkman, 2006), culture (Aleid, Rogerson, & Fairweather, 2010; Kamal, 2006; Senior, 1997), organisational structure (Kamal, 2006), innovation ability (Al-Qirim, 2007; Thong, 1999), financial (Kamal, 2006; Kuan & Chau, 2001), investment (Kamal, 2006) and performance (Kamal, 2006). For the purpose of this study, our study explores culture, firm size and firm resources as being relevant to organisational context.

The ‘intention to use’ and ‘usage behaviour’ of IT have been exclusively validated in Western nations (Al-Gahtani, et al., 2007). However, in a non-Western cultural context, specifically Saudi Arabia, in which norms and human behaviour play a significant role (Al-Gahtani, et al., 2007), there is a need to highlight

organisational culture as an important factor to explain the anomalies of norms and behaviours that influence IT integration and acceptance in Saudi Arabia (Al-Gahtani, et al., 2007; Rose & Straub, 1998). Hence, in our study we focused on the organisational culture based on the user's behaviour and the norms of Saudi Arabians that might influence IT utilisation in terms of petrol stations supply chain integration.

Moreover, several prior studies stated how firm size impact on IT investment, where the larger the firm, the greater the investment in IT and associated resources. (S. Al-Somali, et al., 2010; Brynjolfsson, Malone, Gurbaxani, & Kambil, 1994; Ramdani & Kawalek, 2007; Zhu, et al., 2003). Moreover, Al-Somali et al. (2010) found that the size of a business is positively related to e-business adoption in Saudi Arabia. Nevertheless, Morrisson et.al (1994), surveyed 300 micro-enterprises in seven different countries (i.e. Niger, Swaziland, Algeria, Tunisia, Ecuador, Jamaica and Thailand) amongst them two Arab countries (i.e. Algeria and Tunisia) surveyed, over 90 per cent of these enterprises have fewer than ten workers. Therefore, they state that "micro-enterprises proper one to ten workers, including independent workers" (Morrisson, et al., 1994, p. 26). Accordingly, petrol stations in Saudi Arabia are considered micro businesses that have an average of eight workers. From the contribution of the literature, we included firm size as an organisational factor that might impact on the technology utilisation towards to Saudi Arabian petrol stations supply chain integration.

It is also noted that the resources that a firm intends to employ as their IT solutions is a critical factor in the development of IT capability (Bharadwaj, 2000). Amit and Schoemaker (1993, p. 35), refer to capabilities as a "firm's capacity to deploy resources". More so, Bharadwaj (2000, p. 171), defined a firm's IT capabilities as "the ability to mobilise and deploy IT-based resources in combination or co-present with other resources and capabilities." These definitions show the contribution of capability in combination with IT, firm, and resources. As this study aims to explore the key factors that characterise Saudi Arabian petrol stations supply chain integration, IT capabilities, if combined with firm resources are important to be included in this study and its importance is to achieve petrol stations supply chain integrations (Tai, Wang, & Lee, 2013) and eventually gain cost-savings, add-value and decrease lead time (Applegate, McFarlan, & McKenney, 1999; Turban et al., 2008).

The third context in this study is the environmental context. Environmental factors refer to the environment in which an organisation conducts its business (Lim, Chesbrough, & Ruan, 2008). There are various types of environmental factors, including: an organisation's industry; competitors; access to resources supplied by others; and dealing with the government (Tornatzky & Fleischer, 1990). In this study, the geographical locations have been included despite the lack of literature within the context of TOE (Giunta &

Trivieri, 2007) only because of the importance of the geographic location of Saudi Arabia (Burnson, 2010; SAGIA, 2009). In addition, the distance from Saudi Aramco's petrol distribution stations to petrol stations is expected to be an issue in the petrol supply chain in Saudi Arabia.

We have also included competition intensity as another environmental factor in this study because several studies have highlighted its significance in terms of supply chain integration (Lai, et al., 2008; Lertwongsatien & Wongpinunwatana, 2003; Zhu, et al., 2003) and its impact on developing countries (Dittmer, 2008). Last but not least, we have also touched on the aspect of government regulation owing to it being extensively mentioned in the literature, and having been pinpointed as an important factor influencing Saudi Arabian governance (S. Al-Somali, et al., 2010; Wang, Wang, & Yang, 2010).

Based on the above review of the literature and the contribution of TOE on our study, the proposed framework appears to be an appropriate and comprehensive theoretical guideline for exploring the key factors that influence the integration of Saudi Arabian petrol stations supply chain. Figure 1 shows the conceptual TOE framework.

## RESEARCH METHODOLOGY

Given that this is an original study (i.e. Saudi Arabian petrol stations supply chain integration), we employed a qualitative exploratory approach to explore and understand the Saudi Arabian petrol stations operations management and supply chain from the perspective of individuals. Moreover, qualitative research is useful in cases where the researchers attempt to understand and explore what a technology or practice means to people (Kaplan & Maxwell, 2005). We also used the embedded case study methodology to examine the factors that influence the Saudi Arabian petrol stations supply chain and operations management, because Saudi Arabian petrol stations utilise traditional human-based petrol supply chain processes e.g. predicting future needs in fuel stations. Last but not least, we undertook an interpretive research epistemology, by which we could interpret what we see, hear, and understand (Creswell, 2009).

In terms of research sites, petrol stations in Saudi Arabia are supplied by the state owned oil company, Saudi Aramco, which is the only provider of fuel in Saudi Arabia. Saudi Aramco owns four refineries, two joint venture refineries and one integrated refinery and petrochemical plant and 20 bulk plants (distribution stations) located in different regions of Saudi Arabia. These regions can be categorised into two investigative areas: rural and metropolitan. Rural petrol stations mainly consist of petrol stations that are located in villages or on national highways, and are considered far in terms of distance from Saudi Aramco's distribution stations

(e.g. Alkhurmah). Metropolitan petrol stations consist of petrol stations that are located in metropolitan cities, and are considered near in terms of distance to Saudi Aramco's distribution stations (e.g. Riyadh). The reason behind investigating these two distinctive areas is to explore if there are any differences between the two areas based on the factors of TOE.

Between November 2011 and February 2012, we interviewed ten participants from six different petrol stations. Five of the participants were from three rural petrol stations in Alkhurmah village, located 450 km away from Saudi Aramco's distribution station in Jeddah city, and the other five participants were from three metropolitan petrol stations in Riyadh city.

We approached the petrol stations by the Saudi Arabian Chambers of Commerce and Industry, which provided a list of petrol stations based on the government permission to provide the required data that researchers need. These petrol stations were represented by key informants (e.g., owners, truck drivers, workers, and accountants) who were invited by sending them invitations to participate in this study, which described the study in plain Arabic language attached with a consent form that participants were required to sign for voluntary participating in this study. We collected data using multiple approaches: face-to-face audio recorded interviews, documents provided by organisations and key informants, and other publicly available information (e.g., press releases, financial statements, and trade press articles). Extensive notes were taken during these interviews.

The rigor is needed in qualitative research perspective to insure that findings are to be trusted or believed. Kvale (1996) stated that reliability and validity pertain to the consistency of the research findings. Therefore, the activity implemented to increase the validity of this study is through member checks (Merriam 1995; Neuman 2000). This activity ensures that participants given the opportunity to provide their opinions in terms of the findings that the researchers addressed and to add their own truth to the findings derived and interpreted by researchers. Therefore, the first member check, the researchers sent a copy of each transcript that had been transcribed by the researchers to the participants to review their own interviews. This allows the participants to change their transcripts in terms of terminology used or errors by the researchers misinterpreting the recording of the interviews.

The second member check was performed when the findings of this study accomplished. The researchers sent each member a summary copy of research findings translated from English to Arabic plain statement. This allows the participants to provide more information and to check the truth to anything that the researchers may



have taken in the wrong context, or provide anything that is relevant to the case study. Overall, the changes from the participants and the experts were minimal. These minor changes did not affect the analysis of the research findings.

The hermeneutic approach was adopted in this study to understand what participants say, do and why. More so, we used the hermeneutic circle in this study, which indicates the impact of the researchers on the analysis of the data based on the meaning of the text (Heidegger, 1976). However, the literature also influences the researchers and the way they interpret and analyse the data, based on the existing literature. Furthermore, hermeneutic technique helps to put the interpretation on the data being analysed as a basis for further discussion and future understanding. This resulted in new avenues of research emerging with the TOE framework which will be discussed in the following section.

### CASE STUDY

Petrol stations and participants have been given a pseudonym to protect their identities and that of their petrol stations. Table 2 demonstrates rural petrol stations and table 3 demonstrates metropolitan petrol stations.

#### **Rural petrol stations:**

Mr. Sami is the owner of MS petrol station that has been operating for 12 years. The MS petrol station is located on the national highway that links the Southern region with the Western region. There are four workers working consecutively; two workers for every 12 hours. The IT infrastructure within MS petrol station consists of one computer, one printer and a USB stick to connect to the Internet to order petrol online. The petrol pumps are mechanical pumps, which are described as old petrol pumps.

Mr. Ahmad is the owner of NS petrol station that is also individually owned station and has been operating for 15 years. Its location is also on the national highway linking the Southern region with the Western region, approximately one kilometre away from the MS petrol station. Mr. Ahmad owns three trucks that transport petrol to MS petrol station and other petrol stations in Alkhurmah. The use of technology is minimal in terms of infrastructure as Mr. Ahmad orders petrol from Saudi Aramco website from home. The petrol pumps in this station are also old mechanical pumps.

AS petrol stations that consists of two petrol stations; one is located in the middle of Alkhurmah and the other is located on the national highway. Mr Faisal is the owner of both AS petrol stations, he is contracted with the government to refuel government vehicles since his petrol station was the first in the area established

19 years ago. The use of technology is limited within the premise of the petrol kiosks as Mr. Faisal makes his orders online from home. There is no evidence of automation as the accountant Mr. Bashir reads tank meters twice daily and manually records the readings into his notebook while using pocket calculators to work out the readings. Mr. Bashir also mentioned that he collects debts from government agencies that are contracted to AS petrol stations, via cheques or cash. It is noted that the petrol pumps used at these stations are old mechanical pumps.

### **Metropolitan petrol stations:**

Mr. Majed is the general manager of the AA petrol stations and hauling fleets that consist of a chain of 460 petrol stations spread throughout Saudi Arabia. These stations are owned by one family in Saudi Arabia. In 2006 the company became publicly listed. AA petrol stations have been in operation for 50 years. Approximately 4000 workers work at AA petrol stations and hauling fleets. Their IT infrastructure consists of Radio Frequency Identification technology (RFID), which costs approximately three million Saudi Riyals (~\$775,000 AUD). AA petrol station headquarters consist of more than 100 employees, to supervise the workers and make online orders, utilising 100 computers, a LAN, 30 printers, Microsoft Office software, and three main servers. The company has an IT administrator and IT support personnel. The petrol pumps in most of the metropolitan petrol stations are new electronic pumps. However, the pumps in AA petrol stations that are located in rural areas are old mechanical pumps.

The DB petrol station is a wholesale petrol station owned by Mr. Mansour also has another business which is fuel hauling. The business age of DB petrol station is 60 years. Technology infrastructure at DB petrol station in which the headquarters is located consists of ten computers, three printers, a LAN. The accountant Mr. Siraj addressed that he utilises MS-Excel in terms of accounting processes. The petrol pumps are old mechanical pumps.

ALO petrol stations consist of four petrol stations, two located in the metropolitan city, Riyadh, and two located in rural areas, on the national highway, which links the Middle region with the Eastern region. ALO petrol stations are owned by Mr. Saleh who also owns three trucks to transport petrol to his petrol stations only. The largest petrol station is located in the middle of Riyadh city. This petrol station contains ten petrol pumps and eight workers. ALO petrol stations do not utilise much technology within the petrol stations to receive, supply or distribute petrol. The petrol pumps at ALO are old mechanical pumps.

## FINDINGS

In this section, we discuss the Saudi Arabian petrol stations in respect to the TOE framework. We highlight the contribution of TOE framework during the interpretation of the participant's perspectives and analysis. Hence, we classified the findings based on the TOE contexts.

### Technological Context

We collected the perspectives of the petrol stations owners' experience in petrol stations and also met with accountants, and managers to describe their understanding of technology and the need for it within their petrol station in terms of supply chain and operations management. Two significant factors were highlighted as factors that contribute to the knowledge of technology in Saudi Arabian petrol stations (i.e. IT infrastructure and Relative Advantage). The participants confirmed that there is a lack of technology within rural petrol stations in Saudi Arabia. The only use of technology is to procure petrol online from Saudi Aramco's e-procurement system. When comparing rural petrol stations with metropolitan stations, we found that rural petrol stations were hardly using technology as opposed to metropolitan petrol stations.

We found that the petrol tanks in Saudi Arabian petrol stations are measured manually two times each day utilising traditional dipsticks. The readings are recorded manually to know how many litres were sold during the day and to know whether the replenishment level has been reached in order to procure petrol from Saudi Aramco's distribution stations. It is interesting to note that petrol orders can only be made online from Saudi Aramco's e-procurement website based on the customer's available funds. Customers (stations' owners) needing petrol supply are required to deposit money into Saudi Aramco's account through direct debit, phone, ATMs, or online banking. Once a customer has funded his account 14 days in advance, he is able to procure petrol online, however each order should be made 14 days in advance. Customers can order the monthly quota as long as the account is funded. Once the procurement process is completed online, a hard copy of the receipt is delivered to the truck driver, who then delivers the receipt to Saudi Aramco's distribution station employees. This means there is an assumption that all petrol stations are connected to the Internet whether they are in rural or metropolitan areas or are at least able to get access to phone and banking facilities. Given this assumption, one would suspect that there is easily assessable telecommunications and IT infrastructure available throughout Saudi Arabia. Our research shows that this is not necessarily the case, because there is lack of Internet connection, especially in some rural petrol stations. Moreover, some rural petrol stations owners lacked knowledge to access banking facilities online and hence they need to travel from one village to another to perform banking transactions personally. Mr. Sami said,

*Some rural petrol stations' owners procure from Saudi Aramco by approaching petrol haulers those has an account with Saudi Aramco or they should have contact with people those have internet connections to procure from Saudi Aramco on their behalves.*

In order for accounts to be tallied, the accountants in the petrol stations read, calculate and record the petrol pump meters twice a day, manually, to identify the income of the petrol sold. To ensure that the total amount is right, accountants read the column of litres sold for each petrol pump and multiply that result with the petrol price. For example, X litres multiplied by 65 halalas (\$0.17 cents) for octane 95 with the result matching the collected amount. If the sales do not match what is sold, the balance would be deducted from the worker's pay.

The other technological context in this study is relative advantage. Relative advantage refers to the direct and indirect perceived benefits that take place in petrol stations in terms of technology utilisation, such as minimising operations management processes, cost saving and gaining competitive advantage. Only two metropolitan petrol stations utilised forms of technology out of the six interviewed (i.e. DB and AA petrol stations). The DB wholesale petrol station utilised computer software, such as MS-Excel in all of its accounting processes. MS-Excel helped DB petrol station's accountant to access historical records of all previous sales and calculate the income. This helps DB petrol stations to reduce operations management processes by dispensing the traditional calculation forms, such as calculators and book-based accounting processes. However, in terms of significant technology, AA petrol stations have implemented RFID technology and reaped up the following benefits:

- preserved the privacy of the AA chain of petrol stations' customers (private sector, government sector and individuals) and preserved the privacy of the amount of petrol that they purchase;
- controlled the sales in appropriate technique and minimised exploitation of petrol meters and receipts;
- provided safety to the AA chain of petrol stations' operations management that the fuel has been procured from Saudi Aramco and has been unloaded in AA petrol stations' tanks in the right quantity;
- &
- ensured that end consumers, e.g. contracted firms, refuel the right vehicle in the custody of the authorised driver.

The interviewed rural petrol stations on the other hand claimed that they were aware of the utilisation of electronic pumps (advanced pumps) in their petrol stations but were not using them owing to the extra charges

by suppliers for the installation and maintenance of such pumps in rural areas. These extra charges are quite high owing to the distance of the petrol stations from service and repair stores in metropolitan cities. These issues hinder petrol stations from utilising technology effectively and eventually this may hinder petrol stations supply chain integration.

To sum up, the significant technological factors that influence the technology utilisation in Saudi Arabian petrol stations which contribute to the petrol stations supply chain integration are IT infrastructure and relative advantage. Our findings highlight that the relative advantage of technology utilisation in the Saudi Arabian rural petrol stations is limited and is based on the infrastructure available. However metropolitan petrol stations are able to use technology based on the infrastructure available and eventually this will help in terms of petrol stations supply chain integration.

### **Organisational Context**

There are several factors pinpointed by the participants in terms of the organisational context. The significant factors reported are firm size, culture, and firm resources. Firm size was raised as an important factor in this research. Although most petrol stations in Saudi Arabia have an average of eight workers, indicating that most petrol stations in Saudi Arabia are considered small stations, we found a reliance on workers to serve customers in Saudi Arabian petrol stations, a somewhat more manual process. This highlights the importance of the workers in Saudi Arabian petrol stations which considered (human-based stations). Hence, firm size based on the number of employees was determined a significant factor that influences petrol stations operations management and ultimately this influences the supply chain integration in terms of technology that can replace the labour to gain cost saving and enhance operations management in the stations.

In terms of organisational culture we found that user's behaviour influences technology utilisation and petrol stations supply chain integration. Saudi Arabian petrol stations are not self-service petrol stations because they lack of the minimum requirements of service quality such as, hygiene and technical infrastructure e.g. petrol pumps. Extreme hot weather of Saudi Arabia also influences in customer's behaviour; therefore customers prefer not to get out from their cars to refuel their vehicles. Mr. Majid said,

*Customers prefer not to get out from their vehicles in the hot climate that reach to more than fifty degrees in summer, so we can imagine how the workers are suffering in such work environment.*

Mr. Majid expounded that AA petrol stations were the first station to implement a self-service station in Saudi Arabia 25 years ago. However, they are not successful and the company's ROI sank into the red

because the stations lack the technology infrastructure and there were no promotions or sales to encourage the customers to use self-service stations. As a result, customers avoided refuelling themselves at AA self-service petrol stations and look for other petrol stations. Therefore, the behaviour of customers those prefer to be served, unless hygiene and technical processes provided, influenced the utilisation of self-service petrol stations (and its demise) in Saudi Arabia.

We also found that firm resources served as an important factor as all participants tested their machines for leaks by closing the entire petrol station and resetting petrol pumps. This is done because it is difficult to explore petrol leaks in most of Saudi Arabian petrol stations due to the age of Saudi Arabian petrol stations where at least 70% of them were built more than 30 years ago via underground steel extensions (Alsaied, 2011). Participants claimed that petrol stations in Saudi Arabia float on lakes of leaked petrol due to the lack of leakage testing technologies and a lack of government surveillance on such processes. Participants claimed that if any leak were to be found, it would be too late to repair the soil because they only do this test twice a year.

The participants expressed their view for the implementation of a flow-meter, which could help to measure the petrol flow from tanks to the pumps and vice versa. Leaks could then identified in its early stages and this will help preventing soil pollution and save people from an environmental disaster. In addition, lack of petrol leakage tests leads to wasting country resources and petrol station resources in particular. Information system effectiveness can be defined as “the extent to which the information system actually contributes to achieving organisational goals” (Thong & Yap, 1996, p. 252). Thus, participants claimed that the lack of technology utilisation in the testing of leaks was a significant issue in petrol stations and hence the contribution of technology utilisation is crucial to deploy petrol station resources and enhance petrol stations supply chain integration.

To summarise, the significant findings of the organisational context are firm size, culture and firm resources. Firm size influences the petrol stations integration in terms of the number of workers. Culture influences on the petrol stations supply chain integration in the Saudi Arabian petrol station because of the behaviour of customers that require the hygiene, encouragement promotions and technology utilisation. The failure of self-service petrol stations in AA petrol stations resulted in customers going to other petrol stations instead, where they do get served at the same cost. In addition, firm resources were found as a significant factor due to the importance of petrol products and the awareness of soil pollution disasters due to leaks. Eventually, the lack of technology in the testing of leaks increased this issue in Saudi Arabian petrol stations

and this contributes to the importance of petrol stations supply chain integration in terms of monitoring petrol stations operations and resources.

### **Environmental Context**

There were three significant factors related to the environmental context: geographic location, competition intensity and government regulation. Saudi Arabia occupies 80% of the Arabian Peninsula and it is estimated that the size of Saudi Arabia is 2,217,949 square kilometres (Central Department of Statistics and Information, 2010). Consequently, the large size of Saudi Arabia means challenges in petrol supply within the country. Hence, we found that rural petrol stations experience issues due to the geographic size of the country and their petrol stations' locations. For example, some rural petrol stations are located approximately 450 km away from Saudi Aramco's distribution station in Jeddah. This distance causes petrol supply delays in those petrol stations because truck drivers travel 14 hours each day to supply petrol to their petrol stations for each product.

Moreover, this distance increases the probability of road hazards, which threatens the drivers and trucks. The probability of lost camels crossing the national highway, which links the southern region of Saudi Arabia to the Western regions, is high. Participants from rural petrol stations also mentioned that the desert weather and sandstorms hinders the utilisation of technology in petrol stations because sandstorms disrupt machines and devices such as electronic pumps. Therefore, this problem requires extra maintenance costs due to the distance of rural petrol stations from technology supplier's stores, which are normally located in metropolitan cities.

In addition, we found that both rural and metropolitan petrol stations are affected by competition intensity. Participants described the competitive environment in which they run their business as a dishonest environment due to the competitor's fraudulent behaviour in wanting to increase profit. Considering that approximately 90% of Saudi Arabian petrol stations are operated and managed by individuals, either locals or expats, this intensity to compete causes serious problems such as mixing petrol products to reduce petrol prices and thus, attract customers; defrauding petrol pumps' meters; wasting petroleum resources; and, petrol smuggling to nearby countries, leading to a shortage in petrol products in the domestic market (Alwatan, 2011). Another contributing factor was the illegal leasing of petrol stations to the expats. Many local Saudi Arabians rent a petrol station and lease it to the expats who are registered under a Saudi name because the Saudi owners lack the knowledge in petrol stations management and charge the expats for this cover up. Some petrol stations earn approximately 1,300,000 SR per annum in rent. The fact that expats are only keen on short-

term returns produces a low quality service. These expats indulge in many fraudulent practices and are not interested in utilising technology towards petrol stations supply chain integration to provide better service in their petrol stations.

In terms of government regulation, the undersecretary of Riyadh region municipalities addressed a list of regulations to operate petrol stations, which have been imposed and published by the government since 2001. However, the regulations did not mention the importance of technology in terms of petrol stations supply chain integration. Petrol stations owners and operators also do not follow these regulations due to the lack of surveillance from government authorities and there are no earnest legal implications if they do not follow these regulations.

As a result, we found that the lack of supervision and control by the government on petrol stations is the main reason for most problems occurring in the Saudi Arabian petrol stations which ultimately influence in the petrol stations supply chain integration. This then allows the expats and local individual petrol stations owners' to breach the rules consistently. We also found that in the Riyadh region, along the national highways, there are approximately 1,000 petrol stations, and 400 of these were not built in compliance with pre-construction regulations of the Ministry of Municipalities and Rural Affairs. (Dawood, 2012).

To summarise, we found that the significant environmental factors are geographic location, competition intensity and government regulation. Geographic location is a challenge for rural petrol stations, specifically truck drivers who drive for more than 14 hours to supply their petrol stations. In addition, the weather in rural areas influences the technology utilisation because sandstorms lead to expensive maintenance costs due to the location of these petrol stations in semi-desert climate, which also considered far from suppliers' stores. Competition intensity was pinpointed as an important factor that negatively influences the competitive environment due to competitor's fraudulent behaviour. Lastly, lack of government surveillance and punishment influences negatively on Saudi Arabian petrol stations and leads the expats and individual petrol stations owners' to breach laws and provide no incentive to invest in technology to enhance their stations supply chain.

### **CONCLUSION**

Overall, this research highlighted the factors that hinder or help technology utilisation and petrol stations supply chain integration based on the three contexts of the TOE framework. In addition, this study explored the case study of Saudi Arabian petrol stations based on two regions, rural and metropolitan areas.



We addressed the issues that occur in the Saudi Arabian petrol stations that hinder technology utilisation such as the expats and individual local owners who rent petrol stations illegally and the lack of surveillance by the government. We found that both rural and metropolitan petrol stations in Saudi Arabia utilise traditional operations management processes in the petrol station supply chain, which leads to an increase of lead-time and minimising quality service. The Saudi Arabian petrol stations supply chain integration is influenced by the technological (i.e. relative advantage and IT infrastructure), organisational (i.e. firm size, culture, and firm resources), and environmental (i.e. geographic location, competition intensity and government regulation) contexts. Finally, the absence of appropriate government policies and regulations is seen as a deterrent by owners and tenants from using technology in their petrol stations. In addition lack of knowledge in terms of technology and management of petrol stations amongst the petrol stations owners and operators could hinder the petrol stations supply chain integration.

Our study has led to several recommendations for both petrol stations and government. Firstly, our findings suggest that government should monitor Saudi Arabian petrol stations in order to eliminate the dishonest competition that leads to poor service quality due to the fraudulent behaviour amongst the expats and local individuals. For example, government regulations should require business proposals from the owners to ensure that they are able to manage their petrol stations appropriately otherwise they need to learn how to manage petrol stations. Given this, petrol station owners would benefit from their petrol stations instead of leasing their petrol stations illegally to the expats.

Moreover, government should direct petrol stations' owners and push them towards petrol station supply chain integration by outsourcing some operations processes e.g. (technology installation, maintenance operations and logistics operations) to third party logistics providers in order to minimise delays that are caused by traditional measurement and accounting processes in Saudi Arabian petrol stations. In addition, this can help to offer good service and ultimately gain competitive advantage whilst keeping cost and lead-times low. For example, the integration of Saudi Aramco distribution stations with petrol stations and haulers through ERP systems such as SAP or web-based operation management systems, could lead to accurate petrol demand prediction and just-in-time petrol supply. However, we also see the need for government authority to monitor these petrol stations and impose regulations.

Our study has the potential to provide contributions to both industry and research. Our study is one of the first to be conducted in the area of the petrol station supply chain in Saudi Arabia and it provides an

understanding of the current condition of petrol stations operations management in Saudi Arabia. Additionally, it discusses the factors that contribute to the technology and supply chain integration of Saudi Arabian petrol stations.

This study has certain limitations that can provide direction for future research. Firstly, this study focused on only one rural village (Alkhurmah in the western region) and one metropolitan city (Riyadh in the middle region). Future research could examine other regions of Saudi Arabia to identify any similarities and/or differences. Second, our study adopted a qualitative research approach to explore the Saudi Arabian petrol stations operations management; future researchers could adopt a quantitative approach to generalize the findings based on other regions of the country. Importantly, our study determined the TOE factors that theoretically and practically contribute to Saudi Arabian petrol stations supply chain integration, however further research could explore the theoretical and practical contribution of the other supply chain units such as Saudi Aramco, petrol haulers, third party logistics providers in order to take a deep insight into the Saudi Arabian petrol stations supply chain integration.

#### REFERENCES

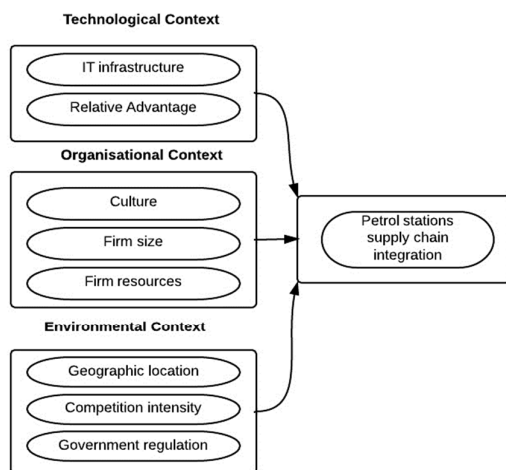
- Al-Gahtani, S. S., Hubona, G. S., & Wang, J. (2007). Information technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT. *Information & Management*, 44(8), 681-691.
- Al-Jabri, I., & Roztock, N. (2011). Adoption and Use of Information Technology in Mandatory Settings: Preliminary Insights from Saudi Arabia.
- Al-Qirim, N. (2007). A research trilogy into e-commerce adoption in small businesses in New Zealand. *Electronic Markets*, 17(4), 263-285.
- Al-Somali, Gholami, R., & Clegg, B. (2009). An investigation into the acceptance of online banking in Saudi Arabia. *Technovation*, 29(2), 130-141.
- Al-Somali, S., Gholami, R., & Clegg, B. (2010, 23/03/2010). *An investigation into the adoption of electronic business in Saudi Arabia using the technology-organization-environment framework* Paper presented at the UK Academy for Information Systems, United Kingdom.
- Al Falah, K., Zairi, M., & Ahmed, A. M. (2003). The role of supply-chain management in world-class manufacturing: An empirical study in the Saudi context. *International Journal of Physical Distribution & Logistics Management*, 33(5), 396-407.
- Aleid, F., Rogerson, S., & Fairweather, B. (2010). *A consumers' perspective on E-commerce: practical solutions to encourage consumers' adoption of e-commerce in developing countries - A Saudi Arabian empirical study*. Paper presented at the Advanced Management Science (ICAMS), 2010 IEEE International Conference on.
- Alsaied, H. (2011, 4/06/2011). Saving Fuel Stations by The Institutional Work Extends The Circle of Employment of Saudis, Electronic Article, *Aleqtisadiah*. Retrieved from [http://www.aleqt.com/2011/06/04/article\\_545415.html](http://www.aleqt.com/2011/06/04/article_545415.html)
- Alwatan. (2011). ARAMCO confirms that fuel supply is continuous to all cement firms, *Alwatan*. Retrieved from [http://www.alwatan.com.sa/Economy/News\\_Detail.aspx?ArticleID=55455&CategoryID=2](http://www.alwatan.com.sa/Economy/News_Detail.aspx?ArticleID=55455&CategoryID=2)
- Amit, R., & Schoemaker, P. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33-46.
- Angeles, R. (2012, 20-23 June 2012). *RFID supply chains of Purdue and Cephalon: Applying the TOE framework in seeking e-pedigree compliance*. Paper presented at the Information Systems and Technologies (CISTI), 2012 7th Iberian Conference on.
- Applegate, M., McFarlan, W., & McKenney, J. (1999). *Corporate Information Systems Management* (5 ed.). New York: McGraw-Hill Professional
- Archer, N., Wang, S., & Kang, C. (2008). Barriers to the adoption of online supply chain solutions in small and medium enterprises. *Supply Chain Management: An International Journal*, 13(1), 73-82.

- Bharadwaj, A. (2000). A resource-based perspective on information technology capability and firm performance: an empirical investigation. *MIS quarterly*, 24, 169-196.
- Bolumole, Y. (2001). The supply chain role of third-party logistics providers. *International Journal of Logistics Management*, 12(2), 87-102.
- Brynjolfsson, E., Malone, T., Gurbaxani, V., & Kambil, A. (1994). Does information technology lead to smaller firms? *Management Science*, 40(12), 1628-1644.
- Burnson, P. (2010). Beyond DUBAI. [Article]. *Logistics Management*, 49(3), 52S-55S.
- Central Department of Statistics and Information. (2010). Key Indicators Retrieved 10/12/2010, from <http://www.cdsi.gov.sa/english/>
- Chang, T., Liao, L., & Hsiao, W. (2005). *An empirical study on the e-CRM performance influence model for service sectors in Taiwan*.
- Chau, P., & Tam, K. (1997). Factors affecting the adoption of open systems: an exploratory study. *MIS quarterly*, 1-24.
- Creswell, J. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3 ed.). Los Angeles: Sage Publications, Inc.
- Davis, F., Bagozzi, R., & Warshaw, P. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003.
- Dawood, S. (Producer). (2012, 28/03/2012). Petrol Stations in Saudi Arabia Retrieved from <http://shahid.mbc.net/media/video/27168/10>
- Dedrick, J., & West, J. (2003). *Why firms adopt open source platforms: a grounded theory of innovation and standards adoption*.
- Dittmer, L. (2008). Asia in 2007. *Asian Survey*, 48(1), 1-4.
- Giunta, A., & Trivieri, F. (2007). Understanding the determinants of information technology adoption: evidence from Italian manufacturing firms. *Applied Economics*, 39(10), 1325-1334.
- Groznik, A., & Trkman, P. (2006). *A case study of supply chain management in oil industry*. Paper presented at the Information Technology Interfaces, 2006. 28th International Conference on.
- Heidegger, M. (1976). *Being and Time*. New York.
- IEA. (2006). World Energy Outlook 2006. *International Energy Agency*, 2008.
- Jeffcoate, J., Chappell, C., & Feindt, S. (2002). Best practice in SME adoption of e-commerce. *Benchmarking: An international journal*, 9(2), 122-132.
- Jhaveri, N. J. (2004). Petroimperialism: US oil interests and the Iraq War. *Antipode*, 36(1), 2-11.
- Julka, N., Karimi, I., & Srinivasan, R. (2002). Agent-based supply chain management-2: a refinery application. *Computers & chemical engineering*, 26(12), 1771-1781.
- Kamal, M. M. (2006). IT Innovation Adoption in the Government Sector: Identifying the Critical Success Factors. *Journal of Enterprise Information Management*, 19(2), 192-222.
- Kaplan, B., & Maxwell, J. (2005). Qualitative Research Methods for Evaluating Computer Information Systems. In J. Anderson & C. Aydin (Eds.), *Evaluating the Organizational Impact of Healthcare Information Systems* (pp. 30-55): Springer New York.
- Kuan, K., & Chau, P. (2001). A perception-based model for EDI adoption in small businesses using a technology-organization-environment framework. *Information & Management*, 38(8), 507-521.
- Lai, F., Li, D., Wang, Q., & Zhao, X. (2008). The information technology capability of third-party logistics providers: A resource-based view and empirical evidence from China. *Journal of Supply Chain Management*, 44(3), 22-38.
- Lee, C., & Shim, J. (2007). An exploratory study of radio frequency identification (RFID) adoption in the healthcare industry. *European Journal of Information Systems*, 16(6), 712-724.
- Lertwongsatien, C., & Wongpinunwatana, N. (2003). E-Commerce Adoption in Thailand: An Empirical Study of Small and Medium Enterprises (SMEs). *Journal of Global IT Management*, 6(3), 67-83.
- Lim, K., Chesbrough, H., & Ruan, Y. (2008). Open Innovation and Patterns of R&D Competition.
- Matar, M., & Al-Zahrani, F. (2011a, 12/02/2011). Petrol stations: Concealment and neglect beating investment, *Aleqtisadiah*. Retrieved from [http://www.aleqt.com/2011/02/12/article\\_503069.html](http://www.aleqt.com/2011/02/12/article_503069.html)
- Morrisson, C., Lecomte, H., & Oudin, X. (1994). *Micro-enterprises and the institutional framework in developing countries*: OECD.
- Ramdani, B., & Kawalek, P. (2007). SME Adoption of Enterprise Systems in the Northwest of England. *Organizational Dynamics of Technology-Based Innovation: Diversifying the Research Agenda*, 409-429.
- Ramdani, B., Kawalek, P., & Lorenzo, O. (2009). Predicting SMEs' adoption of enterprise systems. *Journal of Enterprise Information Management*, 22(1/2), 10-24.
- Rogers, E. (1995). *Diffusion of innovations* (4 ed.). New York: Free Press.
- Rose, G., & Straub, D. (1998). Predicting general IT use: Applying TAM to the Arabic world. *Journal of Global Information Management (JGIM)*, 6(3), 39-46.

- SAGIA. (2009). Economic Cities Retrieved 19/01/2011, from <http://www.sagia.gov.sa/en/Why-Saudi-Arabia/Economic-cities/>
- Salwani, M., Marthandan, G., Norzaidi, M., & Chong, S. (2009). E-commerce usage and business performance in the Malaysian tourism sector: empirical analysis. *Information management & computer security*, 17(2), 166-185.
- Senior, B. (1997). *Organizational Change*. England: Pearson Education Limited.
- Squalli, J. (2007). Electricity consumption and economic growth: bounds and causality analyses of OPEC members. *Energy Economics*, 29(6), 1192-1205.
- Tai, C.-F., Wang, E. T., & Lee, N. C.-A. (2013). How IT-Enabled Supply Chain Integration Is Achieved For Supply Chain Agility: An Institutional-Political Perspective.
- Teo, T., Lin, S., & Lai, K. (2009). Adopters and non-adopters of e-procurement in Singapore: An empirical study. *Omega*, 37(5), 972-987.
- Thong, J. (1999). An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems*, 15(4), 187-214.
- Thong, J., & Yap, C. (1996). Information technology adoption by small business: an empirical study. *Diffusion and adoption of information technology*, 160-252.
- Tornatzky, L., & Fleischer, M. (1990). *The processes of technological innovation*: Lexington Books.
- Tornatzky, L., & Klein, K. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on engineering management*, 29(1), 28-45.
- Turban, E., King, D., McKay, J., Marshal, P., Lee, J., & Viehland, D. (2008). *Electronic Commerce 2008 A Managerial Perspective*: Pearson Education
- Wang, Y., Wang, Y., & Yang, Y. (2010). Understanding the determinants of RFID adoption in the manufacturing industry. *Technological Forecasting and Social Change*, 77(5), 803-815.
- Zhu, K., & Kraemer, K. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information Systems Research*, 16(1), 61-84.
- Zhu, K., Kraemer, K., & Xu, S. (2003). Electronic business adoption by European firms: a cross-country assessment of the facilitators and inhibitors. *European Journal of Information Systems*, 12(4), 251-268.

## APPENDIX: FIGURES AND TABLES

**Figure 1: A modified TOE framework that has been adjusted to Saudi Arabian petrol station supply chain integration.**



**Table 1: Prior Studies Using the TOE Framework**

Authors	Why TOE?
(Chau & Tam, 1997; Kuan & Chau, 2001; Lee & Shim, 2007; Thong, 1999; Zhu, et al., 2003)	information technology adoption to enhance supply chains
(Teo, et al., 2009)	Evaluates the adoption of information technology
(Zhu, et al., 2003)	Appropriate theoretical framework to support empirical studies
(Chau & Tam, 1997; Kuan & Chau, 2001)	Suitable for identifying factors that impact the adoption of technology
(Zhu, et al., 2003)	Popular foundational model to study the drivers contributing to successful e-commerce
(Dedrick & West, 2003)	TOE is useful analytical tool for distinguishing between inherent qualities of an innovation itself and the motivations, capabilities, and broader environmental context of adopting organizations

**Table 2: Rural Petrol Stations**

Petrol Station	Age	No. of staff	Technology
MS Petrol Station	12 years	4	Basic use in office administration but not in terms of collecting, distributing and service of petrol
NS Petrol Station	15 years	6	Minimum use in terms of office administration and certainly no usage of IT in terms of providing petrol service or infrastructure for the supply and receipt of petrol
AS Petrol Stations x 2 branches	19 years	4 in each petrol station	Minimum use in terms of office administration and no usage of IT in terms of providing petrol service or infrastructure for the supply and receipt of petrol

**Table 3: Metropolitan Petrol Stations**

Petrol Station	Age	No. of workers	Technology
AA Petrol Station – chain of 460 petrol stations	50 years	4000 8 workers in each station	Very high tech usage of RFID to provide service, supply and receipt of petrol within the station
DB Petrol Station	60 years	8	High in terms of office administration but low in terms of receipt and supply of petrol within the station
ALO - 4 branches with 2 in the metropolitan areas and 2 in the rural areas	29 years 5 years 8 years 6 years	8 in each station	Very low usage of IT in terms of office administration and hardly any use of IT infrastructure to receive, supply or distribute petrol