Corporate Competitive Advantage Through Information Technology: Saudi Aramco Case

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Abstract--There so many articles argued weather Information Technology has any effect or relation with the competitive advantage of the companies. Nemours papers have addressed this issue when IT was advancing exponentially in the last decade. Some researchers come with a conclusion that IT would have no effect on the company competitive advantage. On the other hand, some other papers proved the relation between IT and IT performance with the corporate performance. This paper will discuss and analyze this relation. More specifically we will address the effect and the role of information technology on the strategic management of Saudi Aramco and how this would add extra dimension for the corporate competitive advantage. Saudi Aramco is an oil production company producing and exporting oil from Saudi Arabia. The company also had various business lines that serve the country with oil refined product. IT was integral part of the company strategy since it started producing oil since the 30's of last century.

I. INTRODUCTION

Companies, either small or large, would have some kind of competitive advantage that enables them to survive in a competing environment. The sources of competitive advantage will be different from one company to another and from an industry to another industry. For example, the sources of competitive advantage in the banking industry would be different from the sources of competitive advantage in the oil industry. On the other hand, there are sources of advantages that would be common across a wide range of, if not all, industries. For example, financial position of firms could be a source of competitive advantage. According to Resource Based View (RBV), company resources such as human resources, information technology, are common sources of advantages for companies.

In this paper, we will be reviewing the sources of competitive advantages and will discuss the form of advantages. The paper will also address the schools of competitive advantage. Next, we will introduce Saudi Aramco, the oil company in Saudi Arabia, and its emergence as a major player in oil industry. We will also look into how Aramco gain competitive advantage in the oil industry and how they introduce new strategy to fit into Saudi Aramco Business model. Finally, the paper will discuss how Information system or Information Technology added a competitive advantage to the company.

II. SOURCES OF COMPETITIVE ADVANTAGE

One way to define competitive advantage according to Cater would be as a unique position that the firm could develop compared to its competitors. Another definition by Bamberger is a position of superiority in an industry or market. If two companies are producing the same product or service then they can gain advantage through their prices or by differentiating themselves compared to the competitors [5].

If a company wants to survive in a competing environment, they have to possess resources that produce competitive advantage. Sources of competitive advantage had been classified in various ways in the literature. There are four different schools that look into the sources of competitive advantage in different perspective. These schools according to Cater are:

1. The industrial organization school,
2. The resource-based school
3. The capability-based school and
4. The knowledge-based school. [5]

According to the industrial organization school, sources could be internal to company and could be external. They also could be intangible and tangible sources. The competitive advantage gained from external sources are determined by the nature of the environment surrounding the firm not from within the company. Examples of external sources are the bargaining power of suppliers or buyers; the threat of new entrants, substitute products or services; and current competition within the industry.

Internal sources are considered under the other three schools which are the resource based school, the capability based school and the knowledge based school. The capability based school proposed that the firms could gain competitive advantage through their capabilities. These capabilities could be skills, organizational, dynamic, or core capabilities. These capabilities could be classified into managerial, input-based, transformational and output-based varieties as proposed by Lado. These capabilities won't gain firms advantage if they could be easily copied by other firms. Therefore, these capabilities have to be complex and difficult to be imitated [5].

Knowledge Based school, on the other hand, proposes that companies could gain competitive advantage if they have relevant knowledge compared to its competitors. Knowledge could be related to human capital which is employee's knowledge and skills or could be structural capitol which is related to firms. It is the role of the management to integrate these two capitols to gain competitive advantage. Finally, the resources based view of competitive advantage is to use the company resources to differentiate itself from its competitors. [5]

A. Resource based View

According to the resource based school, the competitive advantage of a firm can be built on a firm's resources where these have to meet some important conditions such as value, heterogeneity, rarity, durability, imperfect mobility, un-substitutability, and imperfect limitability. Barney had classified the resources into physical, financial, human and organizational [5]. In order for the Resource Base view of competitiveness to be effective, it has to have four features that are value, rareness imperfect limitability and non-substitutability. RBV of each company is based on two situations. First the resources and capabilities that a company has are different than other companies which mean resource heterogeneity. The second view is that these differences could last too long which means resource are immobile. The performance of each company depends on how they integrate these conditions into their business model to gain competitive advantage on the industry and the market they compete in.

B. Sustain competitive advantage.

There are several factors for a firm to gain sustain a competitive advantage. These factors had been addressed by Kettenger and his colleagues. These factors could be environmental factors and foundation factors. Environmental factors include industry changes, political changes, competitor restrictions, and changes in the regulatory environment.

Foundation changes are listed bellow:

1. Size: company sizes are only advantages if there is compelling economy.
2. Geographic scope: involves infrastructure, location and telecommunication.
3. Product scope: defined as the product or services that are offered by the company.
4. Vertical scope: the degree of vertical integration compared to competitors.
5. Organizational base: is the fit between firm's capability and performance.
6. Learning curve: the firm's ability to acquire and maintain knowledge.
7. Technological resources: technical expertise and resources provide an innovative power to companies.
8. Information resources: richness and content of the knowledge the firm has. [11].

The proposed model by Kettenger is in the figure below.

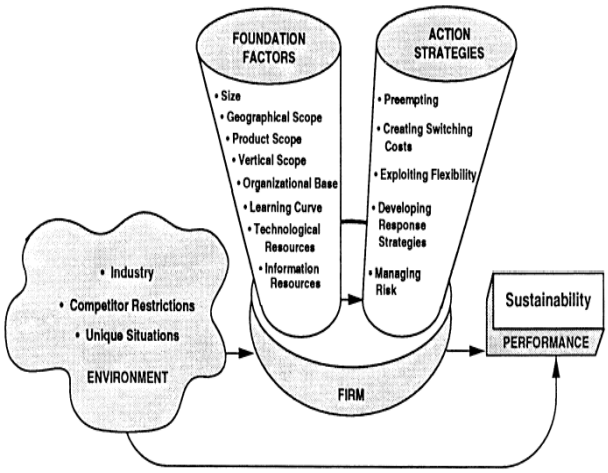

Figure 1. Sustainability Model
Source: William J. Kettinger; Varun Grover; Subashish Guha; Albert H. Segars *MIS Quarterly*, Vol. 18, No. 1. (Mar., 1994), pp. 31-58.

Another dimension of sustained competitive advantage is addressed by Barney. He stated that firms can not gain sustained competitive advantage from its resources unless they are heterogeneous and immobile. If so, firm's resources can be sources of sustained competitive advantage if they possess the following features:

- Must be Valuable: resources that enable the firm to implement strategies that the company efficiency and effectiveness.
- Must be rare: When the resource owned by a number of firms in an industry is less than the number in need for this resource.
- Must be imperfectly imitated: difficult for other firm to gain the rare and valuable resource of the firm.
- Substitutability: no strategically equivalent substitute of the resource. Two resources are strategically equivalent when they are used to implement the same strategy. [2]

The below figure represent the model for sustained competitive advantage proposed by Mata, Fuerst, and Barney.

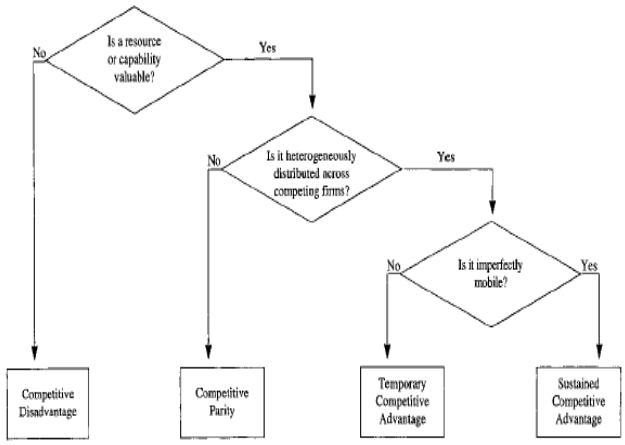

Figure 3. Resource Based model of competitive advantage [13]

C. IT as a competitive advantage

Researchers had different views of how information technology would affect or be a tool for competitive advantage. Some are not supporting the idea of IT being a source of advantage. Other scholars support this perspective toward IT and they stated that IT has no impact on competitive advantage or performance. Others, on the other hand, concluded that IT would have negative impact on performance or competitive advantage. Banker, Kaufman and others had different opinion about IT as a source of competitive advantage and they think that it has a direct and positive impact on the company performance. [12]

Information technology adds value to company and improve performance in various dimensions. There are numerous papers written about those attribute of IT that makes it a good source for competing with other. Following are some of those attributes:

As proposed by Parsons, IT would:

1. Increasing customer's switching cost by using IT to improve service and information delivery.
2. lower switching cost with suppliers
3. encourage product development and minimize the potential substitute
4. enable resource sharing with competitors
5. reduce or replace labor
6. improve customers satisfaction with better access of information [17]

McFarlan added more attribute for which IT would provide a positive effect to improve the firm's position in competing market. He added the following contributions:

1. IT can help in changing the basis of competition
2. it would enhance entrance barrier
3. it could increase switching cost
4. IT can also change power balance among competitors.
5. IT would help in the process of developing new products [17]

Bokos and Tracy had more contribution in this field of study to prove that IT will improve company's performance, they argued that IT would:

1. enhance the efficiency and effectiveness of firm's operations
2. improve coordination among organizations
3. develop new products
4. Obtain advantage of negotiation with suppliers and customers. [1]

Ives and lermonth also added that it would improve firm's Bargaining power with customer. [8]

The above is clear evidence that IT would be a source of competitive performance. But other researchers argued that IT will not be a source of advantage because other firms can acquire those attribute by acquiring IT. They argued that the above attribute of IT will enable the company to survive in a competing market but not to gain a sustained competitive advantage. IT is one of the resources that easily imitated and copied by other company and this does not meet the resource based theory for sustained competitive advantage through company resources. In order for IT to prove a sustained advantage, in addition to its value, IT has to meet one or all of the following features rareness, immitigability, and un-substitutability. In addition, IT has to enable the company to differentiate itself from competitors. This differentiation could be accomplished through several other attributes. According to Mata, Fuerst, and Barney, the five major attributes of IT that can provide sustain competitive advantage are: customer switch cost which they claimed that it could be imitated and will not provide a sustained competitive advantage, access to capital, proprietary technology, Technical IT skill and managerial IT skill. [13]

A certain capital would be needed to be invested to develop and apply IT. These investments are risky and huge for the firms to gain sustained competitive advantage from IT. Those ones that have the capital to invest would have better position in the competition. [13] In general, investment in IT has to meet the following conditions to provide the company a better position on the competition: efficiency (raising productivity); *effectiveness* (assisting leaders in choosing the right thing to do) and *competitiveness* (changing the way a firm competes in the marketplace) [20]. Proprietary technology is also suggested by Mata, Fuerst, and Barney to be a source of advantage and they claimed that this technology would not be protected from imitation by patent only but through secrecy. [13] IT technical skill means the know-how staff that the firm has to operate IT systems such as communication protocols, computer languages, operating system and also develop IT application that meets firm's requirements. However, technical skills won't be of any advantage if they are highly mobile meaning that employees could leave the company at any time and heterogeneously distributed across companies. Out of the five factors for IT to gain a sustained competitive advantage, Managerial IT skill is the most important. It is the ability of the IT managers to manage IT skill and integrate IT function with rest of the company, in addition to his ability to understand how to support and enhance the functions of other business functions within the firm. Managerial skills are difficult to imitate because it take quite long time to be developed. [13].

III. SAUDI ARAMCO

A. Background and Strategies

The story of oil production in Saudi Arabia started in 1933 when California Arabian Standard Oil Company (Casoc), affiliate of Standard Oil of California (Socal, today's Chevron) started the exploration for oil in the east cost of Saudi Arabia after the failure of British affiliate to find any oil in the region specially the British had already found oil in the small neighboring island of Bahrain. In 1938, they have found the first commercial oil field in the area in a city called Dhahran and have been exported through Bahrain. In 1939,

another American company got involved in the oil exploration and production in Saudi which is Texas Company (known as Texaco, now part of Chevron) acquires 50 percent interest in Social. Since then Casoc were shipping oil from the region through Saudi port called Ras Tanura that has been built for that purpose. By 1944, Casoc changed its name to Arabian American Oil Company known as ARAMCO.

As a new strategy for ARAMCO, they started refining the crude oil within Saudi by building a new refinery to meet the increasing demand for refined products to produce electric power and other uses of the source of energy.

As more fields being discovered in huge amounts in Saudi Arabia and also the international demand kept increasing, more American Oil companies had more interest in Saudi oil when Standard Oil of New Jersey and Socony-Vacuum Oil (both now Exxon Mobil) joined Socal and Texaco as owners of Aramco in 1948. Later these four companies were known as sister companies to ARAMCO.

In early 50's, Aramco diversified its market reach by building a 1700 Km (1,050 Miles) pipeline that was named Trans-Arabian Pipe line were completed to have the oil shipped to Europe and the US through Lebanon on the Mediterranean. The fifties were also very promising to ARAMCO since they have discovered the largest inshore field in the world (called Ghawar) and the largest offshore field in the world (called Safaniya)

In the 60's, Aramco had started another strategy by shipping refined products out of its own refinery in Ras Tanra on the west cost of Persian Gulf. This was enabled by the existing of a sea island that has a huge terminal that can host the huge oil tankers.

Saudi Arabia government started to own part of Aramco in the early 70's, and by the end of the decade they have owned Aramco 100%. The Saudi government has bought all the assets of the company. In the 70's, oil prices increased exponentially causing a huge profit for the company and the government of Saudi Arabia.

With the complication of local war in Lebanon during the 70's, the tap line was not functioning. This had forced Aramco to think of alternative path of shipping the oil other than the tankers porting in the Persians Gulf. In 1982, Aramco had built the east west pipeline (capacity of 3.2 Mbpd) that ship the crude oil from the east cost of Saudi Arabia where the oil is produced to the west cost on the Red Sea where it is closer to the international market. Aramco was renamed as Saudi Aramco in 1988. [19]

Saudi Aramco started a new era in the 90's. Saudi Aramco took charge of oil refining, distribution and marketing by merging SAMARAC, the government owned company that was in charge of these activates before. This is considered a complete change in Aramco strategy. They started to acquire other refineries that were owned by other companies like Petrolabe. Nineties was also the decade in which Aramco acquired several other businesses overseas and established also other ventures with other companies. Following are the acquisition and joint venture they made during this period:

1. Purchased 35% of S Oil Corporation the oil company in South Korea.
2. Acquired 40% of Petron, the largest refiner in Philippine.
3. Saudi Aramco acquires 50 percent of Motor Oil (Hellas) Corinth Refineries and Avinoil.
4. Company also assumes controlling of two Jiddah-based lubricants companies, now known as Saudi Aramco Lubricating Oil Refining Company (Luberef) and Saudi Arabian Lubricating Oil Company (Petrolube).
5. Saudi Aramco, Texaco and Shell establish Motiva Enterprises LLC, a major refining and marketing joint venture in the southern and eastern part of the United States.
6. A project with Sinopec and ExonMobil to triple the capacity of Sinopec's existing Fujian refinery in southern China to 240,000 bpd and add Trochemical manufacturing capacity.
7. Showa Shell, in Japan. [19]

Moreover, Saudi Aramco in an effort to improve market reach and increase oil sales margin, they have establish Villa the oil transportation company that is totally owned by Aramco. In 1995, Aramco built 15 very large oil tankers.

Another strategic change in the market of oil industry is the increasing demand on the gas products that usually exists in separate fields or combined in the same field with crude oil. With the remarkable demand for this strategic product, Aramco had invested in multiple huge multi billion projects to produce gas in commercial quantity. [19]

B. Competitive advantage of Aramco

Saudi Aramco has a strong competitive advantage compared to its competitors. The main source of competitive advantage of Aramco is its huge reserve of crude oil and gas. Saudi Aramco crude oil reserve is about 260 billion barrel which is about quarter of the world reserve. Aramco also has the capability to produce 9.1 barrel a day which is about 3.3 barrel every year which.

On the other hand, the gas reserve is about 239.5 trillion standard cubic feet. It has a production capacity of about 7.9 billion cubic feet a day which constitute about 2.9 trillion cubic feet each year.

Another source of competitive advantage for Aramco is the ownership of an oil transportation company that can reach anywhere in the world. Vela International Marine Limited, a wholly owned subsidiary by Aramco, was established in 1984 with four ships. It has grown to include 21 very large crude carriers (VLCCs) and seven product vessels.

In addition, Saudi Aramco has a large terminal that can operate up to 10 tankers daily. Saudi Aramco loading terminal handle up to 9000 tankers per year from its main terminal in East cost of Saudi Arabia.

Early in the 50's as mentioned earlier, for Aramco to gain competitive advantage compared to other oil producer in the area they had run a pipe line to ship oil from Lebanon to reduce shipping time an cost. To substitute that dead pipeline

and to maintain competitive advantage through different shipping point, they had a shipping terminal in the west cost of Saudi and a pipeline running from oil production area in east to service terminal in west closer to main customers in Europe and avoiding the political problems in Persian Gulf in 80's.

Added to the above, Saudi Aramco gain an advantage through its capabilities that enable them to produce in the range of 10 barrel per day of crude oil and around 8 cubic feet of natural gas. This make Saudi Aramco ranked as number one producer of oil in the world.

Strong presence in the local market provides more advantage from Aramco with a local market of about 3 million barrel per day. Moreover, Aramco owns and operates four refineries, and two joint venture refineries. They also own 20 bulk plants through which they distribute refined products, in addition to 8 terminals for shipping oil and off loading oil in the west cost of the Kingdom.

Aramco also had a good social presence that makes it a company that the society value and respect through its many social and service program they launched over the years. They were building and financing public schools around the area they are working in. Moreover, they were building paved roads that interconnect different cities and villages in the area. They also empower small businesses in the area by having them involved in the supply chain for the company. As part of its social commitment, Aramco built the University of Petroleum and Minerals to support its R&D efforts and to train the Saudi's to be professional work force.

To improve its position in the market, Aramco had several joint ventures locally and in other in different part of world. The joint ventures serve two advantages. One is to invest in other market overseas and the other is guaranteeing some customers for its crude oil and gas products that are shipped from Saudi. [19]

C. IT in Aramco.

Aramco or earlier CASCO started in the early 30' where no basic infrastructure in the country. Saudi Arabia just got unified couple of years earlier. The country was named in 1951 as The Kingdom of Saudi Arabia. CASCO had to build it own communication system after they have discovered that there is a very reasonable amount of oil in Saudi. More over, the fields that are discovered are very far apart by hundreds of Kilometers. Communication between exploration sites, drilling site, processing sites, industrial plants and management sites was curtail and affect the successes of CASCO as oil producer in the area. That is why the company was a head of the country and built its own communication system putting in ground all basic infrastructure of IT which include:

- The basic telephone switches
- Cabling infrastructure.
- Microwave systems
-

The purpose is to minimize traveling and reduce the time for decision making. With the emergence of computers, Aramco was a leading company in using the new comer to the business to improve performance and minimize processing time and improve engineering efforts and decision making. The Mainframe IBM was deployed to process seismic data that are collected from seismic tests where tremendous of time and efforts where reduced in deciding where to drill, other than using human calculation to decide on drilling which most of the time gave no positive results. The seismic test also provide other characteristics of the ground layers, the possibility of oil, how far deep is the oil, amount of oil reservoir, if it has gas or not and quantity of gas. Some seismic data could take days from The IBM Cray computer that was considered the fastest computing processing power at that time. With the development of information technology, Aramco continue to be self dependant on its own facilities to run its business. They built a huge communication infrastructure from communication to computing and including the process and control of plants, oil tanks and information super highway. The figure below show how Aramco IT infrastructure is built based on super efficient information technology products. IT system in Aramco include:

1. Telephone services
2. Computing services
3. Networking services
4. Wireless communication service
5. Satellite connection service
6. Internet/Intranet services
7. Process and control services
8. High Frequency services to communicate with ships over the world.
9. Other services that support operation in the desert areas.
10. Aramco for quite long time had its own TV channel and Radio channel.

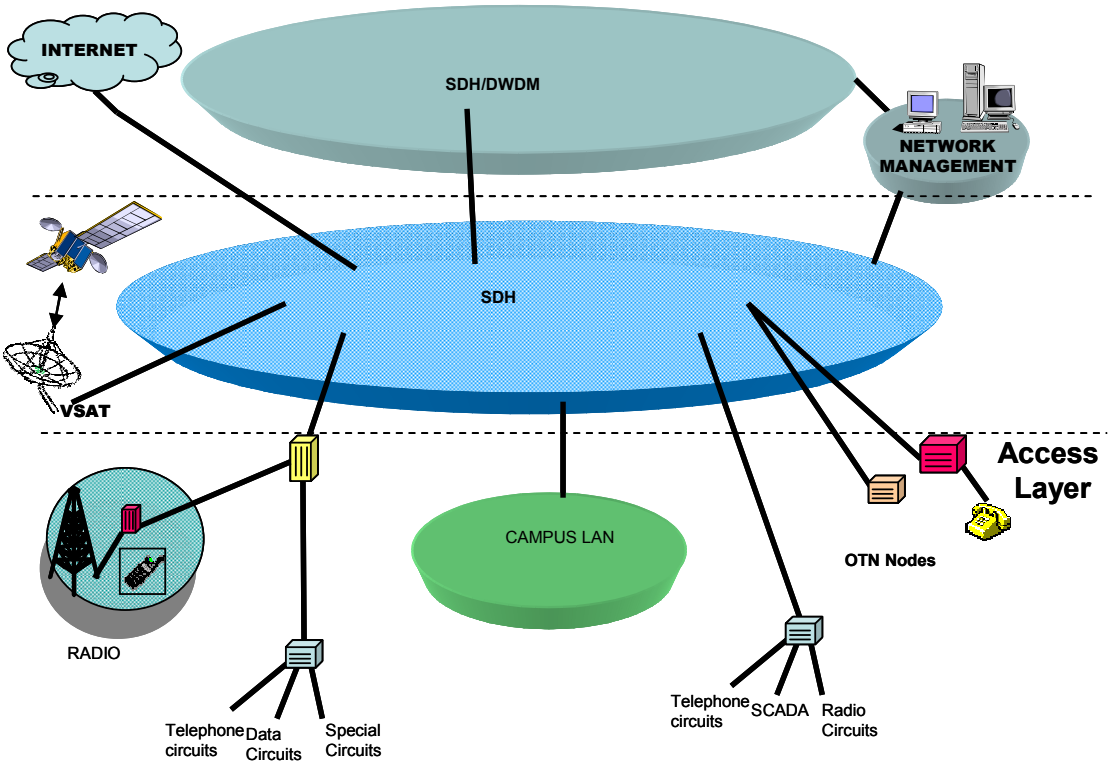

Figure 4. Suadi Aramco Information Network overview.

D. Aramco IT as a competitive Advantage

Saudi Aramco gave a great attention to IT infrastructure and service due to several factors. One of the reasons is its need to communicate with rest of the world where its market is. Aramco started its business in Saudi Arabia in the early 30's where no basic infrastructure was available. In addition, the country did not have the capability to build or improve its facilities. Therefore, Aramco found itself forced to build a complete IT system ranging from basic cabling infrastructure to a sophisticated computing systems. Originally, Aramco was owned by four major American companies as started earlier which had a huge investment on Aramco to make oil available for their market. Those companies also wanted to have a fall access to information from Aramco to make proper decisions. Moreover, Aramco facilities span a very large area of the east cost of Saudi Arabia as shown on the figure in the figures in the appendix. Those areas needed to be on contact for proper decision and efficient operation and also to minimize the time needed to produce the oil from the remote sites and ship it the processing plants.

Lately, Saudi Aramco considered Information Technology an important tool to improve productivity, increase efficiency, minimize production time, improve time to market, meet market demand, strengthen the R&D, add more control on the production process, enhance services, and altimetry lower the production cost. Aramco has no control over oil prices. Politics play a great deal in the determining the price of oil. Moreover, oil prices like any strategic product are affected by the demand and offer. Crises in any oil production facilities anywhere in the world will also affect the prices. Saudi Arabia is part of OPEC (Organization of the Petroleum Countries) which is a major oil producer from developed countries have a strong role in deciding the oil price. However, Saudi Aramco has a control of oil production cost through which it is trying to gain competitive advantage. Abdulla Juma'a who is the CEO of the company was quoted on his speech in Cambridge, Massachusetts in February 01, 2007; "*Saudi Aramco is a leader in utilizing and developing technologies that efficiently and effectively, yet safely, maximize the extraction and use of oil and gas. The company relies on its state-of-the-art electronic network and its extensive human network to keep it among the leaders in the oil and gas industries*". The quotation stated clearly that IT has a major role in the company strategy that aims to put Aramco among the leaders of the industry. In the same speech he also stated that Aramco will reduce production cost and per-barrel energy expenditure by 50% by the end of the next decade.

As stated earlier, owning a resource does not provide competitive advantage until it is well integrated with the other business line of the company and IT is no exception. Earlier Mata, Fuerst, and Barney stated that for a resource to provide a sustained competitive advantage for companies, it has to have five attributes: switching cost, access to capital, proprietary technology, technical IT skill and managerial IT skills. They have eliminated the switch cost attribute since it can be imitated easily by other firms and this attribute is not valid in Aramco case. Aramco used to have IT preparatory technology from IBM since it was dominating the computing world during the 70's and 80's. IBM provided Aramco with its best computing power at that time which is the Cray computer systems that was used to analyze exploration data. This computer system tremendously reduced the time for data analysis and improves production time. Aramco did put a

huge investment to acquire this technology since it knew that will tremendously improve analysis time. However now a days Aramco is deploying a Multi-vender networking infrastructure in order not be locked in with only one supplier of IT supply entity. The company directed enough budget for IT improvement purposes. For example, in the 90's when the internal distribution company was integrated with Aramco, the company put huge budget to bring the new integrated company to the standard of Aramco IT facilities.

From the quote of the CEO above, he mentioned that Aramco invested on its human capital to improve its position on the competing market and IT personal is part of this capital. Aramoc hired very skilled IT personal from all over the world to integrate the IT resources with corporate strategy. At the same time, they have established an extensive program to develop the Saudis over the years who became an asset for the company. In addition, the IT managerial skills development was also taken a good consideration from Saudi Aramco executives. Even though, Aramco core business is in oil industry, IT is considered one of the major business lines where its director is reporting to the CEO. They have provided various paths for the development of technical and managerial skill. They offered program internally, through Professional Engineering Development Program, Intranet courses and others, and externally whether in or out of Saudi Arabia. All this development efforts is to make sure that the company will efficiently use its resources to gain competitive advantage.

IV. CONCLUSION

In conclusion, IT is a must have resources for each company, but not all of those companies will be able to use IT as competitive advantage. They have to use the IT system to differentiate themselves from other competitors. This differentiation is accomplished through a careful implementation of IT and integrating it with other business of the company. Copying IT facilities has to be complex in order for others not to imitate it and if they do so they could not get the full advantage like the imitated company.

Aramco had a long history with IT and had to have its own to be competitive and provide oil to the market with lowest production cost. Aramco had invested on its IT facilities and employees to get a full advantage from IT.

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SECONDARY SOURCES

[1] Saudi Aramco Booklet

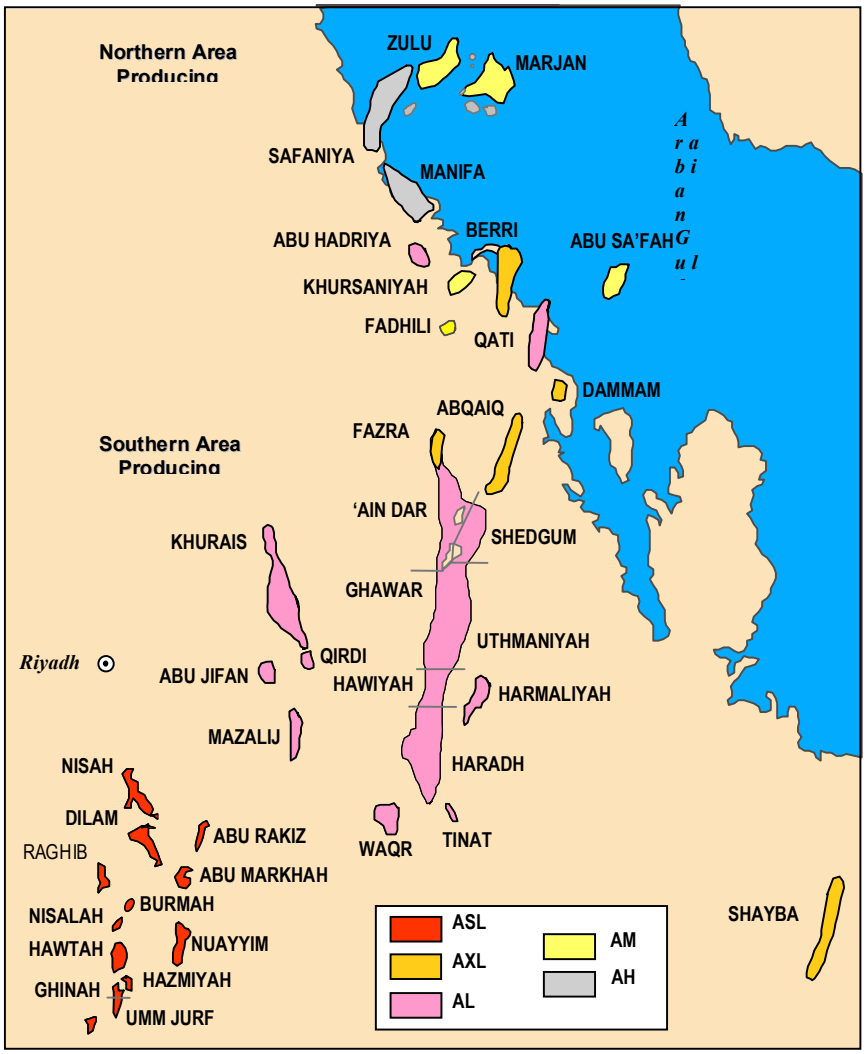
[2] IT transmission system

[3] Saudi Aramco Strategy Map with Strategic Imperatives, presentation slides

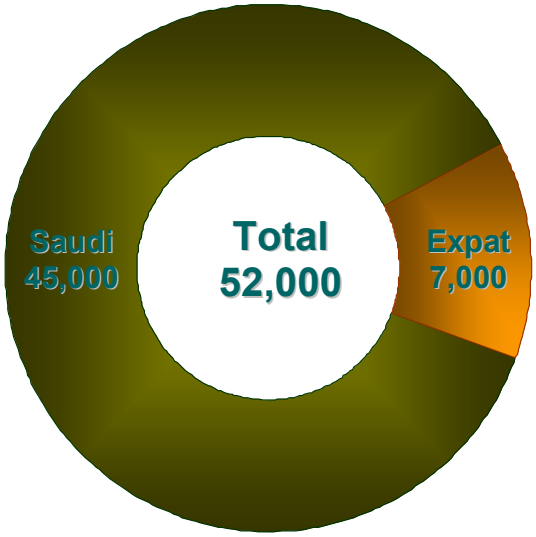
[4] Central Engineering Team Business plan, Presentation slides

[5] Saudi Aramco- Overview by Ziyad M. Alshiha, Manager, Public Relations Department in MIT, January 2007. Presentation slides.

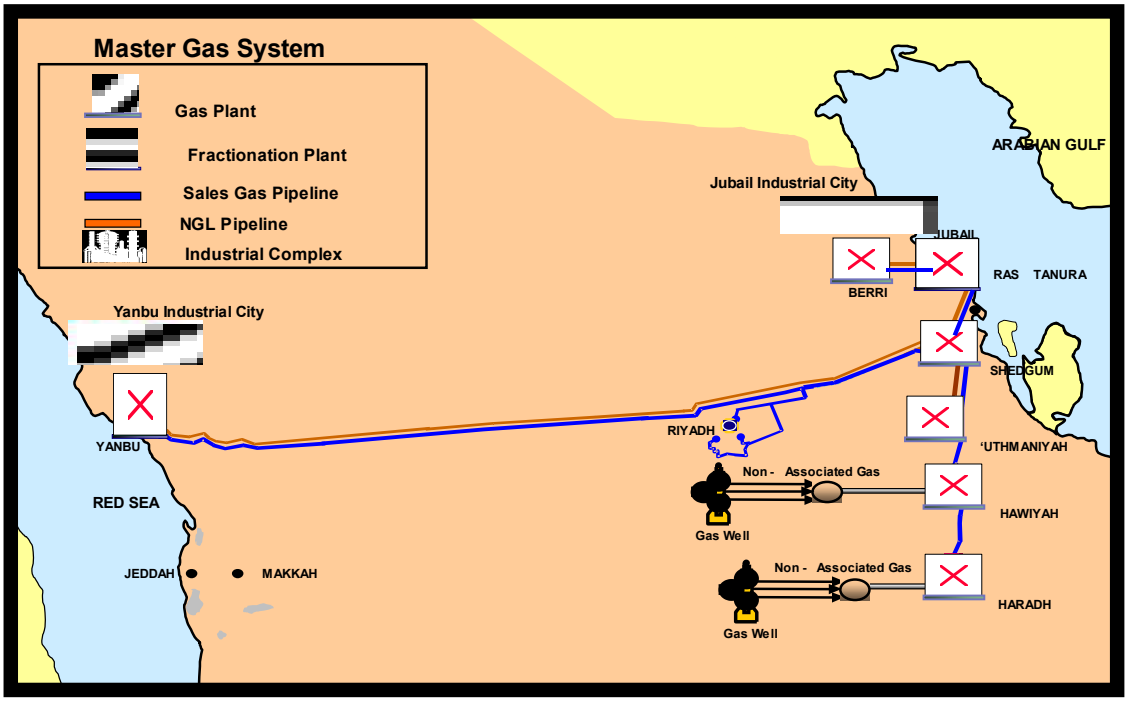
APPENDIX 1



Oil and gas fields plan in the east cost of Saudi Arabia. Source: Saudi Aramco- Overview by Ziyad M. Alshiha, Manager, Public Relations Department in MIT, January 2007. Presentation slides.



Aramco workforce by end 0f 2005,
Source: Saudi Aramco Central Engineering work force



EastWest Pipeline that transfer oil from east cost to west cost of Saudi Arabia estimate length is 1300 Km. Source: Saudi Aramco- Overview by Ziyad M. Alshiha, Manager, Public Relations Department in MIT, January 2007. Presentation slides.