History of Computing in Saudi Arabia: A Cultural Perspective

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***Abstract*—Saudi Arabia is one of the biggest exporters of oil in the world. The discovery of oil proved to be the starting point of the country's rapid modernization. The use of computers and data processing equipment in Saudi Arabia coincided the early applications of such equipment in the western countries. The Saudi entrance into the personal computing and the Internet age presented the country with opportunities for further social and economic advancement but also raised questions about the impact of the global computerization on the preservation of the unique cultural and religious heritage of the Saudi society. This paper is concerned with the roots and the development of computing in Saudi Arabia and the cultural constraint it has undergone. The impact of computing on culture and society will also be presented.**

***Index Terms*—Arabic software, computer history, culture, Saudi Arabia.**

I. Introduction

Founded in 1932, Saudi Arabia holds one of the world's largest oil reserves. The discovery of oil in the early 1900s provided the necessary funds for building the country's basic infrastructure and proved to be the starting point of the country's rapid modernization. The use of computers and data processing equipment in Saudi Arabia started in the 1940s and reflected the early applications of such equipment in the western countries. The Saudi entrance into the personal computing, and later to the Internet age, presented the country with opportunities for further social and economic advancement but also raised questions about the impact of the global computerization on the preservation of the unique cultural and religious heritage of the Saudi society. The roots and the development of computing in Saudi Arabia is a fairly new subject and no comprehensive research dealing with it has been done. Computing history in Saudi Arabia in the context of culture and society is covered in this paper. Specifically, how the Saudi culture effects computer technology adoption and acceptance and how the technology could modify the culture. Due to immense nature of the subject, this paper concentrates more on religion, language, and communication aspects of the culture. National and regional histories of computing, such as the one addressed in this paper, are significant not only to the regions in question, but also to the global understanding of computing because, as historians Saarikoski and Suominen stressed in one of their works, "they remind us that developments are not globally uniform and that technology is culturally dependent [1]."

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II. Historical Background

Significant technologies do not develop in the historical, cultural, and socio-economic vacuum. This is even more true of social acceptance of such technologies. Therefore, it is necessary to review the history of Saudi Arabia to give a proper context and properly situate my analysis of computing and information technologies in that country. The geographic location and early cultural and economic activities are as important as later state organization and laying the foundations of technological infrastructure.

A. Geography

Saudi Arabia is located in the Arabian Peninsula, also referred to as Arabia. Saudi Arabia named after the family name of its original founder Muhammed bin Saud in the 18th century. His alliance with the religious leader Muhammad ibn Abd al-Wahhab in 1744 is the basis of Saudi Arabian religious and dynastic rule today [2]. Today's modern Kingdom of Saudi Arabia was founded in 1932 by Abdulaziz ibn Saud the ancestor of all following kings of Saudi Arabia.

Record of early man's presence in Arabia goes back to the New Stone Age 7000-2000 BC. Sites in northern and southern Arabia testify to the presence of hunting and gathering groups who used crude stone tools. In the Neolithic period, the Northern Arabia's inhabitants were not as technologically sophisticated as other neighboring civilizations [3]. With time, they were able to make pottery and fine chipped spearheads and arrowheads with high degree of sophistication. Clay tokens that was used for counting was found in Saudi Arabia from the 2800 BC era indicate that the distributive economy was shaping up in that region and that there had to be some settlements [3].

Prior to the rise of Islam in the 7th century, the Middle East was controlled by two empires; the Roman-Byzantine Empire in the west and the Sasanian Empire of Iran in the east [4]. Arabia was a vast desert squeezed in between those two empires. With the exception of Yemen in the south of Arabia and few scattered settlements elsewhere. Most areas of the Arabian Peninsula of the early 7th century did not have any organizing authority. It had no state structures, nor legal system. Tribes were the only large social and political organization. The majority of people of Arabia were pastoral nomads engaged in raising camels, sheep, or goats. The harsh environment and scarcity of resources forced continuous movement from one place to another. At the southern part of Arabia, Yemen was a fertile and well watered region that was able to support settled societies. It was a source of external

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influence into the peninsula. Arabia was a very important transit route between the Middle Eastern empires and Yemen. Goods traveled through Arabia from India, East Africa and Southern Arabia to the Mediterranean region. Arabia looked like a barrier or a fence between two great economic areas. However, the people of Arabia had the skills to transport such goods and caravan provisioning centers grew up and became major settlements.

B. Writing, Numerals, and Calculation History

The histories of numerals and writing are intertwined. Some prominent scholars, such as Schmandt-Besserat, maintain that the early writing evolved from recording numerals [5]. Based on ethnographic research, primitive people operated with only limited set of numbers. In some cases their languages could only contain words for 0 and 1. With numbers came primitive ways of recording them. For instance, by cutting notches on bones and pieces of wood or tying knots. For counting, primitive humans used fingers or pebbles. This is how they carried out their household business duties and performed trades.

In "The Histories," Herodot's writes in the writing of characters and reckoning with pebbles, while the Hellenes carry the hand from the left to the right, the Egyptians do this from the right to the left. This was based on his own observation [6]. Herodot was living in 5th century BC and was extensively traveling. From this it follows that counting boards (as in "calculating with pebbles") was known not only to Greeks but also to Egyptians at least in 5th century BC. Arabia was a very important transit route between the Middle Eastern empires and Yemen. Goods traveled through Arabia from India, East Africa and Southern Arabia to the Mediterranean region. It is highly plausible that counting boards were in use in Arabia for trade as well and around the same time.

It is generally accepted that writing first started in Mesopotamia, just north of Arabia, in the fourth millennium BC. The origin of Mesopotamian writing has its roots in ancient counting devices which were used to record quantities. It is demonstrated that the precursor of cuneiform writing was a counting system of tokens. Tokens (or counters) were small clay or stone objects of many shapes and sizes which were used as a method of counting and recording. Each counter indicated the quantity of goods specified by its shape. For instance, a small cone-shaped counter record a small measure of grain and a sphere is used for a large measure of grain. Tokens can be traced to the Neolithic period around 8000 BC and they evolved according to the need of the people and the economy [7]. There were two methods to store tokens. The first one was to pierce a string through the tokens and the second was to enclose them in clay envelopes. Some of the tokens that were used from the 8000 to 2500 BC were discovered in the Middle East. One of the sites where these tokens were recovered is Dhahran in modern day Saudi Arabia. The recovered envelope from Dhahran is dated to the period of 2800 to 2600 BC [7].

By the end of the 8th century, the Indian positional decimal system (with the zero) entered the Arab world. Its original form was later changed by Arabs enough to appear to be new. Arabs developed it and transmitted this system to the west, and because of that the numerals that are commonly used today have come to be called Arabic numbers.

Some of the Arab contribution to mathematics and arithmetic include the development of the decimal place value number system to include decimal fractions. In addition, they systematized the study of algebra and began considering the relationship between algebra and geometry. According to [8], in a general way it may be said that the Golden Age of Arabian mathematics was confined largely to the 9th and 10th centuries; Arab scholars preserved and transmitted to posterity the classics of Greek mathematics. Their work was chiefly that of transmission, although they developed considerable originality in algebra and showed considerable creativity in their work in trigonometry.

The Arabian school of mechanics in the 9th century also played an important role in transmitting the ideas and techniques of the school of Alexandria to Europe during the Medieval and Renaissance periods. It is entirely plausible that even some of the early techniques for mechanical calculations came from that school. A more recent example can be seen in Matrakci Nasuh work, who lived in the Islamic Ottoman Empire from 1480 to 1564, came up with a mechanical calculation method that would later be known to the world as Napier's bones which is a calculating device used to facilitate multiplication and division. Napier published this method approximately 50 years after Matraki [9].

III. Introduction of the First Computers

The arrival of computer technology in Saudi Arabia was influenced by the development of the industrial sector driven by the oil industry. According to [10], the beginnings of computing and data processing development in Saudi Arabia were a reflection of the beginnings of computing and data processing around the rest of the world. The oil industry played a big role in the early introduction of computer technology to the country. The use of computers at Saudi Aramco, one of the largest oil companies in the world, began in the 1940s with the introduction of the electrical tabulating machines. For a few years subsequent, usage of computer technology as an application was limited to small number of companies and government agencies. The first mainframe computers purchased for installation in Saudi Aramco arrived in the early 1950s. By the late 1950s during the same year of their introduction in the US, Saudi Aramco acquired two IBM 1401 computers. They were used for processing the company payrolls, financial and cost-accounting systems, personal statistics, and material supply records. During these early years, highly technical applications such as seismic data rendering and simulations were done on computers at Aramco facilities in the United States and Europe or contracted to specialized companies. In 1966, a new computer system capable of processing digitally recorded seismic data arrived to Aramco headquarters. A powerful Texas Instruments TIAC 870 seismic computer which was one of the first integrated-circuit computers, unveiled in 1966.

Subsequently, the Saudi entrance into the personal computing and later, to the Internet age presented the country with opportunities for further social and economic

advancement. Since the introduction of the first PCs in North America in the 1970s, these machines started to show up in Saudi Arabia in small numbers. In the 1980s, Japanese MSX computers were the favorable type of computers in the country. In 1989, about 80,000 personal computers were in operation in Saudi Arabia. This ranked the country second only to Brazil in the developing world in regard to the number of PCs in operation [11].

Most developed countries computer manufacturers and software companies in the 1970s and 1980s have taken third world countries users for granted and made no big effort to enter their markets [12]. Most companies had no specific published price lists for third world countries. In addition, companies employed expatriates at inflated prices for technical assistance and maintenance for the developing nations. Most companies were sending junior staff members who were introduced to third world country users as experts. Also, the careless customization of hardware and software is a big problem because of the social and cultural differences. Furthermore, the lack of contacts between users in the third world and users in developed countries make it hard to compare the support and services they are getting with those offered in developed countries. Even though these situations may had had influenced the early adoption of home computing in Saudi Arabia, they should not be drawn as facts since this cannot be confirmed for all manufacturers.

With the introduction of the Internet in the late 1990s, IBM clones invaded the Saudi market. There is no doubt that the introduction of the World Wide Web to the country was the major contributor to the increasing use of computers by individuals at homes, schools, and offices as it is the trend globally. The Internet opened the door for a new world the closed society experienced for the first time. People wanted to be part of the experience and the easiest way to do it was to purchase a PC. However, questions were raised about the impact of global computerization on the preservation of the unique cultural and religious heritage of the Saudi society.

IV. Computing and Culture

The discovery of oil in commercial quantities is one of the most significant factors leading to the modernization of the Kingdom of Saudi Arabia. In 1946, around the time of the introduction of computers to the country, oil revenues reached 10 million per year in US dollars. Utilizing their wealth, the country soon began an extensive program that would build modern systems of transportation, communications, housing, utilities, and education facilities [13]. The increased oil prices in the 1970s helped with the creation of a world class petrochemical industry and huge infrastructure development.

The slow computer technology acceptance in developing countries could be attributed to poor infrastructure, language barriers, socio-political, economic and cultural risks, and conflicts. In Saudi Arabia, the economic factor does not apply.

In 1977, Saudi Arabia was ranked the second in the world, in terms of monetary reserve [13]. Traditionalists have been always mistrustful of the alien technology, fearing a threat to traditional social values. The government continues with their development plans regardless. Culture and traditions abstracted as the general way of life in the Kingdom of Saudi Arabia. The Saudi Arabian society is a conservative society where Islamic teaching and the Arabian cultural values dominate. As most technology is designed and produced in developed countries, it is culturally biased in favor of those developed social and cultural systems. The bias creates cultural and social obstacles for developing countries to transfer technology into practice.

Social and cultural characteristics of Arabs and Muslim societies are very different from that of the west. Understanding how the society functions is a very important aspect to better understand the development of computing technology. This is especially true in a not very welcoming for new trespassers country such as Saudi Arabia. Arab culture seems to exert a stronger social influence than Western culture on its society through the development of social norms and beliefs. Arab culture is characterized by more uncertainty avoidance and power distance than the western culture. It is a very social-oriented culture, unlike the individual oriented more liberal culture prominent in west. Most new technologies are designed and produced in societies with highly developed economies. It is expected that there would be some social and cultural gap with less technologically developed societies. Failing to put the technology implementation process into the proper social context of economics, sociopolitical, and cultural dimensions can slow down the process and increase the risk of failure [14].

Uncertainty avoidance in the Saudi Arabian culture is very high and goes through many steps of inspection and examination through the society before it may be accepted [15]. Collectivism also dominates the Saudi society. Mainstream citizens reflect on the perspective of first adopters of a technology. The majority of the population tend to avoid the uncertainty associated with new technologies until the first adopter have accepted and recommended such innovations to others. The political environment can still implicitly control and govern the adaption of any new technology and the government made sure that the new technologies do not interfere with it.

The following subsections emphasis more on computer technology effects on religion, language, and communication. In addition, the impact of these cultural factors of the society on computer technology acceptance is presented.

A. Language

English has been the common language for computer technology since the first computers started to surface. One of the main obstacles to the development of computer technology in the Arab societies has been the language barrier. According to [16], efforts to "Arabize" the technology were very weak in the first years of computers introduction. Arabization of software, hardware, user manuals was needed as computing in the Arab region could not cope with the rate of advancement in the technology.

Arabic script utilizes an entirely different alphabet of that in English. It is meant to be interpreted from right to left. Problems encountered when trying to utilize Arabic in computers include, but not limited to, design and implementation of character sets, developing the character

generating routines, and problems associated with programming in more than one language.

The introduction of computers utilizing script written in the Arabic language took a bit of time but was eventually integrated. There were no graphic patterns existed for displaying Arabic script on a computer. Before 1960, Arabic transcription used Latin characters used in computers. However, it was not very useful because of the huge difference between the two. In the late 1960's, Victorine Abboud [17] designed a computer-assisted instruction (CAI) to teach the Arabic language for her students and her attempt was successful. Even though she was able to program a computer to display Arabic characters from right to left for the first time, this method was not very useful for general use because it was for a specific use and lacked portability to other systems.

Arabic applications, programming languages, and operating systems stared to appear in the 1970s and 80s. During the early 1980s, Japanese MSX home computers started to invade Saudi homes. Al-Alamiah's versions of MSX, Sakhr computers, were very popular in those years. Due to its affordable price, functionality, and bilinguality, Sakhr was the favorable introductory computer in the country [16]. Al-Alamiah Technology Group was established in 1970 the neighboring Kuwait. Sakhr was initially established as a division of Al-Alamiah in 1982 to bring Arabic language computer support to the Arab World. Al-Alamiah Company with the help of hardware and software developers in Japan and in the Arab world was able to produce an inexpensive fully bilingual Arabic-English microcomputer system capable of running Arabic software. Al-Alamiah developed a library of Arabic educational software, games, Arabic versions of some programming languages, and much other utility software. During the Gulf War, Sakhr Software relocated to Saudi Arabia. Producing software, from educational and games programs to religious software, Sakhr had sold 2 million software packages by 1990 in the Arab region [18].

Computer technology influence on the Arabic language can be seen since the early computer use. Early computer operators had to learn English (or enough of it to use foreign software) to be able to run computers. In addition, computer jargon has had a considerable effect on the Arabic language and new vocabulary has emerged. Moreover, the Arab cultures preferred face-to-face communications over communications using technological means [14]. The lack of face-to-face communication when using networked computers affected the nonverbal contextual cues of the conversation.

B. Communication

The speed of adoption of new information and communication technologies is often seen as an indicator of the growth of technological innovation and development in any society. Indeed, technological progress and scientific inquiry in any society are highly dependent on collaboration and access to information, and those, in turn, have undergone a particularly profound transformation with the introduction of computer networks. Since the 1980s, in just a few decades, the proliferation of computer networks has transformed the way the world communicate.

Communication technology advancement has significantly affected the way business transaction and information processing in Saudi Arabia is conducted. The history of publicly accessed computer network communication in Saudi Arabia dates back to 1985 when the country launched Gulfnet network with the help of IBM. Gulfnet linked computer centers and libraries of Saudi Arabia and universities of other neighboring Gulf countries through high speed communication lines. Gulfnet was the first public computer network in the Arab world. At its peak, 1,400 organizations in 49 countries were connected for the electronic non-commercial exchange of information in support of scientific research and education. Its creation was the result of the globalization of communication technologies and of existing well developed infrastructure. Gulfnet changed the way the society communicate and collaborate with the outside world. It made it easier for Saudis to access information that was not available otherwise. During its decade and a half-long existence, was the connection that linked Saudis to the outside world. It also demonstrated that the scope and functionality of public computer networks in Saudi Arabia have to be fine-tuned for compliance with Islamic culture and political system of the country. Gulfnet set the groundwork for the Internet to be introduced in 1998.

Later, the Internet opened the door to a new world society experienced for the first time. Saudi Arabia has been linked to the Internet since mid-1990s, although public access was not available until late 1990s. Many Saudi individuals, organizations, and companies did not wait for the official launch of the Internet to the country to benefit from it. Saudis who desire access subscribed to foreign services offshore [9]. In 1998, The Internet was first publicly available and the whole population could access.

C. Religion

Saudi Arabia's society special characteristic is based on the Islamic teachings as the main source for its laws and regulations. Mainly, only those laws that conform to the Islamic teachings are accepted and implemented. Computer Technology presented the country with opportunities for more social and economic advancement but raised questions about the influence on the religious heritage of the Saudi society and ways to keep it protected.

The use and acceptance of technology varies between one culture to another. Technologies can be rejected or slowed down because of the incompatibility with religious practice and believe. This can be seen when many newly introduced technology that links to the outside world were first introduced to country. There is anecdotal evidence of an incident that took place around the time of the introduction of telephone technology. Saudi religious clerics condemned the telephone, radio, and TV when they were first introduced into the country. After the introduction of the telephone in the country, King Abdulaziz, the first king of modern Saudi Arabia, arranged a special demonstration of how the phone could work to try to convince the religious clerics the usefulness of this new technology. He had it call up a distance town. He said to one religious sheikh (cleric), "why don't you speak on the phone and see what you can hear in the other end". At the other end, the king had stationed another

religious sheikh. When the religious men saw this "work of the devil" could in fact be used to make their own communication easier, they changed their minds. There was a similar resistance with respect to satellite TV channels introduced in the early 1990s as well as computers. This is especially true for networked computers that allowed foreign influence to arrive to the country at a click of a mouse. Cellphone with cameras also were controversial when they were first introduced and were condemned by the religious clerics.

Saudi government leaders have always regarded computer and telecommunication technologies as signs of modernization and automation and did not oppose their introduction to the country. However, some compromises has to be made to somewhat satisfy religious principles of the society. Internet filtering has always been in effect in Saudi Arabia since the Internet was first publicly introduced. The concern for Internet access in Saudi Arabia comes because of cultural, religious, and political reasons. Therefore, the government decided to enforce a tight censorship policy. There are many forms of censorship prohibiting any material thought to be politically or socially harmful and against the morals and teachings of the Islam. The government makes no qualms about the censorship of the Internet. Sometimes, it is the citizens of Saudi Arabia that are responsible for of the censoring by voluntarily submitting filtering requests forms block some websites.

V. Conclusion

The speed of early adaption and development of computer technology in Saudi Arabia exceeded many developing countries. It corresponded to the early use of such equipment in the developed countries. The country's support of the computer field immense income and the influence of foreign expertise from the oil industry played a central role in the early introduction of computer technology to the country. Saudi Arabia is a country that has long upheld strong cultural and religious values. The Saudi society has always regarded computers as signs of modernization and as essential for country's prosperity. However, some cultural resistance to accept it and some social adaptation has taken place as for any new technology. Indeed, being a conservative society where Islamic teaching and the Arabian cultural values dominate affected the way the new technology is adopted. National histories of computing are significant to the global understanding of computing and its history.

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