WIRELESS TECHNOLOGY USES IN THE OIL AND GAS INDUSTRY

Joseph N. Roge’, University of Texas Pan American, jroge@panam.edu
Lester Rydl, University of Texas Pan American, lrydl@panam.edu
Claude Simpson, University of Texas Pan American, csimpson@panam.edu

ABSTRACT

Wireless technologies are being used in dynamic business environments to link systems and the people who control those systems. The use of these technologies in the oil and gas industry is highly beneficial for collecting and analyzing data concerning operations in widely dispersed geographic areas. This paper focuses on the use of various wireless technologies in management and operational functions of the oil and gas industry.

Keywords: Wireless Technology, Oil and Gas Industry, GPRS, SCADA

INTRODUCTION

A primary characteristic of data that makes it valuable to managers is its timeliness. Uncertainty and velocity of operations in oil and gas markets fuel a demand for timely information (9,11,12,15). Required information is typically geographically distant from where it is needed. Information may be at the wellhead, at points along a pipeline, or offshore. Providing timely information at a distance was not technically possible in past years because technology was not available. Today this technology exists. In the future, even better technology will provide better operating capabilities.

This article will examine the issue of wireless technologies as a means of providing managers and organizations with better decision-making ability. While there are many different ways to express the decision-making process, they follow the same general path and require timely and accurate data.

Increased amounts of irrelevant information decrease decision-making performance. In a dynamic, fast-paced industry such as the oil and gas industry, decisions must be made in a timely manner based on relevant information. Eisenhardt (1989) suggests that decision speed affects firm performance in fast pace industries.

The Eisenhardt (1989) study is relevant to this paper in that she suggested five antecedents regarding decision speed; two of which are relevant to this study: 1) the use of real-time information, and 2) multiple simultaneous alternatives.

DECISION-MAKING IS A CORNERSTONE OF THE ORGANIZATION.

“The work of managers is largely work of making decisions and solving problems.” (9) It is work of choosing issues that require attention, setting goals, finding or designing suitable courses of action, and evaluating and choosing among alternative actions.

Huber (1990) proposed a theory linking information technology to organizational design, intelligence, and decision-making. He proposed that the effects of computer-assisted communication and decision-aiding technologies have an impact on decision-making and that technology will prompt changes in organizational design and affect the quality and timeliness of
Wireless Technology Uses in the Oil and Gas Industry

intelligence in the organization. His main ideas are that the advancement of communication technology should now be considered a variable that facilitates access to people and groups in an organization and that the information technology employed by the organization will aid in decision making by providing the ability to store and retrieve large amounts of information quickly. Because of certain advancements in wireless communications, this capability is considerably enhanced in today’s oil and gas organization.

A wireless technology infrastructure would fit the framework proposed by Huber (1990) because wireless technology would provide managers with a more efficient means of information retrieval at any time without regard to distance. Ultimately, the use of wireless technologies will lead to a larger number and variety of individuals and groups participating in the decision-making process. Wireless technology, with its ability to provide managers with relevant, real-time information, could help the manager to better understand and assess rapidly changing environments (9).

Response uncertainty may create difficulties predicting the consequences of a decision that has been made. (7, 12) Organizationally, if a threat exists, a manager must assess the threat and make an appropriate decision based on available information. Should an immediate threat present itself to the organization, a manager must make the appropriate decision immediately. Using wireless technologies that have abilities to monitor firm operations would provide managers with the capability to make better informed decisions quicker.

The need for new technologies has become essential because of growth in the industry. Early adopters of wireless technologies use these technologies to control operations, reduce costs, and gain competitive advantage (13). Use of these technologies is becoming more commonplace. With the maturity of these technologies, use will likely become a competitive necessity. Integration with existing information technologies will be crucial. In subsequent sections we review past technologies, consider current technologies, and attempt to focus on future technologies to promote better information understanding.

The latest wireless technologies may provide a way for firms to control operations and maintain a competitive edge by providing organizations with timely information. Thus, the need to understand the latest wireless applications is necessary to better control operations and reduces costs of labor and transportation. A serious study of wireless technologies would be prudent for firms in a fast-paced, environmentally uncertain, and turbulent industry.

Wireless devices allow employees to conduct their daily business without having to be in the office or travel to retrieve needed data at substantial costs. This would be especially important for oil firms that maintain a number of offshore or remote drilling sites.

On a grander scale the oil industry needs timely information retrieval to help prevent operational problems that could have serious consequences. For example, a study by Eisenhardt (1989) regarding fast strategic decisions in high velocity environments, a microcomputer company filed for bankruptcy because of delays and indecision that affected its competitive advantage. Wireless technologies and applications could provide a solution to some operational problems in the oil and gas industry by providing the ability to access real-time information and rapidly react to these problems.

WIRELESS TECHNOLOGIES IN A COMMUNICATIONS MODEL

Shannon’s classic communication systems model (14) is one framework for this paper. In addition, a discussion of communications within the organization and its impact on the
dissemination of information throughout the organization will be addressed to further the idea of the importance of wireless technologies and their use.

**PAST, PRESENT, AND FUTURE TELECOMMUNICATION TECHNOLOGIES**

The dynamic marketplace and the need for real-time information have caused firms, especially oil and gas firms, to adapt to new ways of communicating. Digital systems have replaced dedicated hard-wired systems that use analog capabilities. Businesses are no longer geographically bound to a central location to obtain and process information. Wireless communications have developed and thrived in this environment.

**Telemetry**

Telemetry describes the technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources to receiving stations for analysis. This technology has been used for some time in a number of applications. Telemetry is the basis from which all wireless technologies have sprung and are still used.

Present oil and gas industry operations include the use of mobile radio and telephone communications. Originally, the first generation mobile communications systems used in the 1970’s were used for voice applications, i.e., simple talking. These systems were taken a step further to mobile communications systems that supported voice applications as well as providing data services to the managers or technicians monitoring the system. Today, computerized data gather devices (SCADA) at the well-head are connected to a fileserver at headquarters via wireless technology. Application software processes this real-time data making information available to decision makers.

**The Next Generation Wireless Technologies**

The cutting edge of wireless technology lies in the new “generation” networks. The trend in the wireless industry is the movement to third generation (3G) networks that can provide enhanced data and voice transfer. Sound quality is better and data transfer is much faster. In addition, there is no need for wires or cables.

Wireless technologies have evolved, but still have the same general capabilities. Within the current digital world of wireless, there are four primary technologies: code-division multiple access (CDMA), global system for mobile communication (GSM), integrated dispatch enhanced network (iDEN), which is used by Nextel, and time division multiple access (TDMA). Each of these technologies has their second and third generation path and the acronyms will merge accordingly.

**WIRELESS APPLICATIONS FOR THE OIL AND GAS INDUSTRY**

How does this technology fit into the operations of the oil and gas industry? Firms have developed new systems to aid in their business operations by using these technologies. Past and present methods of communication in the oil and gas industry have included satellite communications (on a limited basis), Cellular and Specialized Mobile Radio, fiber-optics, and general offshore telephone service using radio frequencies. Offshore telephone service usually
Wireless Technology Uses in the Oil and Gas Industry

consisted of a radiotelephone based antenna/transmitter that would allow communications between any offshore oil platforms and land-based telephone networks. These systems required a team of employees to monitor and report to management on a continuing basis.

Currently, cellular and specialized mobile radio services are in the process of providing better services to the offshore drilling platforms and are generally expected to replace the older offshore radiotelephone systems found primarily in the Gulf of Mexico region. Such systems make use of these technologies to reduce and/or eliminate on site monitoring by a team of employees.

SCADA

One system that is being used by the oil and gas industry is SCADA or Supervisory Control and Data Acquisition. A SCADA system is usually built to a customer’s specifications, but all SCADA systems are meant to perform the same task; acquire remote data and provide real-time information on the operations of the plant or well. Because the information can be gleaned from any location, wireless technology assists in this situation by transmitting collected data to a central location for analysis and action.

Wireless Oil Exploration

Oil exploration and prospecting is a very expensive component of the oil and gas industry. There is a new wireless technology device that can be used in the exploration thus cutting the cost of oil and gas exploration. This device, developed by a UK company Generics, can detect the likelihood of oil in the ground to aid in exploration. This device helps map the sub-surface geology of an exploration area. This device, unlike other exploration devices, does not use wires. “Because it is wireless, it means the task of data acquisition can be achieved more cheaply.” (10)

Remote Performance Monitoring

New wireless technologies in the oil and gas industry also include the ability to monitor, model and manage reservoirs in real time. These models have capabilities of modeling such things as depletion-induced rock stresses and reservoir levels. (3)

Wireless at the Pump

Shell oil selected IBM to pilot a wireless gas station. This system will link retail locations of Shell to corporate systems to help monitor and improve retail operations. Shell feels that this will eventually reduce operating costs. (1)

General Packet Radio Service (GPRS)

GPRS provides a non-voice service that allows the connection to networks in the United States and in Europe. IP packets are transmitted over existing cellular telephone networks. This capability has much potential for monitoring well head activity for a well that is within reach of a cell phone. (4)
Satellite Remote Monitoring

A Houston, Texas based oil company, Apache Corporation, is using a Verdisys, Inc. wireless communications system that utilizes satellite communications for remote monitoring. Apache Oil has a large number of widely dispersed well heads that require monitoring. The Verdisys Satellite Private Networks (SPNs) are providing secure monitoring and communications of data from these remote sites. (2)

Oil Spills and Leak Detection

The Leakwise Company has developed devices that are capable of detecting oil-sheen and remotely transmitting data to remote locations. These devices are designed to be installed at tar pits, pipelines and oil-tanker buoy terminals. These devices float in the area that spill detection is required and are impervious to dirt, salinity and temperature. The devices use solar panels with rechargeable batteries, transceivers and other data communications capabilities. If leaks are detected, a gateway ground satellite transfers alarm e-mail messages to monitors. (16)

FUTURE WIRELESS APPLICATIONS

New wireless applications include new wireless technologies that allow for more data to be processed at a faster speed. This suggests that information retrieval will be faster and more reliable. In addition, the new wireless hardware will be able to display these data from screens as small as those found on mobile phones. Messaging, data transmission, and GPS location services can now become commonplace using a mobile phone.

Future Trends

The future trends in wireless communications will include enhanced voice clarity and faster data transfer speeds. The third generation wireless technology has been implemented e.g. Sprint PCS new product, Sprint PCS Vision. Although limited to the display size of the wireless hardware device, the technology boasts faster data transfer speeds that will allow color screens and increased connectivity. The oil and gas industry will be able to use the next generation wireless technology for online-time or real-time applications. The new generation of wireless technology has the ability to send Global Positioning System (GPS) data. Faster data transfer speeds and the ability to relay GPS positions would help diagnose problems in the pipeline in an almost real-time environment.

Managerial Applications

Timely information is needed to correct problems and help provide solutions. In addition, productivity gains are always desired to provide evidence that the manager is doing well. The “bottom line” of projects and the maintenance of existing processes and production lines are always examined to provide ways to minimize waste. Given the tasks the manager must perform, wireless applications could assist. Problems in production lines, product quality, and machine breakdown can be instantly known via a wireless medium. In addition, using wireless technology to transmit real-time data could possibly eliminate interruptions in service before a
problem occurs. Furthermore, should a termination of service occur due to an overload or power interruption, wireless technology could assist the manager in determining what the problem is, where the problem is located, and help provide solutions to fixing the problem.

**ORGANIZATIONAL IMPACTS**

The manager is only one member of the organizational team. The “big picture” of the organization and how wireless technology would affect the organization needs to be investigated and possible solutions proposed. Underlying the present article is the idea that wireless communications provides an organization with increased productivity from improved communications.

An important feature of a successful organization is the way it communicates job-related information to employees. In the oil and gas industry, knowing where and what product is being produced or delivered is essential to an efficient and effective organization. The use of wireless communication to offer possible remote control of equipment and facilities, transaction services monitoring, and even transportation management service is an important consideration of this paper.

With respect to labor costs, the organization could save substantial amounts of money because there is no need to have personnel continuously on location to inspect, monitor, maintain, and/or report conditions. Wireless data provided by implemented wireless technology would automatically produce reports on processes. Adjustments could be made at appropriate times reducing any overtime payments. The benefits of wireless technology to the organization as a whole could be substantial.

**RECOMMENDATIONS**

What should a firm do with wireless technology? There is probably not a simple answer. However, certain ideas and recommendations could be proposed. The organization could potentially face large problems in implementation of a wireless system into their existing technology systems. An infrastructure would have to be in place for the purpose of improving profitability or performance or both. Essential to this assertion is the fact that the wireless systems would have to be able to measure the profitability or performance. Otherwise, determining a significant return on the wireless investment would be difficult.

Organizationally, firms would have to start looking at the use of real-time data as a corporate asset similar to the local area network or wide area network architectures. In addition, the use of wireless technology should be implemented with some form of security in mind. Government regulations will force refineries to control emissions of volatile organic compounds, clean ground-level storage equipment, and provide monitoring of equipment that would house hazardous waste. The need for a technology infrastructure that will monitor compliance with regulatory statutes will be essential. The need for real-time data acquisition via wireless technology would be a perfect fit for this situation.

Last, most managers and organizations are concerned with profits and increasing shareholder wealth. The ability to implement wireless technology to offer real-time capabilities in the management of inventories and storage, as well as transportation from one enterprise to another is key to profitability and creating an effective and efficient operation. Wireless systems could operate on a global scale and help manage offshore systems and offshore exploration with
globally located units. Ultimately, wireless technology could enable the oil and gas industry to have better control over their assets globally, thus improving profitability and reducing losses.

REFERENCES