It is 10 years since the oil price crash of the mid 1980s. During this time oil companies have put their highest priority on cutting oil production costs - a move which has led to widespread redundancies and major downsizing in both producer and service companies.

So, after a decade of constant cost-cutting, is the industry at the point where it must find new ways to improve production efficiency? This question proved to be one of the major themes at the ninth SPE Middle East Oil Show in Bahrain. Over 100 delegates, from a host of national and international companies, attended a special conference session in which speakers outlined their scenarios for the years ahead.

In this article, Mohammed Awad and Farouk Kenawy explain the new cooperative approach to cost effectiveness in the oil and gas industry and anticipate a time when long term oilfield alliances, shared databases, risk- and profit-sharing have become standard practice.
Savings, business efficiency, cost-effectiveness, value, total quality management - the oil industry is no stranger to business-optimization drives. The oil and gas industry has undergone significant change during the last 20 years, with an emphasis on cost-effectiveness growing out of experiences gained since the 1970s. The underlying assumption of that decade - that energy prices would always increase - was swept away by events in the 1980s and 1990s.

In the 10 years since the price crash of the mid-1980s, oil companies have put a high priority on cutting oil production costs - a strategy which has led to widespread redundancies and major downsizing in both producer and service companies. Around the world, more than 500,000 oil and gas jobs have been lost since the mid-1970s.

So, after a decade of cost-cutting, has the industry reached the point where new ways must be found to improve production efficiency? This question proved to be one of the major themes at the 9th SPE Middle East Oil Show in Bahrain. Over 100 delegates, from a host of national and international companies, attended a special conference session in which speakers outlined their scenarios for the years ahead.

‘Pursue quality in the broadest sense, throughout our business, in order to improve efficiency and effectiveness whilst increasing job satisfaction.’

Rashid Al-Jarwan
ADCO Deputy General Manager (Operations)

There is no doubt that the drive for production efficiency is here to stay. In 1994, Abu Dhabi Company for Onshore Oil Operations (ADCO) saved almost $7 million (figure 1.1) as a result of the company’s ‘Performance Enhancement Program’. In future, however, the quest for greater efficiency may have to follow a different course. The industry has already paired costs to the bone - the world now has the leanest and most efficient oil industry it has seen for 30 years. Many experts are now saying that forcing further reductions in production costs may harm overall efficiency and hamper long-term technical development.

All of the delegates at Bahrain agreed that the industry faces another 10 years of weak oil prices (figure 1.2). During this time, companies will concentrate most of their efforts in developing marginal fields and facing up to increasingly stringent environmental controls - difficulties that are bound to increase production costs.

Many delegates proposed a new, cooperative, working relationship between oil and service companies - so that future challenges could be tackled more efficiently. They also pointed out that traditional tendering can be an obstacle to the development of new technology and makes no allowances for the close inter-company cooperation often required to make marginal fields profitable.

The common observation among service companies was that conventional tendering, in which the lowest price is usually accepted, leaves no room for dialogue between the operator and the service company. Prescriptive tenders often force the service companies to propose their lowest suitable technology in an attempt to secure the contract. More often than not, the successful service company is then obliged to ‘sell up’ technology to complete the job.

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For example, a contract secured on the basis of conventional resistivity logging techniques is of little value to an
operator facing problems that can only be solved using a higher, and more effective, level of technology but at a higher cost.

Improved collaboration between operators and the service sector will ensure that tenders can offer the most appropriate technology for the proposed work.

Wytch way forward?

There is clear evidence that this approach works. At its Wytch Farm site in the UK, British Petroleum (BP) proposed a forward-thinking approach in which the bid price for the tender accounted for only 15% of the overall evaluation. The rest of the bid was assessed on the service company’s potential for alliances and its access to new technology.

As a result, the Wytch Farm work has broken world records for efficient and cost-effective operations. While BP has spent over three times the amount it originally budgeted for field development work, the project has been an order of magnitude more successful than expected.

BP now intends to continue this type of tendering procedure and to develop alliances and longer-term strategies with its service companies. This commitment to cooperation has been welcomed by Schlumberger.

Mohammed Awad, Middle East Vice President for Dowell Schlumberger, maintains that there is no more room for straightforward production cost savings. Instead, savings must be made through improvements in production efficiency - and this can only be achieved by harnessing new methods and embracing information technology and quality management procedures.

Abdullah Samari (General Manager, Drilling and Workover, Saudi Arabian Oil Company) backed this philosophy and provided additional illustrations to show how new technology had led to major cost savings within Saudi Aramco.

Awad offered numerous examples of ways in which new technology provides cost savings throughout the industry. One of the areas he focused on was 3D seismic acquisition and processing. Recent improvements, using powerful parallel processing computers and multi-streamers, have led to more costly but extremely efficient seismic acquisition interpretation (see Seismic Success Story).

In seismic processing, a 3D job that would once have taken a year to process now typically requires only a few weeks to complete. Drilling companies such as Sedco Forex have also moved with the times to develop smaller, more cost-effective drilling rigs which are less harmful to the environment and permit field development at reduced cost (see Leaving Smaller Footprint).

**Seismic Success Story**

In some ways, oil exploration and production is tougher than it used to be. As the major oil producing regions of the world reach maturity, the average size of new discoveries is decreasing. At the same time, operators are being pushed into harsher environments - deep water, deep drilling, high pressure and high temperature wells etc. where they face higher operating costs.

New techniques and technologies will be required to ensure that small and complex fields can be located and developed profitably. Marginal fields have to be managed more carefully than giant or supergiant fields - errors and overspend in the exploration and early development phases of a marginal field could make production uneconomic.

One of the most important tools in oil exploration is seismic surveys. Seismic techniques have been enhanced over recent years, with an increased quality of processing and the routine use of 3D acquisition methods in complex areas.

In seismic surveys, as in all aspects of oilfield development, the operator must weigh up the costs and potential benefits of new acquisition and processing developments.

For example, in many cases, image-ray based velocity analysis of a time-migration will produce useful results relatively quickly. However, in cases where the subsurface structure or velocity is complex, depth-migration based velocity analysis can help to reveal structures. However, this approach is roughly ten times more expensive than image-ray depth conversion. So what are the benefits?

**Seismic worth its salt**

In sub-salt and salt-flank reservoirs (figure 1.3) 2D seismic surveys are of little use. The marked velocity contrast between salt and other sediments complicates the imaging and leads to uncertainty about the true thickness of the salt and the actual depths and thicknesses of sedimentary layers which lie beneath it.

By using depth-migration rather than time-migration, the base of the salt can be accurately identified. Images from 3D pre-stack depth-migration allow the analyst to image the sediments beneath the salt. When accurate salt velocities are not used in processing, the bottom of the salt and events below it appear at shallower depths than they should. This ‘velocity pull-up’ affects structures too - potential oil traps in structural highs can appear at significantly shallower depths than they should. This may not be a major problem for basin reconstruction and other large-scale studies but incorrect depths and thicknesses make accurate drilling extremely difficult.

Depth-migration can be applied to 2D seismic data to help improve the imaging, but 2D migration assumes that the seismic line is perpendicular to the structure - which is often not the case when the target is associated with a salt structure. The rapid lateral velocity changes associated with salt depositions mean that 3D pre-stack migration is now the way forward for sub-salt imaging. However, this technique presents a formidable computational challenge.

Increased computer power has been a driving force behind the development of seismic imaging methods (particularly the shift from 2D to 3D) and will continue to be a controlling factor. The future will probably see a closer link being forged between velocity models and migration which will ultimately incorporate lithological and pore fluid data. The emergence of massively parallel computing will control the pace of future developments in seismic imaging.

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Many new technologies, including slim-hole and coil-tubing drilling, logging-while-drilling and geosteering have also been identified as contributors to cost-effectiveness throughout the industry.

Coiled for oil

Coiled tubing is one of the best examples of a technical development which revolutionized the cost-efficiency of exploration and production. Pushing small diameter tubing down a producing well to perform simple workover operations was first attempted in the late 1960s. Since then, coiled tubing has undergone a rapid growth in popularity and reliability.

The tubing itself is a high-strength, yet ductile steel tube with diameters typically in the range 1 in. to 3 1/2 in. The steel is wrapped on a portable reel which may hold as much as 6000 m of tubing. At the wellsite, tubing is unspooled from the reel and fed through a gooseneck, then through an injector, stripper and blowout preventers (BOPs) and into the well (figure 1.4). The injector moves the tubing into and out of the well and supports its tensile load.

Once the tubing has been deployed the appropriate workover fluids can be injected - nitrogen for kick-off, foam for cleaning, acid for matrix clean-up or cement for squeeze jobs.

The crucial development in the coiled tubing success story has been the growing popularity of highly-deviated and horizontal wells. In these wells coiled tubing provides the rigidity necessary to reach the producing zones, while the addition of a wireline allows production logging in horizontal completions.

New shallow wells, conventional re-entries and under-balanced wells have all been drilled successfully with coiled tubing (figure 1.5). The most important applications of coiled tubing to date have been in through-tubing re-entry or under-balanced drilling - activities which can not be conducted efficiently or safely with a conventional rotary drilling rig.

Through-tubing re-entries are typically drilled to deepen or sidetrack a well without removing the production tubing. Coiled tubing is ideal for this because no additional equipment is required to pull the tubing. The coiled tubing unit can move in, rig up and start drilling within a few hours.

In environmentally sensitive and remote drilling locations, coiled tubing drilling offers two major advantages - fewer rig loads are required and the resultant wellsite is smaller than for conventional drilling rigs. This helps to control costs and minimize environmental impact. Space saving is also important offshore because many platforms have limited deck space for drilling operations.
Increasing environmental awareness in the oil industry has encouraged some companies to develop smaller facilities. Drilling rigs, production platforms and, at the extreme end of the scale, artificial islands all affect the environment in which they are deployed. To minimize the "environmental footprint" of production many companies have tried to do more from existing facilities using long range deviated wells. At British Petroleum's Wytch Farm Field in the United Kingdom (figure 1.6) an extended-reach drilling development saved the operator around $180 million and avoided drilling additional wells in environmentally sensitive areas.

In other regions, companies have attempted to downsize their drilling and production facilities. Smaller drilling rigs produce less waste and can be removed quickly and cheaply at the end of the drilling program.

"Technology is the lifeblood of the upstream industry."

David Jenkins
BP Chief Executive Technology

Since June 1993 Sedco Forex has been investigating every aspect of its drilling operations in an effort to streamline drilling practice and optimize rig design. The aim was to design a highly mobile rig with slimhole capabilities that could drill medium depth, conventional diameter wells and perform heavy workover. Sedco Forex have managed to combine environmental benefits with reduced drilling costs. Their new concept drilling rig - the SIMPLER rig - has been designed as a compact and efficient alternative to conventional rigs. The SIMPLER rig requires between 25% and 35% of the area needed for a conventional rig (figure 1.7). The completed design was based on existing or slightly-modified state-of-the-art technologies rather than new and untried systems. Technology transfer from other industries helped to solve some of the rig handling problems.

Specific changes include:
- Placing cement and mud activities under the control of a single fluid engineer means fewer wellsite personnel and allows sharing of equipment;
- Closer links between mud logging and mud engineering. The logger and fluid engineer share work space to encourage cooperation and ensure consistency in fluids and formation information;
- Single maintenance team - having all equipment maintained by a dedicated maintenance crew improves consistency and simplifies planning;
- Cross-training personnel increases skills and promotes an awareness of all aspects of rig operation;
- Integration of Measurement While Drilling (MWD) and wireline logging functions. The same personnel can run all directional, density, resistivity and porosity logs whether logging while drilling or on wireline. However, more sophisticated wireline logs would require the expertise of a specialist wireline engineer. The driller and drilling crew may assist in running wireline tools using a logging unit that is integral to the drilling rig.

If these changes were made, the crew required to run a typical drilling operation could be cut by as much as 30% and support facilities downsized accordingly.

Slim wells are efficient wells

Slimhole wells are much less expensive than their conventional counterparts. These savings derive from lower quantities of consumables (e.g. mud, cement and casing) simplified logistics, reduced cutting disposal and smaller rig deployment. A 2500 m well completed with 3 1/2 in casing is between 10% and 40% cheaper than an equivalent well with 7 in casing.
Companies such as Dubai Petroleum Company (DPC) have increased their operational efficiency by adopting new logging technology. In the past, several runs had to be made into a well to gather a series of well logs. Today, logging technology has improved to the point where several tools can be combined and many logs can be obtained during one ‘combination’ run into the hole.

In 1994, DPC ran nine ‘super-combination’ logs, replacing 27 logging runs that would have been needed with old technology. The super combinations consisted of six or seven different tools being run with simultaneous data recording. This approach has saved 300 hours of rig time and around $700,000.

Technical improvements such as these have been facilitated by the introduction of equipment such as the MAXIS 500* Wellsite Surface Information system and the associated new generation of imaging tools. These new systems also enhance the quality of logs in both deviated and horizontal wells.

Dr Farouk Kenawy, Chairman of the Gulf of Suez Petroleum Company (GUPCO), explained how new technologies have led to significant savings within his organization. Well productivity has been increased by shutting off bottom-hole water production using through-tubing plugs. In the Gulf of Suez, several wells were found to produce water from lower zones while measurements taken using the Reservoir Saturation Tool (RST*), Production Logging Tool (PLT*) and Thermal Decay Time (TDT*) tool indicated that the upper zones continued to produce oil. GUPCO engineers decided to adopt the through-tubing PosiSet* mechanical plug-back tool (figure 1.8) to shut off the bottom part of the hole and reduce water influx.

A strategy of close cooperation between GUPCO and Schlumberger engineers was developed. Once the bottom-hole had been shut off, the through-tubing Pivot Gun* was used to re-perforate because it offers a greater depth of penetration than conventional through-tubing guns. About 100 wells have been reworked this way with 85 seeing a reduced water cut and significant improvement in production. Overall, there has been a production gain in each well of between 50 and 6000 barrels of oil per day.

GUPCO saved $40 million (an average saving of $400,000 for each of the 100 wells) using this approach rather than conventional workover rigs. On average, re-perforation costs were recovered by production gains within 48 hours.

As the world’s oil and gas provinces are more thoroughly explored the average size of new field discoveries will decrease through time. Giant and supergiant field discoveries peaked before 1960. Development of new marginal fields has highlighted the need for reliable, low cost production methods and equipment.

Dr Farouk Kenawy pointed out how Schlumberger develops purpose-built early production facilities (figure 1.10) with designs dictated by the field completion programme. These facilities can be delivered very quickly - thanks to the system’s advanced modular technology. To add further flexibility, these modules are supplied on a lease or sale basis. They have proved particularly popular in offshore areas and are being deployed at many land-based sites around the Middle East.

Another new drilling technology, geosteering coupled with measurement-at-the-bit, allows operators to drill wells with a fully steerable trajectory. This has increased productivity and improved efficiency as fewer wells have to be drilled to exploit the reservoir (see On Course For Cost-Effectiveness).
ON COURSE FOR COST-EFFECTIVENESS

In the 1970s horizontal wells were extremely expensive, inaccurate and unpopular. The recent boom in horizontal drilling was made possible by intensive research and development to perfect directional control techniques (figure 1.11).

Horizontal wells had long been considered ‘last-chance’ solutions in problem wells. Recently, however, they have become the first choice for efficient production in some regions (Middle East Well Evaluation Review, Number 16, 1996). In the right circumstances horizontal wells offer higher recovery rates and help to delay water production. In Oman they have almost completely replaced vertical producer wells.

One of the most recent advances has been the introduction of the GeoSteering* (Steerable Positive Displacement Motor) tool. In the past many wells were drilled on simple geometrical paths - the driller was essentially drilling blind on a predetermined track.

The development of Measurements While Drilling (MWD) and Logging While Drilling (LWD) systems have revolutionized the driller’s task. Modern drilling techniques combine measurements at the bit with geosteering methods to ensure high-performance and accurate positioning for every horizontal well (figure 1.12).

Horizontal wells can now be drilled around obstacles, guided straight into the appropriate reservoir layer and kept on course within thin bed reservoirs.

One of the most important uses of horizontal drilling is the recovery of bypassed attic oil (figure 1.13). The high accuracy of well positioning ensures maximum primary oil recovery. The driller and geoscientist can monitor progress and correct the well trajectory in real-time - guiding the drill bit away from shale and aquifer layers. The IDEAL* (Integrated Drilling Evaluation and Logging) system allows the drilling progress to be relayed to regional or global headquarters from almost anywhere in the world. This means that when potential problems are encountered and major decisions about a well have to be made, drilling managers have as much information as the engineer at the wellsite.

Drilling can be a very expensive process and mistakes can often only be rectified by more drilling. A technique which can position wells exactly within the formation is a welcome step forward.

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* IDEAL: Integrated Drilling Evaluation and Logging

* GeoSteering: Steerable Positive Displacement Motor

Fig. 1.11: The most important thing about drilling is getting the borehole in the right place. High costs and inaccuracy in horizontal and deviated drilling can be avoided. The latest generation of horizontal drilling methods can thread a drillstring through the narrowest reservoir zone - helping to maximize oil and gas production.

Fig. 1.12: Horizontal and directional drilling techniques have evolved over many years. The simplest methods simply drilled on a predetermined geometrical track. Modern geosteering methods analyse the surrounding rocks and allow well trajectories to be adjusted in real-time; helping to keep the well in the reservoir.

Fig. 1.13: Attic oil, isolated in the reservoir by vertical faults, can be easily and quickly drained using horizontal wells. These attic compartments may be relatively small and accurate drilling is critical for economic oil recovery.
LITTLE GUNS FOR BIG PERFORATIONS

Re-perforating can help to revive a well that has gone into production decline. However, tubing in production wells makes successful treatment difficult since only small diameter guns can get through the tubing to the target zone (figure 1.14).

The Pivot Gun* perforating system overcomes this problem in a unique way. Its high performance charges are folded inside the gun during its passage through the tubing, then pivoted into position at the appropriate depth.

This simple, but effective, innovation allows large charges to be run into a well on a small diameter gun - giving the Pivot Gun the penetrating power of a casing gun (figure 1.15).

Wells subjected to re-perforation using through-tubing strip guns often experience relatively small or short-lived production gains. However, wells perforated using the new Pivot Gun system have recorded remarkable production improvements.

Recent trends in perforating tools have seen the guns get progressively bigger as deeper and cleaner perforations are sought. The need to re-perforate watered out wells led to the development of powerful, small diameter guns. The most impressive results to date have been achieved with the Pivot Gun.

Rotating charge guns - which can be run into small diameter holes with the charges vertical - were first developed in the 1960s. Early prototypes and production models were unreliable. More often than not the charges would fail to rotate, or there would be incomplete detonation and the gun would stick in the tubing. The high failure rate of these primitive rotating guns counted heavily against them and for a time their development was abandoned.

The Pivot Gun (figure 1.16) has eliminated these problems and combines reliability and safety with a surprising depth-of-penetration for such a small diameter gun.
Many technological innovations rely on long-term R&D investments by the leading service companies. These companies believe they should be rewarded for taking the initiative in research and development and argue that technological improvements can only be sustained if operators are prepared to enter into longer-term arrangements based on trust and mutual respect. Advanced imaging techniques such as the ARI* tool etc. etc. could not have been developed without a long-term commitment to new technology.

Dr. Farouk Kenawy backed Awad’s call for improved relationships between operators and service companies. Kenawy explained to delegates that he saw three interactive factors which will be the strategic mission of the oil community for the future:

• Development of innovative field technologies which have evolved during the last decade. He cited examples such as 3D seismic, petrophysical imaging and stochastic modelling as techniques which have proved their worth around the world and should now be adopted throughout the industry. He stressed that new oilfield technology is not introduced simply because it is available, but on economic merit.

‘The importance of using these emerging technologies is not just to ensure we change the way we do our business, but because they yield significant cost savings in the discovery and exploitation of hydrocarbons. For our industry to achieve future profitability, the spirit of technology must dominate.’

• The information technology revolution. Connecting the high potential of super computers and work stations through a wide area network should facilitate data transmission, communication, processing, interpretation and eventually reduce response time and increase efficiency. The evolved knowledge based on expert systems is essential to build a learning organization, the best practices can be mutually exchanged and an objective link with the R&D staff can be established.

• Operators must seek better partnerships and new alliances with oil service companies.

This shift should create competitive advantage for the oil firms through focusing on their core business while practically outsourcing non-core activities to eliminate non-value added costs. Of course, this approach will require mutual trust and commitment in order to professionally assess and share the risks and profits.

For the operating companies this means dealing objectively with potential problems within strategic alliances. This goes beyond a fundamental concern about ‘getting the best deal’ and encompasses concerns such as a risk of losing jobs or the loss of power associated with shared control of field development.

‘...while we are reaching saturation with traditional approaches to low costs, there is a growing need to search for a newly creative path.’

Dr. Farouk Kenawy
Gulf of Suez Petroleum Company

**DRILLING MUD GOES ‘GREEN’**

In the past, oil-base mud released during drilling operations has been a significant source of marine pollution (figure 1.17). However, many oil and gas companies are now developing alternative strategies and new drilling fluids.

Saudi Aramco has always placed a high priority on environmental issues. In its latest initiative, the company will introduce a new environmentally-acceptable oil for drilling operations. Safra oil has been laboratory-tested and approved for use in offshore horizontal drilling operations where it will replace a diesel-based drilling fluid.

The Safra oil, which is produced within Saudi Arabia, is biodegradable and less expensive than other commercially-available oils. Further cost-savings may arise out of tests on a water-based PHA system which it is hoped could replace the Safra oil. The combination of cost-saving and environmental benefit is surprisingly common. Many modern drilling products provide alternatives which are cleaner and more cost-effective than oil-base muds. Other companies have moved from oil-based to vegetable- or water-based drilling fluids. In the North Sea, for example, Chevron have used a vegetable-derived drilling fluid in one of their gas wells. Although more expensive than conventional fluids the new product is completely recyclable, Chevron effectively ‘rented’ the fluid for the duration of drilling.

The new fluid, which is an ester derived from palm oil, also allowed much faster progress - saving five days of drilling on a 22-day program.

![Fig. 1.17: A GREEN SOLUTION: In the oil industry environmental benefits do not have to hurt profitability. New methods can save money while protecting the environment. Offshore, the effects of oil released from cuttings drilled using oil-base mud may be detected up to 15km from a drill site. Biodegradable muds and recycling of drilling fluids will help to reduce the environmental impact of drilling operations and reduce costs.](image-url)
In the oil and gas industry, the volume of geoscience data is growing exponentially. This growth rate has accelerated with the development of new high-resolution imaging and seismic techniques. In the coming years, the emphasis will shift from improvements in data acquisition to the efficiency and maintenance of data storage and retrieval systems. In the 1970s and early 1980s, major oil companies relied on ‘in-house’ expertise for non-core activities such as data management. In recent years, however, more and more companies have chosen to outsource the storage and management of their exploration and production data. In addition, many operators have realized the potential benefits of shared access to a single database where proprietary data is protected and non-proprietary data is available to all users. Outsourcing means that the variability of exploration and production schedules, and corresponding fluctuations in labour requirements, can be passed on to a service company.

**Better data integration**

The Egyptian General Petroleum Corporation (EGPC) is leading the trend towards greater cooperation by setting up a major data management initiative. The company has devised and developed a national petroleum data archive. The standardization of data formats and access through a single interface (figure 1.18) has encouraged the free flow of information between companies who operate in Egypt. This national ‘information highway’ has benefits within participating companies too - information is finally passing through the invisible barriers which separate the professional disciplines. Geologists, for example, can now access and integrate petrophysical and geophysical data into their models directly - reservoir engineers can match their test results with geological models.

**The missing link?**

One of the major service improvements which Schlumberger has made in recent years is the development of the ClientLink initiative. The fundamental aim of ClientLink is to align or link service company actions directly with the operator’s goals and objectives. The ClientLink Solutions and Database Program is a systematic process for understanding, anticipating and solving client requirements through the development of relevant technology. Joint research and engineering projects encourage technical cooperation to avoid duplication of effort in research and development.

The most effective partnership between oil and service companies is within integrated services and strategic alliances. Both trends are driven by a desire to increase efficiency. Worldwide, integrated services allow an oil company to deal with fewer contractors and offer the flexibility to provide custom-made teams of drilling contractors, engineering groups and other third party suppliers. In the North Sea, for example, integrated services account for over 20% of oilfield service activity.

Alliances require excellent communication, time to develop and an opportunity for the contractor to share some of the risks/rewards through incentive contracts. Since 1992, Dowell has placed design and evaluation engineers in various oil company offices to understand and help solve client problems. This approach is very different to the competitive traditions of the oil industry, but when conventional methods cannot lower costs, radical alternatives must be considered and applied.

**Fig 1.18: High-quality data management is a critical part of exploration and production activities. Integration of petroleum data into a tight system accelerates data transfer and eases data management. In the EGPC system every piece of data appears just once – there is no file duplication.**

**Fig 1.19: Cooperation is easier when all parties have access to the data at exactly the same time. Using the IDEAL* drilling system clients can monitor drilling progress in real-time, either at the well site or almost anywhere in the world.**
Cost-saving calls for vigilance, determination and an open mind. Major changes in tendering, contracts, working practices and technological development may all be encountered in the search for high-performance.

For delegates at the Bahrain conference the preferred long-term scheme for cost-efficient operations in the oil and gas industry is an integrated package deal. If operators and service companies continue to work in isolation, pursuing cost-cutting policies uncritically, the technological base within the industry will deteriorate. Only through cooperation can all parties prosper.

Research and development

Modern tools require intensive, long-term development phases. The borehole variation algorithms developed for the AIT required years of processing time on a supercomputer. This level of investment in research is the key to continual tool improvement.

New tools and techniques are ready to use when they go to field-testing, but only through the continued use of a tool can the limitations and potential of any new technique be realized. Many tools are used (and in some cases abused) in ways which could not have been foreseen during development. This, in turn, affects future design modifications and the course which research and tool improvements follow.

Cooperation - the way ahead?

Is there room for sharing of basic technologies? How much scientific and technical cooperation can be expected between competitors? What are the possible mutual benefits in cooperation? If two oil and gas companies and two service companies are all trying to develop a similar tool or technique independently, each may invest $10 million in a research program and one will emerge with an advantage. However, this advantage may be short lived and the other three may decide to continue their own development programs. So, a technique or tool which could have been developed cooperatively for $10 million, costs the industry $40 million to develop competitively.

The future

Oilfield technology, like any other, can be mis-applied or needlessly reinvented. Many techniques have been investigated and developed in two or three locations around the world where similar problems must be overcome in different oil and gas provinces. This lack of 'technology transfer' can only be eliminated by closer cooperation between regional offices within the oil and service companies.

There is, however, another dimension to technology transfer for the development of oilfield technology. Processes can be identified in other industries which have direct application in oil and gas exploration and production. Sedco Forex used systems from the chemical industry to automate the handling of mud and cement for the SIMPLER rig.

In the medical sciences, imaging technology has led geoscientists down new avenues in rock imaging (figure 1.20). Whenever possible, the ability to identify and ‘borrow’ techniques from other disciplines is a much more efficient solution than designing from scratch. Construction methods and systems have been ‘pre-tested’ and may require very slight modifications to meet oilfield requirements.

Cost-saving calls for vigilance, determination and an open mind. Major changes in tendering, contracts, working practices and technological development may all be encountered in the search for high-performance.

For delegates at the Bahrain conference the preferred long-term scheme for cost-efficient operations in the oil and gas industry is an integrated package deal. If operators and service companies continue to work in isolation, pursuing cost-cutting policies uncritically, the technological base within the industry will deteriorate. Only through cooperation can all parties prosper.