Conducted by Satinder Chopra

INTERVIEWS

The old saw ‘publish or perish’ is often derogatively used to account for the flood of publications coming from certain members of the academic community. A different, and less humorous, interpretation of this term applies, I believe, to some of those doing industrial research in private corporations.

While academics are under ongoing pressure to publish to obtain promotions and research grants, industrial scientists often face the opposite problem: they are discouraged from publication by management fearing that release of significant technical know-how must invariably benefit the competition. This can happen when a manager, not sufficiently familiar with the subject of a paper requested for release, finds that the simplest way out is to say no. It is true that such restrictions are sometimes justified, but my experience over several decades in industrial R&D suggests that these concerns are usually unfounded. My own professional experience has been with a major oil company, but I venture to guess that the observations I make here are hardly unique to this industry.

What happens to a scientist working in this kind of an industrial environment? As the years roll by, he writes technical reports, which are read by a few of his coworkers, but the research never faces the scrutiny of peers on the outside. A successful scientist needs to interact with his professional colleagues through the vehicle of written as well as oral publication: those who do not do this tend to become professionally ossified over time. Of course the employer loses as well: an unmotivated and insular R&D staff is unlikely, even unable, to come up with cutting edge results.

There is an additional and equally nefarious consequence of a restrictive industrial publication policy: a scientist’s worth in the job market is in large measure his publication record. Layoffs in industry have become an increasingly popular means to cut costs under the unrelenting pressure from investors. R&D often seems to be an early item to go on the block, and now the unknown, terminated industrial research scientist is left to fend for himself. He or she must compete with those better-known in their field by virtue of their publication record, and thus faces an uncertain and increasingly grim professional future. Clearly the best way for an industrial scientist to avoid falling into this trap is to make certain that the prospective employer’s practices include a reasonably open publication policy.

...MAKE CERTAIN THAT THE PROSPECTIVE EMPLOYER’S PRACTICES INCLUDE A REASONABLY OPEN PUBLICATION POLICY.
From the employer’s viewpoint, a reasonable publication policy makes even more sense: a company staffed by aggressive and creative scientists continuously interacting with their peers outside their own organization is much more likely to be successful over time than one which is obsessively secretive. A scientist remaining in such a restrictive environment is bound to perish professionally over time and lose marketability outside the company. As Matt Hall put it so aptly to me when I proposed this essay to him:

“It’s ironic that preparing yourself to be laid off would probably lead to you not being laid off!”

Q&A:
SVEN TREITEL

Technical communication is a must for the advancement of our science. Yet as you have stated very rightly, we have two distinct scenarios – flood of academic publishing and a drought of publications from private organizations. In the former case publishing is required and in the latter case it is discouraged. What do you think could be done to improve the latter situation?

When I started in the oil industry in the late fifties, publication was usually an uphill struggle. Things have improved significantly since then, particularly among the service companies, which cannot expect to sell their services unless they back up their claims with technically informative publications. Nevertheless, other companies continue to lose top technical talent because they fail to understand that technical people are motivated by more than good salaries and good benefits – they want and need peer recognition through publication. Managers lacking R&D experience often do not appreciate this basic need of their technical staff, and often end up by jeopardizing their own careers by losing their best people to the competition.

The private organizations as you have stated are also at a disadvantage in that unmotivated scientists may not have the drive to produce the cutting-edge innovations. The top-class scientists may not like to continue in such a working environment. Do you agree?

Yes, I agree. Top performers will not put up with rigid publication policies, and simply move on. Of course anybody working in industry knows that not every detail of a novel technology can be disclosed as soon as it has been developed, but a skilled management knows when there is a time for silence, and when there is a time to disclose – in today’s job market, top-performing scientists will simply not put up with unreasonable publication restrictions.

Publishing has also undergone a drastic change in the last two decades. Apart from the traditional hard copy journal publication, electronic format is readily available, and has brought about a revolution in communication, which is very welcome. Do you see any downside to this?

We have gone from famine to feast in half a century. When I started out, reading GEOPHYSICS was enough to keep up with most of what was new exploration geophysics. Now we literally drown in a sea of e-journals, many of indifferent quality. No human being is capable of absorbing the information available electronically and on paper, for that matter. Even GEOPHYSICS has grown to the point that nobody can begin to master all that we should be absorbing from a single journal. Perhaps we need one that summarizes important developments described elsewhere in the geophysical literature? This is a truly serious problem; I have no good solution to offer.

As we are talking about publishing, we have light-reading journals such as TLE, FB and the CSEG RECORDER, and then we have peer-reviewed journals such as Geophysics and Geophysical Prospecting, and others. Peer-review is a good concept for warranting quality of the publication and guard against plagiarism. Do you think there are any failings of the peer-review process?

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There are plenty of reasons to criticize peer review, but as a former editor of GEOPHYSICS I frankly can’t think of a better alternative. There is an element of luck for any author submitting a paper: it has been shown on numerous occasions that different sets of reviewers often come to opposite conclusions about the same manuscript. That is why I have always advised younger colleagues either to resubmit after a while, or to try the next journal.

Being an experienced member of our industry, you have seen it all. Beginning with the single-fold 2D seismic data, going over to multi-fold data, digital processing and interpretation, and then 3D seismic survey acquisition and processing. You have also witnessed the gradual shift from the traditional resource exploitation to the unconventional that is taking place. Had you been expecting any revolutionary technology (such as 3D exploration) that could help our industry?

It is true that I am experienced, given that I have been at our game for some 60 years!

Yet my record as a predictor of future trends in our industry has been poor, I’m ashamed to say. For example, I had always thought that 3D exploration, while technically feasible, was far too costly. On the other hand, I always felt that inverse methods would eventually come into their own after so many false starts. This is something I believe is now beginning to happen.

Let me turn to geophysical problems here: what do you think are the three most important unresolved problems in geophysics? Sometimes it is interesting to ask bold and open-ended questions.

As I just mentioned, my crystal ball is a tarnished one, but here are three problems that strike me as important:

I. How do we weight different geophysical data sets when inverting for structure, lithology and fluid content? Is there an objective criterion to do this?

II. Current processing methods make assumptions about random as well as organized noise. But what happens to our most advanced techniques if they are based on the wrong, or inappropriate physical model? For example, to what extent does the elastic wave equation fail to describe propagation in the inhomogeneous, fluid filled, anisotropic, fractured, etc., etc. real earth?

III. Is there an objective way to decide whether observed seismic attenuation is primarily due to intrinsic absorption, i.e., to irreversible frictional losses, or to extrinsic absorption, such as the redistribution of multiply scattered energy in a layered medium?

Do you think the current levels of R & D being carried out in our industry will be able to solve these problems? If not, then what needs to be done?

Probably not – these issues are basic and surely require many years of dedicated effort. Long term R&D in our industry is by and large dead. Progress might occur in academic environments, but here funding is the big problem. Were our industry ever to find its way to create a jointly funded long-range R&D facility to attack these and other fundamental problems, that would be wonderful. What comes to my mind here is the French Petroleum Institute (IFP). But I’m not optimistic that the vision is there to make this a reality.

The seismic method has been largely used for hydrocarbon exploration in the last five decades and despite its shortcomings we have found large quantities of oil and gas around the world. This said, do you think by following best practices in carrying out seismic projects around the world could have drastically improved our ability to find appreciably more quantities of oil and gas?

This is a tough one to answer. I believe, but of course cannot prove, that our finding record would have been even better, perhaps even much better, had our industry not obsessively concentrated on the seismic method while often ignoring all others. Recent success in combining seismic with CSEM is a case in point.

On a different note, please permit me to ask this: what differences did you notice when you turned 30 years, 40 years, and 50 years old, and then at present? As an example, some people think 30s allowed them to experiment with options, 40s gave them time for self-introspection or naughty at 40, nifty at 50, and so on. Your comments?

At age 30, I tried seismic mapping, but was soon steered by my employer to become a gravity interpreter. By age 40, I had become an R&D aficionado, with a passion for geophysical signal processing, one which has persisted to this day. I did have several opportunities to try the academic life, yet preferred to stay in an oil company R&D lab because of the freedom it offered to work on problems I found challenging. Now in my eighties, I look back on my career with nostalgia – I’m fortunate to have chosen geophysics as a career, and glad that I did not become a naval engineer. That was my intent when I started at MIT, until my freshman advisor suggested that since I could not pass descriptive geometry, I had better consider another field – and that turned out to be fine advice!
No more innovation at a snail’s pace

Paul de Groot

In the mid 1970s I went to Delft University to study applied geosciences or mining engineering as it was called at the time. I was attracted by the sky-is-the-limit mentality of the oil men of the era. This was the heyday of exploration in the North Sea: oil was found almost daily and new fields were developed in turbulent seas using technology that had to be invented along the way. This was the vibrant, high-tech industry that I joined after graduation.

In the 30 years since, I have worked for a major oil company and a large R&D organization, and formed my own company. I have been fortunate to always work with the latest technology in my chosen field of seismic interpretation. This field has gone through a fantastic evolution. It is hard to imagine that when I started, a coloured pencil was the most important tool in the technical arsenal of a seismic interpreter. And look at us now – we immerse ourselves in a 3D model and steer a horizontal well through a thin layer of reservoir rock to extract the last drop of oil for an energy-hungry world. This is cool stuff that surely supports the image of a vibrant, high-tech industry. But are we indeed so vibrant and high-tech?

Personally, I don’t think we are. We certainly have great technology, but it takes ages for innovations to become accepted and to be used widely. A former R&D director of the major oil company I worked for once told me that it takes 10 years from invention to production mode. Sadly, I believe he was right. And he’s still right today. It seems to me that when it comes to innovation, ours is a very conservative business. Only a handful of geoscientists and companies stick their neck out to try something new. Most prefer to wait for new technology to be proven and to come back on their own initiative. In my experience early adopters are more successful than followers, which makes me wonder: why are we not innovating at a much faster pace?

The following analysis is not complete and it has no scientific foundation. I merely highlight a few factors that may explain why innovation in the field of seismic interpretation is going at a snail’s pace, and suggest what we can do to speed it up.

- **Demography.** The G&G population is skewed with lots of old guys (like me). Most prefer to press the same buttons they have pressed for the last 20 years. Only few are willing to learn new tricks. Be one of them!

- **IT departments.** In large companies IT departments control rather than service the user community. Standards are important for IT people because standards make life easy for them. New technology does not fit into standards hence is blocked by them. In the rigorous drive towards standards there is no room for new technology that subsurface specialists need to find and produce our precious commodity. Help your IT department see the big picture by showing how you will help meet standards with new technology.

- **HSE consciousness.** The emphasis on HSE has made our industry a much safer place for people and the environment. I cannot agree more: HSE should be a top priority in everything we do. Still, I wonder whether we have changed the mentality of our work force somewhere along the line such that no one dares to take any risks at all. The risk-seeking spirit of the pioneers who built this industry has gradually been replaced by office workers who are not willing to stick out their necks and try something new. Learn to recognize when the reward is greater than the risk.

**Q&A:**

**Paul de Groot**

Please tell me about some of the recent innovative applications in a couple of areas of geophysics.

*In the last decade we have witnessed great advances in seismic acquisition and processing. Take for example the introduction of variable depth streamer technology and new algorithms for Pre-Stack Depth Migration, which has allowed pre-salt exploration plays to be opened up.*

To a lesser extent, in the area of seismic interpretation I also feel that we are at the onset of a golden age of innovation. I am convinced that so-called “global seismic interpretation techniques” are about to change the way we work as these methods add unprecedented value to seismic data.

Global seismic interpretation techniques such as the commercial products: Paeloscan, Age Volume, Extrema, and dGB’s own Horizon-Cube, aim to arrive at fully interpreted seismic volumes. “Fully” in this context is misleading as it gives the impression that we are dealing...
Q&A: PAUL DE GROOT

Some people opine that innovation usually comes with experience. This is not the case. The correlated geologic time lines of these volumes open up new ways to analyze seismic data, thereby increasing our understanding of the depositional history and improving our ability to find stratigraphic traps and build highly accurate geologic models. Global interpretation techniques are still evolving but as these techniques mature I am confident they will become mainstream. In future, I predict that any seismic interpretation project will start with the delivery of various seismic processing products including a fully interpreted volume.

To continue to do what we are doing is human nature. But you rightly point out – ‘we must be willing to learn new tricks.’ How do you think this can be made possible? By making individuals realize, by citing examples, or what?

In my opinion, one of the most effective ways in which innovation is brought about, is when individuals develop a passion for what they are doing. Would you agree? Please elaborate.

Yes, this is an important point. When you like what you do, you will naturally want to improve things given the chance. If your innovation is implemented and provides tangible, real-life benefits to the end user, there’s no better feeling. This will fuel your passion and commitment to making a positive contribution; it’s a positive vicious circle. But passion alone is not enough, you also need vision and drive and a desire to improve things.

Some people opine that innovation usually comes with experience. This is because when an individual is completely immersed in solving the problem at hand, there are various ideas that are put into practice, out of which some pan out, and innovation happens. What is your take on this?

It really depends on the problem that is being addressed. For some problems experience is a prerequisite but experience can also limit one’s vision to seek solutions outside the bounds of existing concepts and preconceived ideas. Toyota became the largest car manufacturer in the world by constantly innovating their production process. These innovations were initiated from the bottom up. Experience plays a role in this process but even more important is a corporate culture where every employee is constantly questioning what and how the things he or she is working on can be improved.

Do you think innovation has taken place more in certain areas of geophysics than others? Could you cite some examples either way?

There is a clear relationship between innovation and budget. There is more money in seismic than in any other geophysical method, hence we see more innovations in this domain. And in the seismic arena there is more money targeted at acquisition than processing and seismic interpretation. As explained already we see this reflected in the innovations that have led to broadband seismic and improvements in seismic imaging.

Although money is an important driver, however, it is not the only one. You also need a supportive environment. Only a few years ago innovations in seismic processing and interpretation were restricted to those who had access to expensive software and proprietary data sets. The open source movement with packages such as Seismic Unix and Madagascar for processing and dGB’s OpendTect for interpretation, and the availability of free data sets, has drastically changed the landscape.

Nowadays any University in the world can access tools and data sets needed to make innovative contributions in these areas. As a company dGB takes enormous pride in the role we play in shaping this environment. Together with partners ARK CLS, Earthworks and Sitfal, we currently support more than 3,500 academic licenses of OpendTect and its commercial plugins. Moreover, we started the Open Seismic Repository to give users access to free data sets. Free software and free data certainly elevates education to higher levels and stimulates research and development. But even more important than free software and free data is the free exchange of ideas: openness sparks ingenuity. This is the opposite of conventional business wisdom and the mindset that you either hide, or protect your IP rights. This type of thinking delays and frustrates progress.

Continuing with the previous question, why do you think that is?

As I said: money rules the world but the landscape is changing in some areas as a result of the open source movement. dGB remains committed to this movement.

How do think it is possible to keep a track of the geophysical innovation taking place in our industry?

We have all become specialists in one domain or other and even keeping up with developments in our own area of expertise is a challenge. Obviously it helps to talk to colleagues, to visit conferences, exhibitions and workshops and to keep up with literature. Apart from these conventional ways, the Internet provides new and faster ways to keep up. Professional groups in LinkedIn and blogs (e.g. the blogs by Matt Hall and Evan Bianco of Agile Geoscience) are good instruments in this respect.
Innovation has economic, social and environmental implications in our industry. How is it then that not enough emphasis is laid on innovation by the oil companies or the government institutes.

The cycles of a petroleum development project are much longer than economic cycles. Our industry should make long-term plans not only for specific field developments but also for R&D and innovations, which will lead to more efficient, safer and environmentally friendlier solutions. Instead the industry reacts on spikes in the oil price and takes decisions aimed at increasing short-term shareholder value. This is not just a flaw in the decision making process in our industry but a fundamental flaw in pure capitalism that values short-term individual profits above long-term benefits for the planet and society as a whole.

On a different note, permit me to ask this: what differences did you notice when you turned 30 years, 40 years, and 50 years old, and then at present? As an example, some people think 30s allowed them to experiment with options, 40s gave them time for self-introspection or naughty at 40, nifty at 50, and so on. Your comments?

It is inevitable that your views change as you grow older.

I joined Shell after graduating from Delft University. This is where I learned the profession. I was pretty naive in these years. Not really concerned about a career, but just focusing on enjoying my work. When I saw a technical improvement I thought it would be embraced simply because of the technical benefits. I didn’t see (or didn’t want to see) that in the bigger picture other factors (budget, training, complexity) play a role that may prevent the innovation from being implemented.

In my thirties I left Shell for TNO, the Dutch R&D institute. I used a project on reservoir characterization I had started up with the help of TNO to get my PhD. This is the time when I was closest to real R&D.

I learned that an R&D environment is good for prototyping but not for commercializing products. A commercial enterprise is a much better vehicle to develop products that meet or exceed customer’s expectations.

This is what I have been doing since Bert Bril and I founded dGB Earth Sciences in 1995. As a company we strive to be at the leading edge of seismic interpretation technology. In the early days, when I was in my forties, I thought our solutions, because of their technical benefits, would sell by themselves. That is not the way it works. To sell seismic interpretation software solutions you really need to understand the market and deliver products and services that address all concerns a client may have. I’m now in my fifties and my main innovation focus is on improving workflows. The challenge is to design simple workflows for non-specialists without sacrificing the flexibility required by specialists. I am enjoying it a lot. Innovation is not about age but about mind-set.