UNIVERSITY OF ABERDEEN

Effectiveness of ITF 1999-2009 and Future Possibilities

Draft Report

Prof. Alex Kemp, Jana Schultz

University of Aberdeen

Contents

Effectiveness of ITF 1999 – 2009 and Future Possibilities

1. Introduction and Objectives of ITF

ITF, the Industry Technology Facilitator, is celebrating its 10th anniversary at the end of 2009. It was established as the result of the work of the Oil and Gas Industry Task Force in 1999 as part of the PILOT Vision 2010. Back then the industry found itself challenged by a number of factors like the significant fall in oil prices, declining production rates in many fields and the maturity of the UK Continental Shelf (UKCS) more generally. With the oil and gas industry being a major contributor to the UK economy ways were sought to enhance activity levels and thus secure jobs and tax revenues.

As part of its work, the Task Force examined the role of innovation and technology in the future of the industry. Results and recommendations were published in the 'Oil and Gas Industry Task Force Report – A Template for Change 1999' (DTI, 1999). The report states that *'from 1990 to 1997, technical advances were responsible for additional reserves of 5.8 billion barrels of oil equivalent in the UKCS.'* This clearly showed the potential for technological innovation to help deal with volatile oil prices, mature field production and small field developments. Three major benefits resulting from technological advancement were identified follows:

- *"in the next five years an additional 5.6 billion boe of reserved could be made economic providing a total potential gross revenue in present value terms of £78 billion;*
- *UKCS oil and gas production could be sustained at above 3 million barrels of oil equivalent per day (boepd) to beyond 2010; and*

- *recognition as a technical innovator with associated export potential to the rest of the world's oil and gas industry".*

ITF was set up as non-profit organisation owned and funded by its members and has remained so throughout the last 10 years. Its main objective is to *'produce the overview which will enable technology needs to be identified, supported and developed more efficiently and at lower cost through effective collaboration'*. As an intermediary between innovative SMEs or universities and operator companies (i.e. technology providers and technology users) ITF was to focus on existing fields paying attention to multi-lateral wells, coiled tubing drilling, through tubing drilling, underbalanced drilling, smart wells and facility automation with a goal of dominant impact on 1.3 billion boe additional reserves from existing fields. The other area on which attention was to be concentrated was new reserves, in particular looking at monodiameter wells, high resolution seismic/ dynamic reservoir modelling, and long tieback technologies addressing flow assurance and back pressure reduction. The value goal for this technology cluster was set at 1.05 billion boe reserves. Collaboration between operator companies was to be fostered to spread the risks and benefits of technological innovation. This would be achieved through the promotion of Joint Industry Projects (JIPs) involving research, field trials, and product development reflecting the technology needs of the UKCS.

The purpose of this report is to assess the impact ITF has had on the oil and gas industry over the last 10 years since its foundation and to suggest future possibilities. It looks at the membership, how it has changed and the motivation for change. An overview of the projects facilitated is given as well as a brief characterisation of the developers involved. The emphasis in the report is on the assessment of ITF's effectiveness and how this might be improved. A survey has been undertaken of

members and developers. The reasoning behind the survey and the results are presented below. Interviews were also conducted with interested third parties who have knowledge of the work of the ITF. The report concludes with a discussion of lessons for the future.

2. ITF Membership

ITF initially had 13 members comprising the major UK oil and gas operating companies. In the last 10 years there have been significant changes in the membership with respect to both type and location to accommodate changing industry needs.

From the early years of ITF in addition to operators service companies have been involved. This involvement then phased out. In 2006 ITF decided to revive the service company involvement and to actively seek their engagement. This was undertaken in recognition of the fact that the current membership policy alienated some sections of the industry, and there was a desire to ensure that ITF's stakeholder groups reached beyond operators. The inclusion of service companies as members also aimed to introduce a new knowledge base to the existing members, to enable field trials to take place and to provide the potential for partnerships to commercialise new technology.

Up to 2006 the focus of ITF was on companies and their operations in the UKCS. But the technological developments facilitated by ITF were seen to have world wide applications. To reflect the nature of the R&D in the industry ITF thus expanded its membership to include oil and gas companies that did not necessarily have operations in the North Sea.

With a broader membership base ITF hoped to be able to “facilitate more projects, improve the returns to investment and open up new channels to promote UK technology for global export. This will help ... to fulfil ITF’s key role of helping to sustain all sectors of the UK oil and gas industry, including operators, service companies, SMEs and academia.” (ITF, 2006).

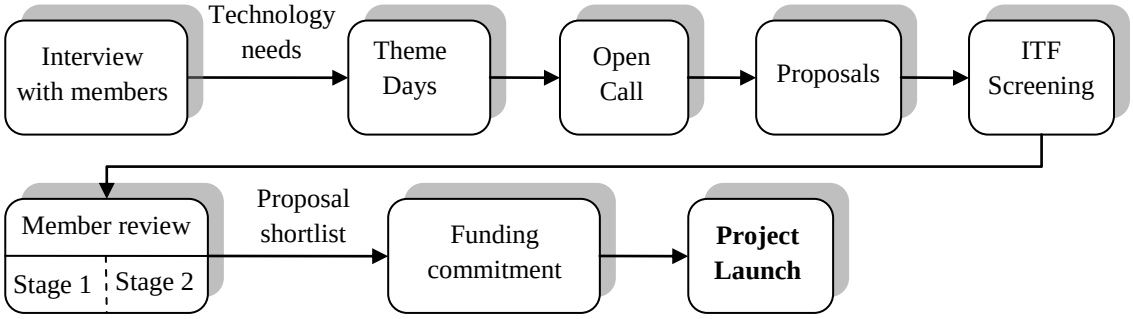
The number of members has grown steadily, and today ITF has 22 global members, split between 16 operators and 6 service companies. Representatives of the member companies have the opportunity to exchange views with each other and with ITF at the quarterly meetings of members. The current membership is as follows:

3. The Funded R&D Projects

To date ITF has facilitated 138 joint-industry projects (JIPs) with a total funding value of approximately £41 million. Every project tries to satisfy some pre-defined technology need identified by the member companies.

The project initiation is carried out in a number of steps as shown in Figure 1. Firstly, ITF conducts individual interviews with representatives from each member company. During these informal interviews the technology needs of each company are identified. The needs are then evaluated, common requirements are specified and theme days are formulated where experts from the member companies are invited to elaborate upon the relevant technology areas. After the theme days an open call for proposals is made. The incoming proposals are then subject to a first screening by ITF staff. They undertake due diligence on each project, and, depending on their findings, rank the proposals accordingly. The proposals are then passed to all members who undertake a two-stage review process. In stage 1 the members assign each proposal a score and create a shortlist of the most interesting proposals. In stage 2 the developers have the chance to present their proposed project to representatives of the member companies during a technical clarification meeting. Members then decide on the projects they want to carry out and make a funding commitment. If there are no complications the project is ready to be launched.

Figure 1: Project Initiation Process



Each project is classified with regard to the technological area where the innovation is going to be implemented. Currently there are three main categories, namely (1) subsurface, (2) wells, and (3) production and facilities. Figure 2 provides an overview of the number of projects launched between the years 2000 and 2008 in each category. The total number of projects facilitated in those 9 years was 135. Production and facilities projects constitute the highest number, followed by subsurface and wells projects. In the last two years the number of projects has been rising from the low level of only 7 projects in 2006. The targeted number of JIPs launches for 2009 is 15. The funding value of the projects for each category over the total time period is shown in Figure 3. A total of £39 million pounds were raised for ITF R&D projects. Most of the funding went to subsurface projects even though they were exceeded by production and facility projects in terms of numbers. The total value of funding fluctuates quite substantially from year to year. The year 2008 saw the highest funding value to date. For 2009 the targeted funding value is £6m. On average 5 sponsors were involved on each project, including member companies and government agencies. It should be noted that even though ITF has six service

companies as members, only 5 projects have received contributions from contractors over the last 10 years. One of these contractors is still a member of ITF today.

Figure 2: Number of Launched Projects 2000 – 2008

Year	Subsurface	Wells	Production & Facilities	Total
2000	2	5	2	9
2001	10	8	9	27
2002	3	5	4	12
2003	3	3	9	15
2004	7	1	4	10
2005	4	0	6	10
2006	2	2	3	7
2007	6	4	6	16
2008	8	7	14	29
Total	45	35	57	135

Figure 3: Funding Values 2000 – 2008 in £000

Year	Subsurface	Wells	Production	Total
2000	390	1,032	173	1,595
2001	4,060	1,359	2,034	7,452
2002	652	1,701	738	3,091
2003	359	326	1,586	2,2701
2004	2,186	585	655	3,426
2005	1,826	0	3,562	5,388
2006	525	698	920	2,143
2007	1,360	2,493	765	4,618
2008	4,756	1,923	2,557	9,235
Total	16,114	10,116	12,989	39,220

Of the 138 projects 12 were trial projects or included a trial phase. The remaining projects were either development or production projects. ITF only recently started to subcategorise projects as trial, production, development or pioneer project.

4. Characteristics of Developers

Innovative SMEs and academia play a crucial role in the R&D process as they deliver the required technology. ITF has worked with a considerable number of different companies as well as universities. Figures 4 and 5 show the number of projects carried out by universities and other developers respectively. Subsurface projects were mainly carried out by universities, whereas the other projects were usually developed by SMEs and others.

Figure 4: Projects Carried out by Universities

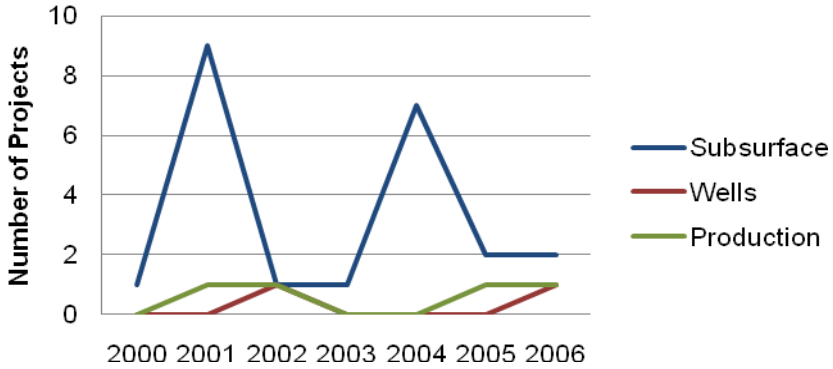
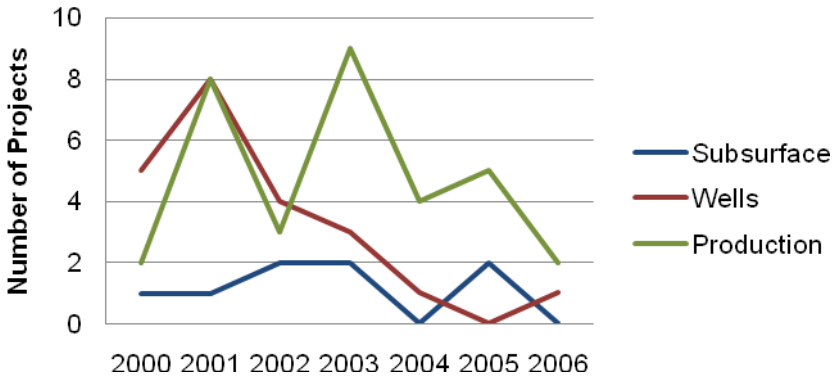


Figure 5: Projects Carried out by other Developers



It is noteworthy that in 2008 54% of proposals received for production, wells and subsea themes were submitted by new developers who had not worked with ITF before. Also 24% of developers were from outside the UK. For the subsurface themes in that year 35.4% new developers submitted proposals, and 33.8 % were located outside the UK.

5. Funding Programme Comparison

ITF is not the only organisation promoting innovation in the oil and gas industry and it was thought to be useful to make comparisons with other initiatives. Figure 6 shows a comparison of ITF with four other programmes, namely DeepStar, RPSEA, DEMO 2000 and Petroleum Research Atlantic Canada. There are significant differences between the funding bodies with regard to how they operate. A brief outline is now given of DeepStar and how it compares with the ITF model.

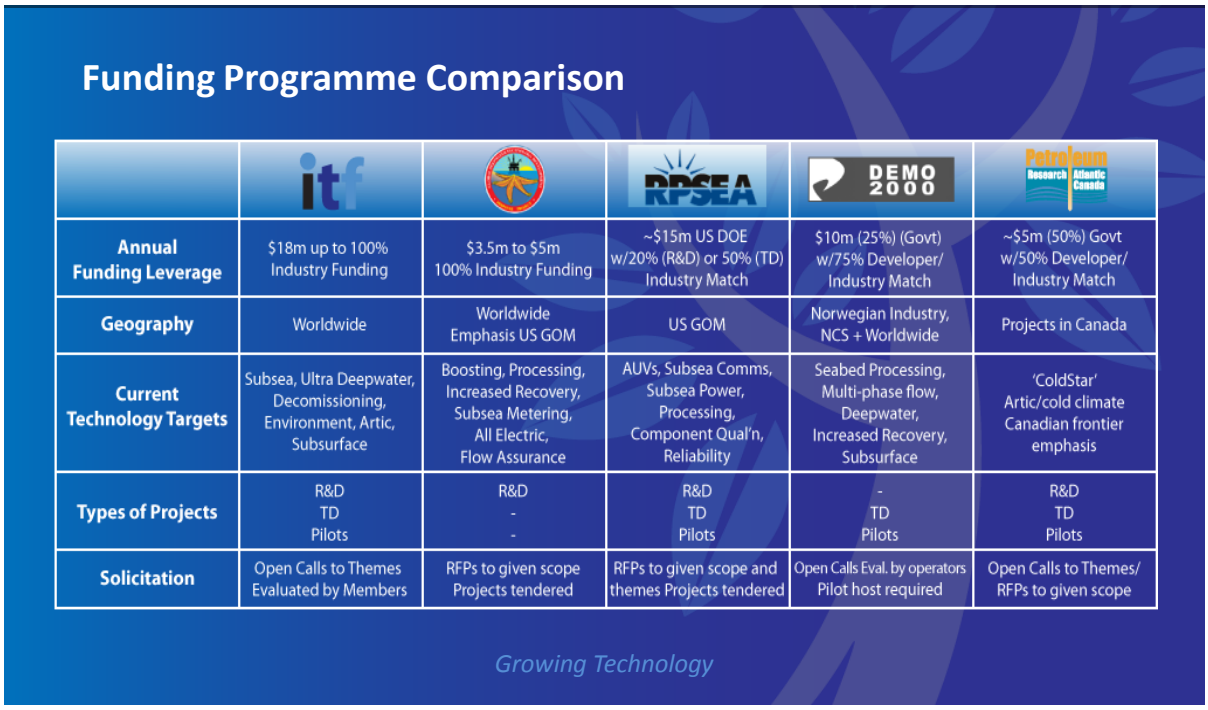
DeepStar has an annual funding leverage of $3.5m to $5m (figures from 2008). In comparison ITF has funded projects up to annual total of $18m (2008). This big

difference in funding values might be due to the fact that funds are generated in a completely different way at DeepStar. DeepStar member companies pay an annual membership fee as do ITF members. The membership fee for DeepStar is higher though it is not used to cover operation costs as is the case with ITF. Instead the membership fee payments go into a single fund which is then used to finance R&D projects. ITF projects on the other hand are financed directly from the members who wish to participate in specified projects. Thus in the ITF model members have complete control over where their money goes and what projects will be carried out. More funds are available to support R&D projects. DeepStar members hand over that control and do not have a direct influence on which projects will be chosen.

Another major difference concerns the innovating companies. They can submit R&D proposals to DeepStar which are screened and a selection of proposals is made to receive funding. These proposals are then subject to tender and the company offering the lowest price for carrying out the project is awarded the contract. Once a technology has been developed DeepStar keeps all intellectual property rights. Since DeepStar is owned by Chevron, the IP is kept by Chevron. This has caused some problems with respect to incentives for companies to submit proposals when a firm might engage in the project while the IP rights are retained by DeepStar.

DeepStar projects focus exclusively on technology for deepwater application and are US-based whereas ITF does not impose any restriction on the technology or geographical area.

Figure 6: Funding Programme Comparison



Source: ITF

6. Assessment of Effectiveness: General Principles

Technological progress has widely been recognised as a main driver for long run economic growth. Macroeconomic growth models state that enduring economic growth can only be achieved through continuous technological advancement, as new inventions and processes make the use of labour and capital more efficient. This does not only apply at the national level but also to individual industries, in this case the oil and gas industry. Shapiro (1985, p.25) argues that “long run industrial performance is influenced not only by static efficiency, but also by the rate of technological progress.” He claims that the rate of technological progress in a given industry can be assessed with the level of industry-wide R&D expenditure. Another

factor is the rate of diffusion of new technologies. The diffusion of technology has two effects. An ex post effect “directly affects costs of non-innovating firms and hence the speed with which technological advances are utilised throughout the industry” (Shapiro, 1985, p.25), and an ex ante effect influences the incentives of firms to carry out R&D.

In general the product produced by research and development activity is knowledge. Knowledge is widely considered to be a public good, in the sense that it can be consumed without decreasing the amount available for other members of society. It is also non-excludable. Once made available everybody can have access to it. The implication of the economic characteristics of knowledge and thus research and development for firms in a particular industry has been stated by Adam Jaffe (1986, p.984) as follows: “since knowledge is inherently a public good, the existence of technologically related research efforts of other firms may allow a given firm to achieve results with less research effort than otherwise.” This effect is called spillover and is regarded as a positive externality of R&D. Benefits realised by research projects spill over to other firms in the industry even though the firm has not paid for the utilisation of the generated knowledge (see Bernstein and Nadiri, 1989, p. 249). “From a technological point of view, R&D spillovers constitute an unambiguous positive externality, [but this] is potentially confounded with a negative effect of others’ research due to competition” (Jaffe, 1986, p.984). The incentives to research are diminished by the fact that others can exploit a firm’s R&D efforts without reimbursing it. The innovating firm solely bears the cost even though the entire industry might benefit from its R&D. Since the firm’s return is then significantly lower than for the industry as a whole there will be some degree of market failure as

firms might decide to under-invest in R&D projects because they are not able to fully recoup the fruits of all their research efforts.

Cooperative R&D agreements internalise the positive externalities from R&D, i.e. the benefits from spillovers, as firms share their R&D output, and provide a solution to the negative effect which spillovers can have on the incentive to undertake R&D. According to Sakakibara (2003, p.117) “cooperative R&D has been widely celebrated as a means of promoting private R&D and some see it as a major tool for enhancing industry competitiveness.” Cooperative R&D agreements can come in several forms such as research contracts, R&D consortia; research joint ventures (see Sakakibara, 2003, p.129, Shapiro, 1985, p.25). The costs incurred in the research process are fixed costs. Cooperative research agreements allow all participants to share the costs. They also increase the efficiency of R&D activities and eliminate wasteful duplication (see Katz, 1986, p.528). Endogenising the benefits created by spillovers through cooperative research agreements is achieved by firms committing to a certain financial contribution before the R&D is conducted.

The form of cooperative research agreement used by ITF is JIPs. Firms agree to fund a project before it is carried out. Rather than each individual firm conducting parts of the R&D and then sharing it, one firm or a small consortium of firms is conducting the R&D. This way the innovating firm does not have to bear the R&D cost on its own, which otherwise might produce a negative effect on the incentive to research activities. JIPs are a form of ex ante licensing allowing the funding firms to utilise the outcome of the R&D project. The ex ante licensing agreement plays an important role in the dissemination of technology.

The Oil and Gas Industry Task Force observed that the R&D activity in the industry was below the optimal rate. The foundation of ITF was intended as one means to boost the level of innovation.

To assess the effectiveness of ITF different measures can be used. The most straight-forward measure is the take-up of the technology. This indicates the extent to which the technology that was developed has actually been utilised. This is important because even if a project has been completed successfully it does not mean that the developed technology is actually employed by the industry. Hence there would be no enduring effect with regard to the basic objectives of ITF.

Examining the effect of the implemented technology is achieved by assessing the magnitude of the impact. This could be in terms of potential benefits such as enhanced productivity, reduced costs, or the enabling of exploration or development projects to be undertaken which otherwise might not have been viable. To discover the possible effect on enhanced production is clearly of great interest, but quantifying such effects is very difficult.

Another factor to consider is the international competitiveness of the UK Oil and Gas Cluster. Technological developments facilitated by ITF may not solely be developed for application in the UKCS but for global use. A stronger international focus strengthens the prospects for foreign business of the relevant UK-based companies. Increased international business activity is likely to result in increased revenues which in turn could be used to invest in other much needed R&D projects.

Even though projects might not always deliver positive results as initially anticipated, there may still be some benefits to the participants. The value of failure can be important. Thus a project which seemed to have failed can provide valuable

insights to companies. Wasteful or unproductive expenditure can be avoided and efforts geared in other directions.

To assess the dissemination of the technology data on patents and licensing agreements may be useful indicators. Patents grant the holder exclusive rights over his invention. Licences operate as a transfer mechanism between developer and user of these rights and enable the latter to legally employ the developed technology on specified terms. The specifications of the technology have to be published and thus become public knowledge which in due course is beneficial to the entire industry.

Technological innovation is fostered through Joint Industry Projects (JIPs). This involves a number of sponsors participating in a project resulting in the benefits from the R&D project being more widely spread. In turn this can result in a wider diffusion of the secondary benefits. On the other hand, of course, JIPs mean that break-through technologies may well not be examined in this way because the sponsor prefers to have exclusive rights to himself and thus decides to carry out the project internally perhaps with exclusive arrangements with contractors. In general a combination of both types of arrangements is likely to be optimal.

7. Survey of Projects

A sample of 42 projects was examined during the course of the study. These projects constitute about 1/3 of all projects facilitated to date. The sample was drawn from all technology areas and years of operation of ITF in order to be representative. From the project files a contact list was compiled listing all developers and sponsors involved in the relevant project. Emails with questions regarding the project and ITF were sent out to both groups. It is important to note that, due to the fact that a project might have several developers and sponsors, the answers given are not necessarily for different projects. The following paragraphs summarise the responses obtained. A tabulated version of the responses can be found in the Appendix.

a. Developers

A questionnaire containing 8 questions was sent out to 52 addresses. Problems were encountered as the relevant representative of the sponsor of the project had moved away. This happened particularly with projects undertaken some years ago. The results from the responses (20 developers and 19 projects) are summarised below.

Q1: Were the proposal deliverables achieved? If not, why and what has been done about that?

Seventeen developers answered “yes”, two said that the deliverables were partly achieved, and one person was not able to give a response. Even though almost all projects delivered what was proposed there were subtle differences. Some projects were extreme successful, and even were extended further than initially planned, whereas others just managed to deliver.

Q2: Were there any complications during the R&D process? How were they solved? What role did ITF play in solving these problems or supporting the problem solving process?

During an R&D project it is not unusual that problems occur. Especially when working with different parties on rather complex projects complications at different levels can readily arise. Most of the developers said that no major problems occurred during their work. If they faced some technical complications they solved them themselves without the involvement of ITF. Several developers mentioned that the biggest challenge they had to deal with during the project was of a contractual nature. At times it took a very long time to agree the details of a contract and to get all participating sponsors to sign up. This can, of course, be very problematic for the developers, as there is often only a small window of opportunity for them to undertake the proposed project. The result is a significant increase in costs.

Q3: Have any follow-on R&D projects been undertaken after the completion of the project?

Twelve out of 20 developers reported that they have engaged in follow-on R&D projects. These typically included the development of different sizes of the developed mechanical unit, another phase of the project, or spin-off projects. The remaining projects did not lead to any follow-on activity because this was felt not to be needed or for other reasons was not supported by sponsors.

Q4: Did the project result in any patents being granted and licensing agreements being made with others than the sponsor companies?

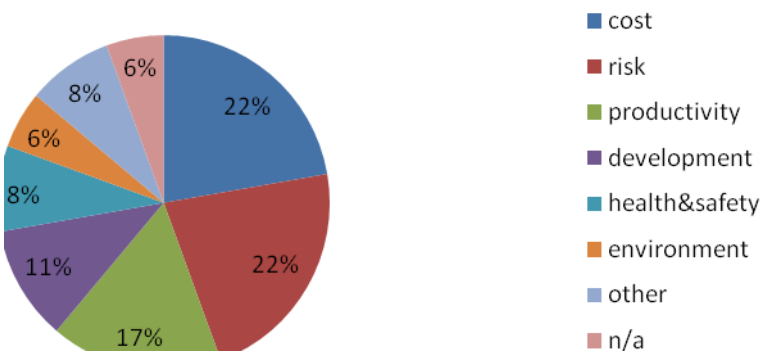
Forty per cent of the projects resulted in new IP being created. Apart from one developer who licensed the technology to the co-developer there were no licensing agreements in place with parties other than the sponsoring companies. It has to be emphasised, however, that at least two of the projects were purely conceptual studies, and six of the developers who provided feedback were employed at universities. The output generated by these projects is usually in form of some sort of publication, e.g. journal articles.

Q5: What are the main benefits of the technology for the organisations using it (e.g. cost reduction, reduced risk, enhanced productivity, extra field development, further exploration/appraisal)? Please rank benefits if possible. Can you quantify benefits?

The key benefits of the technology were classified into several categories: cost reduction, risk reduction, enhanced productivity, extra field development, health and safety, environment and other. The main contribution was made towards cost and

risk reduction followed by enhanced productivity and field development. Figure 7 shows the percentage in each category. From the answers it became clear that a quantification of benefits was difficult if not impossible. In particular software applications make a quantification of benefits difficult. One developer raised the issue that the oil and gas industry lacks “the ability to pull in and use new technology”. He was concerned that the research and steering committees were dominated by only a few individuals.

Figure 7: Nature of Perceived Benefits to the Industry



Q6: Have the benefits been utilised outside the UKCS? If so in which countries?

Fourteen developers said that their technology has been utilised in some way outside the UKCS. They do not clarify whether this has been within a field trial or implementation. Countries/regions where the developed technologies have been utilised include Norway, Netherlands, US (Gulf of Mexico), Canada, Malaysia, the Middle East, Oman, Kuwait, South America and West Africa.

Q7: Was it beneficial to go through the ITF route? Why/What difference would it have made not going through ITF? Would you decide to work with ITF again?

Sixteen developers said it was beneficial to go through ITF and 12 would work with ITF again. Overall the collaboration with ITF was seen as worthwhile. Without ITF many developers would have had problems in attracting the necessary investment. It would have meant approaching each sponsor individually, which was felt to be a very time consuming activity. Also, the possibility of establishing contacts for future projects and the support with administrative procedures was seen as beneficial. Reasons for not going through the ITF route again are concerns about the role of the service companies (see below) and the failure to secure funding due to delays "through the ITF admin process".

Q8: Do you have any suggestions on how ITF could improve its support to developers?

This question received the most feedback. Four developers said that they were happy with ITF and the way it was operating. It was said that "it seems more approachable and more of a listening organisation". Negatively mentioned was the membership of major service companies. One developer stated that "as an SME developer our competitors are often Weatherford, or Halliburton or Schlumberger. Submitting a proposal to ITF means that our competitors know what we are trying to develop. [...] So I really don't like telling them about innovative developments that we believe differentiate us from them". Another issue is the time taken to process the proposals. Developers felt that ITF procedures can be slow and that "timescales

often slip way behind those promised". This may lead companies not to submit future proposals. Different suggestions were made regarding how ITF could improve its support to developers as follows:

- Provide a field trial opportunity after the successful completion of a development project.
- Encourage sponsors to think more long term.
- Topic days for developers and member representatives.
- After presentation, one-on-one meetings with interested operators to explore ways to structure the project better.
- Act as an educator between universities and operators to make them understand their different needs and requirements.

b. Sponsors

A questionnaire with 10 questions was sent out to 80 addresses. Twenty-one of these could not be answered as the addressee had moved on. The response rate was 23.7%.

Q1: On behalf of your organisation could you give a general assessment of ITF's impact over the last 10 years?

The answers to this question were not very conclusive. Eight sponsors felt unable to make any comment on the question. One said "Good, facilitation works well". The rest said that they were unable to give an assessment of behalf of their organisation.

One employee of a sponsor stated that “ITF has played a useful role in keeping us informed of new JIP’s, and in starting up JIP’s on topics of interest. Overall we are quite pleased”. Another said that ITF has “improved over the last 4 years. Very good the way it is run with theme days, calls, and proposal handling”.

Q2: Were the project results satisfying? If not, why? What should have been done differently?

The majority of sponsors were satisfied with the project results. Two found the results not satisfying. Some said they were pleased with a result not in the sense of useful tangible outcomes, but because a study that was able to prove a certain technique or concept to be useful or not, produced valuable information for the relevant participating companies.

Q3: Were you satisfied with the progress of the project? Why?

In general the respondents were pleased with the progress of projects. One sponsor emphasised the good working relationship with the developer and the professionalism with which the work was completed. Some projects took longer than initially planned. Another respondent said that the developers should be more open regarding what was happening during the R&D process. One feedback was negative saying that the “project lacked direction. The joining of two different groups didn’t work well”.

Q4: To what extent has the technology been implemented? (e.g. not implemented at all, used in trials, widely implemented daily operations)

Four of the sponsors said that the technology was going to be implemented or that they were currently in the phase of implementing it. Other projects did not lead to implementation due to the nature of project, particularly research studies or for other reasons.

Q5: What benefits has the technology brought to your company/industry (e.g. cost reduction, reduced risk, enhanced productivity/competitiveness, new field development, further exploration/appraisal)? Please rank the benefits if possible. Is it possible to quantify the impact?

Due to the rather low uptake of the developed technologies it was difficult to categorise benefits let alone quantify them. One sponsor said that “it is hard to quantify the impact, but the way we integrate this with our existing workflow the value is in the 100’s million dollars. The key here is how to integrate it with existing tools and technology. Ranking: Reduced risk, cost reduction, enhanced productivity”. Four sponsors found that the project had no impact on their organisation at all.

Q6: Have the benefits been utilised outside the UKCS? If so, in which countries?

Utilisation outside the UKCS has mainly occurred in Norway (three responses) and the US (one response).

Q7: If the results of the R&D project were not adopted were there useful lessons learned nevertheless (e.g. saving likely unproductive expenditures)?

Even though a substantial number of projects did not lead to any useable output the sponsoring companies nevertheless benefited from undertaking the project. One said “the project delivered a clear, negative evaluation of the technology. This result will keep us from making fruitless further investments into this technology. I underscore that we consider this to be a very positive result”. In several cases company knowledge about a certain technology was confirmed which enabled them to make decisions about future actions.

Q8: Have you engaged in any follow-on projects with the developer?

About 1/3 of the projects led to follow-on projects with the developers.

Q9: In general, how has the experience of participating in JIPs/collaborating with other members benefited your organisation?

The interaction with other members was felt to be very beneficial. It enabled member companies to exchange views and expertise on projects and to benchmark against other companies. Undertaking a project as a JIP allows for reducing the cost to each member. Risk is spread. On the other hand this implies that benefits are spread as well. Overall the experience of participating in a JIP has generally been described as positive by the sponsors.

Q10: Do you have any suggestions regarding how the collaboration between ITF and you or your organisation could be improved?

Five sponsors were happy with the way ITF operates. They thought changes were not necessary. Comments included “I think the present collaboration is at the right level”. “No criticism. System works very well”. Four people did not attempt to answer this question. Suggestions made by the remaining sponsors were:

- Push developers to get more results as they go along;
- Make the research process more transparent, e.g. use web pages, blogs etc.;
- Engage companies more at their global R&D centres;
- Be prepared to align with companies’ planning/budgeting cycles;
- Speed up the process;
- Proposals should be more focused.

8. Discussion of Views of Interested Third Parties

The views of several third parties with legitimate interests in the effectiveness of ITF were sought. Such parties included representatives of Subsea UK, DECC, Scottish Enterprise, WSCA, ex-employees of ITIE, and OGUK. It should be emphasised that the representatives generally spoke on a non-attributable and personal basis and thus did not necessarily reflect corporate views.

All those interviewed agreed that ITF was making a positive contribution to the R and D effort and was being effective in its central role of facilitating technological

progress in the oil and gas sector. There was a general perception that its effectiveness had increased in recent years. There was a clear appreciation of the efforts of the ITF staff in facilitating the projects and producing the positive results. In this context it was noteworthy that the staff resources were very limited and the results correspondingly impressive.

The procedures developed by ITF whereby projects were initiated by ITF were generally felt to be appropriate. Thus emphasis on the perceived needs of sponsors with theme day seminars followed by calls for proposals from developers had obvious merits as had the procedures for selecting successful bids.

But suggestions were made for improvements in procedures in some areas. In particular it was noted that sometimes a long time elapsed before contracts for the start of projects were finalised. While this could readily occur when there were several sponsors it was clearly advantageous if delays were minimised. Otherwise the developer could be frustrated and might be discouraged from making an application on a future occasion.

One interviewee felt that the extent of commercialisation of the results of the R and D projects could be enhanced. To this end it was felt that a condition of the award of a contract should be the inclusion of a commercialisation plan by the prospective developer. It is understood that this requirement has been incorporated in more recent contracts.

Mixed views were expressed about the decision made by ITF a few years ago to go global in its operations. The positive case was that it enhanced the potential work for developers, and could increase the prospects for export business for the oil and

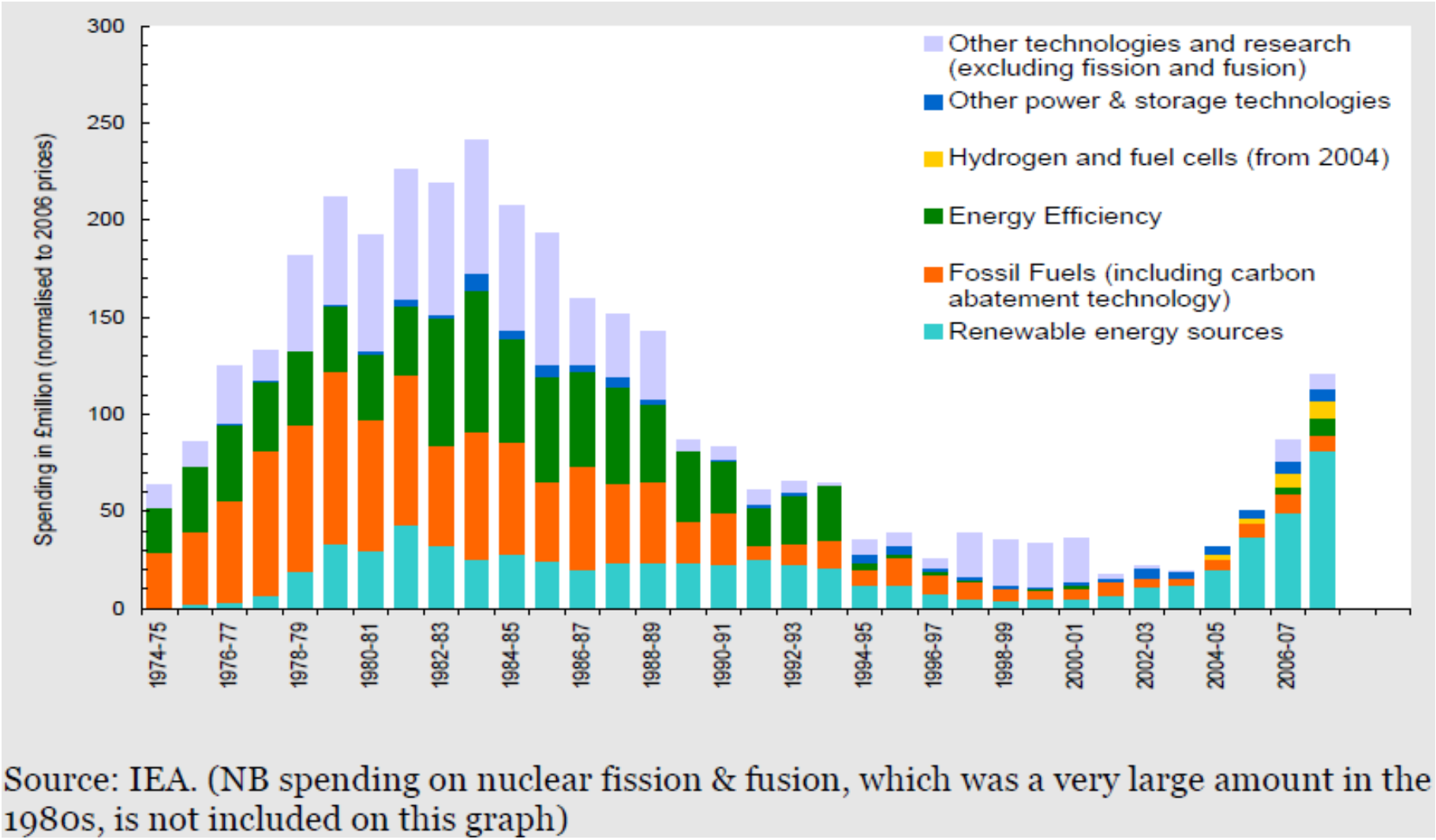
gas cluster based in the UK. Technologies developed initially for overseas markets might also have applications in the UKCS.

But concerns were also expressed about the consequences of a global scope for the activities of ITF. Thus there could be a decline in the R and D effort relating to the UKCS. One argument was that there was merit in the ITF concentrating on the facilitation of technologies particularly relevant to mature petroleum provinces such as the UKCS.

One interviewee linked the decision of ITF to go global to an issue which was felt to be related. The proposition was made that there was no clear R and D strategy for the UKCS, and this was required if maximum economic recovery was to be obtained from the province. There was a concern that the global perspective now taken by ITF could reduce rather than increase the R and D effort applicable to the UKCS. The reason for the establishment of the ITF in 1999 had been to enhance the R and D effort relating to the UKCS.

Interviewees generally felt that the amount of R and D work facilitated was very modest. It was appreciated that much more R and D work relating to the UKCS was being undertaken than came via ITF. Oil companies and major contractors would often prefer to undertake R and D work on an individual basis rather than via JIPs in order to retain exclusive rights to the benefits. It is widely acknowledged that only a small percentage of R and D work for the UKCS goes through the ITF mechanism. The historic perspective on expenditure on R and D in the energy sector is shown in Figure 8. It is seen that R and D expenditure on all fossil fuels in the UK has been relatively small since the early 1990's compared to the 1970's and 1980's.

Figure 8: UK energy R&D spending 1974-2007



Source: IEA. (NB spending on nuclear fission & fusion, which was a very large amount in the 1980s, is not included on this graph)

Secondary Source: M. Wicks (2009)

Interviewees felt that, if ITF was to make an impact consistent with its role as foreseen in 1999, a much bigger volume of R and D work should be channelled through it. It was felt that there were more possibilities for R and D of the JIP type. Concern was expressed not only about the modest volume and value of the R and D to date but also about the nature of the facilitated work. In particular it was argued that only a very limited amount of field trials or comparable implementation activity had resulted from the work facilitated by ITF. It was felt that often the research was undertaken (successfully) but little follow-up implementation work ensued. While this was satisfactory from some viewpoints it was not optimal from the viewpoint of producing the maximum effect on the development of the UKCS. The view was expressed by some interviewees that projects funded via ITF should be geared to the attainment of a perceptible impact on the UKCS in the relatively near term (perhaps 2 – 5 years). For the longer term (5 – 20 years) other funding mechanisms were appropriate. These could include the Research Councils, Technology Strategy Board, and the National Subsea Research Institute (NSRI) for example.

At least one interviewee felt that there was no clearly-defined R and D strategy for the UKCS. The decision of ITF to go global, while understandable and defensible, perhaps did not result in the optimal R and D effort for the UKCS. This would point to emphasis on the development of technologies appropriate to mature petroleum provinces. In turn this would incorporate emphasis on technologies for enhancing oil recovery, the development of new fields in locations stranded from existing infrastructure, and for facilitating decommissioning. It is noteworthy that the recent ITF initiative on long tie-backs clearly fits into the category of relevance to mature provinces.

With respect to the question of how the amount of funding could be enhanced several ideas were raised by interviewees. One was that more government funding should be made available. The government was a stakeholder and would share in the fruits of successful R and D. It should be noted that DECC (and Scottish Enterprise) do participate in the work of ITF and have contributed financially to its ongoing activities. Government funding for R and D came from a variety of sources, for example, the Technology Strategy Board and the Research Councils. To determine the optimal mix of public and private sector funding for R and D relating to the UKCS clearly involves considerable judgement. The expected distribution of the benefits between the parties is one relevant consideration. The government benefits not only directly from any increase in tax revenues resulting from innovations leading to more production, but more widely from the enhanced security of oil/gas supplies to the UK. While this is a national issue the problems emanating from insecurity of supplies very quickly have repercussions on the government. In general R and D and its fruits generate external benefits to the whole economy, not just to the investors undertaking the work. The amount undertaken by the private sector will thus be sub-optimal and some government funding is justified. If the most appropriate types of Rand D to be facilitated by the ITF relate to near-market activities as was suggested by some interviewees then it could be argued that the private sector should finance the majority of the work.

Increasing the funding from the private sector could be achieved in several ways. One is by increasing the number of ITF members. This approach has been successfully adopted by ITF. The membership now includes not only oil companies with a major presence in the UKCS, but large contractors and oil companies with only limited involvement in the UKCS. To a considerable extent there are sufficient

communal interests among the group members to enable JIPs to be funded on an increasing scale. But some problems could also emerge. The larger the number of members the more likely it is that the R and D interests will cover a greater range. While this could be accommodated by a probably enlarged ITF it is also possible that a wide range of interests could prove difficult to handle.

A different approach to the augmentation of funding was suggested by one interviewee. This includes an R and D commitment as part of the licensing process. More than one detailed form of this could be possible. Thus in the 1980's among the criteria used to assess applications for new licences was a commitment to undertake R and D work relating to the UKCS. Applicants were interviewed on their proposals and marks were awarded accordingly. The criterion was frowned upon by the European Commission who objected to the requirement that the R and D work be undertaken in the UK. The phrase "in the UK" was subsequently dropped. Later the need for the UK to conform to the EU Licensing Directive led to more radical changes in licensing procedures.

Currently there is a (published) marking scheme for determining the award of new licences. Naturally this emphasises seismic and exploration drilling activities on the desired blocks. There is, however, one section (with relatively low weights) relating to existing discoveries and redevelopment. It could conceivably be possible to extend this section to incorporate relevant R and D work. Care would have to be taken to ensure that it was consistent with the EU Licensing Directive.

Another interviewee had a rather different emphasis on what as required. While it was certainly desirable that the volume of R and D relating to the UKCS should be increased the current model, themes, and procedures being adopted by ITF were

very satisfactory. Thus the objective should be to increase the volume of activity within the current framework. The extension of membership should be pushed further, hopefully to include all technologically key leading companies. A change in attitude relating to the adoption of new technologies in the UKCS was also desirable. Currently there was much emphasis on the adoption of “tried and trusted” technologies. While this risk averse attitude was understandable the advantages of being first in the field with new technologies were being missed. A change in attitude was thus necessary. An increase in the volume of R and D work could facilitate such a change. The emphasis should continue to be on benefits to the UKCS.

The appropriate key role of the government should be to ensure that no barriers were placed on R and D activities. Thus the government could seek to enhance the connectivity between R and D providers and the related investment in the UKCS. Incentives to investors via tax reliefs were an appropriate method of stimulating both the amount of R and D activity and its application to the UKCS.

9. Conclusions

From both (1) the survey of sponsors and developers and (2) the interviews with interested third parties it is clear that ITF has been effective in enhancing R and D technologies of relevance to the UKCS and in more recent years to the oil and gas industry more generally. The procedures adopted by ITF which results in the determination of the subjects to be researched are widely felt to be generally appropriate for the purpose in mind. Satisfaction was also expressed regarding the dedication and application of the staff whose resources were acknowledged to be small.

Some disquiet was expressed by developers about the time sometimes taken to formalise contracts after a proposal had been accepted. Difficulties in this area sometimes emerged from the involvement of several sponsoring parties in the JIP project. Developers could be discouraged and on occasion projects did not proceed. It is thus recommended that steps be taken to streamline the contract finalisation process. This should be to the advantage of all parties involved.

Broadly, both sponsors and developers were satisfied with the outcome of the funded projects. This related both to the results of the research and the timeliness of completion of the work. While this in itself is satisfactory it does not necessarily mean that the ITF scheme is fulfilling all its potential or fully conforming with the expectations and goals established by the Task Force in 1999. One finding of the survey was that the results of studies undertaken often did not result in substantial implementation in field trials or other serious development activity. It is arguable that this is required if the original objectives specified in 1999 are to be fulfilled. A substantial positive effect on production is most likely to be achieved when the fruits of research lead to substantial field trials/development work.

There is thus some merit in the idea that in the contracts facilitated by ITF commercialisation plans be incorporated. This could result in further development/near market activities. But if the further suggestions made below about enlarging the future scope of ITF's activities are deemed to have merit this should not be a requirement in all cases. There could be cases where the benefits are potentially large, perhaps in the medium/longer term, but near term commercialisation is not appropriate.

It is clear that funding of projects at around their current levels is not going to produce a major impact in terms of enhanced investment and production in the UKCS and/or increased global activity emanating from the oil and gas cluster based in the UK. Further R and D work is financed on an individual basis by oil companies and contractors in the private sector and by the UK government via other routes of which the Technology Strategy Board is a main example. It is arguable that further valuable, relevant R and D work could be facilitated by changes affecting both the private and public contributions to the effort.

The notion that applicants for new licences should be asked to indicate plans R and D activity was discussed in Section 8 above. There is merit in the idea that applicants be assessed in part on their indicated plans to develop and utilise new technologies. It is believed that such a requirement would be consistent with the EU Licensing Directive. The current marking system already has a category entitled “Existing discoveries and re-development” and plans to develop and utilise new technologies could readily be added.

It is arguable that at the present stage of the development of the UKCS the development and use of new technologies is very applicable to mature fields. Currently the stewardship initiative applies to the category of field. There is merit in incorporating under the stewardship umbrella the need to examine the possible development and use of new technologies relevant to the maximisation of economic recovery.

As noted above public funding for R and D relating to the offshore oil/gas industry comes from a number of sources of which the Technology Strategy Board is a main example. It is a non-government body. Its budget is very large and it covers

all sectors of the economy. The former OETB was absorbed into it some time ago. Given the wide range of its activities it is unlikely that it can have the same level of specialised knowledge of the oil and gas sector as rests within the ITF. There would thus be merit in transforming responsibilities for oil and gas-related research to an augmented ITF. This would represent a substantial change in the responsibilities of the ITF. It would have wider and larger responsibilities. The specialist knowledge which it possesses could be put to more productive use than is the case at present. The implication is that the capacity of the ITF would have to be enlarged but the benefit would be more productive use of the funds reflecting ITF's specialised knowledge. Thus ITF would become involved not only with near-term issues but medium-term ones as well. Its constitution would have to be modified to reflect its changed role. Government membership of the ITF would become more important.

On balance it is felt that the decision of ITF to become involved in global oil and gas issues is justified. The oil and gas cluster based in the UK should benefit from enhanced overseas opportunities. Care is required to ensure that R and D issues relating to the UKCS do not become subordinated to overseas ones, but it is felt that the changes noted above should ensure that this does not happen. Thus the ITF could be involved in the process whereby the plans for development of new technologies incorporated in licence applications are being assessed.

With respect to the range of membership, on balance it is felt that the inclusion of contractor/service companies has merit. The disquiet felt by potential developers, namely that their bright ideas are being seen by competitors, does need addressing. It is suggested that a mechanism be found whereby proposals from developers should not be seen and assessed by competitors. It is felt that such a mechanism can readily be found.

The current rules for obtaining tax relief for R and D expenditures should be re-examined with a view to incentivising much work relating to the UKCS. Membership subscriptions to ITF are, of course, tax deductible, but a bigger issue is the situation with respect to the R and D tax uplift or credit. Currently if an operator in the UKCS contracts research from a research institute/university he should be able to obtain the R and D tax credit. But if the R and D work is carried out by a contractor company the tax credit goes to that contractor company and not to the oil operating company. It is understood that in practice smaller contractor companies sometimes have difficulty in obtaining the benefit of the credit. It may well be that the effectiveness of the incentive is reduced. There is thus merit in a re-examination of the operation of the scheme. Consideration should be given to the concept of a joint election whereby whichever party actually pays for the R and D in question obtains the tax credit. It is understood that this mechanism is in operation in Canada. The result would be that in making investment decisions the net of tax cost would be clearly seen. Where there is doubt about the receipt of a tax incentive investment decisions may well be made on the basis that it is not available.

If all the above suggestions are implemented it is felt that the end result will be more fruitful R and D work to the medium and long term benefit of the UKCS and the oil and gas cluster more widely.

Appendix

Table A:

Projects		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Deliverables achieved?		yes	yes	yes	yes	yes	yes	partly	n/a	yes	yes	yes	yes	yes	yes	yes	yes	partly	yes	yes	yes
Complications?		no	no	no	yes	yes	no	yes	n/a	yes	no	no	no	no	no	no	yes	no	no	no	no
Follow-on?		yes	yes	yes	no	yes	no	yes	no	no	no	yes	yes	no	yes	yes	yes	yes	no	no	yes
Patent?		yes	yes	no	no	yes	yes	yes	yes	yes	no	no	yes	no	no	no	no	no	no	no	no
benefits	cost	x				x				x		x	x				x	x			x
	risk	x				x						x	x		x		x	x		x	
	productivity			x		x			x							x			x		x
	development		x													x		x			x
	health & safety												x	x							x
	environment				x								x								
	other	x					x						x								
Utilisation outside the UKCS?		Norway	USA, Europe, CIS, Malaysia	Gulf of Mexico, Middle East	USA	USA	Global	Middle East	no	Oman	n/a	Gulf of Mexico	no	Kuwait	Global: South America, West Africa	no	Global	France, Canada, USA, Netherlands	no	public domain	US, Canada
ITF beneficial?			yes	yes	yes	yes	maybe	yes	n/a	yes	yes	yes	yes	yes	n/a	yes	yes	yes	yes	yes	yes
ITF again?			no	yes	yes	yes		no	n/a	yes	yes		yes	yes	n/a	yes	yes	yes	n/a	yes	yes

Table B:

Sponsors

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Project satifying?		yes	yes	yes	yes	partly	partly	yes	yes	yes	no	yes	yes	yes	no
Progress satisfying?		yes	yes	yes	yes	partly	yes	yes	partly	yes	partly	yes	partly	yes	no
Implementation?		stepwise	no	no	not yet	marginally	no	yes	yes	WIP	no	no comment	no	no	no
benefits	cost							x		x			x		
	risk							x		x					
	productivity	x								x					
	development														
	health & safety												x		
	environment														
	other			x	x			x				x			
Utilisation outside the UKCS?		Norway	n/a	n/a	no	Norway	no	global	n/a	Norway	n/a	US	n/a	n/a	n/a
Follow-on?		no	yes	no	no	yes	no	yes	no	yes	no	yes	no	not yet	no

Bibliography

BERNSTEIN, J. I. and NADIRI, M. I. (1989) *Research and Development and Intra-industry Spillovers: An Empirical Application of Dynamic Duality*, The Review of Economics Studies, Vol. 56, No. 2, pp. 2249-267

DTI (1999) *The Oil & Gas Industry Task Force Report – A Template for Change*

ITF (2006) *The UK Industry Technology Facilitator (ITF) opens up to global membership*, News Release

JAFFE, A. (1986) Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits, and Market Value, The American Economic Review, Vol. 76, No.5, pp.984-1001

KATZ, M.L. (1986) *An Analysis of Cooperative Research and Development*, The RAND Journal of Economics, Vol. 17, No. 4, pp. 527-543

SAKAKIBARA, M. (2003) *Knowledge Sharing in Cooperative Research and Development*, Managerial and Decision Economics, Vol. 24, No. 2/3, pp. 117-132

SHAPIRO, C. (1985) *Patent Licensing and R&D Rivalry*, The American Economic Review, Vol. 75, No. 2, pp. 25-30

WICKS, M. (2009) *Energy Security: A National Challenge in a Changing World*, DECC