

ESG insight 

AXA Investment Managers Responsible Investment

Mind the Gap: Experienced Engineers Wanted

Contents

Context.....	4
Risks stemming from a “mid-career gap” in human capital.....	4
Companies at Risk	5
The impacts of skill shortages.....	8
Gauging companies exposure to skill shortage-linked risks.....	10
What can be done?.....	13
Conclusion and impact for investors....	17

Mind the Gap: Experienced Engineers Wanted

by

Pascale Sagnier,

Head of RI Research, AXA Investment Managers

Maxime Le Floch,

RI Analyst, AXA Investment Managers

Skill shortage is a long-term structural issue for the oil and gas (O&G) industry, and the proper management of human capital will need to become more institutionalised by the companies operating in this sector. O&G companies most exposed to the skill shortage gap rely more heavily on increasingly complex projects to spur growth and do not properly manage the changing human capital supply and demand dynamic in developing countries. Analysis within an ESG (Environmental, Social & Governance) framework reveals that the O&G's short-term approach to hiring decisions taken roughly 15 years ago, based purely on financial considerations, has sown the seeds of a labour supply crunch that now threatens firms' employee safety, the environment, and capital expenditure projects for exploration & production – all potentially destroying shareholder value.

Special thanks to June Choi, Senior RI Analyst, AXA Investment Managers, for his contribution to this study

Context

Skill shortage, in itself, is not a new issue for the O&G industry; it occurs regularly when markets become bullish. For example, the most recent episode of skill shortage in the sector happened in 2004-2008, when major oil companies had difficulty recruiting skilled workers for their exploration and production (E&P) divisions, leading to an upward spiral in salary increases. The number of alarmist reports published at the time predicting a severe skill shortage showed that concerns were widespread¹.

Nevertheless, when oil markets turn bearish, as they have been since 2008, the issue of skill shortage falls back to a second tier issue, leading to a decrease in recruitment. It is no secret that oil and gas firms' investment and hiring in exploration and production divisions are closely tied to the current market price of oil, given that current capital expenditures must meet a minimum rate of return largely dependent on the expected price of the resulting future production.

As a consequence of the volatility of oil markets over the last few years, oil companies have adopted a "stop and go" approach to managing their recruitment, particularly in E&P divisions. In general, this approach increases the likelihood of a potential skill shortage. In practice, "stop and go" hiring practices notably fostered a growing mid-career gap of skilled E&P staff across the sector during the years 1995-2000. It is currently estimated that around 50% of employees in this sector will retire over the next ten years, and there are not enough experienced workers to replace them.

The effects of this middle management gap of petro technical engineers are soon likely to be felt in the form of greater safety risk and delays in projected capex spending. This exposure increases the likelihood of a black swan event that threatens to damage the environment and destroy shareholder value.

Our analysis builds on previous findings wherein we confirmed that three indicators of human capital performance – career and development planning (including training); working conditions (including remuneration system, health & safety and turnover) and growth in staff – have the best correlation with a firm's productivity and stock price performance².

For this study, we conducted qualitative interviews with O&G experts and companies on the topic of skill shortage. We compiled data on the companies' capital expenditure exposure in countries that lack skilled O&G labour, their allocations to highly complex frontier E&P operations, and their reporting of human capital indicators in order to formulate an aggregate indicator of relative risk exposure to the impacts of the observed skill shortage for each company.

Risks stemming from a "mid-career gap" in human capital

According to Schlumberger Business Consulting, it takes 10 to 15 years to train petro technical professionals so that they are fully autonomous, properly managing projects and preventing/responding to accidents. The O&G industry is, on a whole, inadequately prepared to handle the wave of upcoming retirements that threatens to disrupt capital expenditures on E&P because there are simply not enough experienced industry professionals to take the place of retirees.

This is a major concern for an industry already considered high risk, as it means that skill shortage is a long-term structural trend for the industry rather than just a cyclical phenomenon.

We see two growing risks related to the lack of experienced petro technical personnel unless the energy sector becomes more pro-active in the implementation of a succession planning

strategy in line with its long-term business needs:

- A negative impact on process safety tied to lesser-experienced staff being insufficiently trained to manage increasingly complex projects and conduct themselves according to the most up-to-date safety protocol.
- An increase in the delay of major projects in E&P linked to insufficient know-how and lack of seasoned professionals in both the O&G firms themselves and their service-providers.

■ The effects of this middle management gap of petro-technical engineers are soon likely to be felt in the form of greater safety risk and delays in projected capex spending

Weaker process safety and project delays stemming from poor human capital management have material financial, as well as Environmental, Social and Governance (ESG) impacts that can negatively impact shareholder value. The question of how the industry will manage the under-acknowledged issue of skill shortage and guard against these risks should therefore be raised by financial and ESG analysts as a top management concern.

Companies at Risk

An O&G firm's exposure to the impacts of skill shortage can be analysed according to three key factors: the extent of a company's activities in countries with a lack of qualified labour, and the extent and complexity of a company's E&P projects, particularly in new 'frontier' oil and gas operations, and the quality of their disclosure on human capital management indicators.

We found that companies' exposure to countries with insufficient qualified labour is significant, making up roughly 50 percent of overall 2015 capital expenditure. Specifically, Chevron and Total are heavily invested in these regions.

Similarly, all companies analysed have an exposure to highly complex technical projects of at least 30% of projected 2015 capex. BP faces the greatest risk as it is highly involved in continuing efforts with a focus on complex projects. We noted the shift to frontier oil and gas, with firms committing 45% of overall 2015 capital expenditure to unconventional liquids and gas, heavy oil and deepwater projects that are highly complex by nature.

Finally, our analysis revealed the extent to which companies disclose information on their management of skill shortage. We found that in many cases there is room for significant improvement. Only one of the firms analysed disclose information on all of the principal key human capital management indicators related to skill shortage. Three companies – Total, Shell, and Eni, - currently deliver information regarding their staff, while BP and Chevron deliver almost no information at all.

Overall, we find that more than 80% of O&G firms studied are exposed or highly exposed to a black swan event stemming from poor human capital management. Of the companies we evaluated, Total appears to be best positioned to cope with skill shortage risks, while BP and Chevron appear to be least well positioned.

We encourage investors and O&G companies to have an open dialogue on this issue and to improve transparency on human capital management in order to sustainably support future development and prevent major accidents that could endanger environmental quality or human life.

Skill shortage is no longer just cyclical: it is now a long-term structural trend in the O&G industry

Skill shortage is an issue for the O&G industry and significantly a growing material factor. The majority of qualified petro technical workers in the industry will retire over the next 10 years, resulting in a dearth of experienced professionals

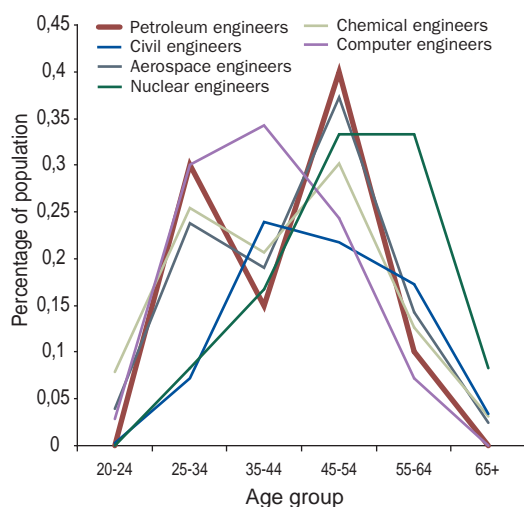
to manage increasingly complex projects in remote regions. Regional disparities play an important role in the labour market. Within the O&G industry areas of supply do not necessarily tally with those of demand. Further, a number of uncertainties call into question the industry's ability to bridge the gap between the supply/demand dynamic in human capital within each region.

There is a real and irreversible risk of knowledge loss given the lack of experienced professionals available to replace retiring workers

Workforce aging is a macro trend but the O&G industry is particularly vulnerable

The problem of skill shortage is deeply rooted in long-term worker demographics, with the population/age pyramid showing baby boomer retirements from multiple industry sectors looming. Companies can anticipate and adjust to the coming demographic shift through the implementation of an effective succession planning policy and the setting of a hiring rate appropriate to ensure replacement/preservation of necessary skills.

Graph 1: Age distribution per occupation, US, 2010



Source: Bureau of Labor Statistics, 2010

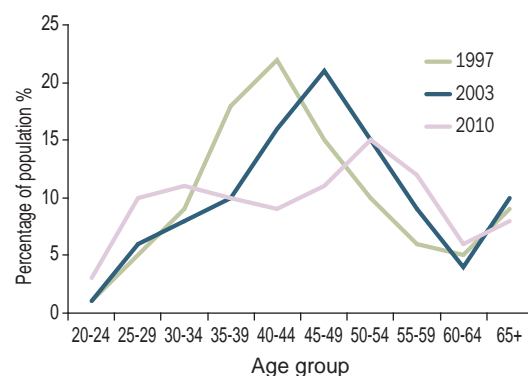
As we can see in Graph 1 by looking at US demographic data, which is a reasonably good proxy for the situation in other industrialised countries, the O&G industry is not the only industry concerned by an aging working population. However, it does face a significant gap in the 35-44 years old engineer segment as compared to other sectors' engineer availabilities.

This mid-career gap is also confirmed in Graph 2 by demographic statistics from the Society of Petroleum Engineers (SPE), the international network of petroleum engineers with almost 100,000 members worldwide. This shows that the problematic age distribution that emerged in the late 1990s and early 2000s is true not only in the US but worldwide.

According to Ali Daneshy, from the University of Houston, "By 2020, about 80% of the professionals who will be employed within the industry are currently not working in it. This means that, on average, we will need to hire 5.5% more people each year."⁴

Even if we were to ignore the 80% forecast, we can still reasonably extrapolate from the data that the O&G industry will have significantly more, but fewer experienced engineers in 15-20 years' time.

Graph 2: Age distribution of members of the Society of Petroleum Engineers



Source: Society of Petroleum Engineers, 2010

There is a real and irreversible risk of knowledge loss given the lack of experienced professionals available to replace retiring workers. Indeed, Schlumberger Business Consulting estimates that already by 2014 the US O&G industry will have lost around 5,000 petro technical professionals, down from 82,000 workers in 2009⁵.

Our field interviews reinforced the observations made by these academic studies. For example, the companies that accepted to be interviewed by our team on the skill shortage issue all agreed that the subject is an important question for the energy industry. However, even though they declared it a top management priority, no company confirmed that they have a specific plan in place to address the issue.

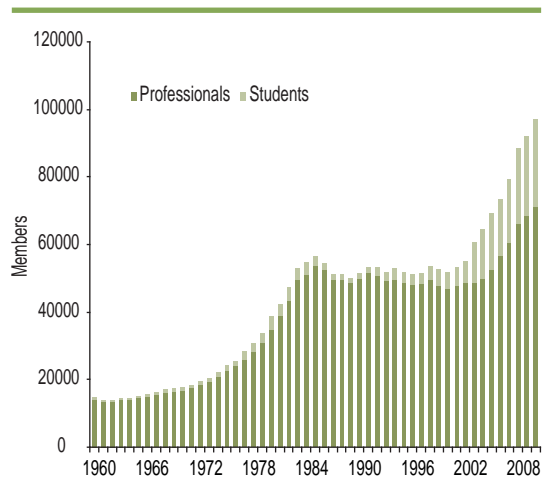
In addition, this demographic shift is exacerbated by regional disparities concerning labour supply and demand, putting further pressure on the sector's human capital management, straining resources and making the allocation of the workers between the different projects difficult.

A changing supply/demand dynamic in human capital within countries

While it's encouraging to see an increasing number of students join the membership ranks of the SPE⁶ (Graph 3) mostly due to an influx of interest from students in Asia, Africa, Middle East and Latin America, we still see a likely potential mismatch in the supply and demand of skilled professionals in certain regions. This is due to a number of factors, including; obstacles to geographic mobility, immigration restrictions, greater competition for local skilled workers in emerging markets, and poorly-resourced educational systems.

First, there are ever-greater obstacles to fluid geographic mobility of engineering graduates. Immigration law is often one of the most challenging barriers to the international mobility of workforces. We have found that this has been an issue in Canada and the US where regulations are increasingly tough, and procedures long.

Graph 3: Members of the Society of Petroleum Engineers 1960-2010



Source: Society of Petroleum Engineers, 2010

Second, in our conversations, representatives from the O&G sector highlighted that growing competition from National Oil Companies (NOCs), typically majority or fully-owned by a national government, has made it more difficult for International Oil Companies (IOCs) to attract skilled workers in emerging countries. This is the case, for example, in Saudi Arabia, Kuwait, and Iraq. Such competition coupled with a local labour supply shortage boosts salaries immensely, which is why Kazakhstan and Azerbaijan are among the highest salary-paying countries in the industry. According to the Hays Salary Survey 2010 of the oil & gas industry, Azerbaijan was the 5th highest paying country for imported staff, with an average of USD \$144k, and Kazakhstan was the 11th with an average of \$129k.

Third, poor quality education systems may not provide sufficient technical knowledge to create an adequately qualified labour supply, leaving unmet demand. The UNESCO 2010 report on engineering⁷ shows for example that in Uganda, universities are increasingly struggling to retain quality professors because pay and other incentives in universities are low. In Nigeria, the report details a lack of public

investment in universities resulting in many engineering schools being poorly equipped or using obsolete equipment. Facing a similar problem, Total Gabon recently announced a partnership with the government of Gabon to create a petroleum technical skills school in order to address the lack of appropriately-skilled people in the workforce⁸.

The impacts of skill shortages

The unbalanced nature of the population/age pyramid in the O&G industry presents two main risks: a likely deterioration of safety and increased delays in future major projects.

Outsourcing can indeed increase complexity in the management of projects, confusion in responsibilities, lack of communication, and poor coordination – all leading to increased safety risk

The mid-career management gap will make the energy sector riskier

The oil and gas industry's age distribution is characterised by a high number of young employees (< 35 years old) as well as senior employees (> 45 years old), with fewer employees in the middle range (35-45 years old). This is a concern because older workers tend to have a higher risk of accident. The same can be said for the under 35 group. The middle group of managers (35-45) who are underrepresented in the industry, tend to have the lowest risk⁹.

At the same time, experts told us that the risk of accident could be high for young, less experienced employees. Young people tend to overestimate their own level of skill and take more risks than their older counterparts. Reliance on a senior, semi-retired pool of labour for project management combined with a lower availability of middle management employees creates a potential gap in transfer of safety know-how within the O&G sector.

Considering the actual age distribution in the oil & gas industry, and the expected widening of the mid-career management gap, companies that do not act to address this issue will be exposed to higher safety risk.

Outsourcing and diminished oversight

Leading culture change commentator Edgar Schein has noted that complexity associated with the increased use of outsourcing makes the oversight work by companies even more challenging: "Work in many companies is getting more complex, and subordinates have more relative power by virtue of their specialised expertise. If they choose to not tell the boss about problems, the company will never know that there's an issue until it's too late." As a result, companies that decide to plug the skill shortage gap through further outsourcing could face weaker oversight, leading to an increase in safety risk.

The BP case is a good example. Various investigations of the Deepwater Horizon explosion that occurred on 20 April 2010 highlighted that shortcomings in the relations between contractors on the oil rig played a significant role in contributing to the disaster. The US Presidential Oil Spill Commission report, released in January 2011, states that the communication failures between BP Transocean and Halliburton were one of the major root causes leading to the accident. Outsourcing can indeed increase complexity in the management of projects, confusion in responsibilities, lack of communication, and poor coordination – all leading to increased safety risk.

Lack of communication and diminished oversight aggravated by outsourcing arrangements is not limited to BP and its contractors, but can potentially affect all companies across the industry. Future development of even more complex technical projects requiring more specialised contractors promises to further exacerbate the situation.

The Gulf of Mexico oil spill clearly demonstrates that heightened safety risk and increased reliance

on outsourcing can have disastrous environmental, social and financial impacts.

First, the oil spill was a human and environmental disaster. Eleven workers were killed, and seventeen injured as a result of the Deepwater Horizon explosion. With 5 million barrels released, this was the worst offshore oil spill to occur in the United States – leading US President Barack Obama to dub it “America’s environmental 9/11.”

The oil spill was also a disaster for BP’s investors. The estimated cost for the company approached \$40 billion – merely a projected amount the firm will pay in the way of fines, lawsuits, reimbursements, etc. Consequently, the disaster wiped out 30% of shareholder value, quickly reflected in BP’s share price. Significantly for investors, the company suspended dividend payments for nearly a year and then restored it at much more modest level in early 2011.

On top of these direct financial consequences, the oil spill held important strategic consequences for BP. It forced the company to quickly sell an important number of assets, to the tune of more than \$20 billion. The disaster led BP’s management to hurriedly reposition the company, trying to decrease its strategic focus on the Gulf of Mexico, and increase its stakes in

the Russian Arctic, through highly controversial months-long talks with Rosneft. After months of efforts consuming senior management time, and after legal battles with AAR, the current partners in TNK-BP, the deal finally collapsed. Lastly, the spill has incalculably damaged BP’s brand value and restricted its licence to operate, especially in the US.

Overall, we find that more than 80% of O&G firms studied are exposed or highly exposed to a black swan event stemming from poor human capital management

The Deepwater example is not an isolated case. In 2005, there was a major accident at BP’s Texas City refinery, and the firm still faces expenses stemming from penalties, fines and prosecution – six years after the fact. This shows that the Gulf of Mexico oil spill, a much worst disaster, is very likely to haunt the company for years to come.

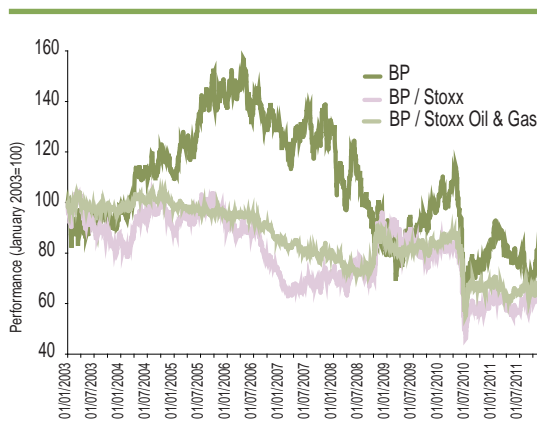
Since this disaster, BP is still underperforming its peer group and the market (Graph 4).

Lack of experienced staff may lead to delays in major future O&G projects

The energy sector faces major challenges, including; maintaining supplies linked to a durable rise in the demand for oil, developing deeper oil fields that are more technically complicated, and improving safety and infrastructure linked to ageing assets. Unsurprisingly, these efforts require significant capital expenditure. Graph 5 shows the industry’s expected increase in capex over the next 10 years.

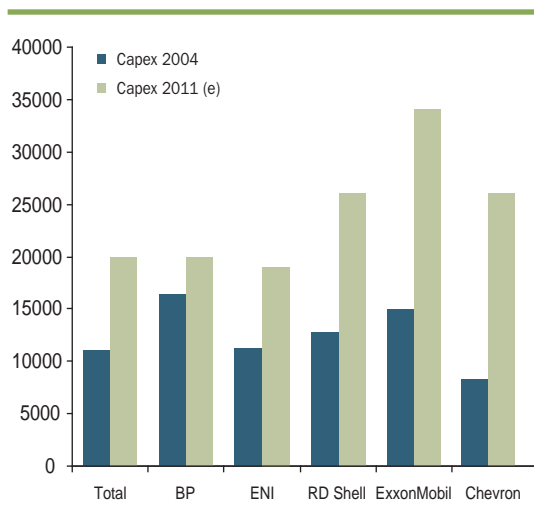
According to Goldman Sachs (GS)¹², 280 projects represent half the planned E&P capex and should deliver the equivalent of 36% of current global oil and gas production by 2021. These projects will be a key driver for the global supply of oil and gas over the next 10 years. This is a significant increase since 2003 when

Graph 4: Market Performance of BP (2003-2011)



Source: Society of Petroleum Engineers, 2010

Graph 5: Capex trend (in USD millions)



Source: Companies' presentations 2011, Natixis 2011

only 50 important projects were reported. The entrance of the NOCs in the market have accelerated the number of projects and heightened competition between the IOCs and the NOCs.

The Gulf of Mexico oil spill clearly demonstrates that heightened safety risk and increased reliance on outsourcing can have disastrous environmental, social and financial impacts

The danger is that fewer experienced people will be available to implement increasingly complex projects. Firms may have trouble launching all of the planned capex projects given the mismatch of labour supply and demand. Those projects that are initiated may face lengthy delays, as they draw on a diminishing pool of qualified professionals who are stretched across a greater number of projects. Even in a low growth environment, we can see the link between skill shortage and successful exploration and production efforts. In the summer of 2011, for example, there were alerts that BP was

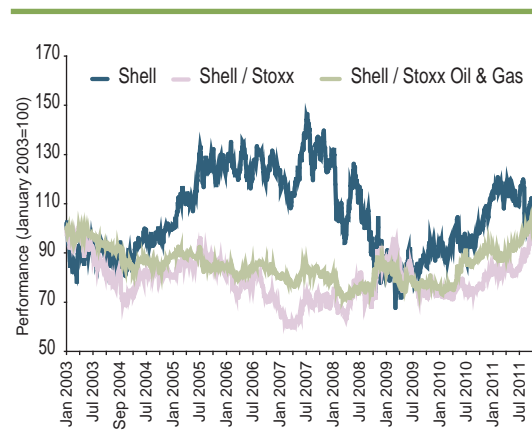
hampered by a shortage of skilled engineers to boost production in its North Sea operations¹³.

For the most part, short-termism dominates current equity valuation models of firms in the O&G industry. Yet, there is an implicit link between production and a firm's valuation, particularly when things go wrong and reserve figures are revised. The impact on the valuation is immediate and strongly negative when there is a doubt about the future production, as we saw with Shell in 2004 (Graph 6) when they cut proven reserves by 3.9bn barrels of oil equivalent (boe) (-20%) which were moved into a lower quality classification. It has impacted the firm's relative performance versus the broad market and versus its peer group.

Gauging companies' exposure to skill shortage-linked risks

Company exposure to risks associated with skill shortage depends on three factors. First, considering that skill shortage is above all a regional issue, companies with extended activities in regions with observed skill shortages will be more exposed. Second, companies with significant investments in complex projects such

Graph 6: Market performance of Shell (2003-2011)



Source: Datastream-Thomson Reuters from 01/01/2003 to 07/11/2011

as deepwater drilling or tar sand will also be more exposed. Third, considering the disparities between companies' human capital reporting, we identify the level of disclosure itself as an indicator of risk. In what follows, we look at how firms rate on each of these factors.

Note that these results have to be interpreted with some caution, given the limited set of companies analysed and the overall poor level of disclosure.

Geographic exposure to skill shortage

Using information from our interviews of companies and experts, we have identified the following countries where skill shortages are likely: Australia, Canada, Nigeria, Angola, Kazakhstan, Azerbaijan, and Brazil.

For each vertically-integrated O&G company in our sample, Graph 7 shows expected 2015 capital expenditure in the aforementioned skill-deficient countries as a percentage of total capex. We have not included oil services companies¹⁴ as their disclosure of geographic

capital expenditure was not granular enough for our analysis.

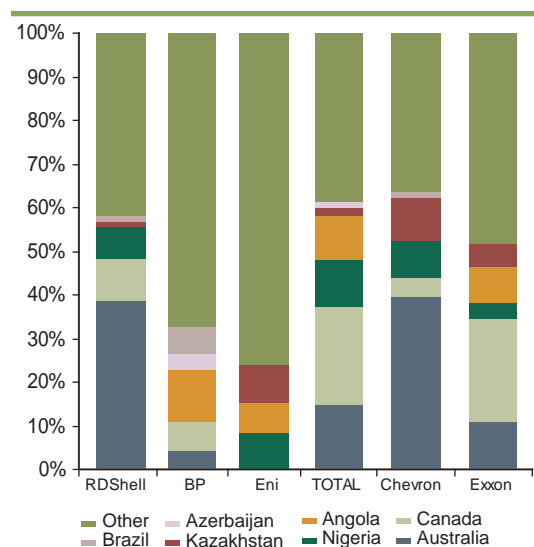
The graph shows that the overall exposure of these companies to skill shortage countries is significant; making up between 30% - 70% of predicted 2015 capital expenditure. The weighted average exposure to skill shortage countries amounts to 49.86%. Consequently, all companies will face the need to improve their human capital management in order to mitigate the risks linked to skill shortage.

Two companies stand out here for their high involvement in countries of likely skill shortages:

- Total, at just above 60% of its 2015 capital expenditures in these countries, especially in Kazakhstan and Angola;
- Chevron, at just above 60% exposure, with a particular exposure (40%) to Australia.

The least exposed firms from our sample are BP and ENI. Nevertheless, both still have exposures in some of the key countries identified: BP in Angola (12%) and ENI in Kazakhstan (9%).

Graph 7: Percentage of oil majors 2015 capex in skill shortages regions



Source: Goldman Sachs, 2010

All companies will face the need to improve their human capital management in order to mitigate the risks linked to skill shortage

Exposure to complex technical projects

Our analysis also showed that skill shortages may have a negative impact on process safety. At the same time, the oil and gas industry is increasing its focus on "frontier" oil and gas reserves, using cutting-edge technologies in often hostile environments such as the Arctic or miles deep into the ocean. Skill shortages will have a higher impact on these technologies, such as unconventional liquids and gas, heavy oil and deepwater, because these activities tend to be more risky and require a higher level of expertise. Companies increasing their focus on frontier oil and gas projects may face

an increased exposure to safety risk if they do not address upcoming skill shortages.

Graph 8 shows the percentage of expected 2015 capital expenditures in frontier projects in terms of overall capital expenditures for each integrated oil and gas company in our sample. Again, we have not included the *oil services* companies as their disclosure of capital expenditures was not granular enough for our analysis.

The industry-wide shift to frontier oil and gas is evident here, with every Firm committing at least 30% of capital expenditures, and in some cases nearly 60%, to unconventional liquids and gas, heavy oil and deepwater projects that are

highly complex by nature. On a weighted basis, 44.80% of overall 2015 capex involves highly complex operations.

Given this exposure, we believe that all the companies in our sample are likely to feel the impact of skill shortages period. BP is the company with the highest exposure to complex projects (57% of its 2015 capital expenditures), followed by Exxon (49%) and Total (46%).

Disclosure and concerns over transparency

Companies' poor reporting of human capital indicators makes comparisons of their exposure to and management of skill shortages difficult. We think that the lack of disclosure increases risk to shareholders.

Table 1: External reporting on human capital indicators

	Turnover	Training hours per employee	Average age	Age structure	Fatalities	Percentage of staff abroad	Conclusion ¹
BP	1	3	3	3	1	3	14
Shell	2	2	1	3	1	1	10
Total	1	1	1	1	1	1	6
ENI	1	1	3	3	1	2	11
Chevron	2	3	3	3	1	3	15
ExxonMobil	2	3	3	3	1	1	13

1 = good reporting; 2 = average reporting; 3 = poor or no reporting.

(1) a higher number indicates poorer reporting on human capital indicators.

Sources: Corporate reports 2010, Asset4 data 2010

Table 2: Summary on risk exposure

	Exposed to skill shortage regions ¹	Exposed to complex technical project ¹	Social Indicators ²	Conclusion ³
BP	2	3	14	19
Shell	3	2	10	15
Total	3	2	6	11
ENI	1	2	11	14
Chevron	3	1	15	19
ExxonMobil	3	3	13	19

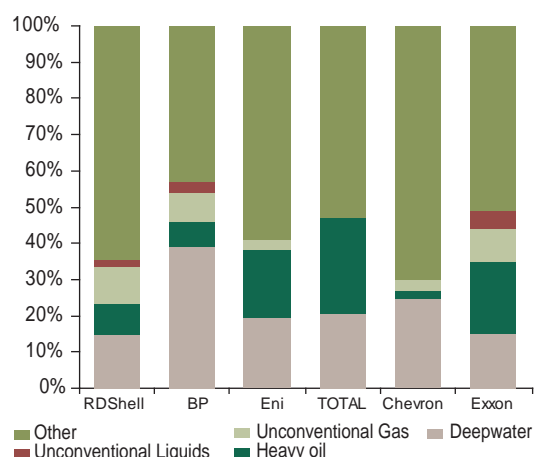
(1) 1 <= 30% capex 2 > 30%-50% capex 3 > 50% capex

(2) see conclusion of the table External reporting on Human Capital Indicators

(3) the higher the number, the higher the risk exposure.

Source: AXA IM 2011

Graph 8: Complexity of oil majors projects
(percentage of 2015 capex)



Source: Goldman Sachs, HSBC, September 2011

Table 1 shows a compilation of some of the most basic human capital indicators, and to what extent the companies of our sample set disclosed them. This table clearly shows wide differences between companies. Total was the only firm to disclose information on all of the indicators, whereas at the other end of the spectrum, BP and Chevron disclose almost no information. We believe that companies will need to better document the tools and processes they use to manage their personnel, particularly regarding skill maintenance and knowledge management.

Companies increasing their focus on frontier oil and gas projects may face an increased exposure to safety risk if they do not address upcoming skill shortages

Findings

Based on our three criteria (exposure to skill shortage regions, exposure to more complex technical projects, and the quality of transparency regarding human capital management), we have compiled Table 2, illustrating the results for the companies in our sample set. Total appears to

be at the least risk while BP, Chevron and Exxon appear to be at the greatest risk.

Overall, we find that more than 80% of O&G firms studied are exposed or highly exposed to a black swan event stemming from poor human capital management.

Material risks lurk throughout the industry

The 6 O&G firms in our sample, at the time of writing, represented 42.96% of the MSCI World Energy index and 4.93% of the MSCI World Index. We think that this sample can be reasonably considered as a good proxy for the situation in the rest of the industry for a number of reasons.

First, the demographic shifts that we noted in Graphs 1 and 2 are macro trends affecting all players in the industry. Second, the root cause of the skill shortage persists: external market constraints such as volatility of oil prices and short-term performance demand from investors are structural features of the industry that affect long-term human capital management. Third, the systemic nature of skill shortage was further confirmed by our interviews with experts. Lastly, the realities of the local labour markets in skill shortage countries necessarily impact any O&G firm operating there. Barriers to geographical mobility of qualified workers are, if anything, being raised further. Consequently, our results likely understate the industry's risk exposure to skill shortage as a whole.

We would point out that each firm's actual risk exposure to the impacts of skill shortage depends on the previously mentioned factors; E&P activities in countries where qualified labour is lacking, the extent and complexity of their capex projects — particularly regarding frontier operations — and level of disclosure on human capital indicators.

What can be done?

The skill shortage gap is quickly approaching, and the trend is irreversible. That said, the upcoming shift in the labour market could be manageable if companies prepare and adapt

accordingly. Unfortunately, during our research we learned that the major oil companies do not currently communicate on skill shortage risk. Indeed, firms' disclosure regarding overall human capital strategy and social data (statistics relating to the workforce) is quite poor, and provides little, if any, transparency to investors.

Companies actively looking to mitigate the safety, outsourcing and project delay risks should start with four key actions to better manage the human capital available:

1. Put into place a long-term employee training programme
2. Support education of young, local workers for their later employment;
3. Diversify the pool of new hires;
4. Enact succession planning.

Training

Training is a way to maintain and improve employees' skills. These efforts should focus on safety and complex project management skills.

Current efforts

Exxon Mobil noted in its 2010 Corporate Citizen Report that training spend per employee decreased by 38% between 2007 and 2010. However, the overall effort is quite notable given that the number of employees trained increased by 74.3% even while costs increased by 26% during the period.

Total, ENI, Halliburton and Technip only gave the information on their effort in training with the number of days of training per employee (graph 9). At Total, 72% of the training concerned safety (26%) and technical (46%) topics.

Shell considers that the indicator of training hours per employee "is not material as we consider average training hours per year to be too crude a measure of how well we are building the competence of our staff"¹⁵. In 2010, they have trained more than 4,000 people (out of approximately 58,000 employees; petrol station workers excluded) in leadership skills and certified 430 supervisors in drilling and well management.

Technip created its own university 3 years ago. They have delivered 24,000 hours of training to 1,800 employees (out of 23,000 employees overall).

■ The O&G sector's short-term approach to hiring decisions taken roughly 15 years ago, based purely on financial considerations, have sown the seeds of a labour supply crunch that now threatens firms' employee safety, the environment, and capital expenditure projects for exploration & production – which, taken alone and as a group, now threaten to destroy shareholder value

In 2010, Eni set up a "Green Project" training programme at the E&P division for workers between the ages of 27 and 35 from the geology, geophysics and exploration areas. The aim is to expand their technical competencies and knowledge of the entire production chain. The programme is scheduled again in 2011, expanded to include international personnel in the foreign subsidiaries.

A need for better disclosure

While it is positive to observe that current training efforts are in place, investors find it difficult to evaluate these efforts, primarily because of poor disclosure. For example, indicators used by companies (when they agree to publish one) are not the same, making comparisons between companies impossible. Granularity is a problem, in that training indicators currently cover the entire business and do not report on the upstream only. Quantitative data, such as the number of training hours per employee per year (reported) or overall training spend (rarely reported) does not indicate the quality of such training, nor does it inform investors about a firm's overall training or human capital strategy.

Education

Increasingly, developing countries are asking international companies to favour local hires. Greater investment in education of future E&P workers in regions where qualified labour is expected to be lacking would allow companies to cultivate the next generation. This can be done through partnerships with universities, schools and government of developing countries to finance the training of students.

Current efforts

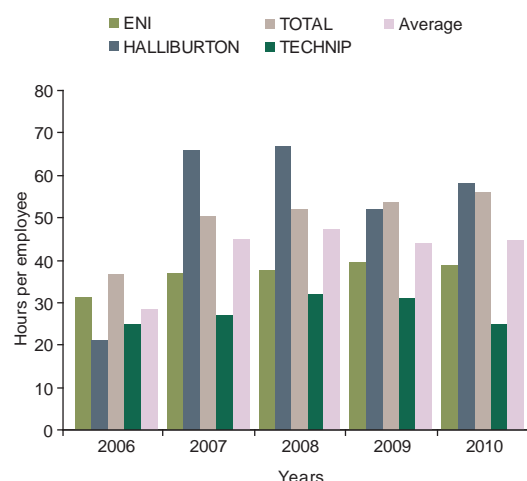
Total delivers information on this issue, and its commitment concerning education is based on three objectives tied to “anticipating future human resources needs by prioritising the use of local people.”¹⁶ In 2005, Total created its own university and later, an education department in 2010. In the United Arab Emirates, Total created Total Academy to respond to the requirement that 75% of staff should be Emirate nationals by the end of 2014. Exxon Mobil plans to have 90% of the Sakhalin-1 project workforce made up of Russian nationals by 2012 (against 80% in 2011). To help reach this goal they created the Sakhalin Technical Training Centre in 2000. Today, all of the centre’s programs are internationally accredited.

To date they have trained 167 students. In 2010 Exxon Mobil opened several training facilities in Papua New Guinea. Moreover, the company intends to train local suppliers to strengthen their business processes and skills. Technip sponsors students from developing countries. In 2010, they financed the IFP School programmes for 20 students.

Most of the experts and the O&G companies that we interviewed confirmed that they finance more and more the training of students in developing countries to create a reserve of qualified workers and engineers for the future projects and also to comply with the obligation to recruit local staff.

However, these initiatives are quite recent and there is no clear, pro-active strategy.

Graph 9: Training hours per employee



Sources: Companies' sustainability reports, 2011

We think that the best way to improve the quality of graduate programmes is that: 1) companies should put an end to ‘stop and go’ hiring practices, smoothing the demand for graduates through long-term hiring policies; 2) firms and schools need to communicate on the steady demand for graduates; and 3) companies must be more involved in higher education, particularly for engineers, through open dialogue, coaching/mentoring, internships and sponsoring.

Diversity

Historically, most O&G firms’ recruitment of engineers has largely consisted of Western, male candidates in the firms’ home countries. Firms can expand their pool of potential recruits by diversifying their hiring in gender and nationality.

Gender

In interviews, most companies told us that they have a voluntary policy to increase the percentage of women in leadership positions. For example, in emerging countries, Technip’s local entities are required to propose at least one woman as a candidate for each open position. TOTAL aims for women make up at least 22% of its managers by

2020, up from 14% in 2010. At Exxon Mobil, 40 percent of new hires are women (47% in Asia Pacific).

Nationality

The breakdown of employees' nationalities is often not published for legal reasons.

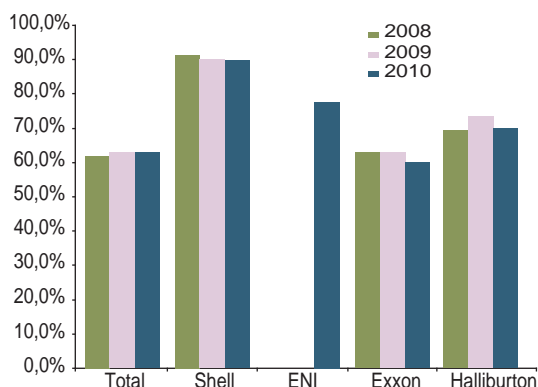
However, the O&G industry is an international business, and this is reflected in the geographical breakdown of the workforce (Graph 10). According to our interviews, the trend is to increase not only the recruitment of local employees but to develop the careers of engineers coming from developing countries. For example, at Total, 58% of managers are non-French and 74% of permanent manager hires are non-French.

At Shell, local employees fill more than half the senior leadership positions in 36% of countries where they operate. More than 90% of their employees worldwide are locally-hired nationals.¹⁷ At BP, 19% of leadership roles are filled by individuals from countries other than UK and US. At Exxon Mobil, 70%

of the new hires are done outside United States. While Graph 10 depicts what appears to be a diverse O&G workforce, it is no secret that this is due in large part to the globalisation of the majors' activities along with many countries' requirements to hire local staff for E&P projects. On the gender issue, the lack of women in the workforce reflects the lack female engineering students worldwide. In our interviews, companies acknowledged there is more to be done to encourage greater diversity in the workplace.

■ We encourage investors and O&G companies to have an open dialogue and improve transparency on human capital management in order to sustainably support future development and prevent major accidents that could endanger environmental quality or human life

Graph 10: Percentage of employees outside of the company's home country in 2010



Source: Goldman Sachs, HSBC, September 2011

Succession planning

Succession planning is a good indicator of how companies manage their human capital to ensure long-term business development. O&G firms should act quickly to get succession plans into place, supplemented by career management, training and mentoring. This will plug identified gaps in management positions and transfer knowledge from soon-to- retire engineers to their successors. Then, firms should communicate on the progress, objectives and results.

During our interviews we were quite disappointed by the fact that the succession planning strategies were not very clear. Moreover, current disclosure regarding staff turnover, hiring and departures, and the rate of replacement of senior management is quite poor.

Conclusion

Our goal is to highlight the potential risks related to the lack of skilled, experienced professionals in the petroleum exploration and production area over the next decade. Indeed, these impacts may be felt more quickly, depending on the market price of oil.

As we have seen, O&G companies that rely more heavily on increasingly complex projects to spur growth and that do not properly manage the changing human capital supply & demand dynamic in developing countries are most exposed to the risks related to the skill shortage. The O&G sector's short-term approach to hiring decisions taken roughly 15 years ago, based purely on financial considerations, have sown the seeds of a labour supply crunch that now threatens firms' employee safety, the environment, and capital expenditure projects for exploration & production – which, taken alone and as a group, now threaten to destroy shareholder value. What's more, the O&G and nuclear sectors are more exposed to this trend than other industries. None of the firms we analysed are immune to the risks cited, nor do any have clearly enunciated strategies to address the issue. One factor not explored in this study is the growing competition between National Oil Companies (NOCs) and International Oil Companies (IOCs), and the impact on the labour markets – particularly in emerging countries.

Our findings confirm those of previous studies' that demonstrate a firm's human capital management has real financial and ESG impacts – affecting both investors and the global community.

Impacts for investors

Investors must demand greater transparency from these firms in order to be able to measure and evaluate the risks for themselves. We encourage investors and O&G companies to have an open dialogue and improve transparency on human capital management in order to sustainably support future development and prevent major accidents that could endanger environmental quality or human life.

In order to better understand how companies are positioned to deal with human capital management risks, such as the ones in our analysis, investors can ask the following questions:

1. Has the company published information about their workforce, such as the population/age pyramid in upstream divisions? If no, why not?
2. Does the firm have an explicit global HR strategy that accounts for regional labour differences for addressing the skill shortage? How is it monitored?
3. Does the firm systematically evaluate the availability and qualification of local labour and use of contractors in its future project planning?

Impacts for companies

Recruitment and retention of skilled workers, along with more traditional success factors such as management's ability to deal with political and technical constraints, will be key to successful E&P projects in new regions going forward. The challenge for IOCs is to not only effectively implement human capital management strategies, but to do so in a timely and transparent matter. In tomorrow's world, dealing with skill shortage means stepping up efforts to attract qualified labour from emerging countries. For that to happen, the tone has to be set from the top, starting with a more diverse board and top management members that better reflect companies' broader horizons.

- ¹ For example, Cambridge Energy Research Associates 2007; or Hoyos, Carola; "Warning over oil industry skills shortages." Financial Times; 30th July 2008
- ² Under the microscope: Discovering Alpha in Human Capital – Pascale Sagnier, AXA IM 2009
- ³ Other sources of information included corporate responsibility and annual reports, websites, broker analyses, academic studies and consultant researches, articles and reports.
- ⁴ DANESHY Ali, "Outsourcing: consequences of the people shortage", in "Training a new workforce", Talent & Technology, Society of Petroleum Engineers, Vol. 1, No 2, 2007
- ⁵ "A new state of Play." SBC Energy Institute: 29 June 2011
- ⁶ The Society of Petroleum Engineers (SPE) is an individual-member organisation for managers, engineers, scientists in the upstream segment of oil and gas industry
- ⁷ "Engineering: issues, challenges, opportunities for development." UNESCO, 2010
- ⁸ "Gabon : L'ONEP jusqu'au bout de sa logique. " Gaboneco. 13 April 2011. <http://gaboneco.com/show_article.php?IDActu=22210>
- ⁹ This phenomenon has been observed in related sectors, such as mining, and was acknowledged by O&G representatives during our interviews.
- ¹⁰ IKLEINER Art, VON POST Rutger, "A corporate climate of mutual help", strategy+business, Booz & Co, January 2011
- ¹¹ The report notes that "information appears to have been excessively compartmentalized at Macondo as a result of poor communication. BP did not share important information with its contractors, or sometimes internally even with members of its own team. Contractors did not share important information with BP or each other. As a result, individuals often found themselves making critical decisions without a full appreciation for the context in which they were being made." Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, January 2011, p123
- ¹² "280 projects to change the world." GS Sustain, 15 January 2010.
- ¹³ Evans, Graeme. "BP struggles to recruit engineers." The Independent. 14 August 2011. <<http://www.independent.co.uk/news/business/news/bp-struggles-to-recruit-engineers-2337591.html>>
- ¹⁴ Oil services companies include Technip, Schlumberger and Halliburton
- ¹⁵ GRI_shell_content_index_2010 page 15
- ¹⁶ http://www.total.com/MEDIAS/MEDIAS_INFOS/3620/EN/TOTAL-Education-GB.pdf
http://www.total.com/MEDIAS/MEDIAS_INFOS/4538/FR/dialogueVA.pdf
- ¹⁷ Shell Sustainability report 2010 p.31

This document is used for informational purposes only and does not constitute, on AXA Investment Managers Paris part, an offer to buy or sell, solicitation or investment advice. It has been established on the basis of data, projections, forecasts, anticipations and hypothesis which are subjective. Its analysis and conclusions are the expression of an opinion, based on available data at a specific date. Due to the subjective and indicative aspect of these analysis, we draw your attention to the fact that the effective evolution of the economic variables and values of the financial markets could be significantly different from the indications (projections, forecast, anticipations and hypothesis) which are communicated in this document. Furthermore, due to simplification, the information given in this document can only be viewed as subjective. This document may be modified without notice and AXA Investment Managers Paris may, but shall not be obligated, update or otherwise revise this document. All information in this document is established on data given made public by official providers of economic and market statistics. AXA Investment Managers Paris disclaims any and all liability relating to a decision based on or for reliance on this document. Furthermore, due to the subjective nature of these analysis and opinions, these data, projections, forecasts, anticipations, hypothesis and/or opinions are not necessary used or followed by AXA IM Paris' management teams or its affiliates who may act based on their own opinions and as independent departments within the Company. By accepting this information, the recipients of this document agrees that it will use the information only to evaluate its potential interest in the strategies described herein and for no other purpose and will not divulge any such information to any other party. Any reproduction of this information, in whole or in part, is, unless otherwise authorised by AXA IM, prohibited.



Imprim'vert and FSC logos indicate the environmentally-friendly methods used in the production of this document.

Responsible Investment

AXA Investment Managers

Our Mission

Transform investing

“ We believe that RI can help deliver superior risk-adjusted returns for our clients over the long term. That is why we embed global ESG research across all asset classes and provide investors the opportunity to select the level of ESG integration that best fits their needs and objectives. It’s how we redefine investment solutions. ”



Matt Christensen
Global Head of Responsible Investment

Our Differentiation

Pure RI funds

- ▶ Thematic strategies driven by proprietary ESG research
- ▶ Third-party label awarded to all our RI funds
- ▶ Quality assurance through external audit

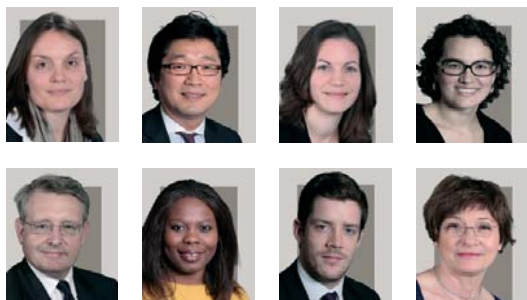
ESG embedded into AXA IM's mainstream funds

- ▶ ESG scoring at portfolio and security level
- ▶ Portfolio management with the integration of ESG research
- ▶ Active stewardship through engagement and voting over all client shareholdings

Tailored RI solutions

- ▶ Customised mandates specific to client ESG factors
- ▶ Engagement overlay services
- ▶ Reporting and control, including carbon and ESG footprint analysis

RI Search® - our unique ESG research platform



Our Team

The RI team is composed of **10 professionals with 14 years experience on average** in both ESG and traditional financial analysis.

We use **RI Search®**, AXA IM's proprietary ESG platform, to integrate fundamental and quantitative ESG research into our investment decisions.

www.axa-im.com/ri

www.axa-im.com

AXA Investment Managers Paris : « Coeur Défense » Tour B – La Défense 4
100, Esplanade du Général de Gaulle 92400 Courbevoie
Société de gestion de portefeuille titulaire de l'agrément AMF n°GP 92-08 en date du 7 avril 1992
S.A. au capital de 1 384 380 euros, 353 534 506 RCS Nanterre.