importance of winning resources from the outside world, the question arises as to where those staff came from originally. Like customers, staff do not spontaneously decide to join a particular organization, so this firm's staff were aware some years previously of organizations they might like to join. Furthermore, most had some understanding of those firms—the kind of legal work they do, the clients they serve, the possible career opportunities, and their chances of obtaining a position.

In essence, staff move through stages of awareness and understanding somewhat similar to customers before actually joining their chosen employer. Chapter 3 mentioned the case of one such firm whose annual applications from newly qualified lawyers fell by over 70 % simply because a merger led to a small change in its name. It had carelessly missed the mechanism that brought potential staff into awareness, and needed to work hard over the next two years to rebuild its visibility amongst students in the various institutions from which it hired.

The consequences of policy changes can be still more substantial and have ramifications that roll on for many years. The Shell oil company's 2005 drive to hire 1000 experienced oil engineers, introduced in Chapter 4, demonstrates the point. Shell was not alone in experiencing this shortfall, as numerous press comments from oil firms and their contractors confirm, so it is instructive to see how this industry-wide situation came about.

Figure 6.18 shows the number of students enrolling and graduating from petroleum engineering degrees in the United States between 1975 and 2006.[16] Note the

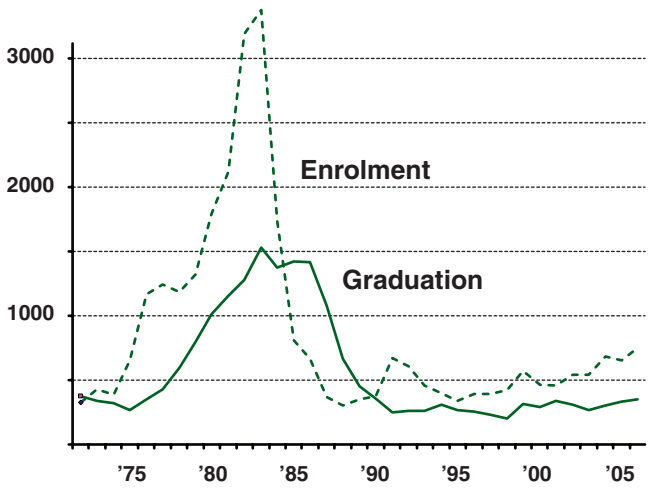

Figure 6.18: Numbers of people enrolling and graduating in petroleum engineering in the US.

exceptionally strong graduation rate during the 1980s. Intriguingly, the 1983 peak occurs four years after the second oil crisis of the 1970s triggered an unprecedented jump in world oil prices, and ends a similar number of years after oil prices fell back. Oil firms typically enjoy strong profitability when prices are high and have big incentives to find more oil, so that era also corresponded to high rates of hiring as companies raised their efforts to discover new reserves.

Employment surges of this kind can attract so many keen youngsters that many are unable to find jobs in the industry by the time they receive their degree. Similar experiences befell many Indian IT graduates when the technology boom of the late 1990s came to an end. As it becomes apparent that job prospects are not as strong as expected, many drop out before they would otherwise graduate. This is illustrated in Figure 6.18 by the considerably larger number enrolling in the 1980–1985 period than subsequently graduated. The problem in this case was exacerbated because the flood of graduates in the early 1980s coincided with much reduced hiring as the oil price fell back. The collapse in graduation rates from 1988 to 1991 can thus be traced back to a collapse in hiring between 1985 and 1988.

Why, though, are we concerned in 2006 with what happened in the late 1980s and early 1990s? First, this was not the first time, nor will it be the last, that an industry and those who would join its workforce have grossly misunderstood the big changes in supply and demand of appropriately trained labour over extended periods. Both employers and employees live to regret this misunderstanding after every such episode. It therefore pays to be conscious of how such a situation is developing, whether you are a young professional seeking to join an industry or an employer seeking to hire. A current safe bet for a mixup concerns the alternative energy industries. Many firms are growing and seeking to hire, and many keen young people are looking for jobs in the sector—there is every chance that shortages and surpluses will come and go over the coming years, with important implications for salary levels and job security.

The more direct reason to examine this long-ago episode is that the industry is still living with the consequences. Major oil companies traditionally hired young graduates in order to develop their own engineering talent, a process that takes 10 years or more of professional practice. Any company finding itself short of people in 2005, must have not hired those people during the early 1990s. Bright young school leavers in 1988 considering a career in the oil industry would have seen large numbers of their predecessors unable to get jobs, and looked elsewhere. If undergraduates did not start courses in 1988, they would not have been available to hire in 1991/2. Fortunately, the low oil price meant that companies had less pressure to find new oil, and in any case, they still had plenty of engineering capacity from the

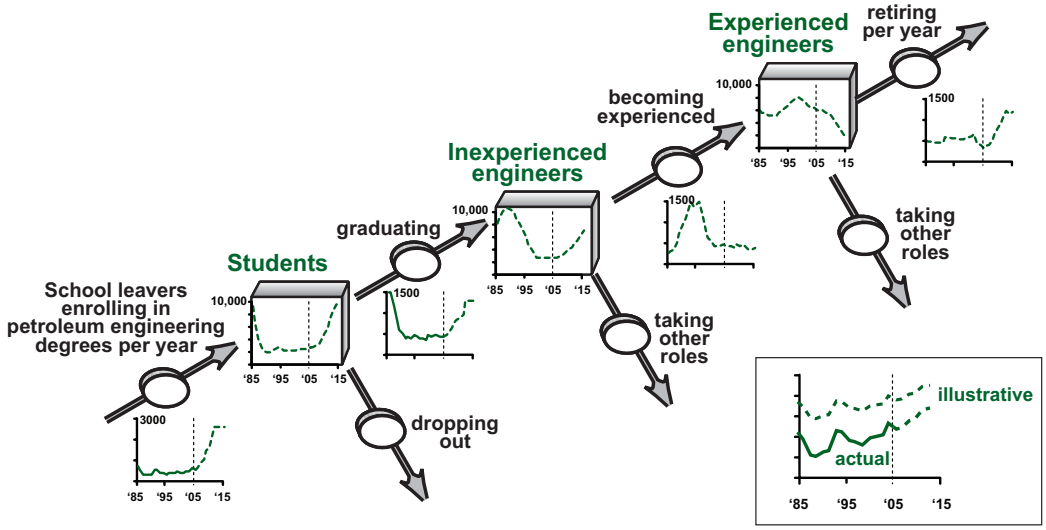

Figure 6.19: Implications of graduation rates for industry experience in petroleum engineering.

hiring boom of the mid 1980s. Hiring rates thus stayed low, only picking up again after a nine-year trough. Shell's shortage in 2005 of 1000 people is thus directly traceable back to slow hiring, not only by Shell itself, but also its peers between 1990 and 1998.

Figure 6.19 illustrates how this particular issue will continue to pose challenges for the oil industry, because the next decade will see the retirement of that 1980s hiring bulge. During the 1970s and 1980s, many thousands of graduates joined the profession. (This total is nowhere near the roughly 15 000 who graduated, however, since most found no jobs in the industry and switched to other careers.) Yet graduation rates since the early 1990s have been just 200–300 per year. Note, incidentally, that Shell's 2005 aim of hiring 1000 experienced staff corresponds to four years of the *entire* US output of new graduates! As Figure 6.19 shows, even if enrolment escalates immediately, this failure to back-fill the profession over the latest period means that the forthcoming retirement surge will decimate the industry's skills, unless rapid growth occurs in courses in other parts of the world.

The dynamics of petroleum engineering graduation and staffing can be explored with the **my**strategy model *petroleum engineers model.msf* available at www.strategydynamics.com/smd6. Note that this model is only illustrative, since some important factors are unknown, for example rates of staff leaving the industry at each stage of their career.

Several issues complicate this situation.

- Domestic demand for petroleum engineers in the United States has almost certainly declined as reserves on United States' territory have progressively been developed. However, United States' and European oil firms are engaged in worldwide discovery and development, which continues to require these engineering skills.
- The United States is not the only source of suitable graduates, of course, with many hundreds emerging each year in Europe and other regions. But this global industry experienced the same boom and bust in oil prices, profitability, and supply/demand as affected the United States, with similar results for graduate employment.
- The problem cannot be laid entirely at the door of oil company hiring policies. Since the early 1990s, there has been huge demand for talent by the IT and communications industries—undoubtedly a major attraction for numerate young school-leavers. However, oil firms' tolerance of such low graduate intake, for so many years has undoubtedly escalated the problem.

This challenge is not unique to the oil industry. One of Europe's largest power generation and distribution companies initiated a review of its physical assets in 2004, triggered by consideration of the model in Figure 6.4. It discovered that its asset maintenance and development strategy was in need of a major boost, and initiated plans to tackle the issue. To its alarm, it then learned that it was badly lacking in the technically skilled staff needed to carry out the program.

The "bullwhip effect" in resource development

Earlier in this chapter it was noted that management needs to be aware of potentially severe disruptions in the product development process from changes in policy regarding the screening of ideas and products early in the process. As shown in this section, the employment chain can also generate highly disruptive consequences for strategy and performance.

This phenomenon of long-term, large-scale disruption of supply-demand balances along all stages of a supply system or other resource-development chain is known as the "bullwhip effect," from its similarity to the wave-form of a cracked whip. It was first specified in the 1960s when it was noted that small disturbances in final demand for a product had highly disruptive effects on product supply and inventories in the various stages of supply from production through distribution to the final customer.[17] For example, a small increase in

final customer demand causes retailers to increase orders on their distributor, not only to meet the new demand rate, but also to cover further anticipated increases. Consequently, the distributor receives a greater increase in orders than actually arose from the end customers. The distributor now places orders on the supplier that are also exaggerated by it anticipation of higher future orders, so the producer has to raise production by a much higher proportion than the original increase in final demand. The anticipatory orders along the chain cause heavy overstocking, and a subsequent collapse in orders, even with no further change in final demand. The supply chain is then sent into repeated cycles of over- and underavailability of product.

Solutions to this problem include the Kanban system, which forces ordering to reflect *only* current demand, rather than uprating orders for anticipated future demand, and information systems that give the entire supply chain visibility of final customer demand.

The parallels with the employment story are clear—a small increase in final demand for petroleum engineers caused a shortage of graduates, so universities expanded capacity and promoted the courses, so potential students (anticipating plenty of jobs and attractive salaries) signed up in much larger numbers than the small increase in actual demand would have justified.

Like many of its peers, this company had responded to the regulatory pressure for low power prices and increased efficiency by limiting its operational costs, including maintenance. To contain its financing costs, it had also tightened its spending on new assets. With less maintenance and capital replacement work, the company did not need so many engineering staff, and was therefore able to reduce its operating costs still further by reducing its headcount. The need for a step-increase in its maintenance and capital replacement program triggered recognition of the staffing crisis. Although it quickly authorized the unavoidable increase in spending, the company then found that it had way too few staff to actually do the work.

Its first response was to try and outsource the solution to the companies that supply the industry's equipment. Although the suppliers were delighted to receive the orders, they too were unable to respond. When the generating and distribution industry had cut back their spending, the suppliers suffered a drop in orders for new equipment and parts, so they had reduced their own capacity and laid off engineering staff. The company in question therefore found that its suppliers were

unable to respond when it called for their support. Regulators in the various markets concerned, it seemed, were blissfully unaware of the havoc their enthusiastic price-cutting efforts had caused.

Determined to establish a medium-term solution to this shortage of the essential technical talent it needed, the company approached a number of universities to sponsor a substantial increase in their electrical engineering programs.

POLITICAL, ECONOMIC, SOCIAL AND TECHNOLOGICAL (PEST) FACTORS

The case of oil industry staffing is just one example of exogenous forces that often have substantial effects on resource development and strategy ("exogenous" meaning external to the situation). Such factors are conventionally divided into four categories—political, economic, social and technological—leading to the process by which they are considered being known as PEST analysis.[18] Some strategy writers add the influences of environmental and legal issues, extending the method's name to PESTEL analysis.[19] Whilst PEST factors are often considered in general terms by firms in evaluating business opportunities and threats, the framework developed here makes possible a rigorous, fact-based evaluation of the scale and pace at which they may drive change.

Hidden assets?

Publicly quoted companies in the US, Europe and other jurisdictions are increasingly expected to provide clear information about the true health of their business, so that investors can make well-informed judgments about their likely prospects. An example of the relevant regulations appears in the following extract from the UK government's 2004 draft regulations.[20]

"*An operating and financial review shall be a balanced and comprehensive analysis of –*

- *the development and performance of the business of the company and its subsidiary undertakings during the financial year,*
- *the position of the company ··· at the end of the year,*
- *the main trends and factors underlying the development, performance and position of the business ··· during the financial year, and*