Taking stock and looking forward

Johana Dunlop[1], Najib Abusalbi[1], and Paula McCann Harris[1]

Abstract

Education systems are the engine rooms of sustainable economic development, generating the essential skills on which wider social progress rests. However, in many countries, and increasingly in developing economies, educational standards are detrimentally low. This is rarely considered a humanitarian crisis, even though it is a root cause of youth unemployment and the multiplicity of destructive social and economic forces that stem from it. The world over, governments are responsible for schools and universities, and it is a truism to say that education is in the interest of all stakeholders. The right to learn and deploy our brains to the greater good is a powerful human motivator.

Introduction

Education matters in so many ways. Successful oil and gas operations, for example, are reliant on the steady supply of talented, skilled, and knowledgeable individuals emerging from the education system. More broadly, for numerous developing nations, hydrocarbons promise a road to economic success, but only if the right human capital is available to the operators and the many companies that make up their value chain. Sub-Saharan Africa, for example, has considerable untapped oil and gas potential, but the capacity of its universities and vocational institutions is inadequate to supply the skills needed — not only skills for the oil and gas sectors directly but also, and more important, indirectly because the oil and gas industry is not a significant employer but has a significant multiplier effect on indirect job creation.

Several 2012 studies showed that Sub-Saharan Africa needs to more than double the capacity of its petrotechnical universities and improve the progression of students from primary schools through to job-market entry points. The premise remains the same today (Figure 1).

Governments and the oil industry, therefore, have a shared interest in improving science, technology, engineering, and mathematics (STEM) education at all levels of the school and university systems. A high-quality, universally available education for all people and ages — from primary school to university — is of almost limitless value. Education reinforces a country's socioeconomic fabric, fosters innovation, creativity, and growth, and creates an economic ecosystem in which businesses can thrive. Education enables a more skilled workforce, a stable and capable local supply chain, and better prospects for growth throughout the economy. Investments in education, in other words, are shared-value investments because companies can meet their own for-profit objectives while contributing to economic development and addressing social problems that intersect with their businesses.

Private-sector companies can make meaningful contributions to education to help build science and technology capacity and inspire more young people to take an interest in STEM subjects, one of the building blocks of today's increasingly knowledge-based economies.

The notion of shared value fits well in the oil and gas industry, which plays such a central role in enabling prosperity and engendering social progress. When used effectively, the wealth potential unlocked by oil and gas extraction can empower national economies through multiplier effects that ripple across other sectors. Local-content rules aim to capture these economic benefits by setting targets for recruitment and training of nationals, technology transfer, the procurement of domestic goods and services, or partnerships with local investors and locally owned businesses. However, mandated percentages of skilled workers can be difficult to achieve in some countries because the pool of qualified people is too small. Such bottlenecks can disrupt business and cause frustration among all actors, from regulators to international companies. Given that no one organization can resolve the challenges, it behooves us all to seek alignment and to work collaboratively so that the industry plays its appropriate role and is recognized for its contributions collectively and individually; equally, the governments play their appropriate roles.

Staying local

Schlumberger pursued the shared-value approach before the term was coined and before headcount targets were introduced under local-content rules, recruiting in all the markets in which

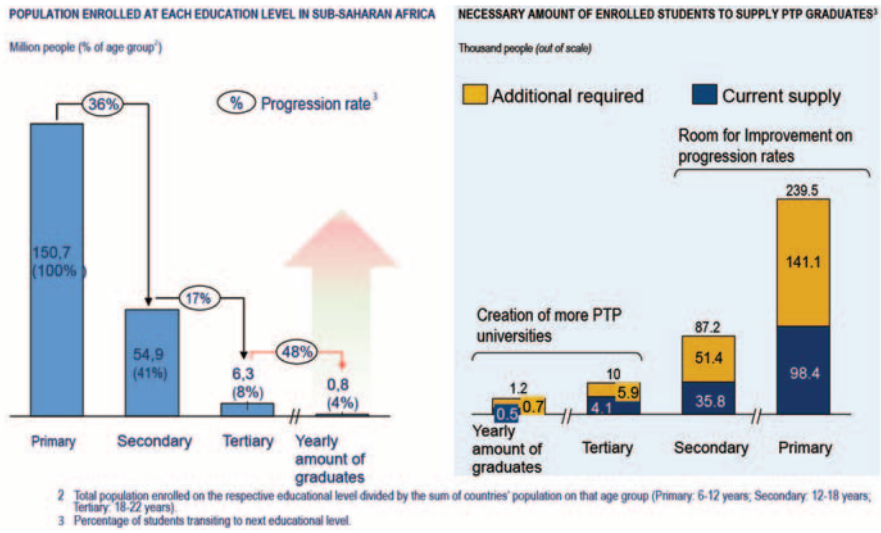

Figure 1. Education as shared value proposition. Example: Sub-Saharan Africa needs to more than double the capacity of petrotechnical universities and improve progression of students. After UNESCO; SBC O&G HR Benchmark 2012; SBC analysis. Copyright Schlumberger.

[1]Schlumberger.

http://dx.doi.org/10.1190/tle34101236.1.

the company operated. What made business sense 30 years ago is fundamental today to the company's culture and values.

The company procures both internationally and where it works, proactively looking for ways to procure from and work with local suppliers to further develop their capacity to meet the industry's quality specifications domestically and overseas. It develops local partnerships, helping local E&P clients to become self-sufficient, world-class operators through collaboration, training, technology transfer, and mastery. It is actively seeking to expand engineering and manufacturing capacity to underrepresented countries where the socioeconomic fabric can host such undertakings.

The health of local industry is predicated on the health of the education system, and so we circle back around to the omnipresence of education as a fundamental imperative of socioeconomic development.

To ensure that there are sufficient numbers of scientists, engineers, and technicians available to oil and gas service companies and operators in the future, the industry has a strong case for encouraging robust STEM education at all levels of education, from primary school onward, as many companies already are doing.

Private-sector contributions to education can take a variety of forms, such as grants that fund research programs or teacher-training schemes, donations of software and infrastructure, networking opportunities, knowledge sharing between experts and students, and faculty-capacity building, to name but a few intervention types. Schlumberger and other companies like it are in a strong position to contribute. Expertise, brainpower, and knowledge sharing are critical to success in the technology- and people-intensive oil-field services industry. Schlumberger is naturally adapted to knowledge sharing in the realms of science, technology, and the subsurface, and it understands the value of education and training, as well as what both processes involve.

University relations

Engagement with universities and vocational training schools, the source of the industry's future employees, fits within the notion of shared value, benefiting the employer by supplying human capital while generating wider socioeconomic benefits.

Universities supply the lifeblood of the engineering sector — the technical personnel on whom progress largely depends — making them critically important to large recruiters. Schlumberger interacts with campuses in a variety of ways, funding student activities and university research programs, enabling students to connect with the oil and gas business through internships and professional organization student chapters, and donating software to academic institutions around the world.

Its corporate investments in university programs at more than 500 academic institutions around the world include activities such as funding the student chapters of professional oil and gas organizations. These benefit the company directly by supporting recruitment. In addition, such efforts can and do have a wider socioeconomic impact by promoting STEM education and research, helping to develop talent in the oil and gas sector, and supporting the connection between the oil and gas industry in general and the academic world.

For example, Schlumberger gives students direct exposure to the oil and gas business through its internship program, which has been identified repeatedly as one of the best programs in terms of the opportunities it offers students at all levels of higher education and in almost all STEM fields. It also shares field experience with students through lectures and placement of professors of practice and research scientists at key universities. It donates commercial software to more than 500 academic institutions in more than 70 countries around the globe, supporting research in and understanding of geosciences, petroleum engineering, and computer sciences, as well as a variety of engineering applications in oil and gas operations.

SEED program

Other programs have broader and longer-term motives and goals than meeting the immediate need for a stronger talent pool. For example, Schlumberger Excellence in Education Development (SEED), a nonprofit initiative, brings science and technology programs to the communities in which Schlumberger operates through teacher-training workshops, a multilingual science Web site, hands-on learning tools, and Internet and technology grants.

SEED is a volunteer-based, nonprofit education program focused on underserved communities where Schlumberger people live and work. It aims to ignite passion for science and learning in students aged 10–18, to engage them in STEM subjects, and to empower them to use knowledge and technology creatively.

The SEED learning-while-doing methodology taps into the passion of Schlumberger people for science and learning, drawing on the technology and science expertise of volunteers to engage students in global issues such as water, energy, and climate change. It builds learning communities and knowledge-sharing environments in which students, educators, and volunteers collaborate on projects in their local languages.

PlanetSEED, a public and free multilingual science Web site, provides a broad range of STEM-based resources to teachers, students, and science lovers everywhere. One of SEED's most original and popular Web-based and application-based programs, "Ask the Experts," puts hundreds of Schlumberger science experts in direct contact with students, helping them to understand some of the world's toughest science questions. The answers to the most popular questions have been turned into a set of frequently asked questions (FAQs) organized by topic, ranging from aerodynamics to water, with physics, chemistry, and earth-science topics in between.

STEM Teacher Academy training program

The SEED program has evolved considerably since its creation in 1998 and increasingly focuses on teachers rather than students. As such, the SEED STEM Teacher Academy (SSTA) is piloting professional development training to secondary-school STEM subject teachers.

The SSTA provides professional development to secondary-school teachers of STEM subjects. It provides the most committed teachers with training in teaching methodologies and technologies and gives them support in developing hands-on STEM lessons, with the end goal of improving student outcomes.

The yearlong training takes place in a project-based group-learning environment supported by mentoring and supplemented

by cohort participation in a professional community. Teachers are generally from the same urban areas, enabling communication and development of relationships that can continue after the program ends. All lessons, tools, technology, and methodology are localized to the needs and curriculum of the area. Participating teachers receive the necessary supplies, tools, technology, and professional resources to implement the lessons covered and to continue the units of study.

The SSTA begins with a pilot academy that runs for one year. Based on that pilot, a specific model can be developed that can be replicated in other parts of the same country. The long-term goal is to provide a self-sustaining program that a local education ministry could run without the continued support of Schlumberger. Throughout the training period, teachers are engaged through an online community, virtual learning opportunities, and shared learning spaces so they can collaborate throughout the school year.

To date, pilot programs have been run in Mozambique and Tanzania. Cohorts of 50 teachers in each country are now in a continuing program that is building their capacity to engage and educate the generations who will enter energy-related jobs in the coming years, as well as jobs across the full spectrum of their countries' economies.

Enhancing diversity and local impact

Some of the challenges in education systems are systemic and global in nature. Women, for example, are severely underrepresented in the oil and gas industry worldwide. In some countries, particularly in the developing world, girls are not afforded the same educational opportunities as boys. Indeed, according to the Global Partnership for Education, girls account for 31 million of 58 million children not in education and for a large proportion of the 250 million children who fail to achieve a reasonable standard of education after four years in school. Even in the developed world, too little is being done to empower women to advance in STEM education and careers, depriving the industry of a vast talent pool and stifling economic development more broadly.

Faculty for the Future, the Schlumberger Foundation flagship program, encourages women to pursue academic careers in science and technology by providing fellowships and logistical support (see sidebar, "Faculty for the future"). Grant recipients are selected as much for their leadership capabilities as for their scientific talents and are expected to return to their home countries to continue their academic careers and inspire other young women.

Other challenges are more local in na-ture. Large numbers of young Nigerians, for example, are pursuing higher-education qualifications — often because their immediate job prospects are poor. Yet this has little benefit to the country's development. According to West Africa Vocational Education (WAVE), a social venture tackling youth unemployment, too few graduates emerge from the university system with the work-ready skills employers need. Meanwhile, across the wider West African region, businesses are being constrained by a shortage of skilled entry-level workers, according to WAVE. Both problems stem from flaws at different stages of adapted education systems, and both exacerbate youth unemployment.

Industry has a valuable contribution to make in turning around such problems. Not all young West Africans should opt out of higher education, but employers can be more imaginative with approaches to employment and training, adapting to the demands of each market. According to WAVE, companies in several West African industries, from airline services to retail banking, are now adopting a more pragmatic hire-for-attitude, train-for-skills approach and abandoning dogmatic requirements for degree certificates in jobs that do not need them. The results so far are apparently positive.

All these elements point to a need for greater joined-up thinking within education if economies are to capture the value that the oil and gas industry and other industries are capable of unlocking. Fifteen years of deploying not-for-profit and business-enabling educational programming leads us to believe that the most effective private-sector interventions require a comprehensive and profound understanding of each country's unique context and development priorities and must fit with the industry and with our own particular profile, competency, and capacity.

As a result, we are now reviewing our own programming with the aim of creating a whole that is greater than the sum of its parts. An interconnected-pipeline view characterizes our contributions as a portfolio of programs that can dovetail and interlink in strategic ways. Such a view creates more value for our program beneficiaries and multiplier effects that would have been unattainable under our previous, siloed, approach (Figure 2).

No single company can make more than a very limited contribution, even when working alongside the authorities ultimately responsible for education policy. However, the case for alignment and collaboration is increasingly strong, both within industries and even between industries that share a common interest in particular disciplines — in our case, science education. TLE

Corresponding author: dunlop4@slb.com

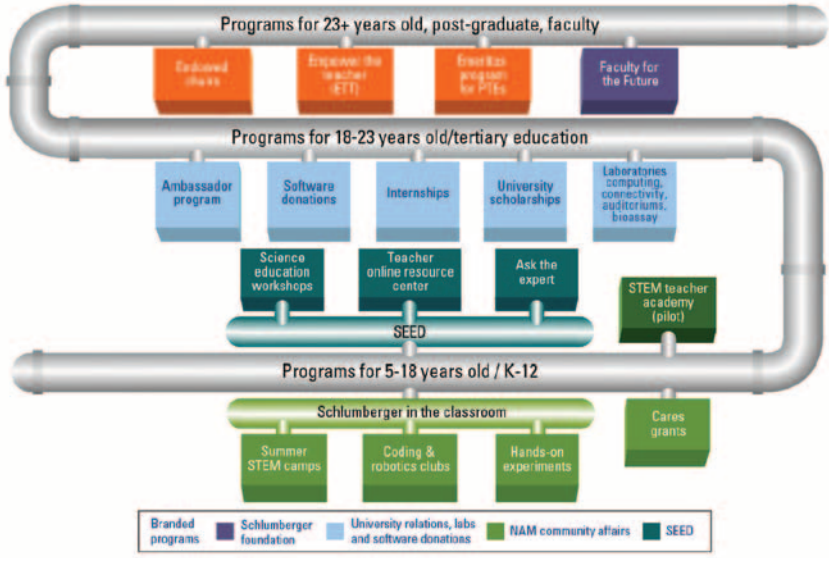

Figure 2. Schlumberger social investment: education portfolio. Copyright Schlumberger.

Faculty for the future

The Schlumberger Foundation's Faculty for the Future (FFTF) program provides fellowships to support women scientists and engineers from the developing world to pursue postgraduate studies at leading universities worldwide, equipping them with the knowledge and skills necessary for them to teach, research, and drive innovation.

The program's ultimate goal is to create a community of women leaders in science, technology, engineering, and mathematics (STEM) who will support the socioeconomic development of their native regions by strengthening the faculties in their home universities through teaching and conducting research into relevant local challenges, inspiring other young women to pursue STEM careers, and using their scientific expertise to influence policy making and to catalyze socioeconomic development.

The foundation awarded new fellowships for the 2015–2016 academic year to 155 women and extended 135 existing grants across a wide range of STEM-related disciplines. FFTF fellows all have achieved academic excellence at schools and universities, often despite considerable financial hardships and traditional barriers to women's education.

Awarded an FFTF fellowship in 2012, Sreeja Nag, from Pune, India, has bachelor's and master's degrees in exploration geophysics from the Indian Institute of Technology, Kharagpur. Nag's master's thesis, prepared in 2009 in collaboration with the University of California–Berkeley, was an analysis of satellite data to interpret faults in the San Francisco Bay area. In 2012, she gained two further master's degrees from MIT, in aerospace engineering and technology policy.

Nag's current research involves the design of nanosatellite constellations for earth-observation missions aimed at estimating bidirectional reflectance distribution functions (BRDF). Small satellites are more affordable and quicker to develop than traditional large systems and can make space-based earth observation accessible to developing countries. BRDF is needed for correction of view angle and illumination angles in image standardization, derivation of surface albedo, climate modeling, and the calculation of radiative forcing at the top of the atmosphere, land-cover classification, cloud detection, and many other applications.

Nag's research is taking place in collaboration with NASA Goddard Space Flight Center and NASA Ames Research Center. While pursuing her Ph.D., Nag plans to establish and maintain professional collaborations with national and international space research organizations, including the Indian Space Research Organization.

An FFTF fellow since 2011, Monica Ramirez Carvalho, from Medellín, Colombia, graduated with a bachelor's degree in biology from the University of Antioquia, specializing in plant systematics. In the final years of her undergraduate studies, she also undertook an internship at the Smithsonian Tropical Research Institution in Panama. Carvalho completed an M.Sc. in geosciences at Pennsylvania State University and is pursuing a Ph.D. at Cornell University.

Elucidating the origins of high-diversity ecosystems is crucial to conservation and to understanding the effects of climate change on vegetation. Carvalho's doctoral research focuses on functional leaf morphology and biomechanics of various plant groups that are known to extend far back in time in the fossil record, to link morphology to plant physiology. Establishing how leaf morphological and physiological features have changed over time and what effect, if any, ancient climatic fluctuations have had on their forms and diversity should provide important clues to the history of vegetation and evolution of high-diversity ecosystems.

Carvalho plans to return to Colombia and take up a teaching position at the University of Antioquia. She still collaborates with the Smithsonian Tropical Research Institute and will establish a paleobotany and plant morphology laboratory specializing in the recovery and study of fossil plants and the evolution of plant forms.

An FFTF fellow since 2014, Esther Mosase was educated in local schools in southeastern Botswana before attending the University of Botswana in Gaborone, where she obtained a B.Sc. in environmental science with a focus on soil science and hydrology. She then studied at the Botswana College of Agriculture towards an M.Sc. in agricultural engineering, specializing in soil and water engineering. While she was in the department, women represented only 7% of the teaching staff.

Mosase is now conducting research at South Dakota State University in the fields of agricultural engineering, water resources, hydrology, modeling, and geospatial tools such as geographic information systems (GIS) and remote sensing. In her study, Mosase is trying to understand the spatial and temporal changes of major components of the hydrologic cycle in the Southern African multinational watershed, the Limpopo River Basin (LRB), which encompasses parts of Botswana, Mozambique, South Africa, and Zimbabwe. The study aims to characterize water resources in the LRB, develop relevant indicators to determine and predict water risks in the LRB, and establish a strategic framework for managing water resources in the region.

In addition, Mosase will create an information system to support stakeholder and general-public decision making in water-resources management. She hopes the outcomes of this study not only will be beneficial for operational and planning purposes to present and future water resources in Botswana and the LRB, but also will demonstrate the usefulness and limitations of remotely sensed data as a viable alternative for water research in ungauged and poorly gauged watersheds such as the LRB. Her study would lay the groundwork for further studies in water resources. Following her studies, Mosase plans to teach at the Botswana International University of Science and Technology, Palapye.