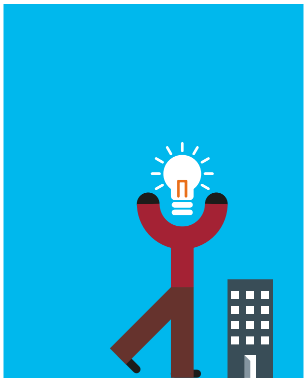


Step 4

Encouraging entrepreneurship and innovation

Problem: Traditional mindsets stifle creativity and risk-taking

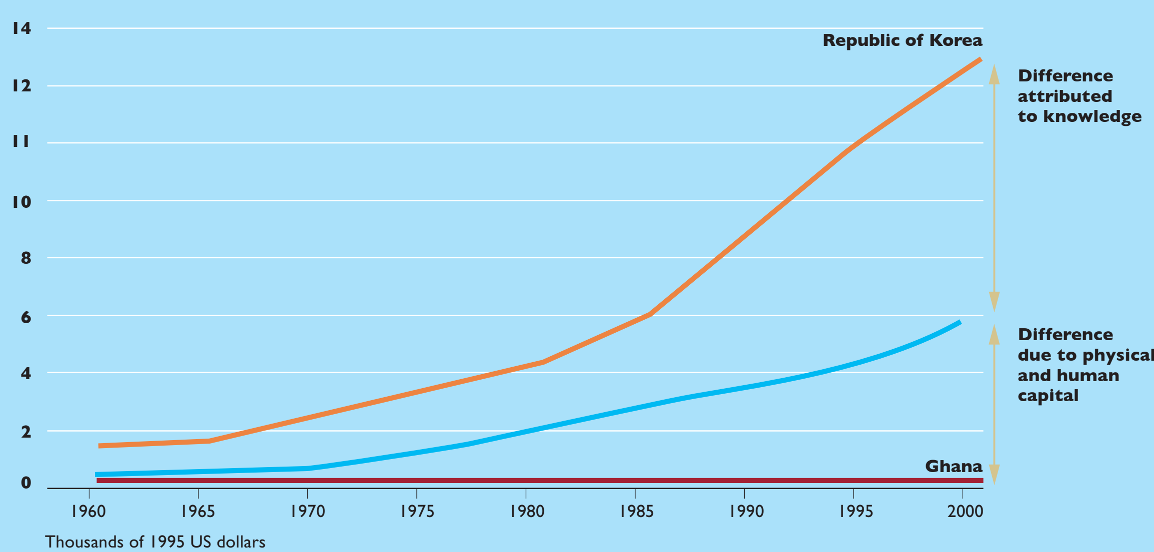
In 1955, Ghana and the Republic of Korea both had a GDP per capita near $300. By 1990, Ghana's real GDP per capita was the same, but Korea's had increased to $7,500. A third of Korea's growth can be attributed to the rapid increase in educational attainment and capital. The remaining two-thirds came from greater productivity in the stock of labor and capital and innovations in the uses and types of capital.[49]

Chile's GNI per capita increased from $590 to $4,330 during 1960–2003. It had modest growth before 1990, largely due to physical capital and labor, but in 1990–2003, when knowledge and innovation started to boom, Chile's growth took off.

What did Korea do over those 40 years that Ghana did not do? And what caused Chile's boom in the 1990s? The Korean success is largely thanks to an aggressive, multi-pronged strategy comprising a rapid increase in primary and secondary education, public support to develop a research base through an emphasis on science and technology, and a knowledge-driven industrial policy.[50] In Chile, labor and capital played an equal role in 1960–73, but the jump in average educational attainment from 6 to 10 years was largely responsible for the growth in 1974–89. The rapid growth of the 1990s, by contrast, was due to knowledge and innovation spurred by even higher levels of education, a new generation with an "entrepreneurial spirit," and competition between firms.[51]

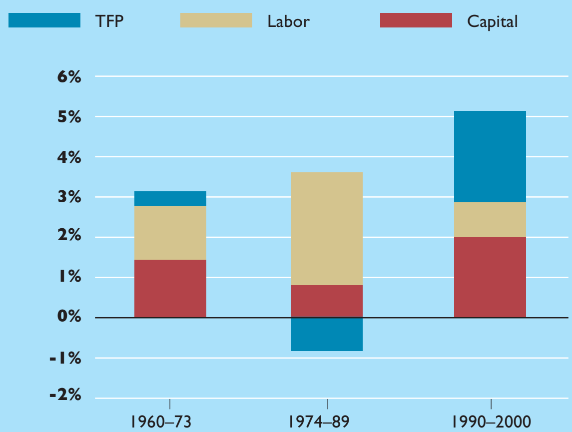
Knowledge produces growth. "Grey matter is a country's main resource," and knowledge has become a key driver of competitiveness.[52] And as the world

Figure 7. **Knowledge makes the difference between poverty and wealth**



Source: Adapted from World Bank. 1999. World Development Report. Washington, DC.

Figure 8. **Chile's recent growth rates came from higher education and innovation**



Source: Fuentes, Larrain, and Schmidt 2004.
Note: TFP is total factor productivity.

becomes more globalized, more reliant on technology, and more service oriented, a country's knowledge base will determine its growth path. Korea and Chile illustrate the need to simultaneously develop human capital, innovation systems, ICT infrastructure, and institutional regimes. This relationship between human development and private sector development is symbiotic, because one key aspect of innovation is not just developing new products and processes but also the ability of individuals to be entrepreneurial in bringing them to good use.

For countries to make the next big move—from developing the right skills demanded by the market to dynamically improving the quality and quantity of that demand—developing an innovation system is critical. The key role of "grey matter" in this points to the importance of steps 1–3 and the need to think about those processes in the context of developing knowledge for growth while implementing additional reforms to transform existing learning into growth-inducing innovations.

Innovation as an input to growth

Innovation is a process whereby people or groups of people with an entrepreneurial mindset (organizations, enterprises) develop new ideas or absorb and adapt existing ones. Together with institutions and policies that affect their behavior and performance, they create new products, processes, and forms of organization. Innovation is not only about scientists in laboratories, theoretical science, or new discoveries. It is about building the capacity to find solutions to practical everyday development problems. So an innovative economy is marked both by Nobel Prize-winning scientists, and by small-scale entrepreneurs who develop ideas for new products or new ways of doing things and transform them into profitable products or activities.

Innovations can come in various forms. They encompass the products, processes, and services that meet market needs. They may be developed and marketed in the manufacturing sector, but they may also apply to new ways of doing things in all sectors, including commerce and service delivery. And the innovative idea needs to be widely tested and applied by those who have the skills and financing to bring it to scale. This calls for engaging those with marketing and managerial skills and venture capital.

Research is important—but not always central—to innovation, which may also be realized through less technical experimentation and discovery. The use of cell phones to provide banking services across India and Africa is an example both of developing cheap handsets and communication networks and adapting the technology to nontraditional use. At a macro level, Italy's rapid growth was almost solely due to process innovations and not to R&D, and Spain's rapid convergence to OECD average growth rates was almost solely due to adopting and adapting existing ideas.[53]

Unlocking entrepreneurship and innovation

Innovation—and thus growth—can be encouraged by three human development–related factors, and the accompanying policies that facilitate them. First, individuals need a range of skills—those developed in steps 1, 2, and 3, but also other innovation-specific skills. Second, these skills and the ideas flowing from them have to be connected to others. Third, productivity increases when innovative small business owners can grow with the aid of risk management tools (step 4) or as innovative skilled workers enter the labor market (step 5).

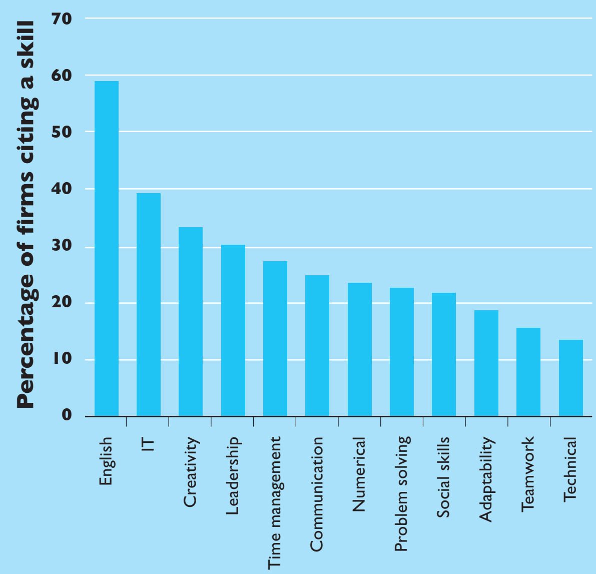
Box 4. The face of an entrepreneur

A young Indian from a poor family leaves for his low-wage job daily, bids his mother farewell as she sits on the floor, crouched over the silk-yarn winding loom. The work is tedious and labor intensive. The young man has the idea to mechanize part of the weaving process, potentially increasing his mother's productivity and earnings. With earnings from his job, he begins to experiment with new loom designs, until he successfully develops a model that eases his mother's task. The partially modernized loom is adopted by other small-scale weavers.

A young man with a university degree in textile engineering travels to Rwanda to close a silk factory after the 1994 genocide. On arriving in Rwanda, he instead makes a deal with the factory owners to give him a chance to revive the factory. Drawing on his academic and business contacts, he resumes production, refines the quality of the silk, and begins designing his own products. Today the factory earns high profits in its export of fine silk products around the world.

Source: www.worldbank.org/education/sti; http://saward.nif.org.in/awardprofile-all.php

Figure 9. **Thailand: Top three skills that professionals lack the most in doing their job (manufacturing)**



Source: World Bank Investment Climate Survey for Thailand.

This three-part process is relevant to all individuals despite their starting points. A young Indian entrepreneur who improved on his mother's loom to increase her productivity and the older Indian Ph.D. in silk production who turned around a silk factory in Rwanda both benefit from general skills, creativity, entrepreneurial abilities, a connecting environment, and risk management tools (box 4).

Skills to be an inventor, an innovator, a creator

Three types of skills are necessary to unlock creative potential and take it to market.[54] First, the general skills in steps 1, 2, and 3 are necessary to adapt existing technologies, compete in an innovation-driven economy, and manage the increasingly networked innovation process. These skills include basic literacy and numeracy, problem-solving, and social and interpersonal skills.

Creativity produces new ideas. Innovative thinkers are curious and persevering and have "divergent thinking,"—imagining several responses to a single problem rather than converging to a single, right answer.[55] Surveys of employers or the self-employed in India, Malaysia, Thailand, and a range of other countries note that these innovation skills are sorely lacking today (figure 9).[56]

Entrepreneurial skills range from managerial skills in running a business to motivation. These are the skills to sort out good ideas from bad ones, find the resources and means to create a prototype, and take the idea through its growth phases. Education and training systems can teach individuals to be cognitively developed, creative, and entrepreneurial—as illustrated by the owners of small firms in Ghana who, as a result of training in management techniques, saw their sales revenue grow and their gross profits equal the effects of 10 years of educational attainment.[57] These skills—attitudinal and behavioral, as well as pedagogical—are best learned through everyday practice to question, analyze, experiment, and interact with the world.[58]

Both creativity and entrepreneurial skills can be incorporated into teaching methodologies at all points of the skill formation process. And education systems can encourage innovation-related specialties, such as math, science, and business and managerial skills. But these strategies will be successful only if education systems improve the quality of the basic math and science skills for

the majority of students. Without such a basis, efforts to instill risk-taking and entrepreneurial skills will be wasted.

In India, the government is implementing a program to increase the relevance of undergraduate education in science and technology by supporting the improvement of learning facilities and the development of relevant curricula as well as establishing reforms to promote academic excellence and school accreditation. Early results show that the project has improved the quality of education, and a second phase aims to scale-up several existing Masters and Ph.D. programs with concomitant research programs, both to develop the country's innovation base and to address faculty shortages that threaten to limit opportunities for tomorrow's students.

Connecting people and ideas

Innovation cannot realize its full potential if innovators are isolated.The innovator needs other creative and skilled individuals to share ideas with and bring those ideas to market, capital to finance the realization of the idea, and an enabling environment that accepts new ideas. People can be brought together through:

- *Migration policies that geographically concentrate innovative thinking.* In the fast-growing countries in East Asia, governments fund scholarships for math, science, and business students to earn degrees in external research programs and bring the knowledge home, while slower-growing Latin American countries invest less to connect their students to knowledge centers.[59]
- *Innovation spaces.* In developing countries, innovation primarily occurs in public universities.[60] Across the world, governments fund competitive research grants to encourage universities to finance spaces for innovation (box 5). The successful Millennium Science Initiative in Chile established a Competitive Fund for Scientific Excellence, which financed Science Institutes and Nuclei. Similarly, the government of Nigeria is providing a small number of promising institutions with the resources to emerge as centers of excellence.
- *Publicly funded incentives for greater collaboration between universities and the private sector.* Chile provides financial incentives for collaborative research between public education and private firms, facilitates internships for Ph.D. candidates in firms, and supports centers of excellence for thinkers and others who develop their ideas to work together. Such collaborative research can also occur without government interventions. In Beijing, nearly 25% of university research is co-sponsored by private partners.[61] In Thailand, an agro-business conglomerate and a local university joined forces to develop DNA diagnostic probes to help reduce the shrimp crop losses through diseases. The marriage of the knowledge with the business led to the development of new shrimp DNA and to Thailand's capturing 30% of world shrimp exports.

Box 5. **Enhancing public-private research cooperation**

The Mexican government provided financial support and technical assistance to assist the formation of knowledge partnerships among private firms, universities, and research institutions. Public science and technology institutes sought to enhance client orientation in support of industry, while joint industry-academia projects were encouraged in applied research, product and process design, and technology adaptation and diffusion.

In Nigeria, grants of up to $800,000 were awarded to partnerships between two or more science and technology education institutions and industry. In Uganda, private sector cooperation was strengthened by creating technology platforms for firms and researchers to define collaborative agendas for solving problems of direct interest to the industrial sector.

Public financing and policy support to a Malian university created a virtual knowledge network of universities and researchers, who joined forces to develop and test malaria vacciness.

Similarly, the government of Chile supported groups of researchers from universities, government laboratories, and private industry to undertake collaborative research in areas of importance to industry in various regions of the country. It also awarded scholarships to doctoral students who would undertake a substantial part of their thesis work in industry. The initiative is widely recognized for its contribution to a culture of innovation in private enterprises and to Chile's greater access to international knowledge networks.

Risk management tools

Innovation is risky. In developed countries only 5% of venture capital firms survive. And these are firms that cherry-pick the best ideas. New ideas need time and experimentation to develop, and if the idea fails, the individual has a negative return on his or her investment. So, in societies with few safety nets, innovation may be constrained.

Policy can give a push to individual innovators by providing fall-back options. Risk management instruments, for example, can provide security to innovators so that they may expend resources on their new activities. An increase in the value of unemployment insurance in (credit-constrained) Brazil propelled the transition from unemployment to small-firm creation as opposed to wage-employment.[62]

These instruments can vary, depending on the complexity of the innovation and the income of the innovator. The poorest innovators need social safety nets to ensure that their families survive if the innovations fail. Since the greatest cost to these innovators is the time they spend on developing an innovation, general social safety nets insure against this income loss.

Those farther from the poverty line may need incentives to invest in innovation rather than more secure income-generation activities. Innovation funds that provide grants to individuals to develop creative ideas are becoming more common.

And for innovators across the poverty spectrum, policies that ensure a monopoly of returns from marketable innovations—patents, copyright laws—lower the income risk associated with developing non-rival ideas. While such legislation is outside the human development arena, its fair implementation and monitoring is crucial as individuals move through the process of implementing their ideas.