Columbia Center on Sustainable Investment
A JOINT CENTER OF COLUMBIA LAW SCHOOL AND THE EARTH INSTITUTE, COLUMBIA UNIVERSITY

Columbia FDI Perspectives

Perspectives on topical foreign direct investment issues
No. 167 February 15, 2016
Editor-in-Chief: Karl P. Sauvant (Karl.Sauvant@law.columbia.edu)
Managing Editor: Maree Newson (mareenewson@gmail.com)

Mining automation: threat or opportunity for FDI technology spillovers?

by
Nahom Ghebrihiwet*

Host countries increasingly seek to benefit from technology and knowledge spillovers from foreign direct investment in their extractive industries by imposing regulations on foreign mining companies operating in their economies. Such regulations include obligations to hire and train local workers, buy from local suppliers and advance local research and development. In fact, more than 90% of resource-driven economies (from a total set of 87) in 2011 had some form of local content regulation,[1] intended to maximize retained value as well as strengthen prospects for technology acquisition, even though such regulation is often banned by the World Trade Organization's Agreement on Trade-Related Investment Measures and by bilateral investment treaties. Nevertheless, due to the profitability of the investment opportunities international mining companies are accepting such regulation.

In recent years, technological improvements in mining have accelerated the process of mining automation. As a result, fewer workers are needed at mine-sites, and mining companies need high-technology equipment produced by international mining suppliers. For example, a leading program in mining automation is Rio Tinto's "Mine of the Future Program," which develops high-technology innovations at worldwide centers of excellence. The company is now using autonomous trucks, autonomous drill rigs and driverless trains; it expects to use robotic wheel-changing systems in the near future. Accordingly, to benefit from technology spillovers from the operations of foreign mining companies with such technological advances, host-country governments need to adjust their policies.

Technology and knowledge may spillover through several channels, including:

- **Labor mobility**, whereby local firm productivity increases as a result of local firms hiring workers that were trained by foreign multinational enterprises (MNEs), or when these trained workers start their own businesses. Many of the senior skilled employees in South Africa's mining equipment and services industry, for example, developed their knowledge and skills as technicians on mine sites and at research centers.[2]
- **Imitation**, whereby local firms imitate foreign firm technologies or management practices. Norway's Statoil, for example, successfully imitated management practices of Mobil, which at the time was Statoil's partner and the operator of the Statfjord oil field. Statoil created an organizational structure that was closely modeled on Mobil's, and Statoil hired Americans for leadership positions.[3]
- **Backward linkages**, whereby foreign MNEs transfer knowledge and technology to local suppliers to enhance the quality of inputs. For example, BHP Billiton has invested over US$50 million in a supplier development program in Chile. The investment is less than half of the estimated savings (US$121 million) to BHPB resulting from the program.[4] Innovative mining suppliers have emerged due to the program: the local cable manufacturer Prodinsa developed a solution for the snapping of steel cables on electromechanical shovels by using BHPB's mine site as a testing lab.
- **Export**, whereby local firms use the international network of MNEs to access new markets abroad. For example, the link created between Prodinsa and BHPB enabled Prodinsa to export its shovel cable solution to BHPB's operations in Peru.

While the increase in productivity due to autonomous equipment is expected to generate higher income for mining companies and host country governments alike, jobs at mining sites will be lost. Automated equipment technologies are used at operating centers often located at a large distance from mining sites. To benefit from knowledge spillovers, local content regulation on foreign companies' mining operations in host countries should take these advancements into account. Resource-driven economies may attract operating and innovation centers that could lead to transfer and spillovers of high technology. Rio Tinto, for example, has established its Analytics Excellence Center in Pune, India. This is a joint center with information technology service provider IGATE Patni. The center analyzes equipment data from Rio's worldwide operations to predict and prevent engine breakdowns and other downtime events.[5]

The existence of knowledge spillovers depends on the capacity of host countries to absorb and utilize foreign firm technologies. So, for resource-rich countries that are less developed it will be harder to attract research centers. These countries may, however, attract operating centers if they make a policy shift toward upgrading local technological and information technology skills to levels that are needed for processing data and operating autonomous equipment. Mining companies should contribute to upgrading these local skills, by training their local workforce through supplier development programs. Mining companies themselves will benefit from such programs, given that training of local workers increases their productivity and transferring technology to suppliers enhances the quality of their inputs.

[*] Nahom Ghebrihiwet (n.ghebrihiwet@vu.nl) is a Ph.D. candidate at VU University Amsterdam and Tinbergen Institute. The author would like to thank Goita Serawit, as well as Nicolas Maennling and Perrine Toledano for their comments and Rafael Benke, Padma Mallampally and Adnan Seric for their helpful peer reviews. **The views expressed by the author of this *Perspective* do not necessarily reflect the opinions of Columbia University or its partners and supporters. *Columbia FDI Perspectives* (ISSN 2158-3579) is a peer-reviewed series.**

[1] McKinsey Global Institute, "Reverse the curse: maximizing the potential of resource-driven economies," December 2013, available at http://www.mckinsey.com/insights/energy_resources_materials/reverse_the_curse_maximizing_the_potential_of_resource_driven_economies.

[2] M. Walker, "Unpacking the nature of demand and supply relationships in the mining capital goods and services cluster: the case of PGMs", Corporate Strategy and Industrial Development (CSID) Policy Papers (2005), available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.137.7030&rep=rep1&type=pdf.

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[5] Rio Tinto, "Rio Tinto launches big data Analytics Excellence Centre to drive productivity improvements", Media Release, March 3, 2015, available at http://www.riotinto.com/media/media-releases-237_14527.aspx.

For further information, including information regarding submission to the *Perspectives*, please contact: Columbia Center on Sustainable Investment, Maree Newson, mareenewson@gmail.com.

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