Beneficiation is touted as a silver bullet. Why it might not be

By Wouter Bam & Karolien De Bruyne

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Like other mineral producing countries, South Africa has considered implementing beneficiation policies to stimulate development. Beneficiation entails the transformation of a mineral (or a combination of minerals) to a higher value product. It's therefore about the downstream processing of a mineral product - all the way from a raw mineral (such as iron ore) to final products (like a car).

The beneficiation of diamonds has brought great benefits to Botswana. Shutterstock

The logic behind beneficiation is that raw minerals don't, on their own, have high value added. Exporting them unprocessed means that they don't contribute that much to the economy. The idea of beneficiation is to capture more value from minerals by processing them locally before exporting them.

There are lots of examples of beneficiation policies across the world. Indonesia restricted and considered banning the export of certain unprocessed minerals. For its part, China implemented policies to force the downstream processing of rare earth elements – essential raw materials for a range of products including magnets, catalysts, alloys and glass. In southern Africa, made De Beers mining licence dependent on diamonds being cut and polished in the country.

Many other countries, including the Philippines, Zimbabwe and South Africa, have all considered policies like this at one stage or another.

But is beneficiation the panacea that it's made out to be? Is beneficiation a good industrial policy?

Some recent studies have cast doubt on using beneficiation policies to drive industrialisation. They argue that countries should rather develop the industries that support the mining industry. The argument is that this might be easier to achieve and more sustainable because local demand for these products already exists.

We argue that beneficiation should be viewed within the context of a country's larger industrial policy strategy. To do this, we analyse value chains in their entirety – from ore to final products. In our research on steel in South Africa, we posed the question: if we consider the steel value chain in its entirety – from iron ore to sophisticated final products such as aeroplanes – which parts of the value chain should South Africa support to gain the best developmental outcomes?

Our research casts further doubt on the wisdom of doggedly following a strict beneficiation approach without considering the other options for development available to mineral producing countries.

Rethinking beneficiation

Our research involved working out the strategic value of different products in the value chain and how difficult it would likely be to successfully export these products competitively given the current capabilities – such as skills and infrastructure – South Africa has.

We did this using two metrics:

- Distance: defining how easy it might be for a country given its existing export capabilities to attain international competitiveness for a product; and

- Complexity: the more complex the product, the more likely it is to contribute to economic growth.

From this perspective, developing countries should try to develop the capabilities to export products with high complexity. And the focus should be on products that could easily be exported competitively (are "close" to them).

In the case of the iron and steel value chain, the upstream part of the value chain – related to iron ore and the activities that follow directly after it – on average, has lower complexity than the downstream part of the value chain – final products made from steel. This is what one might expect from the idea of beneficiation – downstream products are "better" for development.

In the case of South Africa's involvement in the value chain, on average, the country has strong export capabilities upstream – in iron ore and the activities that follow directly after it. But, it is weak downstream – in the various final products made from steel. This seemingly indicates that South Africa should focus on increasing its beneficiation to move toward the more complex products.

South Africa also has larger distances, on average, to the further downstream products. This highlights the difficulty of beneficiation.

But the picture became a lot more nuanced once we started to dig deeper. For example, some products in the value chain that are not far downstream (against the average) have high complexities. Examples include specialised products such as flat-rolled alloy steel products. And there are products further downstream, that have low complexities. Here examples include finished products such as fishing vessels.

Furthermore, South Africa already competitively exports certain downstream products such as mining related machinery. Yet South Africa is not competitive in upstream products such as alloy steel ingots.

The same can be seen for distances. Some products not far downstream in the value chain might be hard for South Africa

to export competitively (such as stainless steel-ingots), while some products further downstream are closely related to products the country already exports. These might therefore be easier for South Africa to export competitively. Examples here include machinery such as bulldozers.

This seems to suggest that our initial instinct from the average data – to follow a strict beneficiation-based industrial policy approach that seeks to consecutively ensure competitiveness of each step of the value chain – might be misguided.

Development route

With this insight in mind, we took our analysis further and investigated what the theoretically best possible developmental route within the value chain might be.

We found that the best developmental route in the steel value chain would be to follow a “leap-frogging” pattern. Our results suggest skipping various intermediate products, and to focus rather on a combination of final and semi-finished products, without first developing each step in the value chain that precedes them.

Instead of following a dogmatic beneficiation approach to industrial policy, it would be better to think creatively about the best way for countries to develop. Drawing from all the existing capabilities in a country, countries can target products with the greatest developmental potential before having to first develop each of the upstream industries.

This has the potential to lead to better developmental outcomes at lower cost.

In future, our methodology could also be used to support development policy in other industries and countries.

ABOUT THE AUTHOR

Wouter Bam, Researcher in Industrial Systems, *Stellenbosch University* and Karolien De Bruyne, , *KU Leuven*