

## An innovation and industry perspective on natural resource development: opportunities and challenges

*Natural resource industries and economies are often innovative, technologically advanced, and can under the right circumstances lead to economic development. Contrary to traditional thinking, natural resources do not make countries poor, but weak innovation systems do. Linkages which enable learning and innovation within natural resource industries, as well as between these industries and the wider economy, are key to promoting development. However, while some natural resource intensive development occurs via the market, government and policy impulses have a key role to play in accelerating this process.*

Traditional academic and policy views tend to consider that there is a contradiction between sustainable development and natural resource industries. However, a fresh perspective on the ties between natural resources and development, based on the principles of industrial development and innovation, shows that **there is no inherent contradiction between the development of a ‘knowledge economy’ and a ‘resource economy’**.

In 2015 the Globelics Secretariat issued a Thematic Review on natural resources, innovation and development which reflects the insights from research in the Globelics community and articles presented at Globelics conferences.

### Review Focus: three policy questions

- To what extent it is currently possible for a country to develop on the basis of natural resources?
- What are the main underlying mechanisms of resource intensive development paths?
- How can such mechanisms be supported politically?

### From curse to opportunity: the value of natural resources in development

Natural resource industries have historically been considered to be low growth and weak innovators, and inhibitors to the development of secondary (manufacturing) and tertiary (services) sectors in the economy.

This has led many to believe that being a natural resource-rich country represents a liability rather than an advantage, in what is often times labelled the ‘**curse of natural resources**’.

However, a closer look reveals that this policy thinking is flawed. This is mainly because it rests on the assumption that natural resources are not an outcome of production and innovation processes, but are the result of simple extraction which requires minimal effort. In addition, this view disregards the fact that industry growth clusters – including natural resource industries - tend to cross sectors through knowledge, learning and capacity development.

Thus the resource curse is not really about natural resources, but about the absence of learning across value chains, sectors, producers and consumers.



***Natural resources do not make countries poor, but weak learning, competence and innovation systems do.***

So contrary to common belief, natural resources are, under proper management, more of an opportunity than a curse for poor countries. This is particularly true in the current global context, characterised by the emergence of a number of opportunities such as the increased technological and innovation capabilities of many emerging and developing countries; the increased focus on corporate social responsibility and local sustainability, as well as the integration of many economies into global value chains.



## A new policy approach: innovation based natural resource intensive development

Access to abundant natural resources does not automatically lead to the emergence of the benefits of natural resource intensive development. Natural resource industry growth must be accompanied by a processes of learning, innovation and competence building within (in producers), around (in suppliers and users), and beyond (inter-industry spill overs) production activities. Innovation based natural resource development (or INRID) occurs when these processes complement each other to produce virtuous circles of innovation and industry development.

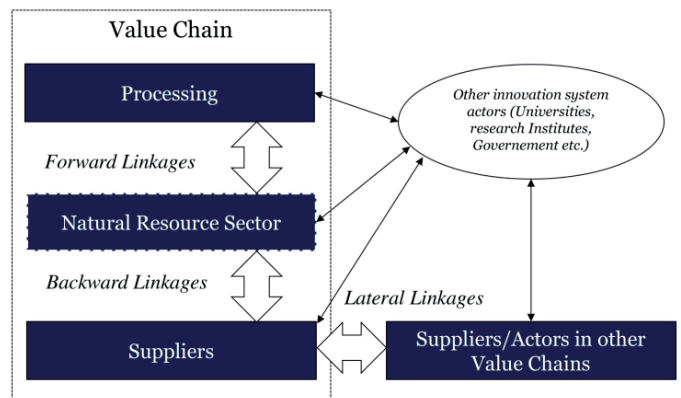
**Linkages within and between value chain actors** (such as suppliers, processors and customers) and other actors in the innovation system (e.g. research institutes and regulatory agencies) drive and enable learning, competence building, knowledge transfer and innovation. They are the key tools to achieved innovation based development.

### Linkages are key to economic development

There are **three main type of linkages: backward; forward and lateral.**

**Backward linkages** refer to the local sourcing of inputs such as machinery (e.g. grain combines for wheat harvesting), products used during natural resource extraction (e.g. chemicals used during oil drilling) and services (from catering to IT-systems). Many governments try to enhance backward linkages by including local content rules for procurement, although lack of available supply that can comply with the required technological complexity and quality standards is often a key barrier for less developed countries. Backward linkages are particularly strong when there are ‘local specificities’ and tailored solutions are required. For instance, salmon farming in Chile required the development of new fish cultivating process innovations compared to market leader Norway due to different environmental conditions and antibiotics regulations.

**Forward Linkages** refer to the local development of downstream value chain in terms of further processing or manufacturing, such as the production of steel from iron ore producing countries. These are often more difficult to develop, as they are an opportunity and not just a necessity (if you build ships, you need steel. If you produce steel, you don’t need to build ships).



**Lateral linkages** can be established through suppliers using knowledge and skills developed in the natural resources sectors are applied in other sectors, when products or process technology migrate between sectors (e.g. the development of bioremediation technologies to deal with environmental damages from gold mining in Peru). As such, they can be considered inter-industry knowledge spill overs. Lateral linkages are especially important for diversification of an economy.

### Successful examples of linkage development in natural resource industries

**Norway** successfully developed a strong local supplier basis for its oil & gas industry, as did **South Africa** for its mining industry. **Finland** strongly developed forward linkages from its forestry sector in the 20th century, becoming a leading player in not just manufacturing of paper and wood products but also paper & wood mill equipment and services. **Botswana** forced De Beers to move diamond processing and cutting activities to Botswana using its natural semi-monopoly. Brazil successfully used its strong position in agriculture to develop a lead in the bioenergy sector through lateral use of knowledge.

## Global Trends presenting new opportunities and challenges

1. The **emergence of global value chains** and reduced costs of transport has made the ‘local advantage’ for many industries smaller. These complex value chains, often governed by lead firms, require that countries and sectors are skilled at positioning themselves in these value chains, requiring more strategic coordination and institutional capacity. However, when countries successfully enter these global value chains, the opportunities are immediately large.
2. **Increased globalisation and specialisation** make traditional forward and backward linkage development more difficult as there is a strong competition with incumbent players. Lateral linkages are an important strategy for diversification, and lateral knowledge migration can help a country to capitalise on local natural resource asset particularities. A key strategy here is the development of human resources and supporting suppliers to apply their natural resource knowledge in other sectors as well.
3. **Increased scrutiny and awareness of the environmental and social impact of natural resources** can be challenging for the sector to manage, but can also provide opportunities for linkages resulting from more attention of MNCs in investing in sustainable supply chains with stronger local embeddedness and engagement with local populations. This social inclusion strategy is strongly synergetic with developing stronger linkages, which requires engagement and local interaction.

## The need for policy impulses: the role of the national and international policy community

While some natural resource intensive development will occur via the market, **government and policy impulses have a key role to play in accelerating innovation** and supporting industry linkages.

The national and international policy-making community can play a key role in catalysing the four key processes linked to INRID. The first process refers to the importance of **learning and competence building in natural resource** producers to participate in interactive learning and to take advantage of new opportunities. The second process concerns the **development of locally based and knowledge intensive industries**, which are suppliers and users to the natural resource industries which are generally multi-national corporations. The third key process relates to **different types of interactions between natural resource industries and other parts of the economy** (spill overs of natural resource industries and diversification). The fourth key process refers to **social inclusion and environmental protection connected to learning and innovation** in a long-term sustainable development path.

### Further reading

Andersen, A. D., et al. (2015). *Natural resources, Innovation and Development. Globalics Thematic Review*. Aalborg, Aalborg University Press.

Andersen, A. D. and O. Wicken (2016). Natural resource knowledge idiosyncrasy, innovation, industry dynamics, and sustainability. Working Papers on Innovation Studies, Centre for Technology, Innovation and Culture, University of Oslo. <https://ideas.repec.org/p/tik/inowpp/20161107.html>

Marin, A., et al. (2015). “Natural Resource Industries as a Platform for the Development of Knowledge Intensive Industries.” *Tijdschrift voor Economische en Sociale Geografie* 106: 154-168.

Morris, M., et al. (2012). One Thing Leads To Another: Promoting Industrialisation by Making the Most of the Commodity Boom in Sub-Saharan Africa, Open access.

**Policy recommendations on innovation based natural resource intensive development**

**Work towards a detailed mapping of the natural resource base, the current state of knowledge and technology in a country; and focus on local specificities.**

‘Natural resources’ is a quite diverse category, ranging from oil to fishery and from agriculture to mining. It is therefore necessary to map what nature offers in terms of existing and potential resources in the country, and to assess the technological capacity to exploit these potential resources, as well as the broader costs and benefits for society as a whole of doing so.

**Invest in supporting the development of backward, forward and lateral linkages between value chain actors in the natural resources sectors and with other sectors and innovation actors.**

Review how foreign and domestic firms engaged in natural resource extraction can be stimulated to create more backwards and forward linkages by focusing on local sourcing, ownership and R&D activities. Furthermore, investment in domestic knowledge and skills through education and research is a key strategy for supporting lateral linkage development, but governments and donors can also directly target value chain actors (particularly suppliers) to transfer their natural resource products and skills to other sectors.

**Focus on developing high-quality institutions in order to prosper in a competitive world linked through global value chains**

High quality institutions are needed to position a country in a global value chains and to deal with ‘lead firms’. High-quality institutions are also needed to support a strong innovation system that can support lateral knowledge migration between sectors and thereby achieve a more diversified economy building on local strengths.

**Ensure social and environmental objectives and priorities are embedded into the innovation based natural resource intensive development policies and support instruments**

Promote both democratic control and the development of long term plans aiming at making the economy more diverse, inclusive (job creation is a key factor in this context) and more sustainable (low carbon solutions in the context of transport, energy and urbanisation are key factors).

**Credits**

The Globelics Policy Briefing is an introduction to policy makers on important research findings made by the Globelics community and analysed in The Globelics Thematic Review Series. The series is edited by the Globelics Secretariat and available as open access e-books on [www.globelics.org](http://www.globelics.org). Printed version can be requested in limited numbers by contacting the Globelics Secretariat.

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