Policy Brief

DPRU Policy Brief: **DSI-NRF CoP/4**
October 2019

Developing Capabilities to Build the Complexity of the Fibrous Plant Economy in South Africa

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Summary

With over 6000 abandoned mines and the associated economic vacuum in these mining localities, South Africa has a post-mine economic development problem. Mining land remediation can act as an industrial catalyst through the cultivation of fibrous plants on this land and the processing of these plants to manufacture a diversity of fibrous plant products.

Using the tools of economic complexity and product space network analytics, we identify a set of fibrous plant products that will, firstly, build economic complexity in South Africa and, secondly, be feasible given the country's current productive capabilities. Further, we identify constraints/capabilities that hinder/enable the development of these fibrous plant products, and hence inform micro-industrial policy interventions.

ISBN: 978-1-920633-68-4

Introduction

South Africa has seen more than 6000 mines abandoned over the past two decades, and more are set to close in the near future. The operation of a mine provides economic benefit to local economies and thus, without some sort of intervention, mine closure can have debilitating effects on these economies. One form of intervention, which serves the dual purpose of remediating degraded mine land and sustaining these local economies, is the cultivation of fibrous plants as feedstock for downstream industries. In order to determine which downstream industries should be targeted, we employ economic complexity and product space network analytics to develop micro-industrial policy that will drive inclusive economic growth.

This policy brief aims to provide context on South Africa's current fibrous plant economy, as well as the available avenues for diversification which exist to both support local communities post-mining, as well as develop South Africa's economy as a whole. It will conclude with selected policy insights for realising these diversification paths, which are informed by engagement with current industry and firm stakeholders.

What Is Economic Complexity?

The theory of economic complexity explains economic development by focussing on product-level, rather than aggregate, analysis. It suggests that by analysing a country's current productive structure, one is able to determine a country's current productive capabilities, as well as feasible future development paths. The notion of economic complexity hinges crucially on the interplay between two important questions:

1. **How many different products does a country produce?**
2. **How many countries produce a particular product?**

The interplay between these questions provides insight into the overall level of economic complexity of a country, which is summarised by the Economic Complexity Index (ECI). More complex countries will be those that produce a greater diversity of specialised products – i.e. where these products are not produced by many other countries. Countries with low complexity will be those that produce a few relatively common products. Analogously, products that are highly complex are those that require specialised productive capabilities only available to a small number of countries, while less complex products are those that are produced using relatively unadvanced and commonly accessible technologies.

Why Is Economic Complexity Important?

There is a strong positive relationship between economic complexity and economic development: if a country can increase economic complexity, it will very likely lead to increased economic development. The process of increasing economic complexity relies on carefully choosing industries to target with product-level policy interventions. However, which industries to choose in this targeting exercise falls foul of the chicken-and-egg problem: how can you encourage an industry to invest in new production processes for a product that does not necessarily have an established

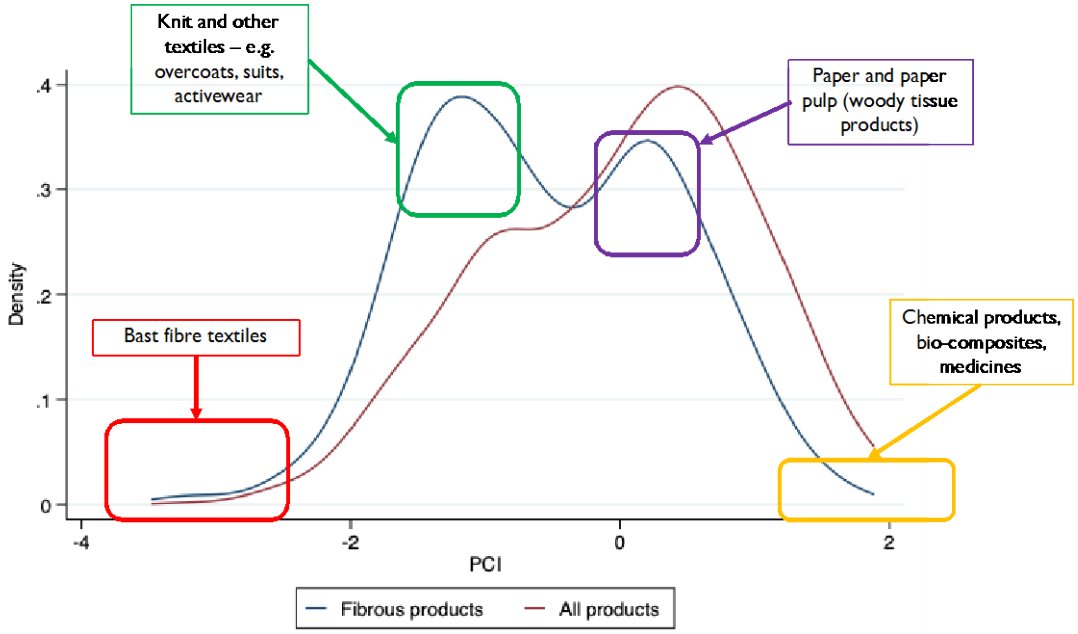
market in the country? At the same time though, how do you establish a market without a manufacturer of the product?

In order to overcome these hurdles while still growing economic complexity, targeted products should be more complex than the country's current product mix, while utilising as many of the existing productive capabilities as possible. For example, a country producing T-shirts may opt to increase complexity by diversifying into blouses before they choose to diversify into jet engines.

Fibrous Products and Economic Complexity

Before identifying which fibrous products South Africa should target to grow economic complexity, it is important to identify and understand fibrous products through a complexity lens. Figure 1 summarises the distribution of fibrous product complexity relative to the complexity of all products. Fibrous products show a bimodal distribution, with low-complexity products such as bast fibre textiles and woven textiles populating the lower end of the spectrum, while high-complexity products such as biocomposites, chemical products and pulp occupy the top end of the distribution. In the case of South Africa, which has an ECI of approximately 0.16, it is clear that the focus should be on identifying products in the latter categorisation for expansion possibilities.

Figure 1: Complexity of Fibrous and Non-Fibrous Products, 2016



Source: Authors' calculations from CID (2019)

The Fibrous Product Space

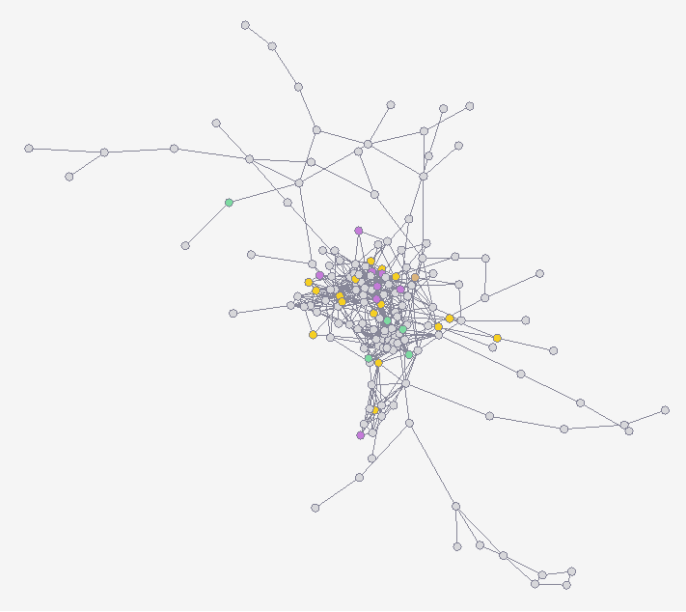
The fibrous product space is a network that provides a visual representation of the relationships and synergies between various fibrous products. More related products are clustered more closely together. Figure 2 shows South Africa's fibrous product space, where coloured nodes show the products which South Africa currently produces competitively. Given that these nodes are located

in the densely-populated area of the product space, it indicates that South Africa is already well-positioned to diversify its fibrous plant economy. Coupled with the fact that South Africa currently exhibits a fibrous complexity gap, indicating that there may be capabilities available in the economy to develop the fibrous economy, this shows that the establishment of a fibrous post-mining economy is a realistic development goal.

Selected fibrous products, South Africa:

- Seed oils and margarines
- Wood charcoal
- Polishes, soaps and creams
- Paper and paper notebooks
- Footwear and hat shapes

Figure 2: South Africa's Fibrous Product Space



Note: Product groupings or clusters are represented by the following colours: Textiles & Furniture (light green); Vegetables, Foodstuffs & Wood (yellow); Stone & Glass (light brown); Chemicals & Plastics (light purple)

Fibrous Frontier Products

Products which provide diversification opportunities consistent with encouraging economic development are termed frontier products. By determining these frontier products for South Africa and cross-referencing them with the list of fibrous plant products, we identified a list of 50 fibrous frontier products that present potential avenues for diversification. These fibrous frontier products included, among others, paper and pulp products; bioethanol; nonwoven and technical use textiles; and motor vehicle parts. Through the use of semi-structured firm and industry expert interviews, we then narrowed down which products were most viable in the South African context, as well as what policy interventions would be required in order to realise these downstream fibrous diversification

Frontier product characteristics:

1. Not currently exported competitively
2. More complex than current product mix
3. Similar enough to current productive structure to make move feasible
4. Provide future opportunities for diversification into more complex products

opportunities. A summary of the policy issues and their relative priority in each industry is presented in Table 1.

Key points to note are the relatively high barriers to entering the bioethanol and paper and pulp industries, while motor vehicle parts and bamboo flooring seem to offer relatively little in the way of policy-related obstacles. These two industries, being easily accessible, provide South Africa with a two-pronged approach to growing economic complexity through fibrous products: firstly, a more immediate low-complexity approach through bamboo flooring products, and secondly, a more long-term high-complexity approach through nonwoven textiles and biocomposite-based motor vehicle parts.

It should also be noted that there are links between certain of the fibrous frontier products, which may speak to an integrated value chain approach to developing the South African fibrous economy. Nonwoven textiles act as an intermediate input into motor vehicle parts, and as such present an opportunity to boost economic complexity along an entire product value chain.

Table 1: Policy Intervention Priority Rankings for Fibrous Frontier Product Communities

	Bioethanol	Paper & pulp products	Textiles		Wood products		Motor vehicle parts
			Non-woven	Technical use	Fibre & particle boards	Carpentry (flooring)	
Input costs (e.g. transport, safety, storage, water)							
Continuity of supply & scale							
High capital outlay							
Transferability of machinery							
Skills constraints							
Water permits & scarcity							
Research & Development							
Macroeconomic constraints (e.g. exchange rate, demand)							
Fibre not suited to the application							
Certification							
Policy constraints							

Key: Red – High Priority; Orange – Medium Priority; Yellow – Low Priority; Green – No Intervention Needed.

Selected Constraints and Related Policy Suggestions

Continuity of supply

Problem: In order to build downstream industries, one needs a consistent and reliable supply of fibrous feedstock of the correct quality. Due to the seasonal nature of fibrous plants, this requires the establishment of upstream supply at scales sufficient to meet downstream demand.

Policy suggestions:

- Government support for cultivation of fibrous feedstock at sufficient scale through financial support to produce storage facilities.
- R&D on farming best-practice in the form of how-to manuals for farmers, rural development workshops to teach farming skills, etc.

Input costs

Problem: Transport, storage and safety all increase input costs due to fibrous feedstock being low in bulk density and dried feedstock posing a fire hazard when stored in large quantities.

Policy suggestions:

- Set up processing plants in close proximity to cultivation sites to decrease transport costs.
- Provide support for a common storage warehouse supplied by farming cooperatives. Make sure this is carefully monitored to ensure that storage of this feedstock is done safely.

Capital outlay

Problem: Buying of new machinery or equipment for processing fibrous plants is costly for the majority of identified industries.

Policy suggestions:

- Encourage participation in existing DTI-driven incentive schemes (e.g. CTCP for textile firms which subsidises upgrading of machinery). If no subsidy exists, consider creating one to support fledgling industries.

Certification

Problem: Capacity constraints at certification authorities stifle product innovation and hamper economic development.

Policy suggestions:

- Improve capacity of the South African standards authorities so as to allow for testing and certification, and thus facilitate product innovation.

Conclusion

Abandonment of mines has created an economic vacuum in parts of South Africa which poses significant socio-economic problems in these mining localities. This policy brief has outlined a method through which the cultivation and processing of fibrous plants can both rehabilitate degraded mine land, as well as develop strong downstream fibrous industries. South Africa is currently experiencing a fibrous complexity gap, which indicates that there may be capabilities available in the economy to develop downstream fibrous industries.

The various fibrous frontier products that were identified as potential diversification opportunities to develop the fibrous plant economy and build economic complexity were interrogated more carefully to determine whether they were economically feasible. The results of this investigation provided a two-pronged approach to growing the fibrous economy: a low-complexity approach through bamboo flooring, and a high-complexity approach through nonwoven textiles and bio-composite panels for motor vehicles. Certain challenges exist in initiating these industries, such as continuity of supply and high input costs. However, these can be overcome with effective and well-targeted micro-industrial policy.

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