

Building Economic Complexity in the South African Fibrous Plant Economy

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Economic Opportunities Post-Mining: A Contextual Overview

- There are currently over 6000 abandoned mines in SA and more set to close in the future
 - Socio-economic: economic collapse as the key employer closes down, resulting in significantly deleterious poverty and inequality outcomes in 'mining towns'.
- One way to rehabilitate this land is through fibrous plants.
 - Positives through land remediation and generation of unskilled, labour-intensive employment.
- The question arises: Can growing fibrous crops on mine lands act as an industrial catalyst for downstream industry?
 - ...and mitigate socio-economic outcomes?

Research Aim and Questions

The aim of this research is to:

- Determine South Africa's potential to diversify into fibrous downstream activities that stem from fibrous plant production on degraded mining land.
- Apply economic complexity and product space network analytics to:
 - Examine the economic complexity of the South African fibrous plant economy
 - Identify potential fibrous diversification opportunities that would build economic complexity
 - Identify capabilities/constraints that enable/hinder the development of these fibrous diversification opportunities

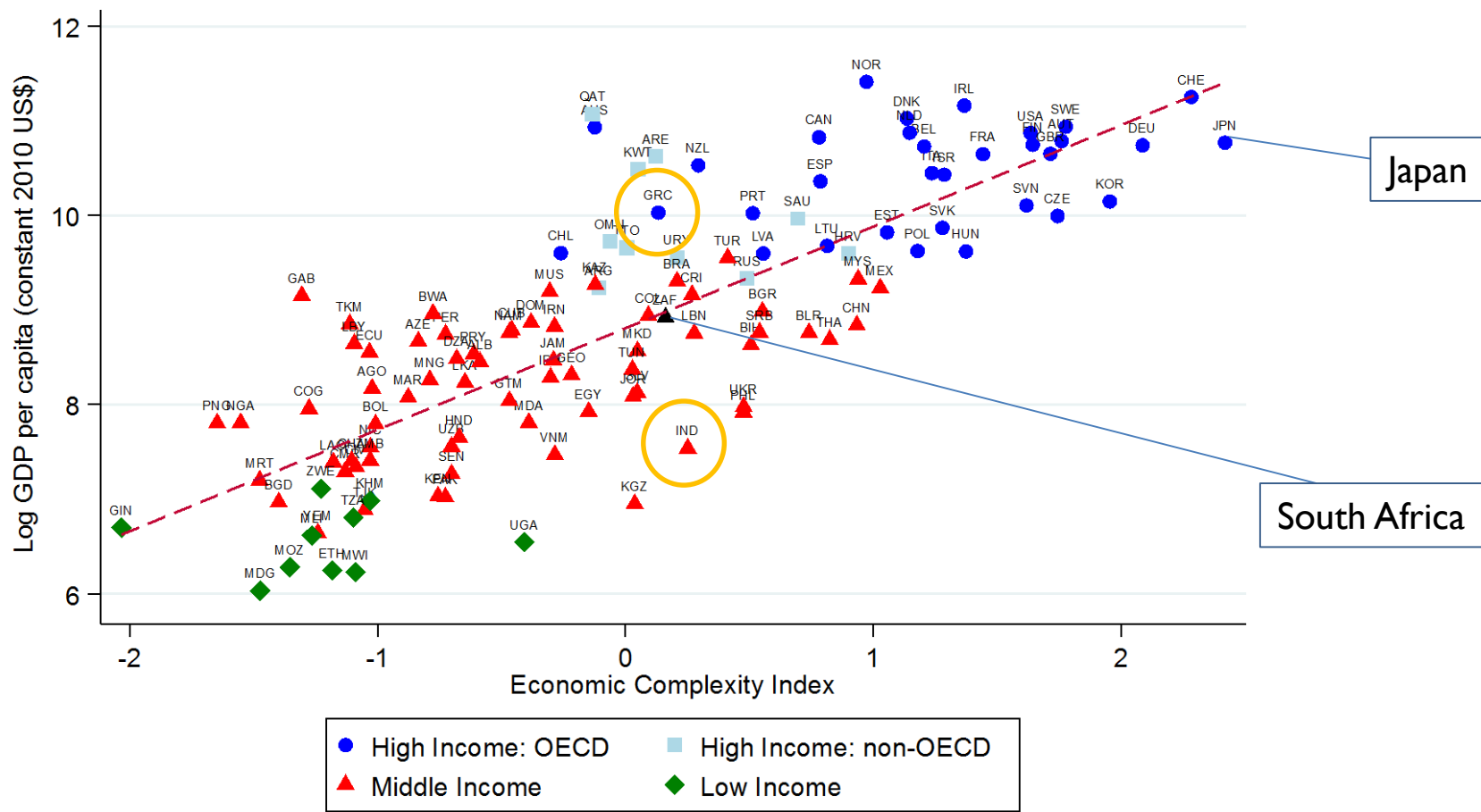
1. Economic Complexity: A Background

Measuring Economic Complexity

- Economic complexity is a **measure of productive knowhow or capabilities** in a country.
- Two important concepts:
 - **Diversity**: how diverse is the export portfolio of the country?
 - **Ubiquity**: how commonly produced is a particular product?
- Notion of economic complexity combines these concepts:
 - More complex country = higher diversity of less ubiquitous products
 - Less complex country = lower diversity of more ubiquitous products
- Important indices to measure complexity:
 - **ECI** measures economic complexity of a country
 - **PCI** measures economic complexity of a product

Building Economic Complexity: Higher levels of complexity → higher levels of economic development

Economic Complexity (ECI) and the Log of GDP per capita by analytical group, 2016



Source: Own calculations using trade data from BACI data (HS 6-digit revision 1992) and GDP per capita data from the World Development Indicators.

Notes: The sample of countries is reduced to those for which we estimate complexity measures.

How to build complexity?

Growing complexity requires accumulating new capabilities for more complex products

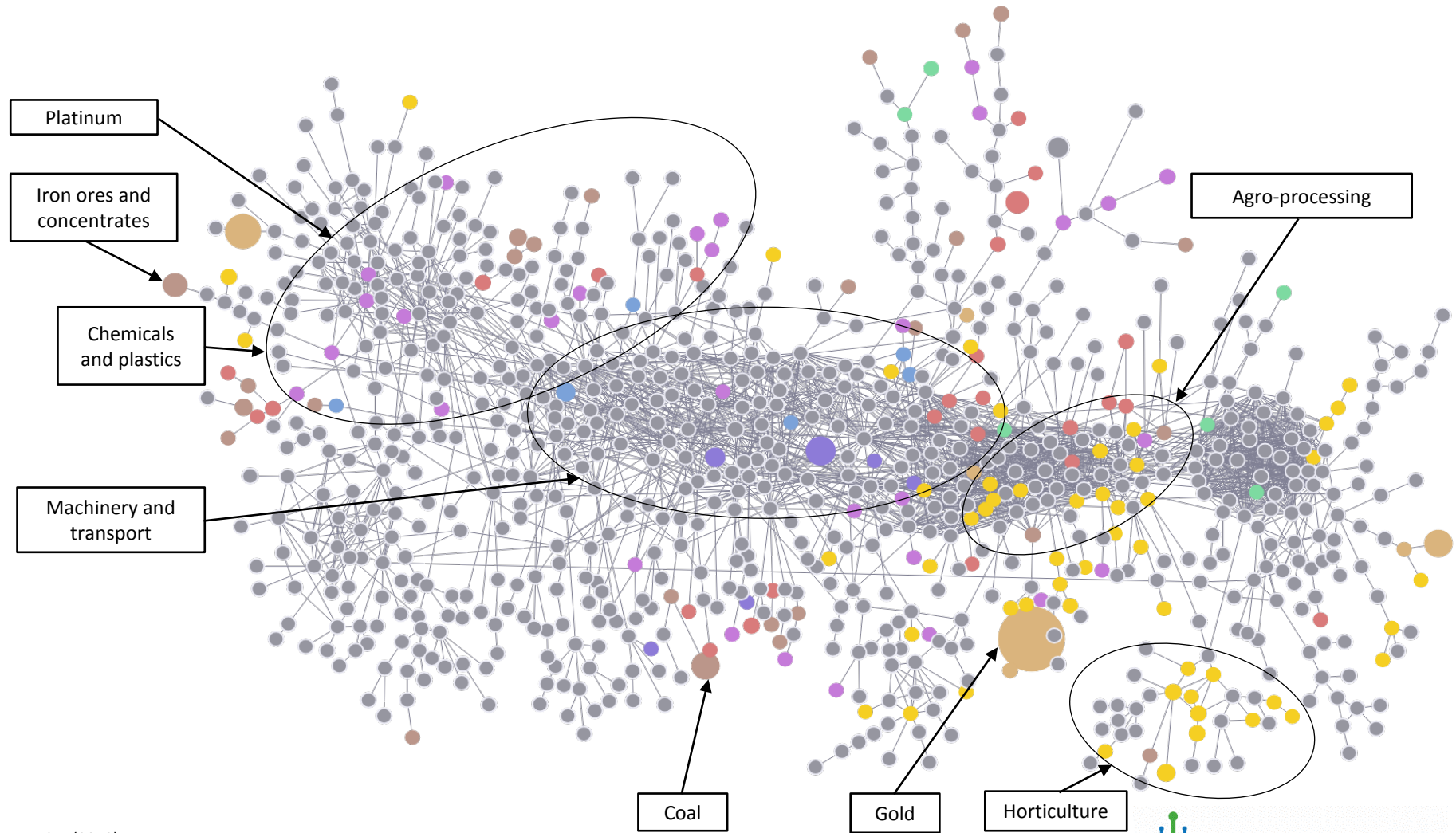
BUT the accumulation of capabilities is complicated by a **chicken and egg problem**:

- You can't produce products that require capabilities that you do not have.
- **BUT** there is no incentive to accumulate capabilities if the industries that demand them do not exist.

So, countries should diversify to closely-related products that use similar capabilities: e.g. from shirts to blouses, not shirts to engines.

South Africa's Product Space, 2015

Peripheral and resource-based



Source: CID (2018)

Notes: Product groupings or clusters are represented by the following colours: Textiles & Furniture (light green); Vegetables, Foodstuffs & Wood (yellow); Stone & Glass (light brown); Minerals (dark brown); Metals (red); Chemicals & Plastics (light purple); Transport Vehicles (dark purple); Machinery (blue); Electronics (turquoise); Other (dark blue).

2. Applying Complexity to Fibrous Products

Identifying Fibrous Products

To begin:

- Identify which products can be created using fibrous inputs (informed heavily by Broadhurst, Chimbanga & Hangone (2019))

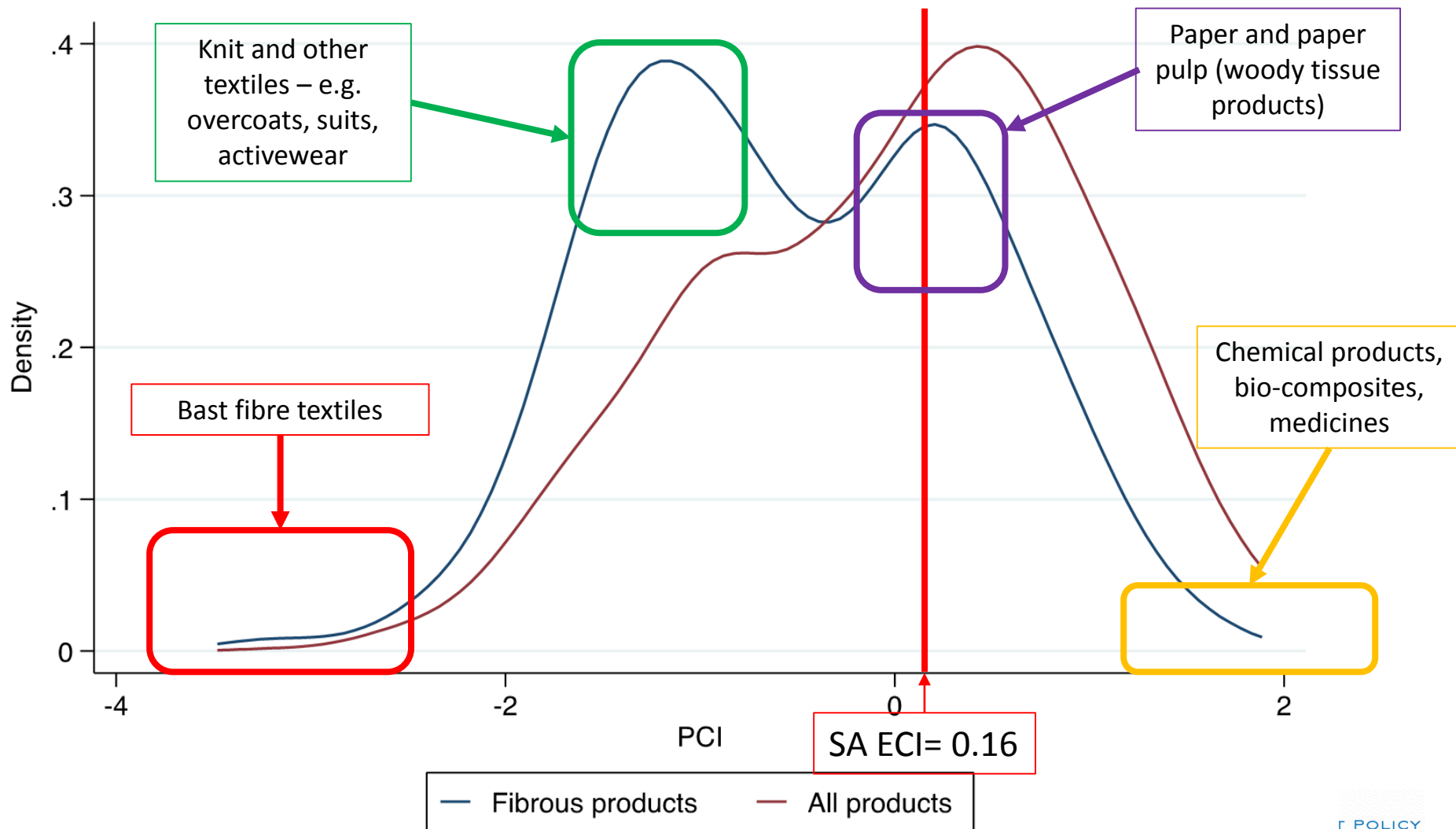
Mapping into the trade data:

- Refer to list of fibrous products developed above
- Map each of these products to the relevant HS04 code
- Manual mapping of products resulted in 175 fibrous products in total

Caveat: Although products identified could be produced using these fibrous plants, there is no way of knowing the share of or viability of production – e.g. bicycles.

How Do Fibrous Products Compare?

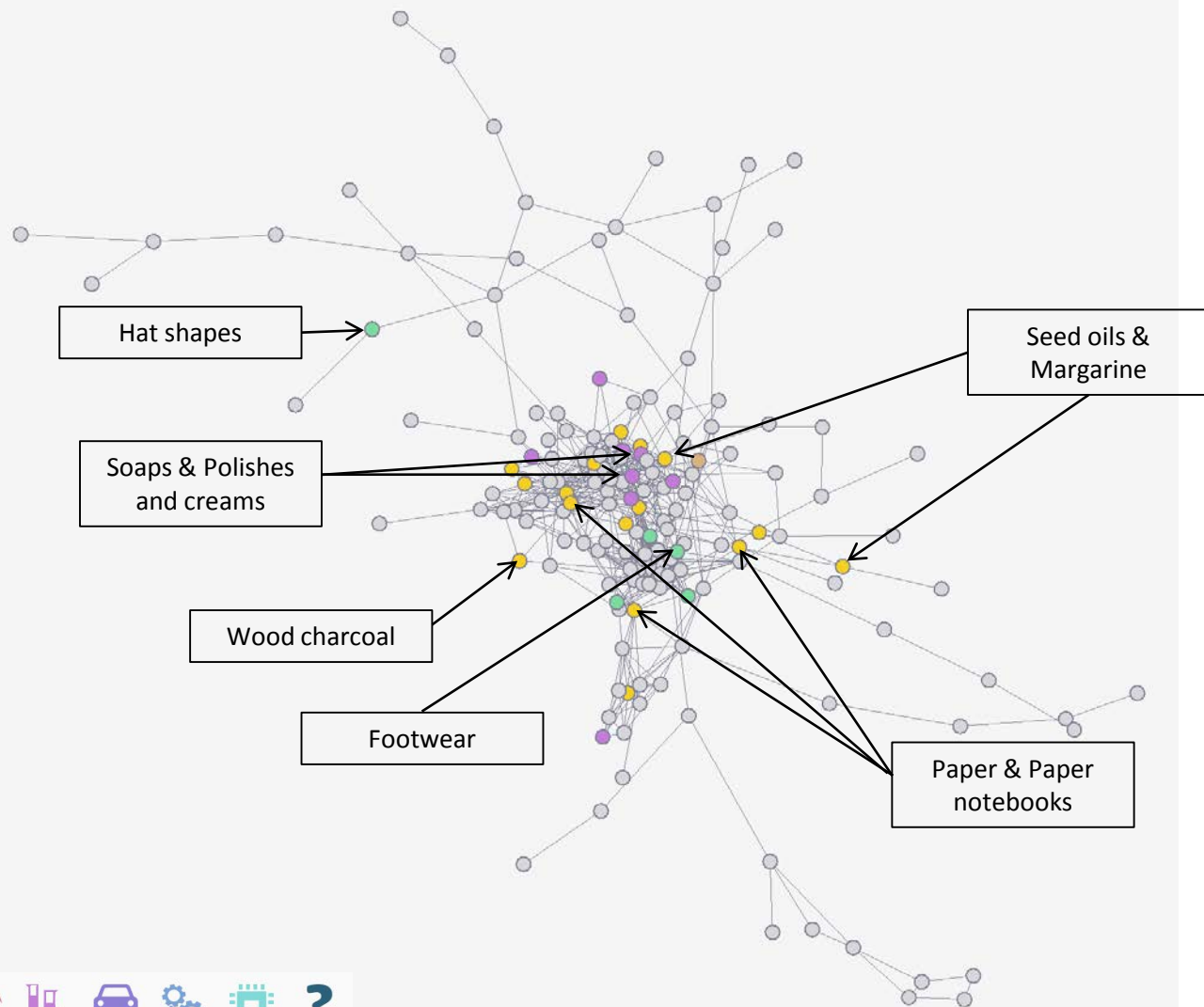
Bi-modal distribution – two-part development path



South Africa's Current Fibrous Product Space

SA well positioned to diversify into complex fibrous products

- South Africa's current Fibrous Product Space is relatively central
 - Good for diversification opportunities in future
- A mix of a number of different product communities:
 - Textiles
 - Chemicals
 - Agricultural



Creating a Fibrous Complexity Index (FCI)

To understand the fibrous market globally and a country's relative position in the global market, we create a Fibrous Complexity Index (FCI).

Rank	FCI	Country
1	2.242	Portugal
2	2.144	Italy
3	2.083	Poland
4	2.081	Spain
5	2.066	China

⋮ ← 70 -0.401 South Africa

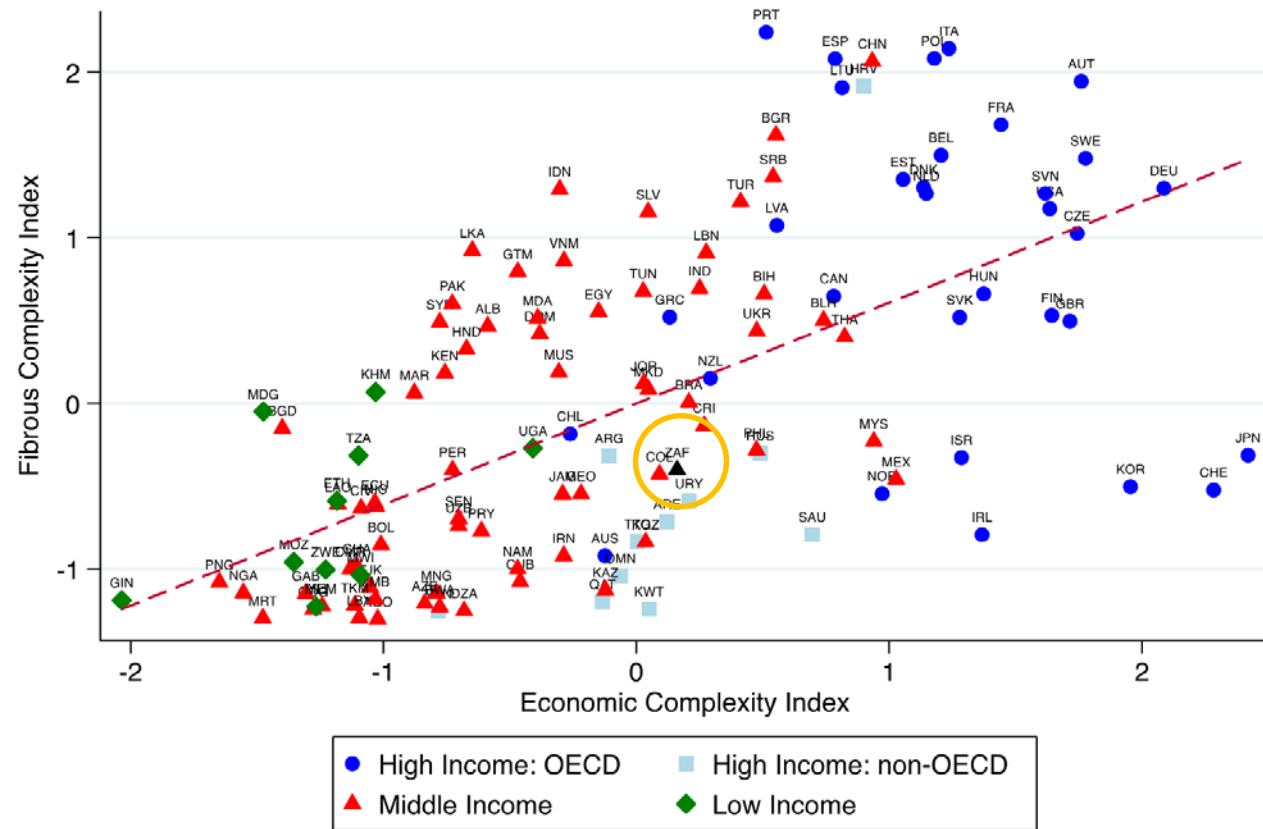
FCI is essentially a weighted average of the complexity of all fibrous products exported in a country

119	-1.230	Guinea
120	-1.233	Congo
121	-1.245	Yemen
122	-1.256	Mauritania
123	-1.272	Angola

The Fibrous Complexity Gap

Build complexity by growing fibrous plant economy

- FCI and ECI are positively correlated:
 - Growing FCI will lead to growing ECI which leads to increased development in LR
- SA is below the regression line
 - Low FCI for our level of ECI
 - Means there is potential to grow the fibrous economy



Source: Own calculations from Atlas of Economic Complexity (2019)
Note: Correlation=0.610, p-value=0.000. Red dashed line is line of best fit



3. Fibrous Futures: Frontier Products

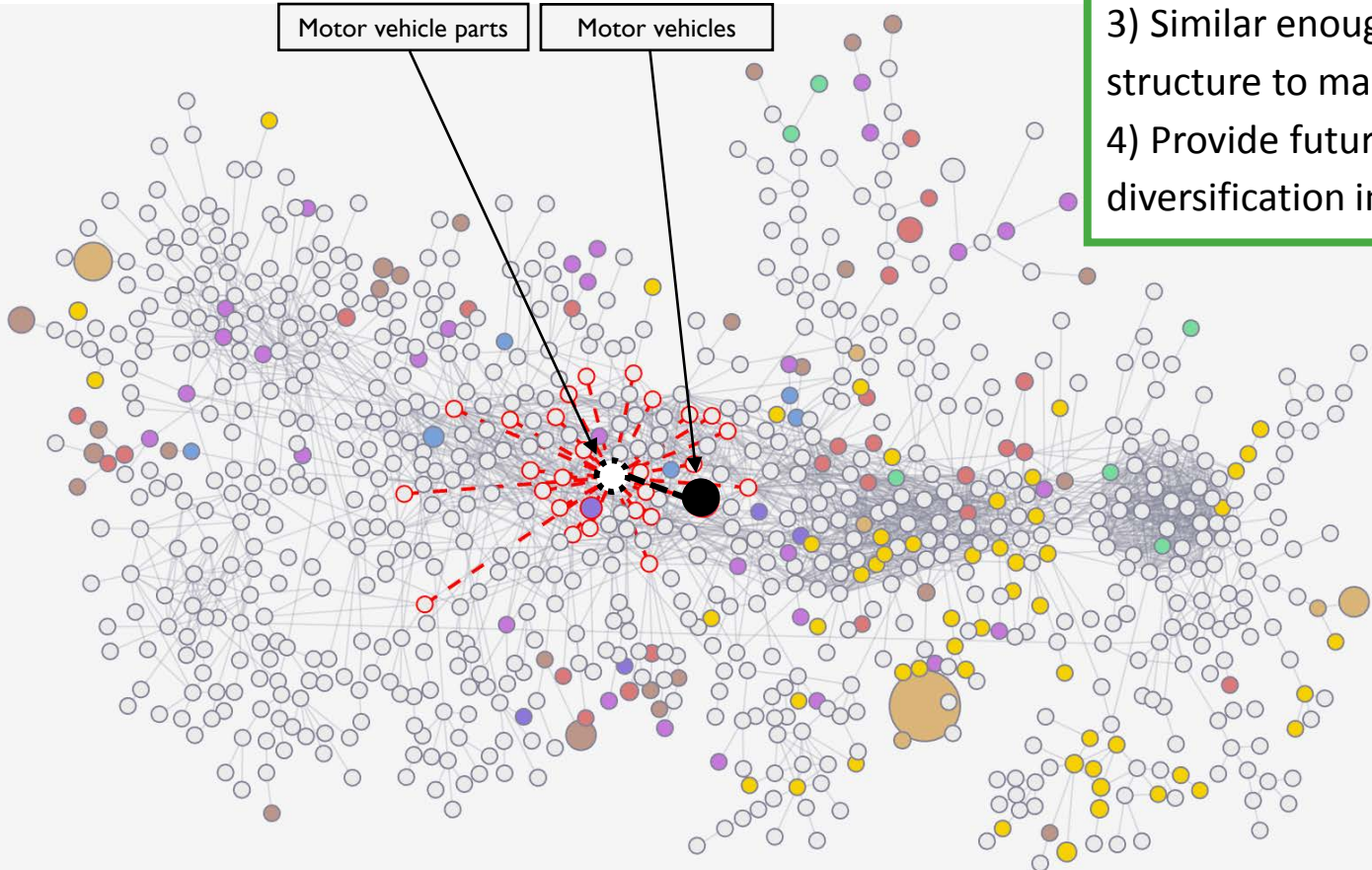


Identifying Frontier Products: An Example

Frontier product criteria:

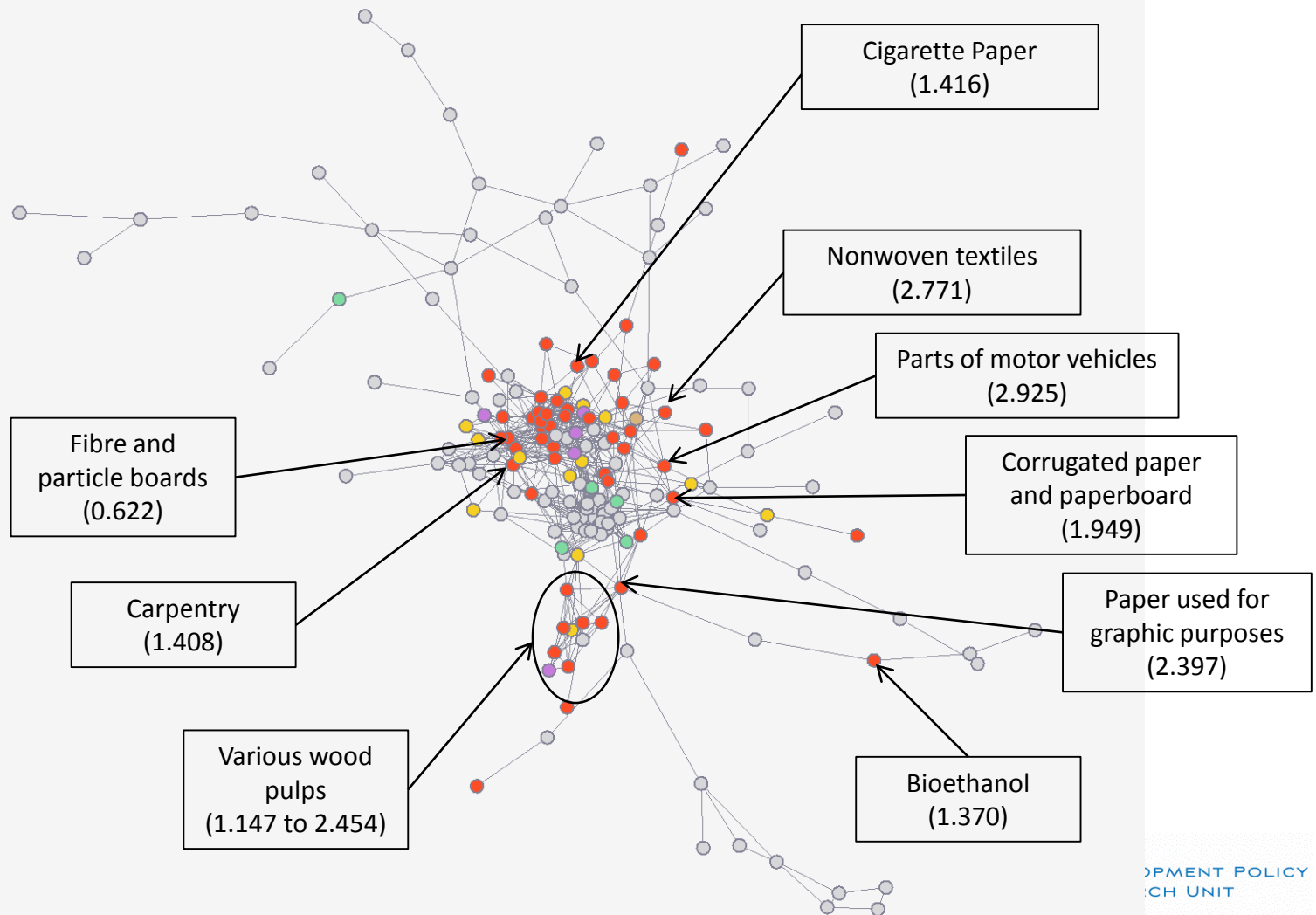
- 1) Not currently exported competitively
- 2) More complex than current product mix
- 3) Similar enough to current productive structure to make move feasible
- 4) Provide future opportunities for diversification into more complex products

These criteria can change based on policy goals – e.g. labour intensity



Fibrous Frontier Products

Shifting to complex and connected products in the core





4. Constraints & Policy Recommendations



Factors Constraining Fibrous Plant Cultivation

Constraint	Bamboo	Kenaf	Hemp
Regulatory			Illegal to cultivate hemp for commercial purposes.
Environmental	Environmental factors, including preferred soil type, preferred annual rainfall, temperature tolerance, and pH tolerance.		
Land type	Land use for cultivation of industrial crops should not compete with land use for food. Use of degraded mine land may impact on crop yields.		
Access to water	DAFF is not issuing water permits for industrial crop cultivation.		
R&D	Lack of productive capabilities or knowhow in fibrous plant cultivation necessitates further R&D into cultivation methods and practices.		
Scale and logistics	Scale of cultivation constrains the potential downstream applications of fibrous plants.		

Constraints by Fibrous Frontier Product

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

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

Suggested Policy Interventions

Constraint	Suggested Policy
Continuity of supply <ul style="list-style-type: none">- Quality of fibre- Scale of production	Develop cultivation capabilities through investment in R&D. Determine best farming practices, provision of training, crop specific farming manuals
High input costs <ul style="list-style-type: none">- Transport- Storage	Establish processing plants in close proximity to cultivation sites. Provision of cooperative warehouses to store feedstock.
High capital outlay & transferability of machinery	Encourage participation in existing DTI incentive schemes – e.g. CTCP – or devise new incentive scheme to drive investment
Standards authority	Enhance institutional capacity of standards authority
Shortage of technical skills	Invest in TVET colleges, or similar training institutions.

Conclusion

- Cultivation of fibrous crops on degraded mine land can serve a dual purpose of remediation and developing industry.
- South Africa has a fibrous complexity gap.
 - This means there is opportunity to develop the fibrous economy.
 - ...and is well positioned in fibrous product space
- Two pronged approach to developing downstream industry in South Africa:
 - **Low-complexity:** Bamboo flooring
 - **High-complexity:** Nonwoven textiles and motor vehicle parts
- Employment potential in both roads – one labour-intensive; one creates jobs along an integrated value chain
- Policy interventions to focus on continuity of supply; lowering input costs; diversity of production lines; and rural skills development of highest importance
- Flexibility of methodological approach – can be applied to other sectors

Thank You