Developing new innovation indicators to inform new policy mixes in African countries

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Africalics Thematic Chair | Webinar | 23 March 2023
Overview

The big picture: what new kinds of STI indicators should we be working on in the future in Africa?

How can indicators be of greater policy value: start by classifying modes of innovation capabilities at firm level

Experimenting with one approach: how to categorise firms’ innovation capabilities

What kinds of policy insights do the evidence point to?
A challenge-led STI policy mix in African contexts

What new and different kinds of indicators should we be working on?
New methodological approaches to create contextually grounded, appropriate evidence

Strategic efforts directed towards innovation performance, capabilities, competences and ecosystems

- Innovation ecosystems
- Innovation manage
- Knowledge exchange
- Access to finance
- Human capacity dev

NEW METHODOLOGY
- Surveys adapting Frascati / Oslo to understand rate and nature of innovation in Health, Green economy
- Multiple comparative case studies
- Institutional dynamics
- Innovation capabilities
- Networks and knowledge flows

NEW DIMENSIONS
- Macro-level socio-political constraints
- Sub-sectoral and spatial analysis
- Technological capabilities/upgrading
- Institutional dynamics
- Innovation capabilities
- Networks and knowledge flows

NEW METRICES
- Indicator frameworks
- Mapping RDI alignment to Innov Agenda
- Typologies of sectoral, spatial, socio-technical ecosystems
- Profiles and modes of innovation
- Maturity Indices
- Design of contextualised knowledge modes and mapping knowledge flows

Global innovation and production value chains

Public Health
Green Transition
Innovation & Tech
Capacities for Science
A process to design new indicators as evidence for challenge led policy mix in African contexts

1. Innovation policy mix to address innovation problems

2. Select focal development priority / innovation problem: **Firm technological upgrading**

3. Conceptualise components of the system / value chain, and identify main innovation actors

4. Analyse specific policy intents

5. Identify and assess available datasets in terms of dimensions covered, and ease of accessibility

6. Design innovation indicators oriented to policy intent: **Modes and patterns**
   - Modes and patterns
   - Linkages
   - Capabilities
   - Systems
   - Economic and social outcomes

7. A pragmatic model and reflective experimentation approach: next steps

Country Innovation Agenda
SDGs
STISA
How can BIS data be of greater value to the policy maker?

Analysing modes of innovation at firm level
From binary to multi-dimensional taxonomies

**Binary**

- Product/process
- Non/technological
- Radical/incremental
- STI/DUI

=> High-level benchmarking over time
=> Country comparison

**Multi-dimensional**

- More fine-grained distinctions
- Profiles of firms
- Contextually specific

=> Evidence for policy learning: fit of instruments, emergent trends, gaps, spaces for leverage
=> Targeted policy interventions
=> Track change over time

Source:
Taxonomical principles to define modes in one or more of three ways (Peneder 2003):

- ‘Cut-off’ approach using a single data driven variable
- Data driven taxonomies using a range of dimensions - groups identified by using factor analysis, PCA or LCA, to allow data to ‘speak for itself’
- Top-down mixed classifications using multiple variables - firms assigned to a number of predefined groups, based on a combination of factors (Arundel and OBrien 2009, Hollanders and Arundel)
How to identify modes of innovation using Oslo BIS datasets

Defining top-down output modes of innovation
Initial analysis: Modes of innovation in South Africa

n=14,742

New to market international innovators: 40%
New to market domestic innovators: 34%
International modifiers: 28%
Domestic modifiers: 19%
Adopters: 10%
### Five mutually exclusive output modes for product innovators

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>New to market international innovators</td>
<td>International</td>
<td>New to international markets</td>
<td>Developed in-house</td>
</tr>
<tr>
<td>New to market domestic innovators</td>
<td>Domestic</td>
<td>New to domestic markets</td>
<td>Developed in-house</td>
</tr>
<tr>
<td>International modifiers</td>
<td>International</td>
<td>New to domestic markets or new to the firm</td>
<td>Developed in-house</td>
</tr>
<tr>
<td>Domestic modifiers</td>
<td>Domestic</td>
<td>New to the firm</td>
<td>Developed in-house</td>
</tr>
<tr>
<td>Adopters</td>
<td>N/A</td>
<td>N/A</td>
<td>Developed outside of firm</td>
</tr>
</tbody>
</table>

Source:
Q1.5: In which geographic markets did your enterprise sell goods or services during the three years 2014 to 2016?

- **International**
  1.5c (Rest of Africa) = Yes
  OR
  1.5d (Europe) = Yes
  OR
  1.5e (United States) = Yes
  OR
  1.5f (Asia) = Yes
  OR
  1.5g (Other Countries) = Yes

- **Domestic**
  1.5c (Rest of Africa) = No
  AND
  1.5d (Europe) = No
  AND
  1.5e (United States) = No
  AND
  1.5f (Asia) = No
  AND
  1.5g (Other Countries) = No

Logic for defining modes:
1. Market Reach
Q2.4: Were any of your product innovations during the three years 2014 to 2016...:

- **New to international markets** 2.4a (New to the world?) = Yes
- **New to domestic markets** 2.4a (New to the world?) = No

AND

2.4b (A first in South Africa but not the world?) = Yes

OR

2.4c (A first in your industry within South Africa but not new to South Africa or to the world?) = Yes

OR

2.3a (New to your market?) = Yes

- **New to firm**

2.4a (New to the world?) = No; AND

2.4b (A first in South Africa but not the world?) = No; AND

2.4c (A first in your industry within South Africa but not new to South Africa or to the world?) = No; AND

2.3a (New to your market?) = No; AND

2.3b (Only new to your firm?) = Yes
Q2.2: By whom were these product (goods and services) innovations developed?

- **In-house developers:**
  2.2 = Mainly your enterprise
  OR
  2.2 = Your enterprise together with other enterprises or institutions
  OR
  2.2 = Your enterprise by adapting or modifying goods or services originally developed by other enterprises or institutions

- **Adopters:**
  2.2 = Other enterprises in your enterprise group
  OR
  2.2 = Mainly other enterprises or institutions
Interpreting innovation capabilities to inform a new STI policy mix

The case of South Africa
Modes of innovation in South Africa: but firm profiles?

n=14,742

New to market international innovators
40%

New to market domestic innovators

Adopters
28%

Domestic modifiers

International modifiers
34%

10%
7%
19%
0%
13%

Source:
Identifying spaces for targeted intervention: sectoral distributions

n=14,622

Source:
Profiling advanced technology usage reveals gaps and emergent trends

Source:

n=14,622

New to market international innovators

New to market domestic innovators

International modifiers

Domestic modifiers

Adopters

None | 1-3 | 4-6 | 7-9

1% | 6% | 2% | 90%

1% | 5% | 0% | 57%

13% | 24% | 59%

5% | 38% | 0% | 6%

34% | 2% | 1% | 24%

75% | 1% | 0%
Analysing barriers points to the need for policy alignment

Importance of factor impeding innovation activities:
0=Not experienced; Low=1; Medium=2; High=3
n=14,622

<table>
<thead>
<tr>
<th>Average importance of factors</th>
<th>New to market international innovators</th>
<th>New to market domestic innovators</th>
<th>International modifiers</th>
<th>Domestic modifiers</th>
<th>Adopters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Factors</td>
<td>1.2</td>
<td>1.1</td>
<td>1.4</td>
<td>0.7</td>
<td>2.0</td>
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<tr>
<td>Knowledge factors</td>
<td>0.7</td>
<td>0.7</td>
<td>1.0</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Market factors</td>
<td>1.3</td>
<td>1.3</td>
<td>1.7</td>
<td>1.3</td>
<td>1.8</td>
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<tr>
<td>Institutional Factors</td>
<td>0.6</td>
<td>0.6</td>
<td>1.1</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Source: [References]
<table>
<thead>
<tr>
<th>Policy priority to inform mix of strategies and interventions</th>
<th>Mode of innovation capabilities</th>
<th>Technology intensity</th>
<th>Sectoral spread</th>
<th>Firm size class</th>
<th>Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broaden capabilities of more firms to access and absorb new technologies</td>
<td><strong>Adopters</strong></td>
<td>Low</td>
<td>Similar proportion of manufacturing and services</td>
<td>Spread over micro, medium and small size firms</td>
<td>Cost and market barriers more strongly important Knowledge and institutional factors less important</td>
</tr>
<tr>
<td>Build stronger capabilities for technology modification and upgrading to operate on global or domestic markets</td>
<td><strong>International modifiers</strong></td>
<td>Moderate</td>
<td>Similar proportion of manufacturing and services</td>
<td>Spread over small, medium, large and micro</td>
<td>Cost and market barriers important Knowledge and institutional factors more important</td>
</tr>
<tr>
<td></td>
<td><strong>Domestic modifiers</strong></td>
<td>Moderate</td>
<td>More services than manufacturing</td>
<td>More likely to be micro firms</td>
<td>Knowledge and institutional factors less important</td>
</tr>
<tr>
<td>Strengthen dynamic innovation capabilities of groups of firms that can operate on global or domestic markets</td>
<td><strong>New to market international innovators</strong></td>
<td>High</td>
<td>Similar proportion of manufacturing and services</td>
<td>More likely to be small firms</td>
<td>Cost and market barriers important</td>
</tr>
<tr>
<td></td>
<td><strong>New to market domestic innovators</strong></td>
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<td>More manufacturing than services</td>
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</tr>
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1. Build technological capabilities across the full range of firms, particularly those displaying no or minimal innovation capabilities.

2. Multi-dimensional indicators as evidence to inform selection of context appropriate STI policy interventions and track change over time, towards country’s desired policy goals

3. Supports shift from binary policy focus of past, based on policy models of high-income countries

=> SA evidence to support new STI policy intent: integrated sets of alignments on a “co-creation continuum” that mandates support to all types of research, development and innovation, through the elaboration of sector specific strategies that support line department strategies (DSI, 2022).
Next steps: Deepen understanding of modes of innovation capabilities in South/African countries

1. Data driven taxonomy using more up to date datasets in South Africa – modes from the ground up?
2. Top down / bottom up analysis of modes of agricultural innovation capabilities and innovation capabilities in informal enterprises
3. Experiment in partner countries
4. Build up an African indicator and evidence base