Lecture 2: GO-SPIN’s methodological approach to analyse SETI policies and policy instruments

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Evidence-based policies

- Tests theory - why will the policy be effective and likely impacts if successful?
- Separates the uncertainties and controls for other influences outside of the policy that may have an effect on the outcome
- Incorporate some measurement of the impact
- Examines both direct and indirect effects that occur because of the policy (unintended consequences)
- Empirical validation
Accountability for spending of public funds requires:

- Informed strategy and forecasting
- Indicator-based joined-up policy
- Coordination of plans and budgets
- Monitoring
- Measurement and evaluation of programmes and projects
- Benchmarking
- Learning
INDICATORS: R&D+i. governance. social. economic. industrial. educational. ICT. environmental. etc.

Political stability and National Contextual Factors

Implicit Policies

Explicit policies and policy instruments

* Texts of SETI policies
* SETI legal instruments
* SETI institutional ecosystems
* SETI operational policy instruments
Why we need political stability, government effectiveness and long-term public policies for sustainable development?
The "Sisyphus challenge" as a metaphor for the patterns of development observed within LDCs.

The gods condemned Sisyphus to eternally push a rock to the top of the mountain. whence the stone would fall back of its own weight. They had thought. with some reason. that there is no more dreadful punishment than this futile and hopeless labour.
1996-2013 around 170 countries
Approximately 2400 points
Government Effectiveness in the Implementation of Policies

Political Stability/Absence of Violence and Terrorism

25 scientific articles per million inhabitants

Source: Lemarchand (2021)
What about the national contextual factors?
### National contextual policies that implicitly affect the performance of SETI policies

<table>
<thead>
<tr>
<th>Institutional Factors</th>
<th>United States</th>
<th>Japan</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Founding conditions</strong></td>
<td>Diversity</td>
<td>Homogeneity</td>
<td>Early industrialization</td>
</tr>
<tr>
<td></td>
<td>Abundant resources</td>
<td></td>
<td>Financing through banks</td>
</tr>
<tr>
<td></td>
<td>Huge domestic market</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Puritanism</td>
<td>Confucianism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Market competition</td>
<td>Strong government</td>
<td></td>
</tr>
<tr>
<td><strong>Role of the government</strong></td>
<td>Encourage market competition</td>
<td>Encourage agreement</td>
<td>Encourage stability</td>
</tr>
<tr>
<td></td>
<td>Low industrial policy</td>
<td>High industrial policy</td>
<td>Direct industrial policy</td>
</tr>
<tr>
<td><strong>Legal system</strong></td>
<td>Common law</td>
<td>Civil law</td>
<td>Civil law</td>
</tr>
<tr>
<td></td>
<td>Transparent</td>
<td>Guiding</td>
<td>Transparent</td>
</tr>
<tr>
<td></td>
<td>Flexible</td>
<td>Flexible</td>
<td>Inflexible</td>
</tr>
<tr>
<td></td>
<td>Adversarial litigation</td>
<td>Conciliatory litigation</td>
<td></td>
</tr>
<tr>
<td><strong>Capital Market</strong></td>
<td>Market for control of ownership</td>
<td>Market for stability of ownership</td>
<td>Market for stability of ownership</td>
</tr>
<tr>
<td></td>
<td>Highly developed</td>
<td>Moderately developed</td>
<td>Moderately developed</td>
</tr>
<tr>
<td><strong>Education System</strong></td>
<td>Decentralized</td>
<td>Centralized</td>
<td>Centralized</td>
</tr>
<tr>
<td></td>
<td>Diverse</td>
<td>Homogeneous</td>
<td>Vocational system</td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td>Individualism</td>
<td>Collectivism</td>
<td>Moderate collectivism</td>
</tr>
<tr>
<td></td>
<td>Heterogeneous</td>
<td>Homogeneous</td>
<td>Homogeneous</td>
</tr>
<tr>
<td><strong>Governance system</strong></td>
<td>Strong institutional holdings</td>
<td>Cross holdings among firms</td>
<td>Bank holdings</td>
</tr>
<tr>
<td></td>
<td>Shareholder oriented</td>
<td>Stakeholder oriented</td>
<td>Stakeholder oriented</td>
</tr>
<tr>
<td></td>
<td>One-board system</td>
<td>One-board system</td>
<td>Dual-board system</td>
</tr>
<tr>
<td><strong>Strategic paradigm</strong></td>
<td>Short-term oriented</td>
<td>Long-term oriented</td>
<td>Long-term oriented</td>
</tr>
<tr>
<td></td>
<td>External growth</td>
<td>Incremental growth</td>
<td>Internal growth</td>
</tr>
<tr>
<td></td>
<td>High managerial autonomy</td>
<td>Low managerial autonomy</td>
<td>Moderate managerial autonomy</td>
</tr>
<tr>
<td><strong>Employment relationship</strong></td>
<td>Employment-at-will</td>
<td>Lifetime employment</td>
<td>Long-term employment</td>
</tr>
<tr>
<td></td>
<td>Non-participative</td>
<td>Participative</td>
<td>Participative</td>
</tr>
<tr>
<td></td>
<td>Performance and market-based</td>
<td>Seniority-based</td>
<td>Performance and seniority-based</td>
</tr>
<tr>
<td></td>
<td>Largest gap between top and bottom</td>
<td>Smallest gap between top and bottom</td>
<td>Moderate gap between top and bottom</td>
</tr>
</tbody>
</table>
Sustainable development Goals Trends in Uganda

Index score  56.8
Regional average score  50.1

Africa Index Rank
13 (OF 51)

Source: Africa SDG Index and Dashboards Report 2018
The inequality of Uganda remained constant over the past 50 years.
Human Resources: different indicators in Uganda

Source: Lemarchand (2021) based on UNDP and UN Statistics Division

Life Expectancy at Birth

- Female (years)
- Total (years)
- Male (years)

Population of Uganda in millions

Human Development Index in Uganda

Source: Lemarchand (2021) based on UNDP and UN Statistics Division
### Human Resources: Education attainment in Uganda

#### Educational attainment [Population 25 yrs or more, % cumulative]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>At least completed primary [Total]</td>
<td>30.6%</td>
<td>34.9%</td>
<td>44.3%</td>
<td>32.5%</td>
<td></td>
</tr>
<tr>
<td>At least completed primary [Female]</td>
<td>21.8%</td>
<td>34.6%</td>
<td>36.6%</td>
<td>24.0%</td>
<td></td>
</tr>
<tr>
<td>At least completed primary [Male]</td>
<td>40.2%</td>
<td>35.2%</td>
<td>50.6%</td>
<td>42.3%</td>
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</tr>
<tr>
<td>At least completed lower secondary [Total]</td>
<td>11.0%</td>
<td>11.5%</td>
<td>23.6%</td>
<td>28.8%</td>
<td>24.0%</td>
</tr>
<tr>
<td>At least completed lower secondary [Female]</td>
<td>6.2%</td>
<td>7.1%</td>
<td>23.2%</td>
<td>22.9%</td>
<td>16.9%</td>
</tr>
<tr>
<td>At least completed lower secondary [Male]</td>
<td>16.0%</td>
<td>16.3%</td>
<td>24.0%</td>
<td>33.7%</td>
<td>32.2%</td>
</tr>
<tr>
<td>At least completed upper secondary [Total]</td>
<td>1.9%</td>
<td>6.5%</td>
<td>8.8%</td>
<td>10.7%</td>
<td>9.9%</td>
</tr>
<tr>
<td>At least completed upper secondary [Female]</td>
<td>0.6%</td>
<td>3.9%</td>
<td>8.7%</td>
<td>8.0%</td>
<td>6.3%</td>
</tr>
<tr>
<td>At least completed upper secondary [Male]</td>
<td>3.1%</td>
<td>9.2%</td>
<td>8.8%</td>
<td>12.8%</td>
<td>13.9%</td>
</tr>
<tr>
<td>At least completed post-secondary [Total]</td>
<td>0.5%</td>
<td>4.8%</td>
<td>6.9%</td>
<td>8.2%</td>
<td>8.1%</td>
</tr>
<tr>
<td>At least completed post-secondary [Female]</td>
<td>0.2%</td>
<td>3.1%</td>
<td>7.0%</td>
<td>6.4%</td>
<td>5.5%</td>
</tr>
<tr>
<td>At least completed post-secondary [Male]</td>
<td>0.9%</td>
<td>6.7%</td>
<td>6.8%</td>
<td>9.7%</td>
<td>11.1%</td>
</tr>
<tr>
<td>At least completed short-cycle tertiary [Total]</td>
<td>4.8%</td>
<td>6.9%</td>
<td>8.2%</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>At least completed short-cycle tertiary [Female]</td>
<td>3.1%</td>
<td>7.0%</td>
<td>6.4%</td>
<td>5.5%</td>
<td></td>
</tr>
<tr>
<td>At least completed short-cycle tertiary [Male]</td>
<td>6.7%</td>
<td>6.8%</td>
<td>9.7%</td>
<td>11.1%</td>
<td></td>
</tr>
<tr>
<td>At least Bachelor's or equivalent [Total]</td>
<td>1.8%</td>
<td>3.0%</td>
<td>1.9%</td>
<td>3.8%</td>
<td>2.3%</td>
</tr>
<tr>
<td>At least Bachelor's or equivalent [Female]</td>
<td>2.0%</td>
<td>1.9%</td>
<td>1.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At least Bachelor's or equivalent [Male]</td>
<td>1.7%</td>
<td>3.8%</td>
<td>2.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: UNESCO Institute for Statistics
Human Resources: Higher Education indicators in Uganda

Enrolment in tertiary education. ISCED 5 to 8

Government expenditure on tertiary education as percentage of GDP

Percentage of graduates, both sexes, by field of knowledge (%)

<table>
<thead>
<tr>
<th>Field of Knowledge</th>
<th>1999</th>
<th>2000</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>From programmes other than Science, Technology, Engineering and Mathematics</td>
<td>82.8</td>
<td>85.6</td>
<td>86.0</td>
</tr>
<tr>
<td>From Science, Technology, Engineering and Mathematics programmes</td>
<td>17.0</td>
<td>14.4</td>
<td>11.1</td>
</tr>
<tr>
<td>Graduating from Agriculture, Forestry, Fisheries and Veterinary programmes</td>
<td>1.9</td>
<td>2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Graduating from Arts and Humanities programmes</td>
<td>7.6</td>
<td>5.6</td>
<td>5.5</td>
</tr>
<tr>
<td>Graduating from Business, Administration and Law programmes</td>
<td>26.5</td>
<td>18.4</td>
<td>26.2</td>
</tr>
<tr>
<td>Graduating from Education programmes</td>
<td>41.1</td>
<td>44.0</td>
<td>34.8</td>
</tr>
<tr>
<td>Graduating from Engineering, Manufacturing and Construction programmes</td>
<td>5.0</td>
<td>7.4</td>
<td>7.9</td>
</tr>
<tr>
<td>Graduating from Health and Welfare programmes</td>
<td>1.7</td>
<td>2.6</td>
<td>4.2</td>
</tr>
<tr>
<td>Graduating from Information and Communication Technologies programmes</td>
<td>0.5</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Graduating from Natural Sciences, Mathematics and Statistics programmes</td>
<td>11.6</td>
<td>6.7</td>
<td>2.2</td>
</tr>
<tr>
<td>Graduating from programmes in unspecified fields</td>
<td>0.1</td>
<td>0.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Graduating from Services programmes</td>
<td>1.8</td>
<td>5.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Graduating from Social Sciences, Journalism and Information programmes</td>
<td>2.2</td>
<td>7.4</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Source: Lemarchand (2021) based on UIS historical raw data on higher education
Characteristics of the labour activities and exports

Exports of goods and services as percentage of GDP

Exports as percentage of GDP (1960-2020)

Distribution of employment by economy sector (ILO estimate)

Employment in services
Employment in industry
Employment in agriculture

High-Tech exports as percentage of manufactured exports

Manufactures exports as percentage of merchandise exports

Source: Lemarchand (2021) based on ILO and World Bank
The Product Space Conditions the Development of Nations

C. A. Hidalgo,† B. Klinger,‡ A.-L. Barabási,‡ R. Hausmann‡

Economies grow by upgrading the products they produce and export. The technology, capital, institutions, and skills needed to make newer products are more easily adapted from some products than from others. Here, we study this network of relatedness between products, or "product space," finding that more-sophisticated products are located in a densely connected core whereas less-sophisticated products occupy a less-connected periphery. Empirically, countries move through the product space by developing goods close to those they currently produce. Most countries can reach the core only by traversing empirically infrequent distances, which may help explain why poor countries have trouble developing more competitive exports and fail to converge to the income levels of rich countries.

Does the type of product that a country exports matter for subsequent economic performance? The fathers of development economics held that it does, suggesting that industrialization creates spillover benefits that fuel subsequent growth (1–3). Yet, lacking formal models, mainstream economic theory has been unable to incorporate these ideas. Instead, two approaches have been used to explain a country’s pattern of specialization. The first focuses on the relative proportion between productive factors (i.e., physical capital, labor, land, skills or human capital, infrastructure, and institutions) (4). Hence, poor countries specialize in goods intensive in unskilled labor and land, whereas richer countries specialize in goods requiring infrastructure, institutions, and human and physical capital. The second approach emphasizes technological differences (5) and has to be complemented with a theory of what underlies them. The varieties and quality ladders models (6, 7) assume that there is always a slightly more advanced product, or just a different one, that countries can move to, disregarding product similarities when thinking about structural transformation and growth.

Think of a product as a tree and the set of all products as a forest. A country is composed of a collection of firms, i.e., of monkeys that live on different trees and exploit those products. The process of growth implies moving from a poorer part of the forest, where trees have little fruit, to better parts of the forest. This implies that monkeys would have to jump distances, that is, redevelop (human, physical, and institutional) capital toward goods that are different from those currently under production. Traditional growth theory assumes there is always a tree within reach; hence, the structure of this forest is unimportant. However, if this forest is heterogeneous, with some dense areas and other more-deserted ones, and if monkeys can jump only limited distances, then monkeys may be unable to move through the forest. If this is the case, the structure of this space and a country’s orientation within it become of great importance to the development of countries.

In theory, many possible factors may cause relatedness between products, that is, closeness between trees; such as the intensity of labor, land, and capital (8), the level of technological sophistication (9, 10), the inputs or outputs involved in a product’s value chain (e.g., cotton, yarn, cloth, and garments) (11), or requisite insti-
Export Basket in 2018

Uganda exported products worth USD $5.32 billion in 2018. Exports have grown by an annual average of 3.8% over the past five years, which has been a drag on overall economic growth, as exports represent a shrinking segment of the economy. Non-oil exports have grown by 4.1% annually over the past five years, outpacing the global average growth. Imports totaled USD $7.11 billion in 2018, leaving Uganda with a trade deficit in goods and services.

Top 3 export destination countries:
- UAE (27.89%)
- Kenya (15.07%)
- South Sudan (10.06%)

Growth in Global Market Share

Uganda has not yet started the traditional process of structural transformation. A key source of economic growth, this process reallocates economic activity from low to high productivity sectors. It broadly moves activities out of agriculture into textiles, followed by electronics and/or machinery manufacturing. Global market share in textile exports in Uganda has stagnated over the previous decade; electronics and machinery have yet to take-off in Uganda, limiting its income growth.

Uganda’s export growth in the past five years has been driven by Stone. Uganda’s growth in Stone has not been by good luck, by simply concentrating in a growing global sector. Rather, export growth in Stone has been driven by expanding its global market share.

Diversification into New Products

Growth in Global Market Share

Diversification into New Products

Economic growth is driven by diversification into new products that are incrementally more complex. Uganda has added 40 new products since 2003 and these products contributed 55% in income per capita in 2018. Uganda has diversified into a sufficient number of new products but at too small a volume to contribute to substantial income growth.

New Export Products, 2003 - 2018

<table>
<thead>
<tr>
<th>Country</th>
<th>New Products</th>
<th>Exports</th>
<th>Total Exported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uganda</td>
<td>40</td>
<td>131M</td>
<td>S$194M</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>32</td>
<td>52M</td>
<td>S$211M</td>
</tr>
<tr>
<td>Tanzania</td>
<td>16</td>
<td>56M</td>
<td>S$38M</td>
</tr>
<tr>
<td>Kenya</td>
<td>11</td>
<td>16M</td>
<td>S$263M</td>
</tr>
</tbody>
</table>

What is the Product Space?

Uganda's Product Space

Countries are more successful in diversifying when they move into production that requires similar knowhow and builds on existing capabilities. Here, Uganda's Product Space illustrates the relatedness of its exports and potential paths to diversify its economy.

Recommended Strategic Approach

Top 50 Products Based on Strategy Approach

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>&quot;NEARBY&quot; DISTANCE</th>
<th>OPPORTUNITY GAIN</th>
<th>PRODUCT COMPLEXITY</th>
<th>GLOBAL SIZE (USD)</th>
<th>GLOBAL GROWTH 5 YR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared culture media for micro-organisms (3921 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$2.22B</td>
<td>56%</td>
</tr>
<tr>
<td>Glues and adhesives (3906 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$12.1B</td>
<td>16.8%</td>
</tr>
<tr>
<td>Machinery parts, not containing electrical features, n.e.c. (8485 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$10.48</td>
<td>10.7%</td>
</tr>
<tr>
<td>Other lifting machinery (8428 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$32.48</td>
<td>22%</td>
</tr>
<tr>
<td>Central heating boilers (8408 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$7.14B</td>
<td>2.3%</td>
</tr>
<tr>
<td>Other agricultural machinery (8438 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$7.83B</td>
<td>17.2%</td>
</tr>
<tr>
<td>Other parts for machines and appliances (9033 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$2.74B</td>
<td>11.6%</td>
</tr>
<tr>
<td>Harvesting or agricultural machinery (8433 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$20.9B</td>
<td>2.2%</td>
</tr>
<tr>
<td>Parts for use with hoists and excavation machinery (8431 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$56.2B</td>
<td>12.7%</td>
</tr>
<tr>
<td>Pigments, nonaqueous (3912 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$2.35B</td>
<td>1%</td>
</tr>
<tr>
<td>Newspapers, journals and periodicals (4902 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$3.46B</td>
<td>34.1%</td>
</tr>
<tr>
<td>Other plastic plates, sheets etc. (3921 HS4)</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>$26.88B</td>
<td>13.5%</td>
</tr>
</tbody>
</table>
Time for questions

First run
What are *implicit* policies? ... and How we measure them?
The GO→SPIN mapping represents the interaction between "explicit" policies, "implicit" policies and their contextual factors.

"Implicit" policies affect the performance of SETI policies. Effects on the SETI policies and goals (effective performance of the policy)
The GO→SPIN mapping represents the interaction between "explicit” policies, “implicit” policies and their contextual factors by comparing plans.
Implicit STI policies and instruments: Here the purpose is to produce effects on variables that do not belong to the group of SETI functions and activities but as a result, unintended effects happen to the latter. Such unintended effects may be termed “side effects” or “implications.” A better knowledge of them may enable policymakers to minimize or eliminate their negative influence or to heighten their positive effects and eventually to transform these implicit policies and their related instruments into purposeful indirect policies and instruments for science and technology.
An analysis of the SETI implicit policies in general laws (on industrialization, mining, foreign investment, etc.) should uncover the main implications or side effects for science technology and innovation functions and activities.

The first step would be to identify those policies oriented to areas other than SETI that could have an important impact on them. For this there is a need for a certain understanding of the way the SETI system functions in the country, through an examination of its place in relation to the economic, social, and educational systems.
Economy: primarily directed to the functioning of the economic system

- Finance (credit, interest rates).
- Fiscal (taxation, exchange rates, exchange control);
- Internal trade (tariff and nontariff barriers);
- Domestic trade (prices, marketing, government-procurement);
- Wages and labour compensation policies;
- Foreign investment, compensation and nationalization;
- Economic development policies;
- Specific industrial policies;
- Legal and general instruments;
- Policies designed to foster regional development.
Sustainability policies:

- Policies for the exploitation and preservation of natural resources;
- Policies on environmental control, pollution;
- Policies to promote green societies;
- Policies to promote green production of goods and services;
- Policies to promote green consumption patterns.

Demographic and social:

- Health care;
- Mortality rates;
- Population control;
- Income policies.
- Distribution of income;
- Policies increasing social mobility.
Human resources:

- Education system (literacy, primary, secondary, TVET, etc)
- Higher education policies (universities, training institutes, management training, post-doctoral training)
- Fellowship and scholarship policies
- Industrial training and retraining, technician training, etc.
- Policies for the use of foreign personnel
- Policies toward emigration of professionals
- Policies or repatriation and networking with skilled manpower (brain-drain vs. brain-gain policies)
- Policies for the promotion of human resources
- Salary structures and awards
- Mobility
Cultural policies:

- Mechanisms which modify general value structures, attitudes, norms, etc.
- Including the position of women (gender equality policies);
- Policies fostering a knowledge society;
- Social appropriation of science (popularization of STI activities; science museums; science contests or Science Olympiads among the youth, etc.);
- Policies modifying the structure of mechanisms and procedures conferring status and prestige, etc.
<table>
<thead>
<tr>
<th>Characteristics of Government economic policies</th>
<th>Implicit impact within SETI activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit policies biased toward capital equipment. particularly when foreign aid and credit are involved</td>
<td>Capital-intensive technologies are preferred over capital saving or labour-using technologies.</td>
</tr>
<tr>
<td>Fiscal incentives geared toward promoting additional capital investments (tax credits, tax exemptions, etc.)</td>
<td>Investment in equipment becomes more attractive than investment in working capital to enlarge labour force</td>
</tr>
<tr>
<td>Social policies that make labour expensive (social security, unemployment funds, medical benefits, etc.)</td>
<td>Demand for capital equipment, machinery and even intermediate products is oriented outward, particularly to developed countries</td>
</tr>
<tr>
<td>Overvaluation of exchange rates (making imports cheaper)</td>
<td>Importing foreign machinery and equipment becomes attractive</td>
</tr>
<tr>
<td>Gross inequalities in the distribution of income</td>
<td>Industrial activities are oriented toward producing goods for a small segment of the population with high income. Technologies are geared to producing a large variety of goods for this population segment and import for this purpose.</td>
</tr>
<tr>
<td>Conservationism of local entrepreneurs</td>
<td>Distrust for local STI capabilities. Preference for well known and proved technologies (generally foreign). Risk capital for new and advanced technologies are not available.</td>
</tr>
<tr>
<td>Protectionism, oligopolies, myopic price controls</td>
<td>Entrepreneurs have no real incentives to reduce costs and operate more efficiently. Hence there is little demand for local research and innovation activities</td>
</tr>
</tbody>
</table>
Time for questions

Second run
The structure of GO→SPIN analytic units
Golden Rule for the implementation of SETI policies

Parliamentarian committee on science, technology and innovation

Inter ministerial cabinet for science, technology and innovation

Policy or National Multiannual Plan

Legal devices (for different sectors)

Organizational structures (@ different national ministries)

Operational policy instruments (organized in a coherent way to generate synergies in order to obtain a particular long-term effect)

Effects over objectives and goals of the SETI policy
Analysing the content of the SETI “explicit” policies

DESIGNING SETI POLICIES AND SETI MULTIANNUAL NATIONAL PLANS

Science & Technology

- Funding
- Mechanisms

- Goals
- Participation

- Review
- Innovation

- Security
- Quality of Life

- Wealth
- Jobs

Explicit Policy
Priority setting mechanisms for SETI policies

Focusing on societal demands

The determination of the technical specifications in order to solve the requirements of the problem-area.

The solution of technological problems that must be solved by the Applied Research.

The Development of new (embodied and disembodied) technologies that will satisfy the technical Specifications to solve the Requirements of the problem-area.

New Knowledge, ideas, creative views and skills that may be proportioned by basic research, to solve the demands of the applied research.
Content analysis of the “explicit” STI policy

1. Policy vision:
2. Policy mission:
3. Policy goals:
4. Policy objectives:
5. Priorities at the strategic level of the STI policy:
6. Normative planning strategies of the policy:
7. Policies related to the supply of STI:
8. Policies related to demand for STI:
9. Policies to foster networking between the STI supply and demand sides:
10. Regional and international dimensions of STI policies:
11. Monitoring, assessment, technological forecasting and prospective scenarios:
12. STI policy start date:
13. Timespan for STI policy planning:
14. Link:
## Ministry of Science and Technology goals to reach by Brazil’s 2022 bicentennial

- Increase investments in R&D to 2% of gross domestic product, with more than half from private enterprise
- Double to 340,000 the number of scholarships awarded annually by the ministries of Science and Technology and Education
- Grow the research community to 450,000, or 2 researchers per 1000 inhabitants, up from the current 8 per 10,000
- Generate 5% of the world's production of scientific papers
- Triple the percentage of higher-education graduates in engineering to 15%
- Master the technologies of microelectronics, pharmaceutical production, nanotechnology, biotechnology, and a host of green technologies
- Increase by 10-fold the number of innovative companies, from 3% of industrial companies to 30%
- Increase by a factor of 10 or more the number of patents a year, to at least 4000
- Ensure independence in the production of nuclear fuel and reactor technologies
- Master the manufacturing technologies of satellites and launch vehicles
Priorities at the strategic level of the STI policy: (1) Establish and begin construction of a science and technology zone by 2018; (2) allocate budget for research projects related to promoting sustainable development that covers 25% of the annual research budget; (3) adopt and apply international technology that is suitable within the Lao context to increase national productivity and competitiveness; (4) develop and expand basic infrastructure in the media industries and IT to become a hub for providing social media services and products.

Normative planning strategies of the policy: (1) Increase investment in research and development from 1% to 2% of public investment by 2020; (2) promote private investment in research and development to cover at least 30% of public investment by 2020; (3) train 11 researchers per 10 000 of the population by 2020.

Policies related to the supply of STI: (1) Improve and upgrade research institutes under the Ministry of Science and Technology so at least one institute is comparable with international standards by 2020; (2) support the development of researchers at universities across the country by allocating a budget to promote research work on at least 50 projects by 2020; (3) create a science magazine, promote research work and publish findings in science magazines and international magazines in at least 250 articles by 2020.
Content analysis of the “explicit” STI policy(ies) in Uganda
The so-called “legal framework” might also be considered as a set of “legal instruments” or “legal devices.” This embodies the policy, or parts of it, in the form of a law, decree or regulation. Formal agreements, contracts and international SETI cooperation treaties may also be included in this category. A legal device goes one step beyond a “policy” by stipulating obligations, rights, rewards and penalties connected with its being obeyed. This is probably the most relevant database to “monitor most of the items of the 2017 Recommendation”
GERD in Israel (1960-2013). percentage GDP

Source: Lemarchand (2016)
Examples of legal instruments

- Legal instruments for the creation of national research labs, universities, national research councils, Ministries of S&T, R&D Funds, Innovation Funds
- For the regulation of the labour conditions and status of scientific researchers
- Regulations on Open Science
- Tax Incentives for Innovation
- Regulations of the Higher Education System
- Regulations on Bioethics and Ethics of Science and Technology
- Regulations to ensuring responsible research and innovation
- Regulations on STI personnel
- Regulations on research labs safety/security
- Regulations on nuclear, chemical, and other dangerous substances
- Regulations on STI gender equality
- Regulations on inclusive and green technologies
- Regulations on Indigenous Knowledge Systems
- Regulations on Intellectual Property Rights
Examples of legal instruments in Uganda

UNIVERSITIES AND OTHER TERTIARY INSTITUTIONS ACT, 2001

(AS AMENDED 26, 2005 AND 42, 2005)

ENACTED BY THE PARLIAMENT OF THE REPUBLIC OF UGANDA AS ACT VII

As an Act to provide for the establishment of the National Council for Higher Education, its functions and powers, and for the establishment, administration and maintenance of Universities and other institutions of Higher Education in Uganda and to provide for other related matters.

Date of Assent: 30th March, 2001.


INTRODUCTION

PART I—PRELIMINARY

SECTION I—INTERPRETATION AND OBJECTIVES OF THE ACT

Short Title
1. This Act may be cited as the Universities and Other Tertiary Institutions Act, 2001.

Interpretation
2. In this Act, unless the context otherwise requires, ‘University’ means a University established or maintained by the government or a University established or maintained by any other body established or maintained by the government.

PART II—ESTABLISHMENT, OBJECTS AND FUNCTIONS OF THE UNIVERSITY

Arrangement of Sections
1. Short title.
2. Interpretation.

PART II—ESTABLISHMENT, OBJECTS AND FUNCTIONS OF THE INSTITUTE

Arrangement of Sections

1. Short title.
2. Interpretation.

PART III—THE BOARD OF THE INSTITUTE

Arrangement of Sections

1. Short title.
2. Interpretation.

PART IV—MANAGEMENT AND STAFF OF THE INSTITUTE

Arrangement of Sections

1. Short title.
2. Interpretation.

PART V—THE NATIONAL COMMISSION FOR HIGHER EDUCATION

Arrangement of Sections

1. Short title.
2. Interpretation.

PART VI—THE NATIONAL UNIVERSITY COUNCIL

Arrangement of Sections

1. Short title.
2. Interpretation.

PART VII—THE UNIVERSITY COUNCIL

Arrangement of Sections

1. Short title.
2. Interpretation.

PART VIII—OTHER MATERIALS

Arrangement of Sections

1. Short title.
2. Interpretation.
Examples of Uganda’s Intellectual Property Laws and Treaties

Laws:
• The Industrial Property Act, 2014
• The Geographical Indications Act, 2013
• The Trademarks Act, 2010
• The Trade Secrets Protection Act, 2009
• The Copyright and Neighbouring Rights Act, 2006

Implementing Rules and Regulations:
• The Industrial Property (Fees) Regulations, 2017
• The Industrial Property Regulations, 2017
• The Trademarks Regulations, 2012
• The Copyright and Neighbouring Rights Regulations, 2010
• The Judicature (Commercial Court Division) (Mediation) Rules, 2007
• The National Environment (Access to Genetic Resources and Benefit Sharing) Regulations, 2005
• Uganda Registration Services Bureau Act (Commencement) Instrument, 2004
• The Patents Regulations, 1993

Treaties:
• Beijing Treaty on Audiovisual Performances, signed on 8 October 2012
• Marrakesh VIP Treaty, in force since July 23, 2018
• Nairobi Treaty, in force since 21 October 1983
• Paris Convention, in force since 14 June 1965
• Patent Cooperation Treaty, in force since 9 February 1995
• Patent Law Treaty, signed on 2 June 2000
• World Intellectual Property Organization (WIPO) Convention, in force since 18 October 1973
How robust is the structure of the STI ecosystem to effectively promote research and innovation for sustainable development in the long-run?
(1) **Agenda-Setting**: refers to the process by which problems on SETI and its relation to society and the economy come to the attention of the government.

(2) **Policy Formulation**: refers to the process by which SETI policy options are formulated by the government.

(3) **Decision-Making**: refers to the process by which governments adopt a particular SETI course of action or non-action.

(4) **Policy Implementation**: refers to the process by which governments put SETI policies into effect.

(5) **Policy Evaluation**: refers to the process by which the impact of SETI policies are monitored by both State and societal actors. The result of which may be a re-conceptualization of policy problems and solutions.

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**Figure 31**: SETI policy cycle in Malawi. 2014. Source: UNESCO
Uganda SETI Ecosystem

Figure 4.5: Proposed Framework for STEI System
Co-Designing Science in Africa
First steps in assessing the sustainability science approach on the ground
Policy instruments are the means employed by those who exercise power and authority to influence the decisions made by other agents.

They induce and motivate individuals, groups, firms, organizations and institutions to behave in accordance with the guidelines and criteria established by the policies.

They are the connecting link between the purpose expressed in a policy statement and its implementation in practice.
<table>
<thead>
<tr>
<th>Industrial deepening</th>
<th>Technological capability</th>
<th>Skill demand</th>
<th>Education and training</th>
<th>In-firm training</th>
<th>Links to other players</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-level, simple assembly and processing mainly for domestic market</td>
<td>Ability to master simple assembly technologies, copy simple designs and repair machines, but no capacity to adapt processes</td>
<td>Literacy, numeracy and simple technical and managerial training</td>
<td>Formal primary education</td>
<td>No formal in-firm training. Informal learning through repetition and trial and error</td>
<td>None likely</td>
</tr>
<tr>
<td>Intermediate level, including export-oriented activities in light industry</td>
<td>Capability to undertake minor adaptations to processes and products, but little or no design and development capabilities</td>
<td>Low base of engineering and scientific skills. Small and medium-size enterprises have low skill levels</td>
<td>Good secondary and technical schooling and management and financial training</td>
<td>Some in-house training mainly by export-oriented firms</td>
<td>To buyers and suppliers, but very unlikely to technology institutions</td>
</tr>
<tr>
<td>Advanced and deep industrial structure mainly in technology-intensive industries</td>
<td>Ability to monitor, import, adapt and operate state-of-the-art advanced technologies</td>
<td>Highly specialized manufacturing skills with a focus on technical subjects such as engineering and mathematics</td>
<td>Excellent tertiary technical education and specialized industrial training by institutions of technical and vocational education and training. High numbers of university-trained managers</td>
<td>Large investments in formal and informal in-firm training</td>
<td>Strong to suppliers, buyers, consultants, universities and technology institutions</td>
</tr>
</tbody>
</table>
Policy instruments are the means employed by those who exercise power and authority to influence the decisions made by other agents.
Functional links between support programmes: SMEs

1. Export promotion
   - Subsidies for development of new projects
   - Subsidies for training
   - Subsidies for consultancy advice and management training
   - Subsidies for collaborative research
   - Preferential loans, venture capital
   - Tax/tariff benefits

2. Internationalization of SMEs

3. Innovation
   - STI policy
   - STI legal framework
   - Organisational Chart for STI
   - Operational Policy instruments

4. Attraction of foreign investment

Effects
### Examples: The Argentine Technological Fund (FONTAR)

<table>
<thead>
<tr>
<th>FONTAR programmes</th>
<th>Instrument used</th>
<th>Objectives</th>
<th>Beneficiaries</th>
<th>Form of allocation and financial contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological development (new products, services or production processes)</td>
<td>Non-repayable contributions</td>
<td>Increased competitiveness through innovation in products, services and processes</td>
<td>Micro-, small and medium-sized enterprises and broader enterprises certified by IBEROEKA</td>
<td>By public competition. Up to 50% of project cost</td>
</tr>
<tr>
<td>Loans for technological development projects</td>
<td>Finance for middle-income technology production projects</td>
<td></td>
<td>Micro-, small and medium-sized enterprises with research and development departments or teams, collaboration groups, and UVTs (Unidades de Vinculación Tecnológica - Technical Linkage Units) underwritten by the enterprise</td>
<td>Compulsorily repayable loans. Up to 80% of the total cost, allocated on an open window basis, with a maximum of 200,000 pesos for three years</td>
</tr>
<tr>
<td>Technological modernization (improvement of products and processes, training)</td>
<td>Fiscal credit programme</td>
<td>Assistance for the execution of research and development activities</td>
<td>Physical or juridical persons who own enterprises producing goods and services</td>
<td>Subsidies through Fiscal Credit Certificates obtained through public competition. Up to 50% of the total cost of the project</td>
</tr>
<tr>
<td>Loans for modernization projects</td>
<td>Loans for technological modernization projects</td>
<td>Technological adaptation and improvement of products and processes with a low level of technical and economic risk</td>
<td>Enterprises with research and development department or groups. Collaboration groups, and UVTs underwritten by the enterprise</td>
<td>Special compulsorily repayable loans allocated on an open window basis. Up to 80% of the total cost of the project, with a maximum of 300,000 pesos for three years</td>
</tr>
<tr>
<td>Loans to enterprises</td>
<td>To finance projects for the development of new production processes, products and modifications thereto</td>
<td>Enterprises, without any restrictions as regards size or sector. No finance provided for projects with a rate of return of less than 12%</td>
<td>Compulsorily repayable loans allocated on an open window basis. Up to 80% of the total cost of the project, with a maximum of 1 million pesos</td>
<td></td>
</tr>
<tr>
<td>Promotion of the technological services market (research centres and business research centres)</td>
<td>Subsidies for projects to develop business plans</td>
<td>Finance for business development projects based on research and development</td>
<td>Micro-, small and medium-sized enterprises whose projects are executed by UVTs</td>
<td>Subsidies allocated on an open window basis. Up to 50% of the total cost of the project, with a maximum of 20,000 pesos, for up to one year</td>
</tr>
<tr>
<td>Loans to institutions</td>
<td>To promote the establishment and strengthening of structures for the provision of technological services to research and development enterprises and institutions</td>
<td>Public or private institutions providing services to the private production sector. The projects may be presented on an individual or associated basis</td>
<td>Obligatory repayable subsidies allocated on an open window basis, up to a maximum of 2 million pesos</td>
<td></td>
</tr>
<tr>
<td>Training and technical assistance</td>
<td>Subsidies for training and retraining projects</td>
<td>Subsidies to support activities for the training and retraining of human resources in new technologies</td>
<td>Micro-, small and medium-sized enterprises whose projects are executed by UVTs</td>
<td>Subsidies allocated on an open window basis. Up to a maximum of 50% of the total cost of the project, or 20,000 pesos for up to six months</td>
</tr>
<tr>
<td>Subsidies for project formulation</td>
<td>Support for the formulation of research and development projects, technology transfer or technical assistance</td>
<td>Micro-, small and medium-sized enterprises whose projects are executed by UVTs</td>
<td></td>
<td>Subsidies allocated on an open window basis. Up to a maximum of 50% of the total cost of the project, or 20,000 pesos for up to six months</td>
</tr>
</tbody>
</table>
## Examples of Sectoral Funds in Brazil

<table>
<thead>
<tr>
<th>Sectoral funds</th>
<th>Objectives</th>
<th>Origin of financial resources</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT-PETRO (1999)</td>
<td>Sectoral development through promotion of research and development and human resources training</td>
<td>25% of value of royalties exceeding 5% of production of oil and natural gas</td>
<td>Collaboration in the definition of policies and the implementation of specific programmes. In 2001, 144 projects worth 7 million reales were approved by the CNPq. Expenditure between January and November 2003: 16,431,002.70 reales</td>
</tr>
<tr>
<td>CT-ENERG (1999)</td>
<td>Sectoral development through promotion of research and development</td>
<td>Between 0.75% and 1% of the net income of enterprises with concessions for the generation, transmission and distribution of electricity</td>
<td>In 2001 the CNPq approved 132 research and development projects involving the investment of 8 million reales by the fund. In 2001 an association agreement was signed between the National Electric Power Agency and the CNPq to promote cooperation between research centres and enterprises. Total expenditure between January and November 2003: 8,397,738</td>
</tr>
<tr>
<td>CT-HYDRO (1999)</td>
<td>Reduction of disparities between regions through investments in science and technology activities of importance for the sector. Strengthening of water resource sustainability</td>
<td>Made up of 4% of the financial compensation of electricity generation enterprises</td>
<td>Financing of scientific and technological development projects and programmes designed to improve water quality and use. In 2002, 28.6 million reales were invested, of which at least 4 million were for the training of specialized personnel. Expenditure between January and November 2003: 3,735,635.85 reales</td>
</tr>
<tr>
<td>CT-INFO (2000)</td>
<td>Promotion of the competitiveness of the sector through research and development programmes and projects</td>
<td>At least 5% of the gross annual turnover in the domestic IP goods and services market of enterprises producing goods and services relating to information technology which receive fiscal incentives under the law to promote the IP industry</td>
<td>It is estimated that over 50 million reales are spent each year on the promotion of research and development activities in this sector. Expenditure between January and November 2003 was 9,971,983.70 reales</td>
</tr>
</tbody>
</table>
a. Strengthening the production of new endogenous scientific knowledge
b. Strengthening the infrastructure of research laboratories in the public and private sectors
c. Human resources for research, innovation, and strategic planning. Capacity building, education and training of specialized human capital for (1) the production of new scientific knowledge. (2) development of new technologies. (3) promotion of innovation within the productive and services systems and (4) management of the knowledge society.
d. Strengthening gender equality for research and innovation
e. Strengthening the social appropriation of scientific knowledge and new technologies
f. Development of strategic technological areas and new niche products and services with high-added value. Promotion and development of innovation in the production of goods and services. Promotion of start-ups in areas of high technology
g. Strengthening programmes on science education at all levels (from primary school to postgraduate)
h. Promotion of the development of green technologies and social-inclusion technologies
i. Promotion of indigenous knowledge systems
j. Research and innovation eco-system: strengthening co-ordination, networking and integration processes which promote synergies among the different actors of the national scientific technological and productive innovation system (i.e. government, university, and productive sectors)
k. Strengthening the quality of technology foresight studies to: Assess the potential of high-value markets. develop business plans for high-tech companies. construct and analyse long-term scenarios and provide consulting services and strategic intelligence
l. Strengthening regional and international co-operation, networking, and promotion of STI activities
m. Awards in science, technology, and innovation
Examples of SETI operational policy instruments in Uganda

- **Proposed ‘Uganda Innovation Fund’**: (several instruments)
- **Presidential Initiatives for Science and Technology**: e.g. research grants; innovation fund at the Faculty of Technology of Makarere University, etc.
- **Innovation and Incubation Instruments**: UIRI; National ICT Initiatives Support Programme, ICT Innovation Parks, FTBIC, NSSF, CURAD, Food and Business Incubation Center (MU), Innovation Village; Mukono-Wakiso Innovation Platform, Outbox (innovation hub); MUST’s Innovation Centers.
- **Matching grants**: E-Voucher Framer Scheme Project (MAAIF)
- **Financing youth entrepreneurs in rural areas**: Youth Livelihoods Programme
- **Regional Mechanisms**: The Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) has a vast set of “policy instruments” in operation for Ugandan partners: (1) Graduate Research Grants; (2) Community Action Research Programme; (3) Field Attachment Programme Awards; (4) RUFORUM Entrepreneurship Challenge Programme; 5) Doctoral Grants; (6) Direct Commissioning System; (7) Nurturing Grants; (8) Technical Skills Development Programme; (9) Short skills enhancement courses; (10) African Universities Leadership and Management Training Programme; (11) Governance and administration of grants.
ASANTE
SANA
... Thank you very much
For your kind attention!

Last run