THE ROLE OF TECHNOLOGY AS A DRIVER FOR ECONOMIC DEVELOPMENT
Africa’s growth options

Targeting the African Market

Developing African talent

Say’s Law – Supply creates its own demand
Resources, policy & growth

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ABSTRACT

This essay reviews the relationship between natural-resource abundance and economic growth around the world, and presents some new results. The principal reasons why resource-based production can inhibit economic growth over long periods are traced to the Dutch disease, neglect of education, rent seeking, and economic policy failures. Across a large number of countries in the period from 1965 to 1998, the share of the primary sector in the labour force is shown to be inversely related to exports, domestic and foreign investment, and education, and directly related to external debt, import protection, corruption, and income inequality. The cross-sectional data show, moreover, that the share of the primary sector in the labour force is inversely related to per capita growth across countries. None of this lies in the nature of things, however. What seems to matter for economic growth is not the abundance of natural resources per se, but rather the quality of their management, and of economic management and institutions in general.
Human capital & growth

The Africa we seek
Strategic differentiation arises from a differentiated value chain.

Innovation enhances the feasibility & sustainability of strategic differentiation.
Entrepreneurship for strategic differentiation

- Because entrepreneurship requires the holistic balance & fit between the opportunity, the founder, the team & requisite resources...

On balance, emphasis is tilted towards opportunity at inception

QUALITY OPPORTUNITY
- Huge & growing
- Definable & accessible

STRATEGIC FIT
- The opportunity
- The team
- The founder
- The resources

TEAM
- Risk-tolerant
- Balanced
- Complete

FOUNDER
- Visionary
- Tenacious
- Self-starter
- Ambitious

RESOURCES
- Accessible
- Leverage-able
- Investor-readiness

QAH seeks balanced entrepreneurial teams with proven skills & experience in both technological & strategic innovation to achieve sustainably inimitable value chains.
Each stage has a unique strategic thrust

- The focus (in red) & strategic imperatives of each stage vary

- New discovery
- Maturity & off-shore manufacturing
- Global roll-out
- New industry std.

Wealth creation stems from a mastery of these stage-specific strategies
Innovation & entrepreneurship are inseparable

- Successful innovation requires a thorough understanding of technology waves and their cyclical nature.

INCREMENETAL & ARCHITECTURAL INNOVATION
- Incremental & architectural technical skills
- Niche strategy & execution
- Abandonment discipline

TECH. DISCONTINUITY
- Entrench competence-enhancing
- Develop competence-destroying
- Pre-paradigmatic research

TECH. RIVALRY
- Due diligence skills
- Entrepreneurial traits
- New venture creation skills
- Strategic differentiation
- Innovation management
- Appropriate management controls

PROCESS INNOVATION
- Process innovation skills
- Executive management skills
- Capital raising skills
- Appropriate management controls
- Global vision, strategy & execution

Domain for entry, innovative entrepreneurship, venture capital & windfall returns

Domain for mass production, globalization & normal profits

Tushman & Anderson (1997)

- Such technology cycles take place at the both product (system) and component (sub-system) levels.
Strategic options

VC Investment Activities

PE Investment Activities

PC Investment Activities

IP Commercialization initiatives

Tech transfer initiatives
Waves, cycles & linkage
Positive-sum global partnership

- Innovation makes global integration (partnerships) possible.
- Because technology cycles take place both at system and sub-system level opportunities for mutually beneficial international partnerships should be sought at both product & component level.
“This article puts forward an interpretation of development as a process of accumulation of technological and social capabilities dependent upon taking advantage of successive and different windows of opportunity. These windows are determined from the core countries, through the technological revolutions which occur every half-century and the four phases of their deployment. The possibilities of progressing at each opportunity depend on the achievements made in the previous phase, on identifying the nature of the next one, understanding the techno-economic paradigm of the revolution in question, and being able to design and negotiate, in each case, a positive-sum strategy, taking account of the interests of [with] the most powerful firms.” Carlota Perez (2001)
Entrepreneurial firms & new products

- Innovation has been confused as a purely technical process
- Innovation creates wealth when understood from a strategic context

### TABLE 1

<table>
<thead>
<tr>
<th>Some Important Innovations by U.S. Small Firms in the 20th Century</th>
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<tbody>
<tr>
<td>Air Conditioning</td>
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<td>Air Passenger Service</td>
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<tr>
<td>Airplane</td>
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<tr>
<td>Articulated Tractor Chassis</td>
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<tr>
<td>Artificial Skin (Cellophane)</td>
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<tr>
<td>Assembly Line</td>
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<tr>
<td>Audio Tape Recorder</td>
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<tr>
<td>Bricklet</td>
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<td>Biomagnetic Imaging</td>
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<tr>
<td>Biosynthetic Insulin</td>
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<tr>
<td>Catalytic Petroleum Cracking</td>
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<tr>
<td>Computerized Blood Pressure Controller</td>
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<tr>
<td>Continuous Casting</td>
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<tr>
<td>Cotton Picker</td>
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<tr>
<td>Defibrillator</td>
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<tr>
<td>DNA Fingerprinting</td>
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<tr>
<td>Double-Knit Fabric</td>
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<tr>
<td>Electronic Spreadsheet</td>
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<tr>
<td>Freewing Aircraft</td>
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<tr>
<td>FM Radio</td>
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<tr>
<td>Front-End Loader</td>
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<tr>
<td>Geodesic Dome</td>
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<td>Gyrocompass</td>
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</tbody>
</table>

Technologies evolve in cycles

- Technologies develop in 4-stage cycles

Stage 1 (Substitution)

Stage 2 (Ferment)

Stage 3 (Selection)

Stage 4 (Retention)

- Each stage of the cycle is an innovation stream
And the distribution of wealth

- Investment opportunities in DCs are on a high-growth product life cycle with great prospects for productivity & profit growth.

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<tr>
<th>SALES</th>
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<tbody>
<tr>
<td>KEY</td>
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<td>STAGE</td>
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</table>

- Returns to DC innovators
- Returns to LDC investors
Knowledge, productivity & markets

Level of scientific knowledge

Potential for productivity growth

Market potential
Factor-intensity & profitability

Capital-intensity

Prospects for Profitability

Potential for use of unskilled labour
### International technology-transfer model

| Imports of Plants & Equipment | • A turnkey solution guaranteeing technology will work despite low domestic skills base  
|                              | • Technologies tend to be capital intensive and mature (high obsolescence risk)  
|                              | • Obsolescence creates need for future tech imports  
| Foreign Direct Investment     | • Tech transfer accompanied by foreign investment & possibly foreign skills  
|                              | • Technologies tend to be capital intensive and mature (high obsolescence risk)  
|                              | • Partnership with locals is essential for skills impartation  
|                              | • Could crowd-out domestic entrepreneurship if structured incorrectly  
| Foreign Licenses and Patents | • Heavy reliance on domestic entrepreneurship and management skills  
|                              | • Use of domestic financial resources, though foreign capital not ruled out  
|                              | • Younger technologies but capped market by limits of license granted  
| Immigration & Skills Imports | • Boosts domestic technological skills and entrepreneurial base  
|                              | • Increases bias towards an outwards-looking approach in the economy  
|                              | • Greater competition within domestic knowledge markets  
| Sending Citizens Abroad      | • Important for skill development and confidence building in developing country  
|                              | • If there is not domestic knowledge creation capacity, long stints may be needed  
|                              | • Could contribute to domestic technological skills development if handled correctly  
| Natural Diffusion            | • This is ideal for countries that already have strong technological capabilities  
|                              | • It is therefore a maintenance strategy and not a technology acquisition strategy  
|                              | • The key is building a self-rejuvenating national system of innovation  

There are 6 generic ways through which technology diffuses internationally and that way enhance the diamond of national competitive advantage.

<table>
<thead>
<tr>
<th>TECH TRANSFER OPTION</th>
<th>(1) Imports of Plant &amp; Equipment</th>
<th>(2) Foreign Direct Investment</th>
<th>(3) Foreign Licenses &amp; Patents</th>
<th>(4) Immigration &amp; Skill Imports</th>
<th>(5) Sending Citizens Abroad</th>
<th>(6) Natural Diffusion</th>
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</thead>
<tbody>
<tr>
<td>High</td>
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<tr>
<td>Moderate</td>
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<td>Low</td>
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<td>GROWTH STAGE</td>
<td>Developing Countries</td>
<td>Middle Income Countries</td>
<td>Developed Countries</td>
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<tr>
<td>RELEVANT STAGE OF TECHNOLOGY CYCLE</td>
<td>TECHNOLOGICAL DISCONTINUITY</td>
<td>TECHNOLOGICAL RIVALRY</td>
<td>PROCESS INNOVATION</td>
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The technology transfer methods differ in relative efficacy, applicability at different economic development stages of the country as well as the stages of the technology cycle they relate to.
THANK YOU!!!