Asia Opportunities in Healthcare and BioBusiness

Stanford University

May 12, 2009

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About Asia: Some Facts and Figures

Largest continent (> 60% of world’s population). Great socioeconomic diversity
- Range: least developed → most developed
- Among the fastest growing economies – also, Asian BioBusiness market expanding rapidly

Several Asian concerns are potentially amenable to bio-based solutions
- Population concerns – from contraception to fertility
- Healthcare concerns – infectious disease, epidemiological transition, rapidly aging populations
- Agriculture and food supply concerns – reduction in arable land with urban development, denatured soil, need for higher yields
- Environmental/Industrial concerns – meeting rising energy needs, growing demand for biofeedstock, responding to pollution and environmental contamination concerns

Potentially valuable Asian resources
- Rich biodiversity
- Traditional and folk medicines – TCM, Ayurveda, South East Asian, Unani (Arabic) traditions
- Increasingly educated and technologically skilled workforce
Aging Populations: Internationally and in Asia

Old-age dependency ratios
Number of people aged 65 and over
As % of labour force (aged 15-64), forecasts

Source: European Commission
About BioBusiness

Definition
Commercial and economic activity based on an understanding of life and life processes:

- **Biomedical** (including healthcare, pharmaceuticals, medical devices, diagnostics, etc)
- **Agri-veterinary and Food**
- **Environmental/Industrial**
- **Related Areas** (bioinformatics/computational biology, bioengineering, nanobiotechnology, etc)

Market
BioBusiness already constitutes over 25% of global GDP and employs some 40% of the world’s labor force:

- Accounts for nearly US$12 trillion (2005)
- Employment figures skewed by > 50% engaged in subsistence level farming and low wage food processing in developing countries (including China and India)

<table>
<thead>
<tr>
<th>BioBusiness Sectors</th>
<th>US$ (trillions)</th>
<th>%Global Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biomedical BioBusiness</strong></td>
<td>4.1</td>
<td>11.1%</td>
</tr>
<tr>
<td>(including healthcare)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Agri-Food BioBusiness</strong></td>
<td>4.2</td>
<td>11.3%</td>
</tr>
<tr>
<td><strong>Other BioBusiness</strong></td>
<td>3.7</td>
<td>10.0%</td>
</tr>
<tr>
<td>(including environmental, biofuels, industrial)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Estimated Global BioEconomy</strong></td>
<td>12.0</td>
<td>32.4%</td>
</tr>
<tr>
<td><strong>Estimated Global Economy (Total)</strong></td>
<td>37.0</td>
<td>100%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>BioBusiness Sector</th>
<th>Global US$ billions</th>
<th>South Asia US$ billions</th>
<th>East Asia (ex Japan) US$ billions</th>
<th>USA US$ billions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>2,611.4</td>
<td>223.2</td>
<td>362.1</td>
<td>529.4</td>
</tr>
<tr>
<td>Healthcare</td>
<td>2,933.8</td>
<td>33.5</td>
<td>108.6</td>
<td>1588.2</td>
</tr>
<tr>
<td>Food Sector</td>
<td>3,288.4</td>
<td>100.5</td>
<td>277.6</td>
<td>1016.5</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>40.0</td>
<td>1.4</td>
<td>4.1</td>
<td>25.0</td>
</tr>
<tr>
<td>BioBusiness-related R&amp;D</td>
<td>257.9</td>
<td>2.4</td>
<td>12.1</td>
<td>105.9</td>
</tr>
<tr>
<td>Other BioBusiness</td>
<td>644.8</td>
<td>15.9</td>
<td>48.3</td>
<td>211.8</td>
</tr>
<tr>
<td><strong>Total BioBusiness</strong></td>
<td><strong>9,776 (30.3%)</strong></td>
<td><strong>376 (47.3%)</strong></td>
<td><strong>812 (33.7%)</strong></td>
<td><strong>3,476 (32.8%)</strong></td>
</tr>
</tbody>
</table>

| Est. GDP                   | 32,239              | 797                     | 2,414                             | 10,588           |

Some Global Trends and Opportunities in BioBusiness

- **Bio-investment around the world** - in health and bio-related infrastructure, R&D and training

- **Non-traditional sources of innovation** - rise of China and India; Asia-Pacific, now increasingly Latin America, Eastern Europe/CIS and Mid-East/Africa

- **Growing arbitrage opportunity** - cost differentials in R&D / manufacturing / services; time-to-market considerations

- **Responding to major global challenges as well as equity concerns** – growing need for bioenergy / biofeedstocks; those having the biggest problems (poverty / infectious disease / food shortages / environmental / ecological disasters) typically have least resources and access to knowledge/technology…

- **Can we build a truly global biotechnology industry?** - competition or cooperation?…opportunity to build “coopetitive” environment by facilitating linkages, technology partnering and transfer between and within regions/bioclusters

- **Financing innovation and value creation** - opportunity to build new business models to facilitate value creation, development, public health, addressing trans-border concerns

*Bottomline: Opportunity for enlightened self-interest…*
Some Considerations: Asia and BioBusiness

Asia is a late entrant in the BioBusiness revolution:

- US – late 1970s/early 1980s
- Canada – early 1990s
- Europe – mid 1990s
- Australia – late 1990s/early 2000s
- Latin America - ? 2007/8

Starting late has its benefits:

- learn from mistakes of those who went before (shorter learning curves)
- scientific/knowledge/technology base more mature and better validated
- opportunity to partner and license pre-existing technologies to jumpstart innovation
The BioBusiness Opportunity Landscape

Valley Opportunities: Commoditized, many competitors, low barriers to entry, low margins, “old” economy principles apply. Low bio-entrepreneurial interest unless innovative approach.

Summit Opportunities: Technology and knowledge intensive, few competitors, high barriers to entry; high margins with well-developed business case, “new” economy principles apply. High bio-entrepreneurial interest.

Cloud Opportunities: Technology and knowledge intensive, few competitors, high barriers to entry, business case not well developed, “future” economy principles apply. “KIV” interest.

Recommended Approach:
- Focus on “Summit” opportunities – putting people, technologies and resources together to capture the value proposition.

Some “Summit” Entrepreneurial Innovation Opportunities (Asia) (1)

Healthcare/Biomedical

✓ Mainstreaming traditional medicines
✓ From generic → proprietary formulations
✓ Nutraceuticals, cosmeceuticals
✓ Diagnostics – infectious/tropical disease
✓ Vaccines and biological therapeutics
✓ Medical informatics and Health-IT
✓ Wellness and disease management
✓ Contract research and contract services
   (including clinical trials, contract mfg, etc)
Some “Summit” Entrepreneurial Innovation Opportunities (Asia) _ (2) _

Agri-Vet and Food

✓ Organic farming
✓ Plantation of high demand nutraceuticals, cosmeceuticals, biomaterials
✓ Transgenics
✓ BioPharming
✓ Vaccines and therapeutics
✓ Diagnostics – infectious disease
Some “Summit” Entrepreneurial Innovation Opportunities (Asia) (3)

Environmental/Industrial
✔ Biomaterials and bioplastics
✔ Sustainable “green” energy
✔ Biofeedstocks
✔ Water
✔ Pollution control and environmental clean-up technologies
✔ Waste management
✔ New industrial enzymes/applications

Other Key Areas
✔ Bioinformatics/computational biology
✔ Outsource information management and services
✔ Molecular modeling and simulations
✔ Systems biology
✔ Life science education and human resource
BioBusiness Innovation Challenges

Environment
- Heavy investment in the life sciences
- Growing scientific base
- Expanding portfolio of intellectual property

Hurdles/Challenges
- Limited translation of academic research and technology development into commercial application
- Lack of strategic and business management expertise in life sciences
- Lack of “smart money” funding for concept development, technology validation and business case validation

Opportunities and Needs
- Identifying and nurturing development of high potential know-how and technologies
- Providing commercial acumen and marketplace orientation
- Critical business and entrepreneurship development support
- Dedicated seed financial support for promising enterprises
- Establishing sustainable life science/biotech start-up companies

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Drivers of Technology Innovation

Market-Driven Innovation
• well-defined market opportunities
• gaps and unmet needs in the marketplace

Technology-Driven Innovation
• availability of appropriate technologies
• availability of skilled personnel with appropriate knowledge and understanding

Point to consider: The existence of investors and communities of interest who are prepared to invest time and effort can potentially help accelerate the innovation development process
Understanding the BioBusiness Innovation and Commercialization Pipeline

responding to market realities

Increasing Value Proposition
Decreasing Execution Risk

Focus on science and technology
Focus on management and business development

Concept
Technology Validation
“Productization” Commercial Product and Service Devt
Business Case Validation
Market Entry and Rapid Growth

Research
(new insights and understanding)

Development
(translation of insights to practical reality)

Application
(commercial and social application)

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Our Analysis: Successful BioBusiness Environments

Critical Success Factors (given good infrastructure, facilities, policies, etc):

✓ **Smart** People
✓ **Smart** Ideas
✓ **Smart** Money (immaterial if public or private sector driven: Silicon Valley model – driven by private money; European model – driven by public money. Post-Obama?)
✓ **Smart** Alliances and Partnerships (throughout the world)

**Key Differentiator** - The quality of money: Smart Money versus “No Brainer” Money. **Note:** Access to capital alone not sufficient!
Some Typical BioBusiness Business Models

• The Service/Sales Model (CROs, CSOs, distributors, etc)
  – Enterprise offers know-how predominantly as services to support established companies
  – Project risks and IP typically belong to customers
  – Growth potential tends to be limited

  Note: Revenue-generation allows greater financial sustainability but lack of innovation in development/commercialization of own IP can hamper future growth

• The IP-Oriented Model
  – Enterprise focuses on development of own technologies/products to sell or license out
  – Project risks and IP typically belong to enterprise
  – Strategic alliances/partnership typically needed to ensure success in commercialization of own products/services/technologies

  Note: Typically financed by venture capital/private equity (the traditional “US/European” biotech innovation financing model)

• The Hybrid “Quick-to-Revenue” Innovation Model
  – Enterprise provides services while working in parallel to develop own technologies/products
  – Project risks and IP may be shared with customers
  – Twin focus on revenue-generation from services and establishment of strategic alliances/partnerships to ensure success in commercialization of own products/services/technologies

  Note: Enables enterprise to ensure financial sustainability while seeking to build own IP for future growth (the “Asia-Pacific” biotech innovation financing model)
BioPartnering: Capturing the Value Proposition

Work for win-win

Encourage public-private partnership

Bet on people

Make smart investments

Why Enter Smart Strategic Alliances and Partnerships?

Some strategic alliance and partnership opportunities across the innovation and development pipeline:

- collaboration in research and new product design/development
- clinical trials and product registration
- manufacturing alliances
- marketing/distribution
Who will be the Partnership Winners?

Successful BioBusiness players:

- are committed to respecting and safeguarding intellectual property rights of their international partners
- demonstrate the necessary technical competence and capabilities to successfully manage and implement technology transfer and partnering initiatives;
- possess strong market and business development capabilities in the region
- are prepared to share the risk of new product development for mutual value creation
# Snapshot: BioVentures in Asia

<table>
<thead>
<tr>
<th>Region</th>
<th>Estimated Number of BioVentures (2001)</th>
<th>Per Capita (per mil pop) 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>1,500 (2)</td>
<td>6.0</td>
</tr>
<tr>
<td>Europe</td>
<td>1,800 (1)</td>
<td>4.7</td>
</tr>
<tr>
<td>Asia</td>
<td>1,200 (3)</td>
<td>0.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated Number of BioVentures (2001)</th>
<th>Per Capita (per mil pop) 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea</td>
<td>300 (1)</td>
<td>6.4</td>
</tr>
<tr>
<td>Israel</td>
<td>160 (2)</td>
<td>33.3</td>
</tr>
<tr>
<td>Australia</td>
<td>150 (3)</td>
<td>7.8</td>
</tr>
<tr>
<td>Japan</td>
<td>130 (4)</td>
<td>1.1</td>
</tr>
<tr>
<td>Taiwan</td>
<td>120 (5)</td>
<td>5.1</td>
</tr>
<tr>
<td>China</td>
<td>100 (6)</td>
<td>0.1</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>50 (7)</td>
<td>7.0</td>
</tr>
<tr>
<td>Singapore</td>
<td>30 (8)</td>
<td>6.9</td>
</tr>
<tr>
<td>India</td>
<td>30 (8)</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Malaysia</td>
<td>20 (10)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Source: BioEnterprise Asia, original research, 2001-4

- Most successful in generating private entrepreneurial investment for early-stage start-ups – Korea and Taiwan
- Most effective in generating spin-offs from existing major corporations – Japan
- Most active public market for biotech – Australia
- Most successful in attracting MNCs and foreign talent – Singapore
- Most successful in attracting foreign VC investment – China and India

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The Reality Check Curve: Advice for Future BioEntrepreneurs and “BioDreamers”

The BioEnterprise Asia Approach

- Pessimism
- Uninformed Optimism
- Informed Pessimism
- Informed Realism
- “Giving Up”
- Successful Completion

Time

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Conclusions

• We are fast approaching critical mass in BioBusiness value creation as innovative technologies mature and come to fruition.

• BioBusiness success will come to those players who create a confluence of enlightened investment (smart money) in bioinnovation (smart ideas) and bioentrepreneurship (smart people) – and who are well plugged in to working synergistically with key players around the world (smart alliances and partnerships).

• There is clear opportunity and need to invest in building up the requisite skills, knowledge and competence to drive innovation and capture the value that the BioBusiness revolution will bring.

• Asia is well placed to be a major player and partner in building global value in the BioBusiness arena.
About The Global BioBusiness Initiative

Inter-disciplinary think-tank dedicated to:

- **Thought Leadership**
- **Research and Policy Analysis**
- **Professional Education and Training**
  - Focus on training “Managers of Science” through our innovative Executive Program in BioBusiness:
    - Strategic Management of Innovation and New Product Development
    - Governance and Management of World-Class Bio Enterprises
    - Financial and Investment Planning in International BioBusiness
    - Market and Business Development in BioBusiness
    - Best Practice Management and BioEthics
- **Project and Program Management and Advisory/Consulting Services**

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Some Initiatives – Global BioBusiness Initiative

• Case studies in Global Value Chain Partnering
  - Inviting project/proposal submissions

• Recognize Global and Regional Leadership in BioBusiness
  - Asia-Pacific BioBusiness Leadership Award process initiated. North America, Europe, Latin America and Caribbean, Africa and Middle East, Global Awards to be announced

• Develop accredited directory of organizations and corporations that practice “GPP” (Good Partnering Practice)
  - Currently working out possible performance standards and metrics such as technical capabilities; respect for IP; experience in partnering, etc. Invite collaboration.

• Establish Global BioBusiness Entrepreneurship Network to facilitate collaboration, professional training/executive education, research, financing, etc

• Global BioBusiness Hotspots Project

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