Seminar on How the Private and the Public Sectors Use Intellectual Property to Enhance Agricultural Productivity
Geneva, June 14, 2011

Analysis of Opportunities and Challenges in Intellectual Property Rights and Agriculture in the Indian Context

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Project Implementation Unit (PIU)
National Agricultural Innovation Project (NAIP)
Indian Council of Agricultural Research (ICAR), New Delhi
The incentive to take the risk of investing in an idea that might fail relies on the promise that, if successful, the investor will be rewarded by protection of the invention as “intellectual property rights”.

Centres of origin of crop plants and diversity of their natural (wild) relatives - Vavilov

PGR are common heritage of mankind that should be made freely available for breeding and research

Facilitate access to GRFA through Standard Material Transfer Agreement


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• Inefficient and ineffective information and knowledge flows may severely constrain development in food and agriculture
### Enterprising in food and agriculture

#### Primary products
- Grains / Staples
- Fruits & Vegetables
- Condiments & Spices
- Milk & Eggs
- Meat * & Fish
- Fodder

#### Industrial Derivatives
- Edible Oils, Cake & Meal
- Sugar, Tea, Coffee, Tobacco
- Fibre: Cotton, Jute, Coir
- Food products/
  Value added Food products:
  Breakfast/ processed/ canned foods
  Baby foods
- Aromatic oils/ Flavours
- Feed Mix
- Nutraceuticals
- Plant based medicines

#### Agricultural inputs
- Seeds & other Planting Material
- Farm Power & Machinery
- Tools & Implements
- Agro-chemicals
  Fertilizers, growth promoters, pesticides/ weedicides
- Bio agents
- Hi-Tech nursery
- Sprinkler/ Drip irrigation equipment
<table>
<thead>
<tr>
<th>Search for</th>
<th>Number of Patents in Database</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>USPTO</td>
</tr>
<tr>
<td></td>
<td>In Claims</td>
</tr>
<tr>
<td>inbred line</td>
<td>807</td>
</tr>
<tr>
<td>cultivar</td>
<td>6335</td>
</tr>
<tr>
<td>variety</td>
<td>13516</td>
</tr>
<tr>
<td>hybrid</td>
<td>13541</td>
</tr>
<tr>
<td>microbe</td>
<td>501</td>
</tr>
<tr>
<td>microorganism</td>
<td>6255</td>
</tr>
<tr>
<td>clone</td>
<td>1086</td>
</tr>
<tr>
<td>primer</td>
<td>7965</td>
</tr>
<tr>
<td>marker</td>
<td>13667</td>
</tr>
<tr>
<td>gene</td>
<td>14133</td>
</tr>
<tr>
<td>probe</td>
<td>31824</td>
</tr>
</tbody>
</table>

\(^1\) world database @ espacenet  \(^2\) Other than US Patents

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World Trade Regime

- ✓ Competitiveness
- ✓ Level Playing Field
- ✓ Development
- ✓ Global Access
- ✓ Innovativeness
- ✓ Stronger IP Rights

Questions:

- Equity/ABS?
- Environment?
- Biosafety?
- Evolution?
IPR in Agriculture: Institutions & Capacity Perspective

- **Extravagance in institutionalizing and governance**
- **Wastage of resources and time in**
  - generic trainings lacking focus on need-based HRD
  - technology incubators without apt R&D or grass-root links
- **Paucity of resources and will-to-invest in**
  - basic research and innovation
<table>
<thead>
<tr>
<th>1. Framework</th>
<th>Common Law jurisprudence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• protection based on use or reputation, even without registration</td>
</tr>
<tr>
<td></td>
<td>• Passing off remedy applicable</td>
</tr>
</tbody>
</table>

**Civil Law jurisprudence**

- protection dependent on registration
- protection available on proof of registration in the country of dispute as well as country of origin

<table>
<thead>
<tr>
<th>2. Definition (Interpretation)</th>
<th>‘<strong>Nemo dat quod non habet</strong>’ : ‘He who does not have a title in a property cannot transfer the same.’</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>Qui prior est tempore potior est jure</em>: ‘As between persons having only equitable interests, if their equities are in all other respects equal, priority of time gives the better equity.’</td>
</tr>
</tbody>
</table>

Farmers’ Rights

1979: Chair, Commission II of FAO General Conference (MSS): compared irony of the poverty of primary conservers co-existing with the prosperity of commercial breeders

1981: resolution moved at FAO General Conference, emphasizing need for equity in sharing benefits from a nation's agro-biodiversity heritage

1983: setting up of CPGR (MSS: Independent Chairman);


1992: Nairobi Final Act (Art.4): Need to resolve outstanding issue of FR

2001/2004: ITPGRFA (Art. 9) : [realization of] Farmers’ Rights

The loss of every gene and species limits our options for the future. This is why genome and gene saviors are invaluable; their efforts provide the tools to meet food security challenges – M S Swaminathan

Source: The Hindu On Line e-paper Saturday, Feb 17, 2007
Inventions not patentable in India
under the Patents Act, 1970

**sec.3(h):** methods of agriculture and horticulture

**sec.3(b):** inventions contrary to public order/morality or prejudicial to human/animal/plant life/health/environment

**sec.3(j)**: plants in whole or in part (other than microorganisms) including seeds, varieties, species and their production and propagation by essentially biological process

**sec.3(n):** a presentation of information

**sec.3(p):** invention, which is in effect traditional knowledge or an aggregation of or duplication of known properties of traditionally known component(s)

Exceptions U/s 3(b) & 3(j) are permissible under TRIPS Art. 27.2 & 27.3(b), respectively

* Whereas there are no patents for transgenic plants, these may be protected as essentially derived varieties (EDV) under the PPV&FR Act, 2001
Disclosure requirements

**Sufficiency of disclosure: U/s 10(4)(ii)):** required to deposit a sample of the material in a notified repository – an IDA under Budapest Treaty; e.g. Microbial Type Culture Collection and Gene Bank (MTCC) at IMTECH, Chandigarh

**Disclosure for source and geographical origin of biological materials: U/s 10(4)(ii)(D):** required to give particulars of deposit made in the patent application

**Non disclosure or wrongful disclosure of GR & TK is a ground for opposition (both pre-grant U/s.25(1) and post-grant U/s.25(2)) and revocation (U/s 64(1)(p)&(q)):** There can be opposition of application/patent or revocation of patent due to non-disclosure or wrongful disclosure of source or geographical origin of a biological material used in the invention and anticipation of the invention through prior knowledge oral or otherwise within any local or indigenous community
Unique *sui generis* provisions of the Protection of Plant Varieties and Farmers’ Rights (PPV&FR) Act, 2001

- **Protection of Extant Varieties**
  {Sec. 8 (2) (a); 14 (b); 28 (1) Proviso; 29 (2)}

- **Farmers’ Rights** (Chapter VI)

- **No to GURT** {Sec. 29 (3); 18 (1) (c)}

- **Benefit Sharing** (Sec. 26)

- **Compensation for Under-Performance** [Sec. 39(2)]

- **Claim for Community Right** (Sec. 41)
• Share (%) of Agriculture & Allied Sector in Total Gross Capital Formation in India has increased from 7.8% in 2004-05 to 9.2% in 2008-09

• Contribution of Private Sector has correspondingly increased from 8.1% to 10.3% whereas Public Sector contributes around 6-7%

Source: Central Statistical Organisation, New Delhi.
- Production Jump of ~ 20 Million Tonnes (21.3%) in Total Foodgrains in Green Revolution Period: 89.36 mt (1964-65) to 108.42 mt (1970-71)

- The technology-led gains were sustained/ enhanced
  Overall Foodgrains: 50.82 mt (1950-51) to 234.47 mt (2008-09)

Strength: domestic Public R&D and International Cooperation
Landmark wheat releases in India

Variety (Year of Release)

Yield Potential (Q/ha)

Sources: Directorate of Wheat Research (ICAR)
Food Sector in India: SWOT analysis

India: the second largest producer of food in the world

- Food industry: US$ 180 billion
- Food processing industry: US$ 70 billion
- Supply chain: Sub-optimal
- Investment: Low
- Share of FDI flows in India (2000-2010): 3.3%

Opportunities

- Growth expected in food retail industry: US$ 150bn by 2025
  - Fast changing demographics and habits
  - Change in consumption patterns
  - Evolution of innovative food processing capacity
  - Emergence of organized retail
- Country-wide popularization of brands that may re-engineer back-end processes and optimize supply chain management system
### Operational Holdings (2000-01) and Debt Incidences in India

<table>
<thead>
<tr>
<th>Category of Holdings</th>
<th>Operational Holdings</th>
<th>Area Operated</th>
<th>indebtedness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Av. Size (ha)</td>
</tr>
<tr>
<td>Marginal (&lt; 1 ha)</td>
<td>75408</td>
<td>62.3</td>
<td>0.40</td>
</tr>
<tr>
<td>Small (1.0 to 2.0 ha)</td>
<td>22695</td>
<td>19.0</td>
<td>1.42</td>
</tr>
<tr>
<td>Semi-Medium (2.0 to 4.0 ha)</td>
<td>14021</td>
<td>11.8</td>
<td>2.72</td>
</tr>
<tr>
<td>Medium (4.0 to 10.0 ha)</td>
<td>6577</td>
<td>5.5</td>
<td>5.81</td>
</tr>
<tr>
<td>Large (≥ 10.0 ha)</td>
<td>1230</td>
<td>1.0</td>
<td>17.12</td>
</tr>
<tr>
<td>All Holdings</td>
<td>119931</td>
<td>1.33</td>
<td>159436</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture. Agricultural Statistics at a Glance
Seed Sector in India

Commercial world seed market  US$ 42 bn approx
India's share in World Seed Trade  < 1 %
Value of Indian domestic seed market  US$ 1,500 m

Value of domestic seed market in selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>US$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>8,500</td>
</tr>
<tr>
<td>China</td>
<td>4,000</td>
</tr>
<tr>
<td>France</td>
<td>2,150</td>
</tr>
<tr>
<td>Brazil</td>
<td>2,000</td>
</tr>
<tr>
<td>India</td>
<td>1,500</td>
</tr>
<tr>
<td>Japan</td>
<td>1,500</td>
</tr>
<tr>
<td>Germany</td>
<td>1,500</td>
</tr>
<tr>
<td>Italy</td>
<td>1,000</td>
</tr>
<tr>
<td>Argentina</td>
<td>950</td>
</tr>
<tr>
<td>Canada</td>
<td>550</td>
</tr>
<tr>
<td>Russia</td>
<td>500</td>
</tr>
<tr>
<td>Spain</td>
<td>450</td>
</tr>
<tr>
<td>Korea</td>
<td>400</td>
</tr>
<tr>
<td>Australia</td>
<td>400</td>
</tr>
<tr>
<td>U.K.</td>
<td>400</td>
</tr>
</tbody>
</table>

Source: International Seed Federation <www.worldseed.org>
Seed Sector in India – contd.

Domestic seed market: In value terms
- Commercial seed market (coverage of the potential) 25%
  - Public sector 24%
  - Private sector 43%
  - Unorganized seed sector 33%
- Hybrids (coverage of organised seed trade) 40%

Domestic seed market: In volume terms
- Rice and Wheat 85%
- Cereals and Millets 96%
- Other crops 4%

Seed import and export

<table>
<thead>
<tr>
<th>Year</th>
<th>Field crops</th>
<th>Vegetables</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed import</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>US$ 15 million</td>
<td>US$ 37 million</td>
<td>US$ 52 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Field crops</th>
<th>Vegetables</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed export</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>US$ 16 million</td>
<td>US$ 17 million (3870 Metric Tonnes)</td>
<td>US$ 33 million</td>
</tr>
</tbody>
</table>
## Indian Context: Some Key Milestones

<table>
<thead>
<tr>
<th>Decade</th>
<th>Event</th>
<th>Agency/Regulatory Body</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950s</td>
<td>Indian Maize Hybrid (release in 1961)</td>
<td></td>
<td>Small Seed Companies (in Veg &amp; Ornamentals)</td>
</tr>
<tr>
<td>1960s</td>
<td>Semi-dwarf Varieties of Wheat and Rice</td>
<td>UPOV (1961/72)</td>
<td>National Seed Agencies/Farmers’/NARS’ Role</td>
</tr>
<tr>
<td>1970s</td>
<td>First Hybrid Cotton</td>
<td>NSP (1976)</td>
<td>State Seed Corporations</td>
</tr>
<tr>
<td>1980s</td>
<td>New Policy on Seed Development (NPSD)</td>
<td>IUPGR (1983)</td>
<td>Breeder Seed to both sectors Private sector surge (in Hybrids)</td>
</tr>
<tr>
<td>1990s</td>
<td>National Gene Bank: capacity 1 million samples</td>
<td>CBD, TRIPS</td>
<td>R&amp;D in seed sector: Private Sector interest in AICRPs</td>
</tr>
</tbody>
</table>

* wheat variety **PBW 343**, rice hybrid **PRH 10**, cotton transgenics >90 hybrids
Private Seed Sector acknowledges Public Sector Contributions

- Many small and medium sized companies produce/market popular varieties released by public Institutes (ICAR/SAUs)
  - Selective list provided

- Private seed companies have also been benefited as these releases formed the base material for the start of their breeding programs
  - Okra hybrids developed and sold by private companies today owe their success to releases resistant to YVMV
  - In tomato, private industry has successfully used the bacterial wilt resistant lines released from public institutes to develop resistant hybrids

Source: Deepak Fertilisers and Petrochemicals Corp. Ltd. <www.deepakgroup.com>
Industry for other agricultural inputs

Fertilizers
Agri-equipments
Pesticides
Other input products
with huge market potential

US$ 30 billion
US$ 5,500 million
US$ 1,500 million

Biofertilizers
Biopesticides
Bioagents (pollinators)
Micronutrients,
Soluble fertilizers

• Predominately non-exclusive marketing presently
• Market goodwill ensured by
  • well known brands (registered or unregistered trade marks)
  • organized chain of registered retailers
• Patenting in agriculture taking momentum
• Future marketing of knowledge intensive input product packages under the exclusive patent regime may depend on how patenting in biotechnological products sets its pace
Published Patent Applications on transgenics in plants

- Indian applicants, 12, 13%
- MNCs/Foreign Co’s, 49, 52%
- Foreign Univ/Institutes, 33, 35%

MNCs and Foreign Companies

- MNCs (2 pub applications), 10, 20%
- MNCs (3-4 pub applications), 6, 12%
- MNCs (5-10 pub applications), 4, 8%
- MNCs/Foreign Co’s (1 pub application), 24, 50%
- MNCs (1 pub appl), 2, 4%

Indian applicants for inventions in transgenics in plants

- Seed Companies, 2, 17%
- NGOs/International Centres, 2, 17%
- Institutes/Universities, 4, 33%
- Public Organizations, 4, 33%

Foreign NARS, universities and research institute applicants

- Foreign univ/Res Instt (3-4 pub appl), 8, 24%
- Foreign univ/Res Instt (2 pub appl), 7, 21%
- Foreign univ (1 pub appl), 9, 27%
- Foreign Res Instt (1 pub appl), 9, 28%
- Foreign univ (1 pub appl), 9, 27%
Novel proprietary technologies in plant transgenics entering the Indian agriculture landscape

<table>
<thead>
<tr>
<th>Field</th>
<th>No. of Appl. (Applicants)</th>
<th>Genes/ Crops/ Other features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Crops</td>
<td>33 (17)</td>
<td>Rice, maize, sorghum, chickpea, pea, soybean, okra, tomato, sunflower</td>
</tr>
<tr>
<td>Transgenic Event</td>
<td>7 (4)</td>
<td>PE-7 (Rice), PE-4 (Rice), MON 89034 (Maize), DP-098140-6 (Maize), MIR I62 (Maize), Elite/ undescript (Okra), Detection</td>
</tr>
<tr>
<td>Yield Increase</td>
<td>13 (4)</td>
<td>HSRP, SHSRP, ACCDP, MTP, ste20-like expression, RNA-editing to generate male sterile lines</td>
</tr>
<tr>
<td>Drought Tolerance</td>
<td>5 (4)</td>
<td>via a plastid genome, nucleotide sequences, encoded polypeptides, non-descript,</td>
</tr>
<tr>
<td>Disease/ stress resistance</td>
<td>20 (13)</td>
<td>Soybean rust, Squash Mosaic Virus, PITA gene, Commelina Yellow Mottel Virus, Cassava Vein Mosaic Virus, Cestrum Yellow Leaf Curling Virus, Bacterial blight of rice, multiple resistance, others</td>
</tr>
</tbody>
</table>
### Patentees by Category of the Granted Indian Patents for "Transgenic Plant" (as on 1.3.2011)

<table>
<thead>
<tr>
<th>Category</th>
<th>Patentees</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Foreign Universities/Institutes</strong></td>
<td>Auburn University, Bar Ilan University, Texas Tech University, The University of Chicago, University of Central Florida, The Hebrew University of Jerusalem, Leibniz-Institut fur Pflanzengenetik und kulturpflanzenforschung (IPK), Max-Planck Gesellschaft</td>
</tr>
<tr>
<td><strong>Indian Universities/Institutes</strong></td>
<td>ICAR (Indian Agricultural Research Institute), Bose Institute, Tamil Nadu Agricultural University</td>
</tr>
<tr>
<td><strong>Foreign Individuals</strong></td>
<td>Raab, R. Michael, Yeh, Shyi-Dong</td>
</tr>
</tbody>
</table>

**Source:** Kochhar, 2011. JIPR 16(2) 69-3; Compiled; Data from http://ipindia.nic.in/... patent search.
## Protection of Plant Varieties

<table>
<thead>
<tr>
<th>Number of PVP applications</th>
<th>2220</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 31.12.2010</td>
<td>2119</td>
</tr>
<tr>
<td>Extant</td>
<td>1222</td>
</tr>
<tr>
<td>New</td>
<td>841</td>
</tr>
<tr>
<td>EDV</td>
<td>1</td>
</tr>
<tr>
<td>Farmer</td>
<td>55</td>
</tr>
<tr>
<td>From 1.1.11 to 1.3.11</td>
<td>101</td>
</tr>
<tr>
<td>mainly new</td>
<td></td>
</tr>
</tbody>
</table>

### Grantee

<table>
<thead>
<tr>
<th>Grantee</th>
<th>Titles issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Sector</td>
<td></td>
</tr>
<tr>
<td>Indian Council of Agricultural Research</td>
<td>186</td>
</tr>
<tr>
<td>Orissa University of Agricultural &amp; Technology</td>
<td>7</td>
</tr>
<tr>
<td>Birsa Agricultural University</td>
<td>2</td>
</tr>
<tr>
<td>Dr. Panjabrao Deshmukh Krishi Vidyapeeth</td>
<td>3</td>
</tr>
<tr>
<td>Private Seed Companies</td>
<td></td>
</tr>
<tr>
<td>New Nandi Seeds Corp.</td>
<td>7</td>
</tr>
<tr>
<td>JK Agrigenetics</td>
<td>4</td>
</tr>
<tr>
<td>Maharashtra Hybrid Seeds Co. Ltd.</td>
<td>2</td>
</tr>
<tr>
<td>Ajeet Seeds Ltd.</td>
<td>2</td>
</tr>
<tr>
<td>Vikram Seeds Ltd.</td>
<td>1</td>
</tr>
<tr>
<td>Farmers</td>
<td></td>
</tr>
<tr>
<td>Individual Farmers</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>217</td>
</tr>
</tbody>
</table>

[http://www.plantauthority.gov.in/application.htm](http://www.plantauthority.gov.in/application.htm)
Geographical Indications: a “way out”

- from subsistence to commercial agriculture
- a model of “industrial agriculture”

There is scope for the registered GI owners to explore partnerships for international trade of some of these GIs.
Changing Nature of Research / Innovation Providers

- **Public R&D System**
  - NARS-SAUs, Incubators, Business Planning and Developers
  - International Research Centres / Foreign NARS & Universities
- **Private R&D**
  - Multinationals / Foreign Companies
  - National Companies
- **Non-Governmental or non-profit organizations**
- **Farmers:** Farmers Breeders, Farmer Innovators (Participatory and Individuals), Farmer Conservers
- **Trade Promoters / Traders**
  - Export Promotion: Commodity Boards for key export commodities (tea, coffee, coconut, spices, etc.)
  - Traders & Knowledge providers in agriculture in domestic circuits
Delivery Mechanisms: Private Extension Services

- Community Based Organizations
  - Farmers’ Organizations, Farmers’ Cooperatives, Self Help Groups, Farmer Interest Groups, etc.

- Para Extension Workers
  - Contact farmers, link farmers, master farmers, gopals, mitra kisans, mahila mitra kisans, etc.

- Agri-Clinics & Agribusinesses

- Input Suppliers/ Dealers
  - Pesticides, Seeds, Nutrients, Farm Implements, etc.

- Corporate Sector
  - Commercial Crops Seeds – tobacco, tea, coffee, oilseeds (sunflower), vegetables, etc.
  - Farm Implements – tractors, threshers, sprinklers, drip irrigation, etc.
Positive interventions in Agri-Biotech by ICAR-DARE

- Public funding for research and higher education in Agri-Biotech
- Research networks in Agri-Biotech
- Crop/ Commodity based vast infrastructures
- Collaborative research – Public-Public and Public-Private Collaborations
- Well-defined / described IPR / Commercialization Policy and Guidelines
- Policy support and Technical Backstopping
Policy & Guidelines
Implemented vide o/o
w.e.f. 2nd October, 2006

Execution
• 3-tier management mechanism
  • Institute level; Zonal; Central
• All ICAR Directors are delegated with the powers to file patent/ IPR applications at the respective offices/ registries in whose jurisdiction concerned institution is located - vide o/o F.No. 6(2)/2001- Cdn(A&A) Dated 1.12.2005/ ...

Soft copy available at ICAR webpage:-
http://www.icar.org.in/files/reports/other-reports/icar-ipmttcguide.pdf
Salient IPR protected ICAR technologies commercialized

- Rapid Detection of *Bt* Cry toxin
- *Bt*-1, *B. bassiana* formulation, *T. virde* formulation
- Biopesticide formulation, neem based pesticides
- Production of antagonistic fungi
- Plant varieties/ Hybrids/ Transgenic events,
- FMD vaccine, Vaccine for *peste de petits* ruminants, Crystoscope,
- CIFAX, CIFACURE, CIFACRYO, Jayanti Rohu, FRB portable Carp Hatchery
- Low energy de-hulling of mustard seed, cheaper bleaching material, maturity index calculator, groundnut pod decorticator, aonla beverage
- CRIJAF Seed sowing machine
- Copra drier, copra chips making machine
- Cassava starch graft poly (acrylamide), extruded cassava snacks
- Immobilizing matrix from bagasses for bacterial biomass
- Software
Strengthening basic and strategic research in frontier areas of agricultural sciences

NAIP Component-4: 61 consortia; 253 partners; 10 Public-Private Partnerships; Aug 2007-Sep 2009

Research focus is on molecular and nano aspects; on following themes:

- Stress (abiotic/biotic) tolerance in agriculture
- Molecular genetics and breeding
- Nanotechnology
- Precision farming
- GIS application in agriculture
- Natural resource management
- Structures and processing engineering
- Social sciences in agriculture
- Animal Reproduction & health
- Sensor network for cattle yard management
- Milk and dairy production
- Rumen physiology and ecology
- Meat production

- Many important genes and other resources deposited to GenBank
- First commercial plant virus detection kit (ELISA based)
- Garima-II: The first buffalo calf produced from Stem Cell research
- Colour based method for detection of detergent in milk
Seed Industry: The Flagship and the Anchor

Seed to Prosperity and Human Well Being: the Iceberg Effect

- Commercial Product
- Genetic Resources and other IP Assets
- Varietal Portfolio
- R&D Industry

- Up-scaling
- Contract Research/Consultancies/Collaborations
- Incubators/Start-ups
- Acquisitions & Mergers

- Breeders/Assignees
- IPR Regime/Licensing
- Traders
- Other regulatory regimes
- Conservers/Curators
- Germplasm Enhancement
- Omics and Gene mining
- ABS Regime

Seed to Prosperity and Human Well Being: the Iceberg Effect

- Up-scaling
- Contract Research/Consultancies/Collaborations
- Incubators/Start-ups
- Acquisitions & Mergers

- Breeders/Assignees
- IPR Regime/Licensing
- Traders
- Other regulatory regimes
- Conservers/Curators
- Germplasm Enhancement
- Omics and Gene mining
- ABS Regime
Having already achieved this, now there is scope for -
Incentivised building up of new diversity for future use

1. Build up/ avail opportunity/ potential to support cryptic evolution under intensive agriculture systems

2. Innovative discovery and selection of desirable variants in climate change context

3. Public disclosure of innovations (variants) and their derivatives in patent/ PVP applications

4. Public access of new inventions/ innovations through licences/ cross-licenses to allow furthering the cryptic evolution.

5. Develop Suitable/ Ethical Codes to (and) pool/ share molecular resources (genes/ promoters/ QTLs/ markers/accessions)
Incentivised building up of new diversity for future use: Managing IP outputs and ABS

- Materialize joint IP ownerships.
  - Facilitate attempting some suitable license agreements/benefit sharing arrangements among the stakeholders
- Assign IP to governments or at least provide a world-wide royalty-free license for any commercial or strategic use in the public domain
- Encourage compulsory licensing to provide access to assigned genes/genomes for all interested R&D establishments
  - Licence fee/royalty may go to national funds for IP/Biodiversity
- Incentivise on-farm conserver innovators through reasonable compensation from national funds
- Firm up workable out-of-the-box institutional interventions at legislative, policy and administrative levels
Facilitated collaborative public-private R&D

• The private sector should appreciate that in general the public research system is either shy or conservative/orthodox in the negotiation process and in drafting/executing of appropriate MoUs/Collaborative R&D Agreements.

• A properly developed ‘Clearing House Mechanism’ for gathering/distributing/disseminating information on germplasm available with various collaborators/stakeholders would be helpful.

• Proprietary and non-proprietary pools of resources and tools in various fields, for use in R&D by collaborating partners on prior-informed/mutually-agreed terms should be developed/managed as a part of the collaborative project activities.
Need for an academic build up of the IPR subject

- To overshadow superfluous, redundant and often-confusing literature/e-literature
- To produce duly streamlined, simple and effective theories, practices and bridging theories; and uniform curricula for schools and colleges- - UG & PG levels
- To update and publish standard textbooks on IPR
It’s important to sustainably harness both value and worth

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