Role of Digital and AI Technologies in Indian Agriculture: Potential and way forward

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NITI Aayog
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National strategy on AI

National Strategy on AI aimed to realise the potential economic and social benefits the technology offers.

NITI Aayog mandated to create the roadmap for implementation of AI in India in 2018 budget speech.

National strategy on AI released in June 2018 to identify AI goals, priority sectors, and major recommendations.

Act as the ‘AI garage for the world’ to realise potential increase of 15% in India’s income by 2035.
The National Strategy on AI recognizes agriculture as one of the priority sector areas for implementation of AI driven solutions.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Strategy</th>
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<tr>
<td><strong>Health</strong></td>
<td>Promote applied research: Two tiered research institute structure with a focus on creation of commercializable products (COREs and ICTAIs)</td>
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<td><strong>Agriculture</strong></td>
<td>Guide innovation: ‘Moonshot Challenges’ to guide research and start-up ecosystems to solve for most pressing government concerns</td>
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<td><strong>Education</strong></td>
<td>Facilitate application: Create foundational data sets for AI application; Ease access of existing data sets; Define data sharing mechanisms</td>
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<td><strong>Mobility</strong></td>
<td>Skilling and education of the workforce</td>
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<td><strong>Infra</strong></td>
<td>Cloud based AI hardware infrastructure (AIRAWAT)</td>
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Challenges in agriculture

Digital technologies and AI have the potential to significantly impact a number of challenges to Indian agriculture today; though major change cannot be driven by technology alone.

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<th>Section</th>
<th>Challenges</th>
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<td>Financing</td>
<td>Poor access to credit and information</td>
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<td>Farm inputs</td>
<td>Small land holding size</td>
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<td>Lack of irrigation coverage</td>
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<td>Poor mechanization of farms</td>
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<td>High dependence on rainfall for water</td>
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<td>Farming</td>
<td>Decrease in soil fertility</td>
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<td>Lack of crop diversification</td>
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<td>Pest infestation leading to crop loss</td>
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<td>Changing cropping patterns</td>
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<td>Selling and distribution</td>
<td>Wastage in supply chain</td>
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<td>Exploitation of farmers by intermediaries</td>
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<td>Poor market discovery mechanisms</td>
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High impact to solve via digital/AI
Low potential to solve via digital/AI
Major areas of digital technology application

The growth of ‘agritech’ solutions and startups is indicative of the growing demand for solutions for specific applications.

**Financing**
- Insurance payouts linked to weather/field data
- Data backed credit risk assessment

**Farm inputs**
- Information dissemination through chat/SMS/call
- Tech enabled agri-extension workers
- Online market for agri inputs

**Farming**
- Precision farming using IoT and remote sensing data
- Predictive pest management
- Real time yield forecasting

**Selling and distribution**
- Price discovery, marketing through online channels
- Track and trace of produce through supply chain

Source: Harvesting golden opportunities in Indian agriculture, Mckinsey (June 2018)
Improving access to enable technology adoption

As penetration of mobile and internet connectivity amongst farmers increases the adoption of technology enabled solutions will only grow; important to develop solutions to take advantage.

Rural internet base growth is leading overall growth, driven by low data cost and increasing smartphone penetration.

Though current usage is primary ‘social media’, projected to expand to other services as consumer maturity increases.

Specific national level initiatives and potential

Some specific areas of AI adoption are already being considered and deployed at a national level as well;

- **Mobile based Recommender Systems and Expert Systems:**
  Enabler of the shift of location based advisory services to the personalized and context specific advisory

- **AI based automatic grading and sorting for vegetables and fruits:**
  Creating an international agri-commodity standard aiding reliable trading across country boundaries

- **AI auto-translation among various languages, text to speech/speech to text in Indian languages:**
  Improve access to required knowledge generated by the National Agricultural Research and Education System (NARES).

Government as an enabler to scale deployment

Agritech AI startups would benefit greatly from government support in providing support for access to AI specific needs; data and compute infrastructure

Requirements of AI Solutions

- Data for training of AI Algorithms
- Compute infrastructure required for storage, training, and inference
- Domain specific expertise to design solutions

Government support outline in National Strategy

- Creation of domain specific annotated data sets (image database of pest infested crops); data standards farm generated data; improved access for existing data through data marketplaces
- AIRAWAT cloud compute platform to enable AI solution developers to train algorithms affectively, host large ‘common good’ data sets
- Application focussed research institutes (ICTAIs) to promote inter-sectoral linkages; Moonshot programs to guide innovation to government priorities
Data: What are the challenges being faced?

Lack of open agriculture data standards has much of agri data stored in silos; which in turn is a key barrier to nurturing an agritech startup ecosystem in India.
Data: Creation of annotated datasets

Facilitation of creation of India specific large annotated datasets for diagnosis, sorting, or knowledge dissemination

Examples of different phenotypes of tomato plants with affected by varieties of pest

Source:
An open access repository of images on plant health to enable the development of mobile disease diagnostics, Hughes and Salathe' (2018)

Annotated corpora of text and speech for agriculture specific requirements to enable localized knowledge dissemination
NITI Aayog proposal: Development of ‘agristack’

Creation of common data infrastructure by the Government can reduce duplication of effort by many startups and researchers in the area, and lower barrier of entry to creating agritech products.

- Identification of data sources and collection of data
- Processing of data to create data in the desired format
- Creation of channels for continuous access to data
- Development of application that uses data for delivery of services

Proposed Stack would significantly ease process of developing viable solutions for the agriculture sector, and enable increased research and analysis.
Next steps for implementation of agristack

Meet with government data owners to understand current data sharing mechanisms and restrictions (open sourcing, etc)

Development of standards for sharing of agriculture data with data owners, in collaboration with the private sector

Establish timelines and targets for standards development and data release
Way forward

Implementation of agriculture initiatives under National AI Strategy

- Establish a agriculture focussed AI institute (ICTAI)
- Launch of ‘moonshot’ projects with focus on identifying pressing agriculture problems
- Creation of annotated datasets for use in agriculture domain (plant pest images, language)
- Leverage AIRAWAT cloud compute platform to facilitate innovation

Creation of ‘agristack’

- Creation of common agricultural data standards and sharing mechanisms through inter-ministerial consultations
- Creation of an ‘API’ layer for access of data relevant for agricultural sector
Thank you

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