



Key enablers & challenges for growth of seed industry

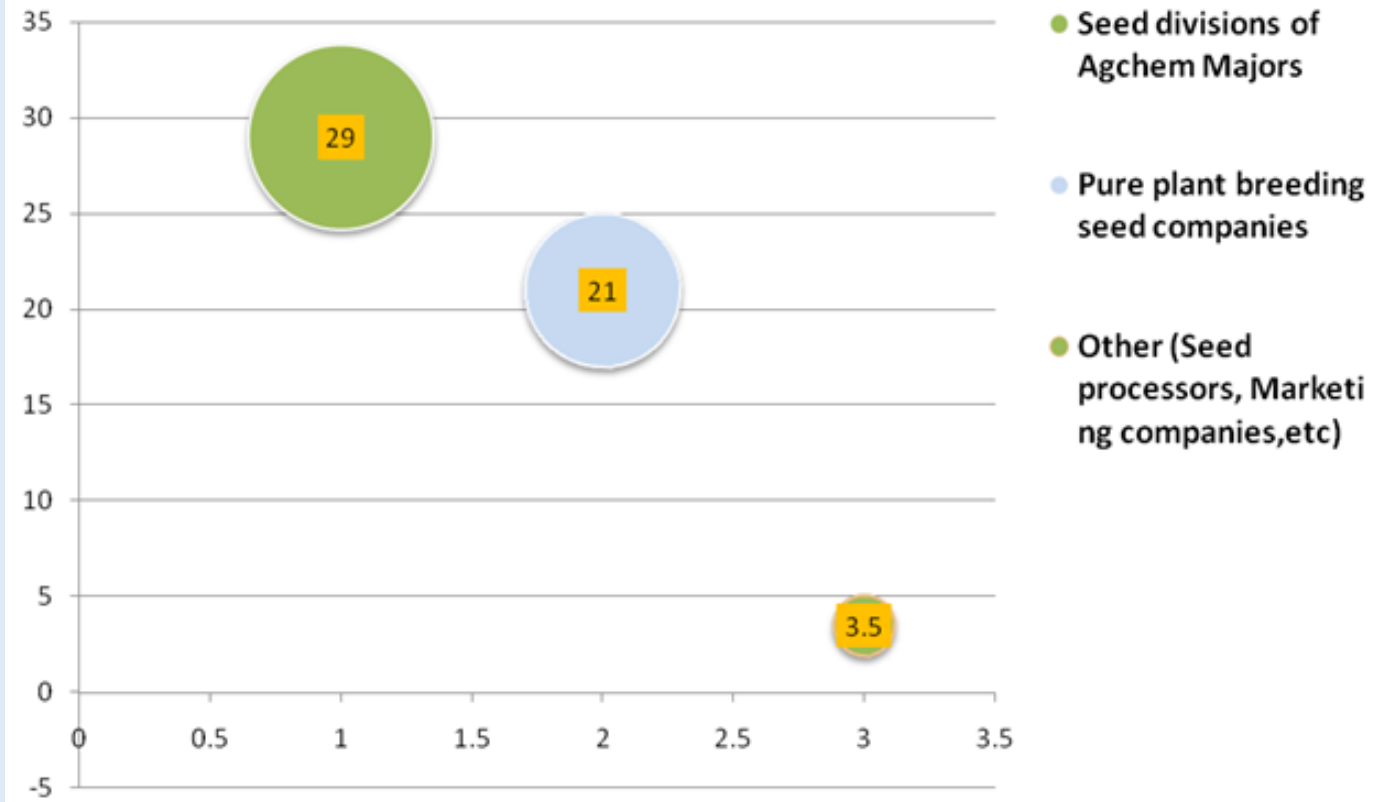
M Prabhakar Rao

President, National Seed Association of India

Chairman & Managing Director of Nuziveedu Seeds Limited (NSL)

Global Seed industry ecosystem

- Global Seed industry comprises of,
 - Individual plant breeders or plant breeding R&D based companies
 - Biotech trait development companies or trait license providers
 - Seed producers & Seed processors
 - Seed marketing companies
 - Farmer cooperatives involved in plant breeding, seed production, seed processing and marketing
 - Public sector institutions involved in plant breeding and seed production,
 - Pure-play Plant breeding /R&D driven seed companies with end to end functions
 - Agri-Chemical majors with Seeds division with end to end functions
 - Intermediaries & organizations dealing with support functions
 - Suppliers (Seed treatment, Processing machinery, etc.)



Global Seed industry is USD ~55 Bn in value as per 2018-19 estimates

Ref: ISF, ISAAA, INRA and NSAI estimates. Estimates of public sector, seed producers and seed marketing companies are only deduced for representative purposes only.

Seed distribution and marketing

Front line Demos to farmers and other stakeholders

Marketing & Channel management

Seed production & processing

Quality assurance at all levels

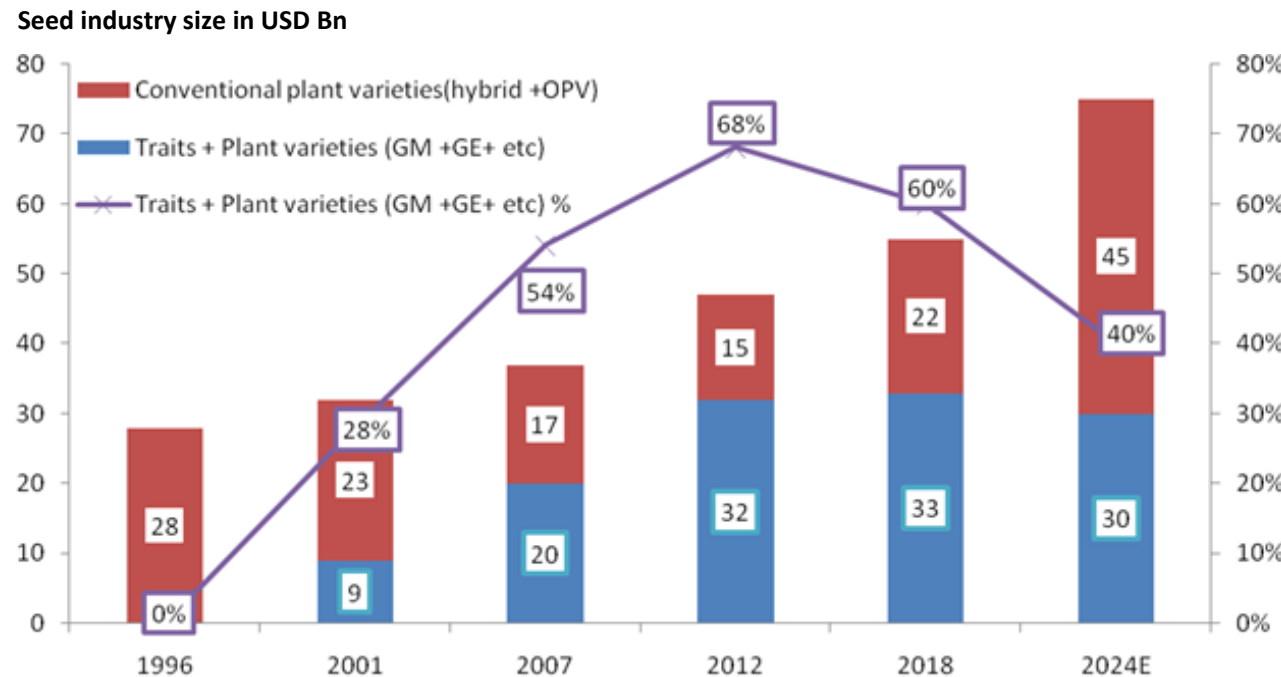
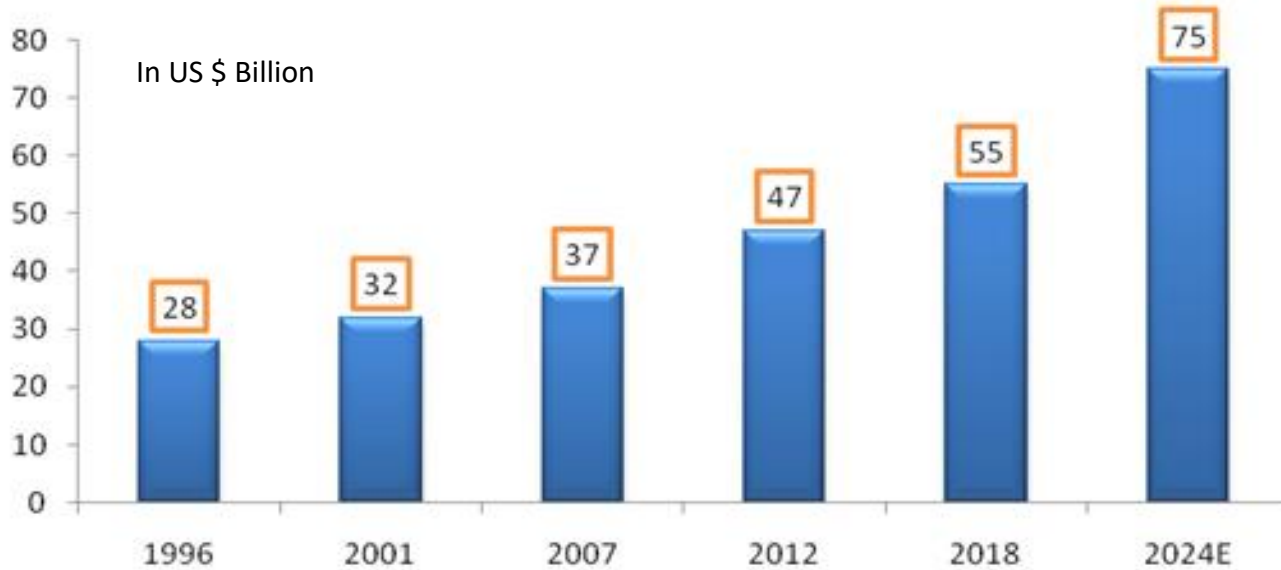
Production monitoring

Seed/Plant variety R&D

Development of Plant varieties using Conventional Plant breeding complemented by Biotechnology tools/Other methods

Product evaluation trials in multiple environments & farmer conditions for varietal release

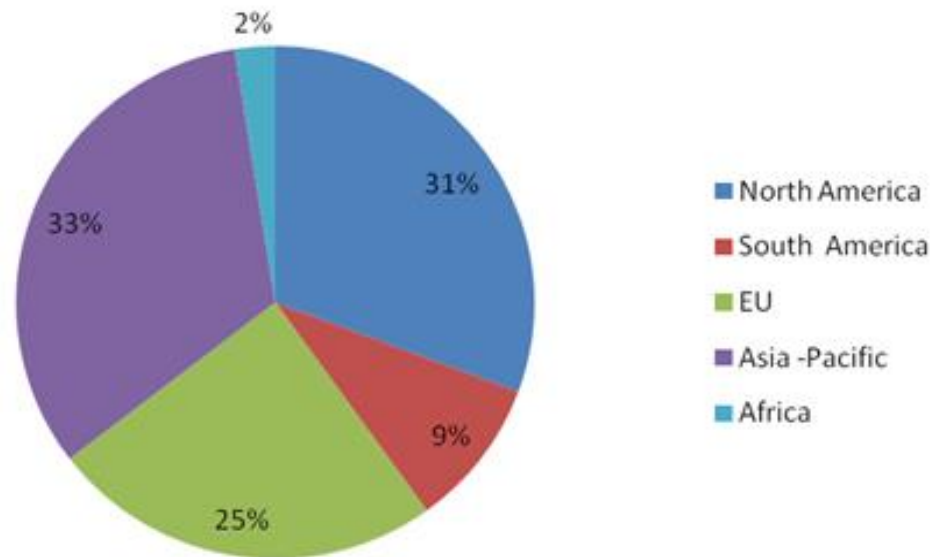
Global seed industry- Key growth trends



Source: INRA, ISAAA, ISF,NSAI estimates

- ❑ The market size of global commercial seed sector has been estimated by various agencies ranging from USD 50 Bn to USD 55 Bn in 2018-19 growing at CAGR of 5.3% based on various sources (INRA/ISF/NSAI/ISAAA) the global seed industry has been estimated to reach USD 75 bn in 2024.
- ❑ Global vegetable seed market is estimated at USD 9 Bn and may increase to USD 16 Bn at a growth rate of 9.5%. Vegetable seed market is poised to high growth rates in view of changing dietary habits and urbanization.
- ❑ While US and EU have largely become mature seed markets with low growth rate (<2%), markets in South Asia and Africa have potential for high growth rates (>10%) due to scope for SRR, Hybridization and need for new plant varieties breaking the productivity barriers with tolerance to biotic and abiotic stresses.

Global seed industry-Key growth trends

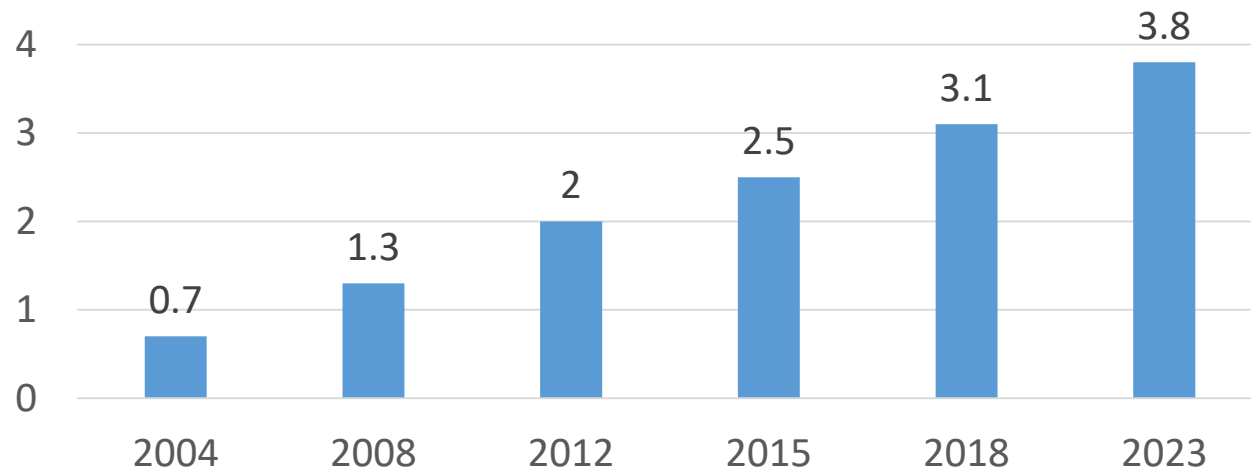


Global seed industry size in 2018 estimated at USD 55 bn

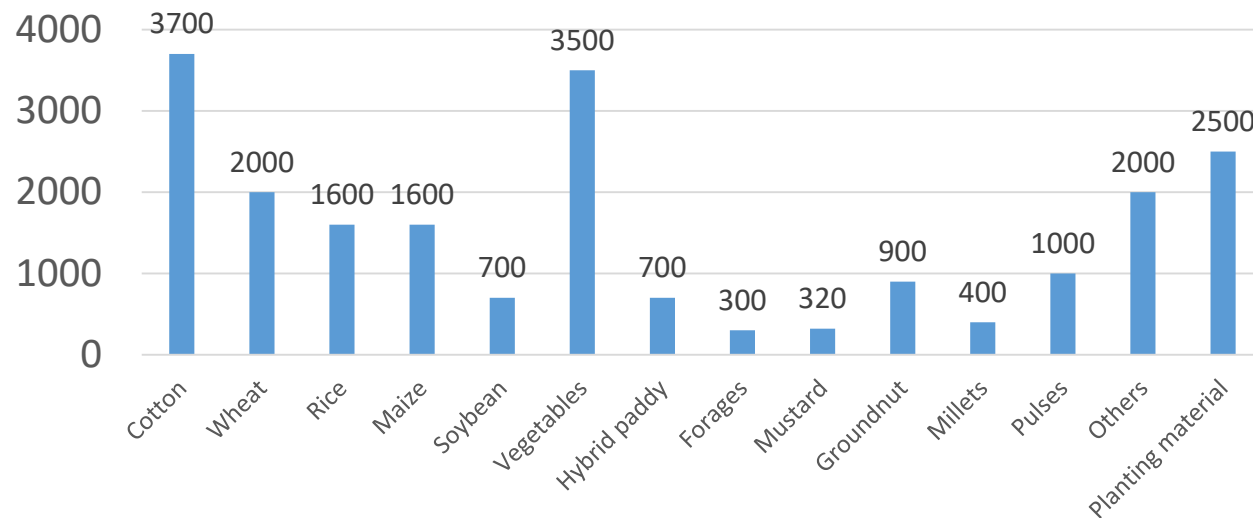
- ❑ GM crops grew from 1.7 million ha in 1996 to 190 million ha in 2017-18 adopted in 24 countries presently. The advent of GM traits in Plant varieties has created a new product segment of GM trait crop seeds of both Plant varieties and Hybrids which grew to USD 33 bn in 2018-19.
- ❑ GM crops have also created bundled agri-inputs (Eg: HT GM trait introgressed in plant variety + use of with Herbicide product).
- ❑ Increased awareness on use of Quality seeds of high genetic purity has led to increase in SRR of cereals, oilseeds and pulses thereby resulting in significant improvement of crop productivity. The SRRs have increased from almost <10% in 1980s to more than 40% in in cereal crops in the past two decades in India and developing countries in Asia and Africa.
- ❑ Increase in global seed trade-imports by 22% from USD 9 bn in 2011 to USD 11 bn in 2016-17 opening up new opportunities for testing and sale of new plant varieties in geographies with similar agro-climatic conditions.
- ❑ Hybridization % also increased in Cotton, Corn and Vegetables rapidly in the past two decades from as low as 20% to 30% to 95% to 98% in different regions of the world

Indian seed industry- A snap shot

Indian Seed industry in USD Bn



Indian seed industry (in Rs crores)



- Indian seed industry is ~ USD 3.1 bn in 2018-19
- India can leverage its competitive advantage in terms of natural agro-climatic advantage for breeding both temperate and tropical crops and skilled/trained scientific workforce to serve domestic and international demand for quality seed of improved plant varieties in key crops.
- Increase in SRR and Hybridization rates will be the key opportunity and growth driver in the future.

Seed industry is defined by its end consumers

Plant variety and seed as a product offering to farmer/end-consumer and the governing legislative & regulatory systems need to be defined based on the specific business/economy/market contexts. What fits for a large acre mechanized farming in Americas/Europe need not be completely relevant in a smallholder context in Asia/Africa.

Also consumer requirement/need for improved plant varieties and realization of genetic gains should be the primary growth driver for seed industry. Crop protection, Mechanization and other inputs follow the seed as a product which represents the plant variety/genetic potential.

The farmer always has the choice to save, use and exchange seed for agriculture, which is a farmer's right. Keeping in view the uniqueness of seed as an input and the nature of consumers and national interest, national laws for seed quality regulation, Plant variety IPR protection have been devised by different countries.

Flexibility in defining IPR protection framework for plant varieties as a *sui generis* model has been allowed as a global multi-lateral agreement between nations. Accordingly India has promulgated PPVFR act for protection of plant varieties and farmer's rights which is a model for Plant breeding/seed industry.

Salient emerging Challenges

The seed & plant variety industry narrative viewed from the lens of “genetic gains developed by conventional plant breeding” has now shifted to a complicated view driven by multiple competing economic interests, especially after advent of GM crops and bundled products and technologies. The key challenge is to view and understand seed & Plant variety industry as it is with conventional plant breeding at its core.

After registering initial exponential growth, GM trait technology based Plant variety market has stagnated since 2012-2016 between USD 32-33 bn. The emergence of resistance among target pests such as PBW in India is a challenge that needs to be mitigated. New technologies such as Gene Editing is at its initial phases which need to be integrated successfully into breeding programs.

Increase in costs of R&D investments, technology costs, labour costs, seed production and supply chain costs has put margin pressures on conventional plant breeding based seed companies leading to exit of small and medium players from the market.

Salient emerging Challenges

Approx. top 4 companies in the global seed industry with 7500 companies were 8% in 1985, 12% in 1996, 51% in 2016 in an industry as per a study by INRA-France. Wave of big mergers and consolidation among Ag-chem majors with Seed business has altered the competitive landscape of seed industry. The challenge is for small and medium seed companies to navigate in such a skewed competitive market environment

Seed and plant variety being unique as a product, the global multilateral treaties have enabled creation of *sui generis* Plant variety protection systems. Force fitting global business models without alignment to local regulations and socio-economic conditions is a huge challenge, which needs to be addressed on all fronts

Failure of regulatory systems to contain unauthorized release of hazardous GM traits into environment is a serious industry challenge and also a public health and social hazard.

Emergence of significant grey market/ fly-by-night players operating for short term economic interests erode the value of seed industry and create reputation loss to entire industry

Global climate change is a direct challenge to humanity. The key challenge for the plant breeding/biotech based seed industry is to develop Climate resilient Plant varieties which can adapt to the new normal of changing climate patterns

Key Enablers

Increasingly breeding programs are designed over a narrow genetic base based on widely accepted plant varieties. The key challenge is to broaden breeding programs with suitable access to genetic resources in line with dynamic market & consumer requirements and global climate changes.

- Clear guidelines for access to germplasm, linked with Benefit sharing frameworks designed for facilitated access to genetic resources will broaden breeding programs and improve optimal utilization of genetic diversity and overcome breeding challenges to biotic (eg: Fall army worm, PBW, BPH, Rust, etc) and abiotic stresses (eg: Drought, salinity, etc).

Global climate change is shortening product life cycles for rapidly breeding plant varieties with tolerance to multiple biotic and abiotic stresses and wider adaptability. This needs continuous innovation in plant breeding and an enabling environment which develops harmony between regulatory, IPR and business systems.

- Coordinated design and functioning of IPR, Product evaluation, regulatory and business systems will create an enabling environment

Improving profitability and productivity of smallholder agriculture has been a key challenge for Plant variety development in harmony with effective agronomic methods and suitable mechanization.

- R&D to develop comprehensive assessment approaches across multiple parameters for holistic assessment of plant varieties to tailor to mechanization and improved agronomies.

Key Enablers

Harmonization of SPS & Quarantine procedures across various countries has been a challenge for boosting international seed trade.

- An integrated international quality assurance and regulatory framework for both seed production and seed quality will enable

Multiple trials for DUS testing, State & Central/Federal varietal identification, Product registration leads to opportunity loss for seed industry

- Alignment of testing mechanisms, standards and sharing of data and coordinated functioning of agencies will enable providing the opportunity for complete product life cycles.

Still a large proportion of seed requirement in food grains is met by farm saved seeds, unlabeled seed and unorganized sector.

- Demonstration and communication of clear and distinct product advantage of new plant varieties developed through comprehensive evaluation systems will lead to need for value added Plant varieties which deliver high genetic gains

Key Enablers

Genetic engineering, Gene editing and Biotechnology complement the conventional plant breeding process in terms of improving precision of selection. They should be viewed as tools which accelerate Breeding progress and genetic gains and not an end in itself.

- As Gene-editing/biotechnologies are capital intensive, PPP models with clearly defined project milestones linked to commercial objectives will enable integration of the new innovative technologies into breeding programs

Improved plant varieties with superior genetic backgrounds coupled with right agronomic practices, necessary nutrition, crop protection and irrigation can only deliver Genetic gains and unlock breeding value.

- Enhanced IT and communications and social media can be a great enabler for transformation in agricultural extension and education to farmers to enable farming as a profitable enterprise

Seed quality enforcement has been a huge challenge for regulators, while monitoring seed quality and building quality systems from production to retail counter in a highly dynamic/uncertain operational environment is a challenge to seed companies

- Seed traceability systems using QR code/Bar code scanning based IT apps coupled with data analytics for regular monitoring of Quality assurance will be an important enabler for seed industry

Prospects and Way forward

Seed being a unique and primary input to Agriculture, IPR protection for the Plant variety and all the traits it embodies should be through benefit sharing mechanisms defined in Plant variety act. Benefit sharing models are inclusive, promote competitive environment and discourage emergence of monopolies and market dominance.

Improved agronomic practices involving farm mechanization, Digital agriculture, Big Data and IOT in agriculture leading to unlocking of expression of 'Plant varieties' and better value to consumers and farmers will open up new possibilities for seed businesses globally .

Emergence of new Plant breeding technologies such as Gene editing (eg: CRISPR-CAS) and Precision breeding methodologies as new tools for Crop improvement. Regulatory mechanisms and commercialization models should be developed for new products developed through these technologies

Emergence of a new segment of value added products such as New chemical treatments, Nano material and Biological coated Seeds, Plant growth promoting Rhizo microbe-Inoculants should open up new value added products for seed industry in the next 5 years

Harmonization and simplification of Plant Quarantine and Sanitary & Phyto sanitary procedures, access to germplasm, Benefit sharing models, IPRs on plant varieties will improve Global seed trade and further unlock value of seed industry.

Thank you