Integrating Biotechnology in Sustainable Development

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What is biotechnology?

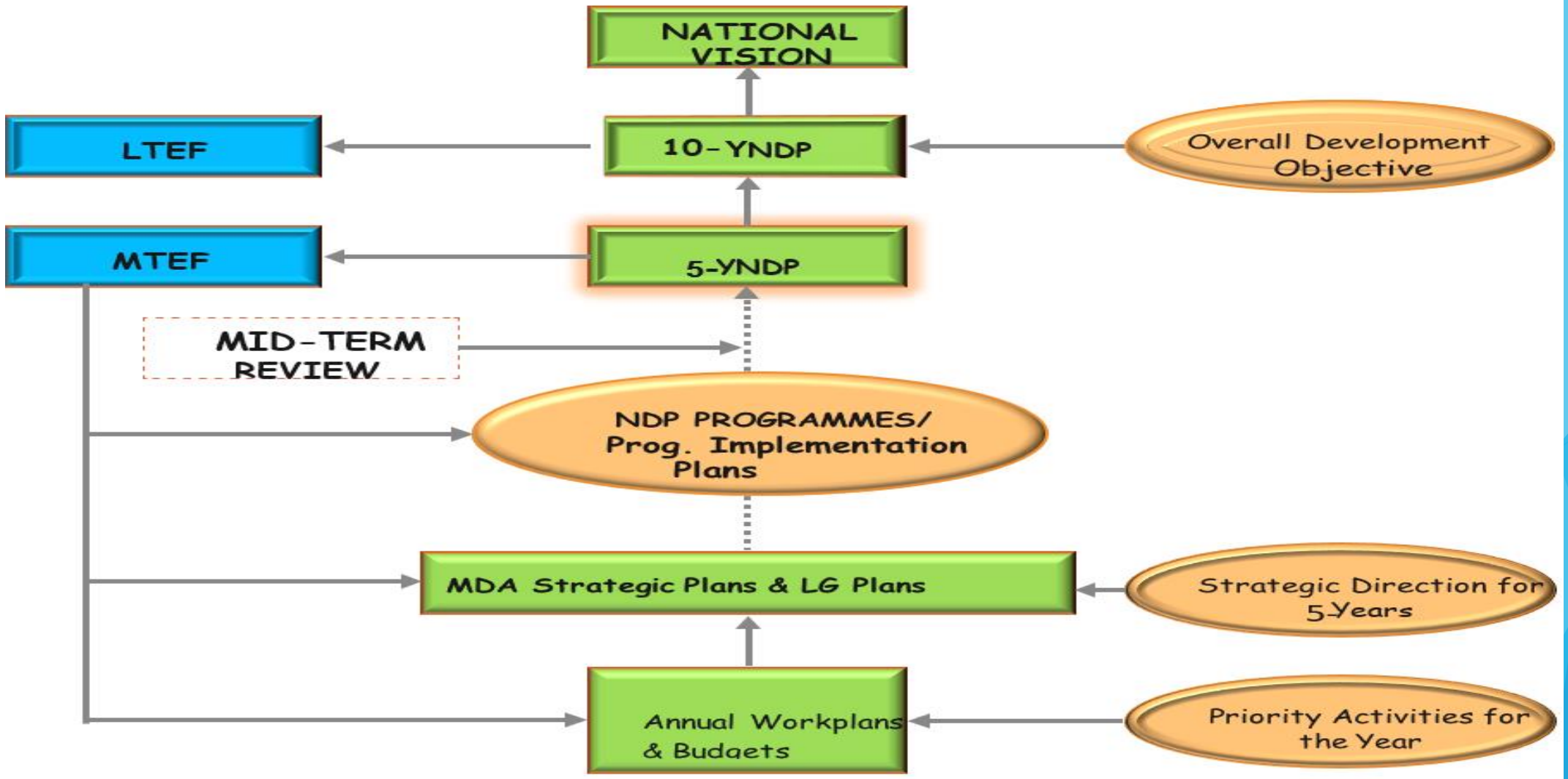
"Is the integration of natural and engineering sciences in the application of organisms, cells, cell parts and molecular analogues to generate products or services." -IUPAC

Source: https://www.engineersgarage.com/biotechnology/

Recap: Anticipated Ugandan Revenue from Biotechnology

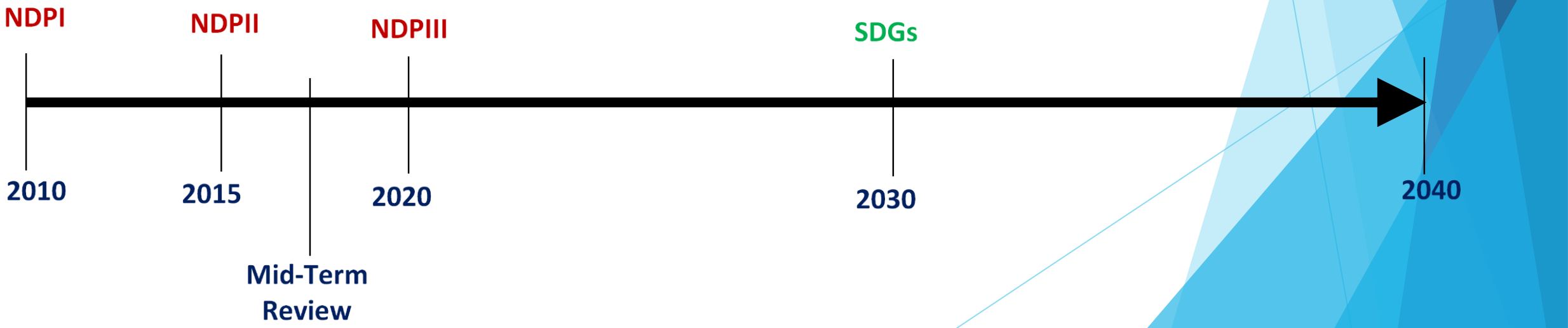
Year	Item/Commodity	US $ in Billions
2015	GMO CROPS	0.2
2020	INDUSTRIAL BIOTECH (Fuel, Chemicals and Enzymes)	3.5
2030	Biotech Materials, Chemicals and Enzymes	12

Comprehensive National Dev't Planning Framework (CNDPF)



VISION 2040 & NATIONAL DEVELOPMENT PLANS

1. Uganda Vision 2040 aims to transform the Ugandan society from a peasant to a modern and prosperous society
2. The third National Development Plan (NDPIII) is the third in a series of six NDPs that will guide the nation in delivering the aspirations of the people of Uganda, as articulated in Uganda Vision 2040;
3. A number of key projects are identified in Vision 2040 that have to be implemented to drive this growth



Envisioned tangible STI products

S/N	Vision 2040 Targets	Marketable Products	Import value as of 2018 ['000 USD]
1	Oil Refinery and associated pipeline infrastructure	Petrochemicals, Oil and Gas	1,291,671
2	A Hi-tech ICT city and associated ICT infrastructure;	e-solutions,	
3	Iron ore industry in Muko, Kabaale	Kiira Motor vehicles, engines,	
4	Phosphate industry in Tororo;	Fertilizers,	
5	Engineering machining centers	Machine parts, machines,	
6	Knowledge Economy	Knowledge	

Envisioned tangible STI products

S/N	Vision 2040 Targets	Marketable Products	Import value as of 2018 ['000 USD]
7	More Processed minerals	Cables from copper,	
8	Materials processing industries (for cotton, silk, leather,)	Clothes, leather,	112,332
9	Medical and Pharmaceuticals	Vaccines, Drugs	367,469
10	Food processing industries (value addition)	Banana floor, pharmaceutical starch, food supplements, acetic acid, enzymes, caissen, mutton, ham,	
11	Biotechnology Industries	Processed waste, enzymes	
12	Dyeing, tanning and coloring materials		49,023

Selected imported industrial biotechnology products consumed by Ugandan industries

S/N	Bioproduct	Application	Estimated cost (UGX per kg)
1	Pectinases	Soften fruit tissue during fruit processing	360,000
2	Amylases	Used to convert malt in beer industry	18,000
3	Proteases	Active ingredient in bio-detergents	72,000
4	Amylases (with keratinase activity)	Used in tannary to remove animal hair	18,000
5	Galactosidases	Used in making yorghut	356,000

NDPIII: What are the constraints to biotechnology development?

1. Inadequate focus on R&D both Private and Public Actors,
2. Inadequate financing for R&D in STI sector,
3. Inappropriate Training for R&D and innovation,
4. Weak collaboration between Planners, Research Institutions, Industry, and Academia,
5. Inadequate personnel in product innovation and services,
6. Slow Adoption of new Technologies,
7. Lack of Incentives to Promote Private R&D

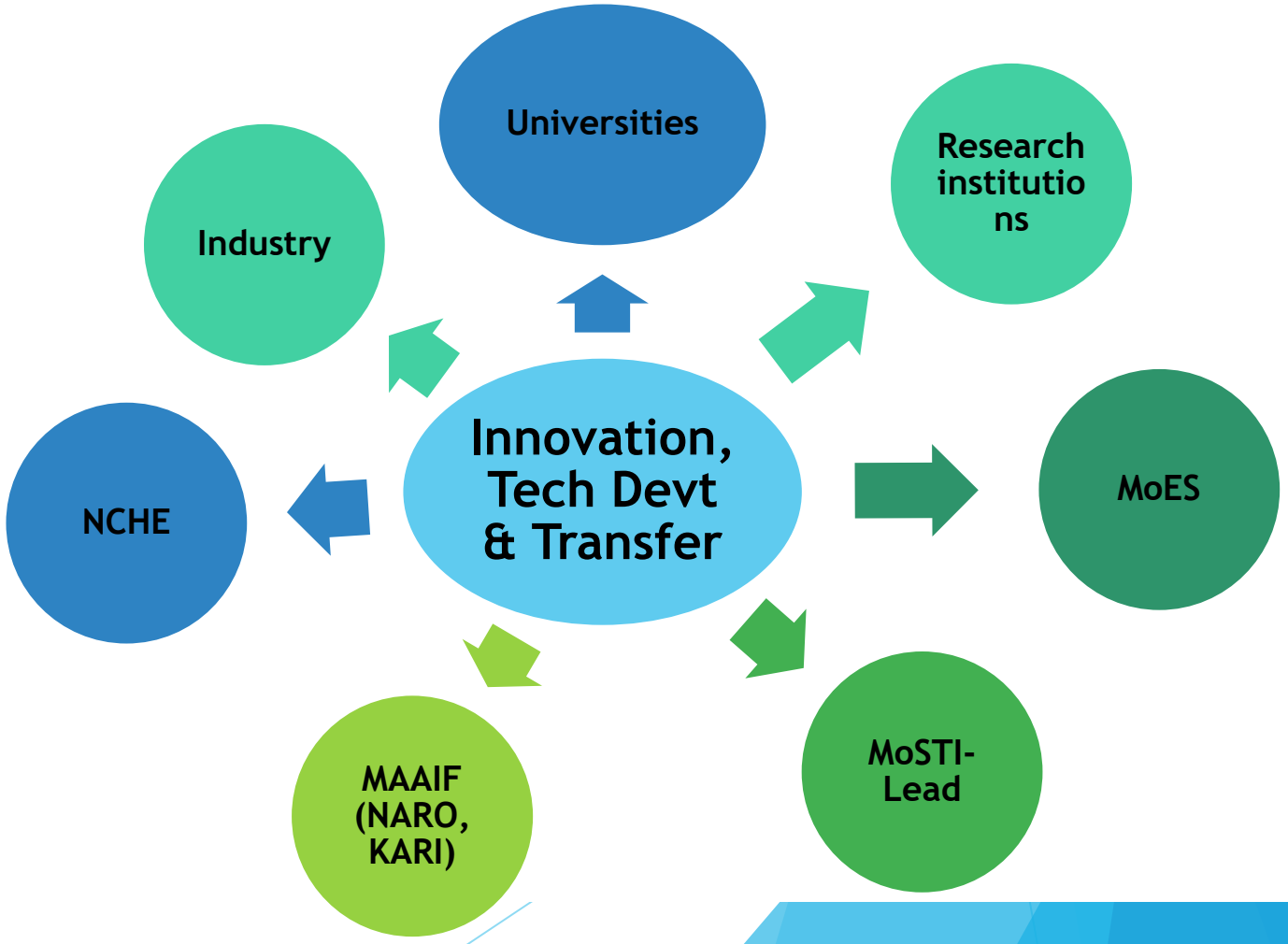
Certificate of Compliance (CoC) Report (2019/2020)

NDPII Sector	MDAs	Compliance	Good performance	Areas of Improvement
Agriculture	MAAIF, NARO, NAGRIC, NAADS, DDA, UCDA, UCDO	58.5%	Sector planning	Budget instruments and Budget performance
STI	MoSTI, UNCST, UIRI, KMC, PIBID	79.9 %	budget performance levels	Sector planning Few sector targets
Education	MoE, ESC, Public Universities, NCDC, UNEB, NCHE	60.3%		Projects planning and budget performance
	Core projects			Budget expenditure

NDPIII- THEORY OF CHANGE

1. **Introduction of Program Approach** to focus on delivery of common results and align with Program Based Budgeting

Favours the STI eco-system approach (Fertilizer development, Research)



CoC results for BFP and MPS (FY2020-21)

Programmes	FY2020/21 Alignment to NDPIII (%)	
	Programme Outcomes (NBFP)	Programme Outputs (MPS)
Agro-industrialization	91.7	77.2
Natural Resources, Environment, Climate Change,…	100	55.6
Manufacturing	100	62.5
Human Capital Development	84.2	59.3
Innovation, Technology Development and Transfer	100	58.6
Overall Average Score	86.0	63.9

Certificate of Compliance (2020/21)

NDPII Programme	Compliance	Areas of Improvement
Agro-industrialisation	63.5%	Majority of core projects have not been developed Greatest funding allocated to production and not value chain (Devt, post-harvest, marketing)
Natural Resources, Environment, Climate Change, Water …	52.5%	Projects still at concept level Underbudgeting
Innovation Tech Development & Transfer	53.6%	low release of approved budget for all the projects Hasten restructuring
Manufacturing	55.1%	Budgeting mismatch for industrial packs
Human Capital Development	61.6%	Establishing COVID-19 pandemic shocks

NDPIII- THEORY OF CHANGE

1. **Introduction of Program Approach**
2. **Increased role of the State.** There is an increased role of the State to invest strategically either alone or together with the private sector to exploit the quasi market and PPP approaches in development;

   -Drug development, Investment in UIRI
3. **More targeted investment in infrastructure and Human Capital.** Investments in human capital (R&D capacities,

Objectives for the Innovation, Technology Development and Transfer Programme

- To strengthen R&D capacities and applications
- Develop requisite STI infrastructure
- Increase development, transfer and adoption of appropriate technologies and innovations
- Build human resource capacity in STI
- To improve the legal and regulatory framework

Manpower Planning for Biotechnology

DISCIPLINE	PRODUCTS	EXPERTISE
Agricultural Biotechnology	Banana wilt and weevil-resistant varieties Orange flesh sweet potato varieties High yielding cassava varieties Drought resistant maize & rice varieties Clonal coffee varieties	R&D IP (tech transfer) Incubation
Industrial Biotechnology	Enzymes, preservatives, additives, bioplastics, Waste bio-products	Industrial engineers Bio-engineers
Medical Biotechnology	Biopharmaceuticals, Vaccines (COVID-19, Hepatitis) Drugs	

Qualifications and Skills Needs for: Innovation, Technology Development and Transfer Programme

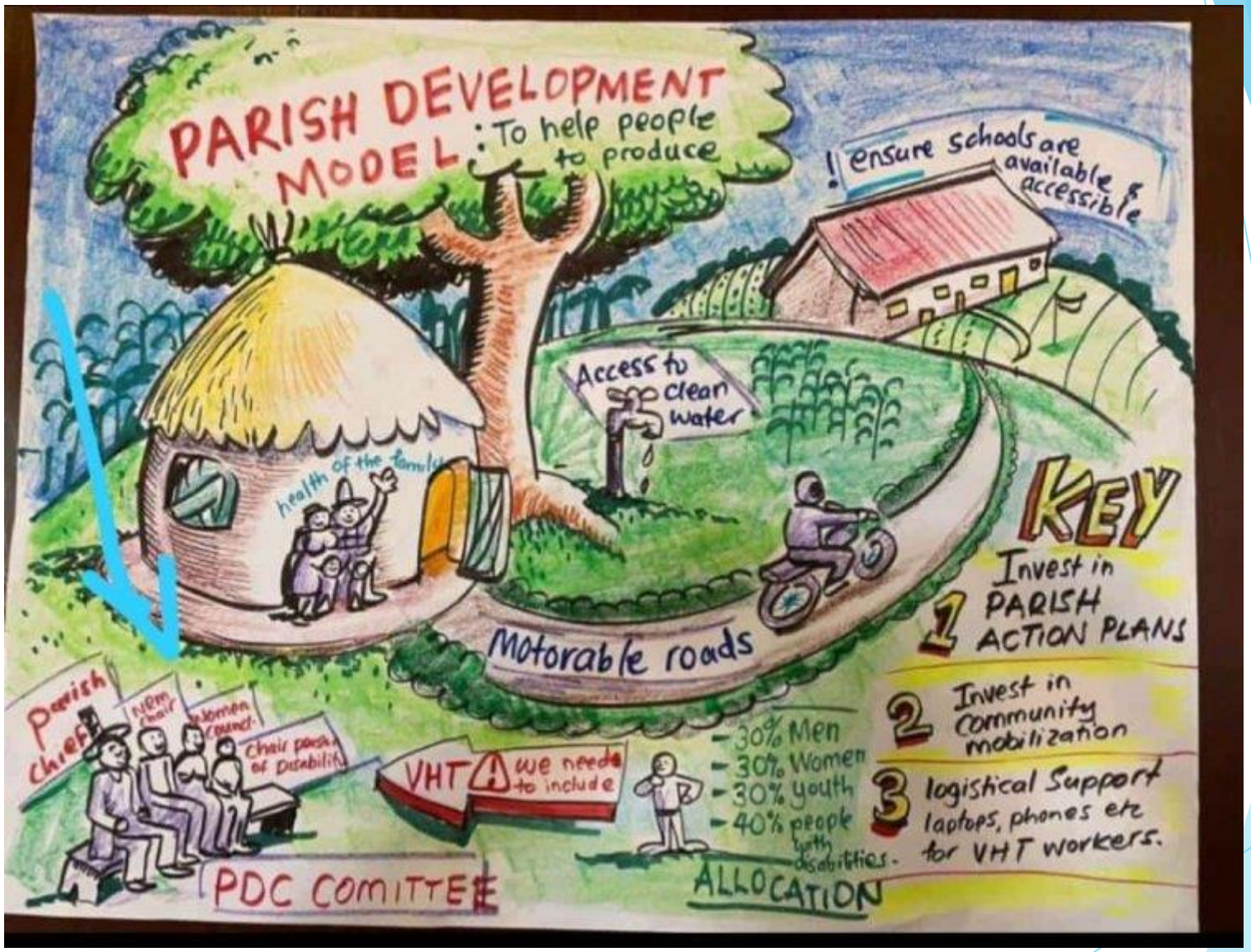
Qualifications and Skills	Status	Base Year Gap (2016/17)	Estimated 5-Year Gap
Animal Geneticists		61	303
Astrochemistry and cosmochemistry specialists		0.0	100
Astronomists specialists		0.0	100
Clinical research specialists		44	220
Clinical manufacturing experts		0.0	290
Cosmology experts		0.0	102
Food microbiologists		20	102
Food Technology and Processing specialists		187	936
Forensic astronomy specialists		0.0	342

Qualifications and Skills Needs for: Innovation, Technology Development and Transfer Programme

Qualifications and Skills	Status	Base Year Gap (2016/17)	Estimated 5-Year Gap
Intellectual Property specialists		59	293
Machine learning and Artificial Intelligence (AI) specialists		46	229
Nanotechnologists		0.0	100
Project investment appraising specialists		80	400
Sterile manufacture and sterile operations experts		58	292
Trade and technology transfer negotiation specialists		36	180

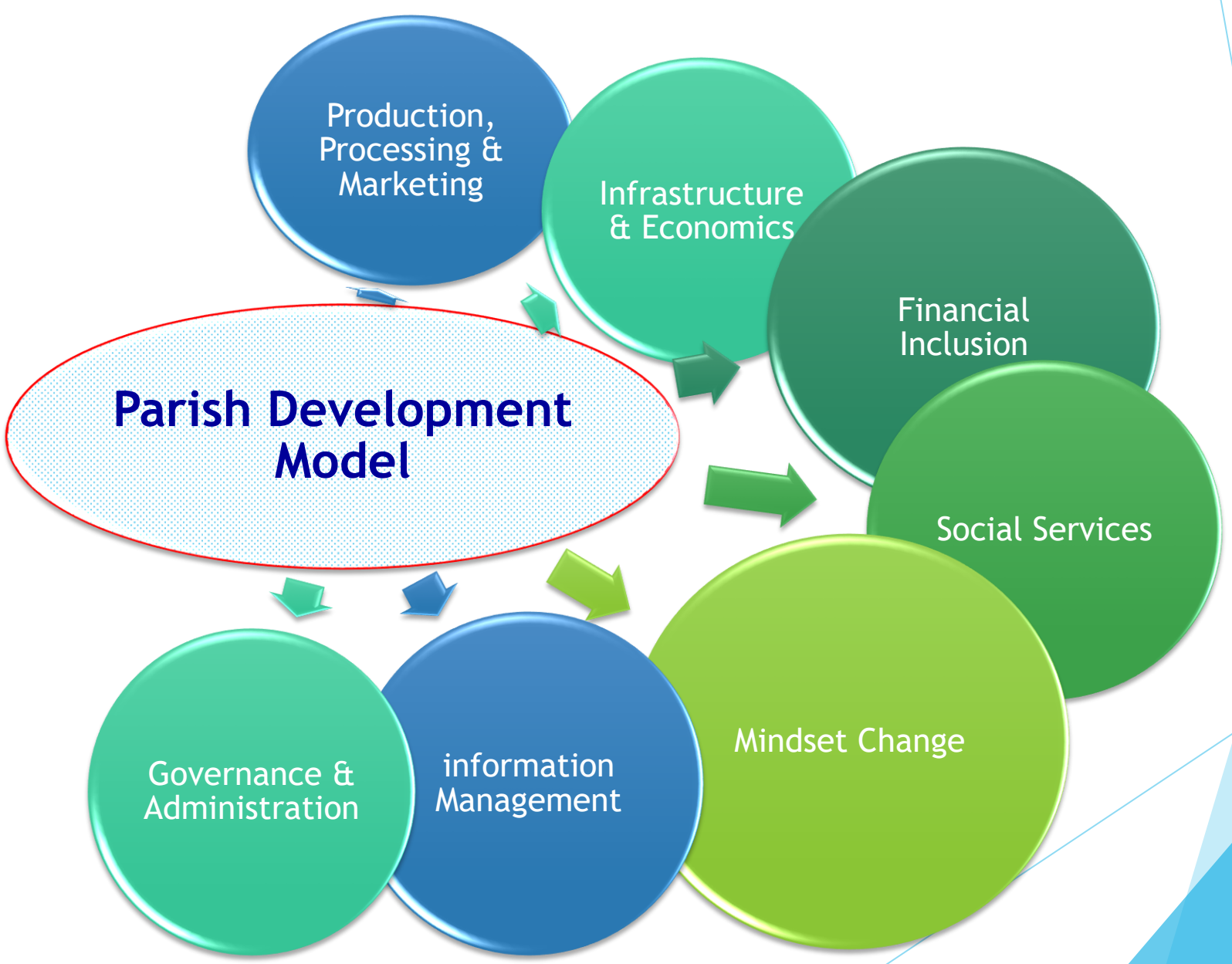
NDPIII- THEORY OF CHANGE

1. **Introduction of Program Approach**
2. **Increased role of the State.**
3. **More targeted investment in infrastructure and Human Capital.**
4. **Introduction of the Parish Development Model (PDM)** to bring government services and support nearer to the people.



Source: https://poatvuganda.com/

Bringing modernization to the People-PDM



Proposed MoSTI Projects to Develop

1. Pathogen Economy – Innovation Technology Development & Transfer (NDPIII Objective 2, Intervention 4), Material Science Laboratory, Establishing a vaccine manufacturing centre
2. Engineering – cuts across a number of Programmes: ITDT; Manufacturing; Mineral Development-Iron & Steel Industry; Petroleum-Petro-chemical
3. Mobility – Manufacturing (NDPIII Objective 2, Intervention 3); Integrated Transport Infrastructure & Services; and Sustainable Urbanisation and Housing
4. Beauty and Apparel – Agro-Industrialisation
5. Agro-Security – Agro-Industrialisation-Special Agro-processing Zones
6. Digital Economy – Digital Transformation-e-government
7. National Systems

Key take-homes

- Biotechnology is an asset to Uganda's sustainable economic growth promoting inclusive growth, improved household incomes and wellbeing of Ugandans
- Integration of biotechnology in the development process requires nurturing eco-systems that will lead us to generate common results with related stakeholders
- Strategic medium-term and long-term planning and budgeting for all proposed reforms to support STI has become a pre-requisite for the country to take-off in modern technologies

But we taking too long to get there…

"Nothing in this world can take the place of persistence. Talent will not: nothing is more common than unsuccessful men with talent. Genius will not; unrewarded genius is almost a proverb. Education will not: the world is full of educated derelicts. Persistence and determination alone are omnipotent", *John Calvin Coolidge (*1872 – 1933)

Thank you