Change in Action

Questions on this session: [link]

Session 1 objectives

- Understanding the change needed in CGIAR breeding
  - Active management engagement
  - Role specialization in a cross-functional team
  - Revisiting breeding as a multi-stage process
  - Data-driven assessment (continuous improvement)
  - EiB support for change

- Example of creating change: Product advancement meeting

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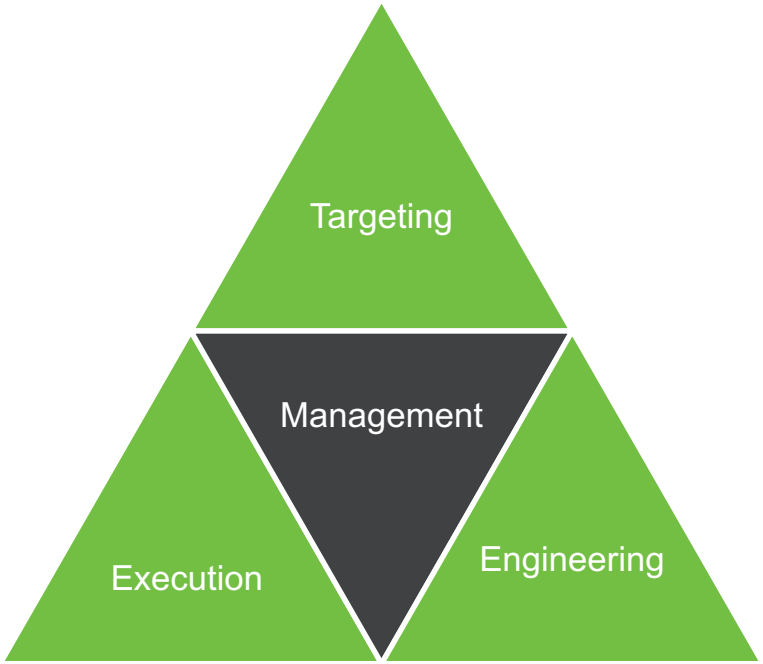
Breeding as a product development process

- All product development processes have clearly defined components
- Each requires specific skills
- Management oversight is necessary
- EiB supports all stages



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CGIAR breeding:
The status quo

- Lack of boundaries for responsiblities managing the breeding process
- Specialized staff are working in silos

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CGIAR breeding:
The ideal state

- More accountable, more defined CGIAR-NARS collaboration
- More likely to deliver on goals
- Breeding staff focus on areas of expertize, but working in collaboration with others
- Lower risk process with shared responsibilities

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Using RACI to assign roles & responsibilities

- Every task has a person defined as
  - Responsible
  - Accountable
  - Consulted
  - Informed
- Leadership comes from the top – accountability and active involvement
- Belief in change comes from the bottom – when staff clearly understand their roles and how they fit in the big picture

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Using metrics to implement change

- Specific KPIs ensure **specialization** and **collaboration** across the breeding process
- Breeding program performance metrics create transparency within programs and in cross-institution collaboration
- Breeding goals are adjusted based on performance

How do we do this….

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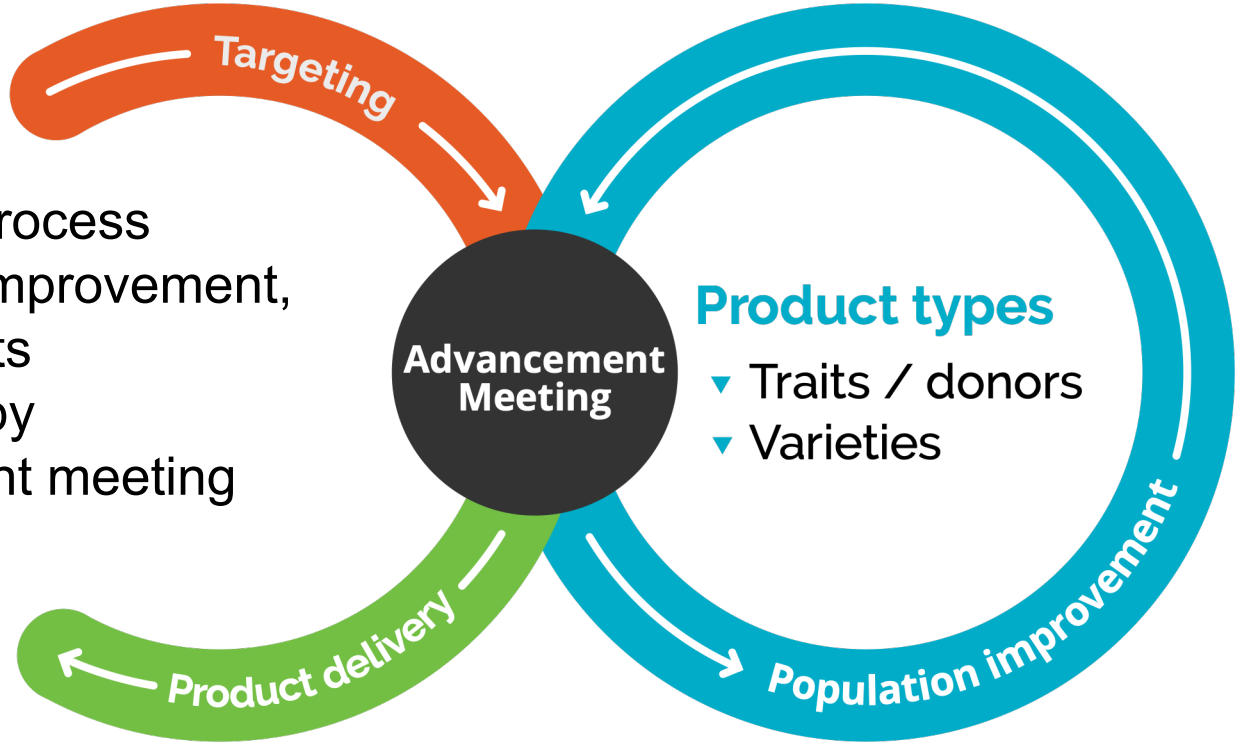
Advancement meeting at the heart of the breeding flow

Breeding is a process
of continuous improvement,
driven by targets
and managed by
an advancement meeting



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What is a advancement meeting?

- **The most important meeting of the year**
- An annual meeting to assess breeding program performance and output
- All specializations and stakeholders in the breeding process are represented
- KPIs and performance metrics are assessed

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Goals of the advancement meeting

- Population improvement and variety development decisions are made based on the data
- Cross-functional input is ensured, from market-facing metrics and technical breeding metrics
- Assess current breeding program performance and define goals for the next year
- Identify products to be released and delivery/marketing strategy

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Who needs to be present from NARS & CGIAR?

- Center leadership (DDGRs)
- Breeding program leadership
- Market expert (i.e. product manager)
  - Socioeconomics
  - Gender
  - Seed systems
  - End user representatives
- Technical expert from each breeding specialization

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How is it set up?

- By invitation of DDGRs/leadership
- Set in between harvesting and planting (when performance data is available)
- Attendees identified and informed long in advance
- Clear expectations, roles and responsibilities
- Required metrics communicated
- Advancement meetings linked to Breeding Lead objectives

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Goals of creating a project advancement meeting

Purpose: Introduce standard product management to increase genetic gain and product replacement in CGIAR NARS within 1 year

Objective: Leaders co-develop a viable process

Output: Meeting format and roadmap for implementation

Outcome: Process implemented in 12 months, follow-up meetings with leaders to gather learning/feedback

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Creating the conditions of change...

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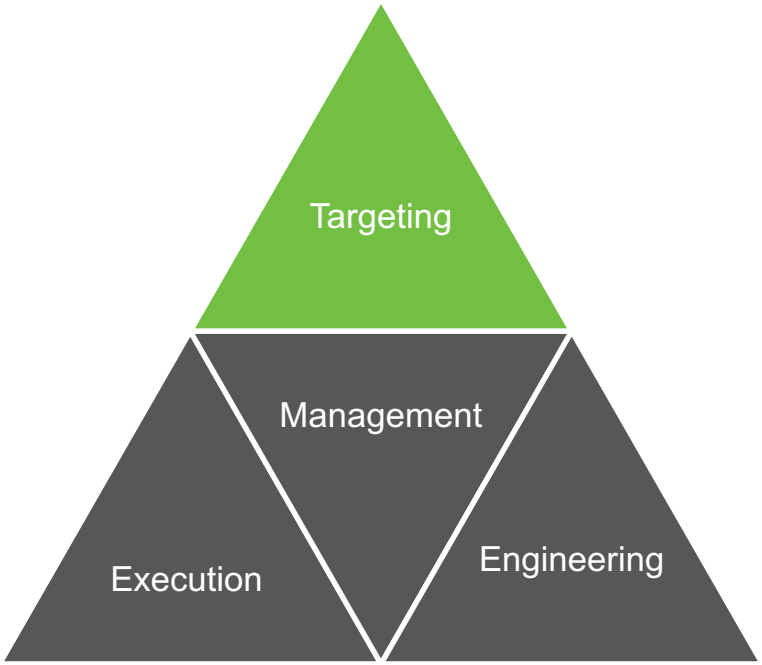
Deep dive 1

Targeting: Good design and management looks like..



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Success Needs Preparation and Prioritization

- Market Segment/TPE Prioritization
- Targeted Product Profiles
  - Demand Driven
  - Design comes from product managers representing the cross-function design team
- Role Specialization in Product Design
- A stage and gate system, based on metrics, manages product progress

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Clear Targeting drives an engineer and manufacturing pipeline

Target Environments

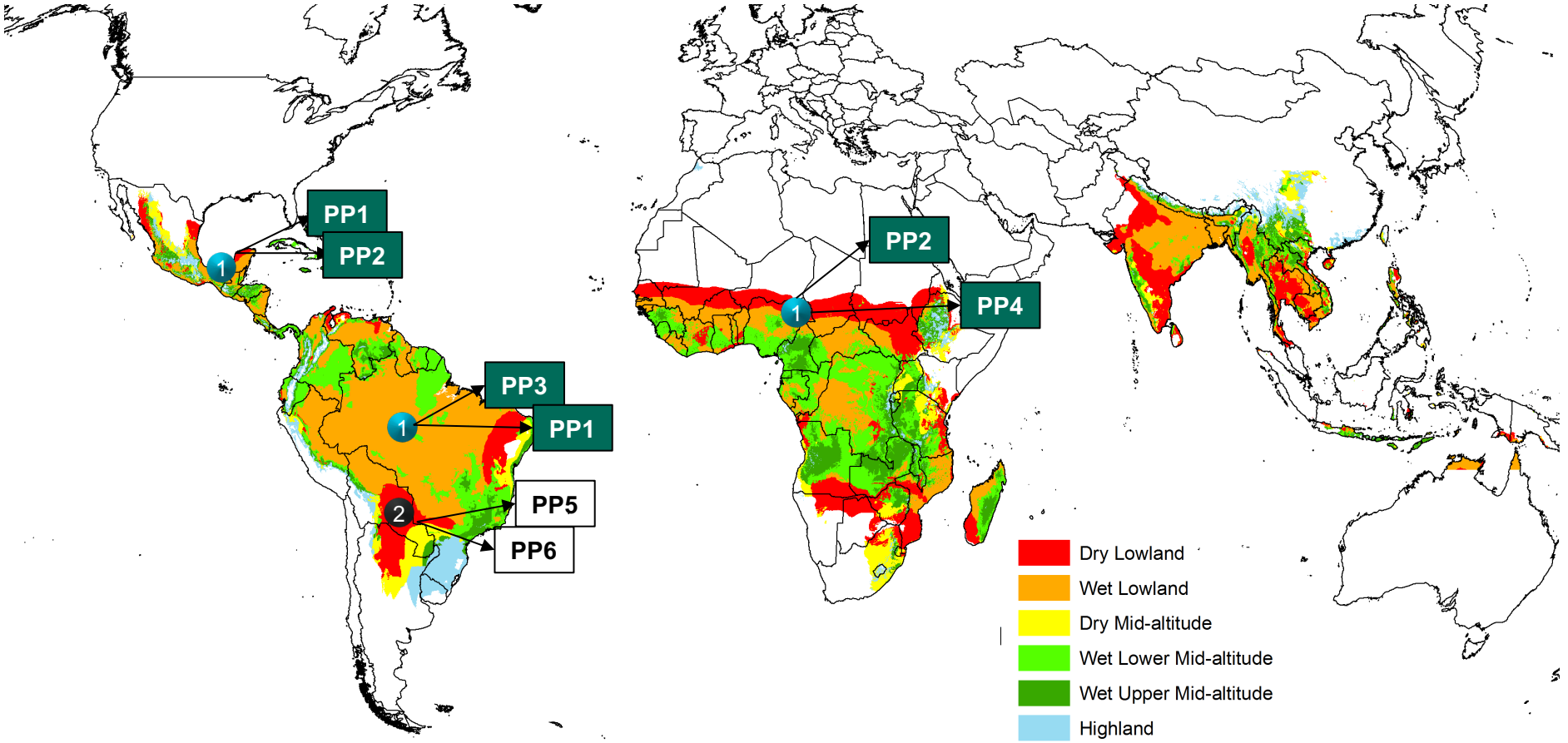
- Dry Lowland
- Dry Mid-altitude
- Highland
- Wet Lower Mid-altitude
- Wet Lowland
- Wet Upper Mid-altitude

Market segments

- Fresh-consumption wet lowland
- Processing wet-lowland
- … … …
- Processing wet-upper mid altitude

Product profiles

PP1 Product profile 1
…
PP6 Product profile 6

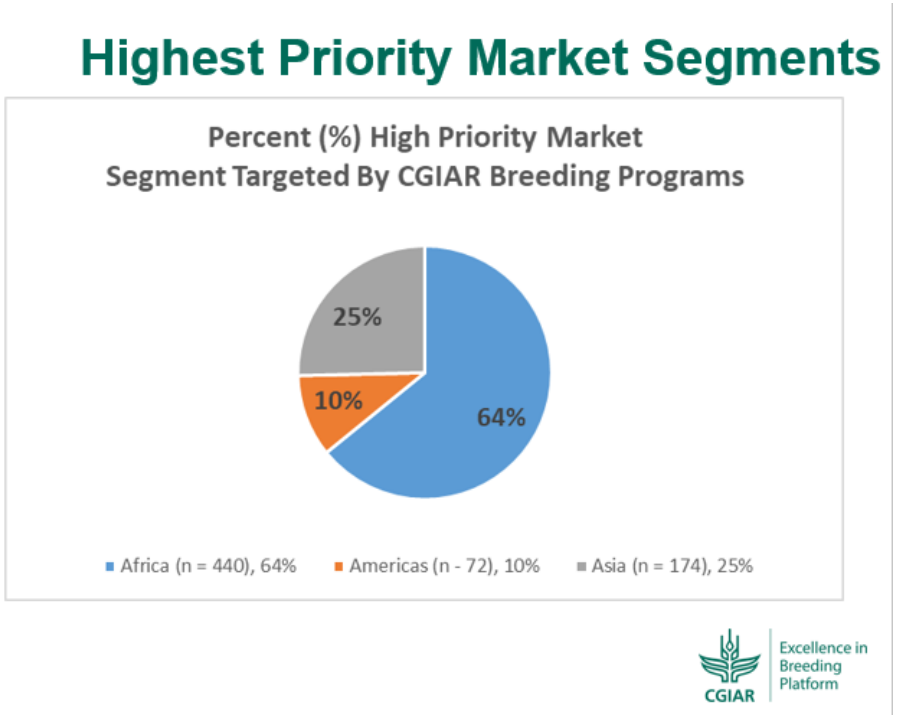


Market Segment

- Market Segment - a sub-group of clients based on some type of shared characteristics.

- <u>Market Segment Survey</u>
  - 7 of 8 centers participated
  - 167 targeted market segments
  - 686 (crop x country) combinations are primary breeding targets

- High performer's focus



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Targeted product profile: The way we deliver

- Written planning documents that define the market-driven products to be developed throughout the breeding pipeline in five year periods
- A new way of setting breeding targets: from economic assessment of traits in breeding area, to cross-functional design teams targeting varieties on the market, today and in the future
- Owned by the product manager
- **Used as a benchmark to measure progress in continuous improvement**

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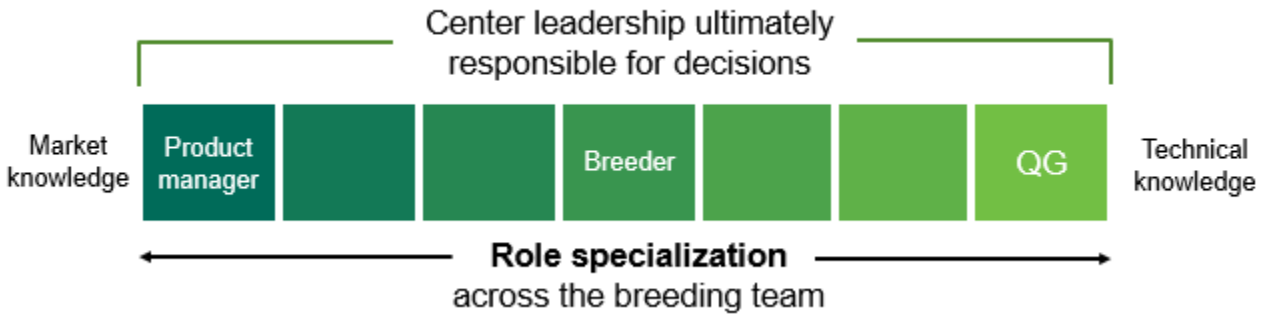
Targeted Product Profiles are a blueprint for engineer

- Population construction
- Product Replacement Strategy
- Benchmark for the product advancement process
- Guides Trait Discovery and Deployment
    - Donor Line

Role Specialization In Design Team



Product Design Team

Product Manager

Breeding Team

Product Targets (TPPs) are passed from the design team to the breeding team

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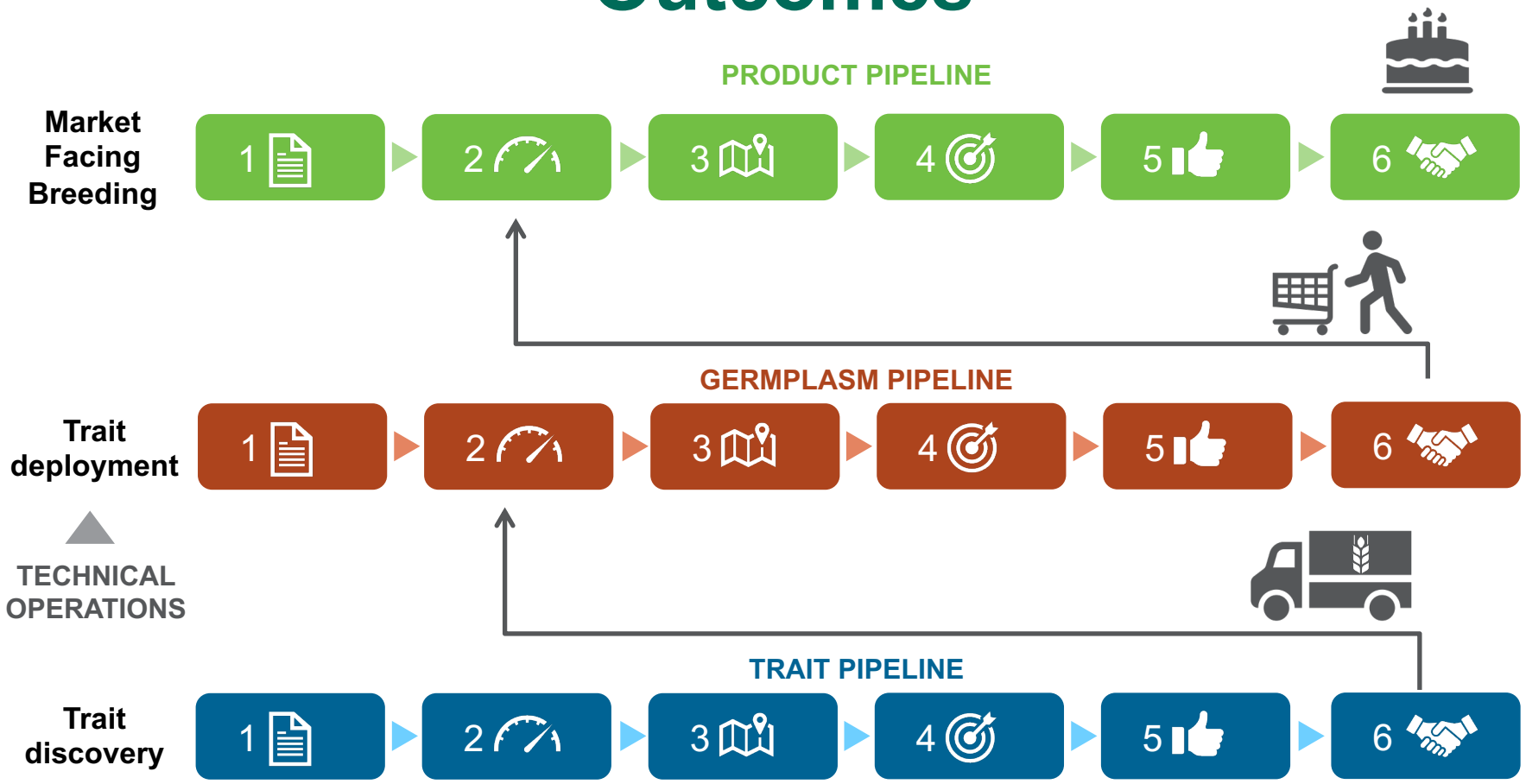
Advancement meeting uses stage & gates process link TPPs to Outcomes



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Product Management Process

- Formalized, transparent and managed focused on increasing the rate of variety turnover
- Guided by a validated product design
- Govern by pre-determined advancement metrics
- Measure breeding team effectiveness in implementing the breeding strategies developed by technical expertise
- Complements the assessment of the breeding program

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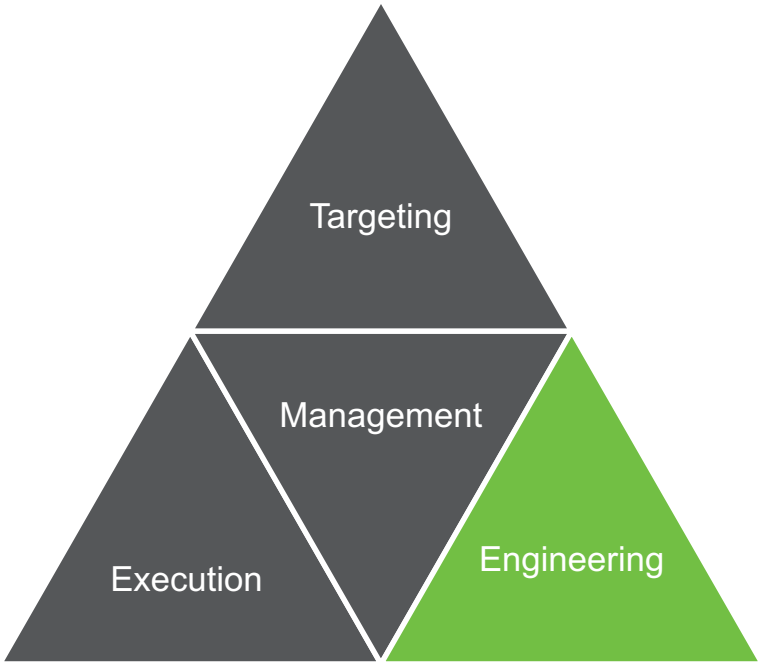
Final Thoughts

- Modern plant breeding has evolved into a team effort
- Modern plant breeding is not a spectator sport the process needs to be managed

Deep dive 2

How to engineer a good breeding scheme to deliver the design



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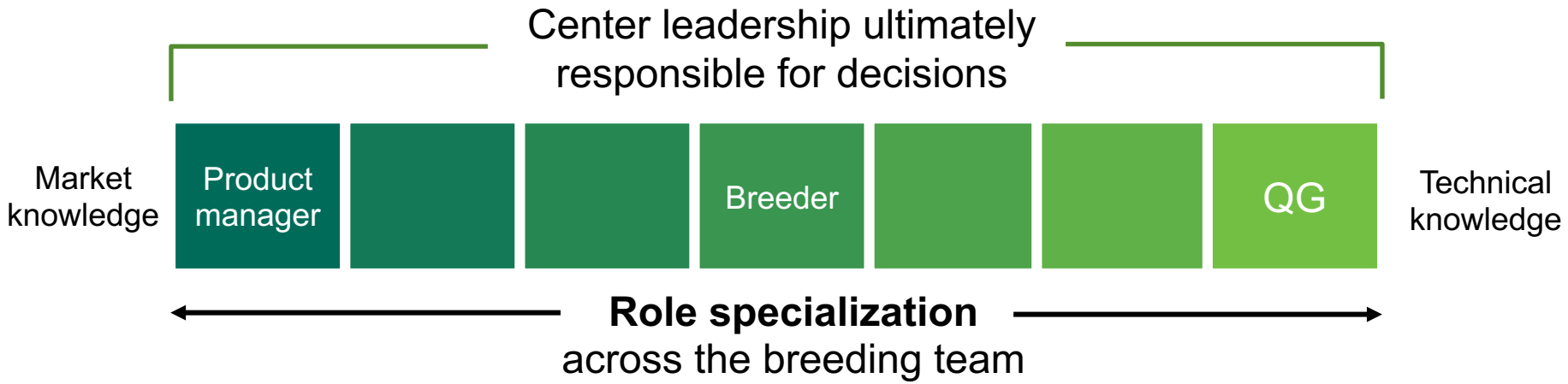
A competitive breeding program has role specializations when comes to engineering the process



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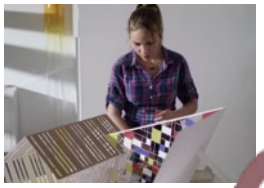
1) A good engineering process requires back and fort discussion between design and engineering

Customer need

Design team



Engineering team
Civil Engineer

Manufacturing team

Customer need

Design team

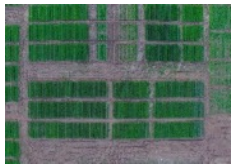
Engineering team
Mechanical Engineer

Manufacturing team

Customer need

Design team

Engineering team
Breeder + QG



Manufacturing team

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2) Clear targets are required before we engineer a manufacturing pipeline

Target Environments

- Dry Lowland
- Dry Mid-altitude
- Highland
- Wet Lower Mid-altitude
- Wet Lowland
- Wet Upper Mid-altitude

Product profiles

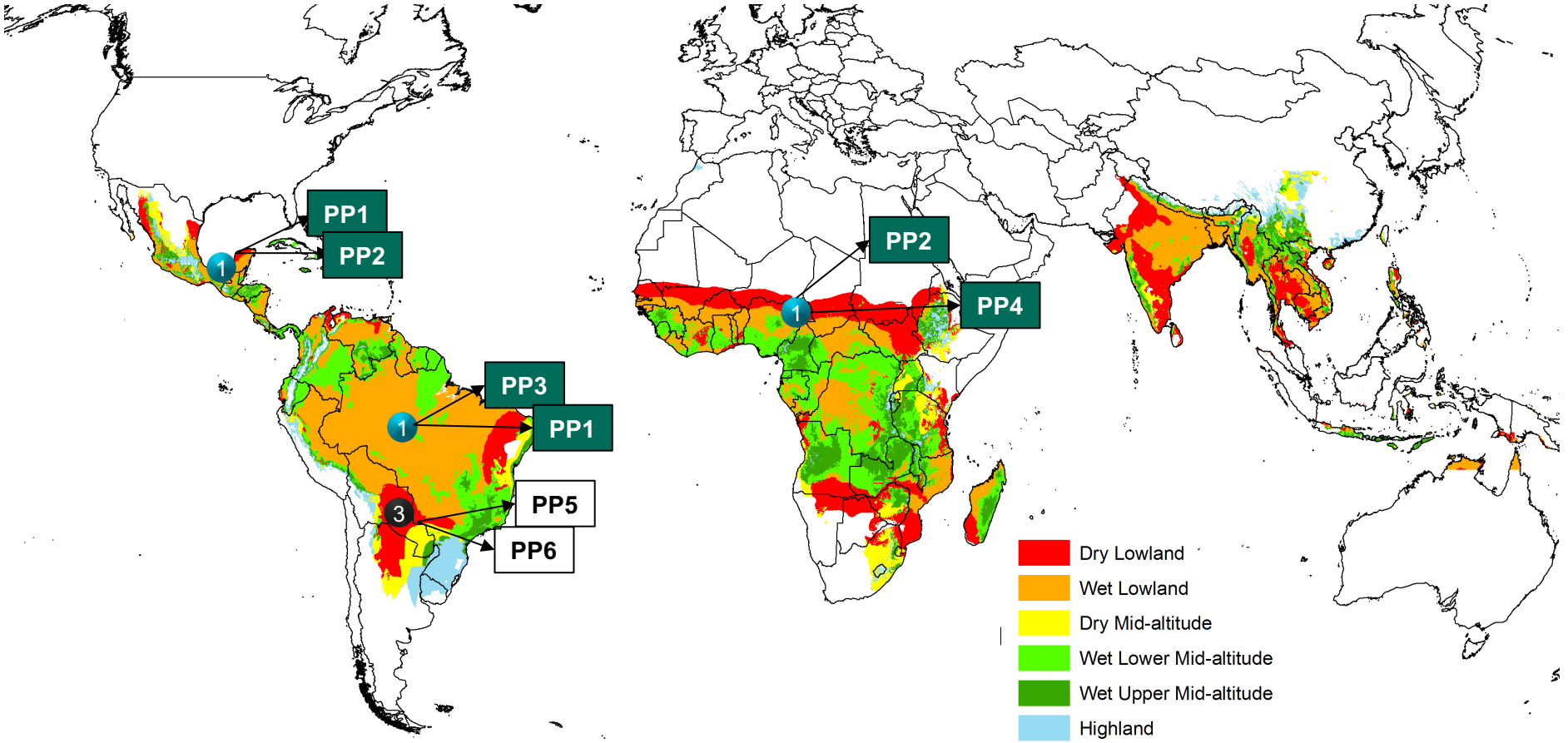
PP1 Product profile 1
…
PP8 Product profile 8

Market segments

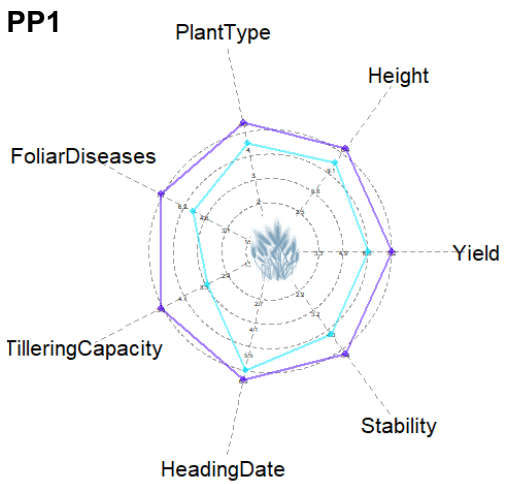
- Fresh-consumption
- Processing

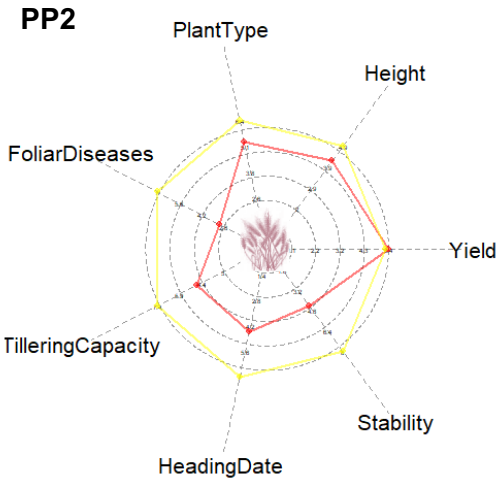
Breeding pipelines

1 Fresh-consumption wet lowland
2 Fresh-consumption dry lowland
3 Processing dry lowland



3) A blueprint stating clearly the values of or desired product has to be used to design specifications





Kumquat Targeted Product Profile (Market Trait Inventory)					
Market Segment: Local Consumption; Region: Sub-Sahara Africa		TPE: Rainfed Lowlands (Low Imput)			
Family (Traits)	**Key Economic Traits**	**Trait Value**	**Bench Mark Variety Assessment**	**Measurement Strandard**	**Threshold Level or Range**
Consumer Traits	Citric Canker	Basic Trait	Hystyle	1-9 Scale; 1 = Best	Score < 2
Consumer Traits	Spherical fruit shape	Basic Trait	PH 317	Polar diameter to the Equatorial diameter	Range: 1.2:1 to 1.4:1
Yield Recovery	Thornless or low spine number	Basic Trait	PH 317	1-9 Scale; 1 = Tornless	Score < 2
Stess Tolerance	Yield set under low water conditions	Basic Trait	PH 317	Yield Advantage under managed drought coditions	> 3 T/HA
Biotic Resistance (Fungal)	Scab Resistance	Value Added	DG 503	1-9 Scale; 1 = Best	Target Score < 3; DG 503 = 6
Stess Tolerance	Ability to Set Under High Night Temperature	Value Added	Hystyle	Flower Drop at night temp. > 32 C	< 10% drop
Biotic Resistance (Fungal)	Antracnose Resistance	Value Added	COLL 13	1-9 Scale; 1 = Best	Score < 4
Yield Recovery	Mechanical Harvest	Value Added	JK 2	Percent Field Yield Recovery	> 70%
Biotic Resistance (Insect)	Mealybug Tolerance	Game Changer	NA	No chemical control - 25% loss of quality	
Biotic Resistance (Bacterial)	Stem-end Rot	Game Changer	NA	As high as 40% loss in storage	
Kumquat Targeted Product Profile (Replacement Strategy)					
Market Leading Variety #1: DG 503					
Consumer Traits	Sweet Peel/Internal Tart Flavor Contrast	Basic Trait	DG 503	Sweet:Sour Index	Range: 1:1 to 1:2
Biotic Resistance (Fungal)	Scab Resistance	Value Added	DG 503	1-9 Scale; 1 = Best	Target Score < 3; DG 503 = 6
Maturity	Early Maturity	Value Added	DG 503	Days to Physiological Maturity	110-120 days range (10 days earluer than DG 503)
Stess Tolerance	Ability to Set Under High Night Temperature	Value Added	DG 503	Flower Drop at night temp. > 32 C	< 20% drop (DG 503 = 40%)

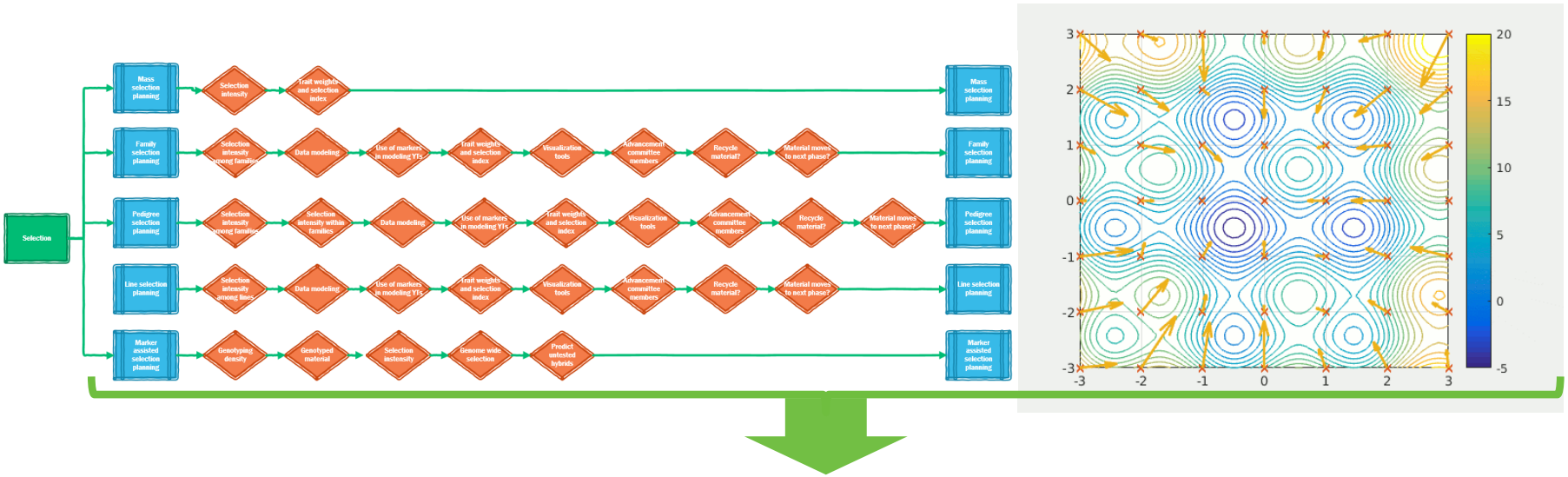
This market segment is defined by subsistence farmers with an annual income of less than 2000 USD. The majority of on-farm activities (sowing, weeding, harvesting and processing) are performed by women, whom are usually in charge of the marketing of the product. Farm labor availability is a rising issue, with availability declining by 5% each year, so earlier maturing with the ability to mechanical harvest is valued. Orchards are normally rotated every two years with stagnant variety turnover. An estimated 60 percent of farmers grow just one variety - DG 503 - largely because of consumer-preferred traits (taste). The Breeding Strategy to replace DG 503 is to retain the taste but to reduce the maturity by 10 days to avoid potential water stress, increase stress tolerance for the ability to set under high night temperatures (> 32 C) and to increase scab resistance due to a loss of chemical control. A suggested gender responsive trait that would be valuable would be a tree to scrub conversion.

Basic traits/Unique Selling Prepositions already present in the product to replaced. A variety could not compete in the market place without these traits. These are a trait that need to be incorporated into the variety.

Value-added traits, which represent improvements on the product to replaced or within the market segment that can be sourced from material available to the breeding program, and delivered commercially on a 5-year time frame

"Game Changing" Traits are significant step-change traits that cause a radical shift in the market. These traits are not found within the elite breeding material.

4) The engineering team should use methodologies and tools that allows them to minimize possibilities of failure



materialPlanted	derived	year	season	seedHandling	acrossUnitsN	amongUnitsN	withinUnitsN	expDesign	nEnvPerTPE	nRepPerEnv	sparsityPercent	percentChecks	numberChecks	estimatesMethod	selectionMethod	markerTechnology	percSelectedAcross	percSelectedAmong	percSelectedWithin	recycling	multiplicationMethod	multiplicationUnit	unitsHarvestedAcross	unitsHarvestedAmong	unitsHarvestedWithin	unitsHarvestedN	nCross	otherPoolParents	nProgenyPerCross	materialGenerated	foliarDiseases	productDiseases	grainAppearance	fertility	harvestMoisture	plantType	plantHeight	grainYield	grainYieldStability	lodging	stressTolerance
P		1	2	singleInd	1	20	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	cross2way	among	1	20	1	20	200	0	1	F1	0	0	0	0	0	0	0	0	0	0	0
F1		2	1	singleInd	1	1	200	none	1	1	0	0	0	visual	mentalIndex	None	1	1	0.3	0	crossSelf	among	1	1	60	60	60	0	400	F2	1	1	0	1	0	0	0	0	0	1	0
F2		2	2	headRow	1	60	400	none	1	1	0	0	0	visual	mentalIndex	None	1	1	0.25	0	crossSelf	among	1	60	100	6000	6000	0	10	F3	1	1	1	1	0	1	1	0	0	1	0
F3		3	1	headRow	1	6000	10	none	1	1	0	0	0	visual	mentalIndex	None	1	0.25	0.3	0	crossSelf	among	1	1500	3	4500	4500	0	1	F4	1	1	1	1	0	1	1	0	0	1	0
F4		3	2	headRow	1	4500	1	none	1	1	0	0	0	visual	mentalIndex	None	1	0.5	1	0	crossSelf	among	1	2250	1	2250	2250	0	1	F5	1	1	1	1	0	1	1	0	0	1	0
F5		4	1	line	1	2250	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	crossSelf	among	1	2250	1	2250	2250	0	1	TC	0	0	0	0	0	0	0	0	0	0	0
F5		4	2	line	1	2250	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	crossTC	among	1	2250	1	2250	2250	1	1	F6	0	0	0	0	0	0	0	0	0	0	0
TC	F5	4	2	tester	2250	1	1	p.rep	3	1	0	0.1	3	BLUE	indepCulling	None	0.1	1	1	0	none	across	225	1	1	225	0	0	1		4	5	0	0	3	0	0	1	0	2	0
F6		5	1	line	1	225	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	crossSelf	among	1	225	1	225	225	0	1	TC	0	0	0	0	0	0	0	0	0	0	0
F6		5	1	line	1	225	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	crossTC	among	1	225	1	225	225	3	1	F7	0	0	0	0	0	0	0	0	0	0	0
TC	F6	5	2	tester	225	3	1	p.rep	5	1	0	0.1	3	BLUE	indepCulling	None	0.3	1	1	0	none	among	68	3	1	204	0	0	1		6	7	0	0	5	0	0	1	2	3	4
TC	F7	5	2	tester	225	3	1	p.rep	5	1	0	0.1	3	BLUPdiag	indepCulling	None	0.1	0.03	1	1	none	among	23	1	1	23	0	0	1		6	7	0	0	5	0	0	1	2	3	4
F7		6	1	line	1	23	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	crossSelf	among	1	23	1	23	23	0	1	F8	0	0	0	0	0	0	0	0	0	0	0
F7		6	1	line	1	23	1	none	1	1	0	0	0	visual	mentalIndex	None	1	1	1	0	crossTC	among	1	23	1	23	20	6	1	TC	0	0	0	0	0	0	0	0	0	0	0
TC	F6	6	2	tester	20	6	1	alpha	10	2	0	0.1	4	BLUE	indepCulling	None	0.5	1	1	1	none	among	10	6	1	60	10	0	1		5	6	0	0	4	0	0	1	2	3	0
TC	F7	7	2	tester	10	6	1	alpha	35	2	0	0.1	6	BLUE	indepCulling	None	0.2	1	1	1	none	among	2	6	1	12	2	0	1		5	6	0	0	4	0	0	1	2	3	0

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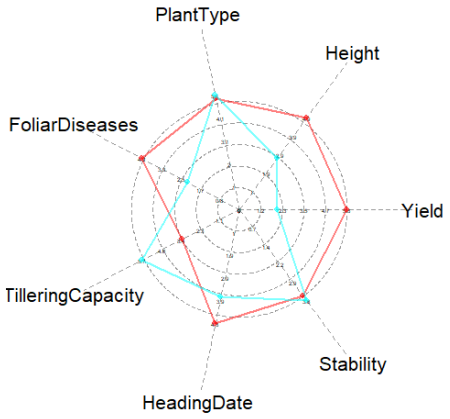
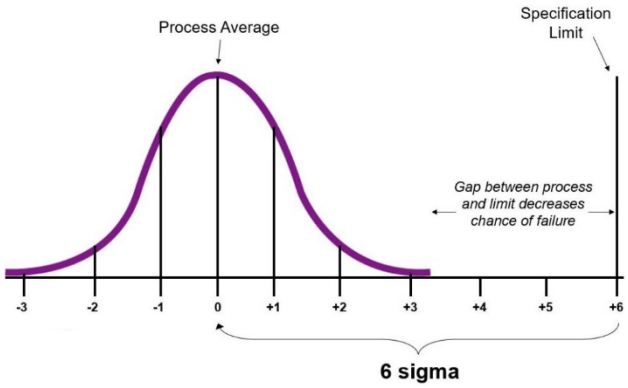
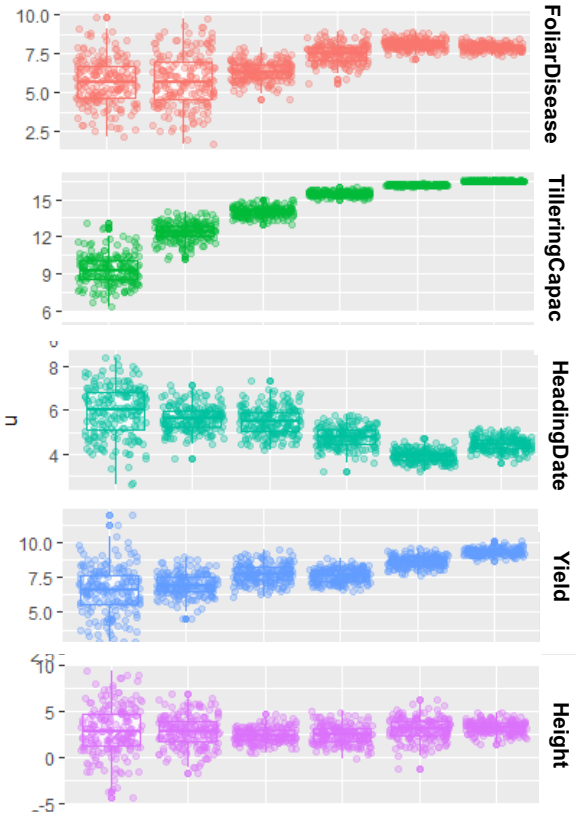
5) A good engineering process has clear metrics to assess performance

Probability to obtain product





Genetic gains



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What EiB has done and has to offer for engineering good breeding schemes?

- Targets
  - Product profile tool
- Mapping pipeline
  - Flowchart tools to map breeding process
  - Breeding pipeline mapping tool
- Optimization tools
  - BMGF grant for across-CG simulation platform
  - Breeding optimization methodology (February training)

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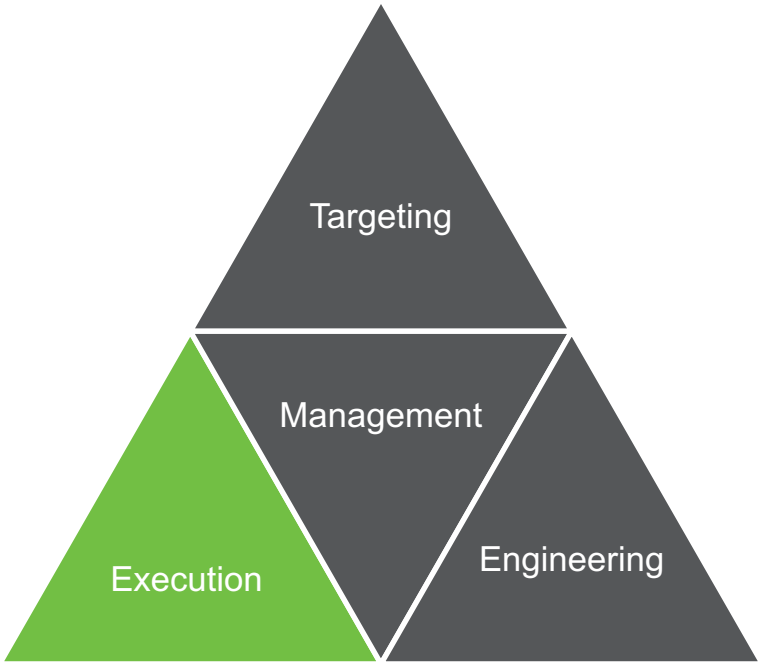
Deep dive 3

Execution: A good manufacturing operation looks like..



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“Quality is the result of a process… A bad process won’t result in the best possible quality.”

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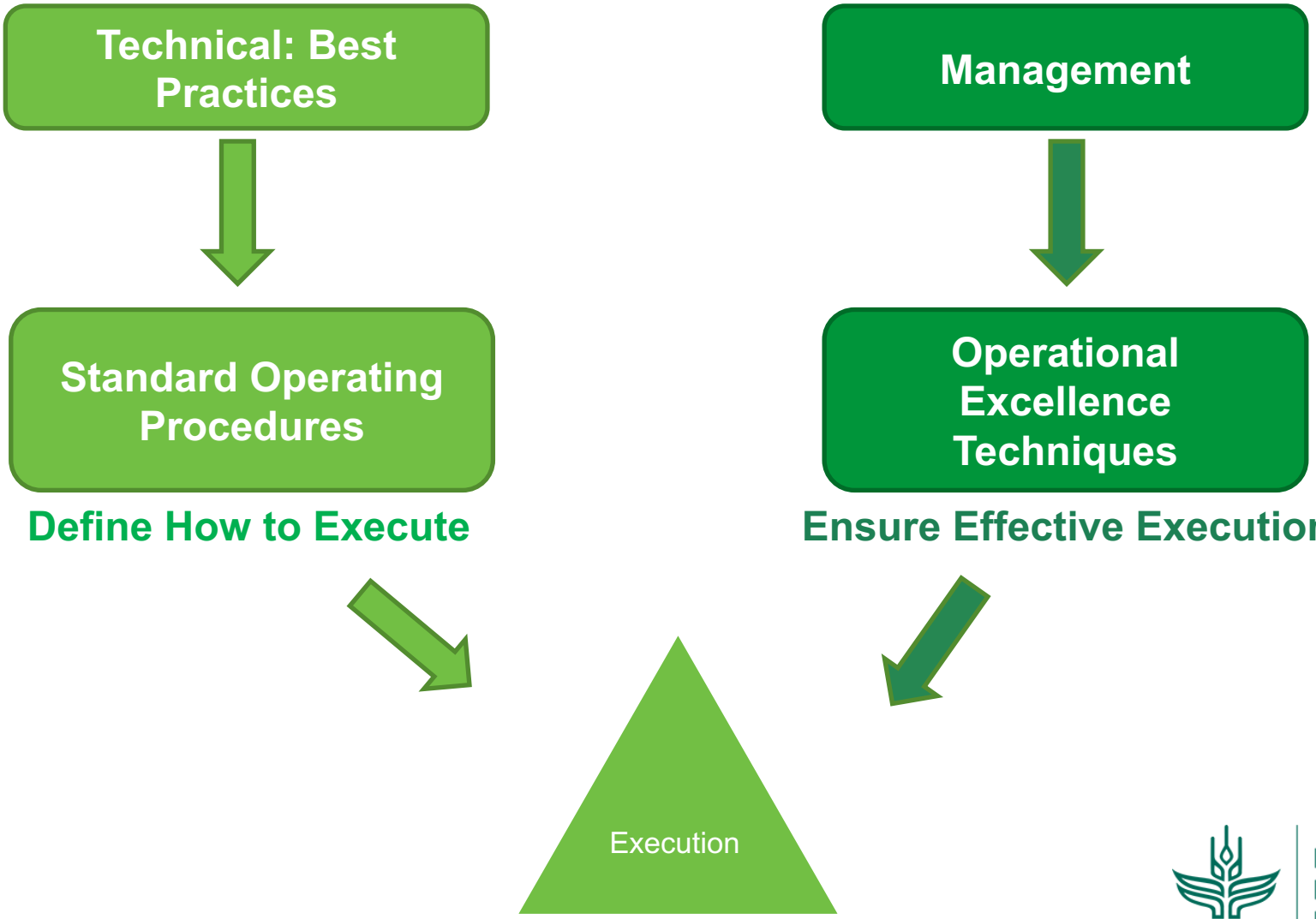
Going from a well engineered Breeding Scheme to Execution



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Benefits of Well Defined SOPs

- Clear and common understanding of breeding processes
  - Consistency – reduction in errors
  - Continuity - training/onboarding
- Enables effective support for the process
  - Biometrics, breeding IT, genotyping, phenotyping, mechanization, …
- Ability to track metrics and identify issues/bottle necks
  - Targeted interventions
  - Ability to provide a clear rationale for investment

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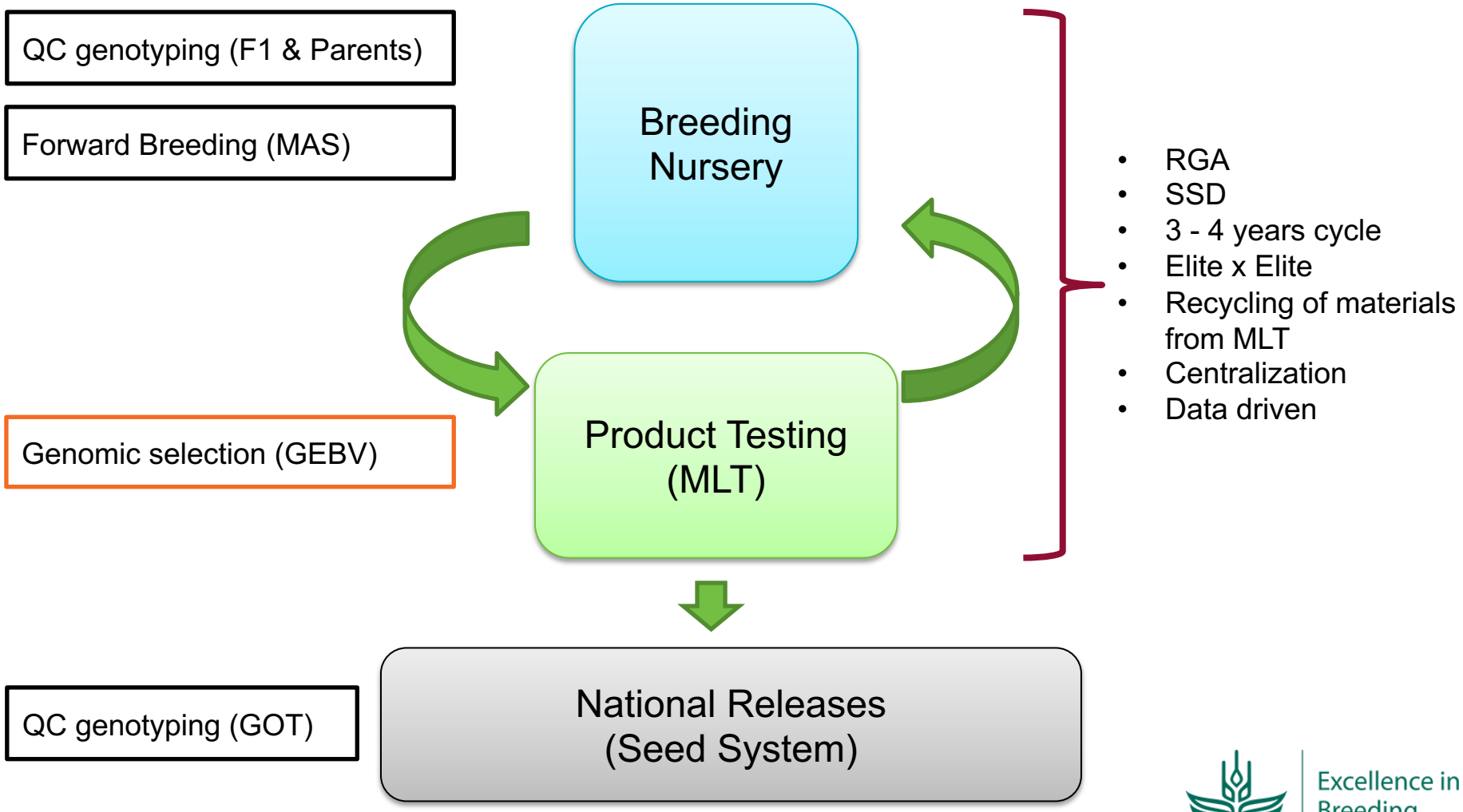
Genotyping as part of the manufacturing process



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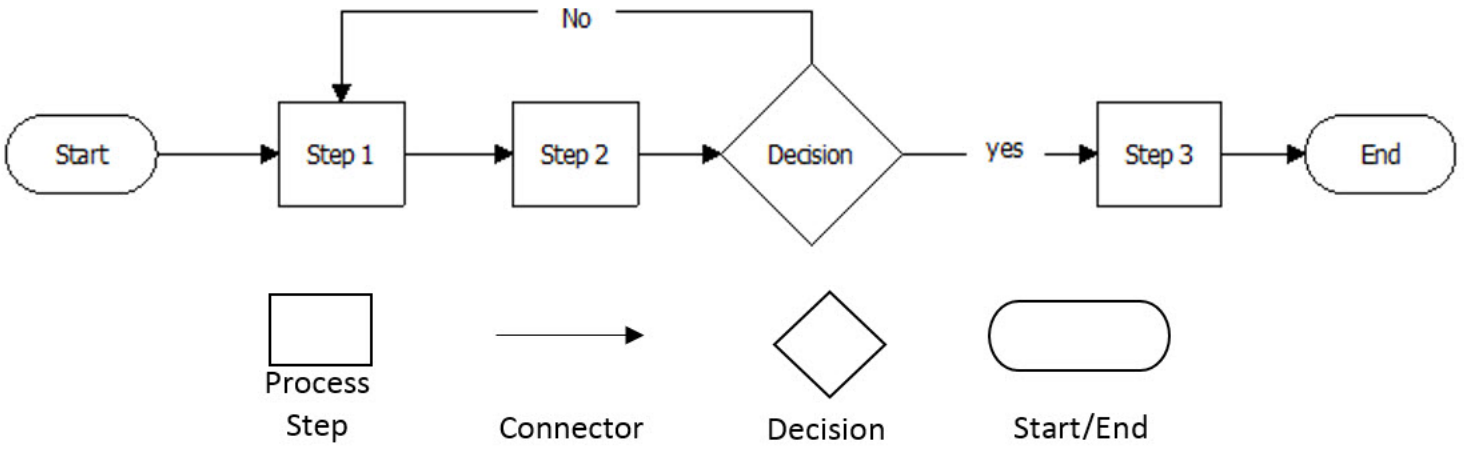
Developing and Documenting SOPs

- Process Mapping – Visual representations of processes
- Effective approach to defining and documenting SOPs at different levels of detail
  - Captures the critical details
  - Enables easy communication of SOPs



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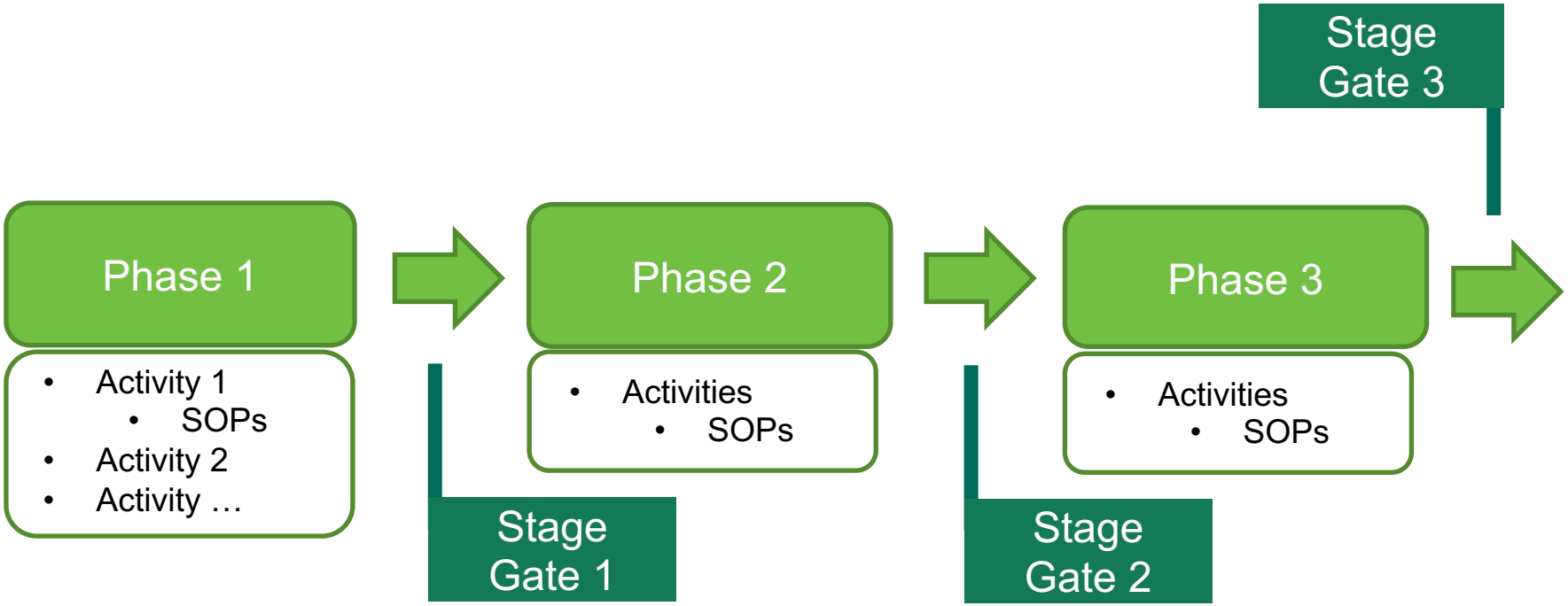
Stage Gates



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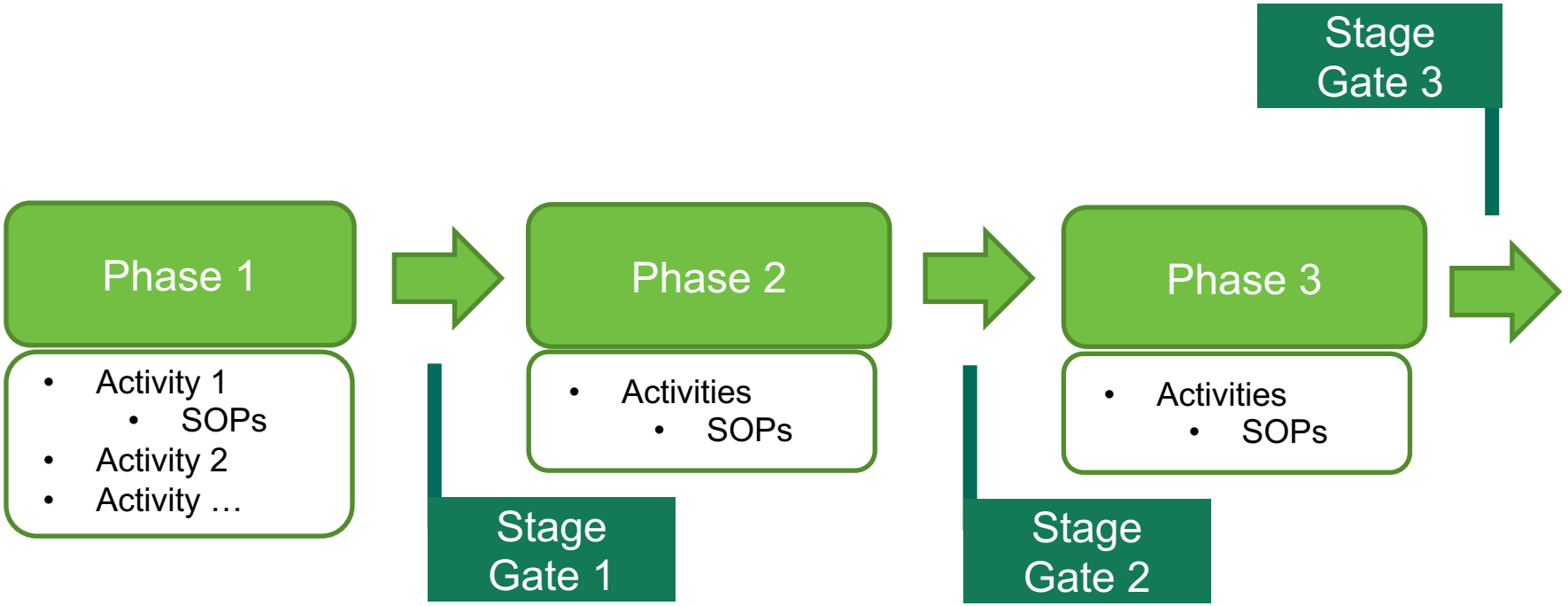
Stage Gates



Stage Gates are "SOPs" for critical decisions

Defines: The process for making decisions

The criteria for making the decisions

The roles, responsibilities, and expertise of those making the decisions

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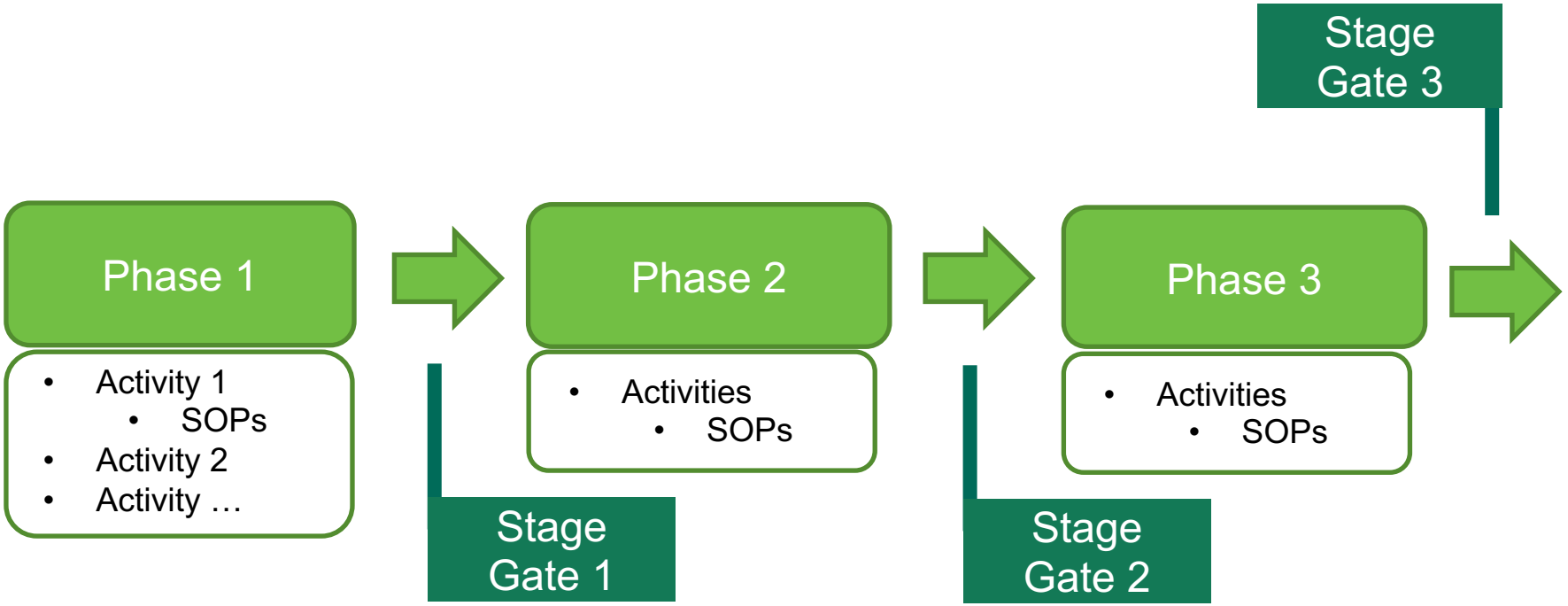
Stage Gates



Stage Gates must be carefully designed to ensure successful delivery

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Advancement Meeting

- Ensures the effective Execution of the Stage Gates (Management - Operational Excellence)

- To enable a successful advancement meeting you must first:
  - Define the process and roles – who does what?
  - Define the criteria for advancement – what information is needed and how should it be used?

  (The process, roles and criteria will be unique to each Stage Gate)

- This requires extensive planning and preparation
  - All activities conducted throughout the year feed into the advancement meeting

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Variety Selection (Advancement)

According to acceptance criteria decide if the advancement decision for a variety is a Yes (+ outcomes, advance to next stage); No (- outcomes, stop evaluating); Maybe (mixed +/- outcomes, retain as feasible)

1. **Define advancement procedure:**
   - Product profiles and advancement decision criteria (with EiB module 1)
   - Breeding schema and corresponding trial protocols (with EiB module 2)
   - The types of decisions to make and how to make them
   - Participants; Meeting procedure; Timing in breeding cycle; …
2. **To Implement define:**
   - Recommend analyses for advancement decisioning
   - Visualization frameworks for making variety advancement decision
   - Data arrays providing data to analyses and visualizations
   - Means for recording decisions
3. **Enable by providing access to:**
   - Analytics
   - BI tools or R modules implementing visualizations
   - Data management
4. **Conduct advancement meeting**
5. **Practice for evaluating how well the process executed**
6. **Phased implementation: Step 1 -> Step 2 -> Step 3-> Steps 4, 5**

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