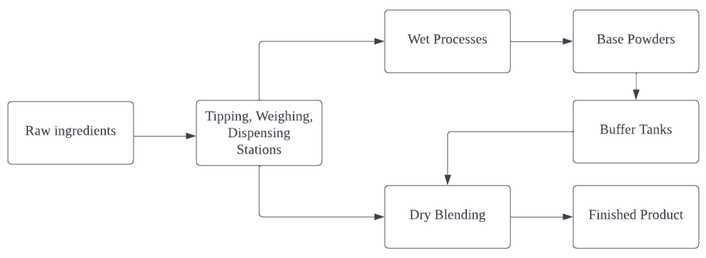
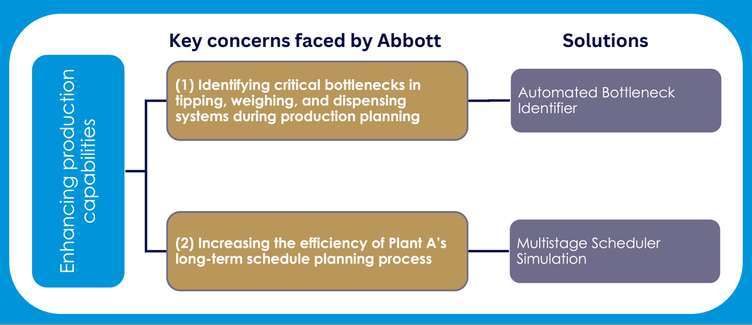
Production bottleneck identification & Scheduler simulation model

SDP Group 1:
Benjamin Png Hao Ze | Per Yi Ru Michael | Lin Wen Jing | Lim Si Yeon

Advisors:
NUS: Professor He Shuang Chi | Abbott: Lester Eng

Production @ AMS Plant





Ability to analyze proposed schedules provide insight into plant's ability to scale up production without operational deficiencies

- **Investments into technologically advanced machinery** enables the plant to scale up production
- Bottlenecks may occur when **upstream resources are unable to cope with the required loads** of downstream resources

- Demand planners are **unable to virtually assess the integrity of proposed schedules**
- Upper limit of the plant's production capabilities **cannot be stress tested**

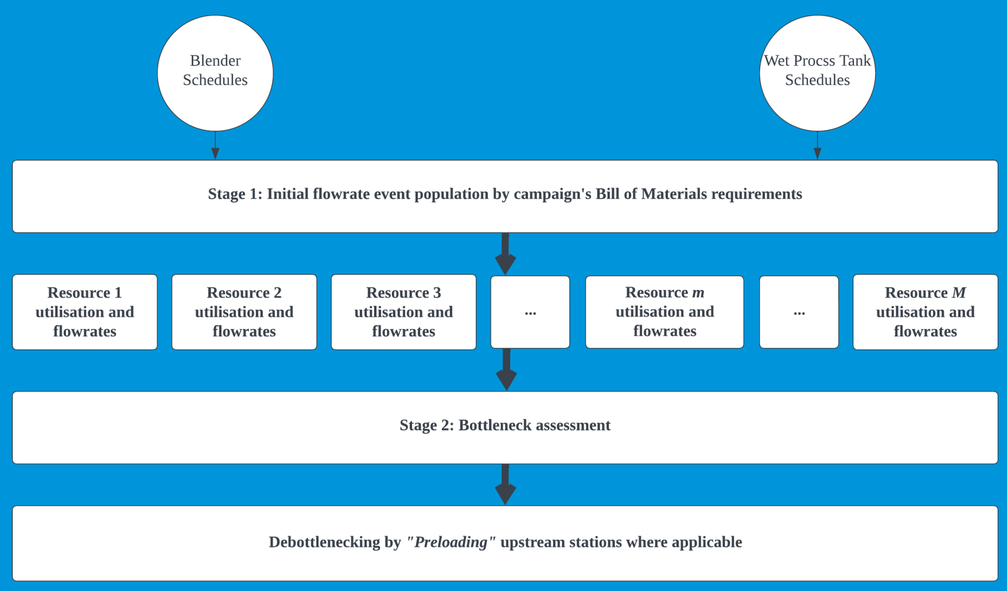
Scope 1:
Identifying & solving bottlenecks in a given production schedule

Scope 2:
Reducing development speed of a Long-Term Production Schedule (LTP)

Conclusion:

- Findings in this study provide improvements to the LTP generating processes in support of technologically advanced resources
- Proposed models to address both scopes of work to allow demand planners to better analyse and adjust any delinquencies in the production schedules

Scope 1: Debottlenecking strategy



Estimated time improvements and User effort requirements

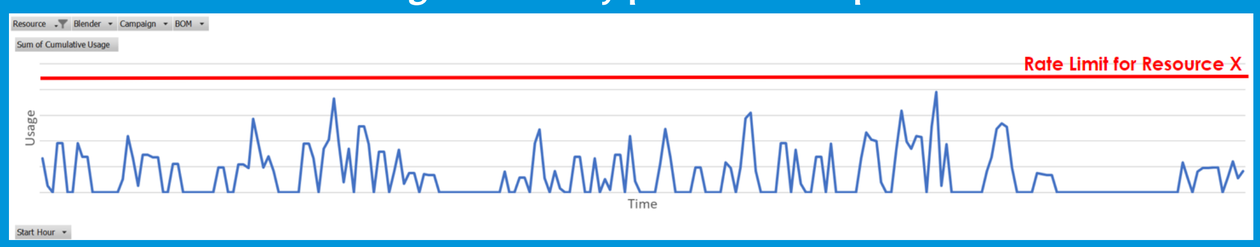
VBA Development	Est. Time Taken (Best case scenario)	Required user involvement
Manual	N.A.	High
Automation	1 Hour	Low

Successful quantitative validation of proposed schedules' feasibility allow for in-depth analysis into future production planning

Case Study:
How can Abbott schedule their production such that it can support the growing demand of their products?

Situation: If Abbott needs to increase production of product A by *xx* tons, is the proposed schedule feasible? Else, how can production be scheduled?

Cumulative resource usage to identify presence and position of bottleneck



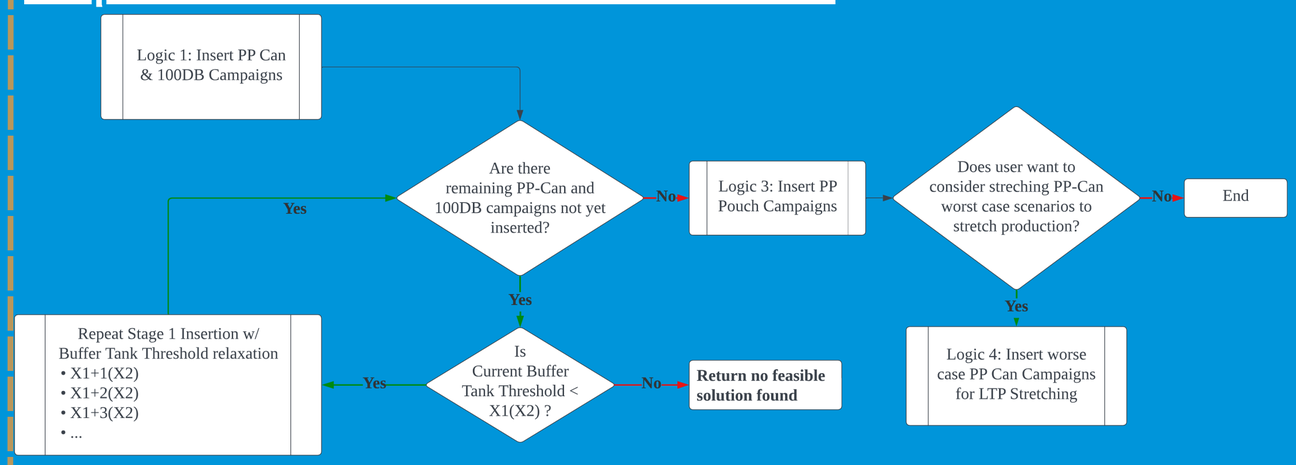
Conclusion:

- The current heuristic validation of the proposed production schedules is time consuming, error-prone and incapable of fully capturing the upper limit of the plant's production capabilities
- The developed VBA model quantitatively validates the feasibility of the proposed production schedules, providing insights into the plant's capacity to scale up production without operational deficiencies

Future developments to bottleneck identifier:

- Topological graph model to encapsulate the entire plant's production process to allow for more complex, granular and long-term analysis
- Debottlenecking solution assessments to tackle the infeasibility of proposed production schedules

Scope 2: Simulated Production Scheduler



Estimated time improvements and User effort requirements

LTP Development	Est. Time Taken (Best case scenario)	Required user involvement
Manual	1 Month	High
Scheduler	2 Hours	Low

"Time-to-Insight" significantly reduced by 99%, allowing for greater breadth and depth when assessing production capabilities of the plant

Case Study:
How should Abbott allocate new resources to the plant in the future?

Situation: If the Plant had 2 new buffer tanks built, how should they be assigned to the products to maximise production output

What-if analysis of Plant's production to increased resources (Buffer Tanks)

	PE Buffers	SG Buffers	Percentage of total production load volume	Scenario details
(1)	X1	X2	0.689%	Current capabilities
(2)	X1+1	X2	1.453%	Expansion to X1 + 1
(3)	X1+2	X2	1.453%	Expansion to X1 + 2
(4)	X1	X2+1	0.000%	Expansion to X2 + 1
(5)	X1	X2+2	0.000%	Expansion to X2 + 2
(6)	X1+1	X2+2	2.039%	Expansion to X1 + 1, X2 + 1

Conclusion:

- Under current planning norms, resources should be assigned equitably across product types to maximize potential gains to production
- Distributing the buffers tank across product types resulted in a 2% gain in production volume under the same operating condition without overloading any one dryer in the plant.

Future developments to scheduler:

- Continuous-Time Simulation employed to compliment LTP developed to make real-time adjustments to the schedule as it is in production
- (Re-) insertion of campaigns to improve resource utilization & optimize production output