The development of a decision support model for the flexible job shop scheduling problem in a multi-product assembly environment

1 Background

Wispeco Aluminium manufactures and supplies aluminium profiles. Wispeco's Powder Coating department paints about 2000 aluminium profiles, packages them, and distributes them to suppliers. Currently the profiles go through two packaging processes.

WISPECO Aluminium

2 Problem

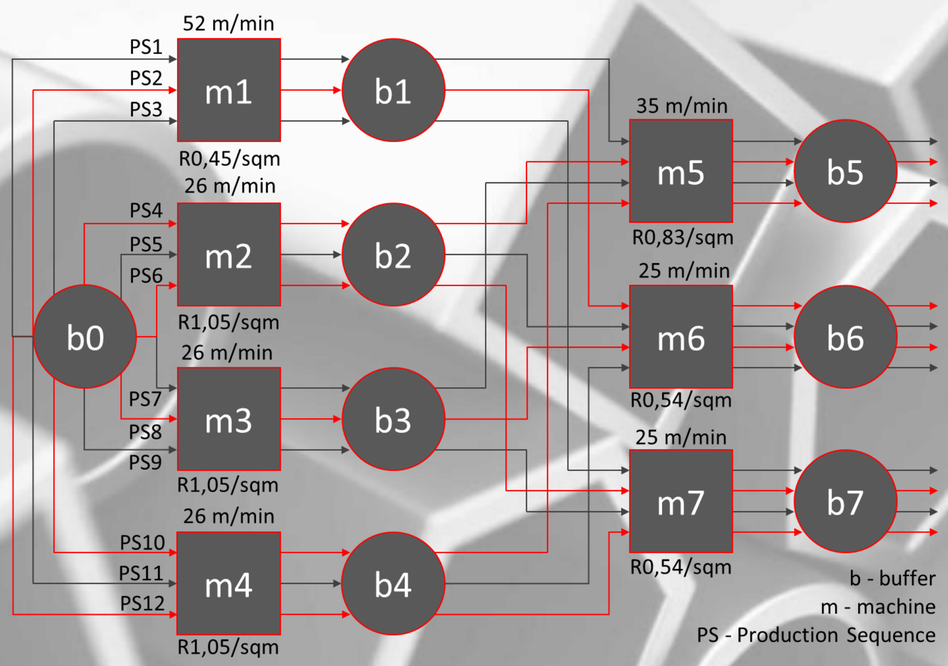
Five new packaging machines are to be bought which consist of two types of machines – one with the purpose of branded packaging and the other with the purpose of cheaper packaging. The problem that needs to be addressed is the allocation of profiles to a machine. There are multiple machines which can perform the same packaging operations.

3 Project Aim

The aim of the project is to develop a mathematical modelling tool that determines the optimal scheduling of profiles in the packaging process while satisfying two conflicting objectives:
1 - Minimising total processing costs and
2 - Minimising total completion time

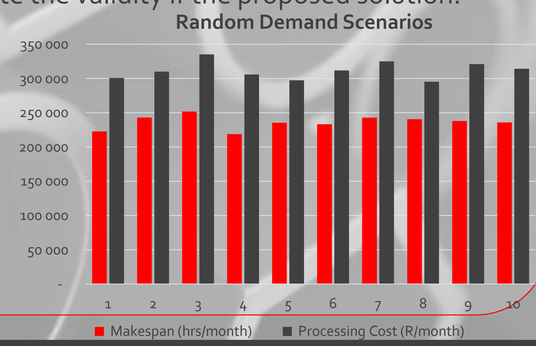
4 Tools Used

- Flexible-Job Shop Scheduling System – Allows the same operation to be processed on a set of alternative machines.
- Multi-Objective Integer Linear Programming Model – Primary goal is to achieve an optimal solution from two conflicting objectives.
- Cost Benefit Analysis – The current packaging costs are compared to the proposed packaging costs.



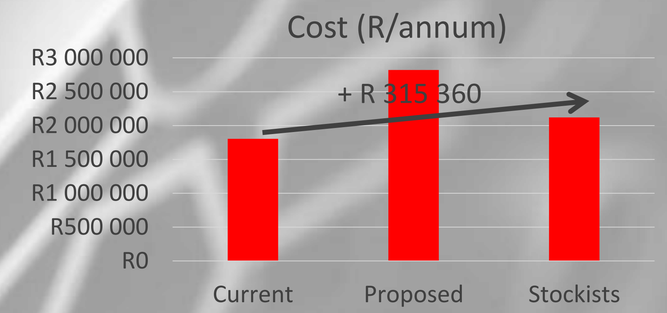
5 Mathematical Model

The mathematical model was tested using different situations (demand scenarios) and constraints to evaluate the validity if the proposed solution. By adjusting various variables and parameters in the mathematical model, it is possible to test a number of different scenarios and replicate tests through the model, which allows for the company to make decisions without physically spending any money.



6 Conclusion

Results show a list of production sequence allocations for each profile to adhere to, to achieve optimal scheduling, and the associated production cost and total completion time.
As was expected, the overall price of packaging increased by approximately R1m per annum for the powder coating department. However, Wispeco's overall packaging costs consider their stockist department as well, which will now reduce in packaging costs due to the new method of packaging. Therefore, the overall cost of plastic only increases by approximately R315 000 per annum.
The mathematical model developed is able to determine the optimal scheduling profiles.
The model can be used and run on a monthly basis by adjusting the demand for the scheduling of profiles.



7 Benefits

- ✓ Branding included in the packing (through machine m2, m3, m4)
- ✓ Customer demands are met
- ✓ Profiles are protected more than before
- ✓ Reduction in stockist packaging wrapping price
- ✓ Real time adjustments for profiles used
- ✓ Using this model for product scheduling is feasible
- ✓ Saving the environment by using less plastic

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