Decision Making for Equipment Selection

Challenge

Equipment selection is an important activity for manufacturing companies as wrong choices can be costly with respect to product quality, production time, production rate and resource allocation. FUJIFILM Imaging Colorants Limited wanted to make an early stage selection of premixing equipment from amongst four options which would be inexpensive, straightforward and reliable to operate.

Approach

Britest were able to match FUJIFILM's business requirement with academic interests and expertise in our academic network. Dr. Richard Hodgett, a post-doctoral researcher at the University of Newcastle[†] worked with the lead decision maker and a cross-functional team from FUJIFILM to develop appropriate decision criteria and evaluate the use of three distinct decision analysis methods to tackle their decision challenge.

The decision making approaches were implemented in the ChemDecide software framework, enabling a convenient side by side comparison of the methods and their results. Following the study, equipment Option 4 was further evaluated but ultimately rejected in favour of the less uncertain Option 1.

Key Features:

Client - FUJIFILM Imaging Colorants Limited

Industry - Application Area

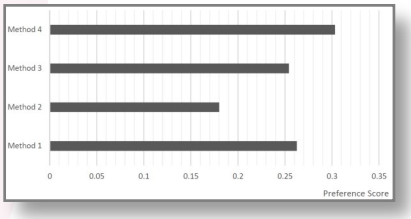
Speciality chemicals – equipment selection in early stage process development

Challenge

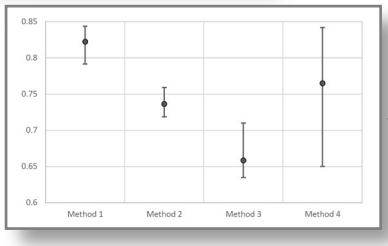
To select the optimum mixing equipment for the premixing stage in the early stages of a new process development.

Outcomes

With support from Britest, FUJIFILM were able to work with an academic specialist in the field of decision support to develop decision criteria and evaluate four equipment options using a range of decision making approaches. An informed decision was made to select a piece of mixing equipment.



Output from the three decision making approaches employed. From top to bottom: Analytical Hierarchy Process (AHP), Multi-Attribute Range Evaluations (MARE) and ELimination Et Choix Traduisant la REalité trois (ELECTRE III).



The Decision Preferences expressed by AHP and MARE are a weighted composite index of multiple quantitative (e.g. capital cost) and qualitative (e.g. ease of operation, reliability) criteria. High decision preference scores are favourable.

MARE uniquely allows data uncertainty to be modelled using low, most likely and high values for each score—indicated by the error bars in each case.

	Descending Rank		Ascending Rank		Final Rank	
1st	Method 1		Method 4		Method 1	Method 4
2nd	Method 4		Method 1		Method 2	
3rd	Method 2	Method 3	Method 2		Method 3	
4th			Method 3			

Benefits

- A structured approach to decision making, with key business and technical information and the desired business benefits captured.
- Qualitative and quantitative financial and practical criteria evaluated side by side within a single tool. Decisions made and the basis for them both clearly recorded.
- Alternative decision making approaches available within a single tool: different approaches may be more suited to different decisions.
- Modelling uncertainty in evaluations allows for better informed decision making, reducing the risk of unexpected outcomes.

[†] *Current address: Leeds University Business School. This case study and the range of MCDMs evaluated are described in more detail in Hodgett, R.E. Int J Adv Manuf Technol (2016) 85: 1145. https://doi.org/10.1007/s00170-015-7993-2*

> ***...the output represents reality [...MARE is...] good for displaying the real situation.***
>
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Generating value from process understanding

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