DoE APPROACHED DIFFERENTLY
MAKING EVERY EXPERIMENT COUNT IN PILOT PLANTS

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“THINKING IS ONE OF THE MOST IMPORTANT WEAPONS IN DEALING WITH PROBLEMS”,
NELSON MANDELA (1918-2013)

Source: http://www.apartheidmuseum.org
DESIRE FOR DESIGN OF EXPERIMENTS

Design of Experiments is:
» Structured
» Efficient

Design of Experiments ensures that:
» Analysis of the results is possible
» Research questions are answered (whether you like the answer or not)

Design of Experiments desires:
» Good preparation
» Good software tool(s)

“The basic idea of Design of Experiments is to ensure that the Research Questions you have can be answered – with a minimum effort – by the results of the experiments you do.”
EXPERIMENTING IN UNILEVER GLOBAL

<table>
<thead>
<tr>
<th></th>
<th>R&amp;D</th>
<th>Pilot Plant</th>
<th>Factory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs per experiment</td>
<td>$$</td>
<td></td>
<td>$$$$$$$</td>
</tr>
<tr>
<td>Number of experiments</td>
<td>High</td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Desire for DoE</td>
<td>High</td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Statistical knowledge &amp; support</td>
<td>High</td>
<td></td>
<td>Low</td>
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</tbody>
</table>
INTRODUCING DoE IN PILOT PLANTS

Challenges:
» 40+ pilot plants, 500+ colleagues
» Statistics is “not their cup of tea”
» Possible lack of knowledge
  • Many DoE’s available
  • Analysis techniques
  • Interpretation of results

Possible solutions:
» Detailed training
» Increase statistical support
» Force the use of DoE
» Simplify the process of applying DoE
SIMPLIFIED PROCESS OF APPLYING DoE IN PILOT PLANTS

Avoid statistically language:

» About type of DoE
» About analysis techniques

Focus on what information is required & knowledge they have

Help at every stage of setting up DoE & analysis

Forced decisions:

» Output of one design
» Predefined set of analysis techniques
HELPING HAND: “PLYOS” SOFTWARE TOOL

Plyos tool (globally available within Unilever):
» Runs in JMP
» Collects known information (responses, factors)
» Q&A for additional information (context sensitive)
» Explains every step and communicates decisions
» Checks input and suggests improvements based on Unilever constraints
» Supplies efficient DoE
» Analyses experimental data
» Helps in interpreting statistical results
FLOW OF PLYOS

Start
Responses
Factors
Q&A
Decisions & consequences
Ready to use design of experiments
Analysis of results
FLOW OF PLYOS

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DEVELOPMENT CHALLENGES

Major challenges/problems during development of Plyos:
» How to assure the correct design as output?
» How to create the design?
» How to present the right help at the right stage?

Some minor challenges:
» JMP language issues
» JMP default setting issues
» JMP version issues
DEVELOPMENT: HOW TO ASSURE THE CORRECT DESIGN

Problem:
» What design would be needed?
» Could we describe the constraints?

Decision:
» Driven by expert knowledge we defined over 280 different situations with specific demands.

Solution:
» Creation of a table with demands/constraints per design (the “Backbone”).
DEVELOPMENT: HOW TO CREATE THE DESIGN

Problem:
» Use of classical designs (no Custom Design).
» Not showing the JMP DoE dialogue panels.

Decision:
» Create designs manually.

Solution:
» Use of nested loop procedures.
» Data table with coded designs for other designs.
DEVELOPMENT: RIGHT HELP AT RIGHT STAGE

Problem:
» Help for DoE set up process, the use of the tool, (forced) decisions by the tool, design data tables and analysis techniques.
» Easy maintenance.

Decision:
» Store help text in different sources.

Solution:
» Some in scripts, most in data tables, description of analysis techniques in a journal.
DEVELOPMENT: MINOR CHALLENGES

JMP language issues:
» Test on language at start of Plyos.

JMP default setting issues:
» No solution found.
» Warnings in help text.

JMP version issues:
» Separate subroutines build for JMP9 & JMP11.
» No longer an issue (all uses JMP11).
ROLL OUT OF PLYOS

Use of Plyos is self-explanatory:
» Guided manual
» Additional procedures available

The use of Plyos is also part of a training:
» Minor background of DoE
» Practising the use of Plyos
» Focus on preparation to set up DoE:
  • “Think Hard Before You Start”
USER STATISTICS (2012-2014)

Worldwide availability
» 20+ countries

500+ registered users
» ~100 “hard core” users

Creation of DoE for 600+ business cases started in Plyos
» Plyos delivered DoE in ~95% of the cases
» ~5% needed input of a statistician

Supported by senior management
CONCLUSION

Simplification of the DoE process seems to be successful.

» First time users react positive:
  • “... I found it easy to play with as a beginner even without the manual. The interface is user-friendly. ... I was clearly guided by the system to reach the final step. ...” (S.Wang, China).

» Questions we receive are primarily on design details not on tool details:
  • E.g. about differences between continuous, ordinal, nominal or interactions.

Possible lack of attraction to the DoE technique remains a concern. It is improving in time.

“Think Hard Before You Start” approach is beneficial.
THANKS TO A FANTASTIC TEAM

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Thank You Questions? Plyos