

# Recognition and Importance of Restrictions on Randomization in Industrial Experimentation

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**Key Words:** Factor relationship diagram, FRD.

## *Abstract*

Statisticians typically recommend completely randomized experimental designs. The reasoning behind this advice is theoretically sound. Unfortunately, engineers who typically run industrial experiments frequently fail to recognize restrictions on randomization i.e. split-plot experiments and are often unaware of the risks associated with analyzing split-plot experiments as if they were randomized. Similarly, issues concerning the inference space of the experiment frequently are not given adequate consideration. Conversely, statisticians frequently are unaware that a restriction on randomization does not necessarily translate into less information than a completely randomized design.

In this paper, we discuss a proactive methodology for identifying and incorporating information concerning restrictions on randomization and inference space in industrial experiments. We also present the Factor Relationship Diagram (FRD), a tool that assists engineers in the recognition of restrictions of randomization and guides the development of questions that encourage the experimenter to understand those sources of variation that may contribute to a lack of precision in a split-plot experiment or lack of repeatability in another inference space. Examples that illustrate the use of the methodology and the FRD are included.