Systems Thinking, Causal Modelling and 'smart data'

BEIS
Office for Product Safety and Standards

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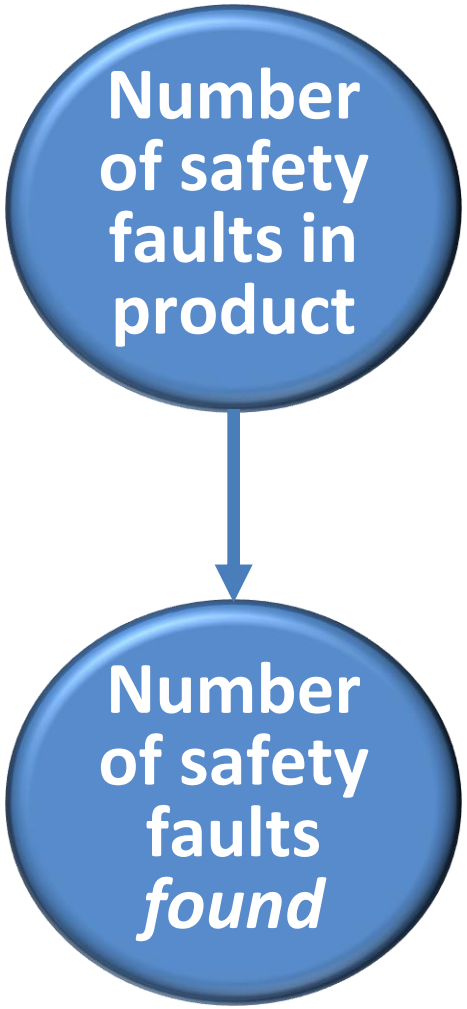
RIM Risk and Information Management

AGENARISK

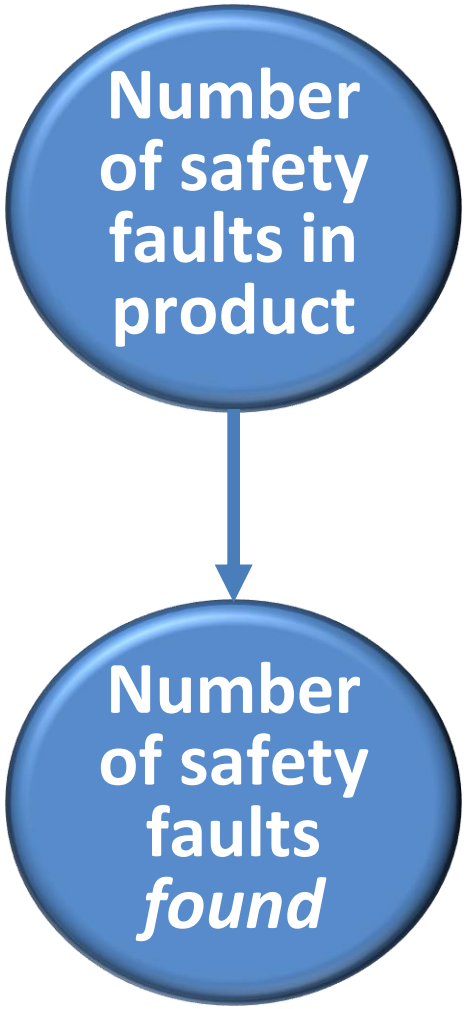
Is this product safe?

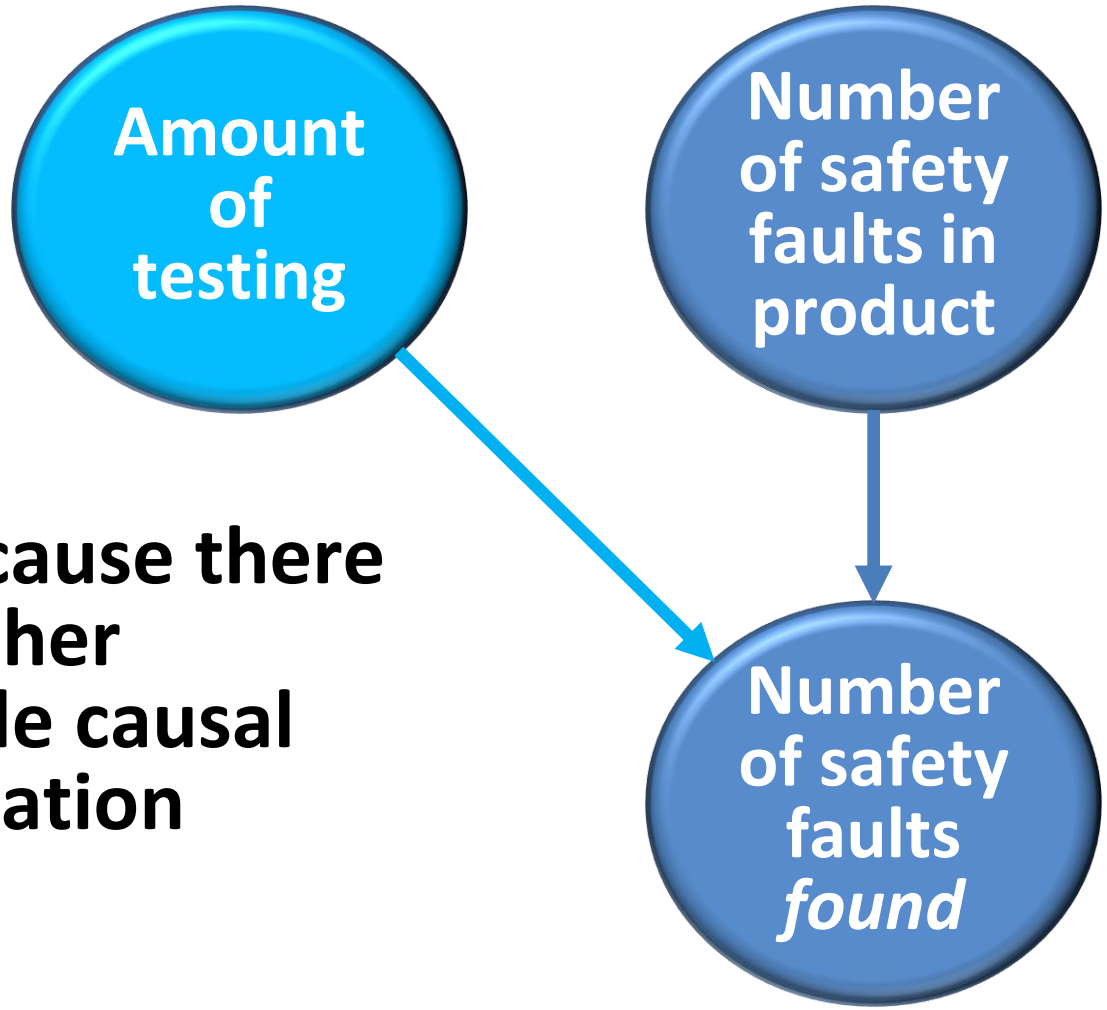
We ‘define’ it as safe if has a sufficiently low number safety faults (faults that can cause a hazard)

If it has no faults then we will not find any during testing

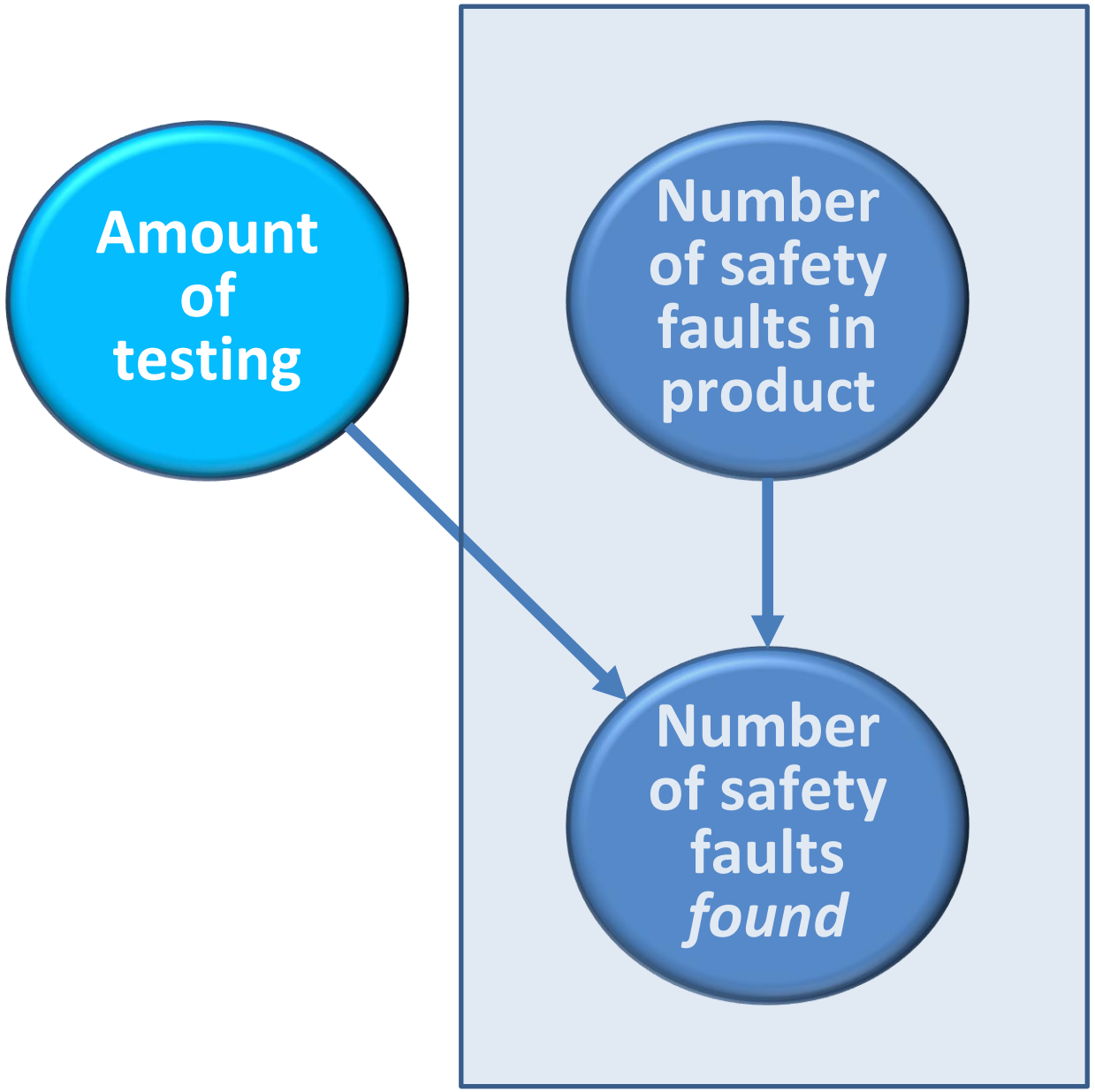


So finding no faults during testing means the product is safe…..?



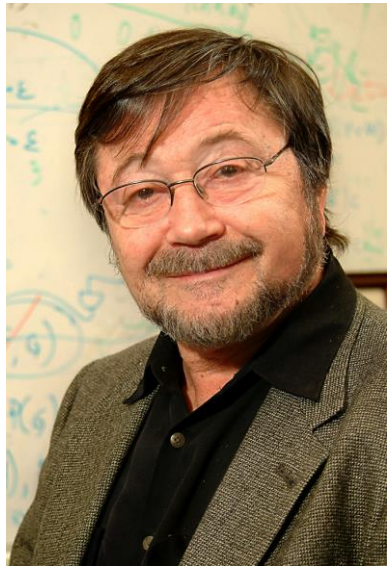


No because there is another possible causal explanation

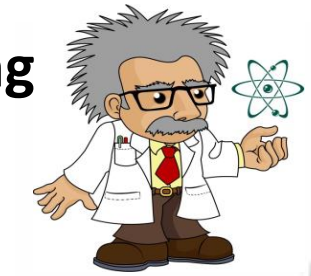


Statistical approaches (including AI/machine learning) cannot 'learn' causal explanations using only data on faults

Pearl's ladder of causation



Imagining



Counterfactuals: "What if I had …"
If I had not applied this intervention would I still have avoided the hazard?

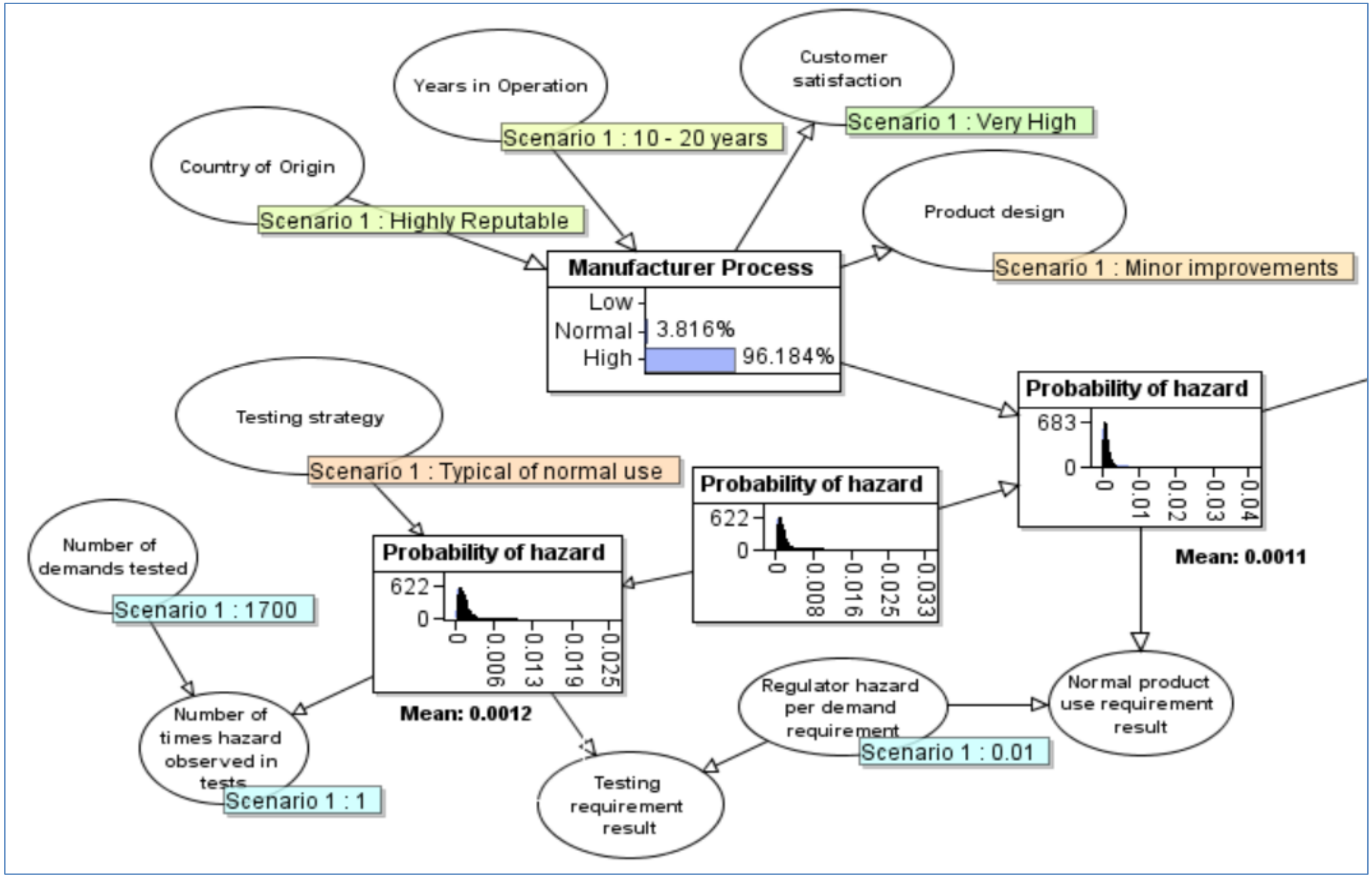
Doing

Intervention: "What if I do…"
If I apply this intervention will it be effective at avoiding hazards for me?

Seeing

Association: "What if I see…"
From testing data is this intervention effective at avoiding hazards

'Standard' statistical methods and machine learning from data alone can ONLY really answer questions of association



Bayesian network models and idioms for Product risk assessment

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Martin Neil
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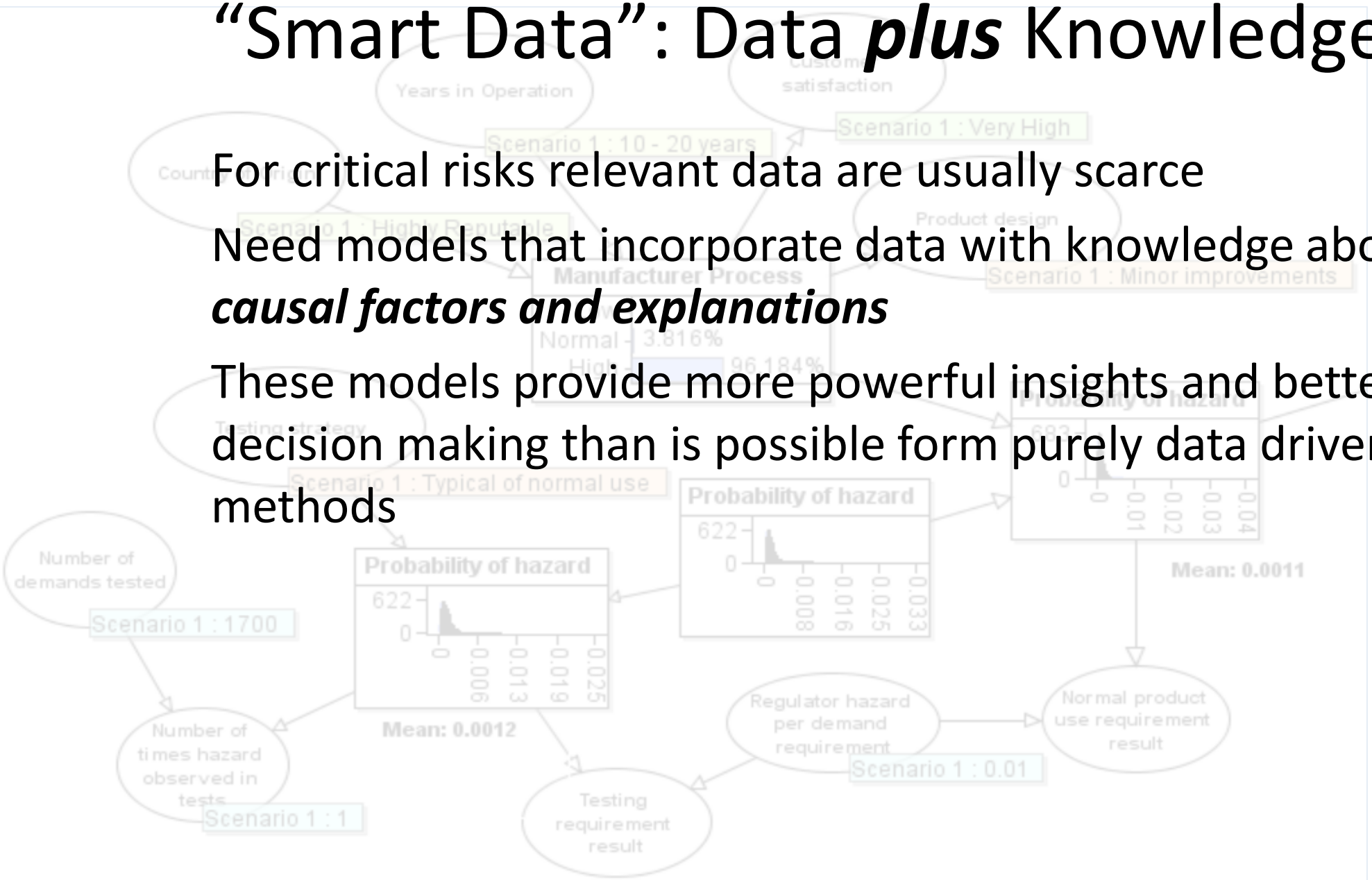
“Smart Data”: Data ***plus*** Knowledge

For critical risks relevant data are usually scarce

Need models that incorporate data with knowledge about ***causal factors and explanations***

These models provide more powerful insights and better decision making than is possible form purely data driven methods



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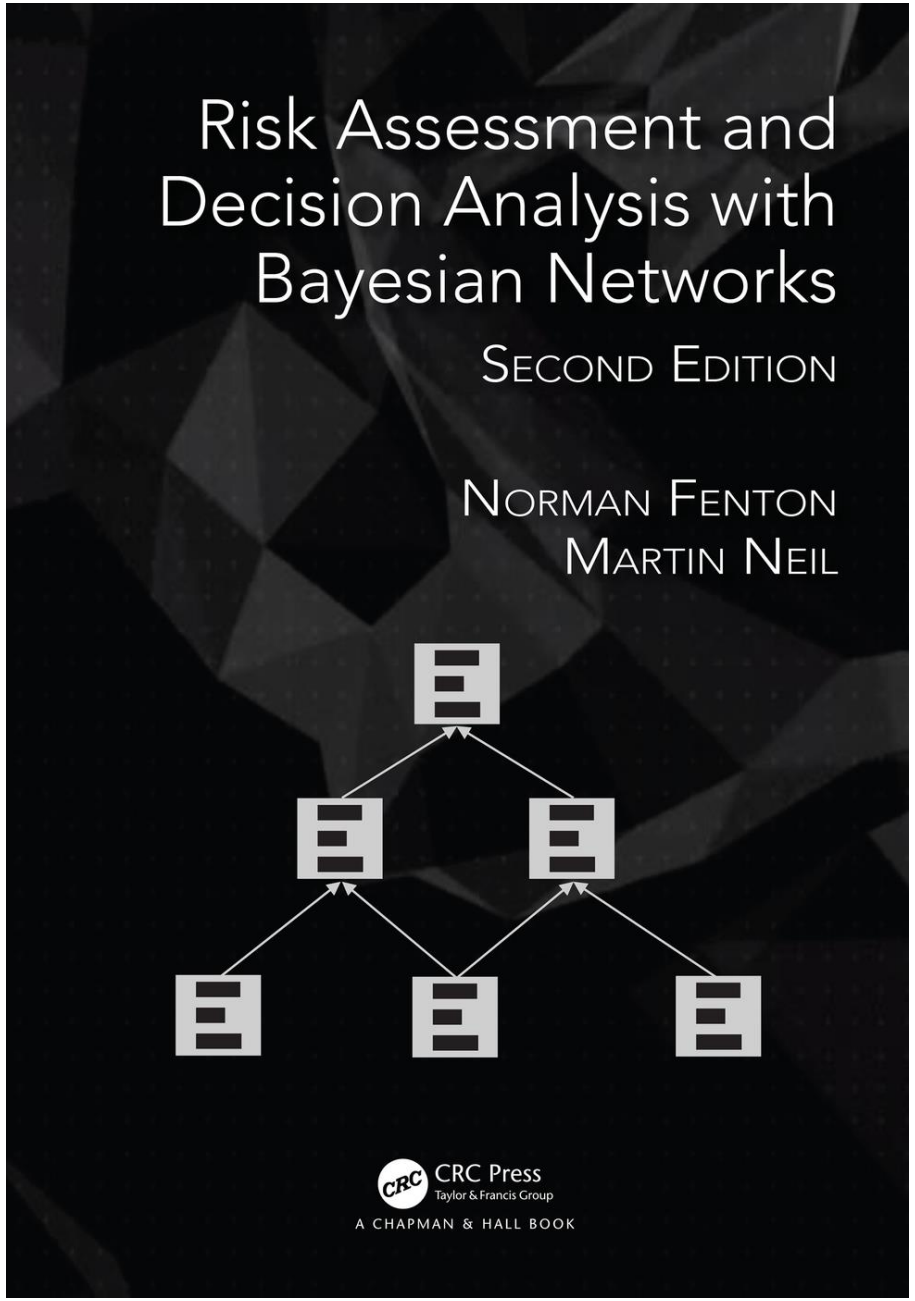
For more See:



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