







Design Space Exploration in Early Vehicle Development

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Introduction

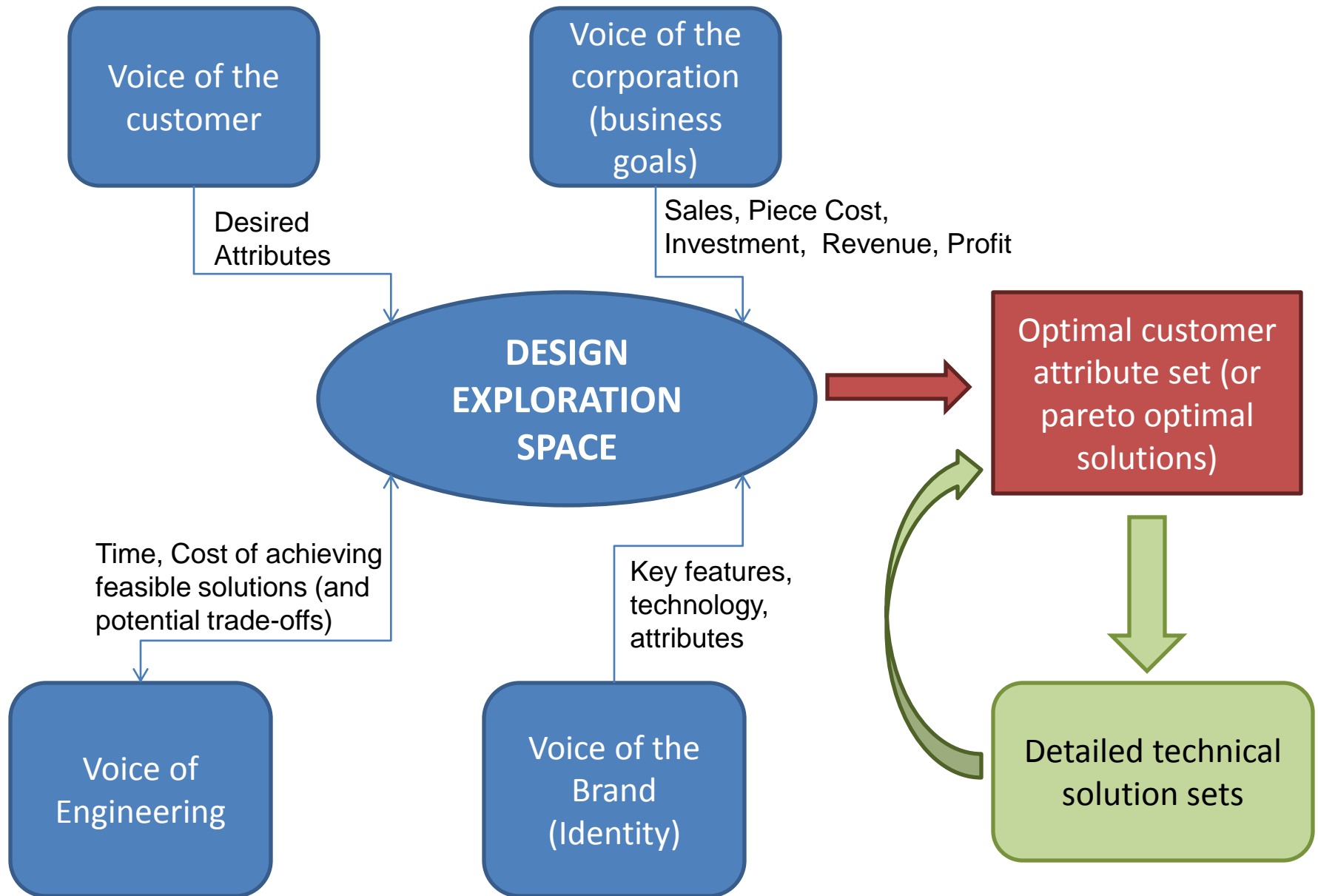
- Background in Mechanical and Industrial Engineering (Decision Sciences)
 - BE - Mechanical (1991)  **Sardar Patel College of Engineering**
Munshi Nagar, Andheri (W), Mumbai 400 058.
 - MS - Mechanical (1994)  **TEMPLE UNIVERSITY®**
 - PhD – Decision Sciences (1999)  **Rensselaer**
 - MBA – Marketing & Strategy (2007)  **MICHIGAN ROSS SCHOOL OF BUSINESS**
- Advanced Vehicle Development at General Motors Corporation
 - Analytical methods development
 - Early vehicle definition
- Work focuses on understanding customer requirements for future projects, translating them into appropriate engineering metrics and assessing for feasibility of solutions

Exploring the design space

Goal: To understand the impact of attribute trade-offs on market demand

- Identify the optimal attribute set that maximizes product objective (sales/revenue/profit/minimize cost)
 - Bridge the gap between business case objectives and engineering constraints
- Involves integrating various models / information
 - Voice of the customer
 - Voice of engineering
- Estimating feasibility (physical, manufacturing, financial)
- Evaluating the “optimal” solution(s)
- Evaluate different solution sets
- Incorporating tribal knowledge / wisdom

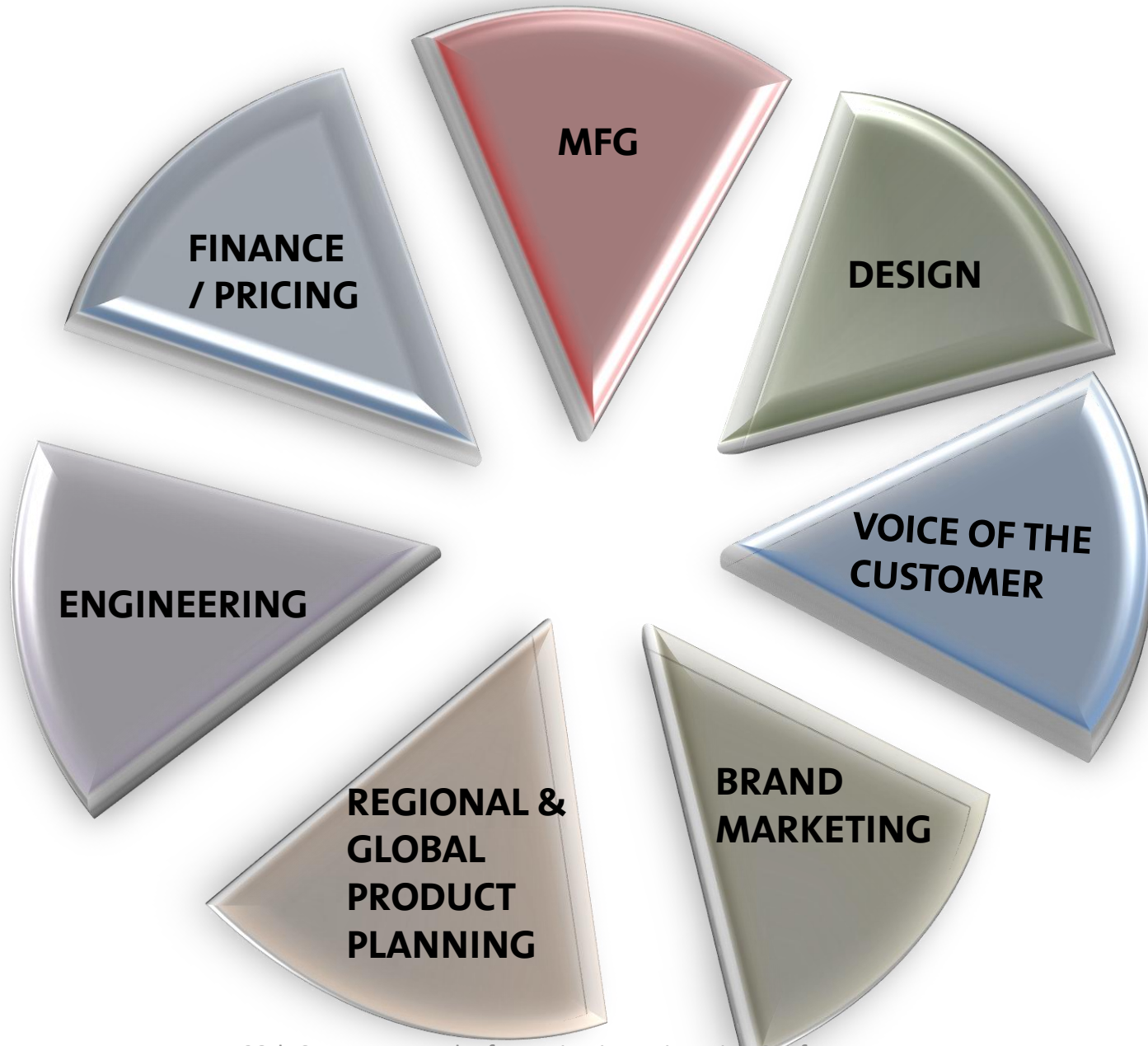
The big picture



Advantages of the current approach

- Ability to choose from various “optimization routines”
 - Design of Experiments (used when looking for an understanding of the entire landscape)
 - Gradient optimization (helps when it is a modification of an existing design)
 - Genetic Algorithms (helps when it is a new segment or a new product idea)
- Ability to link with spreadsheets
 - Spreadsheets are ubiquitous within the corporation and is the software of choice for most people
- Ability to include custom software (as executables)
- Data post processing

Product Development Workgroup





Enhancements we would like to see built-in

Workgroup tool functionality

- Response surface algorithms
- Enhanced visualization tools that aid in data analysis
 - Enables convincing the group about the behavior of the underlying data
- Custom built heuristic algorithms specific to problem types
 - Ability to code algorithms easily
- Easier link to spreadsheets and other in-house software
 - Excel is ubiquitous
- Ability to do what-if scenarios dynamically (as the decision is being made)
 - Helps the workgroup understand the impact of their decisions / recommendations