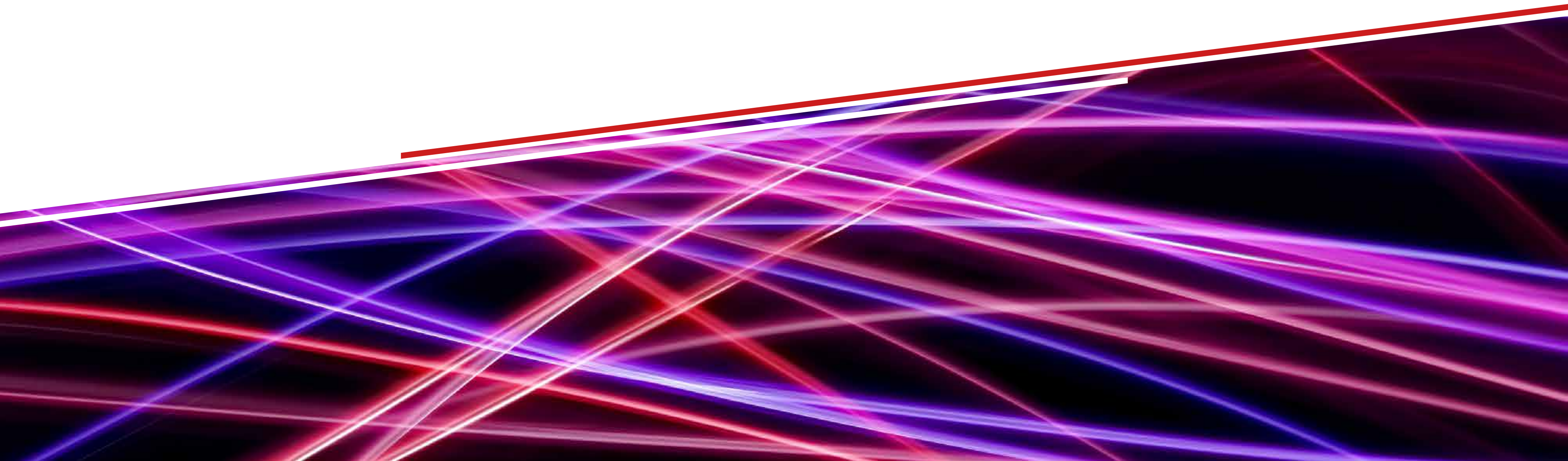


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Strategic Insights into Product Variation Management

Ayla Singhal

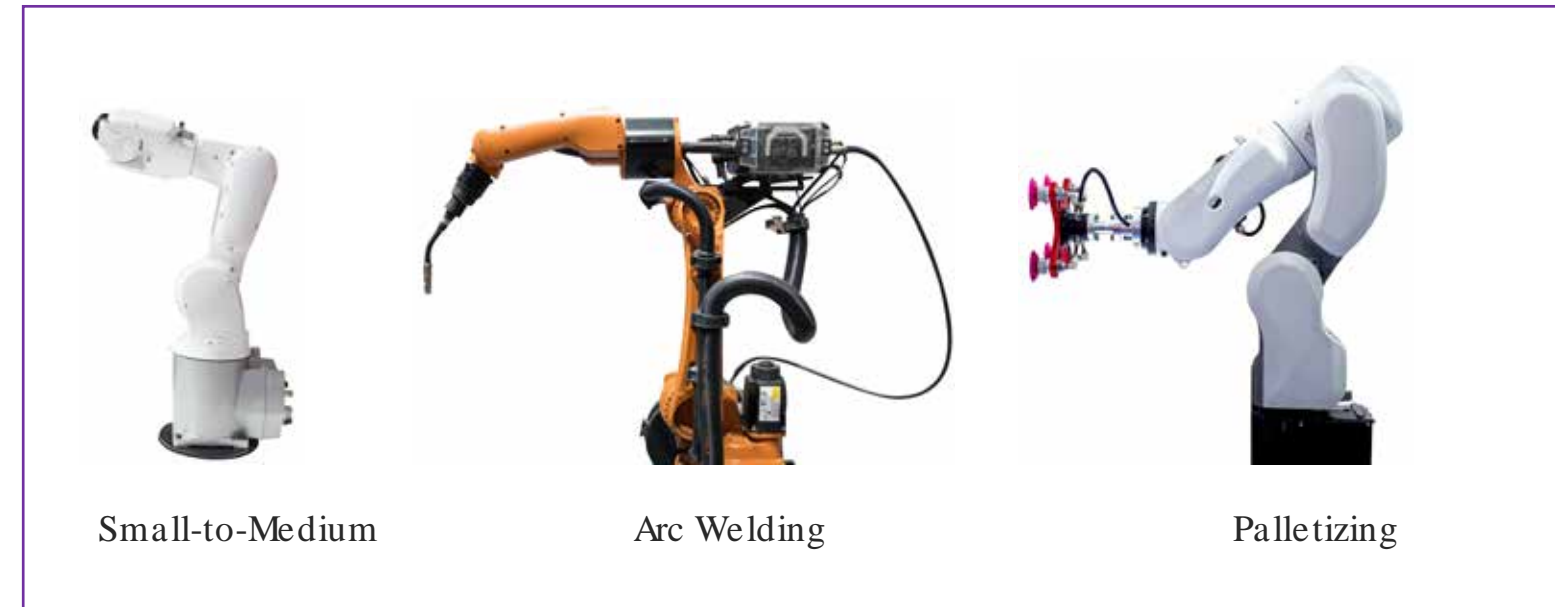
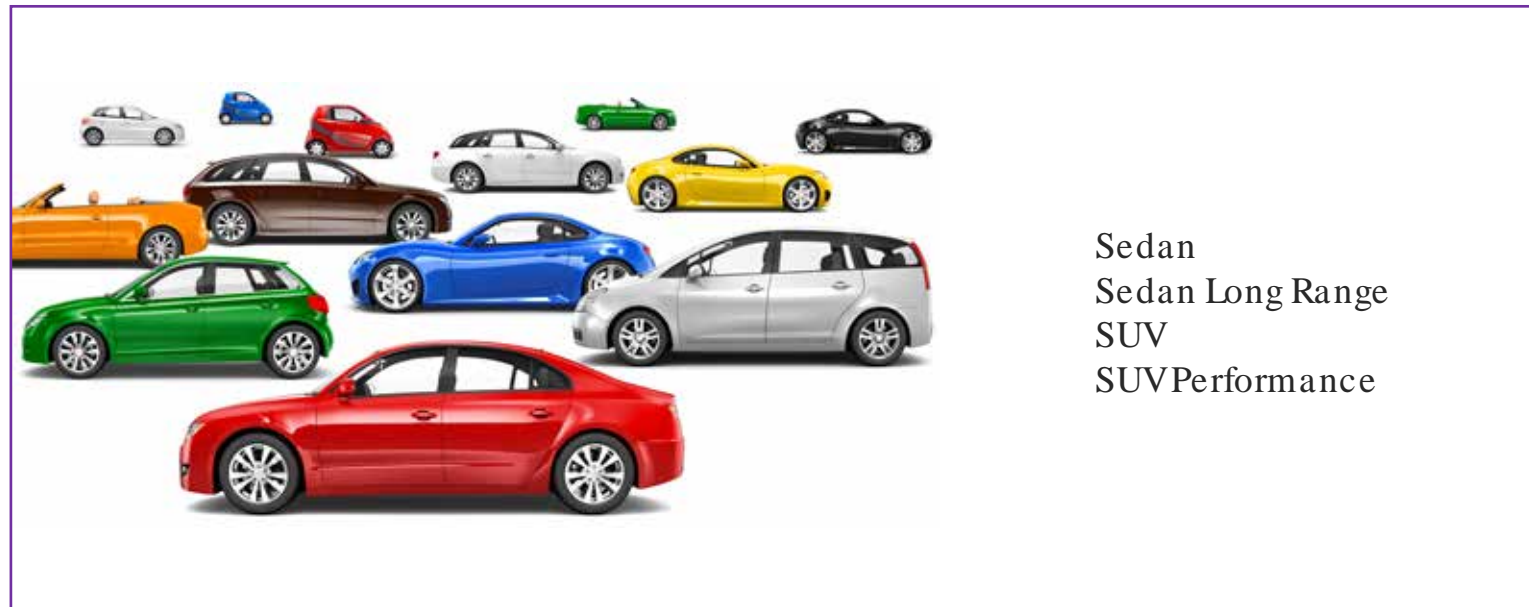
March 5, 2024



Product Variation

Companies across the industries provide variation in their product offerings

- + Strategic tool for driving growth, enhancing customer satisfaction, and staying relevant in a rapidly changing landscape
- Presents challenges related to complexity, costs, inventory management, and brand management



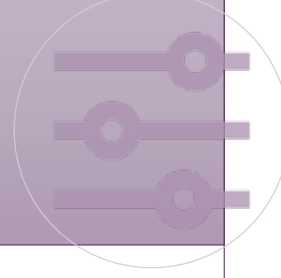
Factors Impacting Product Variation

Manufacturing Approach



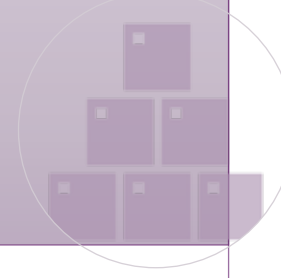
- § Make to Stock
- § Configure to Order
- § Engineer to Order
- § Level of customization in the products

Complexity of Variability



- § Amount of Choices
- § Discrete vs. Continuous
- § Change Frequency

Complexity of Product



- § Product
- § Technological Advancements
- § Regulatory Requirements
- § Globalization and Localization

Others



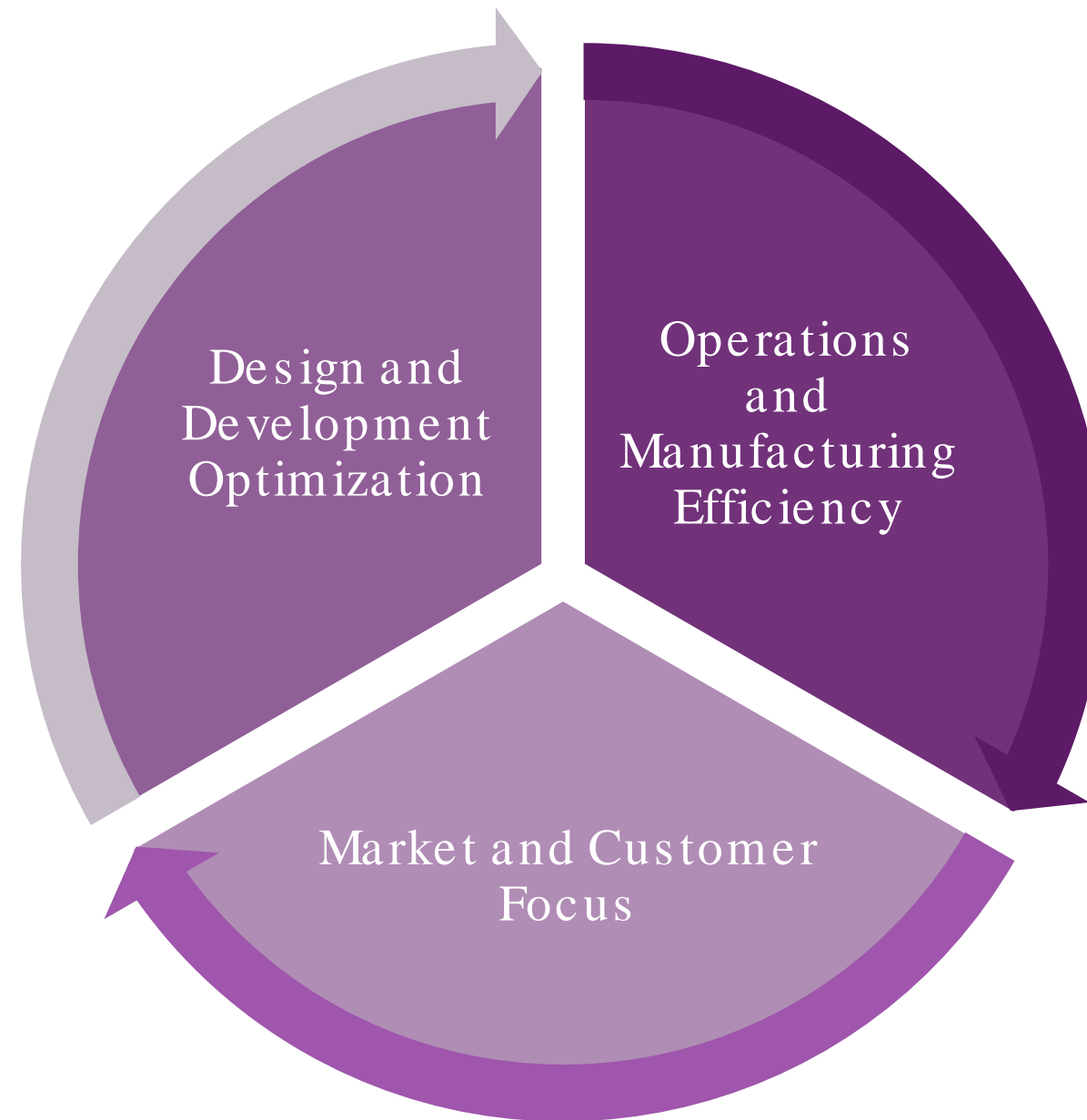
- § Market Demand
- § Competitive Landscape
- § Brand Strategy / Innovation
- § Economic and geopolitical conditions

Challenge: Manage product variation to meet customer needs, drive growth, and maintain competitiveness while staying profitable

Strategies for Handling Product Variation

PLM for seamless data connectivity across all teams and stages of the product lifecycle

- § Modular Design
- § Standardization
- § Collaborative Cross-Functional Teams



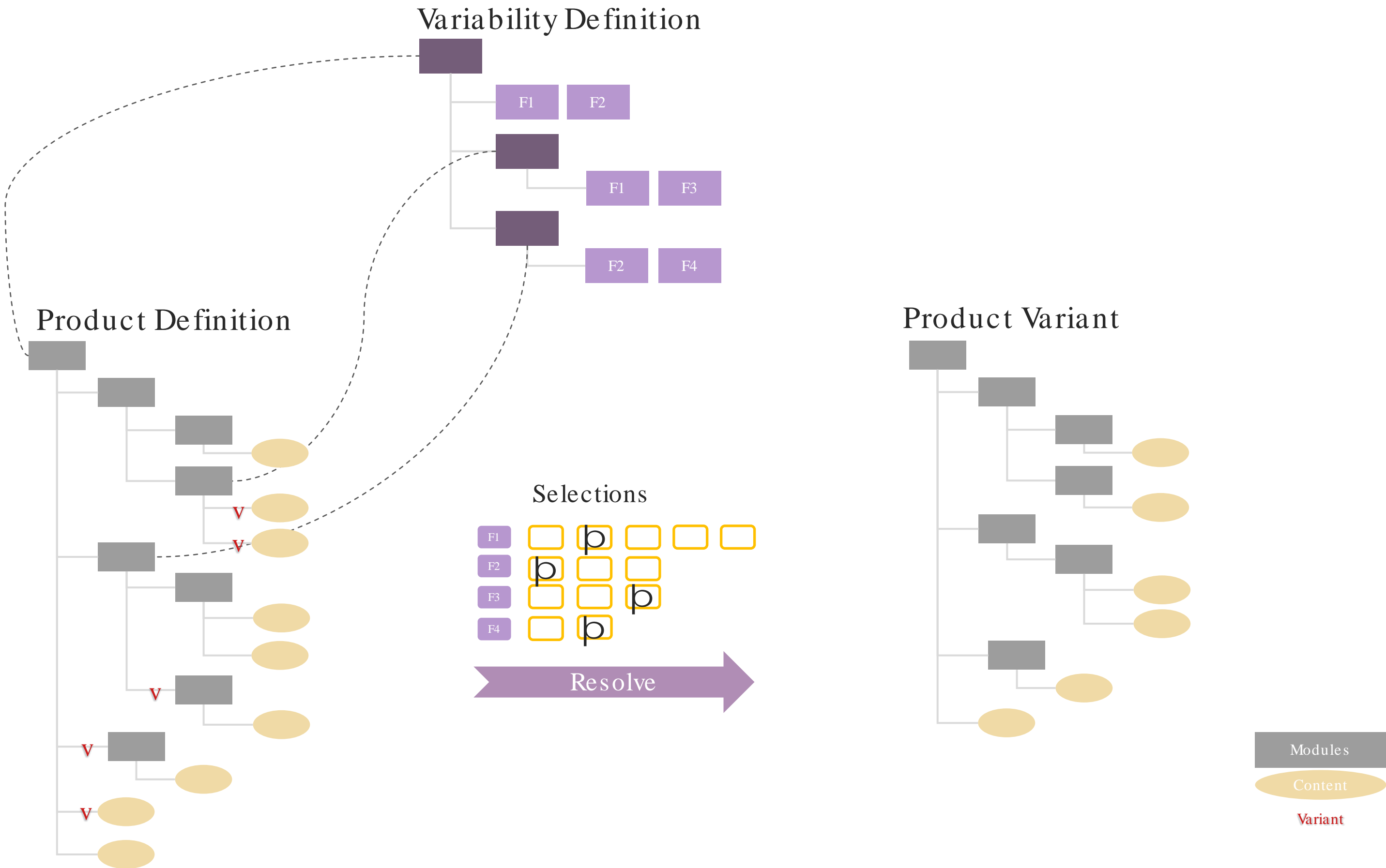
- § Flexible Manufacturing Processes
- § Dynamic Inventory Management
- § Responsive Supply Chain

- § Customer-Centric Approach
- § Data-Driven Analysis
- § Continuous Improvement

Aras Variant Management

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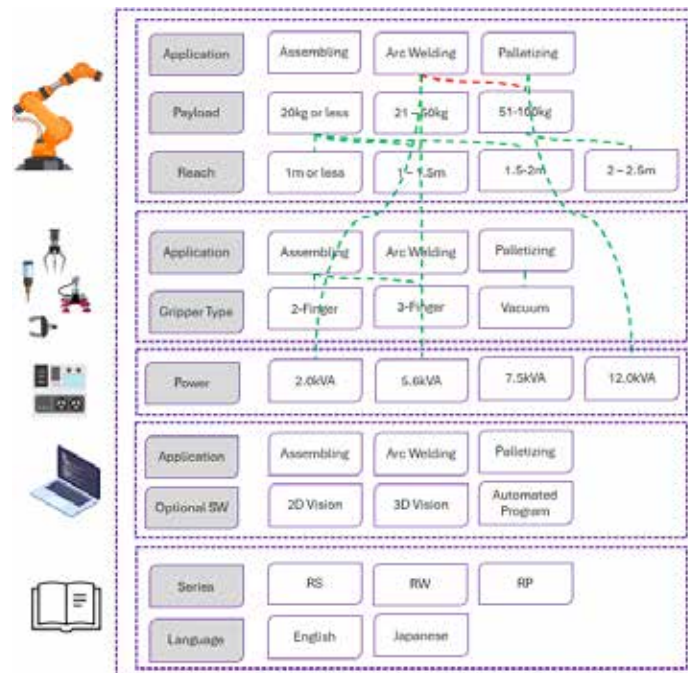
Aras Variant Management | Overview



Effective Approaches to Streamline Variability Definition

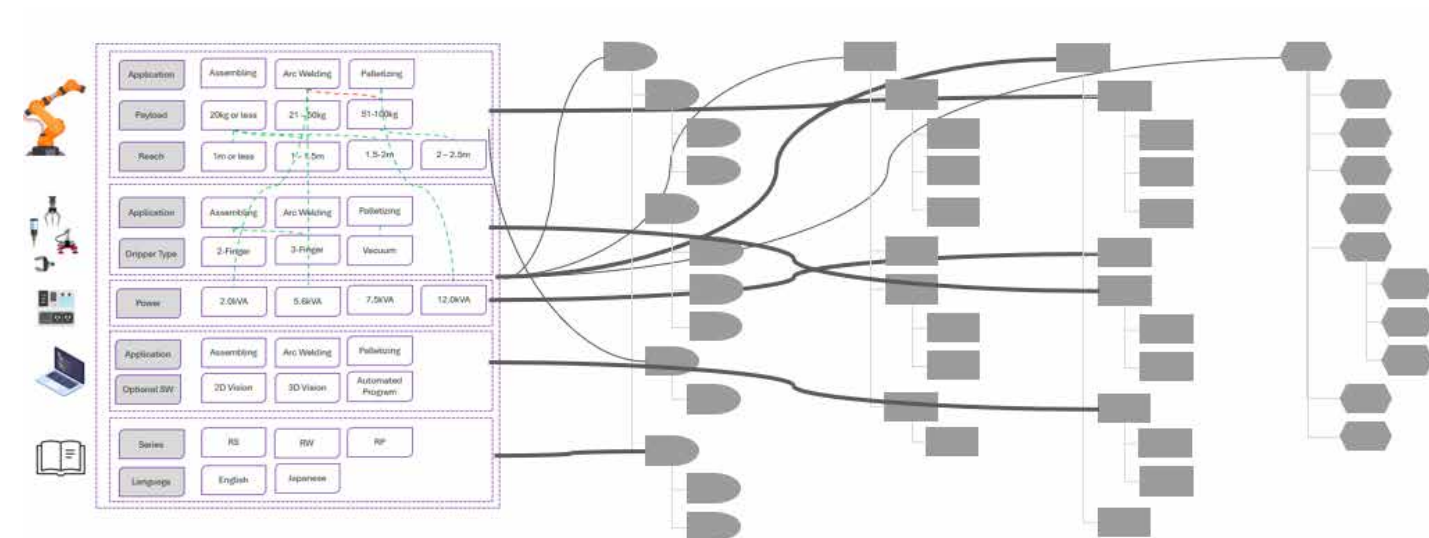
Structured Variability

- § Enables the division of variability into more manageable segments, simplifying usability and handling
- § Supports the application of pertinent variability scopes at different levels of product definition
- § Facilitates collaboration among teams in defining variability, aligning with their specific areas of expertise



Decoupled Variability

- § Allows consistent variability and rule definitions to be applied to multiple structures and across multiple domains
- § Enables configuration experts and content engineers to work with a degree of independence while remaining linked

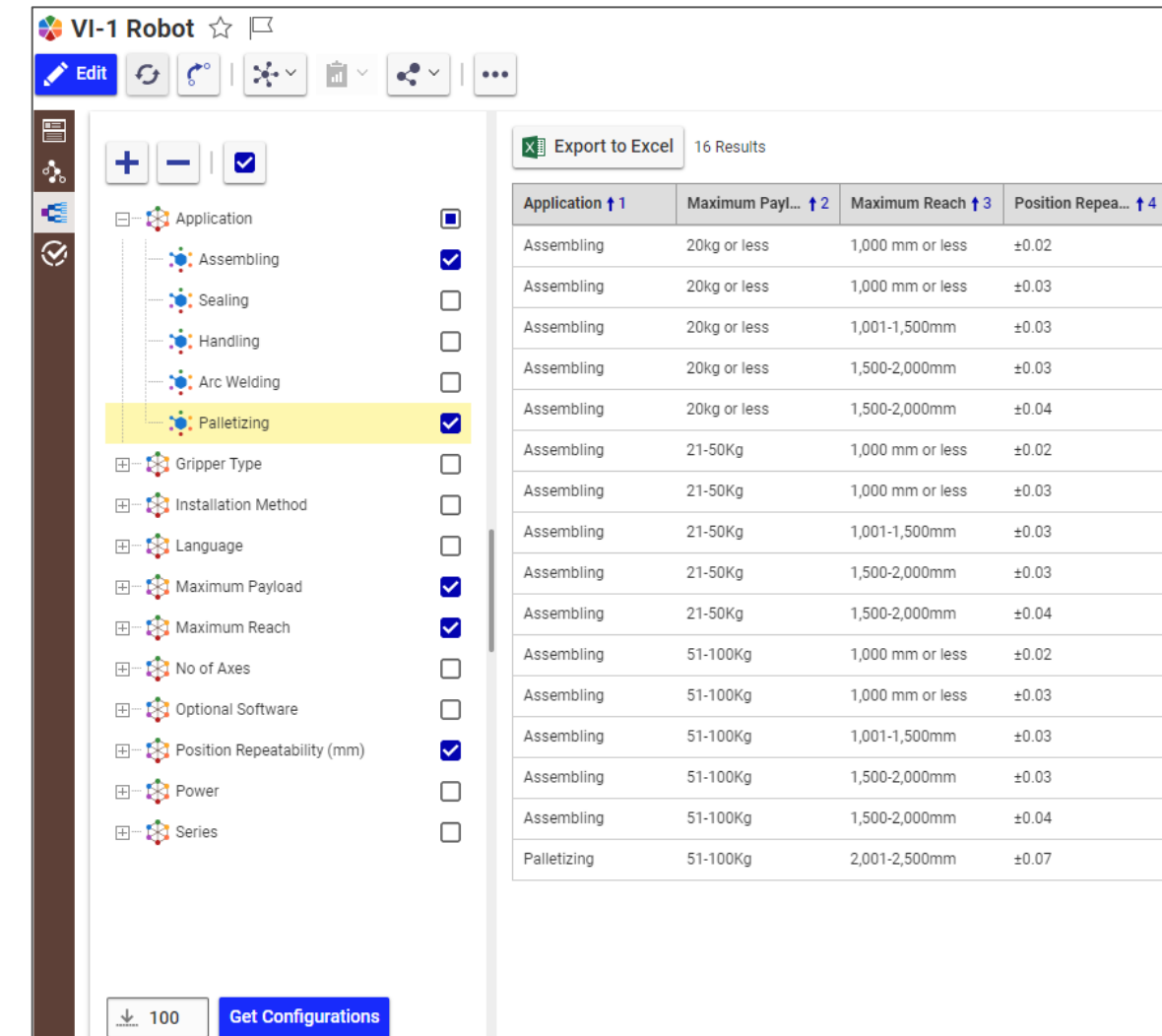
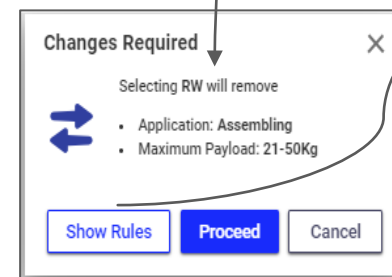
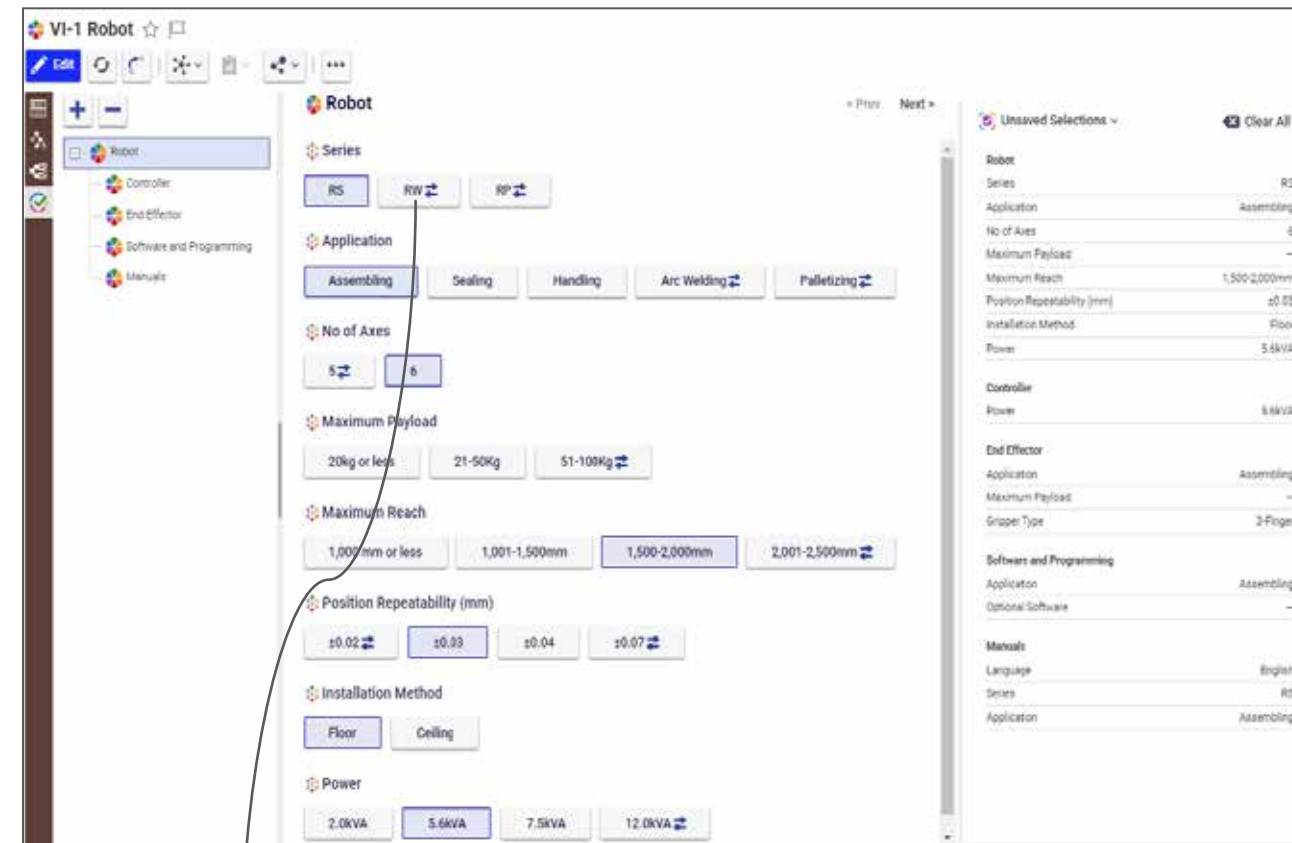
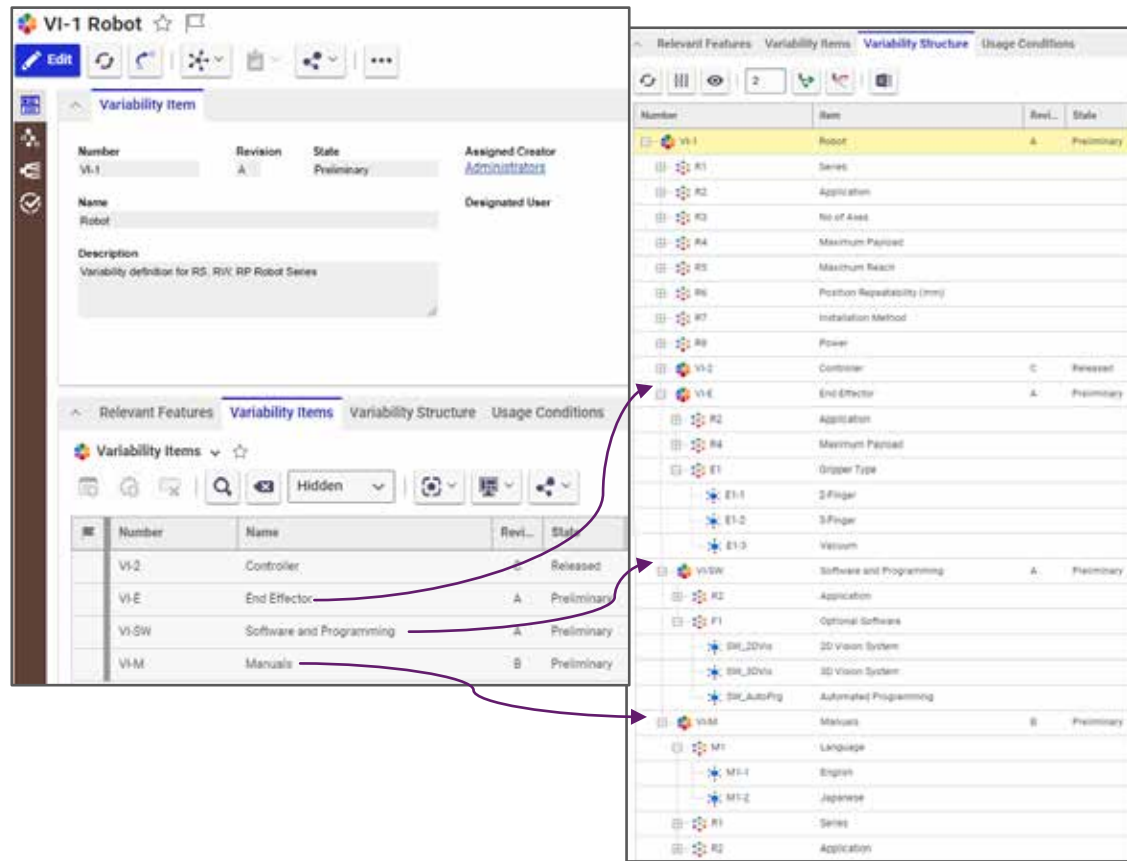


Variability Definition in Aras – Key Values for Your Business

§ Manage structured, harmonized, consistent and independent definition of variability across multiple domains





§ Accelerate variability validation process with rapid access to pertinent rules





§ Improve ease of validating the list of permissible configurations in your range of product variants







Variability Definition

Terminology

-  Feature – Product characteristic with different options
-  Option – Choices for a Feature
-  Rule – Determine which Options can or cannot be combined
 - § Due to technical feasibility, sales decisions, compliance, etc.
 - § Without rules, all option combinations are possible
 - § Rules reduce number of allowed option combinations
-  Variability Item – Defines variability of a scope (e.g., product, system, module)
 - § Using Features, Options and Rules
 - § Can be structured into multiple levels

-  Application
 -  Assembling
 -  Arc Welding
 -  Palletizing

-  Payload
 -  20kg or less
 -  21-50kg
 -  51-100kg

-  If Application=Arc Welding, then Payload=20kg or less

Demonstration Variability Definition

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Effective Approaches to Manage Configurable Products

Modularization and Standardization

- § Divides a product into modular components or modules that can be independently designed, produced, assembled, and replaced
- § Modules are standardized to be interchangeable, allowing for flexibility in product configuration and customization
- § Individual modules can be easily combined or replaced, without requiring significant changes to the overall product architecture

Commonality and Variability

- § Commonality ensures shared features or components across different product configurations, promoting efficiency and consistency
- § Variability allows for customization and flexibility in product design, enabling adaptation to different configurations
- § Balancing commonality and variability is crucial for optimizing production efficiency and minimizing costs while providing product variation

Product Definition in Aras – Key Values for Your Business

§ Maintain configurable product definition with common and variable content, under configuration management

Master	Revision	Name	State	Sequence	Exp.	Expression
BD-1-RBT	A	Robot - R Series	Preliminary			
BD-2-ARM	A	Robot Arm	Preliminary	10	1	
BD-4-1	A	Base Assembly	Preliminary	10	1	
BD-4-B-11	A	Base	Preliminary	10	1	
BD-4-B-11x	C	Base 20	Preliminary	20	1	[Maximum Payload] = [20kg or less]
BD-4-B-11y	B	Base 50	Released	30	1	[Maximum Payload] = [21-50kg]
BD-4-B-11z	C	Base 100	Released	40	1	[Maximum Payload] = [51-100kg]
BD-4-B-12	C	Actuator - Revolve Motion (J1)	Preliminary	20	1	
BD-4-ENC	B	Encoder	Released	30	1	
BD-4-B-14	B	Transmission - Revolve Motion	Released	40	1	
BD-A-2	A	Arm Assembly	Preliminary	20	1	
BD-3-HND	A	End Effector	Preliminary	15	1	
VC-H-WELD	A	End Effectors - Arc Welding	Preliminary	10	1	Application = [Arc Welding]
WA-ARC-1-20	A	Arc Welding Attachment	Released	10	1	[Maximum Payload] = [20kg or less]
WA-ARC-2-20	A	Arc Welding Cable	Released	20	1	[Maximum Payload] = [20kg or less]
VC-H-GRIP	A	End Effectors - Grippers	Preliminary	20	1	Application = [Assembling OR Application = [Handing OR Application = [Palletizing]
GRIP-001-2-20	B	2-Finger Gripper - 20kg or less	Released	10	1	[Maximum Payload] = [20kg or less] AND [Gripper Type] = [2-Finger]
GRIP-002-2-50	B	2-Finger Gripper - 50kg or less	Released	20	1	[Maximum Payload] = [21-50kg] AND [Gripper Type] = [2-Finger]
GRIP-004-3-20	A	3-Finger Gripper - 20kg or less	Released	30	1	[Maximum Payload] = [20kg or less] AND [Gripper Type] = [3-Finger]
GRIP-005-3-50	A	3-Finger Gripper - 50kg or less	Released	40	1	[Maximum Payload] = [21-50kg] AND [Gripper Type] = [3-Finger]
GRIP-001-V...	C	Vacuum Gripper - 100kg or less	Released	50	1	[Maximum Payload] = [51-100kg] AND [Gripper Type] = [Vacuum]
VC-H-SEAL	A	End Effectors - Sealing	Preliminary	30	1	Application = [Sealing]
S001e-001	A	Sealer Attachment (General Purpose)	Released	10	1	
BD-4-CNTLR	A	Controller	Preliminary	30	1	
BD-5_SWb	A	Software	Preliminary	30	1	
BD-DOC	A	Manuals	Preliminary	40	1	
INS-RS-EN	A	Installation Manual - RS Series - EN	Released	10	1	Series = RS AND Language = English
INS-RS-JP	A	Installation Manual - RS Series - JP	Released	20	1	Series = RS AND Language = Japanese
INS-RW-EN	B	Installation Manual - RW Series - EN	Released	30	1	Series = RW AND Language = English
INS-RW-JP	B	Installation Manual - RW Series - JP	Released	40	1	Series = RW AND Language = Japanese
INS-PP-EN	A	Installation Manual - PP Series - EN	Released	50	1	Series = PP AND Language = English
INS-PP-JP	A	Installation Manual - PP Series - JP	Released	60	1	Series = PP AND Language = Japanese

§ Link relevant variability scopes across product definition levels for simplified complexity presentation

Valid Expression: [Maximum Payload] = [51-100kg] AND [Gripper Type] = Vacuum

Item	Name	Revision	State	Seq.	Quantity
GRIP-001-2-20	2-Finger Gripper - 20kg or less	B	Released	10	1
GRIP-002-2-50	2-Finger Gripper - 50kg or less	B	Released	20	1
GRIP-004-3-20	3-Finger Gripper - 20kg or less	A	Released	30	1
GRIP-005-3-50	3-Finger Gripper - 50kg or less	A	Released	40	1
GRIP-001-V...	Vacuum Gripper - 100kg or less	C	Released	50	1

§ Generate a variant from the configurable product definition with guided selection

Robot Series: RS

Application: Assembling

No of Axes: 6

Maximum Payload: 20kg or less

Maximum Reach: 1,000 mm or less

Position Repeatability (mm): ±0.02

Installation Method: Floor

Power: 2.0kVA

Controller Power: 2.0kVA

End Effector Application: Assembling

Maximum Payload: 20kg or less

Gripper Type: 3-Finger

Software and Programming Application: Assembling

Optional Software: 2D Vision System

Manuals Language: English




Series: RS



















Application: Assembling

Number	Name	Revision	State	Quantity
BD-1-RBT	Robot - R-Series	A	Preliminary	
BD-2-ARM	Robot Arm	A	Preliminary	1
BD-A-1	Base Assembly	A	Preliminary	1
BD-A-B-11	Base	A	Preliminary	1
R-Arm-11x	Base 20	C	Preliminary	1
BD-A-B-12	Actuator - Revolve Motion (J1)	C	Preliminary	1
R-Arm-12x	Motor 17HS15-1684D-HG-B20	A	Released	1
BD-A-ENC	Encoder	B	Released	1
R-Arm-10a	Encoder AMT-Ax-02	B	Released	1
BD-A-B-14	Transmission - Revolve Motion	B	Released	1
BD-A-2	Arm Assembly	A	Preliminary	1
BD-3-HND	End Effector	A	Preliminary	1
VC-H-GRIP	End Effectors - Grippers	A	Preliminary	1
GRIP-004-3-20	3-Finger Gripper - 20kg or less	A	Released	1
BD-4-CNTLR	Controller	A	Preliminary	1
VC-CNTLR	Controllers	A	Preliminary	1
x01-ctl	X01 Controller	A	Released	1
BD-5_SWb	Software	A	Preliminary	1
SW-1	Robot Software (Standard)	A	Released	1
SW-2DV	2D Vision System Software	A	Preliminary	1
SW-4	Robot Programming Language (Standard)	C	Released	1
BD-DOC	Manuals	A	Preliminary	1
INS-RS-EN	Installation Manual - RS Series - EN	A	Released	1

Product Definition

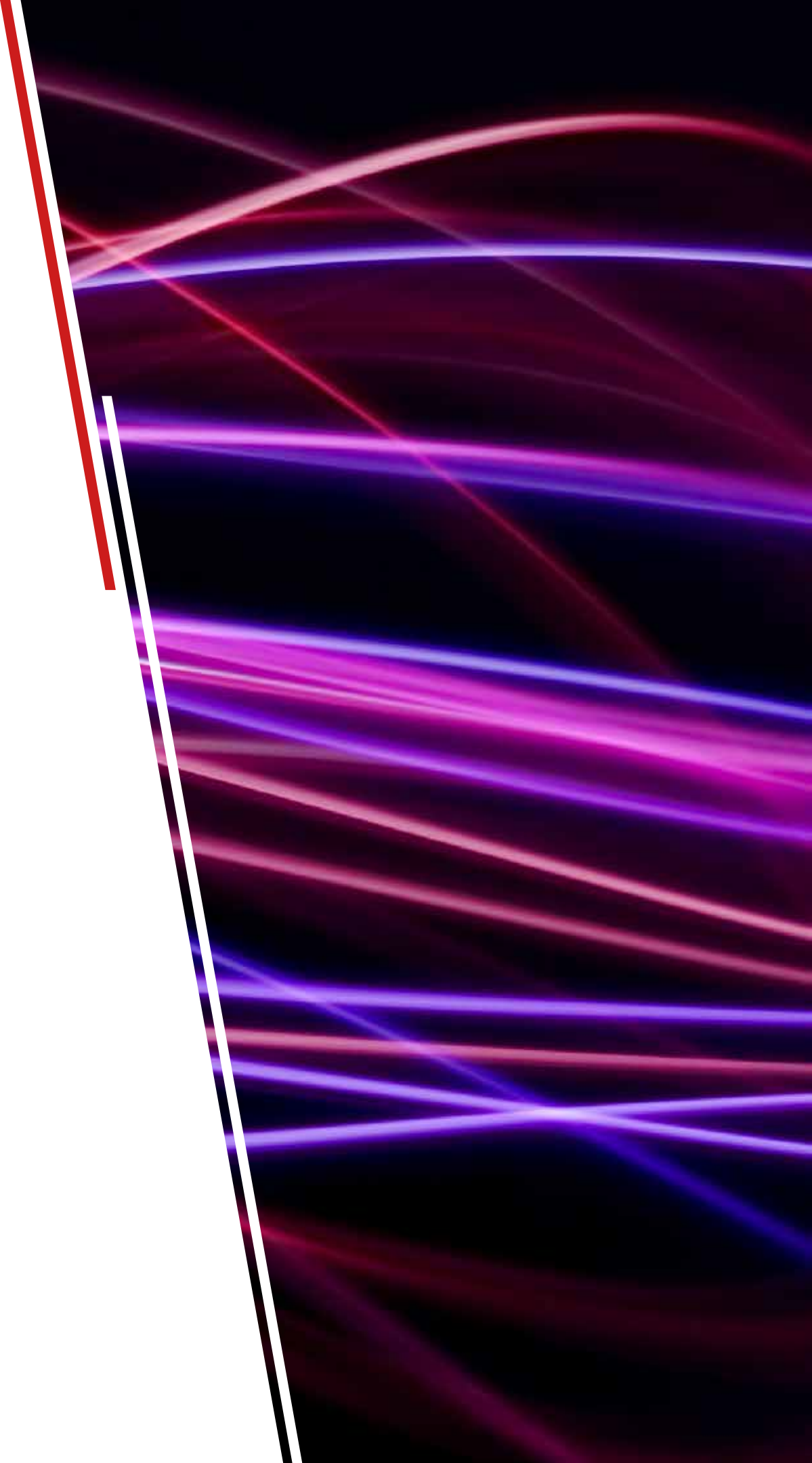
Terminology

-  Breakdown Item – Modular blocks with structure, combined to create varied product configurations
-  Variable Component – Collects assets that serve a specific function in the product, with variable feature and options
 - Asset – Resources that contribute to the creation, functionality, or value of the product
 - § Physical components, software, data, documentation, etc.
 - Content – Items used in constructing the breakdown items
-  Usage Condition – Criteria defining item utilization in product configuration

-  End Effector
 -  Arch Welding
 -  AW-Attach
 -  AW-Cable
 -  Grippers
 -  GRP-2-20
 -  GPR-3-50
 -  GRP-V-100
-  Application=Arc Welding
-  Application=Assembling or Palletizing
 -  Type=2-Finger and Payload=20kg or less
 -  Type=3-Finger and Payload=21-50kg
 -  Type=Vacuum and Payload=51-100kg
-  Manuals
 -  INSTALL-AW-EN
 -  Application=Arc Welding and Language=EN
 -  INSTALL-PLT-JP
 -  Application=Palletizing and Language=JP

Demonstration Configurable Product Definition

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Thank You

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