Modular Management®

How to Design Products for Fast Service?

The How-to Series from Modular Management

Inspiration for Product and Service Design

Designing Products for Fast Service

Fast and efficient service is critical for customers and the brands that provide it.

Industry leaders show that by designing products for customer-centric service they create value in terms of customer loyalty, cost savings and innovation. Service is key to building long-term customer relationships and securing competitive advantage.

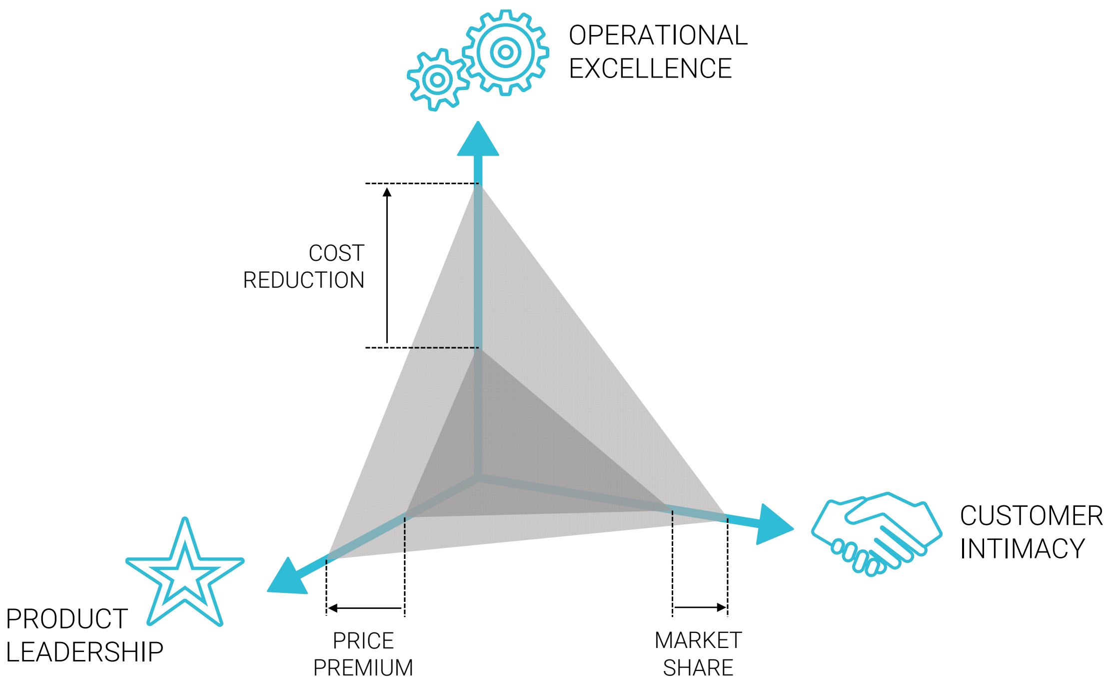

Figure 1: Business Fundamentals, Inspired by Treacy & Wiersema (1995)

So, how can you design products for fast and efficient service delivery? How can you increase customer satisfaction and market share, reduce costs and secure a price premium?

Avoid Slow, Complex and Costly

Imagine the scene. You’re a service technician at a key account customer. You’re finding it hard to identify the service point, let alone record and deliver the service activity needed to get things up and running again. The clock’s ticking and you represent the company brand.

Companies across industries are struggling to generate service quotes fast enough, deliver spare parts on time, and efficiently execute preventive maintenance, periodic overhauls and corrective services on a big installed base.

Customers expect speed and quality from service departments, because downtime due to inoperable products creates losses by the minute. Just-in-time delivery is a key success factor, and everyone involved is keen to reduce tied-up capital. Even identifying and finding the right spare part for installed base can sometimes demand internal work from engineering and R&D departments, which should instead focus on innovation and new features. The direct and indirect costs in planning, procurement, material management and production due to poor serviceability can be huge.

How can we turn slow, complex and costly service around with modular product architectures?

The Power of Modularity

When executed holistically, modularity can both provide a large product assortment (economy of scope) and at the same time limit individual product parts and related engineering work (economy of scale).

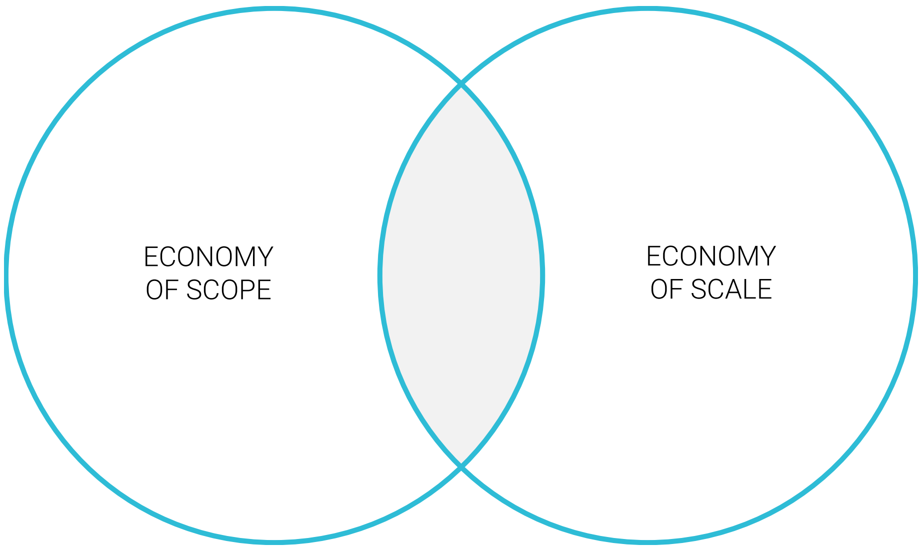

Figure 2: Modularity Enables Economies of Scope and Scale

A modular product gets disaggregated into several modules, each of them available in different variants. This disaggregation allows for specific service strategies to be considered, including quick serviceability, critical spare part availability, preventive maintenance, period overhaul and upgradeability.

In addition to each module having a distinct function or task, the advantage of this process is that all modules deliver on a specific strategy. Each one has a specific role to play.

Benchmark: One Windshield

Scania is a pioneer in how to design for service.

For example, the truck manufacturer decided to offer only one windshield module variant for its entire range of cab designs. Behind this unusual decision was the understanding that a broken windshield forces downtime, as the driver waits for a replacement, which in turn causes inconvenience and income loss.

Figure 3: Scania Cab, One Windshield

Modular service thinking at Scania led to the entire windshield module being available in only one variant, easily available throughout the global service network. Service was prioritized over a larger range or optimizing windshield size, shape or design for different cabs.

Scania's relatively high profitability over decades is seen as testimony to the value of modularity and this way of thinking.

Benchmark: Circular Economy

Another model, as pioneered by Rank Xerox, is the use of rotation modules.

Modular compatibility is necessary for rotation modules to work. A broken module can be exchanged quickly, repaired and re-used for another customer. Downtime is reduced significantly, and all costly parts are reused over and over again.

Figure 4: Reuse at Xerox

In addition to copiers, examples of the rotation module can be found in drive units for electric trains and airplanes. And this is a model that's likely to gain traction in line with increasing environmental concerns and the need to shift to a circular economy.

Imagine what modular compatibility means for the possibility to upgrade and upcycle a product.

Case: Hydraulic Motor

A big company has a big product that needs servicing/turning during operation.

The product is mounted on a slewing ring and turned with hydraulic motors. The hydraulic motors can be mounted directly at the slewing ring, or off-set with an intermediate shaft and angle gear to make space for other auxiliary equipment.

Figure 5: Hydraulic Motor Keeps on Turning

Typically, there is only one hydraulic motor needed for operation, with larger products and heavy-duty applications sometimes needing two.

Any failure in the turning function renders the entire product inoperable, with severe risk of personal injury, material damage and downtime costs. Usually, there is at least one redundant back-up hydraulic motor installed.

60 Hours is a Lot of Hours

Before modularity, hundreds of different hydraulic motor alternatives (types, sizes and brands) are used. Engineering spends on average 60 hours per order to discuss with customers regarding dimension and select motors, to make layouts, to provide detailed drawings and to configure the bill of materials. Worse, variability in engineering time is also huge, ranging from 12 hours for more standard cases to over 300 hours for the most complicated solutions and demanding customers.

Production suffers from endless new designs and long and uncontrolled lead-times for hydraulic motors and gear boxes, while the service department arguably suffers most, with frustrated customers and dependencies on a disgruntled engineering department to execute service and make service quotes.

Clear, Pre-defined Service Packages

After modularization there is an assortment of hydraulic motors consisting of 2 types, 3 brands and 5 sizes. In practice, 25 of these 30 theoretical combinations are available.

Different motor sizes don't need different instructions but do have different spare part packages. Also, the redundant back-up motors need unique instructions and different spare part packages. A total of 12 instructions and 50 spare part packages are now pre-defined. For the angular gear boxes there are an additional 4 instructions and 12 spare part packages. Thanks to modularization there is also an established product architecture with 10 pre-defined alternative positions, 5 directly at the slewing ring and 5 off-set:

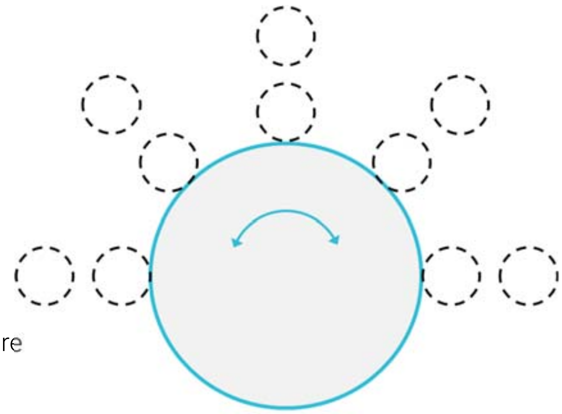

Figure 6: Architecture

A minimum configuration uses only one hydraulic motor, directly at the slewing ring, and preferably at the back position:

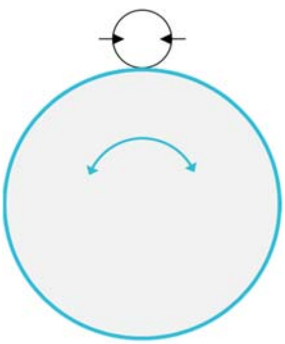

Figure 7: Minimum Configuration

A maximum configuration uses two primary hydraulic motors and two back-ups, in any mix of slewing ring mount and off-set:

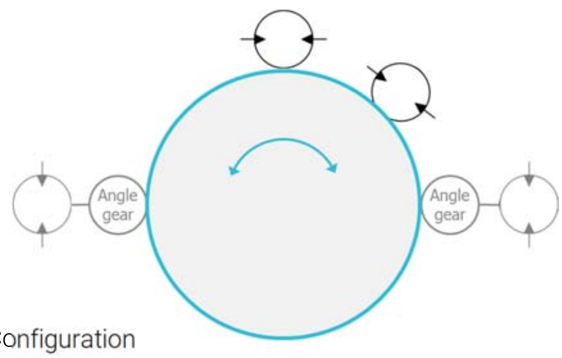

Figure 8: Maximum Configuration

Nodes and a Universal Information Model

In the product structure dimension, modularization should be implemented as a generic product structure based on nodes. By using the term nodes, instead of positions, we can distinguish from the traditional bill of material way of thinking, where hierarchy or structure is not separated from content. And with nodes, the product structure is a standard structure of nodes that defines the modular architecture.

Every end node, or leaf, is linked to a module and can accept any of its module variants according to rules. Every node also has a unique identifier, NXXX, that is repeated for the same node in any bill of material. This type of universal information model is extremely powerful and can be designed and managed with PALMA® software (palma-software.com).

In our hydraulic motor case, the decision was 10 physical positions in the generic product structure nodes, sufficient for mechanical engineering, manufacturing and assembly, plus different nodes for primary and back-up motors to serve hydraulic engineering (different hydraulic diagrams for primary and back-up) and service (different instructions and different spare parts for primary and back-up).

Configuration Made Possible

When configuring a specific customer order, the configurator will put the correct module variants in the correct product structure nodes and omit all other alternative nodes that are not populated in this specific case. Only populated nodes will come out, keeping their standard identifiers and names and populated with the correct module variants. The generic product structure for hydraulic motor assembly includes the following nodes:

N131	Turning drive, slewing ring backside, primary	
	N132	Hydraulic motor
	N133	Angular gear box
	N134	Motor/gear box bracket
	N135	Hydraulic piping
N136	Turning drive, slewing ring 45 degree left, primary	
	N137	Hydraulic motor
	N138	Angular gear box
	N139	Motor/gear box bracket
	N140	Hydraulic piping
N141	Turning drive, slewing ring 90 degree left, primary	
	N142	Hydraulic motor
	N143	Angular gear box
	N144	Motor/gear box bracket
	N145	Hydraulic piping

N215	Turning drive, off-set backside, primary	
	N142	Hydraulic motor
	N143	Angular gear box
	N144	Shaft assembly
	N145	Hydraulic piping
N220	Turning drive, off-set 45 degree left, primary	
	N142	Hydraulic motor
	N143	Angular gear box
	N144	Shaft assembly
	N145	Hydraulic piping
N356	Turning drive, slewing ring backside, back-up	
	N142	Hydraulic motor
	N143	Angular gear box
	N144	Motor/gear box bracket
	N145	Hydraulic piping

Figure 9: Architecture Example Nodes

N131	Turning drive, slewing ring backside, primary		
	N132	Hydraulic motor	Variant X
	N134	Motor/gear box bracket	Variant Y
	N135	Hydraulic piping	Variant Z

N131	Turning drive, slewing ring backside, primary		
	N132	Hydraulic motor	Variant A
	N134	Motor/gear box bracket	Variant B
	N135	Hydraulic piping	Variant G
N146	Turning drive, slewing ring 45 degree right, primary		
	N147	Hydraulic motor	Variant A
	N149	Angular gear box	Variant B
	N150	Motor/gear box bracket	Variant H
N366	Turning drive, slewing ring 90 degree left, back-up		
	N368	Angular gear box	Variant T
	N369	Motor/gear box bracket	Variant P
N376	Turning drive, slewing ring 90 degree right, back-up		
	N378	Angular gear box	Variant T
	N379	Motor/gear box bracket	Variant P
N483	Turning drive, off-set 90 degree left, back-up		
	N484	Hydraulic motor	Variant A
	N485	Angular gear box	Variant F
	N486	Shaft assembly	Variant R
	N487	Hydraulic piping	Variant J
N493	Turning drive, off-set 90 degree right, back-up		
	N494	Hydraulic motor	Variant A
	N495	Angular gear box	Variant F
	N496	Shaft assembly	Variant R
	N497	Hydraulic piping	Variant K

Figure 10: Minimum and Maximum Configurations

Either in the same or a parallel structure, other nodes are populated with the corresponding service instructions and spare part packages. And all nodes are managed in PALMA®.

Costs Down, Satisfaction Up

Total part number count is a cost-driving KPI that can be reduced by 50-75% with modular design for service operations. This is largely thanks to the controlled assortment of module variants for each module and the ability to combine variants into an enormous assortment of end products, which together minimize the need to tailor make and customize solutions for individual customers.

A modular solution is configured into a final product from its module variants, which means it is possible to link much of the service-related information to these building blocks and quickly generate a correct service document package. Information from module variants can be configured into:

- service/maintenance operation documentation, with instructions, priorities and intervals
- wear and spare parts lists, with replacement priorities and intervals.

Traditionally, product structures are based on:

- Physical. Physical positions and groupings (components and assemblies at different levels) and the sequence they come together = Manufacturing BOM
- Functional. Functional positions and groupings (components and systems on different levels) = Engineering BOM
- Combination. A combination of the two views above, maintained by a few companies.

With modularity you can apply any of the three product structure alternatives: physical, functional or a combination. Instead of defining the structure product by product, modularity uses one single product architecture for all product configurations.

The benefits are highly tangible for service personnel, including finding the service point in a standardized and stable product structure, documenting service intervals, and successfully completing the service. And front-line service personnel are critical for customer satisfaction and business performance.

Summary: How to Design Products for Fast Service?

At the beginning of this paper we assumed that your service builds customer loyalty, saves costs and drives innovation. Or it doesn't.

Modularity can turn fast, simple and cost-effective service from strategy into reality. Modularity meets the demands of an increasingly competitive market, because a modular architecture provides a stable product structure that's configurable down to fixed positional references for technicians to find, record and deliver service activities. Imagine more autonomous service personnel, shorter lead times, optimized resource utilization and happier customers. And just contact info@modularmanagement.com if you're curious to find out more.

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