The Future of Mass Customization, Mass Production, and Customer Driven Value Creation

Frank T. Piller, MIT / TUM

**Extended Handout Version** 

www.mass-customization.de



#### An experiment

- In a supermarket, 24 different fruit spreads are offered.
- In a sampling event, customers can sample the products and get a discount voucher.
- Two different settings are compared:
- 6 (out of 24) different fruit All 24 fruits spreads are • offered. spreads are offered.





### An experiment

• 6 (out of 24) different fruit • All 24 fruits spreads are spreads are offered.



offered.



#### **Questions:**

- (a) In which setting do more customers participate in sampling?
- (b) In which setting do customers sample more products?
- (c) In which setting do customers buy more products?

#### The Variety Paradox

- (a) In the case of \_\_\_\_\_ varieties, more customers sample the products.
- (b) In average, both groups sample the same amount of variants.
- (c) \_\_\_\_\_ % of the customers getting offered 6 different varieties are making a purchase.

\_\_\_\_\_% of the customers getting offered all 24 different samples are making a purchase.







mi Adidas

- Adidas Mass Customization Program
- Retail price: 150 USD (30% premium), margin doubled
- How does this pay off?

#### Mass customization comes at additional costs (I)

- Loss of economies of specialization and economies of standardization
  - more complex product development / design / documentation
  - higher set up costs, more complex manufacturing planning, detailed quality control
  - costs for better qualified labor
  - higher capital investments in more advanced flexible production ...
- Cost driving mechanisms to minimize burdens (costs) of customization for the customer

Mass customization comes at additional costs (II)

- Loss of economies of specialization and economies of standardization
- Cost driving mechanisms to minimize burdens (costs) of customization for the customer
  - investments in customer service centers
  - highly qualified staff
  - investments in configuration systems etc.
  - investments in fitting accounting systems
  - after-sales service complexity; product documentation

A quick response strategy is crucial for mass customization to reduce its additional costs

## Response times (service levels) from the customers' perspective

- waiting time most critical issue
- customers show strong preferences to pay more to wait less
- 3-day-car imitative
- investments in distribution systems
- investments in QRM systems
- investments in local manufacturing

# There are two ways to compensate these additional costs of mass customization (I)

- "Mass customization principles"
  - 1
    - Modular product architectures
    - Use of flexible manufacturing technologies (setting solution space & stable processes)
  - 3 Use of dedicated systems for customer interaction
- New cost saving possibilities due to customer integration

## **Scania**



1

## Scania

Effect of modularization		
	Before	After
Number of:		
sheet metal parts	1400	380
interior fitting parts	1800	600
parts in top	7	3
parts in front	8	3
parts in doors	12	8
windscreens	3	1
sheet metal tools	1600	280
	1	1
Factor 1.5 - 5,7		tor - 5,7

1

### Scania's Modular Philosophy

- "A customer pays more for a highly specified vehicle than for a standard product" -- "With SCANIA's system the customer can specify the vehicle that he/she wants"
- "The more closely vehicles can be adapted to a transport task the better the customer's operating economy will be" -- "The modular system is important to SCANIA's development, production and product quality"
- "The modular system provides a carefully balanced number of main components with great flexibility" -- "This allows considerably longer production runs than what were possible with a conventional product system"

1

### Scania's Modular Philosophy: Learnings

- Aligning modular structures with corresponding business processes – stable since 1980 !!!
  - Present modular structure dates back to 1980. Stable product structure has made it possible to develop a set of extremely efficient business processes for sales, configuration, production, delivery and after sales service.
  - Strict modular architecture made NPD projects much easier to manage. Today SCANIA is regarded as the leader when it comes to the introduction of new technological solutions.
- SCANIA is the most profitable company in its industry and attributes this to the fact that systems thinking exists in the entire value chain.



#### Case: Pirelli and MIRS



Pirelli's Tyre Sector has 22 factories and approx. 20,000 employees in ten countries and is among the world's top tire manufacturers, with sales of over Euro 2.857 billion in 2002



- Traditional tire making is done in huge batches, with tires assembled gradually. At any moment, only 12% of materials in a given batch are being processed.
- It takes six days to get from raw materials to tires.
- With <u>MIRS</u> (*Modular Integrated Robotized System*), Pirelli has introduced a new process technology and reduced the production time to 72 minutes.
- The system is small and modular, can be assembled quickly wherever it is needed, unlike traditional tire making, which has big economies of scale.

#### Case: MIRS technology





- MIRS creates tires at a uniform temperature in a single process, eliminating both problems:
  - Stored batch materials cool and must be reheated before use,
  - Conditions that can create flaws in the rubber, as well as waste
- MIRS builds each tire around an appropriately shaped aluminum drum. Raw rubber is heated and extruded on to the drum, followed by successive layers of steel wires and strips as the tire takes shape. At the end of the process, the drum ingeniously collapses, leaving the finished tire ready for use.
- MIRS is controlled by a software system, tire makers can feed their requirements directly into a production line, changing ingredients and design features as they wish → new possibilities for integrated vehicle and tire design and for accelerated testing of new ideas

#### Case: Comparison traditional process vs. MIRS



	Traditional Pirelli Process	M.I.R.S. Process	Delta %
INVESTMENT			
-from scratch Tyre/day	Euro 16,800	Euro 14,200	- 15%
-in existing buildings Tyre/day	Euro 16,800	Euro 8,800	- 50%
FLOOR AREA			
From preparation to finishing area	5.6 sqm / tyre / day	1.1 sqm/tyre/day	- 80%
PLANT EFFICIENCY			
Overall Equipment Efficiency (index)	75 %	92 %	+ 23 %
LEAD TIME			
From preparation to curing	6 days	72 mins.	incomparable
FLEXIBILITY			
Minimum economic lot	3200 pcs.	375 pcs.	- 88%
Size change time	375 mins.	20 mins.	- 95%
OVERALL PRODUCT COST ( index )	100	75	- 25%

COMPARISON OF ECONOMIC / PRODUCTION PARAMETRES - Production unit for 1.000.000 V/Z tyres / year



#### Case: MIRS impact



- MIRS is based, in fact, on the concept of highly flexible "mini factory" that allows more flexible production concerning product variety and response time (location)
- MIRS can be installed right next to a car maker's factory so that it delivers tires directly as they are needed
- MIRS good example of modular manufacturing processes, using modular product architectures



## e-Manufacturing with Laser Sintering

- Requirement:
  - Customised Hearing Aid Shells with minimised wall thickness
- Solution:
  - Laser-Sintering on EOSINT P 38 with PA 2200 material and 0.10 mm layer thickness
- Result:

**ΡΗΝΑΚ** 

2

hearing systems

 shells with excellent surface quality and detail resolution with readable labels Laser-Sintered Hearing Aid Shells



## e-Manufacturing with EOSINT P

- 50.000 hearing aids shells were laser-sintered so far / 1.400 per week
- 600.000 devices are sold per year
- in 2-3 years all shells will be laser-sintered











# The information cycle of mass customization







# MORE TH>N<sup>™</sup>



There are two ways to compensate these additional costs of mass customization (II)

- "Mass customization principles"
- New cost saving possibilities due to customer integration (Economics of customer integration)
  - postponement strategy and on-demand manufacturing (reverse cash-flow)
  - Increase in customer loyalty (reduction in future sales costs, cross-sales, etc.)
  - Access to customer knowledge for new product development process



Dolzer ... an ultimate lean enterprise with (despite?) high variety:

or how can you sell with large profit madeto-measure (custom made) suits for 150 Euro per suits retail price – with manufacturing in Germany ??



www.dolzer.de

### About one third of today's textile retailing value is waste



Today's textile value chain for a men's shirt (based on US and European data)



Source: ETH Zürich, Retailer interviews (1996), Sanders-analysis, McKinsey-Quarterly

# Exemplary calculation apparel: Manufacturing costs will increase, but ...





Sanders 2001



# ... new saving potentials arise. Mark downs can be reduced dramatically.

Sanders 2001

### Bricks and Mortar outlets should be able to almost double their profits with made-to-measure apparel

SANDERS for mass customization of textile products

SANDERS for mass customization of textile products

Possible profit (before tax) with made-to-measure, bricks and mortar outlet, made in Asia, price premium 5%, data in %



Source: Sanders-analysis



Sources: National Automobile Dealers Association, The Goldman Sachs Group, Inc., and Forrester Research, Inc.

# Forrester Research predicts that in the US car industry, BTO could improve average profitability by 57%.



Source: Forrester Research, Inc.

There are two ways to compensate these additional costs of mass customization (II)

- "Mass customization principles"
- New cost saving possibilities due to customer integration (Economics of customer integration)
  - postponement strategy and on-demand manufacturing (reverse cash-flow)
  - Increase in customer loyalty (reduction in future sales costs, cross-sales, etc.)
  - Access to customer knowledge for new product development process

Mass Customization (and high variety manufacturing) enables three kinds of benefits

- Price premiums (higher willingness to pay, reduced price competition, modular pricing)
- Customer retention: Additional sales as customer get more loyal to manufacturer
- Reduction of innovation risk and new product development flops; access to customer knowledge



Customers are not buying products, but a bundle of preferences combined in one market offer.



## **Customization options**

- fit / measurements
  - match-to-order
  - made-to-measure
- functionality
- design / taste

#### Price premiums (increasing WTP)

- theory: quasi-monopolistic position (Gutenberg 1950; Chamberlin 1962) of differentiation strategy
- surveys: 10-30% surplus accepted (miAdidas: 30-50 %)
- own empirical online panel: premium may be up to 100%: choice of customization options important (Piller/Hoenigschmid/ Müller 2002)
- modular and customized pricing
- companies do not utilize possibilities yet
- promising practice: Factory 121 (watches, could double average price by adding diamond option)

#### An experiment (Franke / Piller 2004)



The basic toolkit allows 648,000,000 design variants ...

... and our calculations show that customers use this huge solution space extensively.







mi Adidas -- Learnings

- new dimensions of shopping experience
- real customer relationship management
- customer knowledge
- life panel without panel effects
- lead user information
- higher market research efficiency

Sport communities

Up to 60% of all innovations come from users, most innovators report that at least 3 persons helped

(Lüthje 2000, 2003)





it frees them up from production shaping and allows them to create! Surfers deserve Tuflite because it gives them performance that lasts. Tuflite - it is more than a core, it is exactly what the shaper shaped for you. Randy French

## Learning from Surftech

- New form of division of labor
  - lead users create (but do not manufacture anymore)
  - manufacturer manufactures (but does not design anymore)
- Innovation function seen in the periphery of the firm, but not in its center (Jeppesen & Lakhani 2006; Lakhani 2005; von Hippel 2005)
- New capability set required (new kind of manufacturing technology; co-branding)
- Efficient provision of flexibility and variety (*postponement*), but different way to access need information





#### Learning from Threadless (Ogawa/Piller 2005)

- Observation of 20% of sales allows exact forecasting in fashion industry (Fisher & Raman 2001)
- Observation of strong peer orientation (communities for co-design) in customization co-design toolkits (Piller et al. 2005)
- Low cost innovation niches (von Hippel 2005), user / patient groups
- "Wisdom of crowds" (Surowiecki 2004)
- Threadless business model works and is highly profitable
- 800 submissions/week; 4 new prints/week; 35,000-60,000 shirts sold/month
- Exploratory analysis of customer database (ongoing work)
  - most design contributors (about 68 %) are professional designers
  - most customers also evaluate (NPD process becomes a relationship marketing tool) (only 3% of customers never evaluated)
  - low costs for participation, different participation levels
  - expert evaluation (exploratory) of designs indicates rather limited design space; high similarity of designs ("dominant design" of this community)

Postponement Strategy	Mass Customization	Collective Customer Commitment Method
new product development by manufacturer (based on market research input)	development of product architecture and customization options by manufacturer	development of new product design by some (expert) customers
▼	▼	▼
prefabrication of (some) components	customer co-design process (elicitation)	evaluation and refinement of design by manufacturer <i>and</i> customer community
▼	▼	▼
access to better market information (based on market research input)	placing of order by each individual customer	presentation of selected design concepts and obtaining commitment of potential customers
▼	▼	▼
final assembly of product variant	custom (on-demand) manufacturing	only if minimum lot size is pre- sold, (mass) production of product starts
▼	▼	▼
mass distribution	custom distribution	mass distribution

Parameter	Alternatives	
Source of new product idea	Company ideas	Customer ideas
Community	Cooperation with external existing community (like customer opinion platforms)	Building an own community for co-creation
Pre-selection	Company Panel	Customer Competition
Minimum order size	Pre-defined, representing the development and manufacturing costs of first production batch	Volatile (instead of setting a specific minimum order number, those concepts are produced with the largest number of purchase commitments)
Commitment	Monetary (i.e. customer has to pay at moment of pre-ordering)	Good practice (customer promises to buy product)
Incentives	No incenti∨es for participating users	Incentive for pre-ordering users in form of special pre- order price; awards for user designers
Reorders	Conventional planning and forecasting	Depending from continuous commitment in community
Organization	Project or competition based process	Ongoing process
Relation to conventional product development and market research process	Supplementing the conventional process for developing radical new product concepts	Substituting the conventional process and serving as underlying business model of entire company





Traditional Economy	Customer Driven Value Creation
separation of market research, innovation and sales	integration of market research, innovation and sales
product	+ capability
services separate activity	services dominant part
product innovation	+ service innovation
economies of scale and scope	+ economies of customer integration
experience of use	+ innovative experience
customer	+ co-designer

## Mass Customization & Open Innovation News

continues a long running newsletter on mass customization, personalization, customer integration, and open innovation -- all strategies on value co-creation between suppliers and customers. Published and edited since 1997 by Frank Piller, TUM / MIT.

#### CATEGORIES OCTOBER 09, 2005

## Open innovation and mass customization are among 2005 most popular and pertinent management tools

Since 1993, Bain & Company, a management consultancy, is investigating the use and performance of popular management tools. In <u>this year's edition</u>, **mass customization and open innovation are included for the first time as two of the 25 most popular and pertinent management tools**.

The survey is based on a findings from 960 global executives surveyed during 2004, including 212 Chinese business leaders. Executives were asked questions about the use and satisfaction by their companies with the management tools and techniques.

#### MORE INFORMATION & BACKGROUND

Books

Events

General

Guest Articles

MC/OI on the Web

Personalization

Open/User Innovation

Technologiies & Enablers

Cases-Consumer

Archive 1998-2005: Newsletter bac issues

Glossary: What is MC & OI?

Knowledge base - full papers and reports on MC & OI Speaking Engagements: Make MC&OI a topic of your next event

WED LINKC

# piller@mit.edu

# Updates? Get our free newsletter: www.mass-customization.de

Customization now encompasses a company's ability to differentiate a product or service in any way—from distinct branding to unique delivery." [Read more:

Lego bridges mass customization

ABOUT

Email Me

RECENT POSTS

customization are among 2005 most popular and pertinent

Report MCPC 2005

Open innovation and mass

management tools