Modulight

Value adding solutions to optical applications

Re-qualifying Delivered Devices and Inventory for New Product Specifications, a Case Study

ICEB+eBRF 2006

29-Nov-2006

Mika Aho, *M.Sc. (Eng.)*

Seppo Orsila, *M.Sc. (Eng.), MBA*

Modulight, Inc.

Outline / purpose of the study

1. To examine an e-Commerce system for re-qualifying delivered products and inventory for new product specifications
2. Propose a streamline supply chain model
3. Introduce benefits & foundation for strategy for producing generic renewable designs

- Carried out by means of a case study in a Finnish SME laser diode manufacturer
- Study presents experimental findings from this area

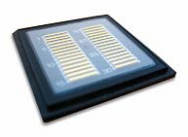
Modulight, Inc.

- Privately held Finnish company with offices in Tampere & Bay area
- Product lines:
  - High-power lasers
    - Welding, marking, reprographics, spectroscopy, LIDAR
  - Transmitter lasers
    - 10Gb/s Ethernet, OTDR, security and defence, Intra-satellite communication, RF-over fiber
  - Custom products and services
    - Range finding, medical, space, military

Certified ISO 9001 by BVQI

Certified ISO 14001 by BVQI

Modulight's wholly owned facility, Tampere, Finland



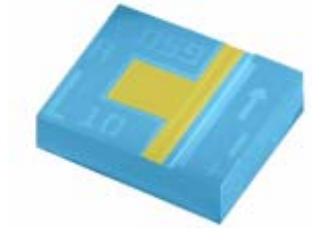
Background and motivation

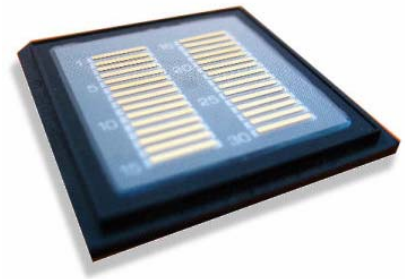
- Sales Force Automation (SFA) has yielded few promising results
- In (semiconductors) industry it is difficult to
  - find a proper information of a product / process
  - make a selection between large product variations
- Customers are aware of their buying options
- Requirements changing from order to order
- Products are often
  - tailor-made
  - ordered in a low quantities
  - beyond the accuracy of today's production technology
  - qualified by the customer
- Customer requirements are mostly fulfilled by
  - trial & error
  - manually looking into QC data of previous production runs

→ A demand for a configurable products and a mass customization system

Product customization in semiconductors industry

- Seldom off-the-shelf products, usually customized designs
- RFQs usually come with a list of very detailed information
- On the other hand the products are very complex
  - Up to 200 manufacturing steps
  - Around 100 different parameters
  - Development of new design is time-consuming
    - Results can be utilized in new product specifications
    - Increased possibilities for database queries and data analysis
- Actual manufacturing takes a couple of working days





Product customization in semiconductor industry

- Laser processes are like other semiconductor processes vulnerable to process tolerance variations
  - resulting in yield fluctuations
  - in application specific parameters
- Variation can be used as a competitive advantage
- A solid undertanding of the individual devices history and other performance limits is needed
- Data has to be in usable format
- Understanding is achieved through holistic information architecture
  - Allows matching of already manufactured devices against new or custom specifications
- Process/sub process model

...

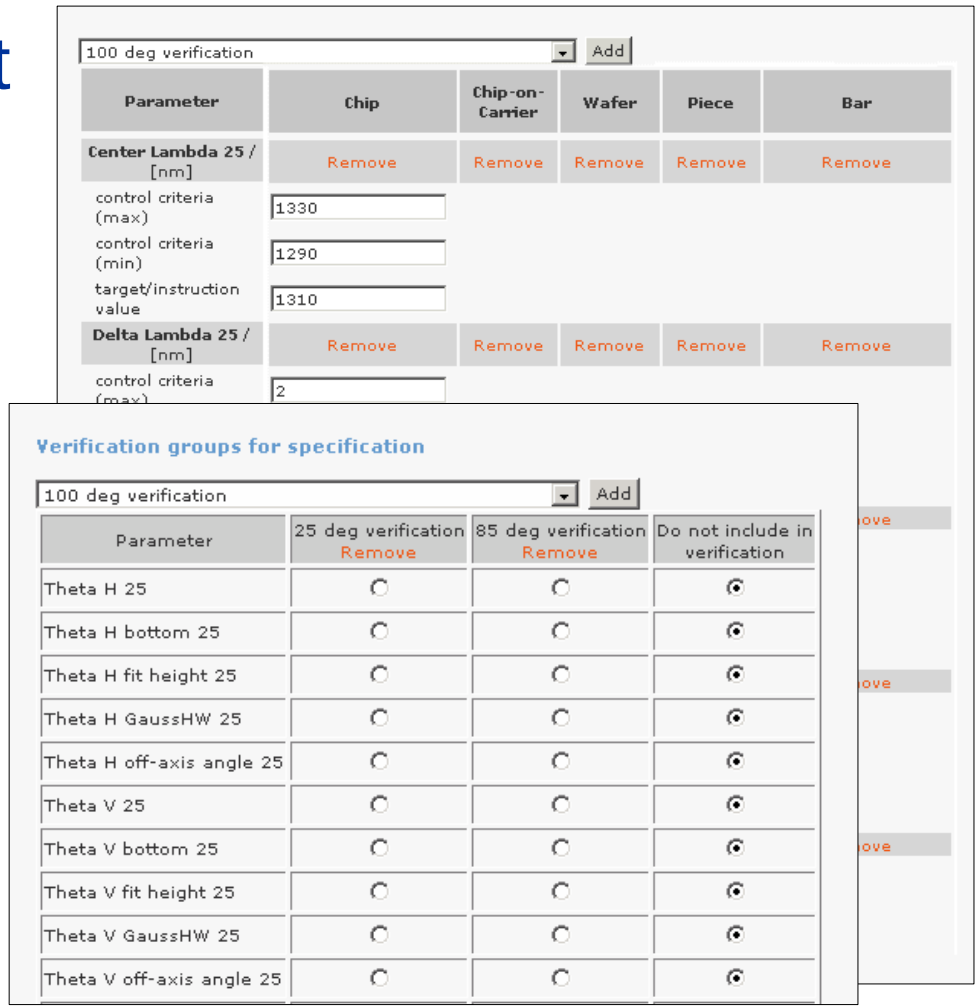
n	Sub-process
29	Wax removal
30	Microscopic inspection - wax removal
31	Visual Inspection
32	Metallization - n
33	Rapid thermal process - contacts
34	Visual Inspection
35	Dry etching - Ar cleaning
36	Metallization - 2nd n
37	Thickness measurement - thinned
38	Microscopic inspection - metal quality

Benefits of in-situ MC

- Make-to-order manufacturing largerly minimizes the risk of forecasting and reduces distribution stocks
- Increased agility and scalability
- Company can react fast to changing market trends
- Involving customers can lead to new products, product specifications, and innovations
- Reduction or elimination of inventory in the distribution chain
- Product differentation and customer segmentation management
- Capture important market trend information from individual customers
- Learn about future customer needs

Laser diode specification

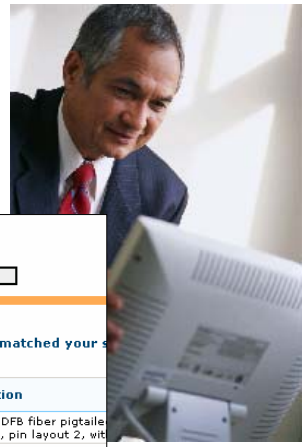
- Hundreds of product specific parameters, such as
  - Wavelength
  - Output power
  - Array
  - Linearity
  - Noise level
  - Beam size
  - Packaging
  - Measurement data

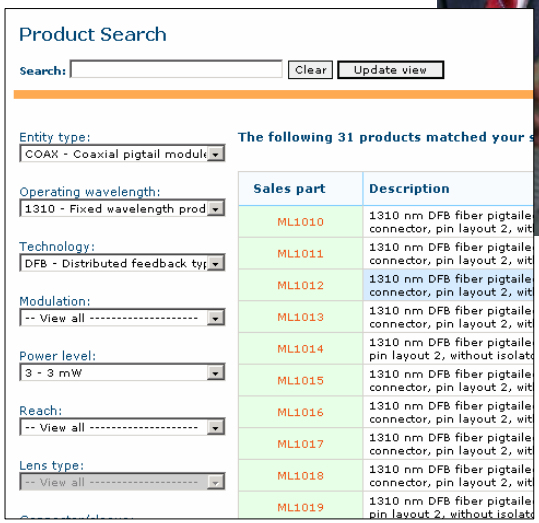


System analysis and design

- Holistic, generic, no redundancy
- Take-in-use time and system benefits are influenced by information architecture consistency
- Importance of training should not be underestimated
- Structure has to be simple enough so that the system can adapt to changes in business
- Big commercial systems often have lots of rigidity
- ROI-% tend to increase overtime

Streamline supply chain model





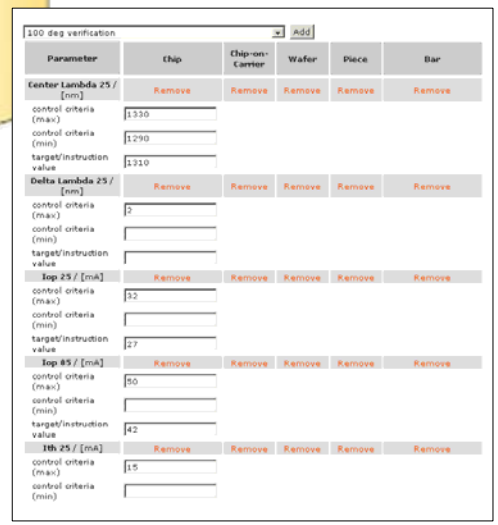
Marketing Intelligence

Product configurator

MLDB

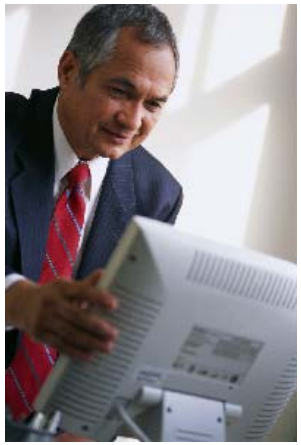
Available product (specifications)

Detailed information, e.g. measurement and lifetime data



- Information and co-ordination is required about the customer needs and desires
- MC system responsible for guiding the user through the configuration process
- Different variations, provide more information, visualize the product, and show its pricing
- Have to be careful not to overwhelm the user(s)

Streamline supply chain model



Request for quotation

RFQ
for responsible
engineer

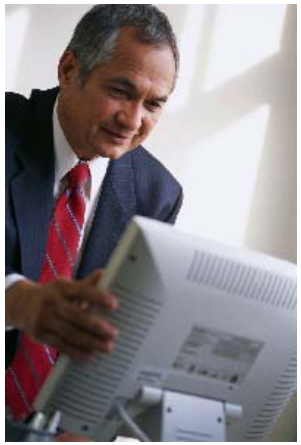
Find a proper
(or close enough)
product specification

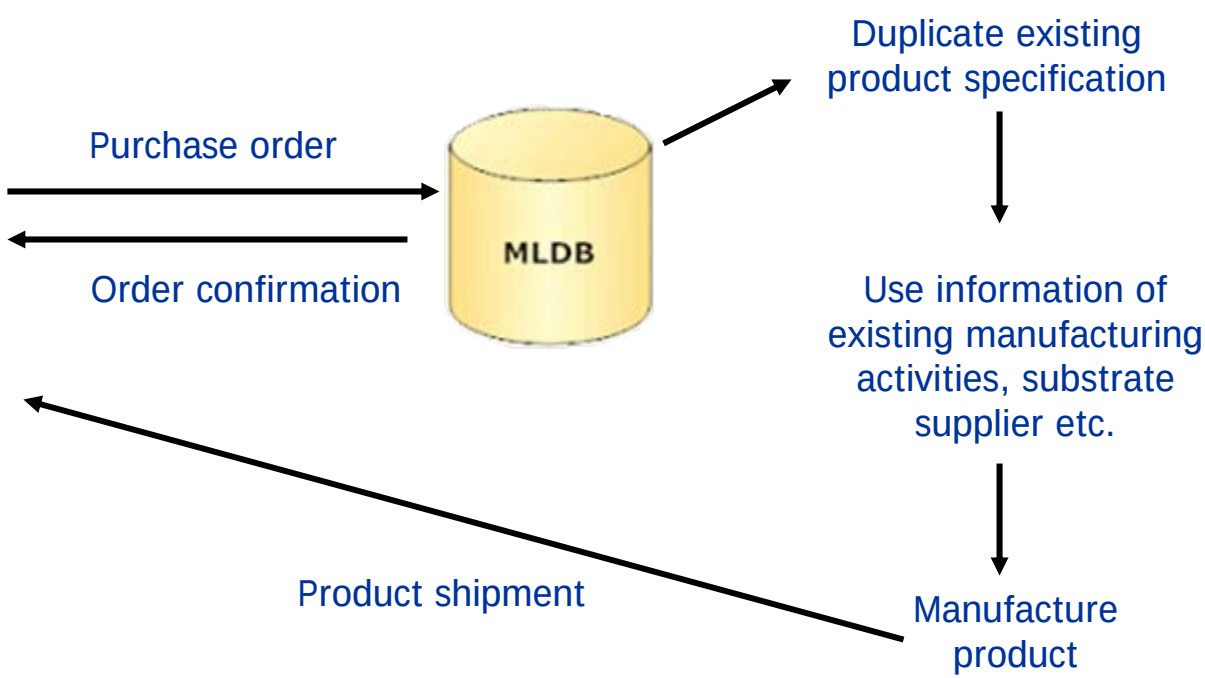
See pricing history and
stock quantity, give
estimated delivery
time

Quotation

- All manufacturing functions are integrated to db centered MES
- MES, SCM, PDM, ERP and CRM integrations
- Case company has been collecting measurement data since 2000
- Production equipment are integrated to db

Streamline supply chain model





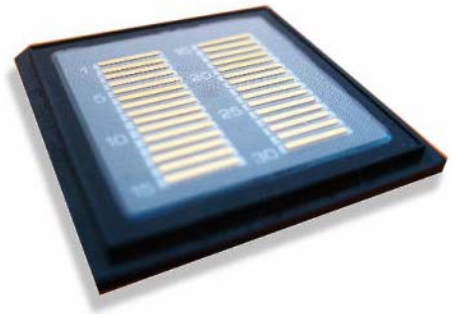
Customer and supplier needs to in communication to complete the product development

System architecture

- Inspection, test and quality take their instructions directly from the same information source that was established by R&D and translated by marketing into product specification
- Completely different level of possibilities for marketing management
  - Product data can be combined with business information w/o lots of manual, error prone work
  - Real-time product datasheets
- Adjust manufacturing process in-situ based on
  - New customer requirements
  - Quality control (QC) data
- Particularly useful in manufacturing of devices with lots of critical variables in the specification

Case example

- A request for 1200 pcs of 100 W Quasi Continuous Wave laser bar emitting at 795 nm wavelength
- Case company had done such design before
- Proper electro-optical (and mechanical) specification was found
- Existing manufacturing processes could be used
- Responsible engineer was able to
  - Find the best substrate for requested design
  - Send detailed lifetime and measurement data to customer
  - Give an estimated delivery date for the product
  - Make profitability analysis



Mass-customization and Activity-Based Costing

- Universal Activity Management Tool (UAMT)
- Accurately calculate the cost of a activity, product, customer or a project
- See the cost of different activities (manufacturing steps) to overall product price
- Optimize new product design
- Educate customers how their behauviour affects to the cost of a product or a service
- Let customers pay only for what creates enough value
- Often the customer also learns about its own costs from ABC

Challenges for MC

- Customers may lack the knowledge to transfer their personal needs into concrete product specification
- Simple product may become complex if one has to decide explicitly between all features
- Have to be careful not to overwhelm the users with many options
  - Use of pre-configurations
- Product also has to be shipped to customer
  - Keep customer's expenditure as low as possible
  - Exceed the value perceived by the customer

Conclusions

- Mass-customization and configurable products are benefical in the semiconductor industry
- New competitive environment requires firms to produce products with a greater specificity to customer needs
  - Supporting system development becomes crucial
- Let the customer do part of the specification work
  - Translate the requirements at least semi-automatically to production
- Use the same SIMPLE structure and perform all functions within the system
- Poor system integration means reduced flexibility and cost control
- System has to express its added value to customer
- Majority of value is created as a result of capability to factually respond to verification and process related questions of customers
- Ability to differentiate products between applications and users

Thank you!

mika.aho@modulight.com
seppo.orsila@modulight.com

www.modulight.com