Impact Factors of Globalization on the Design of Products, Processes and Facilities of Production Enterprises

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Problems in Global supply chains

- Planning method: insufficient models, poor forecast quality, missing controlling
- Bull Whip effect: contrary interests, delayed information, misinterpretation
- Operative business: inconsistent target system, unsatisfactory data quality, no parameter calibration
- Insufficient: Suppliers-connection
- Insufficient: Customers-connection

Plan

Source -> Make -> Deliver

Return

Supplier -> Customer

Products: too early variant formation, too many structure stages

Processes: not quantity flexible, too many transitions

Facilities: not scalable, not mobile

Build Phase

Operation Phase

Paradigm of the global production

- The design of business processes and supply chains has to be carried out primarily from the view of the globally distributed market needs.
- Instead of central factories with high production depth close to the market, adaptable and if necessary temporary production units are required.
- The production logistics is dominated by the supply and distribution logistics.
- Different order types must be mastered by planning and control systems in the same factory.
- Product structures have to be adapted to the changing requirements of an internationally distributed production.
- Production and assembly methods have local conditions take into account.
Distinction of the Make categories according to stockpiling and manufacturing strategy

[after Eidenmüller]

Optimization of the product structure

[Nyhuis]

IFA
Example of a successful product Redesigns [Sartorius]

Reduction of the part number for a weighing system by 27%

Product variety despite standardization [Sartorius]

Identical mechanical components, distinction in the case
Change enablers of supply chains

- Mobility
- Universality
- Scalability
- Modularity
- Compatibility

Plan

Suppliers
Source
Make
Deliver
Customers
Return
Return

Description and features of production modules

Description

Features
Production modules ...
- are functionally and physically units decoupled from the environment
- obtain as performance unity autonomous processes
- strive for planning and executing functionality (decentralization) and
- have standardized interfaces for
  - Media and energy
  - Environment
  - User
  - mechanical connection
  - Area
  - Control and communication.
Specification of module interfaces

Interface type
- interface fixed over the life time
- soluble interface for operation
- soluble interface for reconfiguration

Interface specification
- Name: I-SE X101
- Type: More screwing verbs
- Coordinate system: K1
- Drilling sample: I-SE X101

Hybrid assembly system with turn table
- Grease dosage
- Part check
- Turn table
- Output bad parts
- Container for small parts
- Finished parts
- Base parts
- Press

[Drabow IWF]
Construction stages of an assembly system

- **Basic stage (B)**: Manual operations
- **Intermediate stage (I)**: Automatic screwing
- **End stage (E)**: Automatic supply and screwing

- Increasing number of work stations

Assembly cost comparison
automated vs. hybrid cells (example)

- **Cell 1**: 10,000
- **Cell 1 and 2**: 11,000
- **Cell 1.2 and 3**: 12,000

Assembly automat

Assembly cost [€/piece] vs. Production [piece/day]

- Assembly cost decreases with increasing production.
- Hybrid cells offer lower assembly costs compared to automated cells.
Modular factory for aggregates

• Structure into winners, runners, exotics
• Modular manufacturing cells
• Building grid 21 X 21 m
• Expandable in 3 directions
• Communication beneficial

Mobile factory structure for the final assembly of track vehicles

Features
• Process-oriented order
• Track-independent transportation within production
• Product-specific however order neutral production organization
• Module-wise assembly with late Train assembly
• Defined material dispatching areas
• Marked buffer areas
• Short communication distances
The global variant production system GVP

Aim of the project is the development and proof test of a high flexible production system for high-quality mechatronic products which can be produced at global locations differentiated, manual or automatic in variable quantities and in high diversity of variants.

Summary

The requirements on products, processes, production facilities and logistics in global supply chains needs adaptable solutions under consideration of

- Costs for material and added value at the respective production site
- Local conditions with regard to know how and local content
- Currency relations between production sites and markets
- Conditions referring to commercial law
- Assurance of social standards for working conditions
- Technical imitation protection