Roland Berger
Strategy Consultants

Capitalizing on automatization in light of quality processes and integrated systems

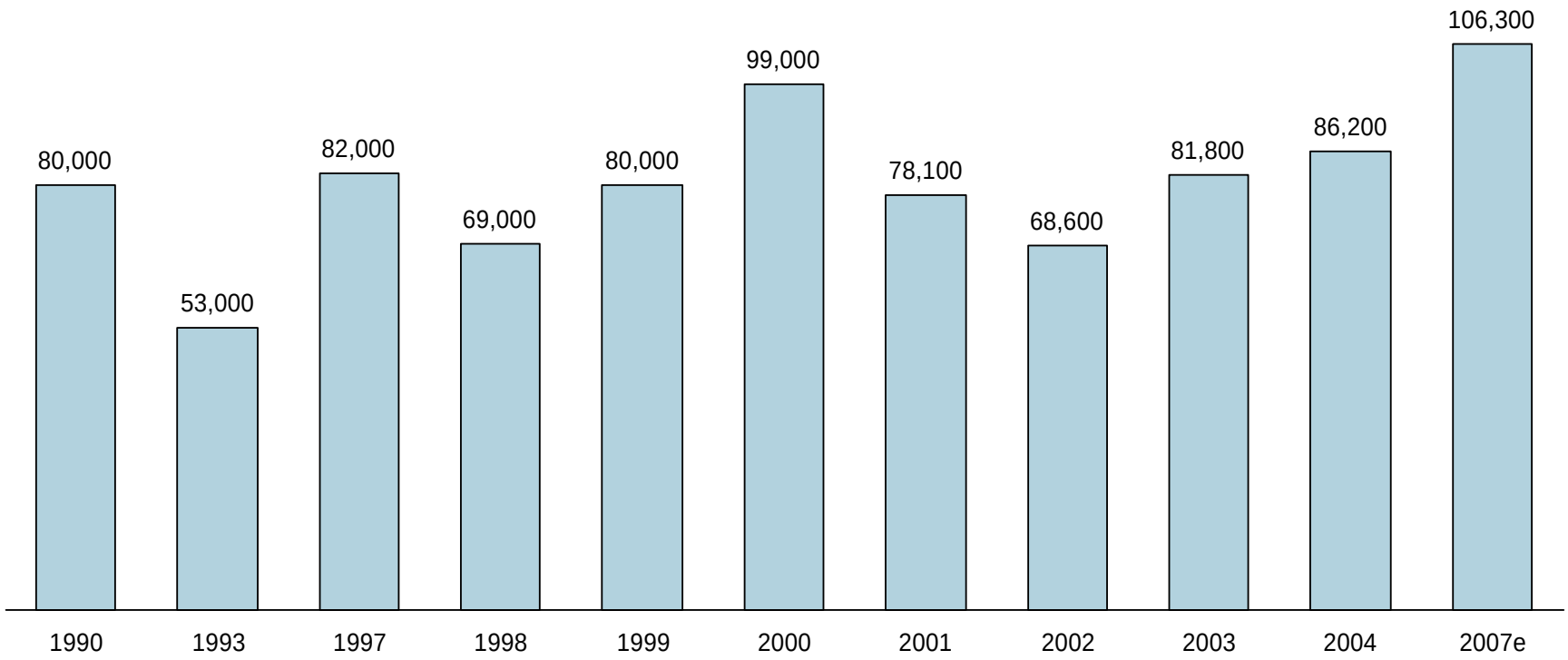
Wim van Acker

AUTOMAN Global Conference

Dearborn, MI, October 13, 2005

The market for industrial robots is volatile and has recovered strongly from the 2002 downturn

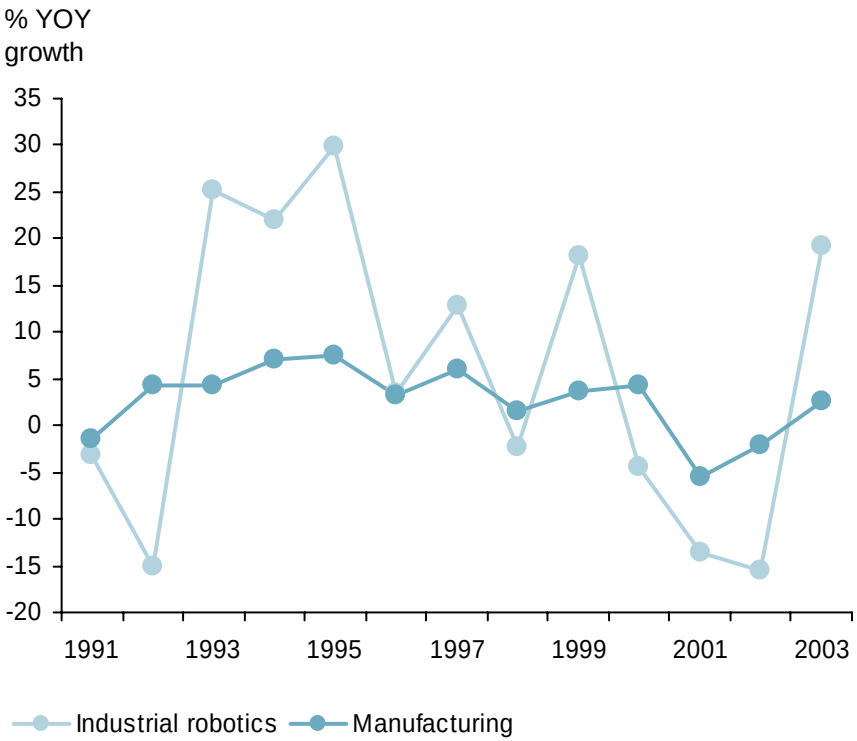
World-wide sales of industrial robots [units]

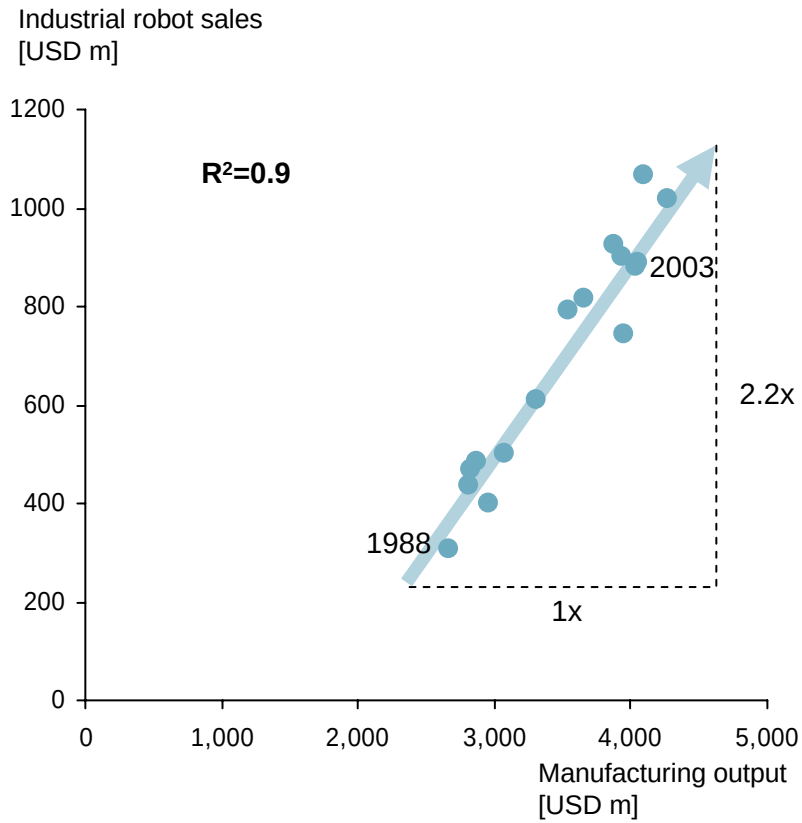


Source: UNECE

While industrial robot sales correlates strongly to the manufacturing industry, it is more cyclical and grows faster

Correlation between manufacturing output and industrial robot sales in the USA

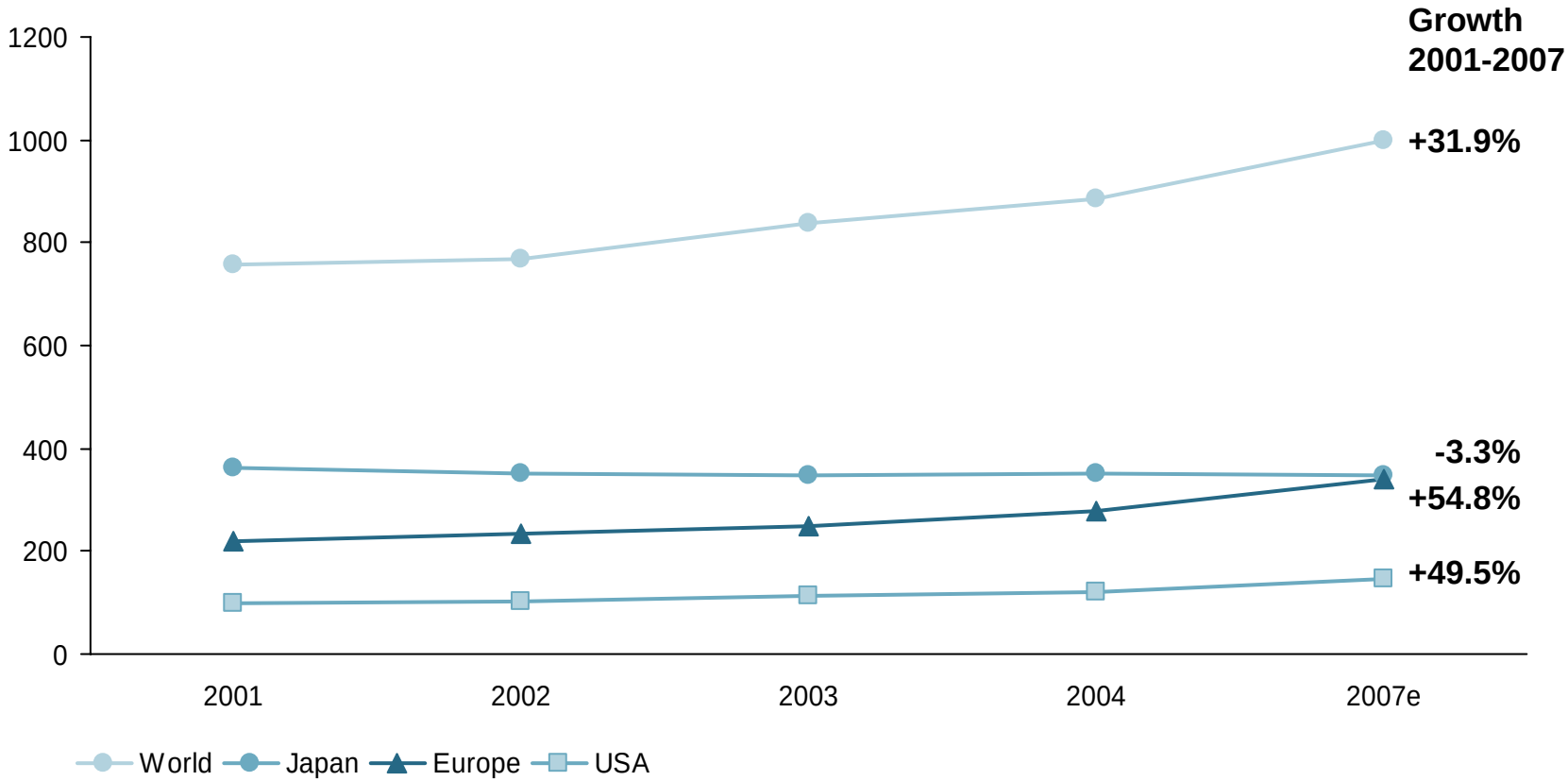




Source: UNECE, IFR

Europe is expected to catch up with Japan in 2007; the USA is also growing strongly

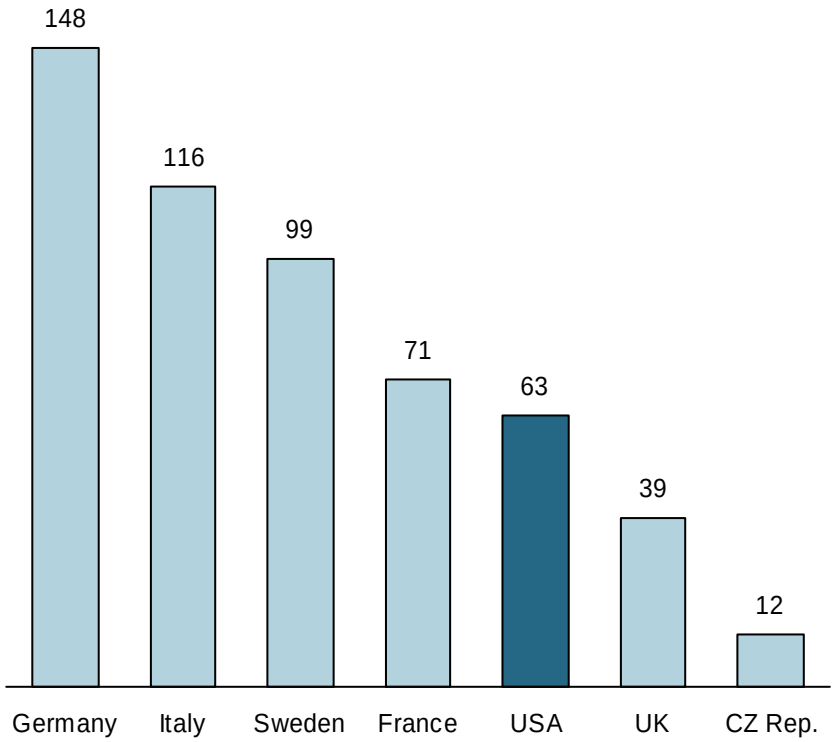
Operational stock of multi purpose industrial robots [000 units]



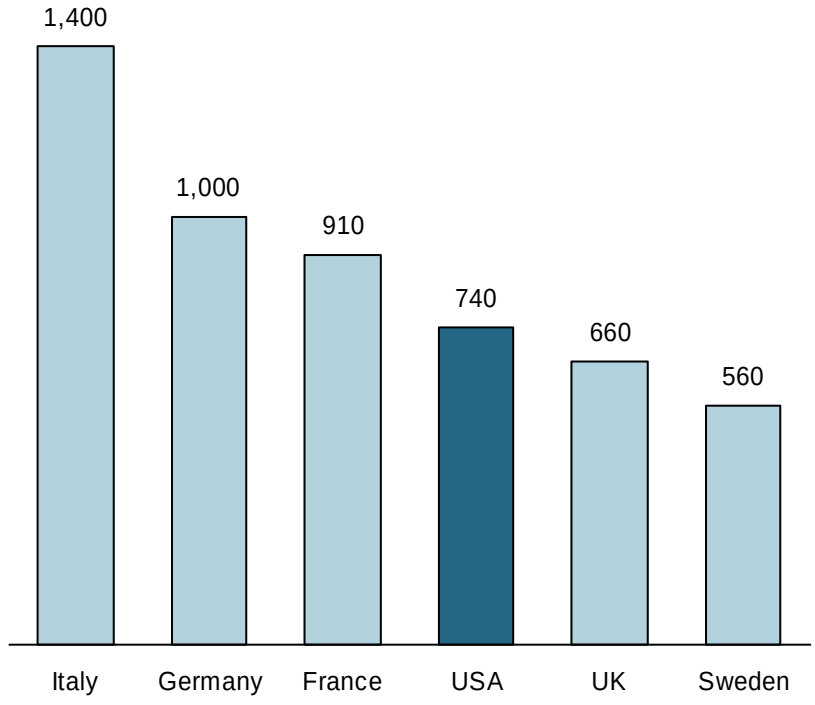
Source: UNECE

The US is behind Europe in terms of robotics use[1)]

Number of robots per 10,000 employed in manufacturing [2003]



Number of robots per 10,000 automotive production workers [2003]

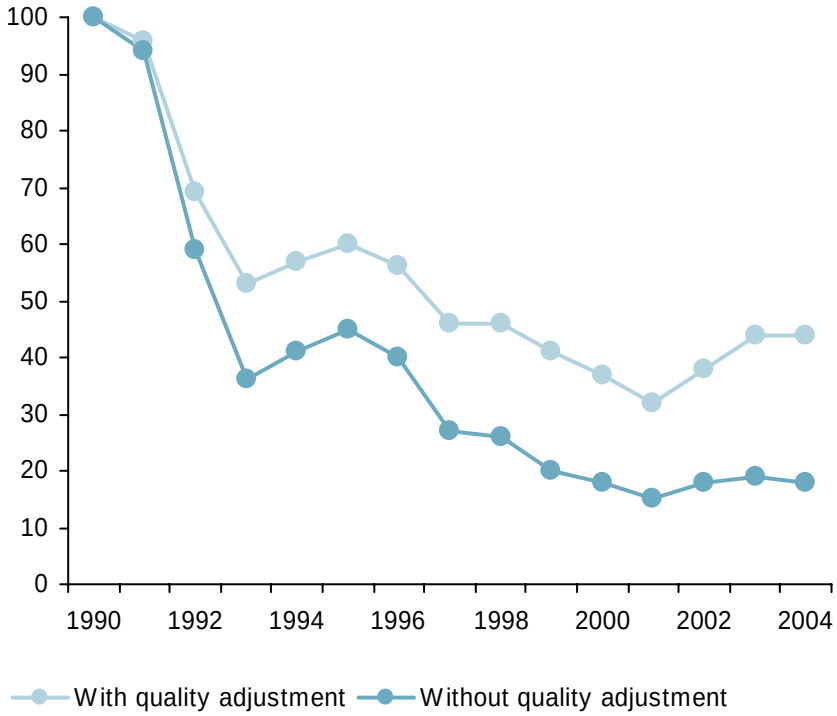


1) Japanese data includes all robotics therefore it is not comparable

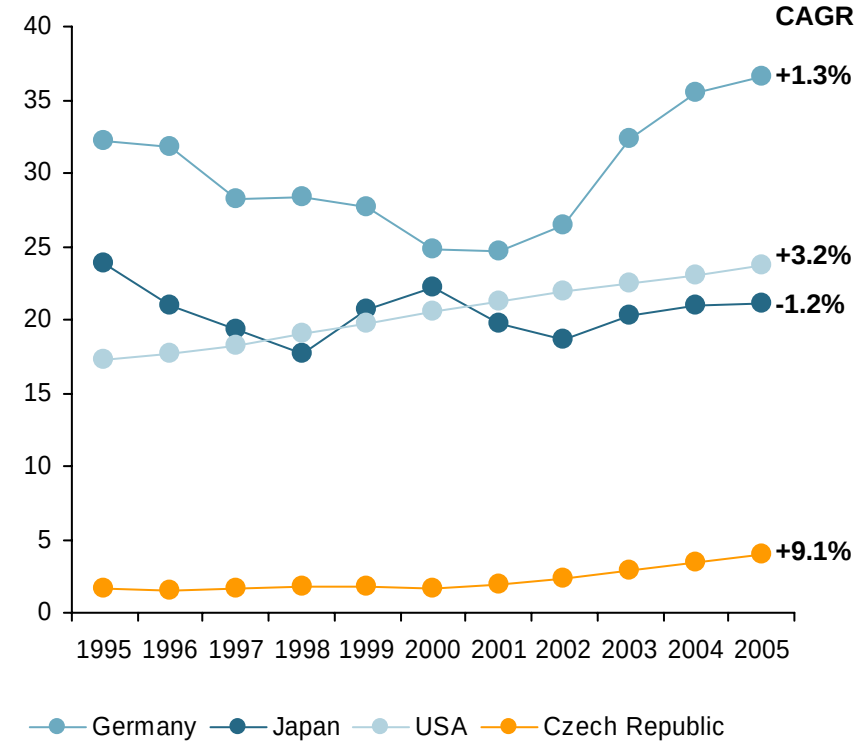
Source: UNECE

Labor costs are increasing while the price of automation is decreasing (recently leveling off)

Price index of industrial robots [1990=100]



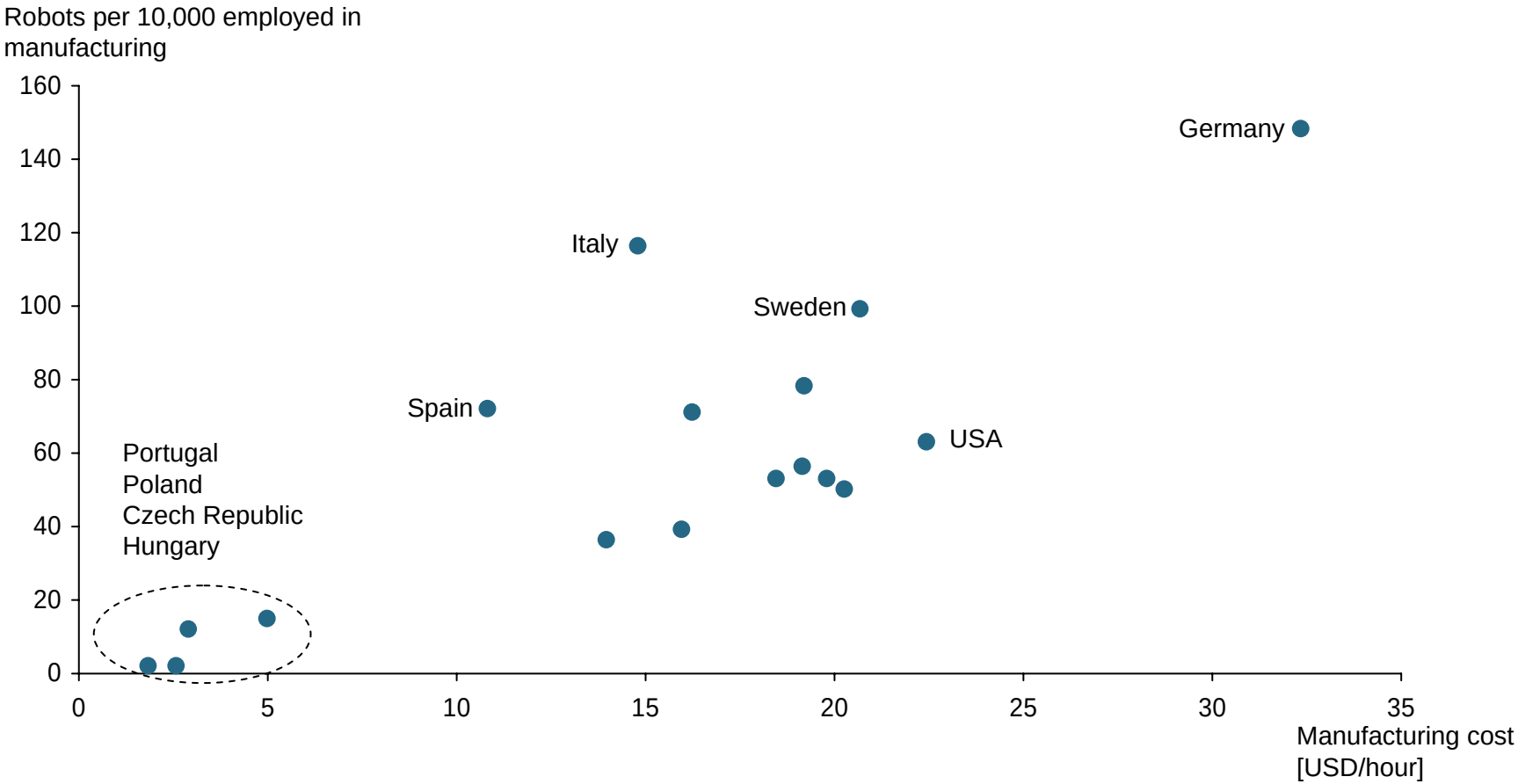
Hourly worker cost in manufacturing [USD]



Source: EIU, UNECE

In high labor cost countries the use of robotics technology is significantly more developed than in low-cost countries

Correlation between multi-purpose robots and labor cost

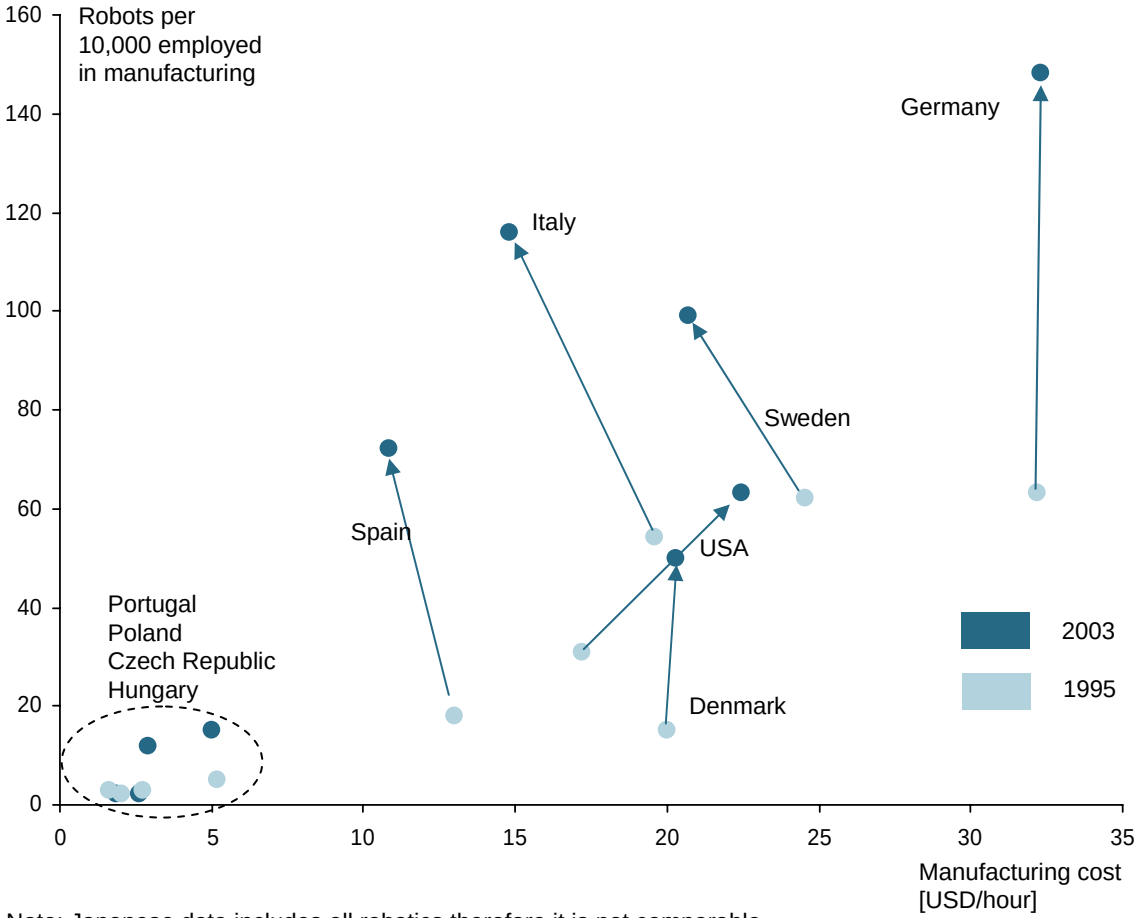


Note: Japanese data includes all robotics therefore it is not comparable

Source: UNECE, IFR

Manufacturing costs are decreasing in most European countries in parallel with high automatization

Change of multi-purpose robot usage and labor costs over time



Comments

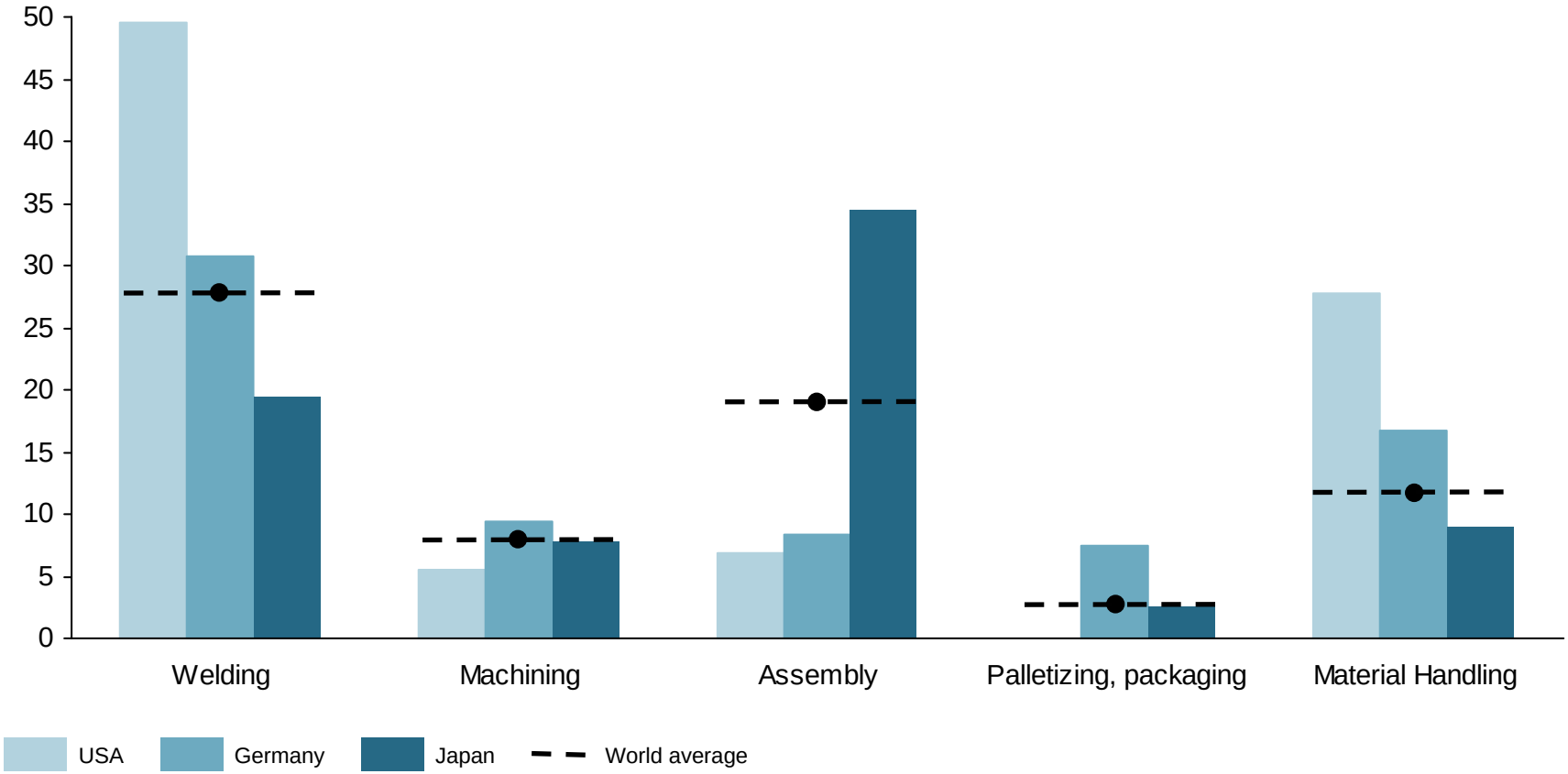
- Since 1995 usage of robotics technology increased significantly
- Labor costs decreased in most European countries compared to the USA parallel to the slightly appreciating Dollar (The USD has appreciated 5-20% 1995-2003 against selected European currencies (and depreciated slightly 1995-2005))

Note: Japanese data includes all robotics therefore it is not comparable

Source: UNECE, IFR

The main use of industrial robots are welding and material handling in the USA; assembly in Japan

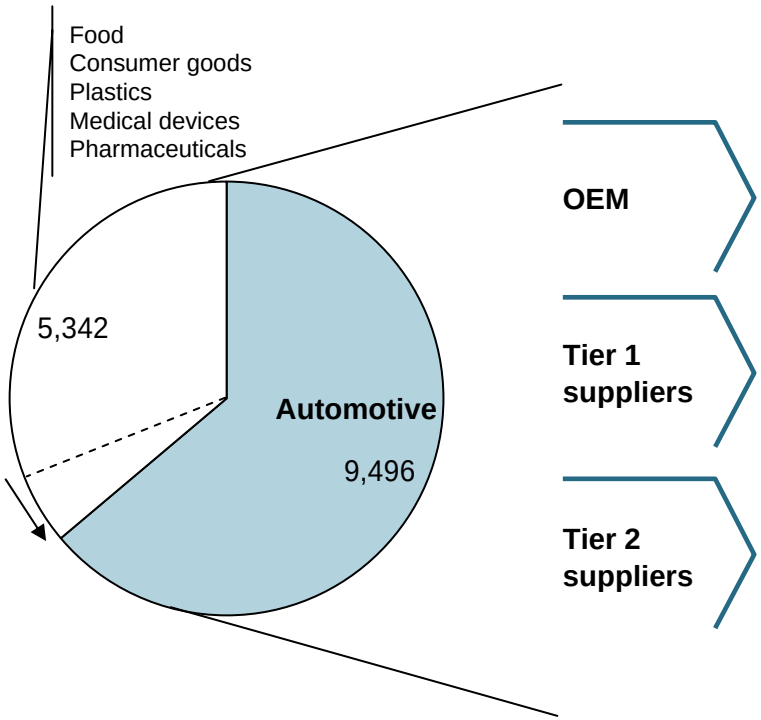
Operational stock of industrial robots by application, 2003 [% of number of units]



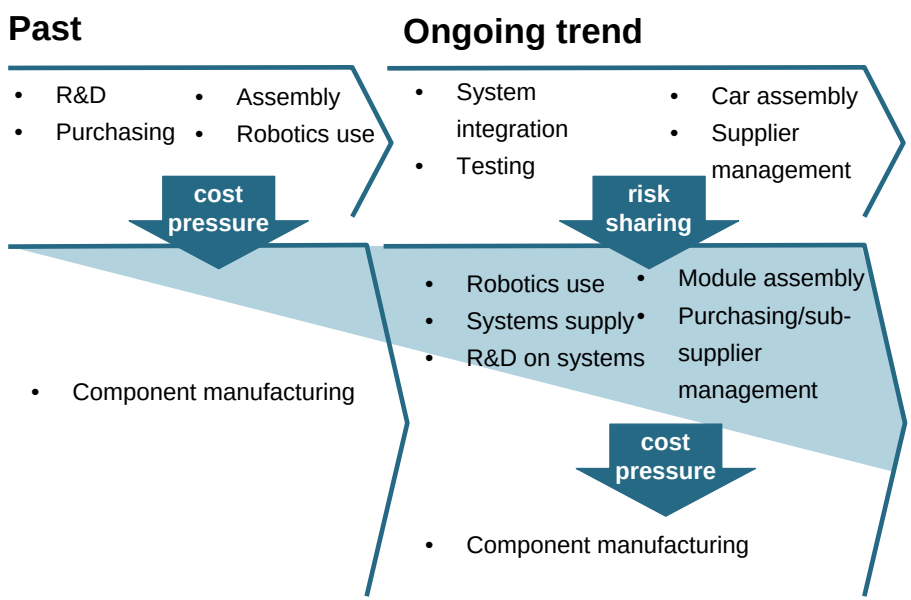
Source: UNECE

The use of robotics and automated assembly is shifting from the automotive OEMs towards suppliers and non-automotive industries

Industrial robot sales in the US [2004, units]



Shifting trend within the automotive industry



Source: IFR, Roland Berger

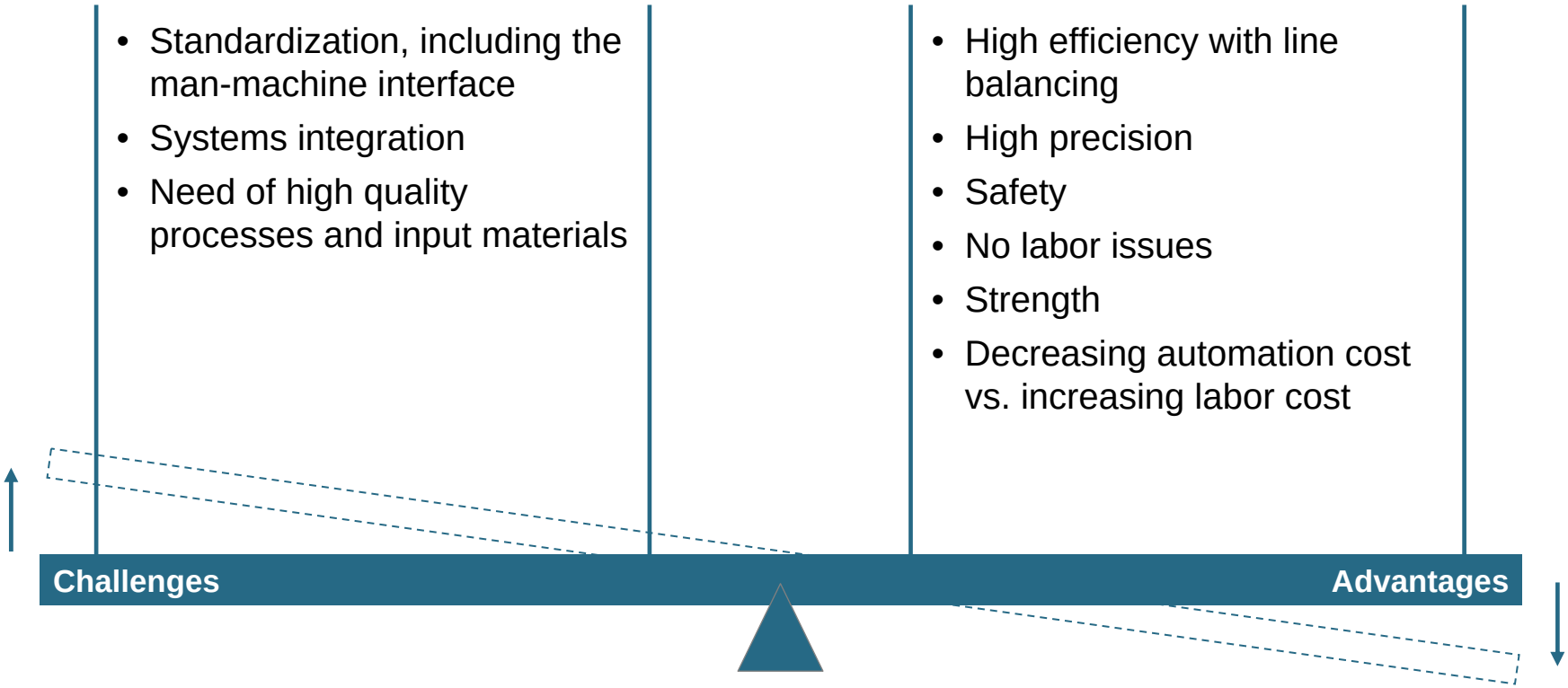
Growth of robotics technology within the Automotive sector is limited by off-shoring and OES growth in high labor cost countries

Sources of growth for the industrial robotics industry

- Automotive industry
  - OEM in North-America
    - OES supplies from North-America ✓
    - OES supplies from low-labor cost country
  - OEM in low-labor cost country
    - OES supplies from North-America ✓
    - OES supplies from low-labor cost country
- Non Automotive ✓

Source: Roland Berger

The use of robotics can be a good alternative to stay competitive in high labor cost countries with a well defined product scope



Source: Roland Berger

The standardization of man-machine Interfaces enables workers to adjust more quickly to a new workstation

Man-machine Interface

Trend

- Human/Man Machine interfaces become more standardized
- Interfaces follow the worker and are not static any more
- Reduction of cumbersome manual inputs
- Graphical, busy to understand data transmittal

Examples

- Windows-based applications
- Hand-held applications e.g. palm tops
- Voice recognition head sets which leave both hands available (hands-free)
- Graphical programs highlighting e.g. manufacturing outside of tolerance

Source: Roland Berger

Maximizing productivity and eliminating inefficiency through the integration of systems is a future key success factor (1/2)

Evolution of system characteristics (1/2)

	Previously	Today	Trend
Level of production automation	Highly automated but "islands of automation"		Integrated factory floor and shop floor automation
Level of system integration	• Island solutions for applications automated at different times with different computer equipment • No vertical and horizontal communication	• Partial integration of certain factory automation systems and few shop floor systems • Few horizontal and very few vertical communication	• Full horizontal and vertical integration of systems through standardized software and middleware products
Data transfer	• Manual data entry from hard copy printouts produced by Business Management Systems	• Partly electronic, partly manual data entry • Highly paper-based for backups	• Complete electronic data transfer among all levels • Low paper use
Software characteristics	• Inhouse	• Inhouse/customized standard software	• Customized standard software

Source: Roland Berger

Maximizing productivity and eliminating inefficiency through the integration of systems is a future key success factor (2/2)

Evolution of system characteristics (2/2)

	Previously	Today	Trend
Information flow	• Business software: batch • Production software: batch	• Business software: batch • Production software: real time	• Exchange of real time and historic information on all levels
Data amount	• Very few, only most necessary information	• All information could be handled • Identification of necessary information is problematic	• All necessary information is identified and processed
Transparency	• Low transparency as systems do not communicate with each other	• Increased system integration has improved data transparency	• Information from all other parts of company is available and accessible
User friendliness	• DOS • Unix	• Unix • Sun • a lot Windows-based	• Windows • Graphical HTML pages

Source: Roland Berger

However, there are various hurdles to realize the goal of integration

Current

- Automated "island solutions" with little integration
- Inhouse solutions

Problems to be solved

- High number of isolated computers and control systems
- High system development and maintenance costs because of the need to continuously update and rework in-house software when ERP software is upgraded
- Fear of strong dependence on standard software providers in core processes
- Vehicle manufacturers are reluctant to share knowledge about their production core processes relevant for competitive advantage

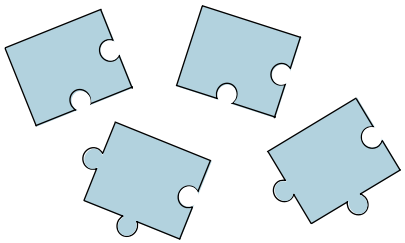
Future necessity

Open information connectivity and integrity that allows for easy harvest of relevant plant and shop floor data (complete and packaged solution)

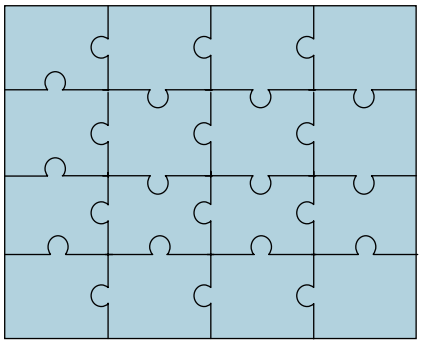
Source: Roland Berger

Integrated control of plant level processes is necessary to optimize company-wide systems

Integration



"island solution"



detailed and integrated system

Advantages for the organization

- Holistic organizational solution with horizontal and vertical integration of production planning and control with plant floor systems
- Simultaneous planning and control of all production resources
- Transfer of control decisions to the production process level
- Integration of line feeding, transport and warehouse logistics
- Consideration of logistics goals
- Differentiated control of parts and orders
- Consideration of material flow dynamics

The dynamics of material flow and production can only be handled through the application of cybernetic principles

Source: Roland Berger

Roland Berger
Strategy Consultants

Capitalizing on automatization in light of quality processes and integrated systems

Wim van Acker

AUTOMAN Global Conference

Dearborn, MI, October 13, 2005