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Research Report

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Contrasting Modernisation Strategies in Germany and the USA

A Comparison of Concepts of Production Modernisation

Jürgen Wengel and Gunter Lay

Résumé

In the modernisation of production processes, German and American firms stress different aspects: a greater number of German enterprises strategically favour technology and innovation and the adaptation of products to customers' specifications. The US firms prioritise more frequently the quality of the products and a lower product price. These differences find their expression in partly diverging production engineering and production organisation. Thus the German firms underlay their orientation towards flexibility and innovation with a broader technology application in design and in the fields in which the foundations for a good supply capability are laid.

In contrast to the common assumption, US industry is only partially the leader in the implementation of e-business. In the utilisation of various organisational and management concepts, German industry focuses strongly on the optimisation of product development processes and on a product-oriented segmentation of manufacturing. There is relatively less adoption by US firms of innovative forms of organisation of production.

Introduction

- USA as model?** The economy in the United States prospered to such an extent in the 90s that demands grew loud that Germany should model itself on the USA. After a lean period at the end of the 80s, in the 90s the US firms recorded growth and profit figures which German industry did not achieve by far.
- Contribution of production modernisation?** In this situation the question arises, how did American firms manage the turnaround to this new strength? The roles of exchange rates, specific market developments or state-set framework conditions are not be dealt with here. Rather, the focus of attention is directed on strategic, technical and organisational activities, undertaken by the firms themselves. In short: What are the US firms doing differently from firms in Germany?
- Comparison with the Georgia Manufacturing Survey** The basis for answering this question is a comparison between the information which was gathered in the *Innovation in Manufacturing Survey* of the Fraunhofer Institute for Systems and Innovation Research (*Produktionsinnovationserhebung*, Fraunhofer ISI, see box on p. 12) and data from the *Georgia Manufacturing Survey*, which was carried out by the Georgia Institute of Technology in Atlanta, USA in 1999 (see <http://www.cherry.gatech.edu/survey>). The possibility to compare them is the result of a coordination process between both surveys which ensured that for a series of topics comparable questions were asked. The *Georgia Manufacturing Survey* is aimed, as can be seen from the name, at companies in the US state of Georgia. It thus covers only a part of the US economy. As a comparison of the economic structural data of Georgia and the USA as a whole show, this segment can be regarded as illustrative although not necessarily absolutely representative. Industry structures, size structures and the extent of industrialisation appear in Georgia to be similar to the USA as a whole.
- Structure of the firms questioned in GMS and ISI surveys similar** As the *Georgia Manufacturing Survey* (GMS) collected information from manufacturing industry as a whole, only the cases from the metal and electrical industries which were the target sectors of the ISI *Innovation in Manufacturing Survey* are referred to for the present comparison. So the data of 232 US firms could be compared with the information from 1,442 German firms. The results of this comparison appear to be meaningful. As a comparison of the company sizes of the firms questioned in the USA and Germany showed, only very small firms in the US study are somewhat more strongly and larger companies somewhat less strongly represented as in the German random sample. The number of firms in the two medium groups correspond almost exactly in both surveys.

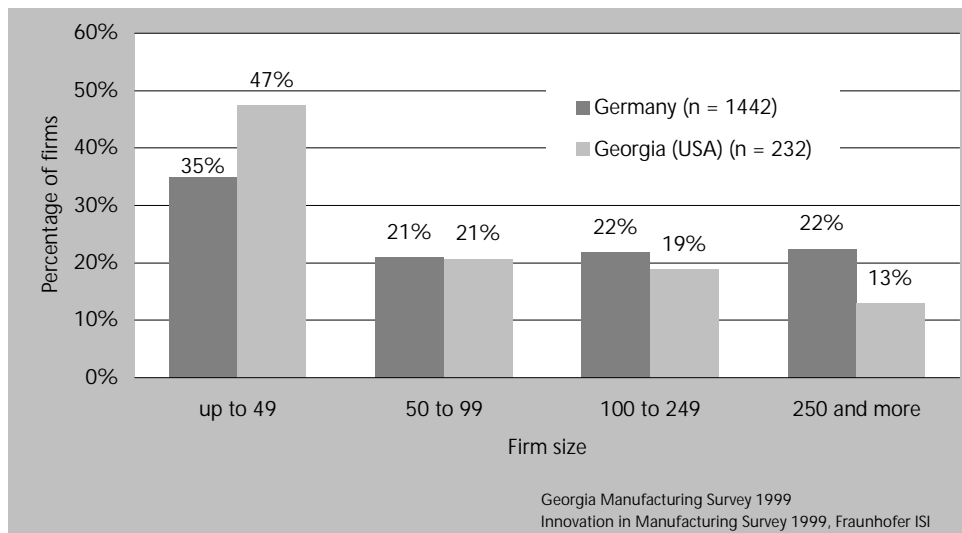


Figure 1:
Comparison of
firm size
structures in the
Georgia
Manufacturing
Survey and ISI
Innovations in
Manufacturing
Survey

The industry structures in both random samples are also almost identical. Mechanical engineering firms are most strongly represented in the surveys, 38 resp. 34 per cent of the responding firms. The manufacturers of metal goods follow in second place with 28 resp. 33 per cent.

In order to ensure that apparent differences in enterprise behaviour could not be attributed to different production modes, the batch sizes produced were also compared. It emerged that single-item producers are represented in the surveys with 35 resp. 37 per cent. Small or medium-sized batch producers form the largest group in both databases, with 44 or 45 per cent respectively. Large-scale producers with 21 or 18 per cent are the smallest group among the firms. This shows clearly that the type of manufacturing in the firms in both samples are similar.

**Comparable
production
structures acc.
to batch sizes**

In addition the following questions were pursued, using these databases for comparison:

- Do US firms focus on other strategies than German firms, in order to position themselves competitively?
- Does the production engineering equipment of the firms differ on either side of the Atlantic?
- What status do organisational innovations in production have in the comparison between German and US firms?

Strategic Orientation of German and US American Firms

In the past, by comparison with the USA, German industry competed mainly on the grounds of product quality ("Made in Germany"), also for the willingness to adapt products individually to meet the customer's needs ("tailor made"). The US firms are credited with winning market shares because of the product price on the one hand, and on the other hand because of leading-edge technology. According to the presently available data, these assumptions must be at least partly revised:

Quality most important competitive factor for US firms

The product quality is the most frequently cited way to compete by far in the USA. For more than two-fifths (42 per cent) of all US firms, the *quality* of their products is the focal point of their enterprise strategy. In Germany, by contrast, only 29 per cent of the firms primarily pursue the aim of quality, in order to be one step ahead of competition. Here it appears that the discussion about Total Quality Management in the 90s which was especially intensive in the USA led to a reversal of the strategic priorities.

German firms rely more on innovative and customised products

Innovative and high-tech products have on the contrary strategic priority for a much larger number of German companies than US ones. One quarter (26 per cent) of the German firms declared that they pursue this strategy. The corresponding figure in the USA lies at 9 per cent. Only a relatively small group of firms base their competitive strategy on innovation leadership and the high-tech basis of the USA. Conversely, the number of firms in Germany which primarily trust in the technology and novelty of their product ideas, is remarkably broad.

The *adaptation of the products to customer needs* has a high status in Germany, as expected. 26 per cent of all German firms stated that this is part of their strategy. As however 16 per cent of the US firms also trust in this strategy, the difference in rating for the so-called custom tailoring is less than many supposed.

Price competition avoided in Germany and also in USA

Only very few firms in Germany strive for *cost leadership*, as expected. At 7 per cent, this strategy is scarcely relevant for domestic firms. Only a very small share of the US firms also attempt to outstrip competitors on the product price grounds. A mere 16 per cent declared that they rely on the price first and foremost. This behaviour of the US sellers documents that also in production locations in the United States the price competition against countries in which even lower wage structures exist, cannot be won. The reference often heard on this side of the Atlantic to the lower wage costs in the USA appears to be

seen only by a relatively small group of firms in a similar light and taken as the foundation of company strategy.

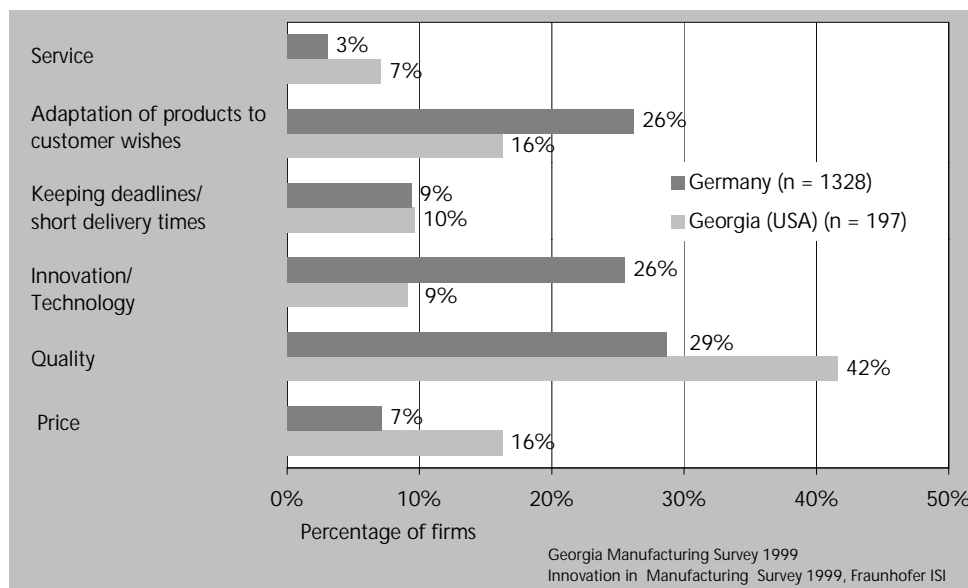


Figure 2:
Strategic
orientation of
German and US
American firms

On the whole, more German enterprises rely on technology and innovation, as well as adapting products to customer needs. The US firms more frequently prioritise the quality of products and a lower product price. These differences in strategy are expressed in a differing estimation of important company fields of activity: in Germany almost two thirds (63 per cent) of the firms describe the development of new products as very important. Only 44 per cent on the other hand accord the task of improving the manufacturing processes the same high status. In the USA the corresponding figures are 53 and 48 per cent, and thus clearly closer together. The manufacturing processes, by which the product quality and product price can be centrally influenced, are also rated relatively higher in the USA, in conformity with strategy. The development of new products, by means of which the firm can become a leader in innovation and offer the customer individual, customised solutions, are on the other hand comparatively more important in Germany.

**Product
development in
both countries
most important
field of activity,**

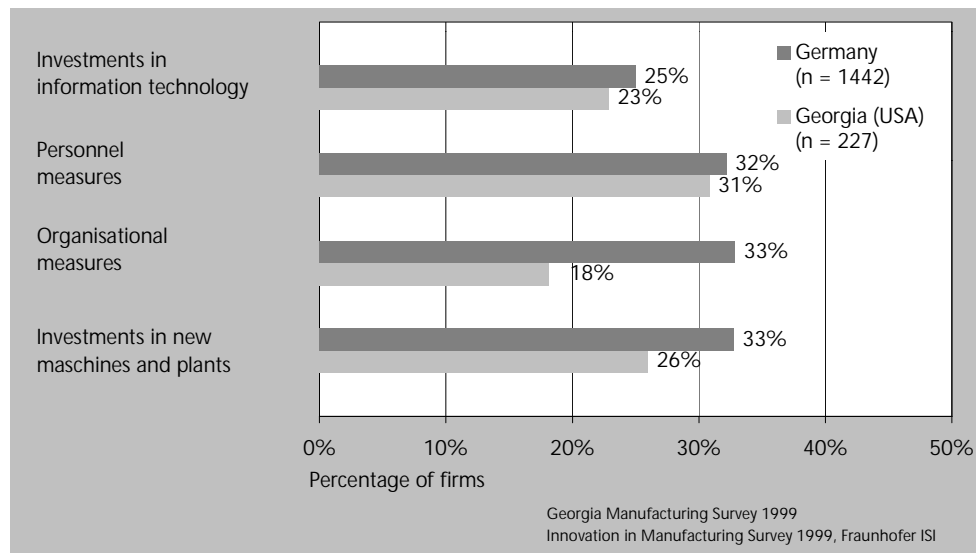
**but US firms
rate production
process
relatively
higher**

A third of the German firms, when asked how the strategic goals in the priority fields should be primarily achieved, answered that investments in new machines and plant equipment are crucial for this. US firms restrain from this topic. Only 26 per cent of the firms on the other side of the Atlantic describe investment measures of this kind as very important. This corresponds to the dominant picture that German firms tend to rely on technical solutions with the danger of over-engineering.

Despite this, ...

**... technical
and ...**

Figure 3:
Measures to
modernise
production
regarded as "very
important"



**... organisational
measures are less
prioritised in the
USA**

The fact is surprising that in Germany organisational measures to improve production are regarded much more frequently as essential than in the United States. This field is regarded as very important by 33 per cent of the companies in Germany, in the USA on the contrary only by 18 per cent. Thereby it appears that larger numbers of German companies are of the opinion that large reserves to boost performance lie in the organisation of production. The debate about Lean Production which stemmed among others from MIT, seems to have met with a broader acceptance in Germany than in its native country.

Status and Development of Production Engineering

**Technology use
follows
strategic
orientations**

If the pattern of technology use in the USA and Germany are compared, the current expectations are only partially confirmed. The American capital goods industry has only a partial lead on the way to an IT-supported "New Economy". Rather, there is a similarity in the diffusion pattern of significant technology concepts. Only the specific competitive strategies of German firms mentioned above are partially reflected in the use of technology: the German firms support flexibility and innovation orientation with a broader technology application in their design departments and in the fields in which good deliverability is generated. In detail this means:

**Teleservice in
Germany's
capital goods
industry used
five times more
often**

Almost every second German capital goods company uses teleservice, in order to get its machines and equipment quickly back to operation again in the case of problems or breakdowns, with the help of the suppliers. Here the attempt is made to influence the deliverability positively, with technical aids. By contrast, only every tenth US firm uses this technology. The US firms are also making no attempts to catch up in utilising teleservices. To what extent the age of the US

machine parks and incompatibilities of the telecommunication infrastructure with the countries of origin of the suppliers of teleservices are responsible, must remain open at this point.

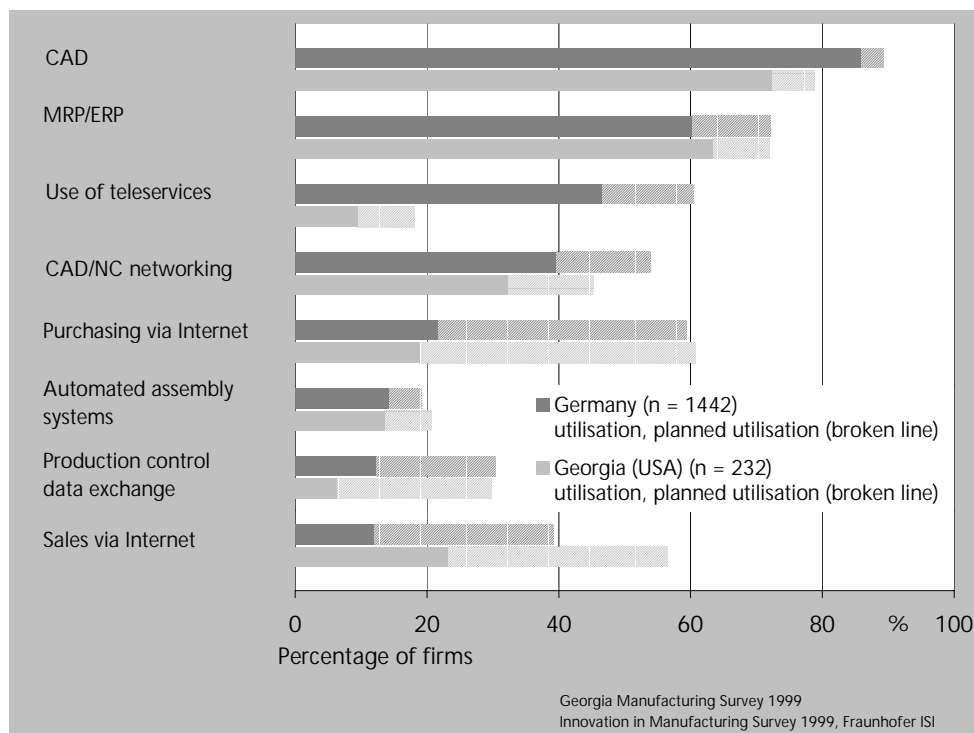
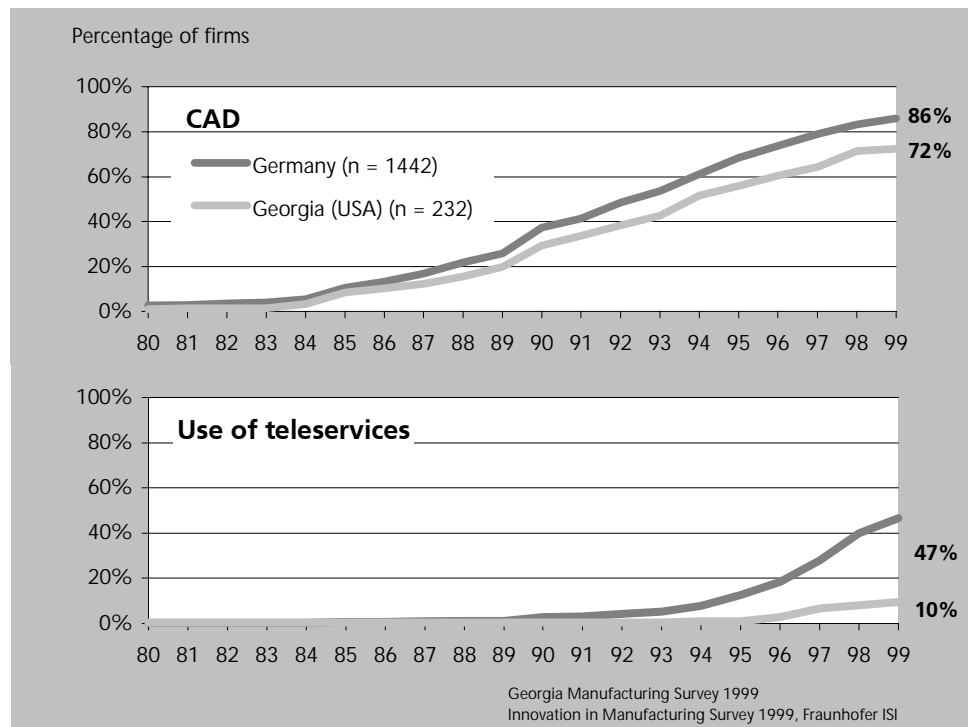


Figure 4:
Technology
utilisation and
planning in
German and US
firms

Computer Aided Design (CAD) belongs in Germany in everyday use, with 86 per cent of the firms using this technology. However, also 72 per cent of the producers of capital goods in the USA have implemented CAD. Although CAD systems stem originally from American software developers in the aviation and aerospace industry, the capital goods firms in both countries adopted the technology almost simultaneously, after first pilot applications at the beginning of the 80s. The ensuing diffusion was more hesitant in the USA however, which led to the deficit in the USA described above. The greater weight placed on customer-oriented adaptations in Germany could be one explanatory factor for the fact that CAD is more utilised there.

**CAD and
CAD/CAM
support German
strategy of
product
flexibility**

Figure 5:
Diffusion of CAD
and teleservice in
Germany and
USA



Partial lead of US firms in e- commerce

The greater diffusion of teleservices and CAD in German firms only partially balances an American lead in the area of e-commerce. The USA were the leaders in this technology. In 1998 every tenth US capital goods company already handled the procurement of supplier parts or the selling of own products, at least in part via the Internet. At present however the US firms are leading in sales with 23 as opposed to only 12 per cent.

The German companies procure component parts and materials in the meantime more frequently via the Internet (22 to 19 per cent). Overtaking was possible because the distribution curve of electronic procurement is already flattening off in the USA, which seems to indicate a certain disillusionment with its possibilities.

No country- specific lead in ...

In comparison with the other production technologies examined, neither the US industrial firms nor the German companies appear to have achieved a specific lead in utilising the following:

... MRP/ERP

- Software solutions to support production planning and control (MRP/ERP systems) are with 60 resp. 63 per cent almost equally used in Germany and the USA.

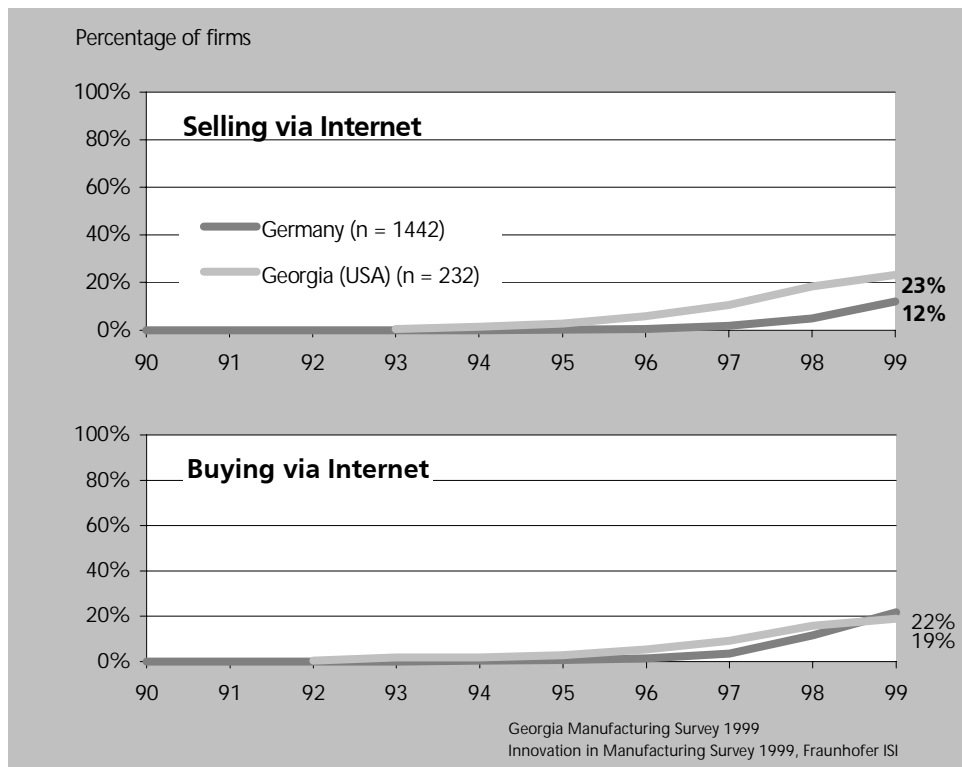


Figure 6:
Diffusion of
e-commerce in
Germany and
USA

- The electronic exchange of production management data within a value added chain between MRP/ERP systems of different enterprises is nearly double in Germany, with 12 per cent, than in the USA. The US companies are planning to catch up however.
- Automated assembly systems are used by less than a fifth of the enterprises in both countries. They are as a rule only practical for large series and less complex products. These kinds of manufacturing conditions as we have seen are restricted in the United States and in Germany to a relatively small number of capital goods companies.

**... exchange of
production
management
data**

**... automated
assembly
systems**

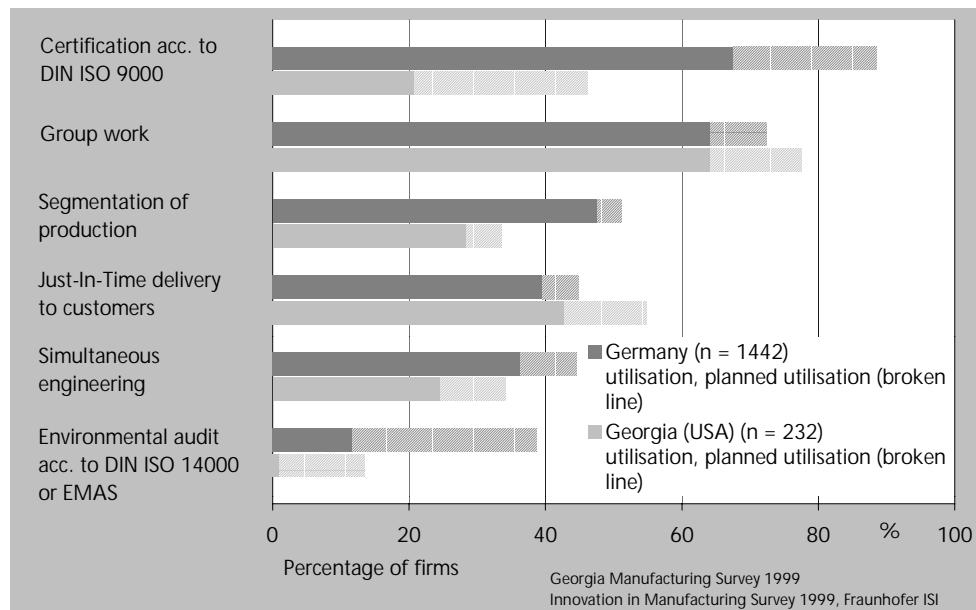
Use of innovative organisational and management concepts

The empirical data on new organisational and management concepts also only partly confirm the current estimates of the position of the USA in relation to German industry.

**Innovative
production -
organisation
not strongly
used in USA**

Although the bestsellers in management literature come almost without exception from America, the US capital goods companies do not take the messages contained under the buzzword "Business Re-engineering" more to heart than their German competitors. The following picture emerged:

Figure 7:
Use of innovative
organisational
and management
concepts in
German and US
factories



**ISO 9000 not
catching on in
US firms**

The certification of quality assurance systems according to DIN ISO 9000 is not usual in the USA, despite the significance of quality in the competitive strategies there. In Germany, on the other hand, the audit has become almost matter of course, after a cautious start at the beginning of the 90s: a good two thirds of the capital goods companies are certified. In the USA only a fifth are certified.

**Broad
introduction of
segments in
production in
Germany helps
to respond to
customer
wishes**

The shift from the workshop principle in favour of a segmentation of production according to product resp. customer groups has been made in the USA by a good quarter of the firms, against almost half the firms here in Germany. The segmentation in German industry fits in with the company strategy of stronger response to customers' wishes and innovation. However, not only differing competitive strategies could be responsible for the difference in diffusion. The different qualification structures in the USA perhaps also limit the possibilities of reorganisation.

Simultaneous Engineering, i.e. having the development steps run parallel with the aim of shortening the process, is practised by more than a third of the companies in Germany, and a quarter in the USA. These diffusion quotas reflect once again the German strategy of customer-flexible, innovative products.

**Company
environment
protection no
subject in USA
and beginning
in Germany**

12 per cent of the capital goods companies in Germany dispose of environment management concepts according to the environment audit regulation of the European Commission or the ISO Norm 14000. This does not exactly speak for a breakthrough for environmental consciousness in industry. In the USA, however, certification of environment management procedures according to

ISO 14000 practically does not exist. At the same time, only few US companies are planning an introduction, whereas more than a quarter of the German firms are intending to establish a certifiable environment management system.

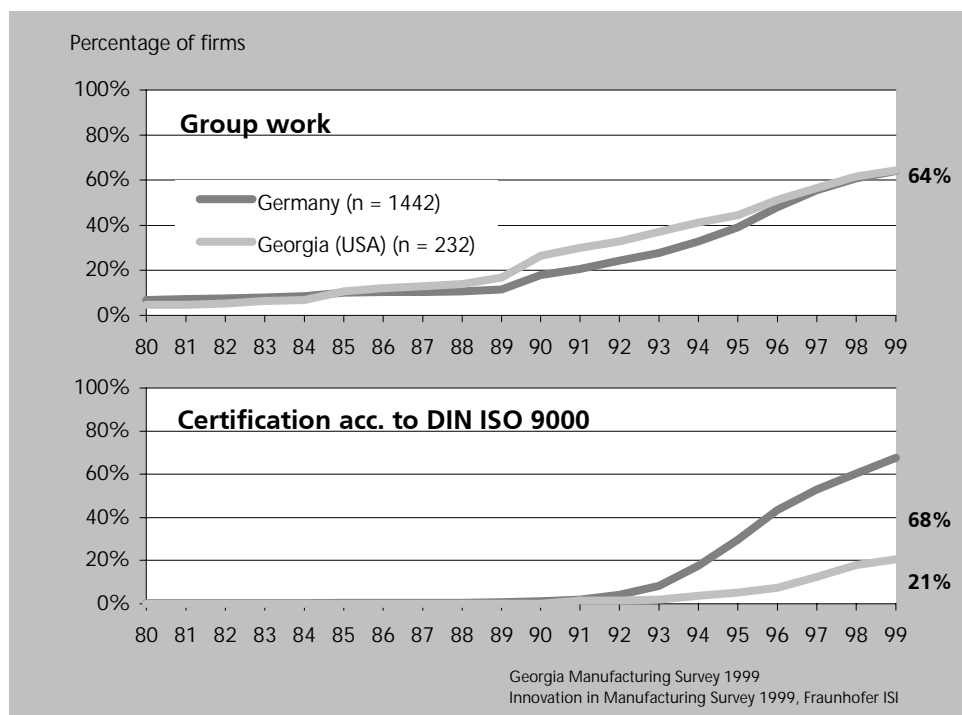


Figure 8:
Diffusion of
group work and
quality
management
systems in
Germany and
USA

Group work exists in the USA and in Germany in two out of three companies. The high spread of group work is however also determined by the general nature of the term. If narrower criteria are applied (planning and controlling tasks as an element of the group's task), then the user quotas sink clearly lower, especially in the USA. The diffusion of this principle received a decisive impetus in both countries only at the end of the 80s. Up till this point in time, group work was a phenomenon, which played a role only in a minority of firms, not only in Germany but also the United States.

Group work in both countries equally popular, but part-autonomous concepts more seldom in US firms

Just-in-time delivery is characteristic for approximately the same number of enterprises in USA and in Germany (43 resp. 40 per cent). The aim of reducing tied up capital was seized as an opportunity in both countries to phase out stocks.

German firms utilise more organisation concepts, which support flexible, innovative products

If one regards the use of the various organisation and management concepts together, then it becomes clear that the German capital goods firms focus on certification of the companies, optimisation of innovation processes by Simultaneous Engineering and flexibilisation by means of product-oriented segmentation of manufacturing, by contrast with the US firms. Corresponding to the low status of organisational innovations as a sphere of activity in US industry,

no leading role for the US firms in organisational innovations could be observed in any of the fields examined.

Summing up

US firms successful, without being leaders in production modernisation

The capital goods producers in the United States have obviously trodden a successful economic path with their strategy of holding onto standard products of stable quality in a boom phase. They pursued less new production concepts than could have been expected from the parallel boom in American management literature. They can also only be partially described as leaders in the application of modern information and communication technology.

Innovative flexibility and selective leading role could mean long-term success for German firms

The German capital goods producers by contrast focussed on customer-specific, innovative products and pursue a modernisation strategy oriented towards this, with as a rule higher technology application and wider use of new organisational and management concepts. The future will show how appropriate this strategy is, in view of the development trends for customer needs and international division of work. One pre-condition for success however is not to succumb to the danger of overengineering.

The Innovation in Manufacturing Survey 1999

The Fraunhofer Institute for Systems and Innovation Research has been conducting a survey on *Innovation in Manufacturing* every two years, beginning in 1993. Firms of the capital goods industry in Germany are studied. Objects of examination are the manufacturing strategies pursued, the application of innovative organisational and technological concepts in production, questions of personnel deployment and qualification as well as (for the first time in 1999) the cooperation behaviour of the companies. In addition, performance indicators such as productivity, flexibility, quality and returns are collected.

This Newsletter No. 23 is based on data from the survey 1999, for which 9.823 firms were addressed in autumn 1999. By December 1999 1.442 firms had returned a usable, completed questionnaire (response rate: 14,7 per cent). The responding firms present a representative cross-section of the German capital goods industry.

If you are interested in previous Newsletters of the ISI Innovation of Manufacturing Survey or in special analyses of the new data, please contact:

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