



## 18th ICPR plenary paper: Intelligent Production - Competition Strategies for Producing Enterprises

H J Bullinger, Wolfgang Schweizer

### ► To cite this version:

H J Bullinger, Wolfgang Schweizer. 18th ICPR plenary paper: Intelligent Production - Competition Strategies for Producing Enterprises. International Journal of Production Research, 2006, 44 (18-19), pp.3575-3584. 10.1080/00207540600654491 . hal-00512899

**HAL Id: hal-00512899**

**<https://hal.science/hal-00512899>**

Submitted on 1 Sep 2010

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



## 18th ICPR plenary paper: Intelligent Production - Competition Strategies for Producing Enterprises

Journal:	<i>International Journal of Production Research</i>
Manuscript ID:	TPRS-2005-IJPR-0517
Manuscript Type:	Original Manuscript
Date Submitted by the Author:	02-Dec-2005
Complete List of Authors:	Bullinger, H J; Fraunhofer Gesellschaft, President Schweizer, Wolfgang; Fraunhofer IAO, Industrial Engineering
Keywords:	INNOVATION MANAGEMENT, BUSINESS PROCESS RE-ENGINEERING, MANUFACTURING MANAGEMENT, PRODUCTION PLANNING
Keywords (user):	competition strategy, business model



Special issue of IJPR for selected papers from 18th ICPR 2005

# Intelligent Production Competition Strategies for Producing Enterprises

PROF. DR.-ING. HABIL. PROF. E. H. DR. H. C. MULT. HANS-JÖRG BULLINGER

President of the Fraunhofer-Gesellschaft, Corporate Management and Research  
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.

Hansastraße 27c

D-80686 München

Phone: +49 (0) 89 / 12 05-10 00

EMail: hans-joerg.bullinger@zv.fraunhofer.de

DR.-ING. WOLFGANG SCHWEIZER

Fraunhofer-IAO

Nobelstr. 12

D-70569 Stuttgart

Phone: +49 (0) 711 970 - 2070

EMail: Wolfgang.Schweizer@iao.fhg.de

## Abstract

Producing enterprises in Europe were in a situation, which marks itself by a strong growth of competition and an individualizing of the customer's requests increasing at the same time. In order to maintain the market, many enterprises with mass production find in front of the difficult task of linking two strategic options: the simultaneous improvement of the differentiation and of the cost structures. In consequence controversy measures would be required. Solution attempts in the context of conventional business models exhibited the following characteristics: a strong rise of the information and communication intensity, an increase of the product type and number of variants, a reduction of the manufacturing lot size, unstable, frequently changing production processes and an extensive storekeeping in several stock levels ('complexity costs'). Enterprises, which introduce the mass production for the individual customer, try to combine the advantages of mass production with those of individual manufacture. Intelligent competition strategies based upon concepts of the 'Digital Factory' approach aim to overcome the traditional duality of 'cost leadership' or 'differentiation strategy' and to make both efficiency and effectiveness possible.

*Keywords: Innovation, competition strategy, business model, Mass Customisation, immediate production.*

## 1. Introduction

Innovations are the central instrument of control for nations as well as companies, enabling them to get ahead of the international competition - and to stay on top. As innovations create a new lead, fresh employment and new growth, this is just what we need to be able to further afford our wealth. Nations as well as companies, however, find themselves confronted with a growing obligation for innovation.

European manufacturing has great potential as part of a sustainable EU economy, but its success will depend upon continuous innovation in products and processes.

Especially in a changing world, and particularly in Germany, it is necessary to retain and strengthen the position in the world market through the development of new products and services as well as through the acquisition of new customer groups. In reality this means that companies nowadays have to face

- growing global competitive pressure,
- an increasing complexity and variety of technically excellent, and
- individual products or services.

Due to increased customer orientation this also involves a trend from serial products to mass-customized and service-intensive product packages. In spite of time and cost pressure, companies are still forced to exploit extensively the growth potentials of their value-adding chain. At the same time, they are confronted with ever more complex framework conditions, e.g. extensive legislations.

## 2. Basic concepts of growth

A concerted effort will be needed to transform European manufacturing from a resource-intensive to a knowledge-intensive, innovative sector with all the strengths necessary to achieve and maintain leadership in the global marketplace.

The current typically linear approach to research, development, design, construction and assembly will be replaced by simultaneous activity in all areas to satisfy global demand and shorten time-to-market.

Figure 1 shows four basic concepts of growth from the view of product development, technology and market.

Figure 1: Options for strategic growth

## 3. Innovation as a Driving Force for Intelligent Production

Productivity growth in European manufacturing industry as a whole has been below US levels in recent years [1]. Investment in new Information and Communication Technologies (ICT) and new production technologies is still too low, and has not so far led to the desired productivity gains and innovation activity is too weak. The EU does not suffer from a lack of new ideas, but is not so good at transforming these into new products and processes. Industry's analysis is that this is due to the framework conditions for manufacturers operating in Europe.

Figure 2 shows reasons for location misalignment to low wage countries (out) and back [2]. The significant target 'labour costs' may also be the reason of many cost cutting approaches.

Figure 2: Reasons for location misalignment

However, more and more companies reduce their R&D budget or completely step out of a market. But according to the innovation-compass, research and development intensive goods belong to the fast growing sectors. This results in a definite need for action to keep up with our international competitors.

In particular within a knowledge-based society, accelerated cycles of change in technology, economy and society and the dynamics of international partners and competition represent a challenge but also a fresh chance for a 'management of innovation'.

In order to enable companies to take a leading position within the international competitive field, innovation processes need to be accelerated and a networked and agile economic organisation has to be built up. In this context, an intelligent production also serves as a safety mechanism and should reduce the time-to-market of new products.

New business models will be required, in which:

- Much closer coordination exists between the demand and supply sides;

- Self-sustaining innovation permits efficient uptake of new technologies in parallel to the development of new products – thereby reducing time to market;
- Sharing of knowledge within and between organisations becomes the norm;
- Supply chains take the form of flexible collaborations, networks of specialised small and medium-sized enterprises (SMEs) and ‘virtual enterprises’;
- Well-defined work procedures and specifications are commonly used to maximise efficiency;
- Social, environmental and economic considerations get equal weight in decision making; and
- Provision of services, rather than the outright supply of goods, facilitates the transition towards sustainability.

Drivers for the setting up of intelligent structures in producing enterprises would have to be the in-plant planning departments. In these departments the ‘know-how’ of the classical ‘Industrial engineering’ is present, which receives a new strategic meaning in the background of a turbulent environment. Intelligent business models such as Immediate Production and Mass Customisation however often encounter in practice organisational barriers and obstacles. But, as shown in figure 3 and 4: Rationalization potentials in production are not yet exhausted [3].

Figure 3: How do failure reports of machines and jobs in production arrive at super ordinate places for systematic evaluation?

Figure 4: Reasons, why information systems are missing or production support at the place of the creation of value.

4.      **Teams and Knowledge management**

A central role during the introduction of innovative competition strategies plays group- and teamwork. The transfer of ‘single fighters’, which only accept their own achievement or withdraw themselves into a lockable ivory tower, to integrated members of a team can clarify that. In many cases the department or range-spreading co-operation in the project management is a problem. For example in many enterprises trusting co-operation between manufacturing, development, sales and marketing is a problem. Non-communication and blocking of co-operation prevents the development of an innovation culture.

The values of the individual must be brought in agree with the values and the strategy of the enterprise. This aim requires an organisation of the values in the enterprise and thus the enterprise culture. This can be reached only if internal communication is effective. That means that also the co-workers have sufficient time and free space, to creatively develop and be allowed to exchange knowledge, and this not as ‘unproductive’ work one understands. At the term ‘confidence’ that can concrete be fastened. The management of knowledge is meaningful only if the mutual confidence is a component of the culture of an organisation. That cannot be ordered. Reliable, sincere and calculable acting of the management demands confidence and keeps it upright.

At present much discussed, short term result orientation often adjusts the view of long-term, strategic perspectives. Visions, that arrange the success of future innovations into a changed surrounding field, require a more long-term orientation. Enterprises, which arrange their future actively, connect that strategic, long-term orientation with the flexibility to be able to react also at short notice to challenges. About it is important not only to orient themselves and try to copy success templates.

Enterprises must also be able to recognize innovations on a long-term basis beyond the borders of existing power spectra and markets, around possible interactions between partners or new authorities. Innovation success, in the sense of ‘overhauling, without to catch up’, must be aligned on a future-oriented, company-specific problem solution and innovation authority.

5.      **Innovation and intelligent production**

Innovations in the sense of a process form research and development up to the introduction on the market in particular in high-wage countries such as Germany have a special meaning in the international competition.

The present discussion shows that the competitive ability of an enterprise depends not alone from successful measures to the rationalization of the enterprise. Many enterprises supply themselves a 'head on head running' with their competitors and have only marginally or briefly lead to competition. The result of such a 'cost cutting' strategy is usually only small profit margins, because the products and achievements adapt themselves ever more and the costs are rising.

One solution of the apparent contradiction is looked for in the production concept called Mass Customisation, a hybrid competition strategy, with the following characteristics: Mass production for the individual customer is the production of goods and achievements for a relative large sales market, which meets the different requirements of each individual, to costs, which correspond approximately to those of comparable standard goods. Enterprises, those the mass production as a business model for the individual customer introduce, aim to combine the advantages of a mass production with those of the individual manufacture (figure 5).

Figure 5: Mass Customisation as a business model

The enterprises will have to shift their innovation emphasis on the demand side. The search for new market entrances becomes the central task of management [4].

An innovation-oriented strategy creates new products and processes as well as new forms of the customer interaction (figure 6). A goal is, not to catch up the competition at the same trace but to overhaul on innovative ways. We are today in a dynamic surrounding field, that is shaped from increasing innovation speed and increased innovation intensity.

Figure 6: Components of the configuration system in Mass Customisation business model

Therefore it is often not possible to transfer the past success factors to the future. New technologies together with different fields of knowledge, e.g. mechanics and electronics or physics, biology and engineering sciences, demand enterprises to extend their technology authority.

The dynamics of the surrounding field as well as new forms of the customer interaction require fast-reacting and flexible acting. In the field of vision that innovation-oriented strategies do not only stand for new products, also the production processes and firm's structures must be analyzed and improved. Only from the holistic view the enterprise can create an effectively and efficiently interlace. The management can activate new markets only if it does not only develop creative ideas, but also time and cost-oriented structures. A condition for it is a long-term, strategic perspective.

## 6. Simple and Clear processes

Correct handling simplifications of processes, assigned technologies and necessary interfaces is the key to simplify control also by given complex production technology. The principle of the 'ingeniously simple' leads to durable systems in particular in complex environments.

The partial paradoxes of connections and starting points for intelligent competition strategies for producing enterprises in Europe are pointed out in Figure 7 and 8. The classic solution of a business process, planned and controlled by an ERP-System, is too complex (and even too expensive) for the Mass Customisation approach.

Figure 7: Workflow by variant manufacturing (small equipment production).

Figure 8: Workflow by immediate production (small equipment production)

The 'Immediate Production System' reduces complexity of the accompanying processes. Immediate reaction to customer inquiries can be performed, delivery times are extremely shortened, stocks were reduced to zero and overhead costs for the manufacturing of unique products were significantly lowered down and the product quality is improved by stronger data integration.



7. Organisation

Innovations are not more structured under employment of a strategic innovation management as a coincident event, but are result of a continuum process. Innovation processes are not only seen today as task delegated to a certain person's group, but refer in all phases specialized spreading participants within the enterprise and also beyond the enterprise borders. Creativity and customer orientation are based on this broadly put on Co-operation.

As shown in figure 9 the development of an intelligent competition strategy is a project of the whole company.

Figure 9: Participants and elements of a Mass Customisation solution - from view of the organisational structure

8. Conclusion

Innovations are the central instrument of control for nations as well as companies, enabling them to get ahead of the international competition - and to stay on top. As innovations create a new lead, fresh employment and new growth, this is just what we need to be able to further afford our wealth. Nations as well as companies, however, find themselves confronted with a growing obligation for innovation.

Especially in a changing world it is necessary to retain and strengthen the position in the world market through the development of new products and services as well as through the acquisition of new customer groups. In reality this means that companies nowadays have to face growing global competitive pressure, an increasing complexity and variety of technically excellent and individual products or services. Due to increased customer orientation this also involves a trend from serial products to mass-customized and service-intensive product packages. In spite of time and cost pressure, companies are still forced to exploit extensively the growth potentials of their value-added chain. At the same time, they are confronted with ever more complex framework conditions, e.g. extensive legislations.

In particular within a knowledge-based society, accelerated cycles of change in technology, economy and society and the dynamics of international partners and competition represent a challenge but also a fresh chance for a 'management of innovation'.

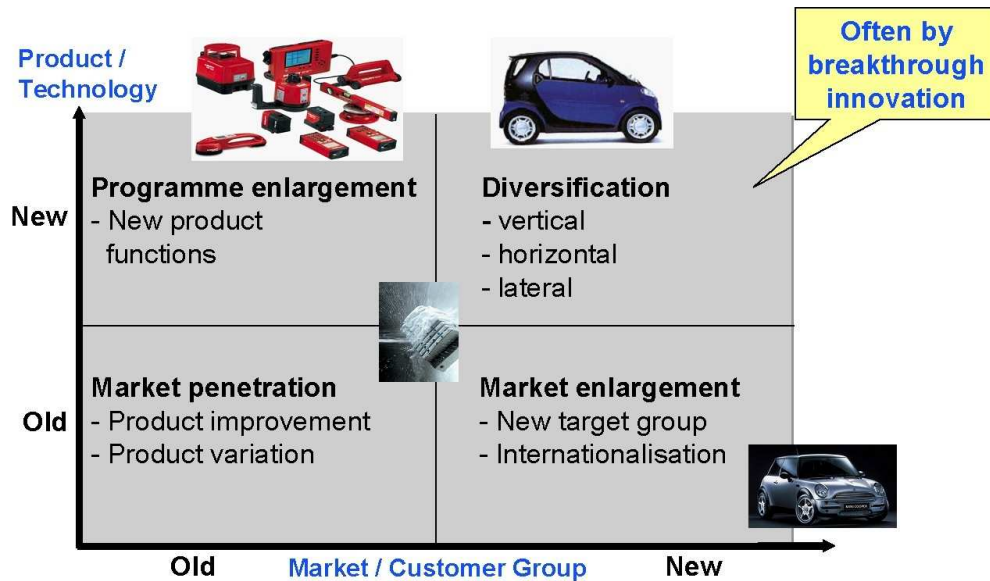
In order to enable companies to take a leading position within the international competitive field, innovation processes need to be accelerated and a networked and agile economic organisation has to be built up. In this context, an intelligent production also serves as a safety mechanism and should reduce the time-to-market of new products.

Therefore Intelligent Production always includes the following areas:

- The customer in the focus
- All functions involved pull also
- Management of knowledge and innovation

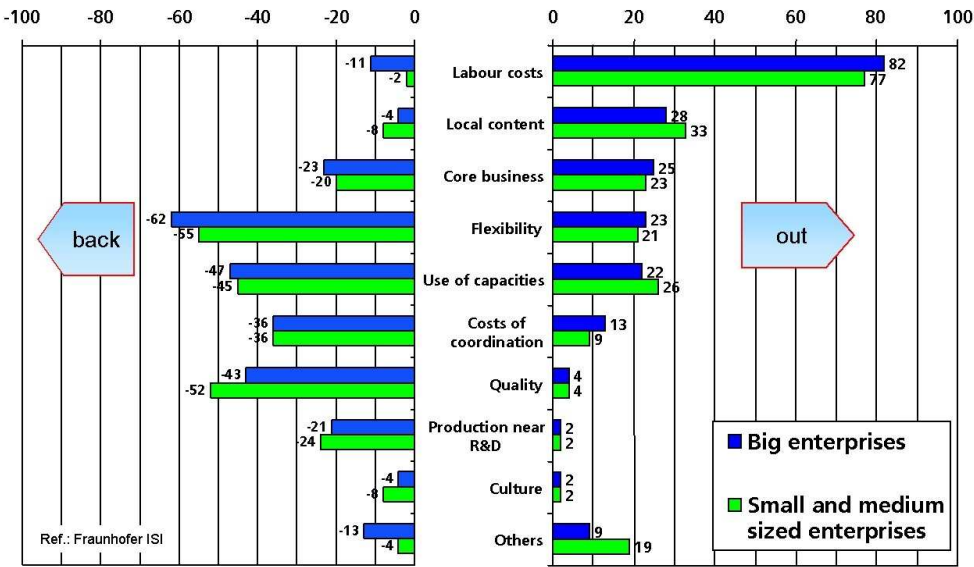
9. References

[1] Flegel, H., Simon, A.: MANUFUTURE – a vision for 2020, revised draft from 3-11-04.  
[2] Study 'Produktionsverlagerung'; Fraunhofer Institute for Systems and Innovation Research, 11-11-2004.  
[3] Study 'Information und Kommunikation in der Produktion', Fraunhofer IAO, 2003.  
[4] Rayport, J. F.: Das Angebot dem Kunden anpassen, Harvard Business Manager, 2/2005.  
[5] Study: Erfolgsfaktoren von Innovationen, Fraunhofer IAO, IPA, IPK 1998.  
[6] Studie des Instituts für Arbeit und Technik für das verarbeitende Gewerbe in Nordrhein-Westfalen.

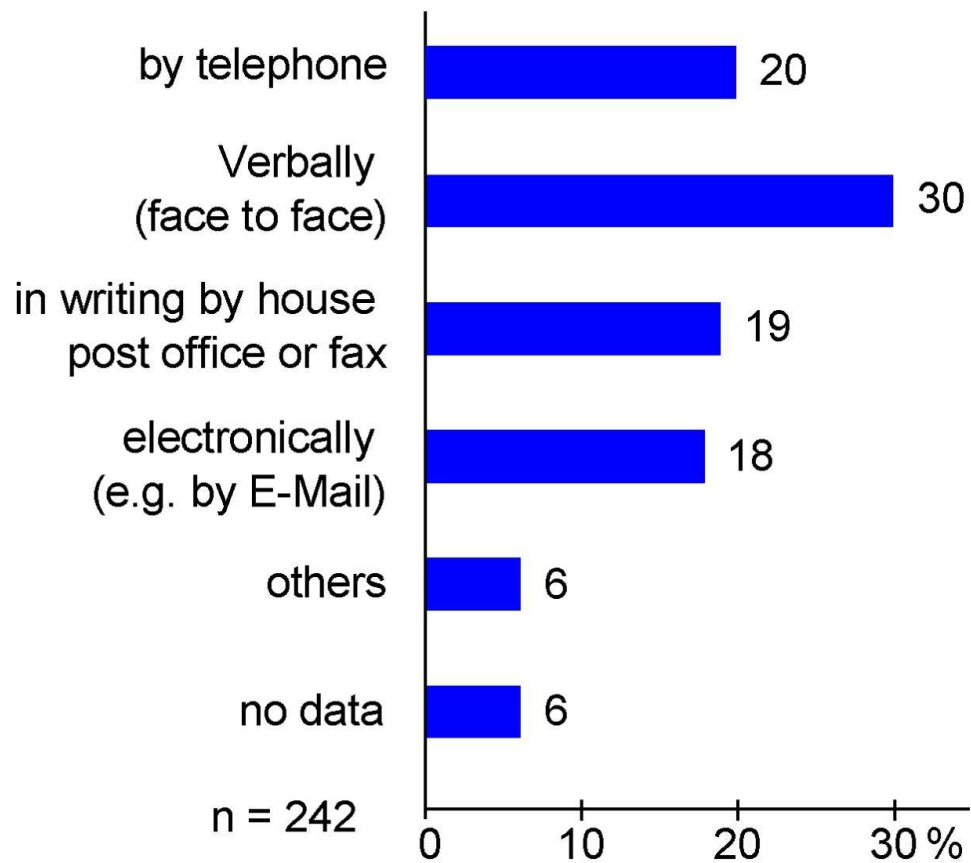


Options for strategic growth

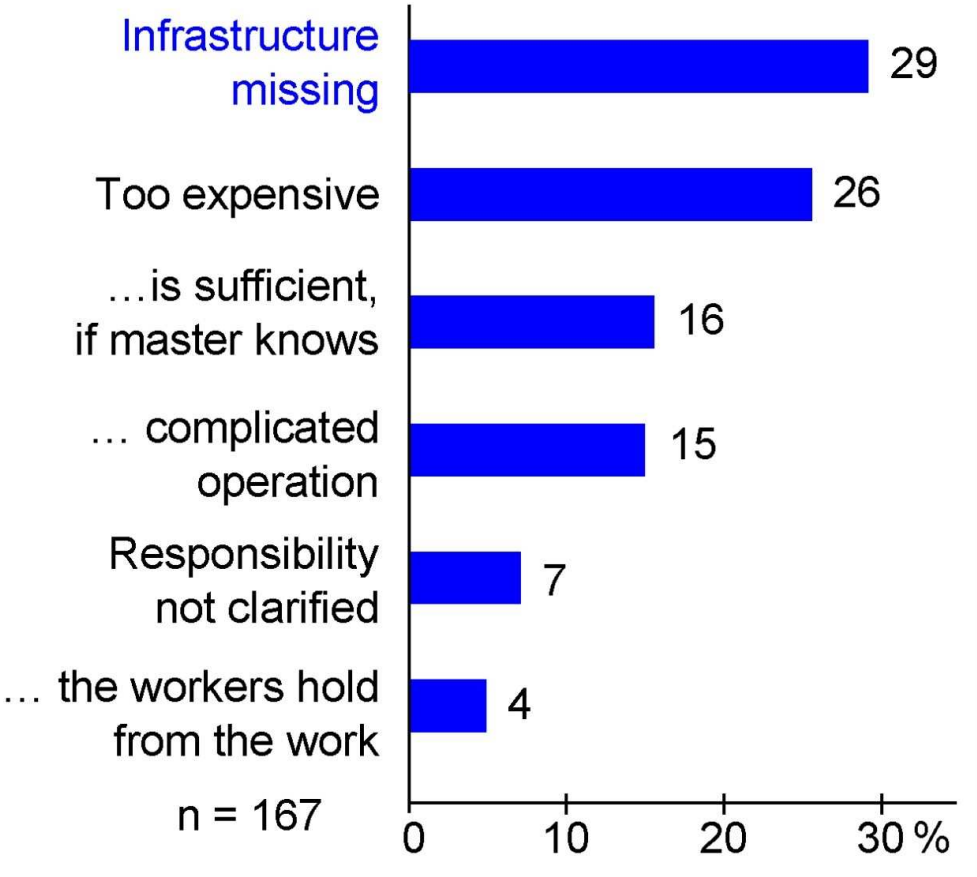




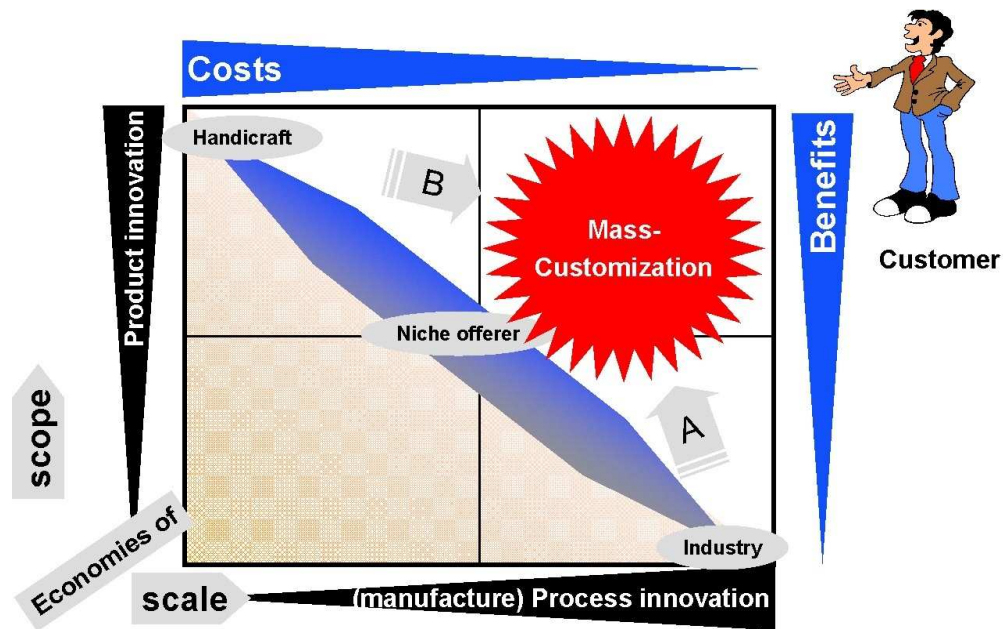
Reasons for location misalignment



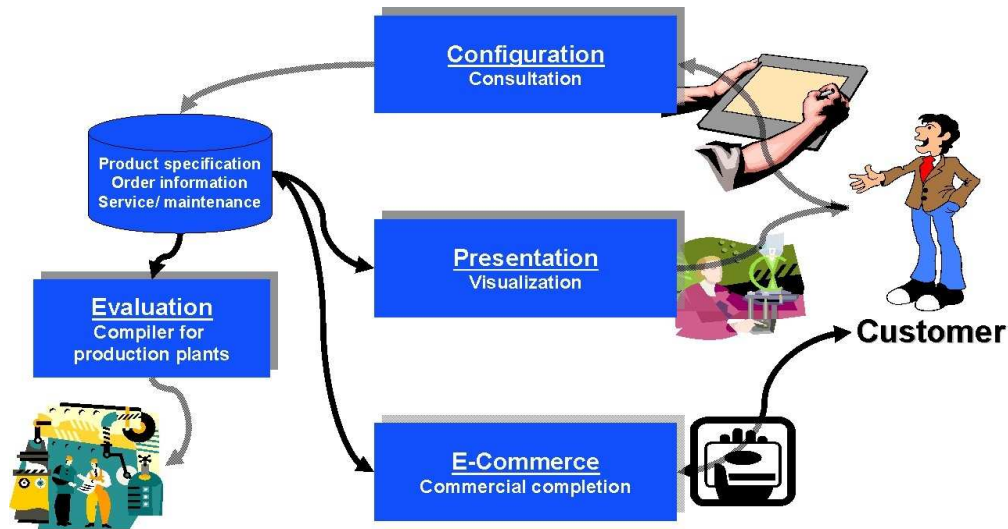
How do failure reports of machines and jobs in production arrive at super ordinate places for systematic evaluation?



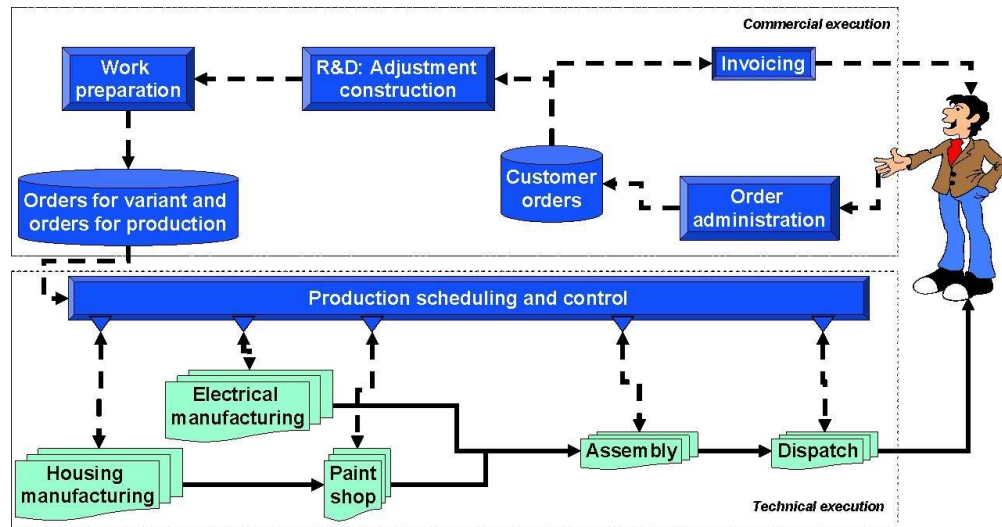
Reasons, why information systems are missing or production support at the place of the creation of value



Mass Customisation as a business model

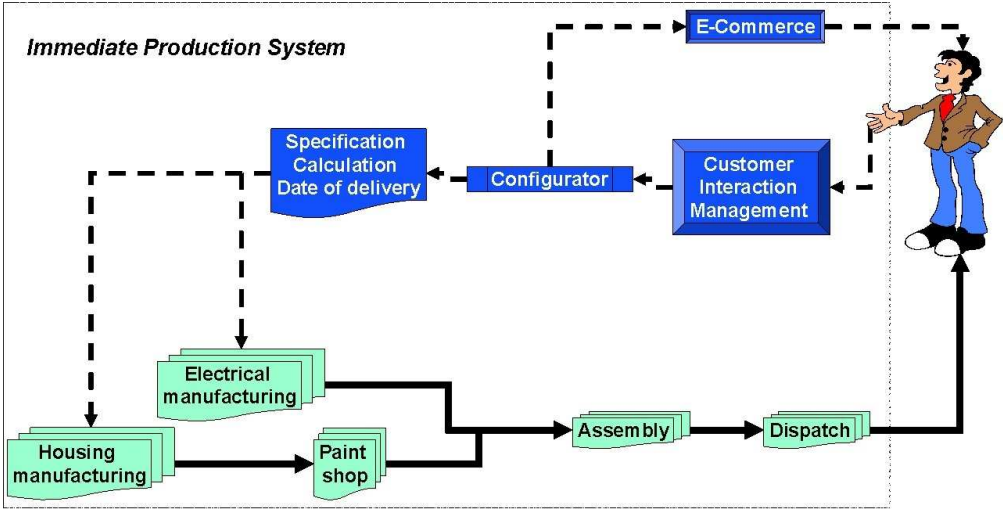


Components of the configuration system in Mass Customisation business model

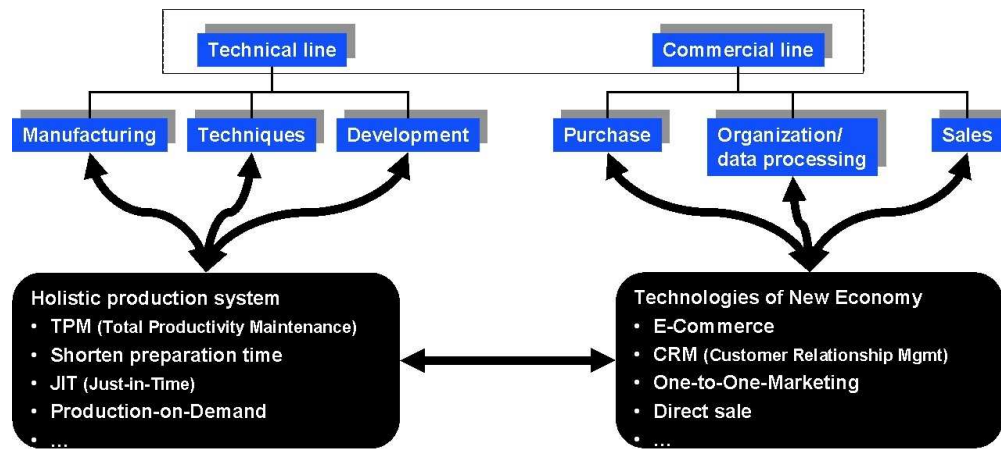


Workflow by variant manufacturing (small equipment production)





Workflow by immediate production (small equipment production)



Participants and elements of a Mass Customisation solution - from view of the organisational structure