12 steps in organizing a virtual enterprise for car suppliers - a case study

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Abstract

Although enterprise cooperation is obviously required, many companies still hesitate to change habits. For temporary cooperation in a virtual enterprise the contribution of each partner has to be optimized, and information flows have to be harmonized. Modeling and evaluation techniques are only two tools out of seven in a twelve-step approach to coach enterprises. A supplier-action-group in Berlin-Brandenburg provides the forum to attract orders, select partners, detect weaknesses, and receive technical and organizational advice up to extra-regional marketing.

Keywords

Virtual enterprise, supply chain, sociotechnical methods, coaching, enterprise modeling, organizational benchmarking

The original version of this chapter was revised: The copyright line was incorrect. This has been corrected. The Erratum to this chapter is available at DOI: [10.1007/978-0-387-35321-0_72](https://doi.org/10.1007/978-0-387-35321-0_72)

1 NECESSITY AND HINDERINGS OF VIRTUAL ENTERPRISES

Ever since the beginning of the discussion of lean production outsourcing has gained strong momentum. Lower overhead costs for suppliers and the willingness of fast reaction propelled this move in times of cost cutting measures. Price reductions of train systems by 30-40%, and of power plants by up to 60% during the last five years forced these branches to buy complete components including the engineering work. Engineering had been in-house delivery ever since for most of the companies. Hardly any supplier is in a position to deliver a complete component, but the train/car manufacturer demands to deal with only one person for this component, and expects collaboration from simultaneous engineering to maintenance.

Although enterprise cooperation is obviously required, many companies still hesitate to change habits. The most often named reasons are: mistrust about risks and profit sharing, lack of examples and routine, lack of methods for distributed business processes, lack of software application integration, lack of harmonized software infrastructure for „production telematics“, lack of risk capital, lack of prepared legal contracts.

2 SOCIOTECHNICAL DIMENSIONS AND TOOLS TO BE USED

For the temporary cooperation in a virtual enterprise the contribution of each partner has to be optimized, and information flows have to be harmonized. A modeling and an evaluation technique are only two tools in a twelve-step approach to coach enterprises.

The tools are summarized by Mertins/Schallock (1996). It has to be recognized that neither a pure technical solution (such as CALS and distributed scheduling) nor a mental coaching (trust, problem solving techniques) nor legal and financial solutions alone can solve this problem. Only a true sociotechnical approach can serve the purpose of building a virtual enterprise.

Characteristic	Traditional Systems Supplier	Bidding Syndicate
Know-How	R&D know-how; core production; administrative know-how (purchasing, marketing)	know-how may be distributed; a smaller partner may also
Financial Strength	at least medium-sized business	small partners may complement each other
Basis of Cooperation	parts from sub-suppliers; contract	trust; common goals; disclosure of costs and business processes
Risk	own risk	carried jointly, in part
Public Relations	systems supplier only presents	the focus is on the product; presentations of the companies are included
Service	has to be ensured by the systems supplier	responsibilities must be clear; can, however, be entrusted to different persons

Figure 1: Distinction of Systems Suppliers and Bidding Syndicates.

Many lessons can be learned from the implementation of group work as done by IPK since ten years. A special research field has been established which deals with solutions for the horizontal cooperation of groups in production management (CeA, EWIG). A diagram has been drawn up to distinguish these internal corporate approaches from virtual enterprises. The most important computer-based enterprise engineering tools are:

- The goal editor, which allows users to work on a goal system interactively with all involved team members, and relate and quantify the importance of goals.
- Modeling of processes, resources and orders as well as input and output products. The model does not only serve consistency checks and a much higher degree of transparency for the involved partners, but also allows an evaluation of duration of processes, costs and loops or departments being involved.
- An organizational evaluation method has been developed by IPK which provides 27 comparative figures as duration, costs, degree of autonomy and skill enhancement to compare work structures. This method can be used to compare distributed work structures of a virtual enterprise as well as if it is modeled before.
- Workflow management tools were not developed at IPK, but can be linked to the modeling tool.
- Decision support tools have been developed for scheduling applications. The focus has been on breakdown strategies: „What to do if the dates cannot be met, if the quantity cannot be fulfilled, if the raw material does not arrive?“ This approach can be extended to the use of distributed scheduling, but it requires program-to-program communication. Therefore, functional application integration and/or transformation programs are necessary if virtual enterprises want to apply advanced production management techniques.

- A cost estimation and on-line cost calculation tool has been developed by IPK for work groups that are managed as cost- or profit centers. Such a functionality is a must for virtual enterprises because the performance units of one enterprise have to cooperate with performance units of the other enterprise without involving the central administrative staff of the purchasing, sales and controlling departments.

3 THE 12-STEP-APPROACH BEING APPLIED

The vital interest, that was given to the Supplier-Action-Group ZAK stems from the fact that building enterprise networks was not done as a theoretical exercise or management course but was based on real offers of subcontracting from the big regional manufacturers as BMW, Mercedes and the train manufacturer Adtranz. For attending the presentations by the manufacturers, IPK invites suitable enterprises from the ZAK database which includes 400 regional enterprises in total. Out of an average of 15 companies per offer the targeted group of three to five companies had to be formed during the following process.

Figure 2: The example of a bidding syndicate for a water pump.

- Identify the parts of the component to be offered, and the materials of the parts. (whole team)
In the case study, the water pump consisted of a casted housing, a steel shaft, a plastic connecting piece, a fan and a bearing, and sealing and minor joining parts.
- Identify required technologies, machines and tools related to the total production volume. (whole team) (first companies leave the team)
In the case study this was alloy casting, precision turning, plastic molding and

sheet metal stamping, and assembly and logistics. It is obvious that a small company is not able to have command of all these techniques. A positive aspect in this case was that the target production volume was 200 000 units per year for eight years.

- List all capable companies, and define first maximum workshare per partner (whole team)
In the case study five enterprises started jointly with IPK to negotiate with the engine manufacturer after IPK had prepared better drawings and bills of material than the original inquiry had. This is one of the little but important external services that help to get the project off the ground.
- Estimate costs per part and per task (each enterprise)
In the case study several costs (casting and assembly) had been much too high in relation of the target costs of approximately 12 pounds Sterling. IPK looked for two other casters in order to find a cheaper one.
- Define and model the production operations, logistics chain and assembly and shipping operations. Estimate duration and effort for management tasks. (IPK)
In the case study it became obvious that the assembly costs and the handling costs were too high. Considering the total production volume, a solution of totally automated assembly was sketched. Immediately, the issue of financing such a machine for 150.000 pounds arose. Scenarios of how to use this machine also for other orders were established.
- Analyze proposed production cost and compare with target costs. Reconfigure workshare per partner and workflow and prospectively evaluate cost reductions (IPK). Discuss individual cost reduction and process spending with companies using process model. (IPK)

These are genuine structural figures; for modeling and evaluation purposes you can use the tool MO²GO.

Figure 3: Modeling and cost calculation of structural alternatives of the bidding syndicate.

In the case study it was discussed how to reduce the handling and transportation costs. The model was used to consider three scenarios: the mechanical treatment at the foundry (scenario A in figure 3), the assembly at the mechanical treatment site of the partner (scenario B in figure 3), or to build a small little factory in the factory at the foundry for complete production (scenario C in figure 3). This virtual factory could be operated by workers of all four partner companies.

- Check quality level of involved partners and consult on software application interaction. (IPK)
 - Select consortium head, detail logistic and management tasks per partner, refine and have signed a consortium contract based on preprocessed contracts (enterprises). (possibly organize loans) Produce samples and have them checked by customer (enterprises)
- In the case study the head turned out to be the assembly partner. In the meantime, the target costs were reduced. Nevertheless, the team was able to offer the best bid of all competitors. Unfortunately, the water pump remained to be built in-house, but the process of building the virtual enterprise has been proven to be successful.
- Support enterprises to improve the manufacturing process and information interchange (IPK)

Necessary System Interfaces for	◦ Geometrical Data for Distributed Construction (STEP)
	◦ Order Data: Order Quantities, Specifications, Deadlines (EDIFACT)
Bidding Syndicates	◦ Inventory Data (also for Intermediate Buffers), Reservations and Consumption
	◦ Transportation Data: Which Amounts are When Delivered Where, from Where; What can be Taken Along
	◦ Documentation of Parts and Batches for Quality-Sensitive Parts
	◦ Process Structure of the Quality Manual for Certification Purposes (Information does not Have to be Exchanged, but should Document the Entire Process)
	◦ Documentation of Orders and Accounts: Processing Status, Accrued Costs per Order and Partner, Transfer Price, Extra Costs, Allocation of Contributions of the Various Partners (if Necessary, Expanded Project Management Software)

Figure 4: Necessary system interfaces for bidding syndicates.

- Setup of a marketing brochure and internet pages of the component being offered by the virtual enterprise (IPK)
- Approach new regional markets and new branches using variants of the component being offered (IPK and enterprises)

By performing this twelve-step process more and more preprocessed elements and solutions evolve that speed up the process of building virtual enterprises from a time span of several months down to four weeks.

4 SUMMARY AND OUTLOOK

A Supplier-Action-Group (ZAK) in Berlin-Brandenburg includes the five manufacturers: Adtranz (largest train system manufacturer in the world), BMW motor cycles, Daimler Benz engine components, Daimler Benz light trucks, BMW Rolls Royce aero engines and 95 small suppliers. ZAK provides the forum to attract orders, select partners, detect weaknesses, and receive technical and organizational advice up to extra-regional marketing.

The twelve-step approach to build a virtual enterprise was developed interactively and applied during the work of ZAK. The described offer for a car water pump by four small companies would never have been possible without the methodological support provided by IPK.

We expect to establish the EC-funded project TRANSTECH in June of this year which promotes transregional cooperation between enterprises and scientific and consulting institutions in all branches of traffic systems. The European regions being involved are Berlin-Brandenburg, Valenciennes, Lisbon, Athens and Narvik.

The Derby Rail Forum (50 companies) and a Dutch suppliers initiative (200 companies) have already expressed interest in informal cooperation. The form of cooperation should copy the proven aspects of ZAK, i.e. technical workshops, order markets by manufacturers and coaching for joint delivery and development of „European components from virtual enterprises“.

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6 BIOGRAPHY

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