Collaborative Engineering in the Automobile Industry

Current Status and Organisational Preconditions

A Study by PROSTEP and Arthur D. Little

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Agenda

With this current Collaborative Engineering 2005 presentation our aim is to...

- Sketch in the area of debate between OEMs and suppliers in the automobile industry
- Illustrate significant results of the current study
- Discuss the relevance and points of departure for your Company

Agenda

1	**Arthur D. Little & PROSTEP – Brief Introduction**
2	Scope of the Study
3	Collaborations and Partnerships
4	Results of the Study
5	Action Recommendations

Your Partner brings you both industry-specific and functional experience

Arthur D. Little GmbH

- Founded 1886
- Arthur D. Little provides a thorough consultancy service from strategy development through to action implementation
- Our teams work in a pragmatic and client-oriented manner at every project phase. Is is an advantage here that our consultants have pronounced industry and technological sector knowledge.
- We advise our clients *inter alia* from the automotive sector (OEMs and suppliers) and TIME industry (Telecommunications, Information, Media, Electronics) plus the machine tool and plant construction industries

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PROSTEP AG

- Founded in 1994 by the German Automobile Industry with the aim of providing IT solutions and consultancy know-how for optimisation of the development process chain
- Partners: Bosch, Continental Teves, DaimlerChrysler, Delphi Automotive Systems, Opel/General Motors, Siemens and PROSTEP iViP Association (approximately 200 member companies from the automobile and aviation industries)
- Leading provider of total solutions in the field of product data integration, migration and communications for engineering processes with the emphasis on the automotive plus aviation and space industries

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1	Arthur D. Little & PROSTEP – Brief Introduction
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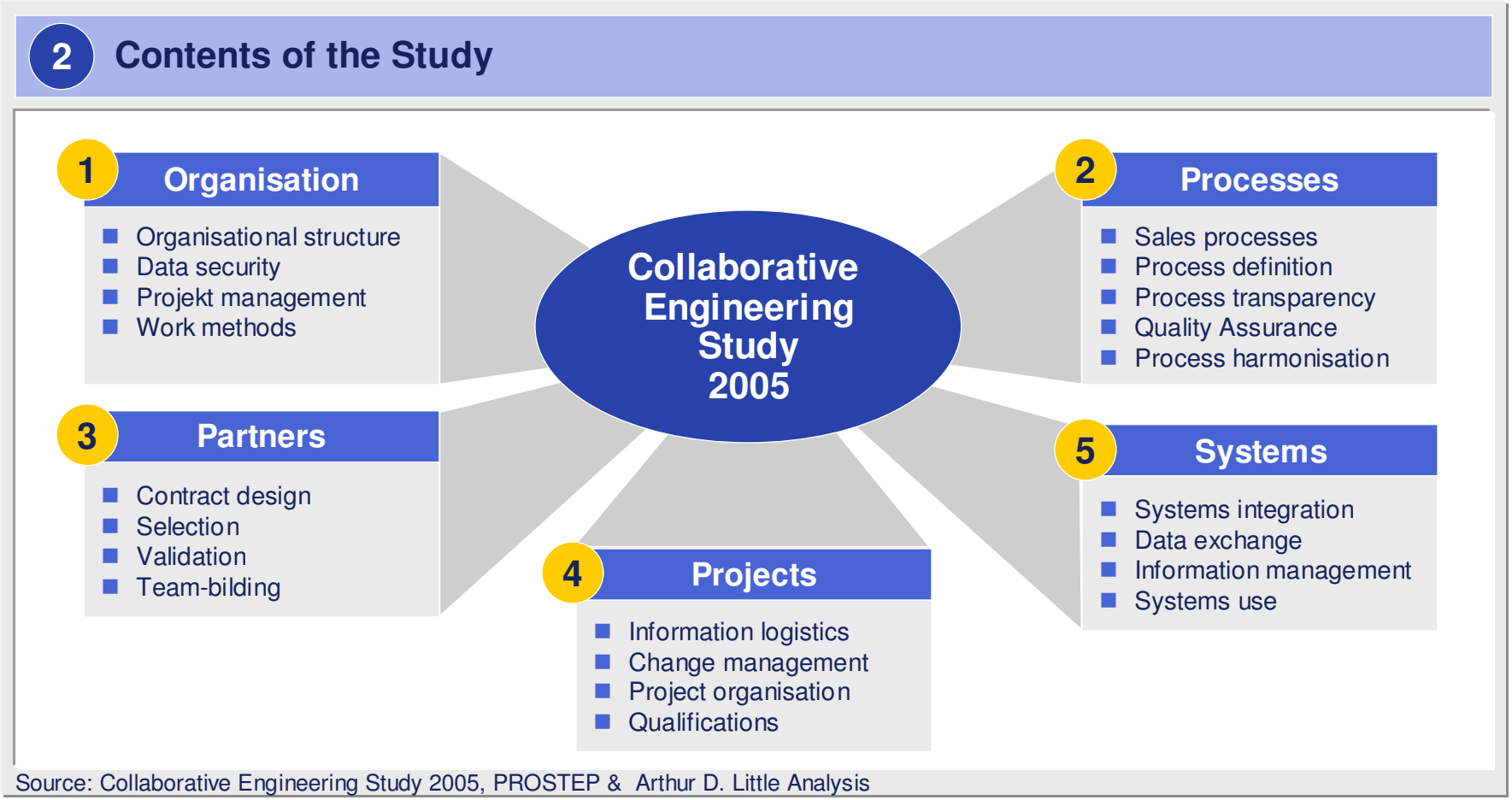
Collaboration in development networking in the automotive sector is increasingly important

1 What do we understand by "Collaborative Engineering"?

Collaborative	&	Engineering
… describes the form of cooperation between involved organisational units of various companies in respect of processes and use of IT systems		… embraces all technical activities in the context of product development

… covers all activities between company organisations and partners in the course of joint development projects based on a defined reference process model and including IT support

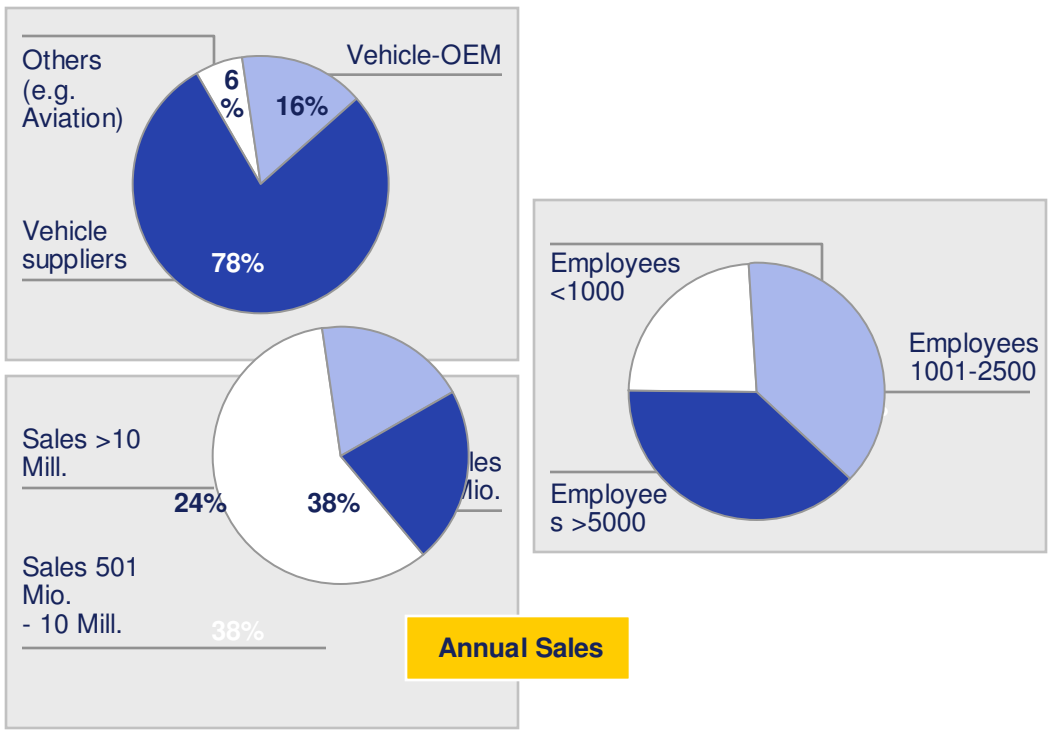
Individual questions in the course of the study are subdivided into five action areas each with several assessment categories



Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Participant competence ensures the quality of the Study

3 Participants



Participants by Function in the Company

- Members of Management
- Executives in the fields of:
  - Research and Development
  - Information technologies, CAD, data exchange & PDM
  - Product/Project-management
  - Project management-, Engineering and Technical Services
  - Business Development, Acquisition & Marketing

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

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Five Mega-Trends will continue to strongly influence the motor industry

1 OEMs' focus on integration and marketing of the complete vehicle	■ Systems and function integration for the complete vehicle (still) at OEM OEM ■ Expansion of product design and planning and brand management (competence at OEM)
2 Standardised Individualisation	■ Further modularisation and non-variable part initiatives ■ Badge Engineering (Example. Cooperation on engines: DCX-VW, Toyota-PSA, …)
3 New key technologies: vehicle electronics and software	■ Development of in-house competence and establishment of specialist subsidiaries by OEMs ■ Demand for new sector-friendly competence profiles
4 Development leadership of Tier-1 Suppliers	■ OEMs demand development, production and logistics cooperation by the Tier-1 ■ Strong reduction of vertical integration at many OEMs ■ Assumption of product, process capacity and financial risks by Tier 1
5 Management of complex network organisations by Tier-1 Supplier	■ Establishment and control of temporary value creation networks ■ Key competences assembly, systems integration, partner management and logistics at Tier-1

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

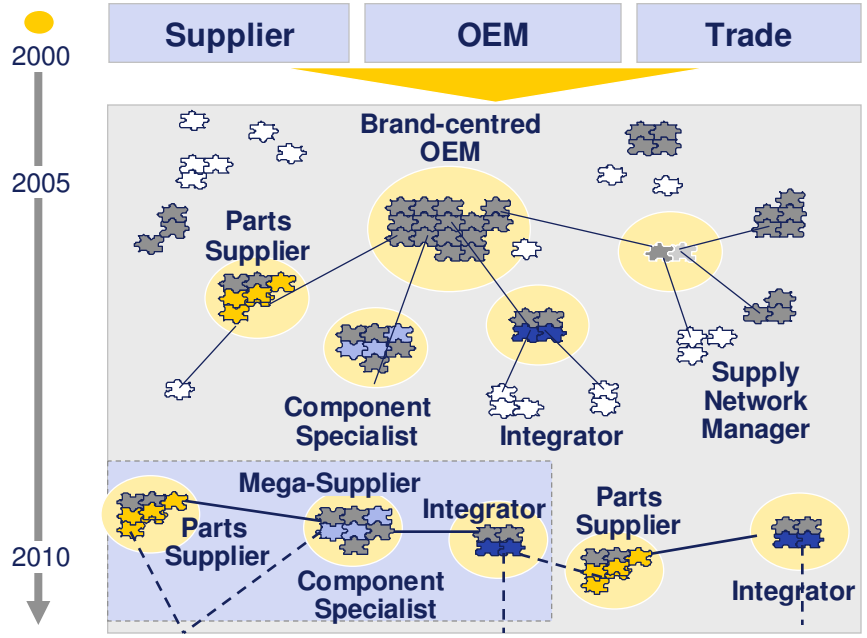
Successful leading suppliers have actively defined their own role

Role Definition				
Parts Supplier	**Component Specialist**	**Module Integrator**	**Systems Integrator**	**Supply Network Manager**
■ Volume provider of materials and products of relatively low complexity ■ Profiling by permanent **cost-leadership and maximum productivity** ■ Internationalisation and market share increase in defined market segments	■ Specialisation in selected components ■ Profiling by systems integrators and OEMs by technologically leading products and **innovations** ■ Nuilding and expanding a continuous innovation management	■ Development/assembly of complex modules ■ Profiling at OEMs by **development partnerships** and assumption of **systems responsibility** ■ Key competences – **geometrical integration and partner management** ■ Gatekeeper role	■ Development/assembly of complex systems ■ Profiling at OEMs by **development partnerships** and assumption of **systems responsibility** ■ Key competences – **geometrical integration and partner management** ■ Gatekeeper role	■ Efficient management of global networks ■ Profilint at OEMs via key competences of **systems integration and partner management** ■ Extension of **Pre-Assembly** and assumption of **vehicle final assembly** ■ OEMs' outsourcing partner

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

This specialisation is superseded by integration and networking of distinct competences in various forms of partnership

Differentiation of New Roles



- OEM focussing on brand-awareness functions/qualities
- Consolidation and/or collaboration for purpose of agglomerating complementary competences
- Changing partnerships also between OEMs in the case of product areas regarded as non-core
- Assumption of development, logistics and production tasks by the
- Focussing value creation within the company or business area with intensive intemeshing value creation chain with partners (customers, suppliers, competition)

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

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Evaluation of the Study subdivided into a general and a specific evaluation block

Evaluation General Section

In the General Section results regarding strategic topics are evaluated:

- Strategic ranking of company collaborations in the given company
- Responsibilities
- Decision-making authority
- Application of the VDA SE Directive

Evaluation Specific Section

- Evaluation of the Study is for the five respective action fields of processes, systems, projects, partners and organisation. For each action field 4-5 topics have each been underpinned by 4-5 individual questions.
- The individual questions have each been evaluated using a performance level (scale from 1= to 10 = "applies 100%, is in progress, has been introduced") and importance (1 = unimportant, 2 = less important, 3 = important, 4 = very important).
- Evaluation of individual questions leads therefore to statements in respect of the individual topics and these in turn lead to interpretation of the individual action fields.
- Results of the results in respect of action fields are always illustrated in a web diagram (left) showing the implementation level by topic and a bar chart (right) showing the importance of each individual topic

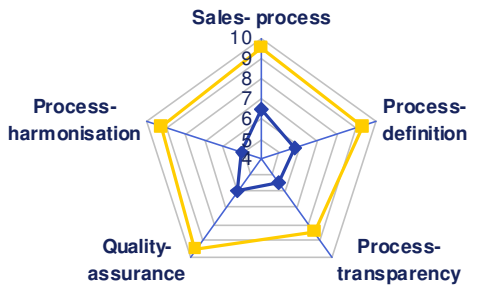
Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

The result (level of implementation or importance) is always illustrated for the respective five associated topics

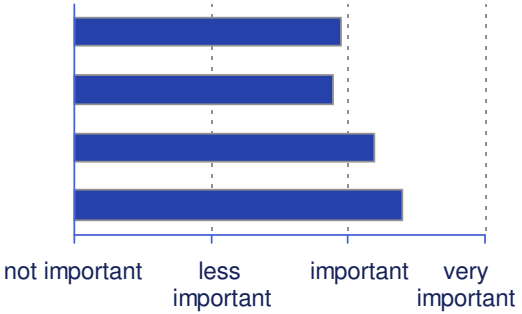
Evaluation

- The individual questions are each evaluated using a performance level, i.e the level of implementation on a scale of 0 to 10 (scale of 0 = "no implementation" to 10 = applies 100% , is in progress, has been introduced")
- Assessment of the importance of this question is on the basis of a scale from 1 to 4; (1 = unimportant, 2 = less important, 3 = important, 4 = very important)
- For example a performance level of 6 would imply 60% implementation
- Assessment of individual action fields is based on analysis of the results and discussions held.
- Evaluation is by the average value (blue lines) and the highest individual assessment (yellow lines) being the benchmark

Implementation Level (web diagram)



Importance Level Illustration (bar chart)

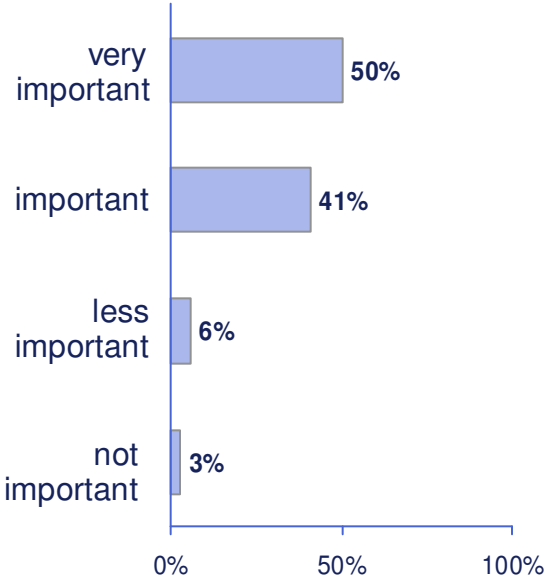


Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

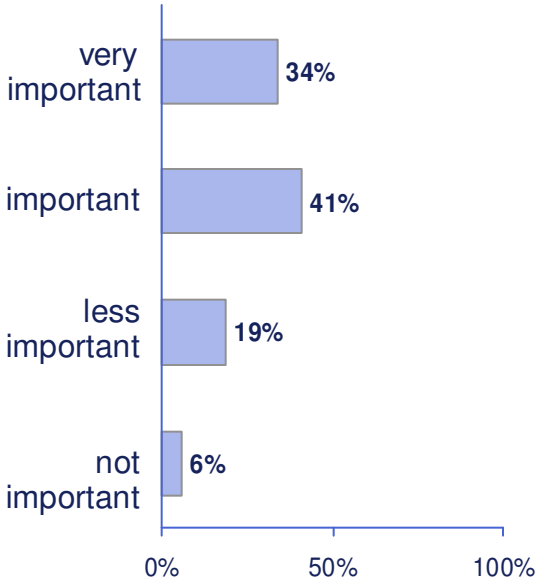
The trend towards cross-organisational collaboration continues to gain in importance due to the current framework conditions (production relocations, shortening of time-to-market etc.)

Company Collaborations

Ranked in Company



Support by Management



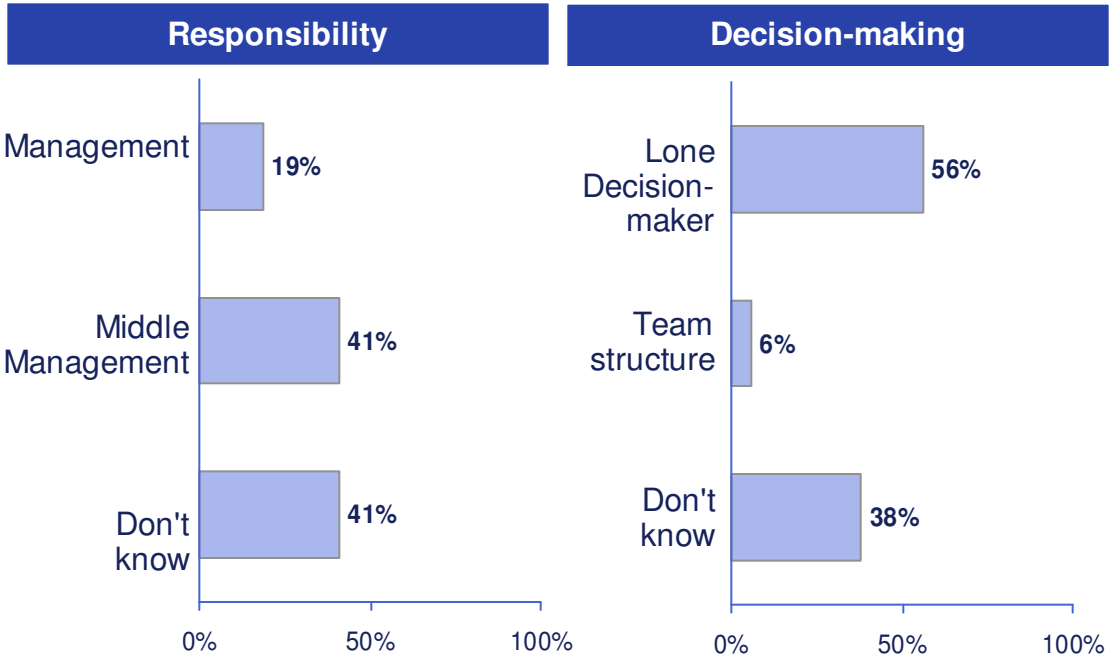
Notes

- Strategic decisions regarding company collaborations continue to have a commercisally relevant consequences
- Company collaborations in the future will consitute an important strategic bulwark for all companies surveyed
- 75% of those surveyed rate support by top management as important

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

In the course of the decision-making process preparation in terms of content processing of the topic is by middle management; the final decision however always rests with top management

Typical functions showing where responsibility regarding the company collaboration topic lies



Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Notes

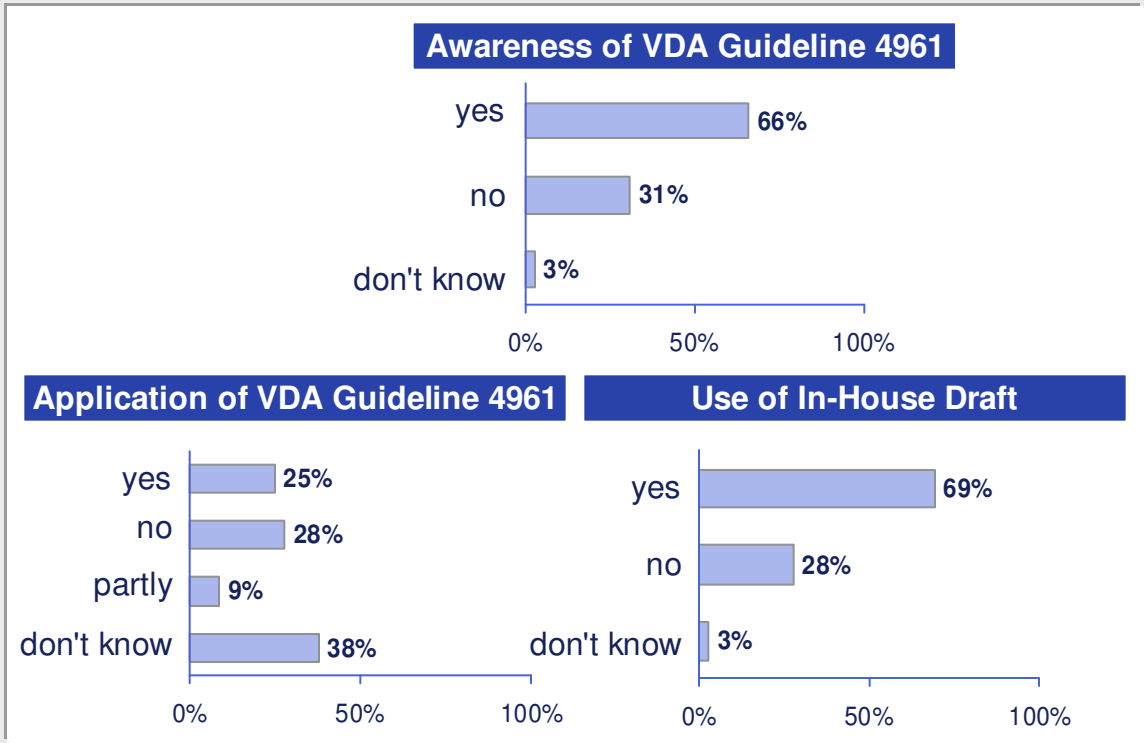
- Largely decisions are taken by lone decision-makers
- In partner selection middle management is primarily responsible who are more involved in operation of the business and implementation of the partnership
- The strategic decision regarding cooperation however is mostly taken at top management level

VDA Guideline 4961 …

- is a recommendation guideline published by the VDA [German Automobile Manufacturers Association]
- is a checklist for coordination of data logistics in systems engineering projects
- regulates information technology requirements in respect of communications and control during development project management for all those involved

Knowledge of VDA Guideline 4961 is not very pronounced in specialist circles

Use of VDA Guideline 4961 (SE Checklist)



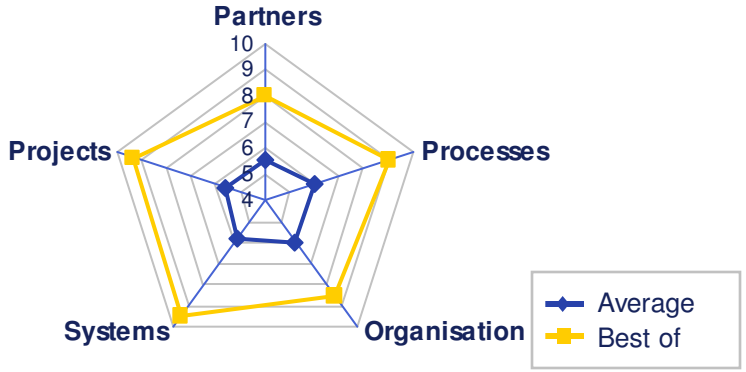
Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Notes

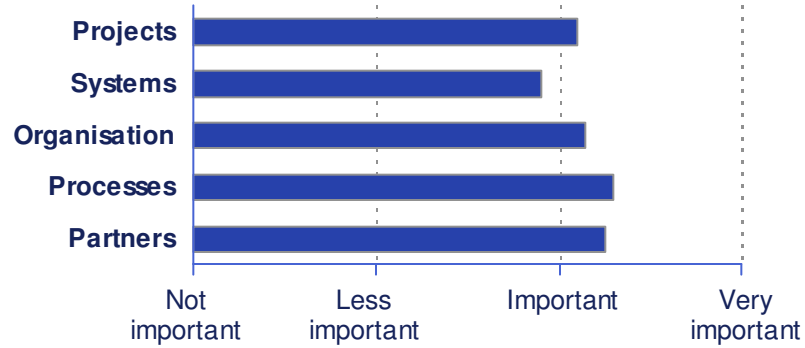
- Awarenessof the VDA guideline is largely in evidence but could be rateable
- IT has driven this topic to date and the awareness level of the Guideline is still slight in specialist circles
- In many companies an in-house draft is used, building mostly on the VDA Guideline f
- Clear potential for improvement of collaborative process through use of VDA Guideline is discernible

Results of the Study show that in all Collaborative Engineering action areas there is still considerable need for improvement

Evaluation - Overall



Importance - Overall

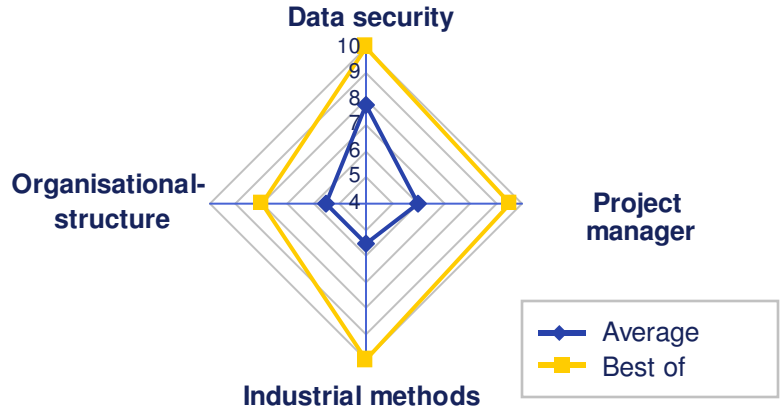


- In all Collaborative Engineering areas there is considerable need for improvement. Deviation from the best in the corresponding field is considerable.
- Tier 0.5 suppliers are in many areas the benchmark for the embodiment of essential Collaborative Engineering action areas.
- Improvement potential with the best is evident in partner management and organistion of collaboration.

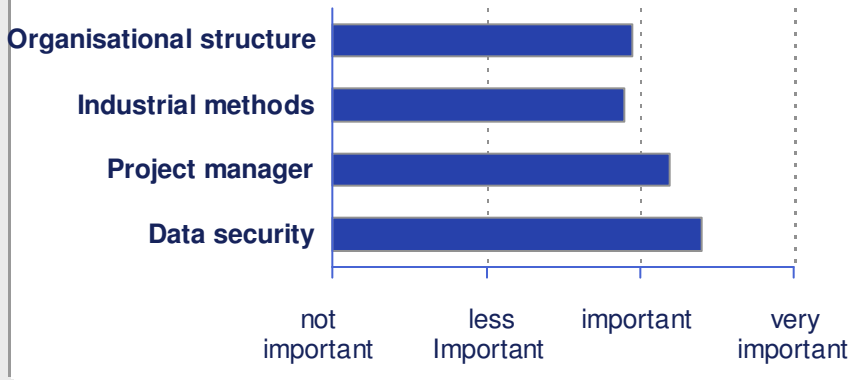
Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Amongst organisational topics the data security aspect is rated particularly highly with regard to both degree of implementation and level of importance

Assessment – Organisation



Importance – Organisation

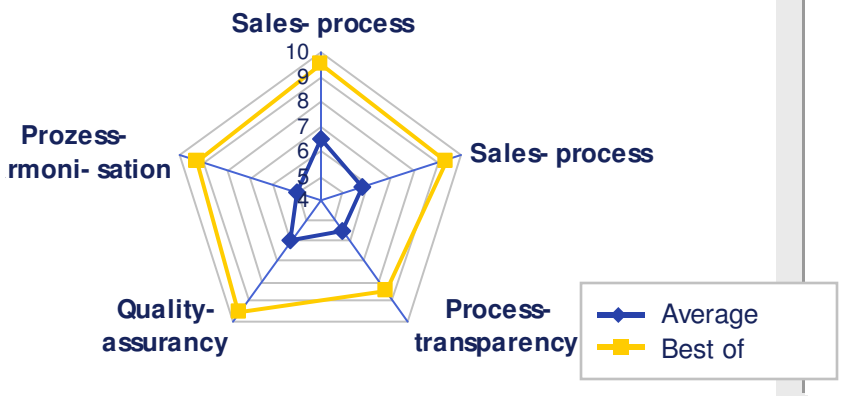


- The data security aspect has been worked on very intensively in recent years and correspondingly clear progress in implementation achieved
- Amongst participants surveyed optimisation potential areas regarding organisational structure were still identified.
- Seamless integration into working methods/development processes between partners is usually absent (= discussion "non-culture")
- Authorities and reporting channels for project management continue not to be clearly defined or are not unambiguously communicated vis-a-vis project participants and management

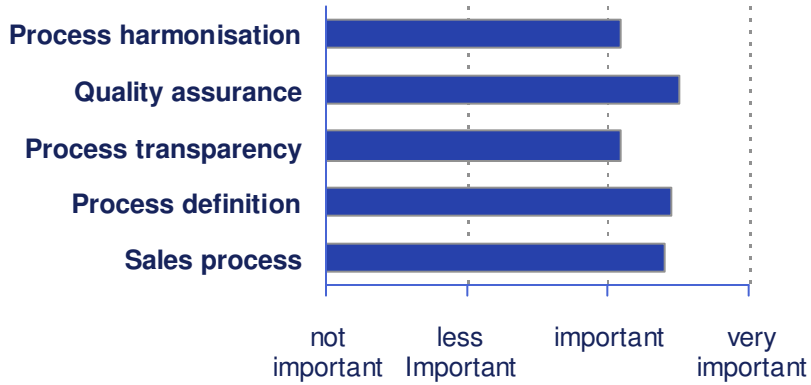
Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

On the basis of the results of the Study great potentials are yet to be recognised on the process harmonisation and process transparency topics

Evaluation – Processes



Importance – Processes



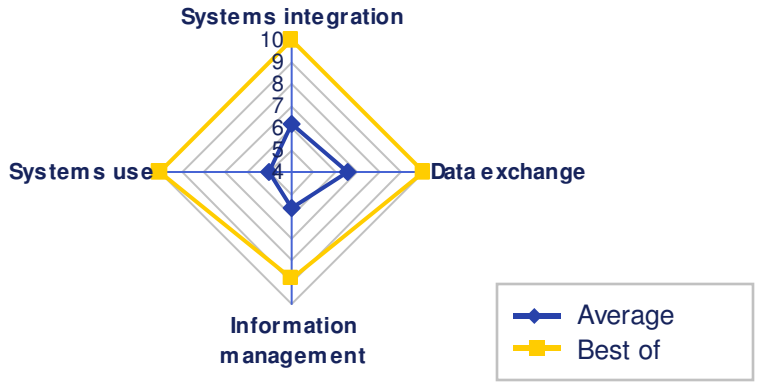
- In the fields of process transparency (proactive communication, common terminology rules, timely involvement of external resources) and harmonisation of parallel activities potential areas still recognisable
- Colaboration between Sales and Project is better with suppliers than between Sales and Project at the OEM (LoM[1]: 6.4 Supplier vs. 5.5 OEM)
- Suppliers clearly rate the degree of support of defined processes by all process partners (OEMs!) for the purpose of facilitating a uniform view of the process progress lower than OEMs (LoM[1]: 5.2 vs. 7.2)

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

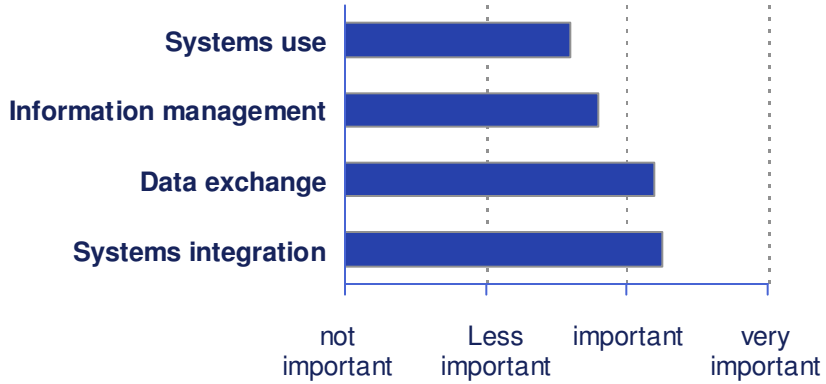
1) Level of Mastery

In system use and integration of systems scenarios there is further potential primarily at suppliers

Evaluation – Systems



Importance – Systems

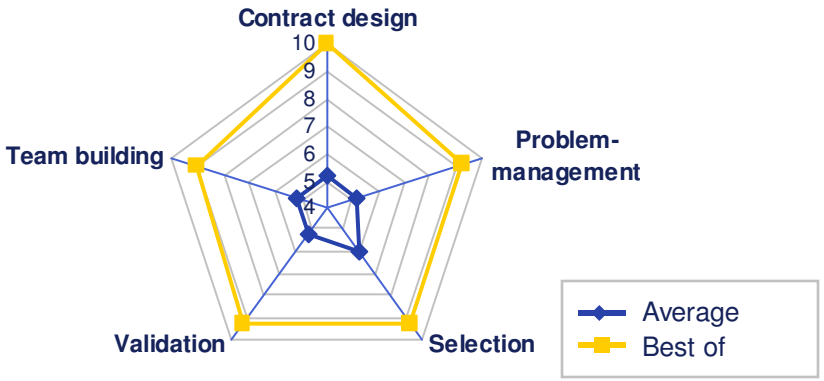


- The degree of integration of systems scenarions (coordination of system requirements, introduction of new systems, integration of standard parts and parts libraries) is clearly higher with OEMs that with suppliers
- Aspects relating to data exchange thematics (establishing data formats, implementation of control procedures, communications technology used, conversion to other formats) indicate further potential for optimisation at OEMs and suppliers.
- Uniform maintenance of knowledge regarding projects/customers/product area is often not satisfactorily supported from a systems technology point of view so that subsequent successful access to the information using different criteria is not possible or on the other hand gives rise to corresponding costs.

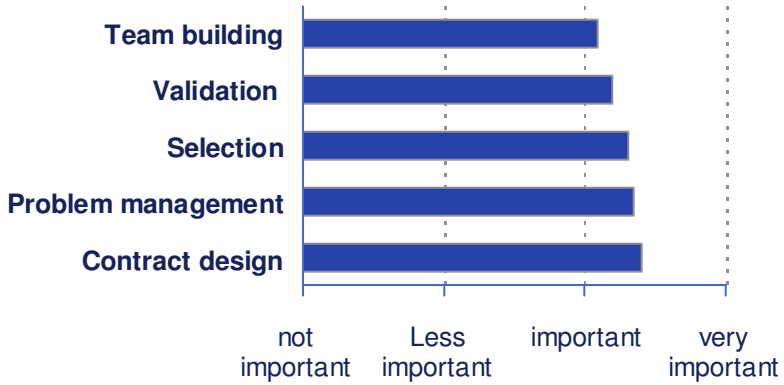
Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Despite the associated importance on the part of suppliers lack of action in choosing partners is still evident

Evaluation – Partners



Imnportance – Partners



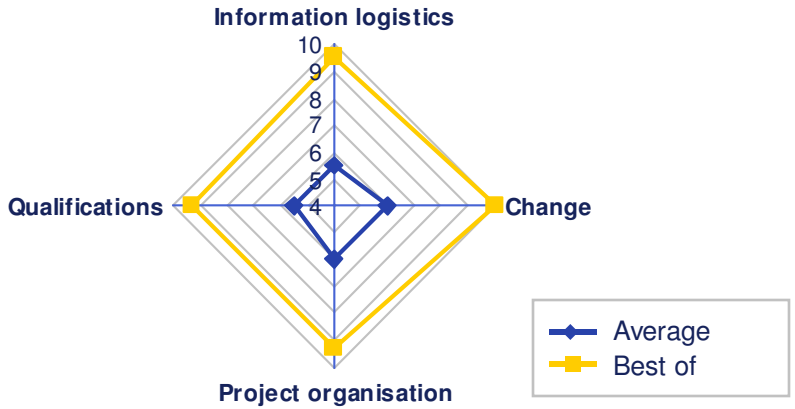
- All topics in this action area are weakly characterised despite the corresponding importance demonstrated
- In designing contracts special requirements (such as clear regulation in the event of deviation from contract, breakdown of expenses incurred, regulation of IT tools used) are still not comprehensively taken into account
- Even more clear differences are recognisable in the choise of partner (LoM[1]: 7.9 vs. 5.3).
  Suppliers
  - put long-term partnerships less periodically to the test (8.2 vs. 4.8)
  - consider fewer general market observations to identify better partners (8.0 vs. 4.8)

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

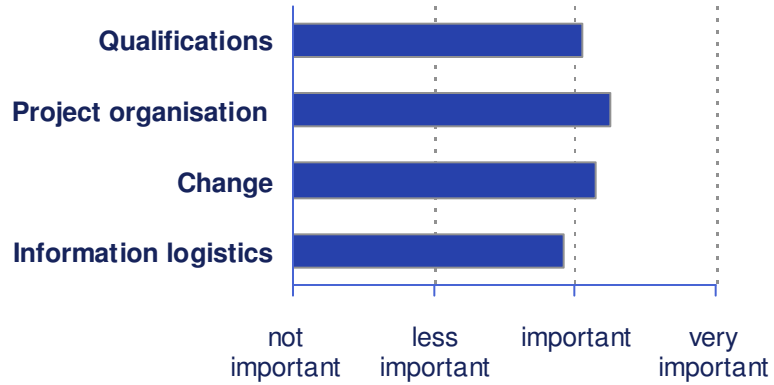
1) Level of Mastery

All concerns in the context of project implementation such as project organisation, information logistics etc. are neglected in Collaborative Engineering projects

Evaluation – Projects



Importance – Projects

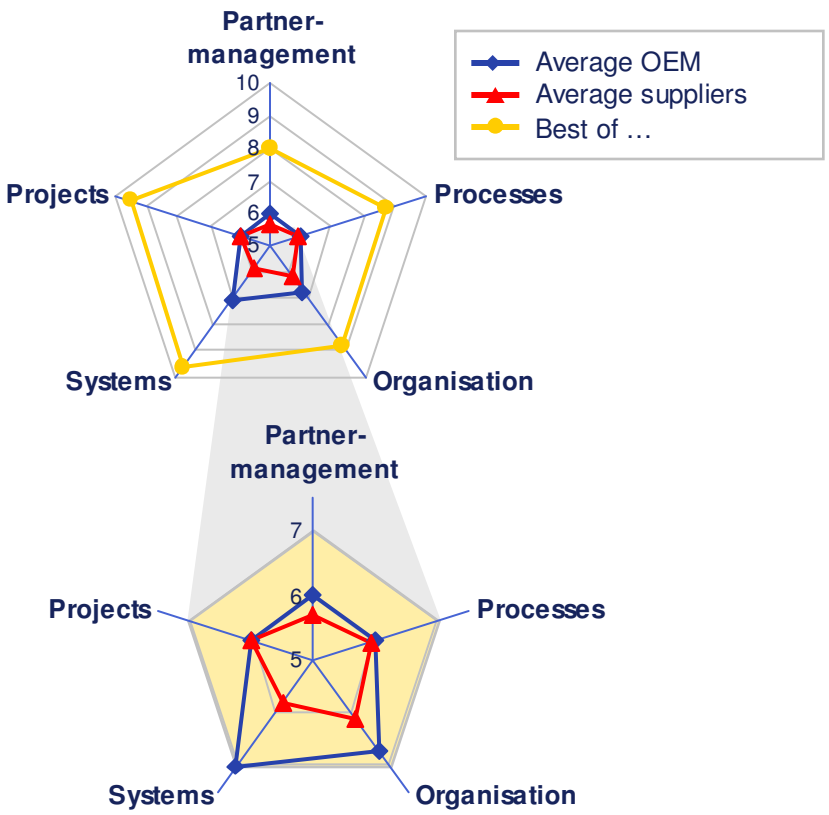


- Although change is allocated great importance in Collaborative Engineering projects, in respect of implementation (process and system support) OEMs and suppliers hanve not yet reached a satisfactory level
- Adequate employee qualifications (project manager tasking, use of project management tools, lessons learned, workshops) are not presently given suffiicient value
- It is still the case with OEMs and suppliers that clarification of the boundaries of a project (data exchange parameters, team room etc) do not always materialise and also be communicated to all project participants

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

OEMs have progressed further than suppliers in many areas of "Collaborative Engineering"

Comparison of OEM to Supplier



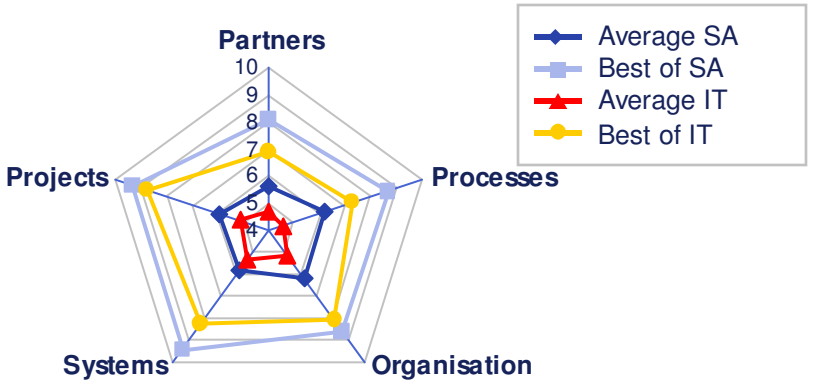
- OEMs have the Systems action area in sharper focus than do suppliers. Suppliers are more often expediters and a less equal partner and they clearly rate their "level of mastery" less highly
- The "Projects" area is rated more highly by suppliers with regard to importance than by OEMs:
  - Suppliers earn their money via project work
  - OEM in-house processes are secured more strongly by use of systems
- In partner management in particular many suppliers have action needs

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

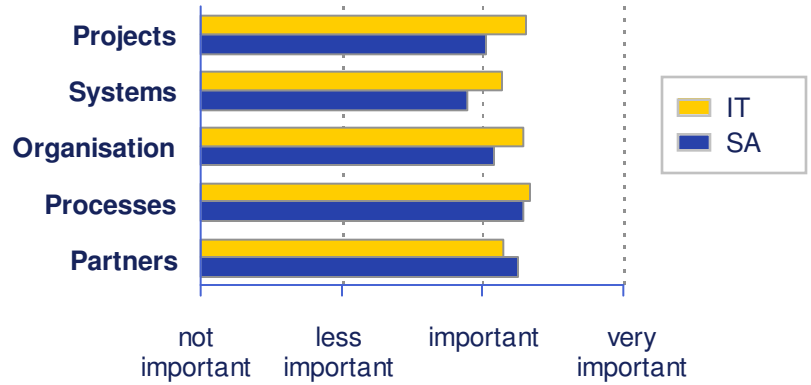
1) Level of Mastery

In general rating by those surveyed of IT functions in all action fields came out clearly lower than assessment from specialist areas

Evaluation – Overall (Comparison IT ⇔ Specialist Area)



Importance – Overall (Comparison IT ⇔ Specialist Area)



- Participants in the Study who use IT in the companies rate all action areas regarding the status of implementation lower than those surveyed from specialist areas.
- There continue to exist clear deviations between best-of ratings and the average values obtained. In all topic areas therefore great potential for optimisation is indicated

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

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Development of strongly branded products at competitive costs requires collaboration between OEMs and suppliers beyond pure "cost pressure"

Strategic Focus

Strategic Partner Management

- Build up innovation networking
- Joint product optimisation by intensive collaborative work in the early phases of product creation
- Fair collaboration with clear rules, rights and obligations

Collaborative Organisation Models

- Close collaboration and co-locations of Development and Procurement (customer/OEM), customer-oriented organisation on the part of suppliers (joint KAM and Engineering teams)
- Project bureaus and over-arching knowledge management

Clearly defined processes

- Clearly defined and live prcesses with clear AKV´s[1] [information, competences, responsibilities]
- Cross-company process harmonisation and optimisation

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

1) **A**ufgaben, **K**ompetenzen, **V**erantwortungen

Good partner management should include constant improvement of collaboration and the agreement of clear and fair rules of cooperation

Partner Management

Partner Choice and Validation	■ Carry out continuous market analysis ■ Continually examine long-term partnerships and cooperative relationships in order to be able to initiate change if necessary at an early stage ■ Institutionalise reviews at project ends and take results into account in future choice of partner
Contract Design	■ Calculate SE-specific expenses in advance and incorporate them as part of the contract ■ Clearly allocate expenditure and costs for the event of deviation from contractual agreements
Problem Management	■ Agree escalation mechanisms and avenues in advance ■ In adition to technical tasking also address potential problems at an early stage in team sessions

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Cross-fertilisation network exchange of knowledge by project bureaus and systematic knowledge management should be promoted

Organisation

Working Methods

- Promote exchange of experience in spatially remote development, e.g. through workshops in cross-locational organisation units
- Exchange and document methods, procedures, systems knowledge etc company-wide
- Understand knowledge management as an entrepreneurial task and organisationally establish :
  - defined strategically important content
  - clear responsibility/incentivisation
  - defined involvement in operational processes

Organisation

- Establish joint project bureau / team room
- Allocate and budget working facilities (hardware / software /infrastructure) to guarantee interdisciplinary cross-fertilising collaboration and clear responsibility

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

A clear definition of system design should be established prior to project commencement

Systems

System Use

- Map out a joint (virtual) systems technical project bureau/team room
- Provide IT infrastructures for spatially remove development
- Know-how transfer for preject-specific operation of IT tools by project participants is to be guaranteed
- Clear regulation between project participant at commencement of project of
  - standards and parts libraries used
  - technical access
  - cost allocation
  - systems responsibility

Interfaces

- Clearly establish data exchange agreements and responsibilities at commencement of project
- Define push-pull relationships regarding data logistics
- Establish masters for data maintenance

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis

Processes and interfaces with tasks, competences and responsibility are to be clearly defined within and between companies

Processes

Process Harmonisation

- Harmonise processes: emphasis of harmonisation is on process interfaces (everyone retains his process!)
- Principle: standardise where prudent, retain differences where competitive advantages are to be gained
- Avoid redundancies/blank spaces in processing

Process Definition

- Clearly define and constantly optimise interfaces and process
- Jointly plan and optimise safeguarding activities

Quality Assurance

- Define and establish clear and unmistakeable rules for elimination of quality deficiencies in advance

Source: Collaborative Engineering Study 2005, PROSTEP & Arthur D. Little Analysis