
More competition, more cooperation. E-business and transition of the automobile supply industry

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Abstract: The paper provides an overview of internet usage in the automobile supply industry according to supplier type and different internet applications and in comparison to all business lines. A special focus lies on the usage of electronic platforms in the supply industry. The automotive industry can be considered a pacemaker in e-business with company-owned platforms dominating industry specific platforms like Covisint or SupplyOn.

In the context of the intensive internet usage in the business line, the paper analyses the impact of e-business on the transition process in the supply industry. We propose that information technologies have contributed to the acceleration of structural changes in the automotive industry. Using arguments derived from transaction cost theory and the concept of electronic effects by Malone et al. (1987), the impact of internet technologies depends on asset specificity and market complexity, which vary along the automobile supply chain. The results support both the 'move to the market' and the 'move to the mixed mode' thesis.

Keywords: e-business; e-commerce; electronic markets; information and communication technologies; internet; supply industry; transaction cost theory.

Reference to this paper should be made as follows: Mühge, G., Hertwig, M. and Tackenberg, H. (2004) 'More competition, more cooperation. E-business and transition of the automobile supply industry', *Int. J. Automotive Technology and Management*, Vol. 4, No. 4, pp.308–323.

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1 Introduction

The automotive industry is considered a pace maker in internet-based 'Business to Business'. On the one hand, modular production benefits from intensive utilisation of the internet: in particular the typical complex value chain within automobile production requires a high degree of coordination between OEM and first-tier suppliers, but also increasingly between the first-tiers and their suppliers (Lung and Volpato, 2002). On the other hand, and by far more frequently as compared to inter-firm cooperation issues, firms make use of the internet in a competitive, market-spreading way. The purchasing and sales departments in particular use web-based IT technology for their supplier or customer management, or to support strategic sourcing activities (Chanaron, 2001). Developments in the automotive industry point to long-range variations in inter-organisational structures, internally-operational flows and work organisation due to the forced utilisation of e-business technology.

In this paper we will, based on both quantitative and qualitative data¹, examine the following questions:

- To what extent is the reputation of the automobile industry as a pace maker in e-business justified? To what degree does the supply industry differ from the rest of the economy concerning internet usage? How much does the internet usage vary *within* the supply industry? One main feature of our examination was its attention to different supplier types along the supply chain, from the system manufacturer on the tier 1 level to the parts supplier with tier 3 status (Chapter 3).
- In the discussion about e-business, internet market-places play a leading role. The paper will examine the question of whether independent or company-owned platforms make a difference in e-business (Chapter 4).
- Given the structure of internet usage within different segments of the supply industry, what effects on inter-firm relations can be expected? How is the division of labour along the supply chain affected, particularly concerning decisions to 'make or buy' (Chapter 5)?

Before we begin to examine the questions of e-business in the automotive sector, we will take a short glimpse at the structure of the German supply industry (Chapter 2).

2 The German automobile supply industry

Specifically due to the differentiation of the value chain, as it is typically found in automobile production, the question arises as to how internet utilisation differs within the supply industry. Which strategies do the different businesses in the supply industry pursue, given the context of organisational change? Before we discuss that question, let us briefly summarise the structure of the supply industry. Afterwards, we will suggest a typology of supplier enterprises.

2.1 The structure of the supply industry by size

An analysis of the structure of the supply industry has to face the basic problem that this economic sector can hardly be defined. One reason is the lack of official classifications:

the supply industry is situated diagonally within the current official industry classifications and statistics. In this paper our definition captures those enterprises which produce direct goods that are intended for the production and assembly of automobiles under the label 'supply industry'. The suppliers of capital goods, MRO suppliers and service enterprising for automobile production are excluded from this definition².

The automobile supply industry is characterised by a heterogeneous size (Table 1). When we look at the number of people employed, the arithmetic mean is 230 colleagues, while the standard deviation amounts to 1749 (!). The high level of variation in company size is an indicator for the industry's heterogeneity. The majority of suppliers are small and medium enterprises (SME). Small firms with one to 50 staff members form the majority of firms (67%). Middle businesses (50–250 employees) account for one-quarter (23.5%) of the supply industry, while large middle enterprises comprise only 4.4%. About 10% of the businesses have more than 250 employees.

Table 1 Structure of the automotive industry by size category

<i>Size (number of employees)</i>	<i>In %</i>	<i>Number of cases</i>
Less than 10	6.6	123
10–49	60.4	1124
50–249	23.5	438
250–499	4.4	81
500–999	2.3	42
1000 employees and more	2.9	54
Total	100.0	N=1862

Source: own research.

2.2 *Supplier types*

In order to be able to discover differences in internet usage along the value chain, given the operational heterogeneity of the supply industry, we distinguish between suppliers according to the category 'supplier type'. For this purpose, the current general distinction between system supplier (first-tier), components (second-tier) and part manufacturers (third-tier and following) is enlarged by a fourth category, the 'system integrator' or 0.5-tier enterprise (Womack et al., 1994; Pampel, 1993; Lay and Wallmeier, 1999). This category contains the market leaders, i.e. those multinational enterprises which possess key competencies in the production and development of highly complex components, like complete front ends. System integrators are thus mainly large firms which work in research and development alliances with OEMs and realise most of their business value with OEMs.

Table 2 shows the structure of the supply industry by type. The parts or third-tier suppliers account for almost half of the businesses but, nevertheless, only one-quarter of employed. The second-tiers and third-tiers together comprise 93.6% of the businesses and employ, with 51.8%, more than half of the employees in the supply industry. The first-tiers make up only 5.2% of cases, but employ a very large number of employees

(43.4%). So it is obvious that at the top of the supplier hierarchy we mostly find larger enterprises whereas the SMEs are frequently located within the component and parts supplier categories.

Table 2 Distribution of enterprises by supplier type

	<i>Number of enterprises</i>	<i>. . . and employees</i>
0.5-Tier	1.1%	4.7%
1st Tier	5.2%	43.4%
2nd Tier	44.4%	26.6%
3rd Tier	49.2%	25.2%
Total	100.0%	100.0%

Source: own research; N=1686.

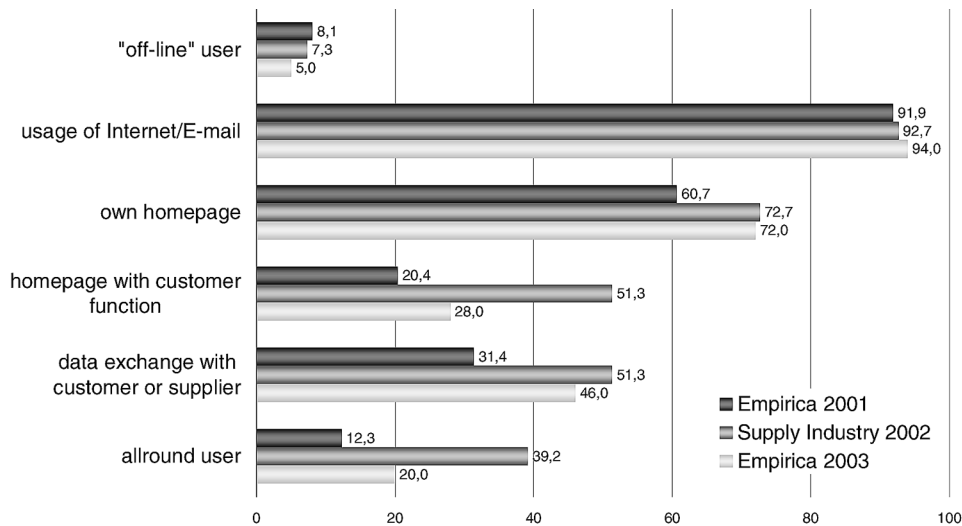
3 The structure of e-business usage in the automobile supply industry

3.1 Advantage of high-quality internet applications

The extent of operational e-business in the German industry is illustrated by the so called 'Empirica study' (Empirica, 2001). The authors of this study introduced a multi-level scale of 'user types'. This scale includes the internet use beginning at the so-called 'off-line enterprise', firms without internet connection. On the second level we find the 'simple user', i.e. enterprises which have an internet connection, but which use it only for simple browsing and the reception and dispatch of e-mail. The scale ends with the so-called 'allround user'. Here we find enterprises which pursue an internet-supported data exchange with suppliers and customers and which also offer a homepage with special functions for customers or suppliers.

A comparison of the data from the Ruhr University project on the supply industry with the data and projections on the Empirica studies for 2001 and 2003 shows that the reputation of the automobile supply industry as a pace maker in e-business is truly justified. The differences in comparison to other lines of business are found neither in the area of simple internet-applications, nor in the intensity of e-mail usage or the connection to the internet, but in the usage of complex tools. Figure 1 shows that only marginal differences are present between the supply industry and the average of the enterprises. With values from continuously less than 10% the so-called off-line enterprise has become an exception – this applies not only to the supply industry, but to all lines of business.

The supply industry holds a considerable advantage concerning the more high-value and complex use forms of the internet. Thus nearly 40% of the businesses of the supply industry are located in the highest step of internet utilisation, the so called 'all around user' – this is twice the amount the Empirica study predicts for the total economy in the year 2003. If we compare these data to the current figures in the year 2001, the value for the supply industry tops the German average by the factor three. This advantage seems even more striking given the supply industry's characteristics, i.e. with the majority of the industry being small and medium enterprises (SMEs). This is actually supposed to be an unfavourable condition for higher forms of e-business usage.

Figure 1 Internet usage by user type category, compared to average economy in Germany, several years.

Source: own research, Empirica 2001, own calculation.

However, obviously the automobile supply industry offers good conditions for the use of e-business systems. Certain conditions for these favourable premisses can be found in the form the production process and the structure of the market.

Automobile production is facing continuously growing cost pressures. This trend began in the 1990s with a demand-side stagnation. Kilper/Schmidt-Dilcher have named two important characteristic developments for the automobile markets for this period: a strongly reduced growth of automobile production, and, in addition, a growing number of OEMs on the North US and Western Europe markets, primarily due to Japanese competitors (Kilper and Schmidt-Dilcher, 1999; Lung and Volpato, 2002; Pries, 1999). OEMs responded to the pressure deriving from an intensification of competition by different strategies: internationalisation and globalisation, introduction of new products and new model strategies, and – last but not least – the transmission of the costs pressure to the suppliers. The suppliers themselves reacted with the compulsion to fast and permanent adaption and rationalisation, partially with the use of e-business-systems.

- The transmission of the cost pressure from the OEM to the supplier base leads to a pressure to increase efficiency (and to decrease inefficiencies) in the whole supply chain. The usage of new information and communication technologies in this case opens new possibilities for certain functions, which were not formerly open to technological rationalisation. This concerns above all business administration. E-business is used for purchase in order to achieve a process optimisation and a reduction of costs.

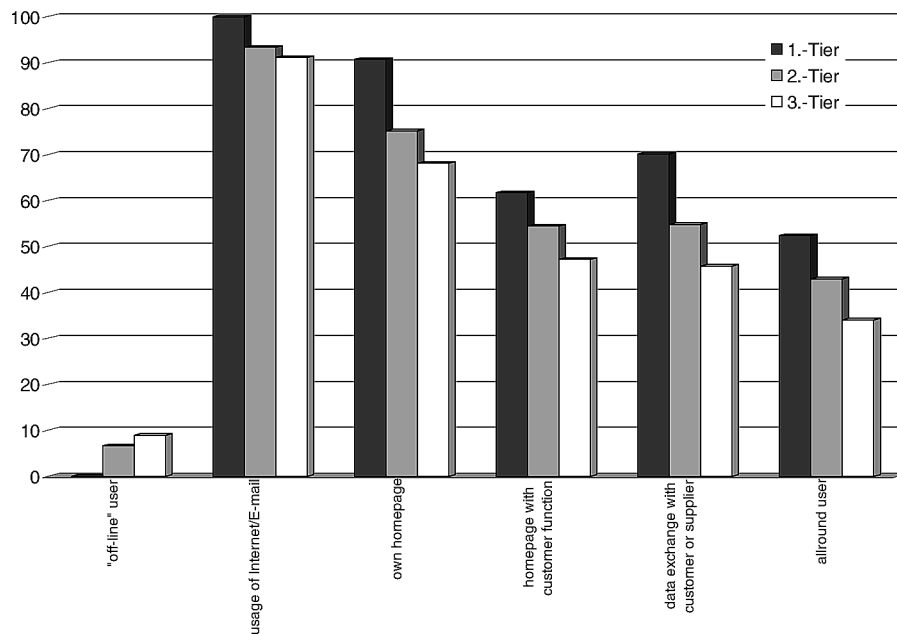
- The extraordinary high degree of structural and organisational change in the supply industry (Ittermann et al., 2003), especially the trend towards the formation of complex value chains (which we observe since the 1980s), also promotes the use of e-business. The modular and outsourcing strategies of the OEMs (Schraysshuen, 1992) have led – with a simultaneous decline in prices – to intensive organisational change and concentration processes. As a consequence, the business of the tier 1 suppliers is characterised by organisational differentiation (VDA, 2003). Under conditions of instability e-business is, mainly in the larger firms, frequently a means to standardise internal workflows and to create structures of data exchange, e.g. between business locations and the focal enterprise.
- An additional argument for the increased utilisation of internet technologies can be found in the high demands on the coordination of production (just-in-time, etc.). Especially in the upper area of the value chain – within the production of complex goods – demands are far higher than in other economic sectors. This argument explains only one part of the internet use, namely the ‘cooperative’ forms of internet use (Hertwig et al., 2002), that are mainly used in research and development cooperations or logistics. The current dynamics in the e-business-business, however, seems to derive more from the competitive form of the internet.

3.2 E-business usage in the supply industry

Specifically due to the differentiation of the value chain, as it is typically found in automobile production, the question arises as to how the internet utilisation differs within the supply industry. Which strategies do the different businesses of the supply industry pursue, given the background of organisational change?

3.3 E-business by user type

The analysis of internet utilisation within the supply industry shows that the advantage concerning e-business decreases – as may be expected – with the decrease in the supplier status. The companies at the end of the supplier pyramid, i.e. the parts and/or Tier-3-producers, use the internet less intensively than the suppliers at the ‘top’ of the value chain, i.e. complex components-producers. So we find that within the Tier-1-suppliers over 50% belong to the category ‘all-round user’, while within the part manufacturers it is only about 1/3 of the businesses (Figure 2). The decline in e-business utilisation along the value chain, as mentioned, results from the lower demands of data exchange that 3-tiers have to face, concerning both logistics during the serial production and data exchange in the context of research and development cooperations. E-business also opens up possibilities for enterprise restructuring, and those forms of use also apply mainly to the bigger 1-tiers. And, finally, the lack of financial and personal resources is a specific characteristic of SMEs, which make up the main part of the parts-suppliers. In numerous of these companies those problems make it impossible to introduce e-business systems as their own initiative. But after all we have to keep in mind that the German supply industry, even in the segment of the parts manufacturer, uses e-business to a considerably higher degree than the German national economic average.

Figure 2 The intensity of internet utilisation by supplier type.

Source: own research, N=1.716.

These results are highly compatible with our accompanying qualitative investigations in different supplier plants within our research project. Mainly the SMEs within the suppliers notice considerable pressure to get involved in e-business strategies of their customers, if they want to retain their position in the purchase lists. The trend to carry out transactions, especially in purchasing departments, increasingly by e-procurement, continues. Our qualitative investigations show also that the acceptance of the purchasing company is declining to engage in a traditional 'hand-made' communication with the suppliers instead of using the – probably – existing e-procurement system³.

4 Platform utilisations in the automobile supply industry

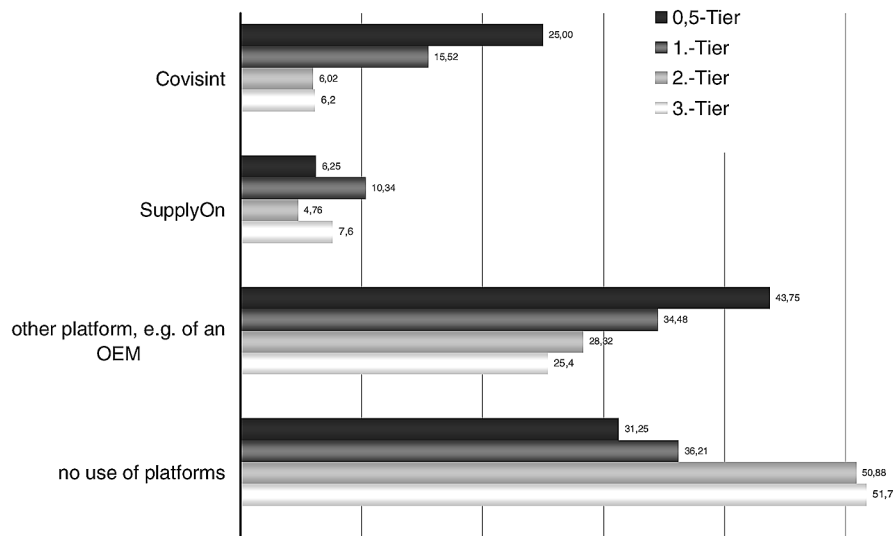
In publications on e-business utilisation of the automobile supply industry extraordinary attention is paid to the independent electronic market places. According to some authors' view e-business is equal with e-markets. Compared to the data of the research project of the Ruhr university, the role of those platforms is highly overestimated (Schubert and Knüwer, 2002) – but the role of platform solutions for business relations in general is not.

To focus on this point, one aspect of our research was to examine to what extent those suppliers which already used e-business were involved in industry specific platforms – like Covisint or SupplyOn – compared to the use of a company-owned platform. Half (49.7%) of the businesses indicated that they already used one or more car specific platforms – a clear sign that platforms were not dominant in the e-business, but played a considerable roll in the internet-support of business processes.

The results reveal that individual, company-owned platform solutions play a by far bigger role in the e-business, than estimated. Thus only 6.7% of the businesses in our sample participated with Covisint; 5.9% were involved in SupplyOn, which was established by big first-tier-suppliers. Far more companies (26.9%) work with OEM platforms like the VW group supply.com, the VW owned platform, or other individual e-business-solutions developed by OEMs or large suppliers.

Figure 3 sketches the utilisation of platforms by different supplier types. The results reveal three typical features for the e-business-utilisation in the supply industry. In contrast to the 'e-business hype' we find that a large number of companies – including the system integrators and first-tiers with shares of 31 resp. 36% – still manage their business relations without any platform utilisation. Furthermore it suggests that the 'driving force' of e-business utilisation is the customer (or demand side) since the higher tiers hold the largest shares in Covisint. The utilisation of Covisint (under compulsion) is higher than that of the platform SupplyOn, which is used by supplier companies. Thirdly, the (obvious) correlation between supplier status and internet utilisation intensity indicates that e-business seems to 'trickle down' the supply chain from the top 'customer' companies to the 'bottom suppliers'.

Figure 3 Platform utilisation by supplier type.



Source: own research, N=968.

To answer the question as to why independently customised platforms have an advantage over the existing platforms, different reasons were delivered by our case studies which were carried out parallel to the quantitative research. The purchasing departments in many cases criticised the lack of flexibility of the purchasing tools of the independent platforms. The formation of these records and data services cannot be sufficiently adapted

to the individual needs of a company. Another reason is that the promise of a considerably expanded supplier pool was not fulfilled: many companies opened up their supplier-base to the other participants of the platform but fell back on exactly those suppliers they already worked with.

However, the situation for the SMEs and part suppliers is totally different. In this segment of the supply industry, the initiative for e-business introduction derives from external forces. The OEM or the larger suppliers that adjust business processes to e-procurement, for instance, exert a considerable amount of pressure on the suppliers to participate in the Internet as well ('VW buys only via network', Handelsblatt, 21.01.2001). Since both OEMs and system suppliers use their own e-business platform for most business transactions, a large share of the part manufacturers will have to adapt many different systems. This can be regarded as a huge challenge concerning resources and workload while no direct gain for the SMEs can be found at the same time. Another limiting factor which excludes SMEs can be found in the costs of the independent market places. The firms systems are usually cost-free, while the independent platforms mostly charge a certain amount for usage.

5 The impact of e-business on the organisation of the supplier customer relationships in the automobile supply industry

This chapter focuses on the affect of e-business applications on the organisation of the automobile supply industry. The supply chain in automotive production is highly complex, and is characterised by a high level of modular production in the final stages. The supplied products are correspondingly heterogeneous: from simple parts like screws and springs at one end of the value chain to complex systems at the other. Both asset specificity and market complexity, especially the complexity of product descriptions, decrease from Tier 1 to Tier 3.

In this paper we propose that information technologies (IT) have contributed to the acceleration of structural changes in the automotive industry, which have been taking place since the 1990s. However, e-business is not the cause of this structural change, rather it allows companies to implement strategies that are necessary in the face of increasing modularisation. Insofar, this paper supports Holland and Lockett's thesis that, '[i]n essence, Information Systems enable organisations to do what they want to do more efficiently and flexibly' (Holland and Lockett, 1997). Yet the technical development of e-business has led to a high degree of different applications, which affect the level of cooperation between firms or function as a market stimulus. In the automotive industry, we actually see an e-business boom in the purchasing and sales departments; the relatively new possibilities opened up by e-procurement are leading to a 'move to the market' in particular segments of the automobile supply industry.

Before we try to explain how e-business applications are affecting the organisation of the automobile supply industry, we would like to describe the highlights of the recent debate about the impact of IT technologies, which has relied heavily on arguments related to transaction costs theory.

5.1 Move to where? The debate surrounding the impact of IT in the 1990s

The article 'Electronic Markets and Electronic Hierarchies' (Malone et al., 1987) marks the beginning of the debate surrounding the impact of IT on forms of organisation and coordination of business activities. The authors hypothesised that IT technologies effect a 'move to the market': they lead to an expansion of the coordination by market, to the detriment of internal, hierarchical coordination. Malone et al. (1987) assume that IT technologies increase the efficiency of both markets and hierarchies, because transaction costs are comprised largely of information and communication costs (p. 488). Due to the relatively strong reliance of the market on communications, network technologies increase efficiency to a higher degree on markets than on hierarchies. The increasing opportunities for companies in the face of IT technologies, for example the exchange of complex product data together with decreasing costs, are affecting a move away from hierarchies and towards market transactions.

In 1994, Clemons and Reddi expanded on this hypothesis. They confirmed the conclusion that IT technologies decrease the advantages of vertical integration. Yet according to them, the predicted increase in outsourcing leads to a decrease in hybrid transactions between markets and hierarchies (hence their phrase 'move to the middle'). The lowering of transaction costs through IT technologies also reduces the advantages of pure market forms like spot markets. They assume

"that since IT investments are idiosyncratic and their benefits involve a learning curve, long-term cooperative arrangements will be preferred to short-term market supplier arrangements so that firms can fully benefit from IT-Investments". (Clemons et al., 1994)

As a result, information technology leads to the proliferation of long-term contracts and increasing cooperation between suppliers and producers.

Holland and Lockett (1994 & 1997), on the other hand, maintain that companies employ a particular mixture of market and hierarchical strategies (Holland and Lockett, 1997, p. 476). Like Malone et al., they assume that electronic network technologies increase the efficiency of market and hierarchical transactions. However, they also note that companies use a particular mixture of electronic markets and hierarchies (hence their phrase 'move to the mixed mode'). The various transaction forms depend on the complexity of the market and the level of asset specificity. Depending on whether both are low or high, there is a bias towards electronic markets or hierarchies, respectively.

The following sections (3.1.2 and 3.1.3) focus on the debate about the impact of network technologies. With the aid of quantitative data about the automobile supply industry, we will attempt to describe the consequences of e-business usage on the organisation of the automotive industry. Additionally, this paper should contribute to the debate and improve the understanding of these impacts with respect to IT, for example by focusing on newer developments, especially the rapid technical progress and diversification of network technologies.

5.2 Effects of different e-business applications

Since 1987, when the debate about the intra-organisational consequences began, information technologies have developed rapidly. In e-business, we see a high degree of

diversification of applications. Nearly every function of a firm could be supplemented by browser-supported technologies, so that every department has got, with an e- as affix, its own internet counterpart, for example e-procurement, e-logistics, e-engineering, etc.

In this chapter we propose that e-business applications affect the organisation of transactions to various degrees. These effects have been worked out by Malone et al. (1987), who ascribe three effects to information technology:

- The *electronic communication effect* means that IT allows the exchange of information in less time and with lower costs.
- The *electronic brokerage effect* assumes that network databases can assume the tasks of a broker to improve the matching between buyers and suppliers. Computer-supported systems allow an increase in the number of potential market participants and the quality of decision between market alternatives, while decreasing the costs of the selection process.
- The *electronic integration effect* occurs when companies define or standardise interfaces for information exchanges and processes, for example in the cooperative usage of CAD/CAM technology. When the same data or information may not be entered in different systems, we find a reduction in time and an elimination of risk of errors in processing data.

A simplified summary of these effects according to the functional categories of internet applications is shown in Table 3.

- Internet technologies in the production department (e.g. production planning systems), logistics (e.g. web-EDI) or in the research and development department (e.g. CAD/CAM) have their main impact in the form of the electronic integration effect. In particular the conditions of modularisation and outsourcing strategies of the OEMs have forced the spreading of these technologies in the automotive industry. 'Just in time', zero error tolerance, or cooperation in development between two or more companies have been the norm for a long time and, without IT, could not have been imagined to this extent.
- Compared to the upper e-business technologies, e-procurement systems aim additionally at the electronic brokerage effect. Thus the central benefits of electronic RFQs or e-bidding applications are increasing competition between suppliers as well as growing quality of the procurers' decisions.

Contributing to the electronic brokerage effect does not mean that an application does not benefit from the electronic integration effect; the electronic integration effect and the electronic brokerage effect are not mutually exclusive. There are e-procurement applications, for example e-bidding, which have only a small outcome attributable to electronic integration. On the other hand, there are internet technologies, like eRFQ, which achieve both the integration of data exchange and the brokerage effect. In this case, there is no logical contradiction between both effects.

Table 3 Strength of IT effects of internet applications according to department

	<i>Effects information</i>	<i>Integration</i>	<i>Brokerage</i>
(a) Internet in purchasing department	High	Low/high	High
(b) Internet in sales department	High	Low/high	High
(c) Internet in production	High	High	Low
(d) Internet in logistics	High	High	Low
(e) Internet in research and development	High	High	Low

5.3 Usage of e-business applications in the automobile supply industry by quantitative data

We actually see a boom in internet applications in the spheres of (a) and (b) as seen in Table 3. In the discussion about e-business, e-procurement systems that are installed in purchase departments are seen as a pace maker, and recent empirical studies show immensely accelerating rates for e-procurement systems. According to the Empirica study, the proportion of German companies that use internet applications in their purchase departments, doubled over a period of two years: the proportion increased from 26% in 1999 to 49% in 2001 (Empirica, 2001, p. 7). Our quantitative data on the automobile supply industry also confirm the function of e-procurement as pace maker in e-business (see Table 4). We asked suppliers which of their departments use specific e-business applications. Our data show only those e-business uses which include more complex applications than just e-mail and surfing the internet. Independent of the supplier type, more than half of the companies use such internet applications in the purchasing department. Therefore, e-procurement usage was more extensive than e-business usage (in a primary integrative way) in production, logistics and research and development.

Table 4 Distribution of e-business applications according to department. Percentage share among e-business of all businesses by supplier type category

	<i>1st Tier</i>	<i>2nd Tier</i>	<i>3rd Tier</i>
(a) Internet in purchasing department	57.1	55.7	58.4
(b) Internet in sales department	58.4	48.9	51.8
(c) Internet in production	18.2	14.3	10.6
(d) Internet in logistics	49.4	36.7	34.1
(e) Internet in research and development	37.7	19.5	15.0

Source: own research, N=1573.

5.4 Move to 'mixed mode' by internet usage

How do these results influence inter-organisational change in the supply industry? When we take a look at 'integrative' internet applications (letters (c)–(e) in Table 4), we see that the intensity of usage decreases in accordance with a decreasing position in the supply

chain. These data are in accordance with the complexity of the supply chain in the automotive industry: in the automobile supply chain, the 'market complexity' (Holland and Lockett, 1997, p. 477) declines from the first-tier to the third- or fourth-tier supplier. Under conditions of modularity we find a higher complexity of product attributes in the system supply sector, as compared to the parts supply sector. The degree of asset specificity follows the same distribution along the supply chain. Table 4 shows that an IT-based 'move to the middle' has taken place. This 'move' decreases along the supply chain, in other words with decreasing market complexity and asset specificity.

We determined that e-procurement systems mainly produce the electronic brokerage effect, which does not necessarily mean that they do not also produce the electronic integration effect. Our survey confirmed the coexistence of seemingly contradictory effects, and the question of what goals businesses hope to achieve with the introduction of e-procurement applications served as an empirical indicator. Table 5 shows that, aside from the goal of improving internal processes (a), both the competition-related goals of increased competition ((b) and (c)) and the integrative goals were equally important.⁴

Table 5 Goals of e-procurement applications

	<i>Strongly agree</i>	<i>Agree</i>	<i>Sum of I and II</i>
	I	II	III
(a) Process optimisation	31.4	42.4	73.8
(b) Discover the new suppliers	30.3	39.1	69.4
(c) Decrease product costs	31.2	37	68.2
(d) Adoption of supplier standards	31.3	36.4	67.7
(e) Reaction on customer coercion	23	36.9	59.9
(f) Decrease personnel costs	19.9	25.6	45.5

Source: own research, N=542.

The results show that even in the case of e-procurement systems there is no simple 'move to the market' as defined by Malone et al. (1987). Rather, the results support Holland and Lockett's 'mixed mode' hypothesis (Holland and Lockett, 1997). The qualitative data from our case studies show that a producer's introduction of e-procurement systems requires a certain level of investment on the part of suppliers. However, it is mainly the producer that enjoys the benefits gained from the integration effect. With increasing market complexity, the supplier's investments lead more and more to hybrid organisation forms. For a supplier engaged in spot markets, investment in the integration effect is associated with sunk costs.

A 'move to the middle', as defined by Clemons et al. (1994), is equally improbable, thanks to the brokerage effect. No doubt, e-procurement systems improve the quality of the procurement process. They do this by allowing more information to be processed simultaneously. As a result of e-procurement, the market increases when contracts expire and are renegotiated.

For the supply industry, e-business leads to various changes in the supply chain. In the part production sector, under conditions of lower market complexity and asset specificity, a 'move to the market' takes place. At the other end, in the first-tier supply sector, our study supports Holland and Lockett's 'mixed mode' approach.

6 Conclusions

We can summarise what we have examined so far:

Given the new quality of competition and restructuring of the division of labour between OEMs and their suppliers, we focused on the quantity and quality of internet-usage in the automotive industry. The underlying data revealed that the automobile industry serves as a role model, particularly for the industrial sector. The automotive industry holds the lead position compared to the total of German business; especially in the internet applications of high complexity.

The 'climatic conditions' in the automobile supply industry are very favourable for the implementation of e-business technologies. The organisational change in the supply industry in particular, affects the implementation of new internet technologies and vice versa. The processes of concentration and differentiation in the supply industry is both cause and effect of the intensive usage of ICT and e-business.

Though we know that reality is much more complex than economic theory suggests, we analysed the impact of e-business on the supply industry by using arguments of transaction cost theory. We determined that e-business applications support different management strategies. E-business systems mainly lead to a 'mixed mode' in the organisation of the supply chain, as defined by Holland and Lockett (1997). If we take a look at e-business in various departments over the past decade, we see that all technologies are not equally developed. E-business accelerates structural change in the value chain of automobiles, but the speed of change also depends on the technical (and organisational) state of the development of internet applications. For example, EDI has, since its introduction in the 1970s, contributed to the emergence of hybrid organisational forms. Though e-procurement, with such applications as catalogue systems, eRFI, eRFQ and reverse auctions, has only recently become possible, it has been incorporated quickly into most purchasing departments.

Whether e-procurement leads to hybrid or market transactions cannot be generally determined. In terms of transaction cost theory the quality of structural change is largely determined by market complexity and asset specificity. At the base of the supplier pyramid, where the production of simple and standardised parts takes place, e-business leads to a 'move to the market'. At the top, under conditions of high market complexity and asset specificity, the impact of e-business is unclear. The simultaneous existence of the brokerage and information effects makes e-business seem to function in a paradoxical manner: while the brokerage effect stimulates competition, the integration effect promotes the development of hybrid structures and long-term contracts.

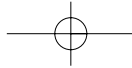
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Notes

- ¹ In the context of the sociological research project, 'E-Business in the German Automobile Supply Industry', the utilisation of e-business technologies in the supply industry is being examined. The project aims to analyse the primary zones of internet use, as well as its effects on organisation and employment. Accordingly, in November and December 2002 approximately 2000 German supplier plants were interviewed by means of a representative telephone survey about their web utilisation patterns. The study focused on the fields of application and the identification of problems concerning introduction, utilisation and organisation. In addition, the project investigated six firms by means of intensive case studies. The project was financed by the German Ministry of Education and Research. It is carried out at the Ruhr Universität Bochum, Chair of Sociology of Organisations and Participation Studies (SOAPS), Prof Dr Ludger Pries (October 2001 until June 2004).

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- ² For a definition of supply products, see e.g. Klinger, K. (1959): Zulieferungen und Zulieferer in betriebswissenschaftlicher Sicht, in: Der Betrieb, Jahrgang 12, Nr. 45. Düsseldorf, p.1229; Rauscher, B. (1993) Herausforderung der Zulieferunternehmen durch das Lean Management-Konzept. München.1993, p.16; for the exact definition of the supply industry in the project see Pries, L., Hertwig, M., Mühge, G. and Tackenberg, H. (2002) Chancen und Risiken von E-Business in der Automobilzulieferindustrie. Workshop-Dokumentation 'Arbeiten und Lernen im E-Business', AK-Forum zur Wirtschafts- und Strukturpolitik, Arbeitskammer des Saarlandes, Saarbrücken.
- ³ However, looking at the employee we find the contrary, which means that both purchasers and supplier staff under certain conditions suffer from the decrease in (direct-)communication and a growing standardisation and control of their individual workspace.
- ⁴ The companies were asked to give an answer on a scale from 1 to 4, where 1 meant 'strongly agree' and 4 'strongly disagree'. Table 5 shows the percentage of answers marked 1 and 2, as well as the sum of these percentages.