Are European Automotive Suppliers up to Date in e-Business? Some Findings of a Trans-Atlantic Survey

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Abstract:
This paper inquires into the integration of e-Business into the automotive supplier industry. In the first part we introduce the automotive supplier industry and the e-Business. In the following we deduce the advantages for this industry to move into e-Business, but underline possible pitfalls as well.
In the second step we present the findings of a survey conducted in Canada, France and Germany. Our aim is to compare the e-Business capability of companies of each country and all along the supply chain. Therefore we examine the information exchange between companies, the usage of e-Business today and the way a company approaches e-Business. We present a three-years estimation and, in the last chapter, highlight the benefits as well as the potential obstacles perceived by the industry to implement e-Business.

Key words: automotive industry, e-Business, international comparison, supply chain

1. Introduction:

Modern IT-Technology and business applications are developing at a high speed. These new opportunities may change the way the supply chain functions, increase the speed of new product development, reduce transaction costs and augment the extent of transparency in a supply chain.
Though the theoretical advantages and pitfalls of these new technologies have been discussed in literature, the degree of their implementation and their usage in the automotive supplier industry rests vague.
Questions as ”to which degree are automotive suppliers implementing e-Business in their daily business? Has e-Business diffused in the whole supply chain? Is Europe straggling behind North America? Is the globalisation of the automotive supplier industry resulting in a tendency to move closer together and overcome national characteristics? Do the cultural differences in theses countries influence their acceptance of new technologies and the methods to manage a business?” remain unanswered.
The following paper is based on a collaboration of the CIRP of University of Ottawa, Canada, the CERAG of Université de Grenoble II and the INPG, France and the Universität Karlsruhe (TH), Germany

2. The investigated industry

To illustrate the context of this study and the field in which it took place, the industry sector of the automotive industry is shortly examined.

The Structure of the Automotive Supplier Market

The global automotive industry consists of multiple players in long, complex, global supply chains. The different Tiers, ergo the different levels of the supply chain, are aligned in a linear order as the figure below shows (Moodley, 2001).

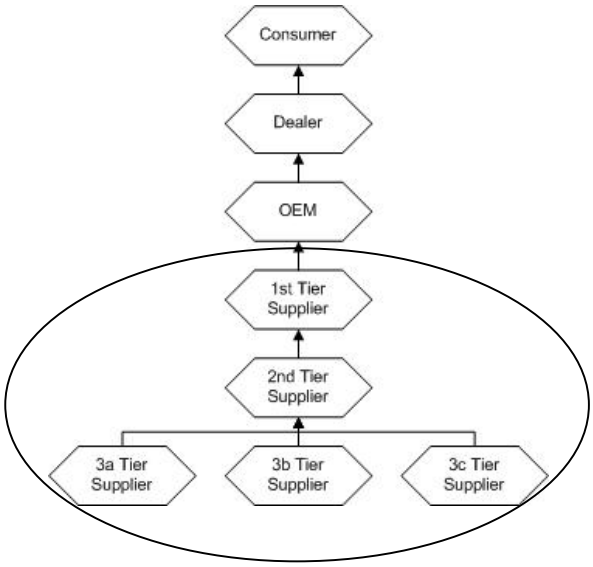


Figure 1: A Stylised Version of a Simple Automotive supply chain[1].

As can be seen, the automotive supply chain is rather linear. It is composed of the car manufactures or *Original Equipment Manufactures*, in the following referred to as OEMs, Tier One, Tier Two and Tier Three suppliers.

Barnes (1999) states that the role of the Tier One suppliers has shifted from being mere component manufacturers towards the role of system integrators or network coordinators who buy from an increasing Tier Two and Tier Three supplier base. They supply the OEMs directly with modules and subsystems. Due to this trend the Tier One Suppliers can meanwhile claim 40% of the added value of a car according to Feith (2003).

While Tier One suppliers are producing whole systems and, Tier Two suppliers usually are producing only one or two subsystems with limited responsibility for the design, testing and warranty. These are delivered either to the Tier One supplier or directly to the OEMs

Tier Three suppliers can be split up into three distinct groups as can bee seen in Figure1

- Tier 3a can be defined as a capability supplier with leading edge capability in one or two processes and a low-cost producer for those
- Tier 3b is a materials supplier at the base of the supplier chain
- Tier 3c is a true commodity supplier, focusing on volume and with a broad customer base

All three levels of the Supply Chain face a challenging economic environment today

Market today and current trends

A stagnant world economy and the slow growth of some highly industrialized markets falls together with a large overcapacity of the OEMs. Capacity utilisation worldwide averages at 72%, in Europe 78% and in the U.S. 82% in 2001 (PWC 2002), which results in a highly competitive environment.

[1] The circle indicates the focus of this survey

Consequently are car manufacturers actively seeking ways to improve their efficiency and reduce their cost structure.
In addition to the cost pressure exerted by the OEM, Morell and Swiecki (2001) discovered three visions of car manufacturers with significant consequences for the automotive suppliers and the automotive supply chain

- *The twelve-month-car*: Shorter design time demand a more intense collaboration of the enterprises. Concurrent engineering, virtual project teams, faster interchange of time-critical data. The new Chrysler Crossfire for example has been developed in cooperation with Karmann in a record-breaking time of just 18 months[2] as result of new ways of collaboration in the supply chain.
- *The ten-hour-car*: Fewer assembling hours necessitate better logistics as well as more complex parts ordered by manufacturers.
- *The seven-day-car:* Shorter order fulfilment requires a sophisticated inventory management as well as an advanced logistics.

These visions coupled with the increasing price pressure all along the supply chain forces suppliers to seek every possible driver to rent their companies more efficient in order to attain these goals.

3. e-Business

One driver towards this goal are e-Business applications. Simchi-Levi *et al.* (2003) define e-Business "as a collection of business models and processes motivated by internet technology, and focusing on improvement of extended enterprise performance." Mesenbourg has a similar approach, defining e-Business as every process conducted over a computer mediated network. A processes may be production focused as procurement, order intake etc., customer focused as CRM or finally internal focused as i.e. training.
Wirtz (2000) sees three innate attributes of e-Business:

- Anywhere: e-Business can be done anywhere and is not confined to a specific location
- Anytime: e-Business is not constrained by opening hours but can be used around the clock
- Anybody: e-Business is not restricted to a specific audience

As mentioned above, e-Business is viewed as one lever to be more competitive. The following figure works out potential benefits discovered by PriceWaterhouseCoopers (2001):

Benefits of e-Businees applications

Mériau (2000) points out that these advantages of e-Business are gained at three levels.
In the first level one can observe that e-Business does not only reduce costs but enhances the competitiveness of the supply chain as a whole. Therefore it offers a better way to innovation. In this new environment suppliers, buyers and engineers are becoming virtual development teams. The OEMs and First Tier suppliers can share the development and the product specifications resulting in a quicker identification of problems and thus a faster resolution of these.
The obvious advantages for manufacturers in the procurement department are the enhanced transparency of costs, a larger supplier base with a worldwide choice of companies and an easier evaluation of the performance of the suppliers.
The enhanced competitiveness of the supply chain by the B2B e-Business is attained by the creation of a *workflow* between the suppliers, OEMs and other partners. Crucial data as stocks, order inflow,

[2] Interview with Mr.Liberoth-Leden; Chairman of the Karmann GmbH, 24.02.2003.

previsions, strategic information and quality can be exchanged. A benchmark for such a supply chain management is the Dell Company as Charter *et al*. (2001) points out. Other examples for the benefits of the collaboration and sharing of productions schedules and forecasts can be found in the food industry. Hoffman (1998) shows that, by integrating the above-mentioned techniques in their companies, Wegman's Food and the Nabisco Brand could reduce their inventory levels of 17 days to only 14 days coverage. This is one step towards the above-mentioned goal of production on demand, or the *seven-day-car* and could result in enormous savings for the automotive industry.
Moreover the implementation of e-Business works as promoter for boosting the efficiency and efficacy of a company. In order to implement e-Business solutions, new levers can be implemented and traditional methods of working can be reconsidered and modernised. This helps to decrease the traditional inhomogenity of project planning or to upgrade the quality. This is, as can be seen in chapter three, especially true for French companies.
be crucial to take full advantage of the e-Business capabilities. They emphasize the advantages of companies concerning e-Procurement, especially MRO (Maintenance, Repair, Operations) products, and the potential to reduce time delays in product development.
Following figure sums up the potential benefits of e-Business (PWC, 2001)

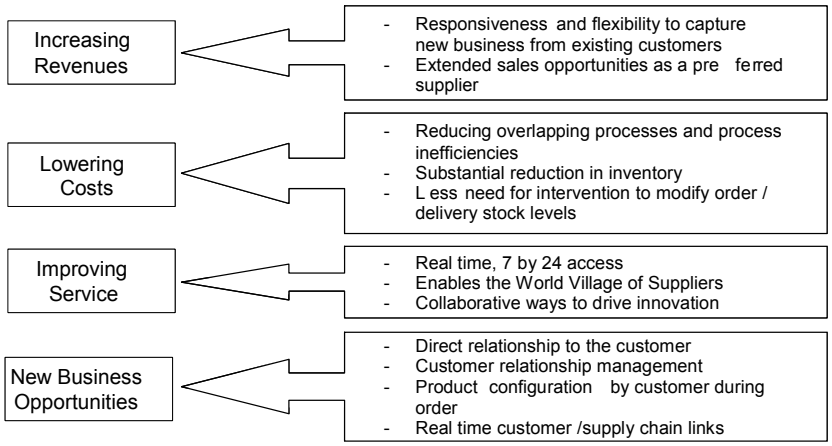


Figure 2: Some advantages from e-Business transformation

Pitfalls of e-Business

Even though the benefits of e-Business cannot be denied, several obstacles and dangers of e-Business implementation can be observed in the market.
One obstacle to overcome is the disappointment the automotive industry encountered so far by implementing e-Business. As per Warren (2000), cost savings of about 3.000$ as claimed by some industry watcher melted to a mere 639$ in Europe and 1.200$ in the U.S.A (Neil 2000). Other disadvantages of e-Business are price pressure resulting of the enhanced transparency in the market and applications as reverse auctions etc. as well as the lack of standardization of software as shown by PriceWaterhouseCoopers (2002).

4. Methodology

The survey has been initiated by Prof. Navarre and the Car Internet Research Program (CIRP) in 2001. The questionnaire was elaborated by the Canadian team of the CIRP on the basis of 23 semi-structured interviews. The survey in Canada was conducted in 2001 followed by the European survey in spring 2003.

The questionnaire contained the following chapters:

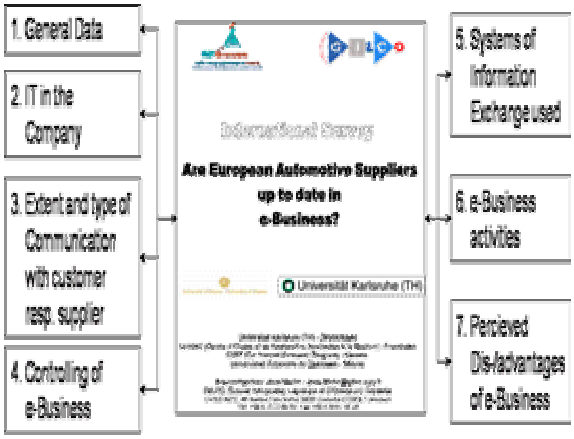


Figure 3: The contents of the questionnaire

General Information			
	Canada	France	Germany
Samplesize	102	73	61
Tier 1	32	23	15
Tier 2	37	24	10
Tier 3	33	26	18
Missing	0	0	18
Employees			
-50	19	16	12
50 - 249	30	14	16
250 - 499	16	6	6
500 - 999	12	7	4
1,000 - 2,500	11	6	5
+ 2,500	14	24	18
Turnover in Million €			
- 100	57	40	27
100 - 499	28	11	8
500 - 1,000	7	4	4
1,000 - 5,000	8	7	9
+ 5,000	2	11	11

Figure 4: The obtained sample

In total 236 questionnaires could be obtained. The obtained sample in the three countries has Above shown characteristics. For the treatment of the data the software SPSS 11.01 was used.

One challenge next to obtain the database is how to define and measure the e-Business capabilities of a company. We created one main indicator and three sub indicators to asses and compare e-Business capabilities along the supply chain and between the countries. In the following we give a short description of the respective indicator

e-Receptiveness:

The receptiveness of a company towards e-business depends largely on its extent of information exchange along the supply chain. Thus this indicator is based on the average extent of communication between the company with its customers as well as its suppliers. E-Receptiveness is the average of the nine different types of information exchanged in the questionnaire.

e-Management::

This indicator measures the preparation of the company to implement e-business and its controlling of its e-Business activities. This indicator depends upon the formulation of formal e-Business strategy, in which way the company audits its e-Business activities and if it applies a proper budget for its e-Business activities.

e-Experience:

The third indicators represent the integration of e-Business in the company today by assessing system installed in the company and business conducted via e-Business today.

These three indicators add up the main indicator, the **e-Business capability SCORE.**

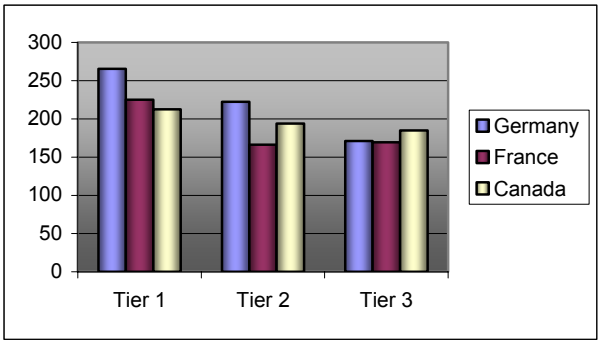
5. The findings

The analysis of the data poduced several main findings:

Finding I: Along the European supply chain exists a gradient of e-Business capabilities.

Tier 1 suppliers have an overall *SCORE* well above average, while Tier 2 (-5%) and Tier 3 (-11%) suppliers rate below industry average.This trend is true as well for the relationship turnover – *e-Business Capability SCORE*. The more turnover a company has, the more distinct are its e-Business

capabilities. This result is further substantiated by the *Spearman Rho*, with a good significance level of ,000 to ,035, confirming this relation for Germany and France.



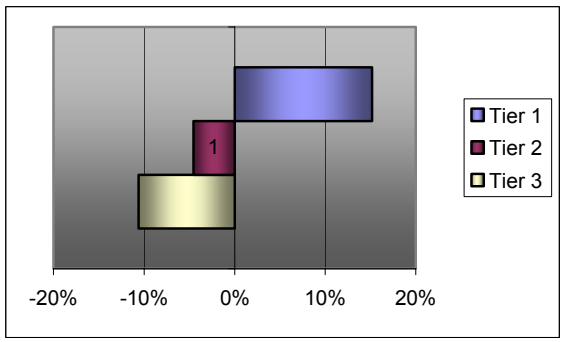


Figure 5: SCORE (cumulated of each country)

Figure 6: Score of each Tier (comp. to overall average)

Finding II: Concerning the global e-Business Capability SCORE, no distinct difference between the countries can be observed

Even if Germany has with 211 points in average the highest score, Canada ranks second with 197 points and France is third with 188 points, the gap is small compared to the differences between the Tiers.

Noticeable however is a large gap between German Tier 1 with an average of 266 and French Tier 1 companies of only 211 in average. But considering the whole supply chain, ergo Tier 1, Tier 2 and Tier 3 suppliers, this difference is not distinct.

E-Receptiveness

To quantify this indicator, we measured the extent of communication between the company with its clients and its suppliers concerning nine different types of information.

Finding III:

The flow of information is not symmetric. More information is shared with the customers than with the supplier.

This is trend is observed in all three examined countries and true for all nine fields of information gathered and is validated by the One-Way-ANOVA test**.** The asymmetric distribution is demonstrated by following chart:

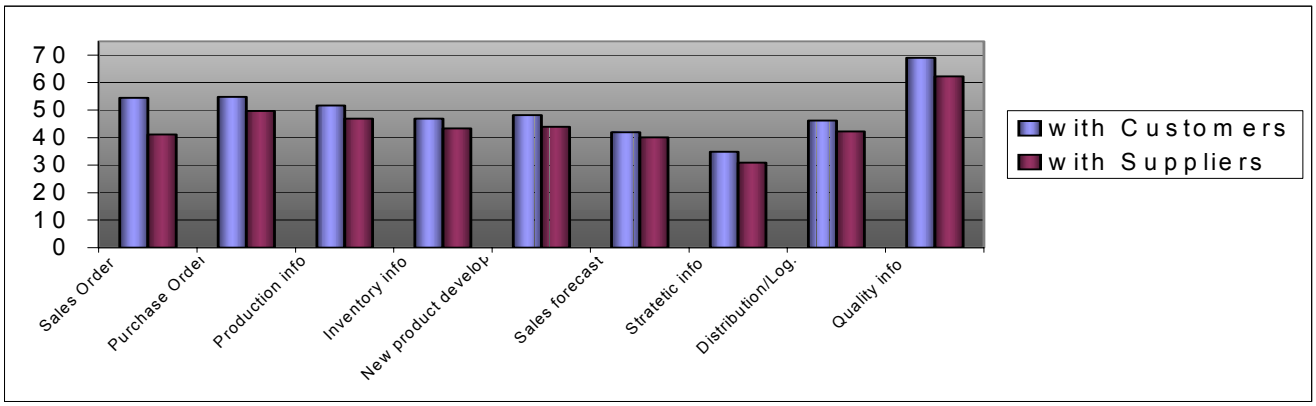


Figure 7: Extent of information exchange in percent (100% = All information exchanged)

As a consequence of this finding, the communication along the supply chain has to decrease. This conclusion is validated by the results obtained in the study as the following charts shows:

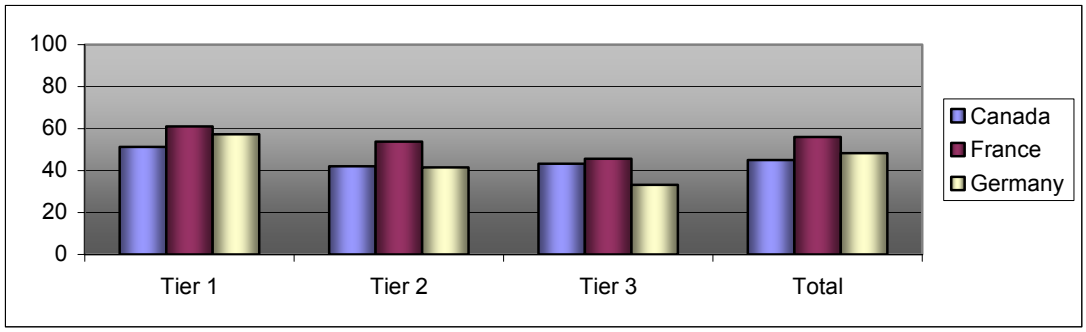


Figure 8: Extent of information exchange with customers in percent (100% = All information exchanged)

The test of the *Spearman Rho* verifies their correlation with a significance of ,004 and a correlation coefficient of 0,2.

Finding IV: Companies will be more receptive to e-Business solution in the near future.

This finding is resulting of a three-year estimation by the respondents. The augmentation covers all areas and this finding is validated by the *Pearson Rho indicator* of Correlation, which showed a fairly strong coefficient of about 0,4 by a significance of below 0,05. The chart below exhibits this finding:

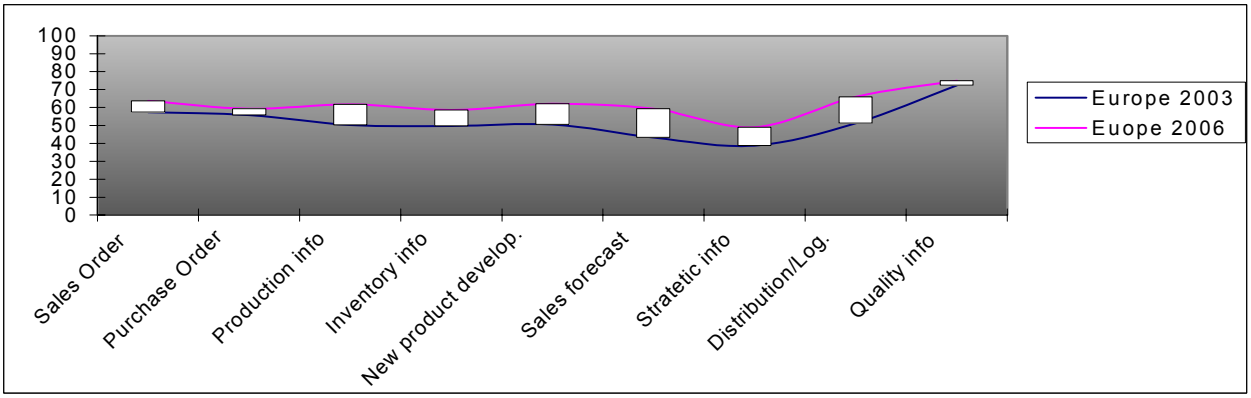


Figure 9: Increase in the extent of communication until 2006 (in Percent)

Finding V: The formal planning and controlling of e-Business in the automotive supply chain is on a very low level.

Both the controlling of e-Business and the formulation of an e-Business strategy, which are necessary for a long-term engagement, are unsatisfying. This fact is striking when one examines the controlling set in place by the companies.

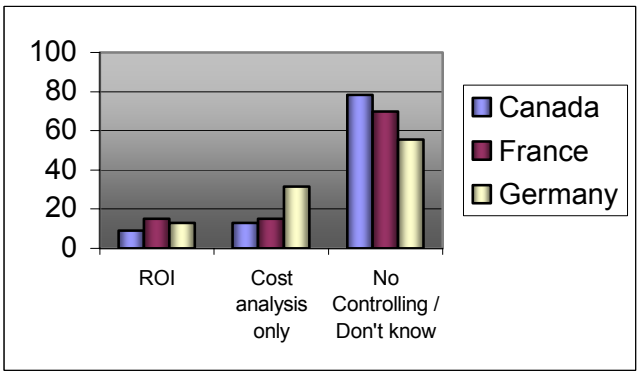


Table 1: Controlling of e-Business in the company

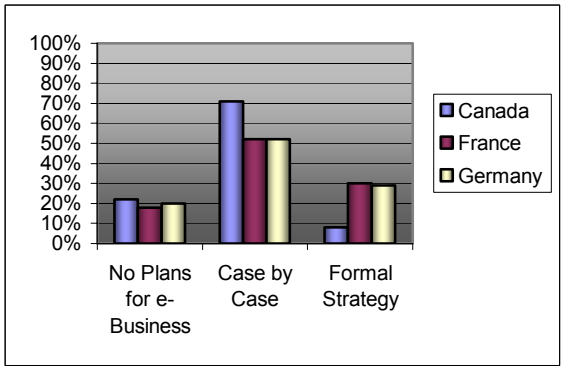


Figure 10: Implementation of the e-Business strategy

Only 15% of the companies in France and Germany have a return on investment calculation set in place. This figure is even worse in Canada, where just 9% have a ROI calculation. However as the Canadian survey has been undertaken one year before the European survey, this gap may be less today.

Finding IV: German Tier 1 companies have by far a higher eExperience SCORE than Tier 1 companies in Canada or France.

Germany, which already put most effort into establishing an e-Business strategy, is using the basic e-Procurement options as buying online, selling online, inverse auctions, responding to *Requests for Quote* (RFQ) and organisation auctions by far the most: Tier 1 suppliers use e-Business today more often than Tier 2 and Tier 3 suppliers. The next two charts demonstrate the mentioned findings by indicating the percentage a company is using each respective function.

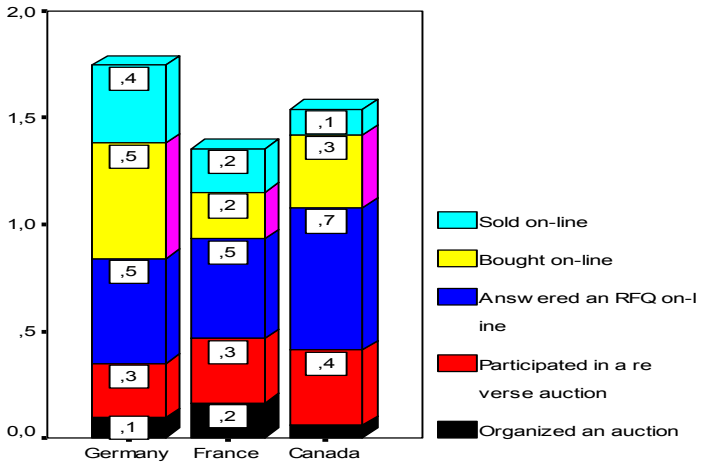


Figure 11: e-Business functionalities by Tier

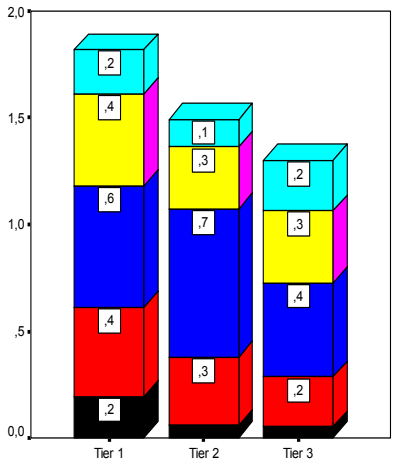


Figure 12: e-Business functionalities used by country

A correlation between the basic uses can be detected: A company buying/selling online is more likely to use other online functions as well. Big companies and Tier 1 suppliers are more likely to use these functions than smaller companies or companies at a lower level of the supply chain.

Another factor contributing to the e-Experience indicator are the systems installed or planned to be installed by the company. As expected, EDI is most common with Tier 1 suppliers. Very expensive and complex systems such as *enterprise resource planning* (ERP) are more often found at the top of the supply chain.

Surprisingly though are Tier 3 suppliers well equipped with new technology, i.e. with CRM systems or Data Warehouse Management Systems.

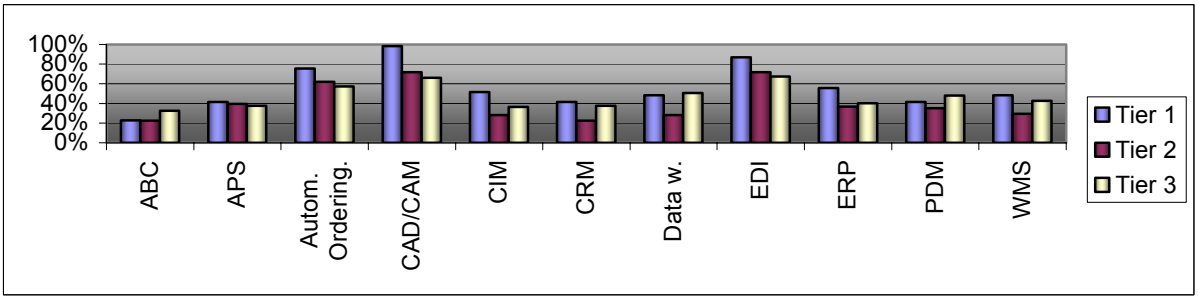


Figure 13: Installed systems in the companies per Tier (in percent)

Along the countries a big gap can be detected between the usage of *Activity Based Costing* (ABC) and *Advanced Planning and Scheduling* (APS), systems which Canadian Tier 3 suppliers are 3,5 times more likely to have implemented in regards to Germany (17% implementation) and even 4,8 times in comparison to France (12%).

Perceived Benefits and Obstacles

By using the factor analyses, the eleven benefits researched in this questionnaire could be clustered into 3 dimensions with 68 % of information remaining:

- The costs advantage
- The time advantage
- Improved competitive position

While these are important benefits for all companies, Tier 1 companies tend to focus on cost reduction while for Tier 3 suppliers the improved competitive position is the major benefit from e-business. This finding is furthermore proven by an ANOVA analysis, which shows a significance of 0,037 respective 0,044. The importance of the aspect of cost reduction is confirmed by the survey of the European Union (European Union, 2003):

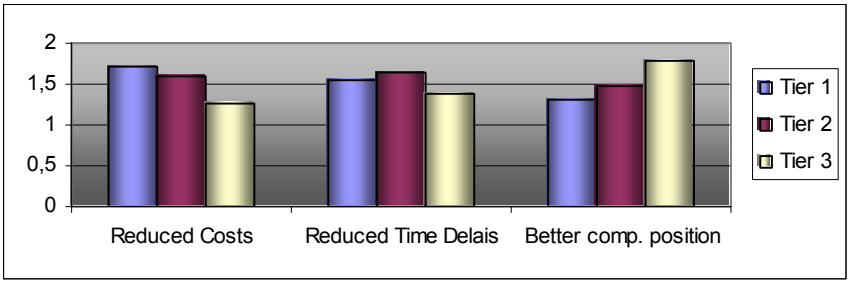


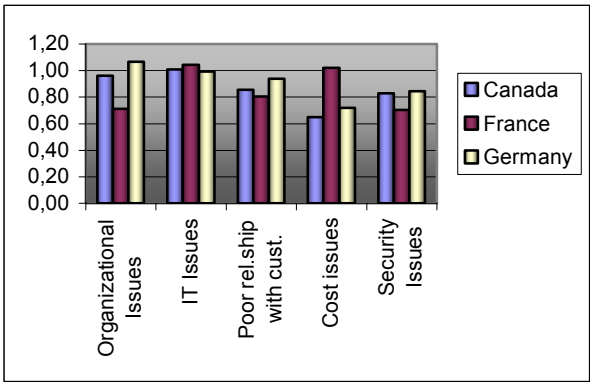
Figure 14: Benefits perceived by companies (2=major benefit, 0=no benefit)

Investigating into the obstacle perceived by e-Business, we detected the following Top five obstacles in each country:
It can be observed that the pricing pressure and the high costs of e-Business, ergo the financial aspects, are seen in every country as a major obstacle. But while German and Canadian firms are regarding technical obstacles as the major problems, French companies consider human related factors as i.e. the lack of expertise and leadership, as the most important. This goes along with the high rating of the problem in French companies that the decision makers are scattered within in the company.
However, no distinct group in regards to the e-Business Capability SCORE could be detected.
Next to these internally perceived problems, there are barriers in the industry as a whole which detain firms from implementing e-Business solutions.

The 15 potential obstacles of the questionnaire have been clustered into five types of problems:

- Organizational issues
- IT issues
- Poor relations with customers
- Cost issues
- Security Issues

The ranking of these obstacles is as follows:



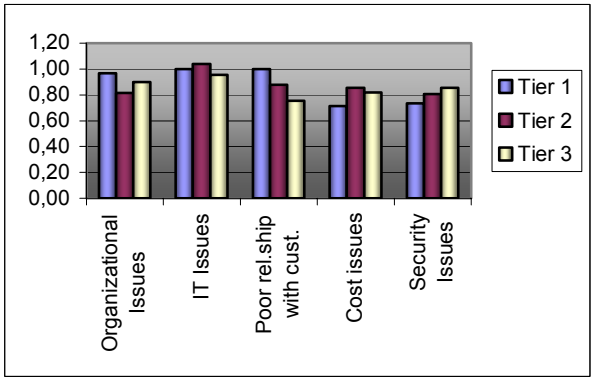


Figure 15: Perceived obstacles (0= major, 2= no obs.) Figure 16: Perceived obstacles (0= major , 2= no obstacle)

No distinct relation between the perceived obstacles, clustered or in the original form, and the e-Business capability SCORE could be detected

In accordance with the findings on the perceived benefits, Tier 1 suppliers judge cost issues more important than Tier 3 supplier. These, however, see the relationship as an obstacle. But these differences are not distinct. The variable cost issue comprises next to the actual costs as well the fear of price pressure due to a higher transparency in the market and by their clients. This fear can be found as well in the survey by R. Strauß (2001) for the German market.

6. Conclusion

To shortly summarize, this paper has been elaborated by following steps:

The Canadian study has been conducted in 2001 followed by the surveys in France and Germany in 2003.

By creating and calculating the E-Business Capability SCORE the overall e-Business capabilities of the companies were made transparent. This enabled a comparison between the analysed markets as well as an investigation along the supply chain.

By comparing the global indicator of the three countries, no distinct differences, regarding the supply chain as a whole, between German, French or Canadian suppliers could be revealed. However, German Tier 1 suppliers have far higher eExperience rating than their Canadian and French counterparts and a superior overall e-Business Capability SCORE as well.

However, along the European supply chain a gradient of the e-Business capabilities could be determined. Tier 1 companies have a distinct higher e-Business capability than smaller companies. Communication is not symmetrical distributed in this industry; companies rather tend to communicate more with their customers than their suppliers. This goes hand in hand with a decrease of communication and thus transparency along the supply chain from Tier 1 to Tier 3.

In the near future, companies in Europe will be more receptive towards e-Business. Requesting a three years estimation by the participants, all levels of the industries expressed their belief in an increase in information exchange. This trend is evident for every one of the nine fields of information analysed.

As literature already suggested, an appalling lack of controlling of e-Business activities could be confirmed. While French companies use 50 percent more than Canadian companies a ROI calculation, the overall figure with 15 % respectively 9 % is very low.

Investigating systems already in place, Canadian firms have more APS and ABC systems installed, however no overall trend towards a higher implementation of systems in general can be observed. Tier 1 suppliers have, as expected, a higher percentage of EDI systems integrated. Expensive and

complex systems as i.e. ERP are more likely to be implemented at bigger companies. Nevertheless, Tier 3 suppliers are surprisingly well equipped and are having in average even more systems installed than Tier 2 suppliers.
Imploring into the obstacles of implementing e-Business, the main reason are both of technical, i.e. worries of technological incompatibility, and of financial nature as i.e. suppliers refrain from investing into e-Business due to the harsh pricing pressure in the industry. While Germans tend to see technical problems as the main ones, French suppliers worry as well about obstacles related to human sources, i.e. lack of internal expertise or lack of leadership.
As the last question to be answered have been the perceived benefits for the industry of using e-Business. While Canadian firms tend to be more optimistic than their French counterparts, the benefits seen by the industry are in every level of the supply chain and in every nation threefold: better relationship with their customers, reducing of costs and time saving.

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