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System Integration in Information Technology - An Intermediation Rather Than a Procurement Task?

by

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SYSTEM INTEGRATION IN INFORMATION TECHNOLOGY - AN INTERMEDIATION RATHER THAN A PROCUREMENT TASK?

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ABSTRACT

System integration (SI) activities are playing a major role in turning IT innovations into competitive business applications. Currently, this business is mainly run in a vendor-type mode where system solutions are purchased from an integrator. Current developments in information technology, mainly the advance of global networking, as well as the fiscal treatment of SI transactions indicate a different business model to emerge for system integration activities: perceiving and implementing system integration as an intermediation rather than a procurement task might prove to be a promising way to do this growing type of IT business in the future.

1. INTRODUCTION

A study of Frankfurt-based consultants Frost & Sullivan estimates the European IT service market to steadily grow from 18 billion dollars in 1995 to 24 billion dollars in 2002 (CW, 1996b). A significant portion of this market is attributed to system integration (SI) activities (CW, 1996a).

Although widely used in business practice, the term *system integration* is not uniquely defined. For the following, we understand this business as a part of industrial marketing characterized by solving a customer's problem by providing an IT[1] *solution* requiring the interdependent usage of a set of heterogeneous

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1 It should be noted, however, that similar activities can also be found in areas other than IT, e.g. the construction of buildings. Usually, they are just not (necessarily) labelled as system integration.

components[2]. This incorporates the conceptual groundwork as well as the procurement of necessary components - usually across multiple vendor platforms - with components generally denoting any product or service to be integrated into the solution. Defined in such a way, system integration activities extend from integrating sub-components (e.g. software modules) to the sale of fully-fledged "turn-key" IT systems. An example for SI would be an offering to introduce computer aided engineering within a manufacturing company comprising an initial project study, procurement of hardware and software, and the setup of required networks. In the last few years, four key factors have substantially contributed to the increasing importance of the system integration market:

- ***Openness of systems:*** While in the early days of information technology an IT system primarily denoted a set of proprietary components produced and sold by one manufacturer, the emerging openness of IT components based on widely accepted standards and interfaces catalyzed the growth of integration activities across multiple vendor platforms. Given (at least partial) compatibility of individual components, the selection problem of choosing the best components from different vendors to build a "mixed" system was born.
- ***Speed of innovation:*** With technology cycles now even down to a few weeks (as e.g. in the PC business), keeping up with innovation is posing a substantial feasibility and cost problem to any customer in the IT market. As a consequence, purchasing a "state-of-the-art" solution and utilizing the technological know-how of specialized vendors is becoming an ever more attracting alternative.
- ***Complexity:*** Innovative and competitive solutions require the smooth fit of an increasing number of components. As a result, understanding and managing the dependencies of all components to guarantee a workable solution is becoming crucial for the success of any system.
- ***Strategic importance of IT:*** With the recognition of information technology to be an important factor for the strategic and competitive position of the company (e.g. Porter/Millar, 1985), a lack of innovation as well as failures in system development might often result in substantial strategic drawbacks. Thus, professional and experienced help from specialized system integrators is frequently applied.

These considerations resemble those of companies resorting to outsource (at least parts of) their IT tasks to outside providers. A rational analysis for this typical make-or-buy decision might in fact suggest to forego an own expensive IT organization and to rather purchase the IT services from a specialized vendor. Obviously, there is a logical connection between system integration and

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2 In the literature, the expressions „system selling“ and „solution selling“ are also used, see e.g. Page/Siemplenski (1983).

outsourcing as depicted in figure 1: In the case of system integration the customer "outsources" the development and procurement task only, while in (full) IT outsourcing he also transfers the whole operation to an outside company. To rely on outside help for setting up solutions which are run under its own control might be a far easier step to take for a company than the (basically) irreversible decision to also have operations managed by an outsider.

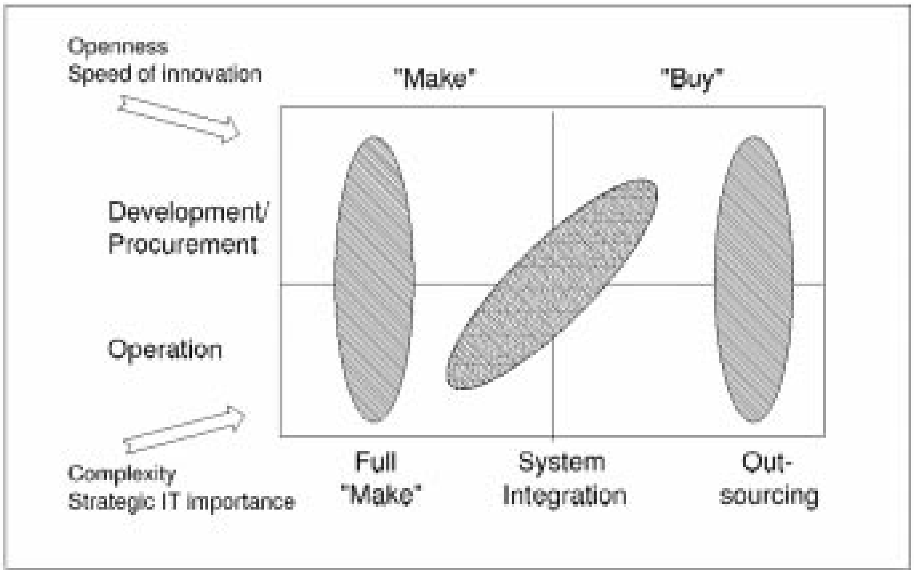

Figure 1. System integration and outsourcing as facets of the make-or-buy-decision

With respect to the supplier side, we may position any IT vendor based on his competence profile (extended from Szyperski/Schmitz/Kronen, 1993). This is determined by his horizontal competence (i.e. competence across different component classes) and his vertical competence (i.e. degree of contribution to the customer's information technology) - illustrated in figure 2. Observations in the IT market (CW, 1996a) reveal that traditional component or system vendors still dominate the SI market (vendor A in figure 2) while suppliers taking an explicit - and independent - solution approach are only slowly advancing (vendor B in figure 2). This may have historical reasons since the traditional vendors started out to tie in other components when the proprietary era came to an end.

Typically, customers obtain complete integrated solutions - usually paying a bundled system price - from an integrator who in turn purchases the needed components from individual suppliers. However, we will show that there is increasing evidence that the system integrator of the future will rather take on an intermediation than a procurement role, since

1. intermediation tasks will gain importance with the arrival of global networking and electronic markets,

2. parts of the integration functions might be outsourced by the integrator himself,
3. results of - often neglected - financial and fiscal considerations strongly suggest a „bundling of contracts“ rather than the sale of a solution.

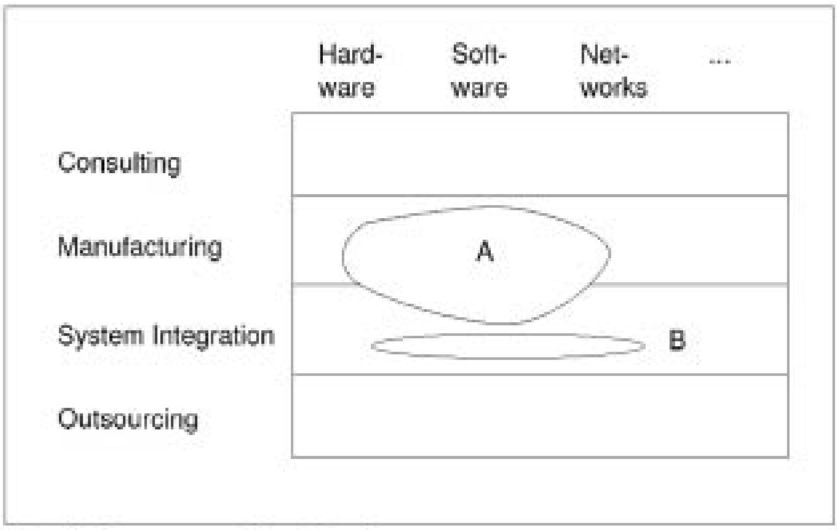

Figure 2. Competence profiles of IT vendors

In this paper, we will first identify the individual functions typically fulfilled by the system integrator (section 2), before we are going to discuss the influences of global networks on the future development and importance of these functions in section 3. Since the lack of conceptual clarity of this problem does not yet warrant a quantitative model, we use a (qualitative) judgmental reasoning approach instead. In section 4, a general model on the fiscal treatment of system integration is used to evaluate different SI approaches. Here, the nature of the decision environment justifies an analytical, quantitative model. Finally, section 5 discusses limitations and application issues of the new system integration structure developed.

2. FUNCTIONS OF SYSTEM INTEGRATION

Whenever a solution is contracted by the customer, the system integrator as solution vendor takes over a variety of functions whose relative importance and contribution to the success of the system usually depends on the individual project. The price difference between the integrated system and the sum of individual components denotes the "added value" of integration. However, as stated in section 1, usually neither component prices nor "added value" are made explicit, but are included in a bundled system price. The main functions earning this "added value" for the integrator are collection and screening of information, contract management, project management, provision of technical expertise, and guarantee of a working solution.

- ***Collection and screening of information:*** One of the basic tasks any system integrator has to fulfill is to collect the relevant information to build the solution. This particularly includes the search, evaluation and pre-selection of potential components and component suppliers.
- ***Contract management:*** Given a set of potential components and suppliers, the system integrator takes over any negotiation with this outside party. This pertains to technical specification matters as well as to the financial conditions of the contract.
- ***Project management:*** Integrating the different components into a working solution for the customer within the agreed-upon time frame leaves the system integrator with the task of project management - in particularly monitoring the progress of the project, coordinating different component suppliers, troubleshooting and the like.
- ***Provision of technical expertise:*** Most system integrators do need a certain amount of technical knowledge to produce a solution. In many cases this is one of the main reasons for the system integration task to be outsourced by the customer (cf. section 1). This may include a feasibility check of the project, development or implementation studies for the customer, responsibility for interfacing individual components, or quality control.
- ***Guarantee:*** Based on observations in business practice, an important reason for the customer to engage in a contract with a system integrator lies in limiting the risk. The system integrator guarantees the usability of the solution and - in the case of failure - is liable for any penalty agreed upon in the customer contract. This implies that - dependent on the importance of the project to the customer - the integrator has to prove himself to be sufficiently "stable"to keep any guarantees. Here we have another link to outsourcing: for *(full) IT outsourcing* similar considerations cause customers to usually select big vendors as partners since contracts run 10 years on average and are hardly reversible. It is interesting to note, however, that sheer size is not a predominant criterion for selecting a *system integrator*: instead, the confidence in the competence of the vendor is considered more important (CW, 1996a).

It should be noted that the first two tasks related to information and contract management basically represent intermediation tasks (related to preparing contracts), while the others denote services within existing contracts. Figure 3 shows the split of the solution into the individual components either typically provided by the integrator himself ("added value components") or by outside suppliers ("base components").

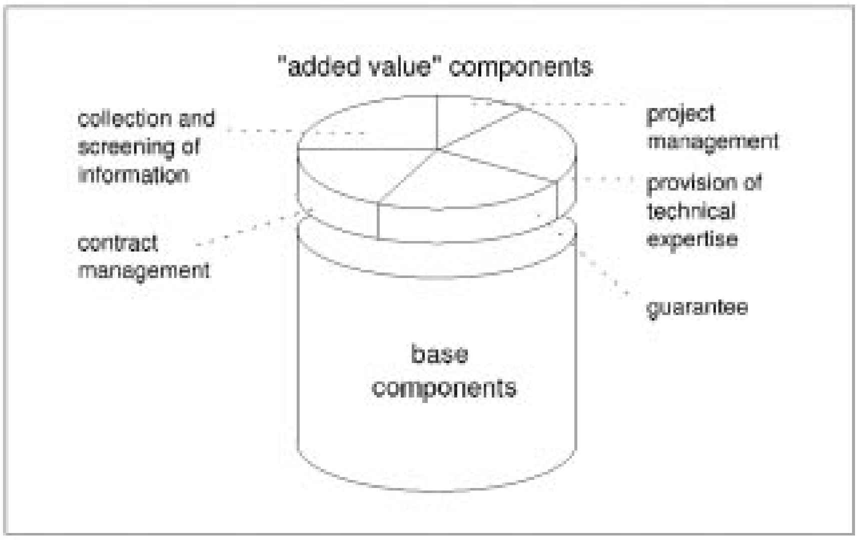

Figure 3. System components within SI contracts

3. GLOBAL NETWORKS AND SYSTEM INTEGRATION

Recent developments in information technology will impact scope and relative importance of the added value tasks outlined in section 2. In particular, the technical evolution of global networking (e.g. via the internet) combined with the low-cost access for most enterprises regardless of their size, will expand the SI market at least along two important dimensions: facilitated market access and distant cooperation capabilities. We will shortly discuss the impacts of global networking on the importance of SI contracts in general as well as on the SI added value tasks presented in the previous section.

Facilitated market access: The extensive use of global networks by suppliers and customers of goods and services should boost innovation capabilities in all fields. Small, innovative companies get direct access to - electronic (Schmid, 1993; Reimers, 1996) - worldwide markets instead of being forced to first surmount a "visibility barrier". Since system integration tasks are usually key to successful innovation and technology management, the potentials to draw profit from combining heterogeneous components are likely to increase with the number of components offered. However, at the same time an ever more sophisticated *information* and selection problem has to be mastered - preferably by a system integrator specializing in this task. Similarly, if we assume that innovative and competitive solutions have to integrate the best globally available components and that these are offered by an increasing variety of specialized vendors, then automatically *contract management* will gain importance. Particularly, offering an integrated solution by committing suppliers residing in different juridical systems might be a challenge to be tackled preferably by specialized system integrators. Similarly, *project management* tasks should be valued even higher the more and more diverse project partners are to be managed. With regard to the *technical expertise*, however, we cannot expect a major change in the importance of these functions: the technical knowledge needed to evaluate components as to their potential contribution to the integrated solution does not differ with the number of components or vendors in question. Evaluating the impact of global markets on the *guarantee* function might be disputable: on the one hand, completion risk might increase with the number of specialized project partners, on the other hand, the increased potential to select "ideal" partners might reduce this risk - compared to the status quo.

Distant cooperation: Information technology - and in particular (global) networks - offer a wide variety of capabilites for remote cooperation. The immediate exchange and sharing of multimedia material, the cooperative work in groupware applications, multi-channel communication, or full (technical) mobility of personnel open up a wide field for cooperation without requiring the partners' physical presence. Although dependent on the specifics of individual SI applications, remote cooperation will allow to cost-efficiently tie in components which - for practical reasons - were not available earlier, e.g. remote consulting in complex technical matters, distributed software development and so on. Therefore, new opportunities for the solution business will arise. With respect to the SI functions we would expect major changes in their importance to happen particularly in the *project management* area. Expenditures for interfacing, permanent control, and troubleshooting should be substantially cut by extensive use of new technologies. Also, distant cooperation should enable integrators to better assess feasibility and status of the project so that the risk of failure (and thus the importance of the *guarantee* function) would diminish. The impact on the SI functions of *collection and screening of information*, *contract management* and *technical expertise* should not be substantial although general communication with potential partners (as a very special form of cooperation) might be positively affected. One should note, however, that the development of remote cooperation capabilities would also facilitate the integration by the customer himself.

Table 1 summarizes the impacts discussed indicating their implications on the volume and the functions of SI to be very significant (++/--), significant (+/-) or not material (o). However, given the diversity of potential SI applications, this evaluation can obviously only be a very general assessment. Nevertheless, it should prove sufficient to conclude that

- demand for integrated solutions will increase,
- the relative weight of SI functions will shift (towards the intermediation functions information and contract management),
- increasing specialization in worldwide markets could also lead to a split of SI functions (e.g. the integrator himself might outsource the project management task or use outside technical consultancy).

Table 1. Implications of global networks on SI and its functions

	market access	distant cooperation
volume of solution business	++	+
importance of SI functions:		
collection/screening of information	++	o
contract management	++	o
project management	+	--
provision of technical expertise	o	o
guarantee	o	-

4. TAXATION AND SYSTEM INTEGRATION

Having discussed the qualitative factors likely to shape future SI business in section 3, we found that SI will take on more and more the characteristics of an intermediation task. Experience in business practice as well as theoretical results indicate that contractual arrangements are often made ignoring tax-induced financial effects - although these may substantially impact rational contract designs[3]. Based on our findings in section 3, we should obviously ask whether the traditional purchase-based SI contract design is still appropriate. Therefore, we will now turn to examine the fiscal and financial implications of different types of SI transactions. In particular, we will compare the traditionally purchased integrated system (as defined in section 1) to an equivalent system developed by an integrator in an intermediary-type approach - by bundling individual rental/lease[4] or service contracts with component manufacturers or service providers. Because of clearly specified taxation rules, the decision environment lends itself to quantitative analysis. We are, therefore, able to work with the following analytical model, which - due to its generality - is applicable to a variety of fiscal systems.

(A1) ***System:*** A system is composed of n components with production cost $C_i > 0$ and market prices $P_i > C_i$, i=1(1)n.

(A2) ***Decision alternatives:*** The customer may either purchase the complete system (SI approach) or may alternatively enter into individual rental/leasing or service contracts with component providers (individual contract "IC" approach).

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3 E.g., Satzger (1995) shows that most trade-in transactions observable in business - also frequently used in the IT market - should be designed differently to exploit tax saving potentials.

4 For the following we do only consider typical leases with the leasing object to be shown on the lessor’s balance sheet.

(A3) ***Decision criteria:*** Component manufacturers, system integrator, and customer make decisions based on their after-tax cash flow net present values (NPV). They are assumed to use identical interest rates $r > 0$ and are subject to identical[5] tax rates s with $0 < s < 1$. Net present values of rental contracts are identical to market prices.

(A4) ***Character of assets:*** Components 1,..,m (with $m \leq n$) have a permanent value and, thus, have to be shown in the balance sheet and are depreciated over time. Service-type components m+1,...n do not have this quality and - if purchased separately - fully impact the taxable income.

(A5) ***Depreciation:*** The system will be used over T time periods. Any asset i, i=1(1)m, is characterized by depreciation/"tax shield" [6] shares of the initial book value $d_{i,t} \geq 0$ with $\sum_{t=1}^{T} d_{i,t} = 1$, their net present value being d_i[7] with $d_i := \sum_{t=1}^{T} d_{i,t}(1+r)^{-t}$.

Let us first look at one individual component i before we are going to focus on the complete system. The sale of the component generates the following tax effects for *both* parties (vendor and customer[8]): in the SI case, the vendor pays taxes on the gain of the sale while the customer receives tax credits over the depreciation period of the asset. Therefore, the cash flow NPV of tax payments is:

$$NPV^{SI} = -s(P_i - C_i) + sP_i d_i \, . \qquad (1)$$

For individual rental/leasing contracts (IC case) the vendor pays taxes on the rental payments and receives tax credit for any depreciation of the asset, while the customer decreases his tax liability by the tax rate applied to the rental expenditures so that the NPV of tax cash flows differs from (1):

$$NPV^{IC} = -s(P_i - C_i d_i) + sP_i \, . \qquad (2)$$

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5 For the sake of conciseness we limit the model to identical interest and tax rates. This is sufficient to demonstrate the basic implications. However, it should be noted that different interest or tax rates make the choice of contract alternatives (A2) even more difficult. Dependent on the individual system, either alternative may be advantageous. This is another field for further research.

6 At the end of period T a positive book value reduces the taxable gain when the component is sold.

7 For simplicity of notation we also write $d_i = 1$ for i=m+1(1)n.

8 We treat the integrator as supplier of "added value components" (see figure 3) and assume that "base components" are just passed through to the customer.

Comparing these results renders the following criterion for the superiority of the individual contract alternative using rental/leasing contracts:

$$NPV^{IC} - NPV^{SI} = s(P_i - C_i)(1 - d_i) \ > \ 0 \qquad (3)$$

Obviously there is an advantage to the rental contract for *any* asset i=1(1)m (because of $r > 0$ it holds: $d_i < 1$). This is due to the fact that in the SI case the net gain is instantly taxed while corresponding tax relief via higher depreciation amounts is spread over time. This advantage by postponing total tax liability can be shared by the contract parties by adjusting price conditions accordingly. Now, this is an effect well-known in the finance literature and often used to explain rental/leasing contracts in business (e.g. Smith/Wakeman, 1985). It should also be noted that for service-type components (i=m+1(1)n) there is no tax impact.

Example 1: Consider a hardware component with a market price of 100.000 $ and cost of 65.000 $. Assuming a time frame of T = 5, an interest rate of i = 6%, a tax rate of s = 35%, and 5-year linear depreciation (rendering $d_i = 0.8425$), a rental/leasing construction would render an after-tax NPV advantage of 1.929 $ vs. the purchase contract. This represents more than 8% of the after-tax gain of a sale! Thus, it becomes evident that the rational choice of a contract alternative is not just a minor issue, but crucial to the competitiveness of both vendor and customer[9].

After these introductory remarks, let us now return to „real“ systems with several heterogeneous components. Calculating the net present value for the purchase of a complete system from a system integrator, we consider that the value of service-type assets (i=m+1(1)n) usually has to be allocated onto the remaining assets: the customer has to split the aggregate purchase (system) price. So, e.g., project management expenditures will increase the value of hardware or software components - the only reasonable allocation key being the market prices of depreciable assets i=1(1)m. In the SI case, the net present value for tax related cash flows of the transaction consists of the taxation of the vendor’s sales profits and the customer’s tax shield of the components i=1(1)m - now proportionally carrying the value of the service-type components:

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9 It should be noted that effects might be even more dramatic if depreciation methods differ between vendor and customer - as e.g. might be the case in an international setting.

$$NPV^{SI} = -s\sum_{i=1}^{n}(P_i - C_i) + s\left[\sum_{i=1}^{m}\left(\frac{\sum_{j=1}^{n}P_j}{\sum_{j=1}^{m}P_j}P_i\right)d_i\right] \qquad (4)$$

The individual contract case, however, shows the same results as (2) - just aggregated for all the system components:

$$NPV^{IC} = -s\sum_{i=1}^{n}(P_i - C_i d_i) + s\sum_{i=1}^{n}P_i\ . \qquad (5)$$

Thus, individual contracting is advantageous if the following condition holds:

$$NPV^{IC} - NPV^{SI} = s\left[\sum_{i=1}^{m}P_i\left(1-\frac{\sum_{j=1}^{n}P_j}{\sum_{j=1}^{m}P_j}d_i\right) + \sum_{i=m+1}^{n}P_i - \sum_{i=1}^{n}C_i(1-d_i)\right] > 0 \qquad (6)$$

Obviously, there is a combination disadvantage of SI contracts: in addition to the disadvantage outlined before for components i=1(1)m, the tax credit for expenditures on service-type components is no longer instant, but rather postponed into the future - depending on the structure of components and their depreciation schemes.

Example 2: Extending example 1 above by additional components of a potential SI contract, let us consider a software component (market price: 50.000 $, cost: 25.000 $) and a project management and consulting services component (market price: 50.000 $, cost: 40.000 $). Table 2 illustrates the disadvantage of an SI contract vs. individual contracting: eye-catching is the high disadvantage for the services component. This is due to the fact that the service expenditure would instantly be tax-reducing in the case of an individual contract, but - in the SI case - is attributed to the purchased system and - indirectly via the other components - is put on the balance sheet so that tax reduction effects are substantially delayed. Again, the overall after-tax disadvantage amounts to nearly a quarter of the after-tax gains of the sale. This means that building the system using individual contracts could (ceteris paribus) drive up after-tax profits for the sum of suppliers by 13%[10] !

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[10] Usually, this advantage would be split between suppliers and customer - depending on the market power of the parties.

We conclude this section with the finding that a solution by "bundling of contracts" is - for tax-induced financial reasons - superior to a traditional purchase-based system integration. The advantages grow with the share of "added value" components, and are - as illustrated in our examples - by no means negligible in the search for a competitive SI business model. Thus, not only does the shift of "added value" components - outlined in section 3 - drive SI business towards intermediation, but also the financial advantages of pure intermediation contracts might change the character of SI activities.

Table 2. Disadvantage of SI contracts vs. individual contracting

Example [$]	Hardware	Software	Services	Total
Market price	100.000	50.000	50.000	200.000
Cost	65.000	25.000	40.000	130.000
Disadvantage SI	1.929	1.378	2.756	6.064
in % of after-tax gain of sale	8.5%	8.5%	42.4%	13.3%

5. CONCLUSIONS AND APPLICATION ISSUES

This paper has shown that there is substantial evidence that the way SI is done in current business practice will change in the near future. The role of today’s system integrators who assemble and sell an integrated solution might lose importance. Instead, there are a good reasons why we should expect a more intermediary-type role for system integrators, acting e.g. as a „market maker“ for virtual enterprises:

- The current developments in IT technology suggest that the intermediation functions (collecting/screening of information and contract management) will become the core functions for system integrators.
- Global competition also for system integrators will force them to focus on their competitive strength and maybe to outsource SI functions.
- Bundling of rental/leasing/service contracts bears financial opportunities to be shared between component suppliers, system integrator and customer. This potential can only be exploited if the system integrator assumes an intermediary role[11].

Finally, a few comments should be made as to the limitations and application issues of the ideas presented in this paper - at the same time opening up interesting prospects for further research:

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11 A possibility to still face the customer with just one contract would be sub-leasing through the integrator.

- The suggested intermediation approach to SI is based on judgmental reasoning as well as on analytical modelling of financial aspects. However, our reasoning and modelling has still to be validated by additional empirical research work.
- The most important limitation to the application of an intermediation approach to SI is the fact that small system integrators currently lack the potential to offer suitable guarantees to their customers. Instead, large companies - not necessarily the most competent ones - act as system integrators (CW, 1996a). Of course, the implicit insurance premium paid by the customer reflects the (potentially inferior) competence of the integrator. Therefore, we could expect a more efficient market[12] to come up for insuring risk in connection with system integration activities: the current problem that any insurance company can hardly assess the risk involved in - usually very individualized - SI contracts and, therefore, is reluctant to take it, could be solved in either of two ways: Insurances could hire specialists to evaluate individual SI projects, or, alternatively, they could use a premium-based system focussed on the integrator rather than the project. Thus, an integrator with good performance and track record would pay lower premiums and by that gain competitive advantage. The problem to design suitable insurance systems, contracts and control/incentive structures should be a promising field for further research.
- Another limitation for the ideas presented is that not all system components may be suited to be provided via rental/leasing contracts, e.g. because they are substantially modified to build the solution and, therefore, cannot be used for other customers afterwards. For IT systems with typical hardware and software components, however, this should rather be the exception than the rule.

6. REFERENCES

CW (1996a). Besonders die deutschen IT-Manager vertrauen IBM. *Computerwoche*, Sept 13, 10.

CW (1996b). Big Blue beherrscht den Servicemarkt. *Computerwoche*, Oct 25, 1.

Page, A./Siemplenski, M. (1983). Product Systems Marketing. *Industrial Marketing Management*, 12, 89-99.

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[12] Since individual solutions are often critical to the strategic success of the customer, the price sensitivity in the market might not (yet) be as high as for other IT products and services.

Porter, M./Millar, V. (1985). How information gives you competitive advantage. *Harvard Business Review*, 4, 149-153.

Reimers, K. (1996). The non-market preconditions of electronic markets: implications for their evolution and applicability. *European Journal of Information Systems* (5) 2, 75-83.

Satzger, G. (1995). Die Gestaltung von Rücknahmegeschäften aus finanzwirtschaftlicher Sicht. *Zeitschrift für betriebswirtschaftliche Forschung*, (47) 6, 558-574.

Schmid, B. (1993). Elektronische Märkte. Wirtschaftsinformatik (35) 5, 465-480.

Smith, C.W./Wakeman, L.M. (1985). Determinants of Corporate Leasing Policy. *Journal of Finance* (40), 895-908.

Szyperski, N./Schmitz, P./Kronen, J. (1993). Outsourcing: Profil und Markt einer Dienstleistung für Unternehmen auf dem Wege zur strategischen Zentrierung. *Wirtschaftsinformatik* (35) 3, 228-240.