

Why Standardisation pays off – Cost/Benefit Analysis of the papiNet Project

A Ponton Consulting Report

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Abstract

The simple message is: If you intend to standardise, then standardise *all* aspects of communication. If you do so, it pays off dramatically. If you only go half way, network effects will be spoiled!

We will empirically demonstrate this based on the papiNet project and compare the cost situation with an uncoordinated, bilateral agreement among many different communication partners.

We will use the *Total Cost of Collaboration* (TCC) indicator. The quantification of the overall, sector-wide cost will lead to a reduction of TCC by 66% if 100 participants agree on a shared document, process and communication standard.

In the case of the papiNet project, this reduction is from 19 Mio Euro yearly costs down to less than 7 Mio Euro.

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1 Alternatives of B2B integration

This article reports on network effects in B2B integration. It questions if centralised approaches are always an advantage when the participants can agree on a standardised document format, standardised processes, and standardised communication software.

We learn from different industries that the collaboration between business partners may be based on very different approaches: In some cases, the direct exchange of messages is appropriate while in other cases a central hub, portal or marketplace is preferred. There are many factors that influence the decision how to implement B2B integration in the most cost-efficient and flexible way.

Among the influencing factors are product characteristics, transaction characteristics, and market characteristics: In one industry, intensive cooperation spans from joint product design to fulfilment and support processes. Many industries like automotive or ship building therefore tend to use collaboration portals (e.g. Covisint). In other industries, however, cooperation takes place through the exchange of a limited set of standardised messages that concentrate on very specific transactions like orders, call-offs, deliveries etc.

1.1 Central or Decentral?

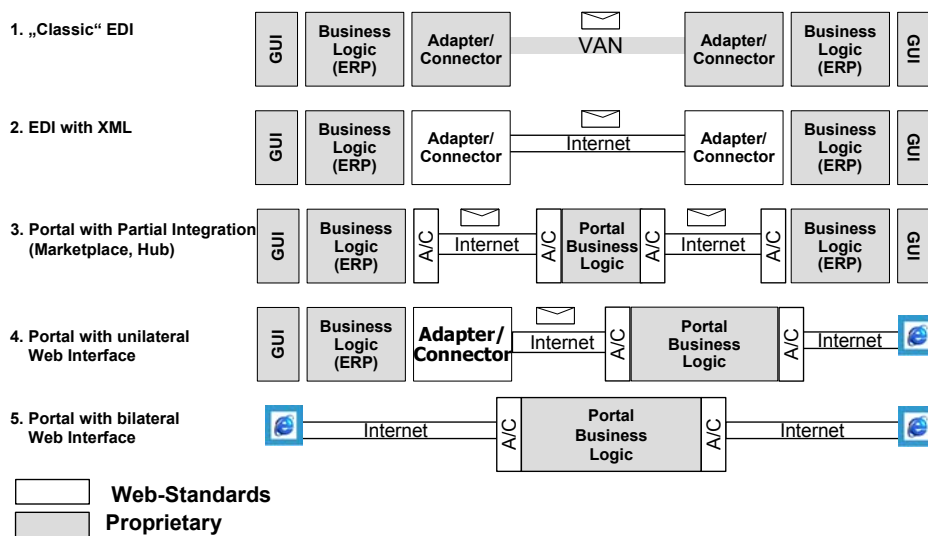


Figure 1: Different Levels of Centralisation for B2B Integration

Figure 1 shows different approaches for the integration of businesses:

1. *“Classic” EDI:* Here, two partners cooperate just by sending EDI messages forth and back. They use a proprietary VAN provider and proprietary adapter components.
2. *EDI based on XML:* Here, standards-based document formats are supported. They are represented as XML documents, and data transfer is organised via standard protocols.
3. *Marketplace, Hub:* This solution centralises the message transfer between two partners. It helps mapping product codes, and provides – if required – additional application functions like an auction module, or a reporting engine.

4. *Portal with unilateral Web interface*: This architecture allows to integrate small partners which use the Web interface for order entry and tracking. The large partner remains integrated using a messaging interface.
5. *Portal with bilateral Web interface*: For SMEs on both sides, this is a suitable solution, since all application logic is centralised inside the portal.

For the following, we assume only large participants on both sides, i.e., the last two approaches are irrelevant. At the same time we will refine the conditions for each of these models:

1.2 Comparison of three models

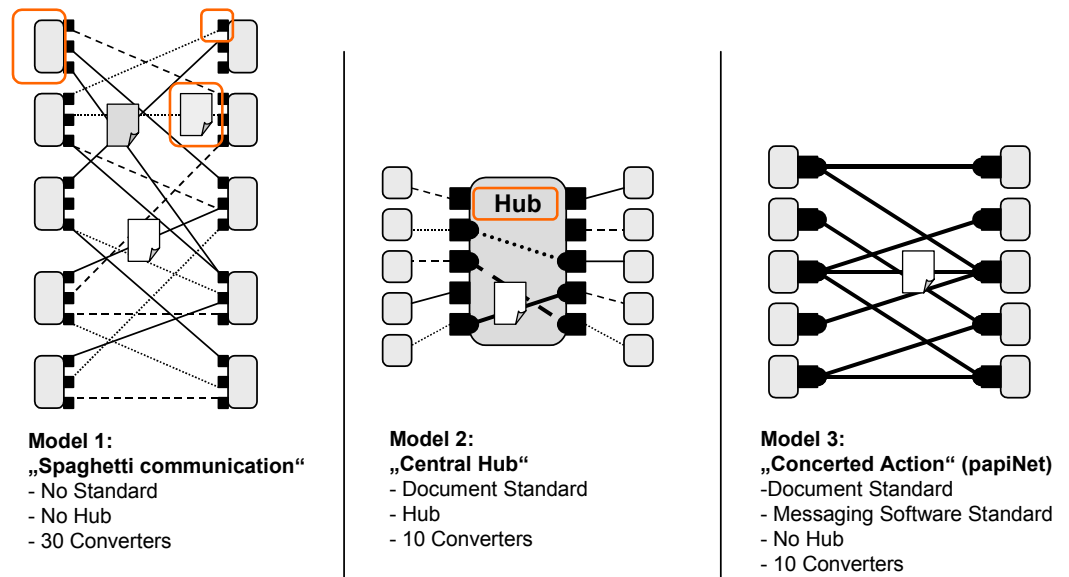


Figure 2: Comparison of three Integration Models

Out of the many possible configurations for B2B integration, we will analyse three:

- **Model 1: „Spaghetti Communication“**. This is the situation that we usually find in many industries. There is neither an agreed format for documents used alongside the supply chain nor a software or protocol agreement. If a document is to be transferred, it needs to be converted from the internal ERP format into the receiver's format on a bilateral basis, since there is no document standard. In the worst case, high agreement overhead is also given for the agreement of processes and business rules – here we find another lack of integration. Finally, the communication takes place across very different software solutions: If the receiver software encounters an error, does the sender understand the error code? Many interoperability gaps need to be bridged – this is a cost intensive process and in many times prohibitive.
- **Model 2: „Central Hub“**. The value proposition of a central hub is in shielding the participant from the heterogeneity of the partners: The protocol “spoken” between the partner and the hub is the partner's proprietary one. It is the hub who maps both documents and protocols to the opposite partners'. Therefore, switching costs for a partner are reduced: Only the one connection to the hub needs to be established. However, internally, many peer-to-peer transformations need to be done, i.e., the effort remains the same although now done by internal staff of the hub provider. Due to the higher internal coherence of the hub provider's software, this effort should be less than if every partner does it locally.

- Model 3: "**Concerted Action**". This model assumes a standardisation of processes, document types and communication software and follows the decentralised peer-to-peer model. For these reasons, the number of converters is the same like in the hub-model, because each partner needs to process only one format, thanks to the standardisation. Also the per-connection effort is minimal since configuration and testing of the communication protocol is not required – all partners use the same software and if this has been configured successfully between two peers, it will also work between others.

Some more background information

- If partners intend to integrate across different software products, interoperability problems usually appear in the following areas as well: Public Key Infrastructure, message envelope formats, envelope semantics (error codes, transaction types, guarantees provided by the receiver, etc.)
- The transformation of documents between two formats is much more complicated in practise than expected: What if the sender's document doesn't provide information that is required by the receiver? Usually, this cannot be created and mixed-in by the hub. Example: The sender doesn't support loading information as a part of a purchase order. This, however, is needed by the receiver to organise an appropriate transport vehicle. This information can only be agreed on by both parties on a bilateral basis, a hub doesn't help very much here...
- If an error occurs while transferring a message, there are three organisations involved the may be responsible for that incident. In practice, complexity is much lower if the two partners communicate directly without an intermediate.
- What if the transferred documents are encrypted? In this case, the hub-side transformation is not possible at all since access to content data elements is not possible.
- Finally, many marketplace participants don't want to disclose the sensitive data that is enclosed in the messages transferred. Quantities, prices, discounts, payment conditions are usually negotiated on an individual basis and no two partners (customer plus supplier) would like to disclose this to the hub operator. However, today most marketplace operators claim for the IPR1 of aggregated information that is derived from the messages.

1.3 Cost drivers

In Figure 2, different cost factors are marked with circles:

1. **Adaptation Costs:** This cost factor can vary very much, it depends on the skills and complexity of each partner's ERP system but also on the complexity of the document formats. Further, it depends on the complexity of processes: E.g., placing and cancelling orders is much simpler than processing order amendments or other flavours of order documents. In practise, adaptation costs are between some person-days and several person months, sometimes even up to the magnitude of a person years. Since adaptation costs depend very much on the individual business and IT infrastructure of

¹ Intellectual Property Rights

each partner, they should be considered as a constant cost factor that cannot be influenced by the chosen B2B integration model.

2. **License costs:** This depends on the complexity and functionality of the B2B messaging software. Depending on the number of installations (and/or licenses) per partner this may vary between 5.000 Euro and 50.000 Euro or more.
3. **Document Type Conversion Costs.** This factor scales with the number of document formats that are to be supported to communicate with business partners. The costs are mainly customisation efforts for the mapping between the internal document format and the "wire format". In practise this effort is ca. 10-20 person days for the agreement of the format, map definition, and testing of the connection.
4. **Connection Set-up Costs.** Independent of the document format is the communication protocol between two partners. If this is not standardised, programming and testing effort is high and always required for each new connection, at least for each new connection that bridges between the own system and a not yet support system on the opposite side. For the following quantification, we assume connection set-up costs at the level of another 10-20 person days.
5. **Third-Party Transaction Costs.** This factor is usually not relevant in the case of peer-to-peer communication via public Internet (at most a few cents per message). Transaction costs therefore only occur in the hub case. We assume that the yearly amount charged by the hub provider is higher than the direct technical integration costs between both sides (in case of a third-party hub, also its profit and marketing effort needs to be covered).
6. **PKI Integration Costs.** Usually, there exists no agreed PKI for a network of trading partners, and even if, third party TrustCenters charge fees for the issued certificates. Apart from this, there exists no harmonised policy for issuing certificates. Also the software integration between EDI and PKI components required high skills. As a worst case, we can assume 20 days for the integration of PKI support per relation and per partner. However, although most industries appreciate authentication and encryption the currently don't use it due to prohibitive integration costs. For this reason, we do not include this factor in the calculation.

It should also be kept in mind that the activities behind these tasks include overheads like meetings, travelling and administration.

2 About papiNet

PapiNet is a vertical document standard jointly developed by the European and North American paper industry plus a messaging software that unifies the communication infrastructure. More information on the papiNet project can be obtained from www.papinet.org and www.ponton-consulting.de/papinet. Specifically the papiNet standard 1.0 can be downloaded from this site as a PDF documents.

The papiNet project started in early 2000. Before, there was an EDI standard called EDIPAP which was agreed over many years but not supported by an significant share of the users. The main reason quoted was that despite of the availability of a "standard", only very few IT and business people understood how to support it technically. Specifically the heterogeneous setting of EDI software products lead to a very complex process when two partners tried to integrate their systems. Moreover, business processes and rules where not enough synchronised.

Thus, papiNet lead to a first European phase and later to the joint standardisation of documents driven by EPC (European Paper Consortium), AF & PA (American Forest and Paper Association) and GCA (Graphics and Communication Association).

papiNet Business Policies

While the document standard was jointly developed by paper suppliers and their customers, software development was initially sponsored by a group of seven paper suppliers. The consortium of customers and suppliers agreed on the following policies:

- Use a common XML Schema as the standard for documents.
- Agree on business processes and rules that will be documented as well.
- Develop a common B2B Software that can be given away to customers without licence costs.
- Agree on a roadmap for the development and rollout of the software.
- Provide an opportunity for other paper suppliers to join the team.

As far as the software is concerned, some conditions had to apply in order to foster its proliferation and shared use:

- It must be portable regarding hardware, operating system & ERP platforms. The resulting software is therefore based on Java and runs on all 100% pure Java platforms.
- The software should not impose any license costs. This was solved by using open source components and software packages that can be given away to others without restriction.
- The solution should not impose 3rd-party transaction costs. This is indeed close to zero since communication takes place directly between the two parties via Internet.
- The software must be kept simple. This is for two reasons: First, it should be easy to install and, second, it concentrates on the communication of messages as the common denominator between two partners. If the software would also cover ERP integration it would penetrate individual policies and configurations too far. Therefore, it was decided to concentrate on the main issues of interoperability.
- Finally, the software should support secure communication, i.e., encryption and authentication. This was developed as built-in services such that ena-

bling these features can be done with very low additional effort: only a certificate must be requested which can be done automatically out of the software.

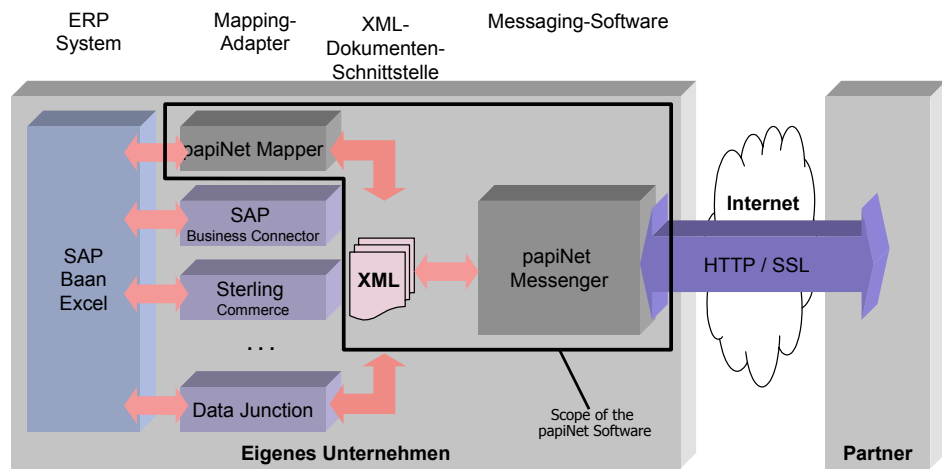


Figure 3: Modules of the papiNet Messenger Software

3 Cost/Benefit analysis for papiNet

In the following, we would like to analyse the Total Cost of Collaboration for papiNet compared with an uncoordinated approach based on "spaghetti communication". We will first quantify the different cost factors and define a scenario that reflects costs and quantities from the papiNet project background.

Thereafter, we will determine the overall sector-wide yearly TCC for both the papiNet and the "spaghetti" scenario and compare these situations.

Finally, main cost drivers will be identified out based on a sensitivity analysis.

3.1 Assumptions

For the European market we restrict ourselves to the following number of participants:

- 25 paper manufacturers are assumed for the supplier side, and
- 75 publishers, large printers and paper consumers for the customer side.
- We assume that these 100 companies are large ones with 5.000+ employees. They exchange 500+ messages per day with a yearly turnover of at least ca. 1 Billion Euro. We also assume, that in this setting investments in software and services are significantly high, also for B2B integration.²
- We assume 30 connections for each supplier and 10 connections for each customer.
- Further, we assume average adaptation costs of 30 man days. As stated before, this is an average value since this cost varies between a few weeks and several person-years. We assume daily rates at 1.000 Euro and three years depreciation. This results in yearly costs of 10.000 Euro per partner.
- Finally, we assume a daily rate of 1.000 Euro for IT services (integration, mapping, testing, programming etc.). depending on the system, customer, region and service provider this may deviate in both directions, however, since this rate is assumed across all cost components, it does not influence the cost ratio between the two scenarios compared further down.

These figures do not depend on the two scenarios, they are therefore assumed as constants.

3.2 Total Costs of Collaboration, sector-wide

3.2.1 "Spaghetti communication"

Step 1: Weighting the Cost factors

- **Adaptation costs** are already defined (10 Keuro p.a.).
- We assume that the **license costs** are 10 KEuro per company. This includes investment in B2B communication software, database software etc. We also assume that the yearly depreciation at the level of 3.3 KEuro.
- Additionally, we face yearly **software maintenance costs** which are assumed as 10 person-days, i.e. 10 KEuro for each partner.

² In a follow-up paper, we may calculate this for the cost constellation of SMEs.

- **Document type conversion costs.** Here we assume on average 5 document types per participant. I.e., out of the 30 business partners of each suppliers, 6 share the same type while from a customer's point of view, two suppliers share the same type (on average). This addresses the fact that usually there are certain "islands" of partners that agreed on a subset of a type. However, it is also a very conservative assumption. We further assume mapping and testing costs of 10 person-days per document type, i.e. 50 KEuro. Since we assume that the "lifetime" of a mapping is 3 years, the yearly depreciation of this investment is 16,6 KEuro.
- **Connection Setup Costs.** For protocol agreement, firewall configuration, mapping of envelopes and error codes, harmonizing the PKI infrastructure and the involved overhead for meetings, travels, and administration, we assume an effort of 30 person-days per partner. If the "lifetime" of such a connection is also 3 years, the yearly costs are 10 KEuro per connection and partner.

Step two: Deriving the TCC per partner

Out of the previous figures we can derive the Total Cost of Collaboration per participant:

For an individual **supplier**, the calculation looks like the following (yearly costs in KEuro):

Table 1: TCC for each Supplier (in 1.000 Euro)

Category	Amount	Comments
Adaptation costs	10.000	Fixed for all participants
License costs	3.300	
Software maintenance	10.000	
Document type conversion	16.600	
Connection Setup costs	300.000	For each supplier we assume 30 customers, i.e. 30 x 10 KEuro
Total	340.000	

For a **customer**, the calculation looks correspondingly:

Table 2: TCC for each Customer (in 1.000 Euro)

Category	Amount	Comments
Adaptation costs	10.000	Fixed for all participants
License costs	3.300	
Software maintenance	10.000	
Document type conversion	16.600	
Connection Setup costs	100.000	For each customer we assume 10 suppliers, i.e. 10 x 10 KEuro
Total	140.000	

Step 3: Sector-wide calculation of TCC

Since we assume 25 suppliers and 75 customers the calculation goes:

25 suppliers á 340 KEuro:	8,5 Mio Euro
75 customers á 140 Keuro:	10,5 Mio Euro
Total sector-wide TCC:	19 Mio Euro

This is on average 190.000 Euro per partner

→ Compare appendix I for the supporting spreadsheet.

3.2.2 papiNet approach

Now we follow the papiNet model, i.e., we assume a standardisation of document formats, communication software, and processes. This will lead to a drastic reduction of the document type conversion costs and connection setup costs. To determine the sector-wide total TCC, we follow the three steps again:

Step 1: Weighting the Cost factors

- **Adaptation costs** are already defined (10 KEuro p.a.).
- The papiNet **license costs** is calculated differently. Here, the software was developed from scratch and the paper industry acquired a world-wide license that also covers the customer side. Here the yearly depreciation plus additional development is assumed as 150 KEuro per year. This is very low since it only covers the additional development on top of open source components. Moreover, costs are only shared among the suppliers such that the license costs are zero for the customers. Therefore, the yearly per-supplier costs are 6 KEuro.
- The **yearly maintenance costs** including further software development comprise a fixed rate of 386 KEuro which is shared among the suppliers plus management efforts for additional developments of 35 person days per year.
- **Document type conversion costs.** Since papiNet uses only one document type, only one mapping needs to be done. This is 10 KEuro per partner, i.e., 3.3 KEuro per year (3 years depreciation time).
- **Connection Setup Costs.** Since the same software is used by each partner, connection testing is very much simplified. Envelope processing is the same on each side, and also the guarantee of correct document reception (verification of signature, decompression, decryption, archiving, logging, document visualisation through stylesheets etc.) is done exactly in the same way. The only per-connection costs that remain are firewall configuration, setup of a partner description information, and mapping of individual product codes. This total effort is quantified as 10 person days per connection.

Step two: Deriving the TCC per partner

Out of the previous figures we can derive the Total Cost of Collaboration per participant:

For an individual **supplier**, the calculation looks like the following (yearly costs in KEuro):

Table 3: TCC for each Supplier

Category	Amount	Comments
Adaptation costs	10.000	Fixed for all participants
License costs	6.000	6 KEuro per supplier
Software maintenance	16.800	This is (384 + 35) / 25 per supplier
Document type conversion	3.300	Only one type to be supported
Connection Setup costs	100.000	Only 10 days per connection (3 years depreciation), 30 connections: 3.333 x 30 Keuro
Total	136.372	

For a **customer**, the calculation looks correspondingly:

Table 4: TCC for each Customer

Category	Amount	Comments
Adaptation costs	10.000	Fixed for all participants
License costs	0	Due to the papiNet business model
Software maintenance	0	Due to the papiNet business model
Document type conversion	3.300	Only one type to be supported
Connection Setup costs	33.300	Only 10 days per connection (3 years depreciation), 10 connections: 3.333 x 10
Total	46.600	

Step 3: Sector-wide calculation of TCC

Again, we assume 25 supplier and 75 customers. Therefore the calculation is:

25 suppliers á 136.372 Euro: 3,4 Mio Euro

75 customers á 46.600 Euro: 3,5 Mio Euro

Total sector-wide TCC: 6,9 Mio Euro

This is on average 69.000 Euro per partner, please also compare appendix II for the supporting spreadsheet.

3.2.3 Findings

Obviously, the papiNet model of sponsored software development in connection with a radical standardisation pays off compared with the uncoordinated peer-to-peer collaboration.

It also proves that the value proposition of a hub provider is questionable: Using a central hub is obviously not the only way to reduce TCC.

Empiric figures support the previous model calculation:

Those who started early with papiNet rollout, report that only mapping and connection setup costs are faces for the second, third etc. business partner.

3.2.4 Sensitivity analysis

Now the models should be tested against some variations in their parameters:

1. Lower the number of participants and their connections

The following table shows the effects of changing the number of participants:

Table 5: Sensitivity Analysis for a varied number of participants (all figures in Euro, PN: papiNet model / SC: "spaghetti communication")

# Suppl.	# Cust.	TCC per Suppl. (PN/SC)	TCC per Cust. (PN/SC)	TCC per Sector (PN/SC)	Comments
25	75	136.000 / 340.000	46.600 / 140.000	6.900.000 / 19.000.000	Calculation from above as a reference
12,5	37,5	109.000 / 190.000	30.000 / 90.000	2.488.000 / 5.750.000	50 % of the partners on each side, 50% of connection per partner
8	24	114.000 / 130.000	23.300 / 70.000	1.478.000 / 2.720.000	9 connections per supplier, 3 connections per customer
5	15	147.000 / 100.000	20.000 / 60.000	1.038.000 / 1.400.000	6 connections per supplier, 2 connections per customer
50	150	225.000 / 640.000	80.000 / 240.000	23.238.000 / 68.000.000	200% of the customers and supplier
250	750	1.015.000 / 3.040.000	347.000 / 1.040.000	513.900.000 / 1.540.000.000	1000% of the customers and suppliers. This extreme calculation is used to nearly eliminate the share of fixed cost components

From reducing the numbers of participants and connections it can be derived that TCC decrease for the customers but for suppliers they decrease first down to the 8/24 calculation above and with a further reduction of partners they increase again. The reason is the high impact of network effects that are not significant any more below the 8/24 calculation. Instead the increasing cost share for the development overcompensates the costs for the reduced number of connections.

This shows that the critical mass is reached with a community of ca. 8/24 participants.

If we scale up the number of participants and connections by a factor of 10, it becomes visible that the mapping and connection setup costs helps reducing the overall TCC by exactly the 2/3. The driver is here the relation ship of 10 person days compared with 30 person days for each connection set-up.

2. Raise the fixed cost block for software development & maintenance

Now we assume that for the integration of a larger group of participants, an extension of the papiNet software is required (mapper tools, orchestration support, ebXML support etc.). We will increasingly raise the software investment (only the papiNet model is considered):

Table 6: Sensitivity Analysis for Changing the Fixed Cost Block (in Euro)

Yearly license & maintenance costs	Investment share per supplier	TCC per supplier	TCC all suppliers	TCC suppliers and customers	Comments
571.000	22.800	136.000	3.404.000	6.904.000	Calculation from above as a reference
1,142	45,700	159.000	3.975.000	7.475.000	Costs are doubled
2,284	91,400	204.700	5.117.000	8.617.000	Costs are x 4

Compared with the license costs of the spaghetti model (340 KEuro per supplier), the TCC are still significantly lower even at four times higher yearly fixed costs.

3. Lower the licence costs for the non-papiNet model

Vice versa, we may reduce the license costs for the non-papiNet model:

Table 7: Sensitivity Analysis for Changing the License Costs (in Euro)

Yearly license & maintenance costs	Investment share per supplier	TCC per supplier	TCC all suppliers	TCC suppliers and customers	Comments
3.300	13.333	340.000	8.500.000	19.000.000	Calculation from above as a reference
666,7	6.700	333.300	8.333.000	18.333.000	Costs are doubled
0	0	326.700	8.167.000	17.667.000	Costs are zero

This calculation supports the idea that software and maintenance costs are not significant – even if these are reduced to zero, the TCCs do not change significantly.

4. Analyse the penetration of the sector with additional software or document standards

Let's assume that some participants follow the papiNet standard (software & documents) and other define their own system. This can be compared with having 2,3 or 4 "islands" of standards in parallel. Therefore, we can re-use the first analysis above ("lower the number of participants") and multiply the per-partner costs with the number of standards.

Let's first assume that there are two standard in parallel, and afterward we assume three. For this reason, we recalculate the situation for 50 and 32 participants:

Table 8: Sensitivity Analysis for the Co-existence of multiple Standards

# Suppl.	# Cust.	TCC per Suppl. (PN/SC)	TCC per Cust. (PN/SC)	TCC per Sector (PN/SC)	Comments
12,5	37,5	109 / 190	30 / 90	2.488 / 5.750	50 % of the partners on each side, 50% of connection per partner
8	24	114 / 130	23.3 / 70	1.478 / 2.720	9 connections per supplier, 3 connections per customer

For the first case, we assume two parallel standards with sector-wide TCC of 2.488 KEuro for 100 participants, this gives ca. 5 Mio Euro. But we did not take into account the "cross-linking" of connections between these two worlds. Based on the current model, we face

$$(12,5 \times 15 + 37,5 \times 5) \times 2 \text{ connections, giving 1.125 connections.}$$

In the standard case (25/75), we find, however $25 \times 30 + 75 \times 10 = 1.500$ connections.

For the remaining 375 connections we assume yearly per-connection costs of 10 KEuro. This is 50% of the mapping & connection costs of the spaghetti model. In total this is

$$375 \times 10 = 3.750 \text{ KEuro}$$

The sector-wide TCC is therefore for the 2-standards model:

$$2.488 \times 2 + 3.750 = 8.726 \text{ KEuro}$$

Compared with the standard model (sector TCC = 6,9 Meuro), this is 1,8 Meuro higher. But still much lower than the 19 MEuro for the spaghetti model.

If we assume roughly 3 parallel standards (8 suppliers & 24 customers per standard), the calculation goes:

Sector TCC per standard is 1.478

Number of connections per standard is $8 \times 9 + 24 \times 3 = 145$, and the total number of connections is $145 \times 3 = 435$

The remaining number of cross-standard connections is therefore:

$$1.500 - 435 = 1.065$$

Again, we weight each of these connections with 10 KEuro giving 10.650 KEuro and sector-wide TCC of

$$1.478 \times 3 + 10.650 = 15.084 \text{ KEuro}$$

The message behind this figures is the same that we found out when we reduced the participants and connections. Now, TCC of 15 Mio is not much lower than the 19 Mio of the spaghetti model. Therefore, the important, yet anticipated message is that two standards are tolerable from a cost point of view, but three are already critical.

If we would calculate this for four standards, the sector TCC would be even higher than in the spaghetti model!

5. Does the papiNet model even pay-off if other B2B messaging systems are pre-installed at some of the participants?

There is another interesting question – not so much for the papiNet community but for other sectors: What if all participants have already invested in B2B integration infrastructure and are willing to standardise and integrate following the papiNet model? Does this pay off?

The answer is “yes”. This calculation is similar to Item 2 above (“Raise fixed cost block”). Even if we consider historic investments as “sunk costs” and assume that they are 3 times higher than the papiNet fixed cost block, the sector TCC is still 8.617 KEuro! This is less than 50% compared with the spaghetti model.

3.2.5 Some considerations from a participant’s perspective

Why does it make sense to follow the papiNet approach, even if there is a messaging software of vendor X already installed?

Let’s assume that a participant already runs the “XYZ Adapter” from a third party vendor but supports the papiNet data format. The participant has now two options:

1. Integrate the papiNet Messenger locally and support the papiNet protocol across the network. Here, installation & configuration cost are for papiNet ca. 1 person day. Further, the adaptation cost will be lower than 30 man days, since it is not an ERP integration but the transfer of XML messages forth and back to the papiNet Messenger. Depending on skills and technology, this may be 10-20 person days (conservative assumption).
2. The participant insists on using the own protocol across the Internet. Here, protocol mapping is required to exchange messages with other participants. While the adaptation costs are close to zero, the mapping, integration and testing costs are, however, higher. Here, we can assume 10-20 person days per connection. (Not included is the harmonisation of PKI components like signatures, certificates, encryption and compression algorithms). This integration will just be a simple FTP or HTTP delivery of documents.

As a conclusion, the decision to use the own messaging software doesn’t save costs but increases complexity as well as the number of formats & protocols. It reduces the overall level of functions as well that are built-in with the messaging software.

Specifically this decision creates obstacles for other partners who follow the standard approach.

4 Conclusions and further options for the development

First of all, the previous analysis simply states that standardisation pays off because of network effects.

Second, it depends on the share of software development & license costs in the sector TCC if the concerted action model has an advantage compared with a third party product approach. In the case of papiNet, this share is ca. 12-15%. If the license cost share increases up to 25% in practice (e.g., if a hub or "marketplace" is to be set-up), the centralised model is more expensive than the decentralised one.

On the other hand, if we zoom out of a single sector and consider the industry as such, we can expect for the next years that free software will be available for many of the purposes discussed. This would reduce the papiNet TCC by ca. another 350 KEuro per year (ca. development costs and 50% of the help desk costs).

This finding is also supported by the companion paper on the economies of open source [Merz01]. For the future, we should therefore pool efforts for the development of horizontal software such that the giving and taking across sectors can further reduce the TCC.

Appendix I – Calculation for the “Spaghetti Model”

1.a) papiNet Investment	Assumption	A	B	C	per			
		2000	2001	2002+	CurrSup	PotSup	CurrCust	PotCust
1.b) 3rd-party product Costs								
webMethods/BizTalk/Seeburger/DataJunction Avg. In Keruo	10		p.a. (3 y depr.	3	3,333		3,333	
Yearly mainenance costs:				10	10,000		10,000	
Total Investment (all participants)				1333,333	13,333		13,333	
2. Mapping Costs								
Formats to be supported by partner (avg)	5							
Effort per format (man-days)	10							
Costs	10		p.a. (3 y depr.	3,333	16,667		16,667	
3. Costs for B2B-enabling a participant								
Training, ERP-IO, Configuration, ERP extension Avg. Per Partner	30		p.a. (3 y depr.	10,000	10,000		10,000	
Total (all participants)				1000,000	10,000		10,000	
4.a) Costs for integrating with non-papiNet user								
Meetings, Programming, Conversion, Configuration, Testing Avg.: 30 man days á 1 Keuro	30		p.a. (3 y depr.	10	300,000		100,000	
4.b) Costs for Integration with papiNet user								
Product code mapping, firewall conf Avg.: 5 man days á 1 Keuro								
				Total for all connections	300,000		100,000	
				Total per partner	340,000		140,000	

Participants

Current Number of Suppliers	25				
		Total Industry	8.500,000	10.500,000	Cust&Supp
Current Number of Customers	75				
Avg. Number of connections per Supplier	30				
Avg. Number of connections per Customer	10				

Appendix II – Calculation for the papiNet Model

Cost/Benefit analysis with papiNet
All figures in Keuro

1.a) papiNet Investment & operating costs	Assumption	A	B	C	per CurrSup	CurrCust
		2000	2001	2002+		
papiNet investment (add. Software Development)		250,000	150,000	150,000	6,000	0,000
papiNet operating costs (18 man-moths HelpDesk)		128,000	386,000	386,000	15,440	0,000
Controlling papiNet Software development		105,000	35,000	35,000	1,400	0,000
Persons involved	7					
Avg. Man-days per person	10					
Avg. Daily costs per man-day (KEuro)	1,5					
1.b) 3rd-party product Investment & operating costs						
Total (all participants)				571,000	22,840	0,000
2. Mapping Costs						
Formats to be supported by partner (avg)	1					
Effort per format (man-days)	10					
Costs	10		p.a. (3 y depr.	3,333	3,333	3,333
3. Costs for B2B-enabling a participant						
Training, ERP-IO, Configuration, ERP extension						
Avg. Per Partner	30 p.a. (3 y depr.		10,000		10,000	10,000
Total (all participants)				1000,000	10,000	10,000
4.a) Costs for Integrating with non-papiNet user						
Meetings, Programming, Conversion, Configuration, Testing						
Avg.: 30 man days á 1 Keuro						
4.b) Costs for Integration with papiNet user						
Product code mapping, firewall conf						
Avg.: 5 man days á 1 Keuro	10		p.a. (3 y depr.	3,333		
			Total for all connections		100,000	33,333
				Total per partner	136,173	46,667

Participants

Current Number of Suppliers	25	Total Industry	3.404,333	3.500,000	Cust&Supp
Current Number of Customers	75				
Avg. Number of connections per Supplier	30				
Avg. Number of connections per Customer	10				