Integrate Your Partners with Interactive Forms
Automated Processing of Purchase Order Confirmations Using SAP Interactive Forms by Adobe

Bernhard Schindlbeck, Peter Kleinschmidt

4process AG, Passau, Germany
{bernhard.schindlbeck,peter.kleinschmidt}@4process.de

Abstract. Connecting to business partners electronically is one of the most important information technology management issues. Interactive forms enable companies to automate processes with their vendors and customers. In comparison to well discussed technologies like electronic data interchange (EDI) or online portals, interactive forms are hardly considered in the literature as an alternative business-to-business (B2B) technology. In this paper, we discuss the advantages of interactive forms and present a real-life scenario in which they are used to integrate suppliers. In our case, an automotive industry company uses SAP Interactive Forms by Adobe to process purchase order confirmations in its SAP system. Based on an empirical study, we developed a comparison scheme for B2B technologies. Interactive forms turned out to be the best technology to support the purchase order confirmation process. We describe the process flow and the implementation of the prototype. Subsequently, we present the results of a feedback round with the process owners of the company which was carried out nine months after the introduction of the new procedure with interactive forms. These results include an analysis of the extent of use as well as some suggestions for the improvement of the solution. Based on those findings we discuss useful enhancements for the application to meet the adapted requirements and to accelerate technology adoption.

Keywords: Interactive Forms · SAP Interactive Forms by Adobe · Business-to-Business · Integration · Purchase Order Confirmation · Purchasing Scenario · Process Automization · Procurement

1 Introduction

For some time, companies have been using information technologies (IT) like EDI or online portals to support the data exchange between their business partners and themselves [1,2]. The benefit of using IT in B2B is confirmed by many studies. Therefore, IT e.g. improve collaboration between firms [3], inventory turnover and delivery performance [4] or performance indicators of the supply chain like time, costs, quality and flexibility [5]. In spite of these positive impacts, many companies are still focusing on the integration of a small part of their partners. Instead, the focus could be on

achieving a high technological diffusion to support the data exchange with as many of them as possible [6]. Hence there is still room for new technologies which are able to automate the data transfer between firms and which enable companies to integrate more of their partners.

One of the technologies of interest here are interactive forms. Unlike EDI or online portals, interactive forms are seldom found to be discussed as a technology to support B2B processes in the scientific literature. In this paper, interactive forms are defined as electronic forms which can be generated from an enterprise application – such as enterprise resource planning (ERP) or customer relationship management (CRM) – enriched with application-specific data. The form can be sent by e-mail to an external recipient, who completes it with the requested data by using a free of charge software and sends the form back to the application where the data entered are extracted and processed automatically. Further processes might be initiated in addition.

This article presents a real-life scenario in which interactive forms are used to automate the recording of purchase order (PO) confirmations in the ERP system of an automotive industry company. The scenario was implemented as a prototype and as part of the doctoral dissertation of the first author [6]. In May 2015, nine months after the production start (September 2014), we organized a feedback round with the process owners of the purchasing department. In this paper, we are therefore able to discuss the following

- how the technology was established after that amount of time,
- what lessons can be learned after nine months of operational use and
- which improvements were suggested by the main actors in order to accelerate technology adoption.

2 Initial Situation

The scenario was implemented for the company HEYCO-WERK Heynen GmbH & Co. KG (http://www.heyco.de/). The enterprise was founded in 1937 and employs about 900 people at production sites in Germany, Ireland and the Czech Republic. HEYCO is a supplier for the automotive industry. The company produces hand tools, plastic parts and forgings. Within the manufacturing process, many components are needed from various vendors at home and abroad. Furthermore goods for maintenance, repair and operations (MRO) are purchased from different suppliers. Some of the most important vendors are integrated by EDI solutions, but PO confirmations for delivery dates and quantities are not processed automatically yet. All in all, the data transfer by EDI is only supported by less than 2% of all current suppliers. Because of that situation, a solution for a more efficient handling of confirmed delivery dates and quantities in the ERP system was needed.

Figure 1 shows the different steps of the PO confirmation process in its original version before interactive forms were used.
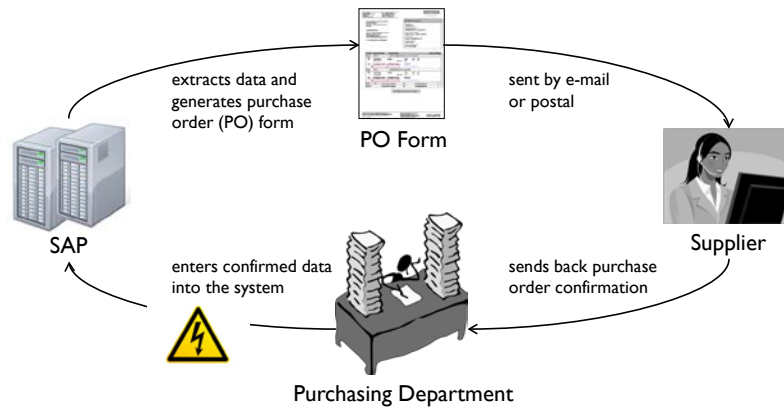
Fig. 1. Original process for purchase order confirmation

The process starts with the purchaser entering a PO in the ERP system. HEYCO uses SAP ERP. When creating the PO, the purchaser determines the vendor and enters the articles and their requested quantities and delivery dates. After saving the PO, the system generates the PO form as a PDF document which is sent to the supplier where the sales clerk in charge checks the availability of the requested articles. Depending on the ATP (available-to-promise) situation he confirms or changes the quantities and delivery dates. Then he sends back a PO confirmation document by surface mail or e-mail. Subsequently, the purchaser has to find the corresponding PO in the SAP system and enters the confirmed data (quantities, delivery dates and the PO confirmation number of the vendor) for each PO item. From this moment, the material resource planning (MRP) module in SAP uses the confirmed data for its computations, not the requested delivery dates and quantities. This change makes it a critical moment for MRP. As a last step, the purchaser archives the PO confirmation document for controlling purposes.

The expenditure of time for entering a confirmation for one PO item amounted to 150 seconds on the average. Based on over 12,000 PO confirmations entered in 2012, more than 500 hours of work could have been saved per year by automating this process.

3 Selection of the Technology

The first step to be taken was to choose a suitable technology to support the process with as many vendors as possible. We considered three types of solutions for automating the scenario described. These can be categorized as one-to-one and one-to-many technologies [7] as well as interactive forms.

3.1 One-to-One

One-to-one includes technologies which are used to integrate each partner individually. These connections are characterized by a mutual exchange of information and efficiency gains for both sides. It is a significant drawback that establishing these connections requires specific investments for each partner. A typical example for one-to-one is the automated exchange of business documents between the ERP systems of two partners processing EDI or XML (extensible markup language) messages [8].

3.2 One-to-Many

One-to-many technologies enable companies to integrate their partners in a flexible way, without extensive coordination. These can be implemented by portals [9], online platforms or e-marketplaces [10] which are integrated with the ERP system of the enterprise. However, these technologies usually force the interacting partner to enter the required data into a web form manually. Efficiency gains due to the elimination of a media break are therefore mostly on the side of the company which has implemented the technology.

3.3 Interactive Forms

Interactive forms are electronic forms generated from an enterprise application [11]. They do not only contain application specific data, but also interactive elements like input fields or dropdown lists. Users can enter data into the form and save them in a structured way (mostly technically in XML structures). Because of the structured storage of information, it is possible to extract the data entered and automatically process them in the source application to eliminate media breaks and initiate further processes. Furthermore interactive forms can be dynamic, which means that they can change their layout depending on user actions. So it is e.g. possible to provide a user-friendly form. Certain areas are hidden and only shown if the user needs them because of his inputs. Embedded scripting allows reactions to user actions like warning or error messages as well as calculations of key figures, which are based on the values entered. Examples for providers of interactive forms are Adobe with its product Adobe Interactive Forms or LUCOM with the application FormsForWeb.

One may argue that interactive forms belong to the category one-to-many. Indeed they share a number of characteristics. Just as one-to-many, interactive forms integrate partners in a flexible way without any individual implementation effort. Moreover, the media break in the process is only eliminated on the side of the company that generates the form and processes it in its ERP after it was completed. Therefore efficiency gains are one-sided as well. After a detailed analysis, however, it seems justified to consider interactive forms as a category of its own with some unique and relevant characteristics. One of these is the offline capability of interactive forms. In contrast to web forms, which are used in typical one-to-many scenarios, there is no need for a connection to the internet when completing an interactive form. Usually all data and scripting are embedded in the form, so no external data sources are needed

during the completion. The offline capability enables users to fill out the form even if they have no access to the internet. So in this point they work like paper documents. Offline capability generally goes hand in hand with the possibility of saving intermediate results and of printing the form. So users can interrupt the entering of data, save the form and complete it later. They can also retain a copy for their own controlling purposes, also as a paper based version. These characteristics make interactive forms more similar to paper documents. Hence, interactive forms have advantages in converting paper based scenarios to electronic processes. Furthermore, in the case of SAP interactive Forms by Adobe, most users are well acquainted with Adobe Forms via other environments.

3.4 Comparison of the Technologies

We go on to describe the reasons for our decision to use interactive forms for the automation of the process presented. We set out to find the most suitable technology by comparing the three categories described above with respect to the requirements of the purchase department of HEYCO. Relevant entry barriers for one-to-one and one-to-many technologies had been identified before by an empirical study with 95 German companies of the manufacturing industry by the first author [6]. Based on the most important barriers determined in the study and the characteristics of the technologies, a comparison scheme was developed consisting of six indicators:

- *Evaluation of Return on Investment (ROI)*
- *Process Know-how and User Acceptance*
- *Flexibility*
- *Partner Acceptance*
- *Possible Level of Automation*
- *Possible Functional Scope*

We proceed to describe the six characteristics in detail.
Project managers are used to having to fight to receive the budget for the implementation of a technology, and they always need to be able to point out very clearly in which way the new solution generates significant benefits for the company. Depending on the technology, it may be more or less difficult to calculate the ROI. In general, one-to-one technologies are used to support one specific process. For example, enterprises electronically exchange orders with their partners using EDI. In this case, it is comparatively easy to determine the costs for the implementation and benefits due to efficiency and quality gains because orders do not have to be manually entered in the system anymore. Like one-to-one, interactive forms usually support a single process and can be evaluated well. In contrast, one-to-many technologies like online platforms or portals frequently provide a wider range of functionalities. They are implemented not just to simplify one process, but to support a wide range of scenarios which lead to more extensive projects. These make it more difficult to estimate all costs and benefits and to break them down to the supported processes. Consequently, it can be stat-

ed that, regarding the indicator *Evaluation of ROI,* one-to-one and interactive forms have advantages over one-to-many technologies.

The use of technologies in B2B often leads to significant changes in the process. Taking the example from before, in which orders are exchanged by EDI, we have a fundamental modification of the original process. In our example, the purchaser created the PO in the system, printed it and sent it to the vendor. With the EDI solution, after entering the PO, a sales order is automatically created in the system of the vendor. The former PO form is obsolete. In addition, one-to-many solutions often replace paper based or electronic forms by web forms. Users need to be trained in the new process and might refuse the technology due to the changes in the process flow. Interactive forms, though, mostly do not touch the actual process and are similar to paper documents, because of their offline ability. Thus interactive forms do not require much training and are likely to be more accepted by the users than other B2B technologies.

Flexibility describes how easily a new partner can be integrated by the solution. The integration of a partner with one-to-one technologies requires individual coordination. Because of the mutual interaction, data structures have to be mapped, interfaces must be implemented, and communication channels for the data exchange have to be established. Therefore, previous investments are lost (sunk costs) when the transaction is not executed any more. An implementation only makes sense if a high volume of data is exchanged between partners and if the business relationship is stable. So one-to-one is preferred for strategic partners. To participate in a one-to-many solution, it is usually sufficient to log on to an online platform with a provided user name and password. With interactive forms, it is even more easy. Everybody who receives and completes a form can take part in the process.

There are (at least) two sides in B2B and it is very important that the partner is willing to take part in the process. Dealing with one-to-one technologies, he faces the same challenges as the company itself. So only important partners with a high volume of data exchange will accept the specific investments to establish a one-to-one connection. One-to-many technologies, on the other hand, only eliminate media breaks on the side of the implementing company. Hence it may cause even higher demands on the partners in a process supported by one-to-many, because they have to enter data into a web form manually. Like one-to-many, interactive forms only avoid media breaks for the company which generates and processes it. But because of their offline ability, they have some advantages compared to web forms (one-to-many). The partner can keep a copy of the form for his own controlling purposes. He does not have to enter all the data in one step, but he can save intermediate versions and complete the form later. What is more, he does not need to log on to a platform. He can provide data as soon as he has received the interactive form e.g. by e-mail.

The highest *Level of Automation* can be achieved by one-to-one. Only if the systems of both transaction partners are integrated, a free-of-media-break data exchange is possible. On the other hand, one-to-many technologies have limited capabilities to automate processes, because data processing is only automated on one side. But at least, it is possible for the user to execute more than one process step when using a web form. Web forms usually are connected to a database, therefore information en-

tered could be handled immediately in the backend systems and further steps could be initiated based on the input. Interactive forms perform rather weakly in this matter. Due to their offline ability, all the information which is needed during the data entry, like data for validation or different layouts and data screens, has to be stored in the electronic document. Of course, a document can never compete against a database in that respect.

By *Functional Scope*, we describe the range of different functionalities offered by a technology to support the interaction between companies. One-to-one technologies are powerful in automating on both sides. So they are able to optimize process flows across companies, but their functions are generally limited to the transfer of data. Limited resources due to the offline capability force developers to keep interactive forms simple. They are mostly used as data collectors with basic functions like validations or the ability to change their layout. One-to-many is most powerful in this category. These technologies run on servers and are connected to databases, so they have access to almost unlimited resources. Besides plain entry masks for data collection, nearly every type of application could be developed based on these platforms. This includes the integration of media files, data sharing, collaboration rooms and much more.

Based on the explanations above, we visualize the evaluation of the three technology categories as network diagrams in figure 2 and 3. Before we explain why we have chosen interactive forms as solution, we want to specify the requirements of HEYCO on the software:

- To get the budget for the implementation, it was important that the necessary investments could be justified. Therefore a qualified calculation of the ROI was demanded.
- Purchasers should be able to use the technology without intensive training. The new process has to be as similar as possible to the old one.
- It must be possible to integrate nearly every partner. Even B- and C-partners with low data exchange volume have to be considered.

In a first step, we excluded one-to-one as a solution worth considering. As explained above and visualized in figure 2, one-to-one is not suitable to integrate B- and C-partners because of its missing flexibility. The required individual coordination with each partner is only profitable if a high volume of data is exchanged. Businesses of minor relevance will not agree to make the specific investments.
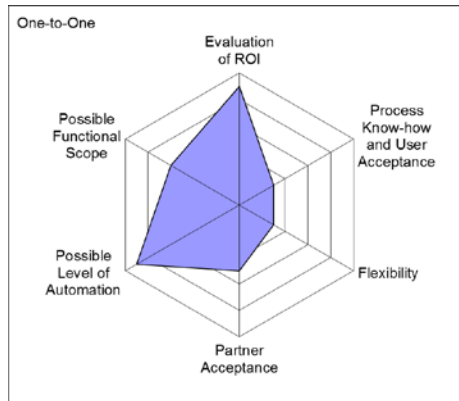
Fig. 2. Evaluation of one-to-one technologies

As figure 3 shows, one-to-many as well as interactive forms are proper technologies for integrating all types of partners due to their advantages in *Flexibility* and *Partner Acceptance*. Indeed, a portal solution as well as interactive forms were shortlisted for HEYCO. The first reason why the purchasers preferred interactive forms was the calculation of the ROI. Costs and benefits could be easily calculated. On the cost side expenses for implementation, infrastructure and licenses had to be taken into account. On the benefit side the estimated time savings were already sufficient to be profitable. The portal solution would have provided some additional functions for the vendor like the possibility to print HEYCO compatible delivery notes. But for HEYCO it was more important to support the core process with a computable cost-benefit ratio.

Secondly, the original process flow hardly changes with interactive forms. The PO confirmation document is replaced by the interactive form. The procedure remains the same. With the portal, the PO confirmation form would have been replaced by a web form. Instead of just completing the PO confirmation document, the vendor would have been forced to log on to the portal, search for his POs and enter the confirmations. Because of the marginal adaptions in the process with interactive forms, purchasers will not need much training. Therefore interactive forms are better in meeting the second requirement due to the advantages indicated by *Process Know-how* and *User Acceptance* (figure 3).

Thirdly, due to higher ratings in *Flexibility* and *Partner Acceptance*, interactive forms are most suitable to integrate nearly every partner. The supplier does not need any specific technical skills. He just completes the received form and sends it back.

The PO confirmation process is a simple and linear procedure. The vendor just needs to enter the confirmed delivery dates, quantities and his order confirmation number. Only one process step (entering the confirmations) has to be covered by the interactive form. Therefore the lower ratings of the indicators *Level of Automation* and *Functional Scope* of interactive forms compared to one-to-many technologies do not matter in this scenario.
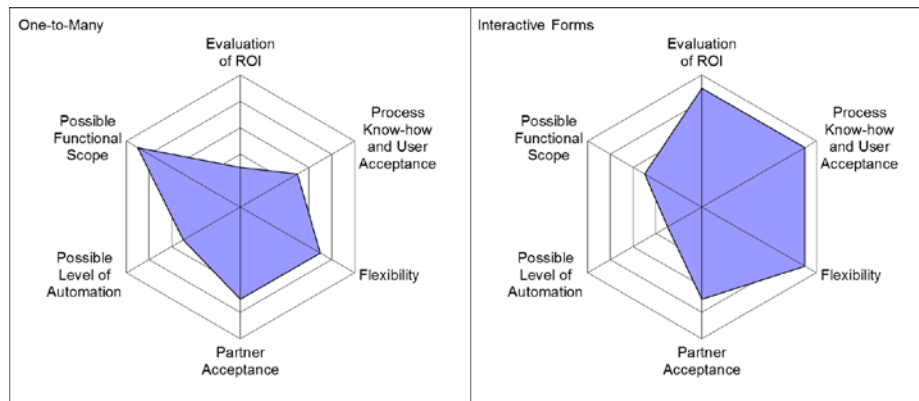
Fig. 3. Evaluation of one-to-many technologies and interactive forms

4   Implementation of the Scenario with Interactive Forms

The solution was created following a rapid prototyping approach. Based on the initial requirements of HEYCO, a first prototype was presented to the main actors. Integrating their feedback, this prototype was then refined step by step. In the end, the solution consists of four main components:

- *form processing*
- *status management*
- *inbound processing*
- *PO confirmation monitor*

The *form processing* module generates the e-mail with the interactive PO confirmation form as an attachment as soon as a purchaser creates a PO in the system. It covers the selection of the application data in SAP ERP. In addition, it implements the interface for the transfer of the application data to the interactive form as well as the form layout of the PO confirmation.

The *status management* tracks the status of each form. Every mailed form is identified by a globally unique identifier (GUID), which is generated from the *form processing* module. With its own data model developed in SAP, the *status management* documents, among other things, the timestamps

- when the form was sent to the supplier
- when it was received back and
- when it was processed by the purchaser in SAP with regard to that GUID.

Possible status are '*confirmation not received yet*', '*ready to process*' (after it is received from the vendor, but not yet processed by the purchaser), '*completed*' and '*form received multiple times*'.

The *inbound processing* module extracts the data of incoming forms. The extracted content is then validated, and the database tables of the *status management* are updated. Archiving received forms in a content server is another function implemented in this module.

The *PO confirmation monitor* reports on the content of the tables of the *status management* and enables the user to display all generated forms with their status. Moreover it is possible to show the archived PO confirmation. Received PO confirmations can be processed with the monitor.

5 Process Flow of the Interactive Scenario

The flow of the purchase order confirmation process with interactive forms (figure 4) is very similar to the original procedure (figure 1). Only the manual transfer of the PO confirmation form to the SAP system is replaced by the automatic processing of the interactive form.
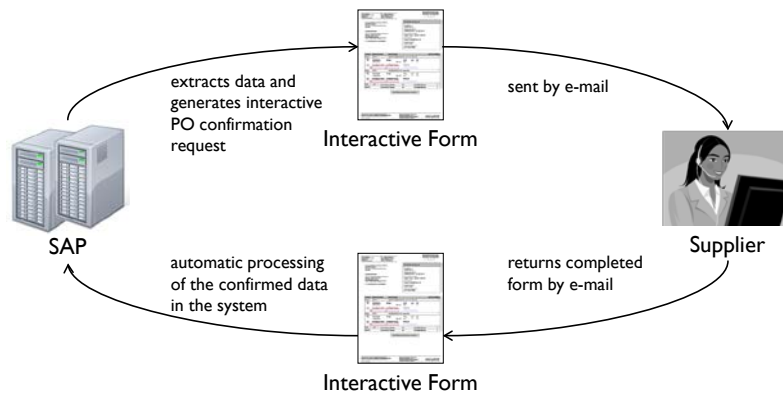

Fig. 4. Process for purchase order confirmation with interactive forms

Saving the PO in SAP ERP generates, in addition to the PO document, an interactive PO confirmation form which is sent to the supplier. It looks similar to the PO document and contains the requested delivery dates and quantities for each PO item. Interactive input fields allow the user to enter the confirmed dates and quantities as well as the order confirmation number of the vendor. Mandatory fields are marked by a red frame. The red frame disappears as soon as the field is filled. So the user can easily identify all the fields where he still has to enter values.

Figure 5 shows a plain example for a PO confirmation with one item. The company requests 80 pieces of a material, which should be delivered on 18 December 2015. In our example the sales clerk of the supplier confirms the quantity and the delivery date (step 1 in figure 5). He can then send back the form to the SAP system of HEYCO by using a special send-button in the form (step 2 in figure 5). With a click on that but-

ton, a number of validations are performed. For example, all mandatory fields have to be filled before the form can be returned. If all validations are successful, the interactive functions of the form are switched off. No changes are possible any more and the document can be used for audit-proof archiving. In addition, an e-mail is created automatically. It already contains the e-mail-address of the SAP system as the receiver and the completed PO confirmation form as an attachment. As soon as the e-mail is delivered to the SAP ERP of HEYCO, the data entered are extracted by the *inbound processing* module and stored in the database of the system. Additionally the form is automatically stored in the content server with a link to the PO in SAP.

Fig. 5. Example for completing an interactive PO confirmation form

The purchaser can use the *PO confirmation monitor* to display received PO confirmations. The monitor shows one reporting line for each confirmed delivery date with all the important information (e.g. requested and confirmed delivery dates and quantities, vendor name, material, related PO number and item, timestamps of the sending and receiving, etc.). Specific exception groups highlight critical confirmations. Possible exceptions are:

- The confirmed quantity and/or delivery date deviates from the requested one.

- The confirmation was rejected by the vendor.

- The related PO item is already confirmed in SAP ERP (e.g. because somebody already entered the confirmation manually).

- The related PO item was deleted in SAP ERP in the meantime.

- The confirmation is not up to date because the requested quantity or delivery date of the related PO item was changed in SAP ERP in the meantime.

With the monitor, the purchaser can check all the actual confirmations at a glance. The exception groups enable him to identify problematic confirmations in a very effi-

cient way. He can take a look at the archived documents and clarify deviating confirmations with the vendor. All the accepted confirmations can be selected and processed with one click. After that step, the confirmations are transferred to the related PO items in SAP ERP. Henceforth, SAP MRP considers the confirmed dates and quantities. With the solution, the purchaser does not have to enter confirmations manually anymore. The archiving of the form is obsolete. All confirmations can be monitored easily and well-arranged.

6 Extent of the Use, Feedback and Ideas for Improvement

In September 2014, the purchasing department of HEYCO started to use interactive forms for automating the PO confirmation process with its vendors. Nine months later a feedback round was carried out to discuss the experience gained in using the application. In general, the purchasers were convinced by the quality of the solution. They underlined the following advantages:

- The solution simplifies the general process of recording PO confirmations in SAP ERP. Therefore it is very helpful in daily business.
- From the point of view of most vendors, it is a 'low-tech-solution'. This means adopting the new process only implies a slight modification of the original one. So many suppliers were easily convinced to accept the new procedure.
- Vendors who have used interactive forms once work with them in a reliable way.
- The *PO confirmation monitor* is easy to use. It provides a good overview of sent and outstanding PO confirmations. Received data can be handled in a very efficient way. Critical PO confirmations are easily identified by the exception groups, while the rest can be processed with one click.
- The transparency of the process is improved because incoming forms are archived with a link to the PO in SAP ERP.

In the first month of usage, 45 different vendors confirmed POs with interactive forms. After that, about 15 new vendors were integrated every month (figure 6). Figure 6 also illustrates that the average number of suppliers using interactive forms within one month grew only slowly from 45 in September 2014 to 60 in April 2015. This emphasizes the fact that vendors with less than one PO per month and therefore a comparatively low data volume can be integrated with the solution, too. So the solution is suitable for integrating all types of vendors.
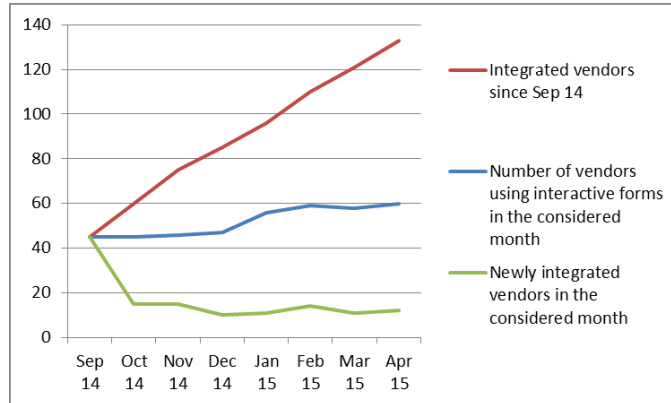
Fig. 6. Development of vendors participating in the new process since September 2014

Figure 7 describes the development of the percentages of PO confirmations processed with interactive forms in relation to all recorded PO confirmations in SAP ERP. The blue line shows the percentage for each month. The red line is a logarithmic trend line, which was calculated with the monthly data. In the first month (September 2014) HEYCO was able to cover already 14% of the data volume with interactive forms. This is quite impressive compared to the adoption of other B2B technologies. The coverage increased strongly in October 2014, but then it declined again and settled at a level of around 23%. This underlines the fact that the solution is also used to integrate C partners, because an increase of the participating vendors does not lead to an increase of the monthly coverage by the same extent.
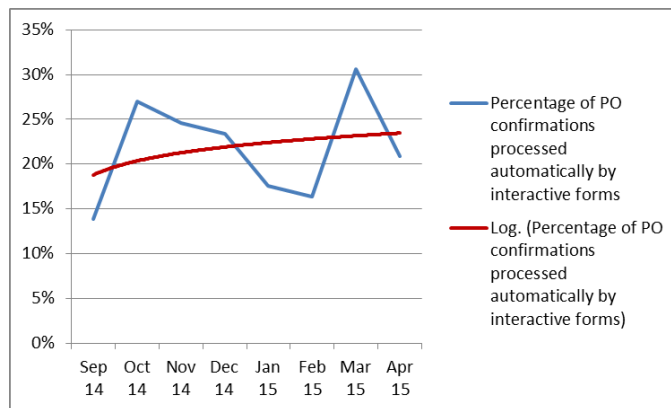

Fig. 7. Percentage of the PO confirmations processed with interactive forms

Nevertheless, we expected a better adoption of the solution during the period of eight months. Therefore we asked the purchasers of HEYCO for reasons why the percentage could not be increased faster. It turned out that – even with interactive forms – there are some barriers for adoption and that there are some challenges to convince

vendors to work with the solution. Before a vendor receives his first interactive form, he is informed by the responsible purchaser. The purchaser explains the new procedure in order to obtain a commitment of the supplier. Some vendors try to avoid a change in the process, even if it is just a slight one. The main reason for this seems to be a general mistrust towards process changes. A good way to support purchasers in their attempts to remove the concerns of their suppliers in this matter would be the development of a conversation guideline. A short documentation of the PO confirmation process with interactive forms could also be provided as a handout for the vendor. In this way, the communication with vendors is standardized.

Vendors give a second main reason why they refuse to work with the interactive forms: They miss a possibility to confirm prices. They argue that they are not able to confirm a PO of HEYCO if purchase prices have changed and the prices on the interactive PO confirmation are not up to date. So it seems important that the solution is enhanced by a function to change and confirm prices in the interactive form.

Accelerating technology adoption could be achieved by another thought provided by the feedback round: users suggested the implementation of a possibility to report statistics of the extent of the use in SAP ERP. Among other things these statistics might include the following key figures:

- the monthly percentage of received PO confirmations via interactive forms in relation to sent interactive forms for each vendor (response rate)
- the monthly percentage of PO confirmations processed by interactive forms in relation to all the recorded PO confirmations for each vendor (coverage of data volume)
- the monthly percentage of PO confirmations processed by interactive forms in relation to all the recorded PO confirmations for each purchaser (internal adoption)

It seems important to include the first two vendor specific key figures in the official supplier evaluation which is generated automatically in SAP ERP. It is used in periodical reviews with the supplier. As part of the evaluation, the supplier can be encouraged to make use of the technology. If the third key figure is used to agree upon purchaser specific targets for process automation and to report them, this can be seen as a good way to motivate the purchaser to advance the use of the technology.

With these activities, the technology adoption can be accelerated and the percentage of processed PO confirmations by interactive forms increased.

7 Conclusion

We have described some challenges that are faced in the process of introducing far-reaching technology changes. It must be stated, however, that the general results of the first eight months are very satisfactory: up to 31% processed PO confirmations by interactive forms and 133 integrated vendors.

This is true in particular for a medium-sized company like HEYCO. The main process actors gave a positive feedback. After the implementation of the improvements

planned, they are confident to achieve an even better and faster adoption of the technology.

Interactive forms were evaluated as a suitable solution to integrate all types of B2B partners. The positive experience with the PO confirmation scenario underlines their capability to enable companies to automate more of their processes with a larger number of their partners. The comparison scheme we developed can help decision makers to choose the appropriate technology for their scenario.

The feedback round also discussed more processes which could be supported by interactive forms. Interesting examples were the implementation of requests for quotations, 8D reports or supplier's declarations. Further projects with interactive forms are being planned. So we are confident to be able to present new implementations and scenarios soon.

References

1. Allen, B. J., Crum, M. R., Braunschweig, C. D.: The US motor carrier industry: the extent and nature of EDI use. International Journal of Physical Distribution & Logistics Management 8, Vol. 22, 27-34 (1992)
2. Hart, P. J., Saunders, C. S.: Emerging Electronic Partnerships: Antecedents and Dimensions of EDI Use from the Supplier's Perspective. Journal of Management Information Systems 14, 87-111 (1998)
3. Campo, S., Rubio, N., Yagüe, M. J.: Information Technology Use and Firm's Perceived Performance in Supply Chain Management. Journal of Business to Business Marketing 17, Vol. 4, 336-364 (2010)
4. Li, G. et al.: The Impact of IT Implementation on Supply Chain Integration and Performance. International Journal of Production Economics 120, Vol. 1, 125-138 (2009)
5. Wecker, R.: Internetbasiertes Supply Chain Management, Deutscher Universitäts-Verlag, Wiesbaden (2006), Diss. Univ. Witten/Herdecke (2006)
6. Schindlbeck, B.: Verbreitung und Durchdringung von Business-to-Business Technologien. Interaktive Formulare als alternative Technologie zur Unterstützung des Informationsaustauschs zwischen Unternehmen, Logos Verlag, Berlin (2015), Diss. Univ. Passau (2015)
7. Wirtz, B. W., Bronnenmayer, M.: B2B-Geschäftsmodelle im Electronic Business. Wirtschaftswissenschaftliches Studium 40, Vol. 9, 454-461 (2011)
8. Wüstner, E.: Standardisierung und Konvertierung: Ökonomische Bewertung und Anwendung am Beispiel von XML/EDI. Shaker, Aachen (2005)
9. Gmelch, O.: User-Centric Application Integration in Enterprise Portal Systems. Eul, Lohmar (2012), Diss. Univ. Regensburg (2012)
10. Petersen, K. J., Ogden, J. A., Carter, P. L.: B2B e-marketplaces: a typology by functionality. International Journal of Physical Distribution & Logistics Management 37, Vol. 1, 4-18 (2007)
11. Hauser, J. et. al.: SAP Interactive Forms by Adobe. 2nd ed., Galileo Press, Bonn (2011)