Global Non-Production Procurement at Motorola:
Experiences from the TIGERS Project

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Abstract

In this case study, we discuss some of the experiences at Motorola to utilize e-commerce technologies to support non-production procurement globally, in an integrated fashion.

Non-Production Procurement (NPP) includes the goods and services that are necessary to support the daily operations of a business. These items range from office supplies to consulting services and can easily represent one-third of a company’s total spend. Until recently NPP lacked the efficiency typically achieved for the procurement of production-related items. Motorola is utilizing Internet technologies to reduce "renegade purchases" and to improve the leverage of its buying power. By creating an easy-to-use, controllable method to obtain non-production related goods and services, the company expects to achieve cycle time reductions, improved process quality, and cost reductions.

We report on the successes and point out some of the challenges and considerations that the company faces moving forward. As one way to overcome the limits of the current NPP solution, Motorola considers the use of mobile technologies.

1. Introduction

TIGERS, the acronym for Motorola’s Total Integrated Global Electronic Requisitioning System points to the comprehensive effort that the company is making to improve its non-production procurement organization. In this case study, we discuss some of the experiences at Motorola to utilize e-commerce technologies to support non-production procurement globally and in an integrated fashion. We report on the successes and point out some of the challenges and considerations that the company faces moving forward.

Non-Production Procurement (NPP) includes the goods and services that are necessary to support the daily operations of a business. These items range from office supplies to consulting services and can easily represent one-third of a company’s total spend. Until recently, NPP typically lacked the efficiency achieved for the procurement of production-related items. Similar

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1 This e-business case is based on two presentations given by Mr. Dean Hacker, in 1999 and 2001.
to other large companies, Motorola utilizes Internet technologies to reduce "renegade purchases" and to improve the leverage of its buying power. By creating an easy-to-use, controllable method to obtain non-production related goods and services, the company expects to achieve cycle time reductions, improve process quality, and reduce costs.

Motorola views the supply chain as an encompassing structure of businesses processes, including the company itself as well as its business partners several steps and down the supply chain, from the supplier's supplier to the customer's customer (Figure 1). Including Motorola, each participant in the value chain conducts three major tasks: sourcing (supply management), manufacturing, and distribution.

![Figure 1 Electronic Procurement and Functions of Supply Chains](image)

A thorough reviewing of the activities up and down the supply chain, in particular regarding process lead times revealed several opportunities for e-business. Among the most important ones were Web-based, direct sales to Motorola’s customers, including extranet-based solutions to facilitate customer care and customer interaction, e.g., with telecommunications companies that purchase Motorola products. In addition, Motorola also identified the value of extranets to work with suppliers and to create online marketplaces.

After early experiences with electronic commerce technologies, non-production procurement turned out to be one of the most prominent chances and fruitful grounds for the deployment of

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emerging technologies. There are three major problems of the original non-production procurement process.

   
   Given its cross-functional yet non-strategic nature, nobody really owned the NPP process at Motorola, by itself a rather centralized organization. As a result, the process had been somewhat neglected, which again resulted in a complex, and non-standardized conglomeration of individual procedures, which were to a large extent based on paper. In fact this process was considered to be one of the most paper-intensive processes of the entire corporation, amounting to a yearly stack of paper documents reaching as high as 40 stories.

2. Poor leverage of corporate purchasing power.
   
   The highly decentralized nature of the process also resulted in low internal visibility and insufficient information about corporate contracts or internal spending patterns, and a situation where Motorola did not leverage its corporate purchasing power or utilized preferred suppliers to full extent. Many times purchase orders were placed ad hoc, and frequently different groups conducted negotiations with identical suppliers in parallel. For example, in the area of office supplies, Motorola used as many as 300 different suppliers for the same items (the number has since been cut down to one).

   The project team was also concerned about the fact that, as a company, Motorola used multiple interfaces to interact with its suppliers. In many instances, individual buyers had established quite personal relationships with “their” suppliers, which they were unwilling to give up for the suppliers that were selected by a central purchasing group.

   In this context, it should be noted that Motorola was less concerned about the sheer number of suppliers, but rather about the low visibility of internal spending patterns. It was in fact possible to determine the annual spending volume with a single supplier, by analyzing accounts payable data. With a supplier, such as HP, however, a company with a broad range of products, including test equipment, printers, servers, desktop computers, and workstations, there was little transparency regarding spending patterns. Many times, the purchasing department had no way of tracking what was ordered, and by whom.

3. Multiple procedures, low level of standardization.
   
   As no single group had responsibility for the NPP process, procedures were typically established at each site independently, as well as within the different domains, such as materials, administration, distribution, and manufacturing. The result was high fragmentation, poor control, and little process optimization.

   A decentralized process can actually work fine, as long as there are no complications with a specific purchase. If, for example, a requestor places an order directly with a supplier, this typically results in a prompt delivery due to the immediate relationship. However, this may lead also to a situation where the invoice arrives after the requester has assumed legal ownership. In cases where, for some reason, the purchase does not receive management approval, or is rejected for another reason, this constellation makes it difficult to return the goods or renegotiate the terms. As a result, the project team was concerned about the poor level of control it had over the process.
An addition, while as a corporation Motorola did not have a standardized non-production procurement process in place, or information technology (IT) infrastructure to support the processes, the level of sophistication varied widely between different parts of the organization. Some of the groups had actually established quite advanced processes, supported by sophisticated IT applications. At the time of the assessment, one business unit had already been using a mainframe-based procurement system for more than ten years. The system provided its users with access to over 400 supplier-catalogs, and supported a business process where payments were handled by receipt without invoicing. Other groups, however, hardly had any processes or IT system in place.

As a result, the project team faced the challenge that “coming up with and engineering what sounds terrific to the group that has nothing, sounds like a step backward to the group that's already got all of these processes in place.”

2. The TIGERS vision – a three-pronged, integrated approach

After had determined that Motorola’s NPP process needed a make over, project team was formed that developed a vision for the new procurement organization:

Provide Motorola with significant cost savings by leveraging and managing the supply base, reengineering business processes, and implementing an enabling system to allow sustaining the benefits.

In this context, Motorola decided on a broad, and encompassing notion of global non-production procurement, reaching beyond MRO (maintenance, repair and operation) supplies. Thus, non-production procurement includes all non-component items, i.e., everything that Motorola buys and that does not become an immediate part of the manufacturing lines. In addition to a wide range of commodities, this notion also encompasses manufacturing equipment and other capital, as well as services, such as the installation of major components for customers.

The project team envisioned an integrated approach, based on three elements:

- Strategic sourcing and commodity management
- Business process reengineering
- Web-based procurement application

All three elements were considered crucial for the overall success of the initiative: “The three of those combined, we like to think of it as a kind of a three-legged stool. … And without any one of those legs, the stool will not stand. If we did the strategic sourcing without the system to support it, we would not be able to sustain the savings from the strategic sourcing for long.” Similarly, system implementation depends on the business process reengineering in order to avoid the automation of “bad” and inconsistent processes.

(I). Strategic sourcing and commodity management
Although Motorola did actually have a high-performance supply management organization, its focus had always been on production commodities, while non-production procurement had received comparatively less attention. A detailed analysis of the purchasing volumes, however, revealed that for some groups in the organization the non-production-spend almost equaled the production-spend.

Consequently, Motorola envisioned a sourcing concept for non-production that was similar to the practices that were already well established in the production area. Commodity managers were appointed with the responsibility to identify opportunities to leverage transaction volume across businesses, and to negotiate favorable deals with suppliers. With a total over 50,000 suppliers, ample opportunities existed to leverage Motorola’s buying power.

The members of the strategic supply management organization can be regarded as the outward facing part of the non-production procurement team, as they are the ones who initiate and manage the interaction with the suppliers. The responsibilities for setting up and managing a corporate commodity strategy includes negotiations with the suppliers, setting up contracts, and rationalizing which suppliers will be used against a variety of criteria. In addition to product costs, other policy rules apply, such as awarding a significant amount of business to small and minority owned businesses.

(II). Business process reengineering

Corresponding to the outward-looking, strategic focus of the supply chain management group, the business process reengineering team focuses primarily inward and manages the operations. As such, it is responsible for analyzing business processes, for establishing business rules, for implementing them, and for benchmarking the resulting processes within and outside Motorola for best practices. Items for which business rules have been developed are typically included in the corporate wide electronic purchasing catalog.

In line with Motorola’s decentralized company culture, each operating unit traditionally had their own authority and independence to set their own business rules. In the context of the e-procurement project, the goal was to develop a set of business processes that were consistent across all of the operating units, as well as across all of the regions.

In this context, Motorola took a practical approach by putting procedures in place for situations where a commodity is procured for the first time, and for items that are not included in the online catalog initially. Let say, an assistant needs to buy a new fish tank for the boss’s office. If this item cannot be found in the online catalog, business rules determine whether the request will be forwarded to the strategic sourcing manager to see if a longer-term deal should be put in place. These business rules are in fact part of an innovative approval process. In addition, the tactical buying organization decides about the procedural rules in line with operational guidelines, and if necessary ensures the item is included in the online catalog. The next time a fish tank is needed the requester will find it online including a link to the supplier(s).

Based on directions from top management, the project team attempts to introduce purchasing procedures on a corporation-wide basis whenever possible, rather than to tailor the processes to individual business areas. Managing the related issues of cultural and procedural change, pose some of the biggest challenges to the project team.

(III). Web-based procurement application
As the third integral piece of its procurement project, Motorola is implementing a Web-based e-procurement solution. The system links the other two parts as it provides visibility throughout the process, and by supporting the implementation of business-specific rules. In addition, ease of use and deployment can ensure its adoption by end users and administrators.

The IT application provides visibility and access to up to date data, which is essential for the sourcing process. Before, information about purchases or supplier contracts and preferred suppliers etc. was not readily available. The web-based system will provide this information up front as well as allow monitoring and analyzing the process after the fact. However, in order to utilize the system correctly, the sourcing process has to be re-organized, once more closing the loop.

The system will help reengineer day-to-day purchasing activities, and, most importantly, enable the introduction of NPP standards for the first time. In sum, the IT system will help to introduce standards and to enforce them, while at the same time improve the availability of items.

Motorola chose an application from e-procurement software vendor Ariba. Some of the details of the implementation are described below.

3. Development and Implementation Issues

In this section, we focus on some of the issues that Motorola faced upon the development and implementation of its electronic procurement system. The issues include strategic sourcing, catalog management, purchasing operations (the business process), system architecture, and links with the suppliers.

**Strategic sourcing**

In order to determine which commodities to include in the catalog first, the project group analyzed buying patterns for non-production goods with respect to volume and value of the items and services (see Figure 2). This step was followed by an assessment of the supply base.

Grouping the commodities according to their value and purchasing volume results in four quadrants, each with a slightly different focus for the project-initiative. Typically, high value calls for improvements on the sourcing side, while high frequency tends to call for an emphasis on process improvements:
• Items of *high value and high buying frequency* (e.g., computers, office equipment, furniture, and services) are considered the sweet spot for an automated NPP solution. The project team decided to concentrate their e-procurement efforts within this group of items, as they promise best results for a combined effort of sourcing improvements and automated process support.

![Diagram](image.png)

**Figure 2 - Buying patterns for non-production goods and services with respect to volume and value**

• For *items of high value that are purchased at low frequency* (e.g., facilities, manufacturing equipment, public relations services and consulting services), improvements of the sourcing process can be most favorable. For this group, the focus is on reducing product costs by applying a more targeted sourcing strategy.

• For *items of low value that are purchased in high quantities* (e.g., office supplies, industrial supplies, software, and communication services), the focus is on process improvement. Value can be derived from streamlining the processes, by eliminating manual steps, and by improving their level of standardization throughout the organization.
Finally, the project team made a decision of not excluding the last group items from the initiative, i.e., low-value items that are purchased infrequently. Motivational reasons lead to this decision and the attempt to provide an easy first step for users to become familiar with the system. Items in this group (e.g., accessories, floral services, books and training services, and promotional items) are typically purchased by office administrators and support staff. Enticing this group of employees can prove to be very valuable to improve overall adoption, and, thus, making a system successful.

Figure 3 Blue Dollar (Volume) Opportunity and Green Dollar (Value) Opportunity

The project team used a second analysis to identify the areas where the benefits of process or sourcing improvements might be most beneficial in quantitative terms. For this second analysis, Motorola’s non-production spend was broken down by value and number of transactions, as depicted in (Figure 3).

Similar to the situation in many other organizations, the value of eighty percent of the non-production purchasing transactions at Motorola are in fact for requests under a thousand dollars. Also, only a very small number of transactions concern requests in the range above ten thousand dollars. From this analysis, valuable starting points can be derived for process improvements, termed “blue dollar (volume) opportunities” by the project team.

Identifying the major spending categories helps identify starting points for improvements on the sourcing side. The analysis shows that almost half of all purchasing dollars are spend for items in the one to ten thousand dollars range, while the other groups are split fairly evenly (less than $1 thousand, $10,000 to $100,000, and above). The results are valuable for supplier management.
and help determine the value of supplier contracts, and the re-negotiation of product prices ("green dollar (value) opportunities").

While determining the "green dollar (value) opportunities" from re-negotiating contract prices is fairly straightforward, the blue dollar (volume) opportunity basically represent improvements of internal productivity, which are more difficult to quantify.

After analyzing the spending pattern, an assessment of the supply base followed, resulting in a three-tiered model, including strategic, preferred, and tactical suppliers:

- The relationships with **strategic suppliers** are complex and mutual. In addition to buying items from these suppliers for the use in its operations, Motorola also integrates their products into the solutions that it provides to its own customers. Examples are products from companies such as Cisco, or Sun. The resulting partnership relations are considered strategic because they reach beyond the mere delivery of goods and cannot easily be substituted.

- The tier of **preferred suppliers** includes longer-term, contracted relationships, e.g., with providers of office supply. Given the relatively generic nature of the items, the relationship with these suppliers is not viewed as strategic per se. Still, a longer-term commitment is considered beneficial, as the contracts typically include a commitment to best services, delivery, price etc.

- A fairly large number of **tactical suppliers** provide supplies ad hoc. This group might include a local hardware store providing a tool required for assembling a cellular tower "out in the field." Typically, payment is done with corporate purchasing cards. Rather than ordering an item from a contracted supplier, for convenience reasons, a more practical approach is preferred in such situations.

While standardizing its purchasing processes, Motorola’s project team made a parallel effort to streamline and globalize its supply base. In some cases, including computers and office supplies, the project team was able to select one global supplier. Similar practices have been established earlier in areas such as manufacturing and engineering equipment. For other commodities, including facilities and services, a strategy of a single-sourcing is not feasible, resulting in national or regional suppliers. Factors to be considered in the evaluation include supplier performance in local markets, reliability, and market domination.

**Catalog management**

The online catalog is an essential piece of every e-procurement solutions as it provides the basic product information that enables end-user requisitioning. Several different options exist to set up an online catalog (see Text box below). Motorola decided to develop the online catalog under its own initiative and the commodity management team collaborated with the suppliers on how to represent the products and services that would be available to Motorola’s employees. Although comparatively costly, the "do it yourself"-approach promises Motorola maximum control over its catalog content as well as over the purchasing information. In addition, the project team valued the solution for its process visibility, end-user friendliness, and control over the speed of implementation efforts.
Catalog options:

When setting up an e-procurement solution to enable end-user requisitioning, there are different options of managing the central catalog, each with different advantages and disadvantages:

1. "Do it Yourself" – individual aggregation at the buyer side

➔ The buying organization manages the entire catalog in line with the specifications and file format of the selected e-procurement solution (e.g., CIF).

Advantages: buying organization in control (regarding updates, look & feel and user interface, ownership of purchasing data, approval rules), aggregated catalog content (e.g., searches across different catalogs are possible).

Disadvantages: catalog management efforts for the most part at the buying side (very costly/time consuming!), suppliers have to comply with CIF format (or whatever is required by the e-procurement solution).

2. Punch Out/OBI model

➔ catalogs hosted individually by the suppliers, can be accessed from inside the e-procurement solution

Advantages: less management effort for the buying organization, more "freedom" for the supplier (e.g., no need to comply to CIF format, individual look & feel)

Disadvantages: buying org has no control over the catalog content because catalog changes don't have to be announced by the suppliers and buying org has no easy and automated way of finding out where/when changes have occurred and approving of them. also individual catalogs are not aggregated, means searches across different catalogs are not possible.

3. Hosted Catalog Solution

➔ individual multi-vendor catalogs are hosted and managed by a third party. The third party (e.g., Essential Markets) works with the suppliers to retrieve and normalize their data and presents an aggregated, customized catalog to the buying org.

Suppliers submit updates and changes to the third party which runs them by the buying org before implementing them.

Advantages: buying org is presented with an aggregated view of the data, plus keeps control of the content, but without having to manage the catalog itself

Disadvantage: fees? buying org and suppliers have to manage one more vendor, immature market, sophisticated solutions not yet widely available.
Alternative: third-party aggregator model (e.g., Requisite): present buying org with individual views of a very large catalog - turned out to be expensive, as both buyers and suppliers are charged. From the buying organization's perspective this solution is possibly less beneficial than option 3 (hosted solution), because it does not offer full control and there are significant fees involved.

Besides working closely with the suppliers to integrate their data into the aggregated catalog, Motorola’s team also needed to integrate earlier catalog approaches into the system. A total of about four hundred catalogs were maintained throughout the corporation. While some units had established highly functional applications on top of the legacy architecture, others had started to buy directly from supplier Web sites. In addition, Motorola was one of the first organizations to test the Online Buying on the Internet (OBI) initiative by setting up an electronic link with Office Depot, a provider of office supplies, in August of 1997.

Although the earlier experiences provided a good basis for selecting a specific catalog model, the integration of existing solutions into a coherent new system and the task of getting all business units to the same level of IT-use was challenging, not just from a technical perspective in terms of linking and possibly replacing the legacy applications but also from a management standpoint. In addition, a number of units did not have any experience with online buying support. The project team plans to retire earlier applications within the next few years.

Similar to many other companies, Motorola encountered significant need to support the suppliers directly in their efforts to provide clean catalog data. In particular the first wave of suppliers required much “hand-holding.” The team expects these efforts to decline for future groups of suppliers as electronic commerce capability becomes more widespread and accepted standards emerge. Nevertheless, it became evident that supplier integration cannot be considered automatic.

In the longer run, however, Motorola intends to ask the suppliers to take first responsibility for maintaining their catalog information. In this context, gauging the effort at the supplier side turns out a critical success factor. A situation where Motorola would rely on a sales representative to create an Excel spreadsheet that would then be included in the catalog, should be avoided. Although this solution might in fact be feasible from a technology standpoint, process issues arise. Although sales reps typically have good product knowledge and understanding of the catalog content, their incentive structures are not in line with tasks such as maintaining a supplier catalog file, possibly resulting in delays, irregular updates and poor ongoing maintenance of the data. Gauging the effort at the supplier side becomes even more relevant in cases where more sophisticated functionalities are required, such as the ability to generate buyer specific pricing in multiple currencies.

After setting up the initial catalog, ongoing updating and management of the catalog data have to be ensured. Questions have be answered, such as:

- How frequently does an update have to occur?
- How much of the maintenance is done internally by the buying organization?
- How much is done externally by the supplier?
- What are the costs for updating the catalog?
Which standards are used to represent the data: product classification (e.g., UNSPSC), data standards (e.g., XML)

Update cycles vary depending on commodities and supplier capability. For example, for office supplies, prices tend to be relatively stable, and incremental updates are rare. In the case of computers, however, technology and prices tend to change frequently. As a result, the data needs to be updated at least on a monthly basis. Most of the efforts to manage the online catalogs consist in interacting with the suppliers. So far, the group in charge is actually very small: only two people specialize in the management of the central online catalog. This includes working with the suppliers to get them up, explaining the technology, and working through things like UNSPSC codes etc. In addition, the four hundred existing catalogs are maintained decentrally, by the individual buying organizations and members of supply management on behalf of the suppliers. After migrating the existing catalogs and integrating them into the central solution, the project team expects the suppliers will be able to take responsibility to maintain the catalogs. This step is expected to happen within a year or so.

The future scenario is ideal from Motorola’s perspective: After the supplier submits the catalog data through an automated receiving system, it is compared with the previous catalog information. This process generates a report for review by the commodity manager, or the commodity specialist. After indicating full or partial approval, the changes are automatically uploaded into the production environment. In case of disapproval, a request for revision is sent to the supplier, re-iterating the submission process. This scenario will help reduce the current efforts to manage the catalog data significantly.

To comply with its software application (Ariba), Motorola requests the suppliers to use a particular format (CIF: Catalog Interchange Format) when submitting catalog data. The general lack of adequate catalog and product meta-standards has proven to be a significant hurdle to setting up the integrated catalog solution.

**Purchasing Operations**

Besides the electronic catalog, another major component of electronic procurement systems is process automation. Utilizing the catalog infrastructure, a workflow system facilitates automated purchasing operations, including requisitioning, management approval, ordering, and payment.
Typically, a requisition process begins with a user, virtually anyone in the company. The system enables the employee to select and order products from the aggregated catalog. In cases where an item is not provided by the catalog (see the fish tank example), the requester can submit a free-form request.

In addition to providing employees with a ready selection of purchasing items and thus reducing individual search costs and efforts, the project team also strives to channel more buying activities to pre-approved suppliers, and thus reduce maverick purchases, and the randomness that comes with it.

For items of frequently changing features or complex equipment that requires configuration, the approach to manage the catalog internally reaches a limit. For these cases, Motorola’s project team considered a solution where the catalog is maintained at the supplier side. From within the purchasing system, requesters are routed to the supplier’s website, where they configure or pick a solution, and bring this selection back into the buying process for approval (punchout/OBI-model). As pointed out above, both methods (onsite catalog management and punchout) can complement each other and allow achieving “the best of all worlds.” The integration of different solutions is challenging, however, as it increases the complexity of the system.

Figure 4 The e-Procurement Process
Once a request for purchase is completed, it automatically gets routed to the appropriate manager(s) based on a set of business rules for a particular commodity and or business unit specifics. Toxic materials, for example, might have to be approved by the environmental health and safety department.

After the request has been approved, a purchase order (PO) is generated and sent to the supplier. In many cases, electronic links with the supplier are in place for PO submission, including EDI, email, or other Internet methods.

In addition, a notification is sent to the accounts payable group, and possibly the receiving desk, announcing to these departments the delivery and that they can expect an invoice. In some cases, Motorola asks the supplier to provide an acknowledgement, in particular, if an item is out of stock, or other delivery performance issues are expected.

After the goods are delivered, they are marked as received, either centrally by the receiving personnel at one of Motorola’s receiving docks, or decentrally by the requestor on location. The receipt of delivery is subsequently sent to accounts payable for invoice matching, while the supplier is notified in cases where payment is done via electronic funds transfer (EFT).

In addition to EFT-payments, Motorola also has an established procurement card program. Primarily used for emergency buys, it also includes travel expenses and indirect materials, under certain circumstances. The convenience provided by the procurement card program comes at a price in the form of credit card transaction fees, and a lack of integration into the central purchasing solution.

The project team made an effort to cover as much of the purchasing process as possible with the electronic procurement solution. In order to come to a fully automated, paperless solution, it also provided support for items that are not (yet) included in the central catalog (free form requests). To date, the desktop purchasing system is run a standalone solution and has not been integrated fully with the enterprise resource and planning (ERP) applications that are available throughout the corporation. The following paragraphs provide a more detailed overview of the system infrastructure.

**System Architecture**

In parallel to sketching out the ideal business process, the project team started to select a software application in December 1997. In February of 1998, a request for proposal (RFP) was issued to about a dozen companies occupying most of the market around the time. The responses to the RFP were evaluated according to functionality and their fit with Motorola’s requirements, the technology that was being utilized within the solutions, and the capabilities of the vendor companies. The resulting shortlist of companies was then evaluated further based on customer references, before one vendor was selected (Ariba).

Although ideally, the project team wanted to design and implement a business process without restrictions by the selected software application, this aim was somewhat weakened by the parallel efforts of IT implementation and reengineering. In some cases this resulted in confusion at the end user side, given the difficulties to determine the causes of change.
The system architecture, as described in Figure 5, reflects Motorola’s decision to standardize the procurement process throughout the corporation, and to leverage its corporate resources. The project team chose to deploy one central, corporate-wide e-procurement system, hosted on two large Unix servers. The procurement application is integrated with two backend systems: human resources (HR) and accounts payable (AP).

Through an interface into the master HR system, personnel data is provided to the procurement application (core directory), including the individual's department number, phone number, location code, and reporting structures. The directory currently contains information about 70,000 employees, and is updated daily into the procurement server (uni-directional). As soon as an employee terminates from the company, access to the system is deactivated the next day.

In comparison, the interface with AP has to be more interactive:

- On one hand, accounting codes are required within the e-procurement system. Currently, no automated link has been established, and AP information is updated manually within the e-procurement system.

- On the other hand, purchasing data has to be passed to the accounts payable system for invoice matching. In November of 1999, an interface has been implemented for business units in the U.S. to facilitate this link, and to facilitate frequent transfers of updated purchasing data (P.O.) into the AP system for further processing.

To implement the interface, the Motorola team used adapters provided by the e-procurement vendor, and customized to fit with its legacy solutions. The solution is a mix of out of the box code and custom, configured code. (“So we’ve had a format from the data feed from the HR systems. You work those through a series of scripts that basically brings the data in.”)

With only one instance of the procurement application worldwide, the requirements for system uptime are high, and much effort and cost has been put to provide 24 hour-availability and full back up functionality. The two central procurement servers are accessible through Motorola’s intranet, and thus available to users throughout the corporation, independently from their geographical location. Access from outside the network is facilitated over a number of network connections.
Figure 5 The Architecture of the e-Procurement System

The benefits of a central solution include:

- The storage of all purchasing data in one central database improves the process transparency, as it makes the aggregation of purchasing data relatively easy and facilitates the access to spend information.

- Ordering as well as approval processes can be performed and administered independently from the location, as the necessary information is available worldwide. For example, if somebody is working in Singapore but reports back to a manager in Chicago, the system can handle all approval routings without the need to log into multiple systems.

- Low long-term maintenance and support costs

- Ability to implement standard processes and leverage across the whole of the organization.

In line with Motorola’s vision of a corporate-wide standardized procurement process, the electronic procurement application does not allow for different process parameters and process rules for different business units. Exceptions are implemented only if considered unavoidable by the project team, such as in cases, where legal differences between different countries have to be acknowledged.

In this context, the fact that Motorola does not have one unified chart of account proved to be challenging. Although in the context of the e-procurement project the efforts to get to a common
chart of accounts have gained new momentum, as of now, multiple charts have to be supported, such as for the business units in China. This means the e-procurement project group had to find a way to apply the appropriate chart depending on the location of a requester, which was not an easy task, given that the software vendor did not readily provide this function.

**Supplier-links**

As with any type of business-to-business application, the success of an e-procurement solution depends to some extent on the willingness of business partners to participate in the solution. On the one hand, suppliers provide catalog data. On the other hand, the ability to reach suppliers online, and to exchange purchase orders, and other transaction related documents electronically, can greatly improve the benefits derived from the systems by reducing process costs and time.

![Figure 6 The Gap in EDI Adoption between Large and Small Organizations](image)

Several possibilities exist to establish online links with business partners, including electronic data interchange (EDI), which became popular during the 1980s and 1990. Although the benefits of these systems have been touted widely, they also proved rather expensive, in particular for smaller businesses without the necessary transaction volumes to offset high initial startup costs.

As a result, EDI reached significant diffusion only among very large organizations (Figure 6). According to Forrester Research, the total number of businesses using EDI and its financial equivalent electronic funds transfer (EFT) was 180,000, or three percent of the 6 million businesses in the U.S. A breakdown of the numbers according to firm size reveals that this number is as high as 95 percent for the group of large, Fortune 1000 companies.

In order to reach as many suppliers as possible electronically, in particular smaller ones, Motorola had to provide for more than EDI-based links. Similar to many Internet-based marketplaces and portals, Motorola put up a Web-site to serve as an interface for business partners to access their purchase orders, and then reply back with ship notices,
acknowledgements, and invoices. Named Cosmos, the platform aims to replace traditional paper-based interaction, including fax, as well as the need for suppliers to implement a full-grown EDI application. As this solution only requires an Internet-connection, plus access to a standard web browser, the project team hopes to have eliminated a major hurdle for suppliers to participate in the online system, and to enable a fully electronic end-to-end process. For Motorola, Cosmos allows supplier data to be fed automatically into its online procurement system.

4. Roll-out Strategy and Current Status

The actual implementation of the e-procurement system at Motorola commenced in April 1999 with a pilot that included two catalogs (computers and office supplies), and only a limited number of about 50 users. The pilot system was operational for orders in the U.S. shortly after a month and could soon be expanded to Ireland and China, reflecting Motorola’s global organization structure.

As the pilot implementation was considered successful, the project team grew the system to a total of 15 catalogs and 4,850 users until June 2000, and at the end of August 2001, 17,500 employees at 270 locations in 13 countries used the procurement system. The total number of participating suppliers had been increased to 6,500. The aggregated catalog encompassed 20 commodity families and included 442 internally hosted catalogs with a total of 340,000 items.

The project team estimated that over 250,000 orders would be generated through the system per year, amounting to as much as $1.2b in transaction value, and providing the company with cost savings of $100m. Early difficulties regarding system performance and missing functionality (e.g., receiving) had been addressed to Motorola’s satisfaction by the software vendor.

5. Challenges and Lessons Learned – Critical Success Factors

Moving through the complete planning and implementation cycle swiftly provided the project team with the opportunity to learn from the experiences fast, and to identify critical success factors as well as challenges for the project that could be considered in subsequent implementation cycles. Issues include management of catalog data and suppliers, flexible process engineering, interfaces with legacy systems, data quality, cultural issues, and platform compatibility (see Figure 7).

<table>
<thead>
<tr>
<th>Technical</th>
<th>User Activation</th>
<th>Platforms</th>
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<tbody>
<tr>
<td>• Accuracy and completeness of data sources</td>
<td>• Tried using “organic growth” approach</td>
<td>• Configuration management and testing is</td>
</tr>
<tr>
<td>• Complexity of interfaces to other enterprise systems</td>
<td>• Escalation and delegation rules were disabled during start-up</td>
<td></td>
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<tr>
<td>• Network connectivity and bandwidth</td>
<td></td>
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<tr>
<td>Schedule</td>
<td>Cost/Benefit</td>
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<tr>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>• Rollout by commodity, geography, and business</td>
<td>• Payback is based on compliance to reengineered process</td>
<td></td>
</tr>
<tr>
<td>• Complexity of buy-in on common business rules</td>
<td>• Management buy-in needed at all levels</td>
<td></td>
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<tr>
<td>• Staffing needs - finding the right people</td>
<td>• Identify functional sponsors for commodity approach</td>
<td></td>
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<table>
<thead>
<tr>
<th>Catalog Management</th>
<th>“Hard Stuff”</th>
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</thead>
<tbody>
<tr>
<td>• UNSPSC codes are incomplete</td>
<td>• Services, Leases, Recurring Charges, Capital</td>
</tr>
<tr>
<td>• Complex products require configuration capabilities</td>
<td></td>
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<table>
<thead>
<tr>
<th>International Trade</th>
<th></th>
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<tr>
<td>• Legal and Commercial requirements; myth versus reality</td>
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**Figure 7 Lessons Learned**

*Catalog management and supplier involvement* turned out critical to the entire project. The project team soon realized that both issues were very much related and that it had taken too much for granted regarding the requirements to create and maintain the catalog. This was true even for working with a large and technology-savvy company such as Dell. Given the importance of the external partners for the success of the project, the need to collaborate across corporate boundaries became evident early on, in particular to find agreement on business rules and processes. In addition to aligning the external partners and Motorola’s processes, the various operating units within the organization had to be aligned as well.

*Receiving* was among the processes that proved to be particularly challenging, as it required a great amount of flexibility. In traditional manufacturing settings, goods are typically delivered to a receiving dock where they are examined physically and checked against the delivery slip. Payment is triggered later by accounts payable after matching the original order, receipt, and the invoice that is sent separately. Legal requirements, as Motorola’s auditors demand them are based on this type of receiving. In the context of NPP, however, decentralized work structures, including satellite and home offices, usually do not permit the set up of a central receiving dock, but rather call for direct delivery to the requestor’s desk, forfeiting an easy three-way matching process. In addition, desktop delivery has been arranged with a number of suppliers, e.g., of office supplies. In addition, many non-production commodities cannot be received through a receiving dock after all, such as services and soft goods. Even if a receiving dock is put in place, oftentimes, it does not have the resources to examine the content of a box to ensure it matches the order, but rather check off the delivery categorically.

In order to cover the various forms of receiving within the corporation, ranging from traditional manufacturing receiving to an individual buys for a home office, and to satisfy the legal requirements at the same time, the receiving process had to be designed in a very flexible way.

In addition to the importance of external interfaces with suppliers to set up the catalog, the *accuracy and timeliness of internal enterprise data* turned out to be an issue. In one case, an
incorrect address resulted in multiple deliveries that reached the requestor only with big delays, while the suppliers complained about late payment for the shipments. As part of the project, cleaning up the enterprise data proved crucial and as well as challenging.

Another issue, somewhat related to the issue of data quality was the complexity of interfaces with other systems. For example, throughout the corporation, multiple accounts payable systems were being operated in the U.S., Europe, and Asia. In addition, network connectivity and sufficient bandwidth to access Motorola’s intranet was not available for all parts of the corporation, in particular for business units in remote areas. Given the three-legged, integrated approach, access to the system is of course a prerequisite to achieve the project objectives, and has to be provided corporate wide.

The project team had set an ambitions rollout schedule, according to commodity, geography, and business unit. In many cases this meant significant changes, because most of the units had been working with their own independent solution so far. In the context of the roll out, changes included a switch to the standard chart of accounts, as well as turning off systems that possibly had been in place for a long time. In addition, tight collaboration with the local sourcing teams and purchasing experts was necessary to ensure optimal availability of all items.

The project also faced some internal resistance in particular from the mid-management levels. Assembling the local project groups and identifying a local “sponsor” was critical to ensure user adoption and to manage the resistance towards the changes, as well as to work towards a process that was compatible with the reengineering efforts. Functional sourcing managers were required for the commodity approach. For example, when implementing furniture catalogs, a specific project manager was available to work with all members of that creative team and to drive the initiative. In addition, the manager worked with the supplier, thus, avoiding that the sourcing specialists had to go too deep into the technology. As a result, the business process specialists and the IT specialists would continue to focus on their specialties, and yet one person was accountable for that specific part of the implementation.

Identifying the right sponsor was not always an easy task, but crucial for every commodity. For example, when announcing plans to switch to a certain supplier for manufacturing equipment, the leader of manufacturing operations would be the ideal sponsor of the initiative. At the minimum, he or she would have to view the plans benevolently, as otherwise, internal resistance might be impossible to overcome.

Cultural issues remain, and incentive structures have to be revised continuously in order to ensure compliance with the overall objectives. For example, a plant manager might resist a shift in the supply base from a regional to a national supplier, if there is a risk of performance loss as a result of this change. In cases where the plant manager is measured on the total uptime of the specific factory, such a shift will be difficult to justify, as compared to a situation where the performance is based on total supply chain cost. As has been pointed out elsewhere many times, implementing cultural changes and facilitating thinking outside of familiar boxes is typically an extremely challenging task.

Overall, Motorola’s rollout strategy was “organic.” After starting out with 56 users initially (QuickStart), individual sites were included. All employees were given access to a commodity, office supplies. After requesting an account, employees received permission to order through the system, according to the regular internal control guidelines.
Once the number of sign-up requests reached a certain threshold, Motorola’s internal escalation system proved to be an issue. For example, if an analyst requested access to the system, the request typically went to a manager for approval. In order to approve the request, however, the manager needed system access as well. Another request to a higher-level manager was the logical result. After a few days, this pattern reached vice president level. As the vice president actually did not want to have anything to do with the project from a hands-on perspective, Motorola’s regular escalation rules had to be suspended at an exception basis. Ultimately, people were granted access without going through the pre-approval process. As the whole process is traceable throughout the system, the issue of employee access was not considered too concerning by the project team.

Compatibility of platforms and systems was another issue that turned out to be more complicated and difficult than anticipated initially. Incompatible graphic cards, operating systems (such as older versions of Macintosh-systems), and browsers caused problems. Although the software allowed access based on a standard browser, this did not eliminate compatibility issues at the desktop level. In fact, this solution created problems for a number of users on older machines, including Macintoshes and NTs and Unix machines, and including many older browser versions. On the other hand, some people upgraded to new platforms and browser versions before the project team was able to support these. It took quite some maintenance effort to synchronize all the different variations of platforms and browsers. Still, this point was considered important, given the detrimental impact that an early negative experience can have on the perception of the user. In this context, network performance also played a role. One manager at the director level tried to download the application over a modem line. After receiving the response that the download would take two days at the speed that he was connected at, he gave up and fired a frustrated email back at the project team.

Additional issues highlight some of the limits regarding the current catalog standards and the flexibility of the procurement application. At some point, when implementing furniture as part of the online catalog, the project team realized that there was not really an accepted standard for this group of products. The UNSPSC codes did not cover the category beyond standard items, such as table, chair, or bookcase. Given that Motorola’s requirements were more sophisticated, including modular furniture, the project team soon found itself part of a working committee to expand the standard. After inviting another manufacturer and three suppliers, the team had the opportunity to participate in the development of the codes, overall a rather high-level effort.

Computer products posed another challenge, given the large number of permutations and combinations of a PC. Although standardized on a common platform, four different monitor choices, three different software configurations, and a handful of different payment options, including different lease terms, the display of all options was difficult. In addition, the products had to be displayed in different currencies depending on the location, all of which resulted in hundreds of different price quotes that ideally have to be maintained by the supplier. Given that the regular catalog option did not provide configuration functionality, it reached its limits for this category of items. One relatively simple solution that the project team considered was the utilization of supplier Web sites (punch-out model).
6. Moving Ahead: The Development and Adoption of Mobile Commerce Technology

Two years after the initial rollout of the e-procurement system and despite its impressive progress, the bigger part of the target user community of 50,000 employees is still out of reach for e-procurement. Consequently, the efforts continue to include new geographic areas and catalogs, in particular outside the U.S. In addition, still more efforts are necessary to decrease maverick buying, or, at least, to capture more of it within the Ariba system, and to eliminate the widespread “expense it” mindset. Corporation-internal efforts also include continuous attempts to increase the efficiency and consolidation of the different buying organizations, demonstrating once again the close inter-relationship between an IT-solution and organizational issues.

Motorola also plans on maintaining and even intensifying the close relationship with its software vendor, e.g., by utilizing the insights from implementation projects conducted elsewhere. Plans also include an increased use of online services offered on Ariba’s market platform (Commerce Services Network) and a stronger shift towards the punch-out model to simplify catalog maintenance, order routing and invoicing at Motorola’s end.

But there is more. Throughout the course of the project, the team identified a chance to turn a necessity into an actual business opportunity. Building upon its own core competencies, Motorola now works on the integration of e-procurement functionalities into some of its wireless products. Such a step would allow managers, for example, to perform the approval of requisitions, especially urgent ones, with a two-way pager or cell phone. The enhancement of the system with an additional way to access it will most importantly increase its availability. Further cycle time reductions and increased productivity beyond what has already been achieved with the e-procurement solution are the expected results. The project team is currently identifying areas of application and we can remark that, suddenly, the task of system development to improve and automate an organizational process has been transformed into an issue of product development.

We conclude this case study with an overview of the considerations at Motorola to take the e-procurement application to the next, mobile level.

The use of mobile technology is growing, but where is it heading?

To this date, it is unclear what impact wireless technology will have on businesses processes and organizations. Although the penetration of wireless devices, including cellular phones, two-way pagers, PDA’s and other handheld devices, is already quite impressive and continues to grow (see text box), the number of commercial applications quite low, and most of the usage occurs on an individual level.
Wireless Penetration:

- Currently 12 million data-enabled phones available in the U.S., with 112 million expected by the end of 2004 (source: IDC, Phone.com, December 2000)
- 1.3 billion wireless data subscribers worldwide in next four years (source: Cahners In-Stat, September 2000)
- 18 million PDAs and mobile phones bundled with J2ME will be sold by end of calendar year 2001 (source: Sun Microsystems)
- By 2003, more than a billion cellular subscribers are expected to create a $83 billion marketplace for wireless services (source: Yankee Group, February 2000)

Figure 8 – Wireless Penetration

In other words, wireless devices (in particular cellular phones) are most often used for interpersonal communication, replacing a regular telephone, rather than to access information systems or to transmit data, which would be comparable to using a personal computer. A number of applications are available, though, as cellular phones and two-way pagers can be used to access stock market data and to trade assets, to check weather reports, to purchase theater tickets, or to send short messages to other phones and computers. To this date, however, and particular in the United States, the volume of data traffic over cellular devices is extremely low compared to voice traffic, and, again, for the most part concentrated on personal and consumer-oriented applications.

When it comes to business-oriented mobile applications, most organizations are still waiting for the so-called “killer-application” that would propel the use of wireless technology, similar to the way that email or the World Wide Web helped spread the Internet.

A number of starting points can be identified throughout the supply chain (see Figure 9).
To take advantage of technological innovations, but at the same time avoid the installation of “expensive toys”, a careful match has to be performed between the requirements of a specific situation with the abilities and limits of the technology.

**Identifying application areas for mobile business-to-business commerce**

Mobile devices can help increase the reach of a business application, say the procurement module within an enterprise system, as they provide an additional way of access (Figure 10). Using an Internet-enabled cellular phone or handheld device, users log into the application by using a personal ID, and then navigate through a simplified menu by using the keypad of the device (Figure 11).

Traditionally, business applications are accessed from workstations or personal computers stationed in a corporate or home office. Situations where employees are away from a computer or dialup connection, e.g., while traveling, can lead to access problems. As a result, email messages, notifications, and approvals are delayed in terms of approval decisions. Consider the case where a new hire’s purchase order for a computer is delayed because the approval manager has left for a vacation and is, thus, away from his desk and out of reach.

![Diagram of wireless business applications](image)

**Figure 9 – Wireless Business Applications**

- Route sales
  - Full electronic order book, inventory data, and revenue recognition
- Field service
  - Work order, labor distribution, and customer data access
- Pick-up and delivery
  - Dispatch and full real-time reporting
- Health care
  - Hospital and clinic patient and resource data management
- Man-machine interface unit
  - Effortless, accurate data collection
    - Reduced cost of automation
- Warehouse and inventory
  - Work distribution, pick-and-pack, stock keeping
In order to identify areas where the application of mobile technologies could enhance current business applications, two issues need to be considered in particular. First, it is important to assess the abilities and limits of the mobile devices, as they compare and relate to current electronic commerce applications. Second, the economic benefits have to be assessed and evaluated in relation with the necessary investments.

The opportunities provided by mobile devices, as compared to stationary computers and wired laptops include: wider reach of business applications as access is not confined to an office or desk, faster access to applications in cases where booting up a computer takes a long time, and advantages from integrating data and voice communication into one device. In addition, the simplicity of the devices and the fact that “they are not a computer,” might increase acceptance where employees feel uncomfortable with using a regular desktop PC. At the same time, wireless devices are typically also cheaper than regular computers.

Limits of the technology include small screens, limited graphical functionality, and a comparatively small number of keys, all restricting the complexity of the information that can be displayed and often resulting in complicated usage procedures and deep navigation structures. Additional issues include limitations of bandwidth, of signal availability, and of on-device storage space, all restricting the amount of data that can be processed wirelessly.
Taking into consideration the characteristics of wireless technology, Motorola identified three main areas of application in the context of its non-production procurement process: creation of requisitions, requisition approval, and status checks of requisitions.

All of these sub-processes are sufficiently simple and easy to perform, and often triggered by an alert or notification (read: urgent). In a next step, the team needs to perform an economic evaluation. Questions include: How many requests are delayed because a manager is traveling? What are the implications in terms of productivity losses and increased cycle time? How often do users circumvent the system in cases where they need items urgently but do not have system access? What are the cost implications of such maverick buys? How often are managers out of the office? What are the consequences on user satisfaction and system perception if users cannot easily obtain information on order status and delivery information?

After answering these questions, and quantifying the benefits, a thorough assessment of the costs required to implement the enabling infrastructure (Figure 10) would result in a sound estimate of the overall benefits and help to further improve the benefits derived from the e-procurement application. At this point, the team is promoting the new concept to the current users of the electronic procurement system and conducting trial studies to verify the expected benefits as well as to gauge user acceptance.
One of the things that can be learned from this case study when comparing it to reports of similar implementations elsewhere is that many of the benefits of an e-procurement solution are not unique to the particular situation of a company, and neither are the problems and issues. Legal requirements, for example, are similar for all multinationals with much room even for competitors to collaborate, in particular in cases where ready solutions have not been developed yet.

Motorola’s case also demonstrates the value of an integrated approach – linking emerging technologies with the requirements of modern business strategies and processes, into what Michael Hammer calls an ETDBW-solution, one that is easy to do business with across the supply chain.