The Evolution of a Global Cash Management System

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SOME COMPANIES ARE IMPLEMENTING INTERORGANIZATIONAL INFORMATION SYSTEMS (IOSs) WITH TRADING PARTNERS THAT ALLOW THEM TO SHARE DATA AND software across organizational boundaries. The authors explore the effect of IOSs on cash management from a managerial perspective and present a case study of Motorola and Citibank. Motorola's strategy has evolved from an internal cost saving initiative to a supply chain focus yielding significant strategic benefits. Cooperation between Motorola, its suppliers, and Citibank has brought cash flows in line with product flows. Motorola and Citibank have effectively meshed parts of their organizations and information systems together to provide a mechanism for the seamless collection and disbursement of cash payments between Motorola companies and their suppliers. The key results are just-in-time money and the integration of financial processes throughout the cash supply chain. Finally, the authors compare the results with existing management/information systems theories on globalization and competition.

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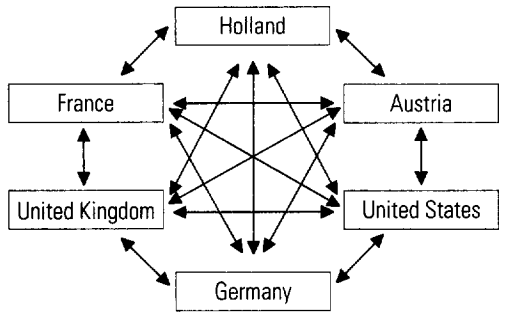
Global competition is a general trend, and new types of organizations are emerging to service international markets.[1] Companies are coordinating manufacturing, distribution, and marketing strategies on a global scale. Information systems are a key part of these globalization strategies because computer networks move large volumes of data across great distances almost instantaneously, thereby negating the importance of geographic location.[2] Therefore managers on different continents can share data and applications easily and quickly. European manufacturing and sales data can be easily collated with data from Japan. Similarly, a manager using a terminal in Europe can access a mainframe computer in the United States. These trends present new opportunities for managers to redesign their organizations and also their relationships with trading partners.

In this paper, we trace the changing role of treasury management at Motorola over a period of sixteen years. We present the organizational, strategic, and information technology shifts. In the context of manufacturing and marketing trends such as increased integration between organizations and just-in-time product flows, cash management is an important business process because of the potential benefits and inevitable outcome of cash flows moving to align with product flows.[3] Our research methodology is based on Eisenhardt's framework and focuses on the importance of theory development from case research.[4] This case study of Motorola is part of a larger study on competition and IOSs in business markets.

Treasury Management at Motorola

Motorola is one of the world's leading providers of wireless communications, semiconductors, and advanced electronic systems and services. Separate Motorola companies act autonomously and trade with each other, often across national boundaries. An internal information systems infrastructure that enables data to be shared easily between Motorola companies has been in place since 1976. It is used in logistics and manufacturing management to reduce costs and improve the quality of manufacturing operations in a continuous improvement program.

Figure 1 Pre-Netting Information Flows



In parallel with these developments, the treasury management function has evolved to manage nearly $5 billion of intracompany payments. The company has implemented an internal "currency netting" system and reorganized the treasury function to take control from local management and centralize all foreign currency payments. The company now uses the system, once primarily for worldwide inter-Motorola payments, as a vehicle to pay suppliers across borders. Our research led us to the following complementary questions about the system:

1. What are the coordination mechanisms to manage cash flows between Motorola companies and their suppliers? Is there a trend toward electronic hierarchies or electronic markets?
2. What is the role of Citibank, the principal banker to Motorola, in the development of payment services?
3. Are there any generalizable trends in cash management, and what are the managerial implications for manufacturers and banks?

Next, we outline the development of the whole system and describe its major phases in more detail. Later, we discuss the IS literature in order to compare the Motorola case and various theories.

Two Phases of Cash Management Strategy

The evolution of Motorola's cash management strategy can be traced back to 1976. Since then, there have been major changes in information technology, strategic direction, and focus while the system has been growing. The objective in the first phase was to improve cash management within the group using existing Motorola-controlled computer networks. A currency netting system was applied to transactions between Motorola companies to achieve cost savings by reducing both cash flows and the amount of foreign exchange deals effected for international payments.

This concept is now being extended to include suppliers and involves the extensive use of value-added networks (VANs) and cooperation with Citibank. The emphasis in the second phase is to improve the management of the financial aspects of supplier relationships as well as to increase the benefits of reduced cash flows and foreign exchange savings already achieved. We therefore describe strategy development in two sections. We illustrate the concept of internal netting with a model of four companies of different nationalities. The full organizational, technical, and geographic details of the system are presented in the external netting section.

Phase One — Internal Netting

Once every week, all foreign currency transactions between Motorola companies are managed with a single payment or invoice from the treasury management center to each Motorola company. National currencies are handled by the separate Motorola companies and are not part of the scheme. Each Tuesday at 9 A.M., data in the form of a transaction file and vendor data are collected from all netting users. The netting system is then locked for about fifteen minutes to achieve a clean cut-off point. In less than one hour, the center knows the total accounts payable and receivable. The center then advises each company by electronic mail whether it will receive a payment or will need to pay the center. All transactions are conducted in local currencies, so, for example, a German company receives or makes a payment in deutschmarks for all its foreign currency transactions. Figures 1 and 2 show how the system reduces organizational complexity. Figure 3 illustrates the currency flows, and Table 1 details a numerical example.

The payments matrix M_{ij} represents the accounts payable and receivable of four companies A, B, C, and D. The columns represent the accounts receivable and the rows represent the accounts payable for each company. For example, company A needs to pay $100 to com-

Figure 2 Post-Netting Information Flows

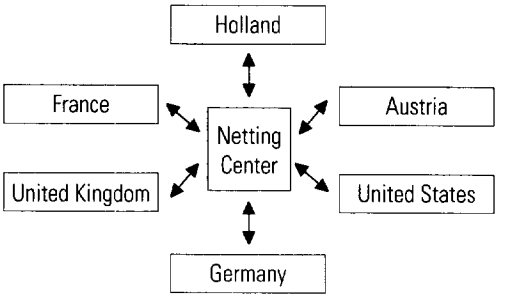
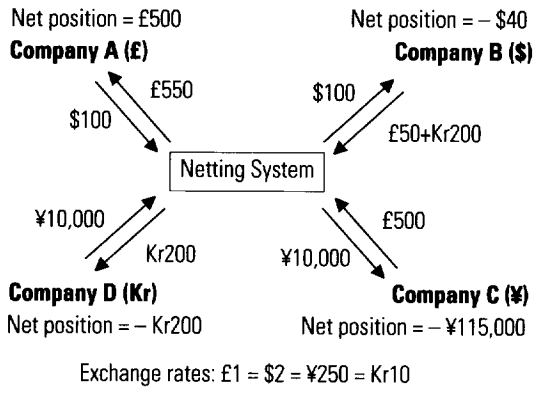


Figure 3 Schematic Model of Currency Netting



pany B and will receive £50 and £500 from companies B and C respectively. The total accounts payable for each company can therefore be represented by the sum of its row. Similarly, the total accounts receivable for each company is represented by the sum of its column.[5]

The net payments for each company are easily calculated:

Company A (£550 - £50 = £500)
Company B ($100 - $140 = -$40)
Company C (¥10,000 - ¥125,000 = -¥115,000)
Company D (Kr200 - Kr400 = -Kr200)

Before netting, the total amount of cash flows was the sum of all payments, which in dollar value is $1,320. The netted cash flow for each company is the sum of its payables less the sum of its receivables. Therefore, in local currencies, company A will receive £500, B will pay $40 dollars, C will pay ¥115,000, and D will pay Kr200. For ease of comparison, the netted cash flow in dollars is $1,000. The center receives three different types of currencies, makes one payment to company A, and has a neutral cash position.

The benefit arising from this system is a reduction in cash flows and in the amount of foreign exchange deals. By moving from localized treasury management operations to one centralized team of dedicated staff, an estimated annual financial savings (from bank charges and foreign exchange) of about $6.5 million per annum is achieved. However, this does not include administrative savings gained from streamlining operations. These obviously are more difficult to quantify and have not yet been measured. However, the system is seen as an outstanding success for the treasury management center and all the companies.

Each separate organization has taken the benefits in reduced costs, made possible by a combination of factors: First is the senior managers' foresight. They were already committed to being at the forefront of IT and saw it as a strategic advantage. This was helpful in overcoming their normal resistance to change. Second, the basic network was therefore already in place, and once the scheme had been proposed, its value was obvious to the participants, so organizational resistance was low. Third, the system was gradually introduced by building on successful stages of implementation. A few sites were chosen as prototypes in the first instance. After these systems had become established and any operational difficulties resolved, the inclusion of other sites took place without difficulty.

Table 1 A Payments Matrix (M_{ij}) Netting Model of Currency Transactions

Accounts Payable \ Accounts Receivable	Company A (£)	Company B ($)	Company C (¥)	Company D (Kr)	$\sum_{j=1}^{4} M_{xj}$
Company A	0	$100	0	0	£50
Company B	£50	0	0	Kr200	$140
Company C	£500	0	0	0	¥125,000
Company D	0	0	¥10,000	0	Kr400
$\sum_{i=1}^{4} M_{ix}$	£550	$100	¥10,000	Kr200	

Phase Two — External Netting

Once the internal cash management was working smoothly, Motorola then turned its attention to external relationships with customers and suppliers. By this time, management felt it had developed the necessary expertise to attempt this more difficult task. However, external netting is a far more complicated procedure in practice — not in concept — because of the potentially large number of banks and information systems involved. The way around this difficulty has been the cooperative relationship with a complementary global banking company, Citibank, which had been considering a similar problem. Citibank's unique delivery system fit neatly with Motorola's system of collection — a clear example of synergy. Motorola's overall aim was to fully automate its netting system and communication platform with Citibank, a logical complementary development with electronic data interchange (EDI) for supply chain logistics.

Figure 4 shows the process for external netting and payments, with information flows and geographic locations. In essence, the system is very simple. Each week, the Motorola netting center collects from each Motorola entity (factory) a transaction file detailing payments to suppliers and a vendor database via the mainframe in Chicago. The treasury function in London controls the netting system from the mainframe, collects the data by

Citibank's unique delivery system fit neatly with Motorola's system of collection — a clear example of synergy.

closing system access, proceeds with the foreign exchange transactions, initiates payment orders, and finally advises Motorola companies of their net position.

After netting incoming payments with outgoing payments and combining common currencies, an approximate foreign exchange position is reached in which surplus currencies are sold and deficit currencies are bought. The transaction value is approximately $100 million per week. Two first-tier banks and one from a pool of other banks are asked to quote for the foreign exchange dealings.

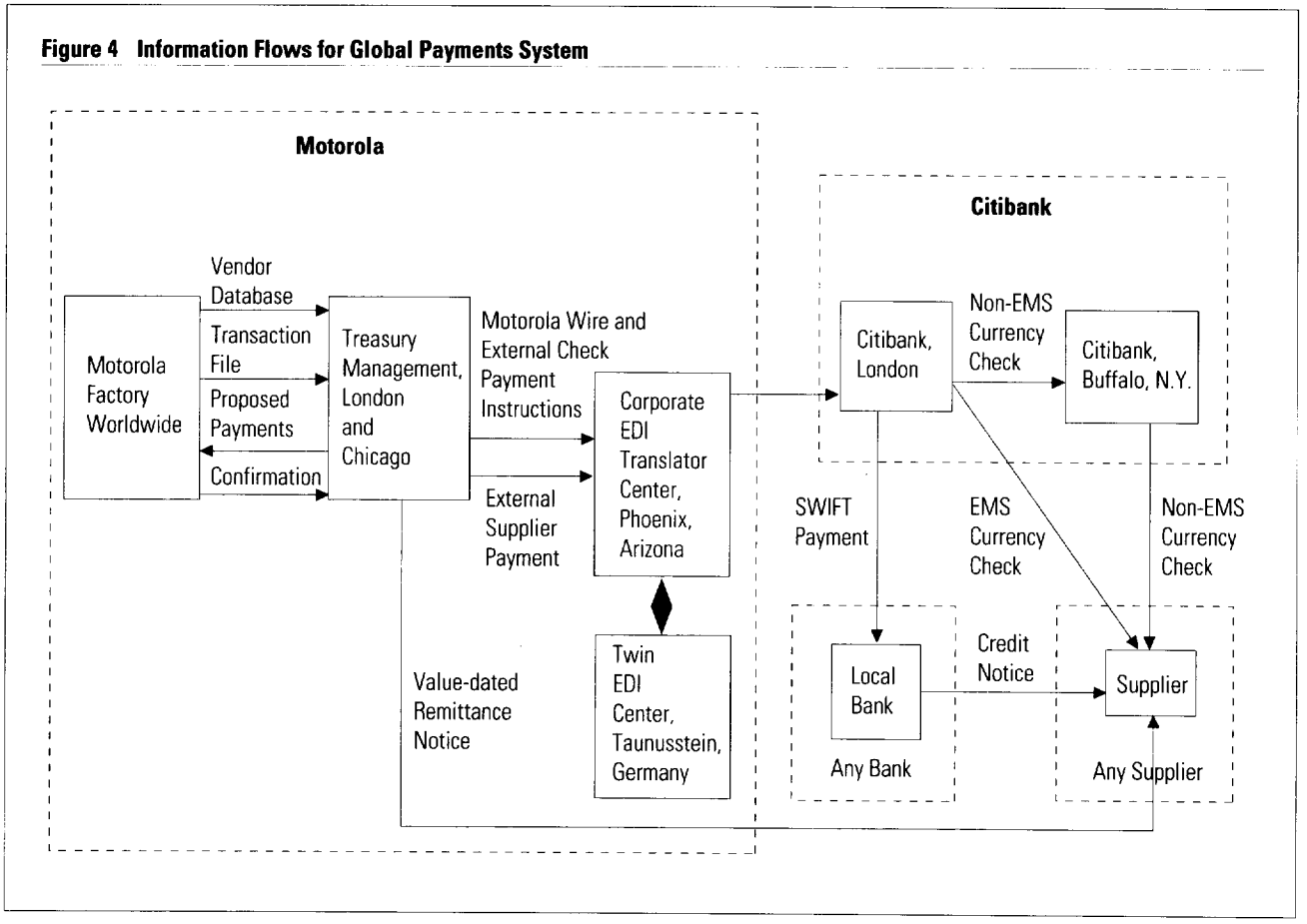
For external payments, better control is required because mistakes are more difficult and expensive to rectify. Therefore, before payment instructions are sent to Citibank, each Motorola factory controller must sign electronically (on-line) all payments to external suppliers before the payments can proceed and also amend or delete payments. Costs of mistakes, principally unnecessary foreign exchange dealings, are borne by the individual netting entities. Therefore, the central treasury function is, in essence, acting as an international bank. The three main classes of payment are: (1) electronic payments to Motorola companies; (2) check payments for less than $7,000 in value to external suppliers; (3) electronic bank transfer payments over $7,000 in value to external suppliers.

All payment orders (wire and checks) are sent direct to Citibank London via the EDI corporate center in Phoenix, Arizona. For check payments, Citibank uses "Worldlink," an application Citibank developed to generate checks off-site. Citibank receives all payments through EDIFACT messages via Phoenix. Citibank then translates the EDIFACT messages into the Society for Worldwide International Funds Transfer (SWIFT) network and generates two types of files — wire transfer and check. Check files are sent to the Worldlink computer in London and Buffalo, New York. Buffalo handles checks in U.S. dollars, and London, all other currencies. If the check is payment for more than four invoices, then the remittance notice is printed separately and sent with the check, each document referring to the other. Otherwise, the remittance notice is printed directly on the check. Payments to Motorola companies are all sent by bank transfers. (Motorola companies have already received, electronically, notice of payments on Tuesday P.M., before the Thursday value-date.)

External supplier payments are slightly more complex. Details of supplier payments and remittance notices are sent to the corporate EDI center in Phoenix for translation into an EDIFACT format, which acts as an electronic gateway for all EDI messages from Motorola to its trading partners, and vice versa. The payment details and EDIFACT standard remittance notices (PAYEXT) are then transmitted to Citibank London. Citibank uses SWIFT standards to effect the payment through the international banking system, and Motorola sends the remittance notice separately and directly to the supplier, using a predefined VAN. Suppliers wanted a direct remittance notice that included the value date of the payment rather than using the SWIFT network as a conduit for receiving this information.

Currently, banks completely manage most cross-border payments, and the time needed for money to become available is highly variable. Six or seven banks may take from fourteen to twenty days before the organization receiving a payment has the cash ready to use. Aside from

Figure 4 Information Flows for Global Payments System



the (often hidden) transaction costs, cash management is the more important problem. In the system we have described, the supplier is informed of the value date of the payment — the day that payment goes into the banking system and the day that funds should be credited into the beneficiary's bank account. With modern electronic systems, there is no reason why the cash cannot be credited to the beneficiary's bank on the value date, allowing more than adequate time for checking and controlling systems to work effectively. Just-in-time money is possible, and the system we describe is a major advance in that direction.

Motorola's payments system uses a variety of different computer networks to support the sharing of data and software between Motorola companies, its trading partners, Citibank, and other banks involved in the cash supply chain. Communication between Motorola companies and the central treasury management function is via an internal electronic mail system composed of three subsystems covering the Central, Mountain, and Pacific time zones. Motorola's treasury management center uses a dial-up line to access Citibank's global telecommunications network. The corporate EDI center is connected to Citibank London via a VAN, which is also used to transmit remittance data to suppliers. Data encryption techniques ensure data security, and contingency/recovery plans are built into the system by mirroring all the activities of the Phoenix corporate EDI center in Taunusstein, Germany. Citibank uses its own global network for transferring payment details between its branches and the SWIFT network to communicate with other banks and effect electronic bank transfer payments. Motorola suppliers choose the VANs for communicating the remittance notices, which include AT&T, Istel's International Network Services, and IBM's Managed Network Service.

Initially, most of the effort was inside Motorola. However, in many respects, Motorola companies are autonomous and very similar to both suppliers and customers. Therefore, the external connections were seen as a natural progression. The companies encountered very few technical difficulties, only a win-win situation.

Evolution and Growth

The success of the Motorola system comes from many factors. It is similar to other large-scale information systems that are used for competitive advantage.[6] It has been driven by Motorola's clear vision for the electronic

Table 2 Evolution of Motorola's Cash Management Strategy

	Strategic Focus	Activities	Information Technology
1976	Reduce cash flows within organization to achieve cost savings.	All payments data physically collected in Chicago and controlled from Geneva. Currency netting system implemented for Motorola companies.	COBOL programming language used to develop internal e-mail system that enables all Motorola companies to share data.
1980	Include external suppliers in currency netting process.		
1989		European treasury management function moved to London and interfacing global systems to Citibank to effect supplier and internal payments.	
1990	Ally strategically with Citibank to develop an EDI service for payments to suppliers.		Extensive use of internal global system, leased lines, and value-added-networks (VANs) to share information with Citibank.
1992	Increase level of value-added services to suppliers. For example, make full remittance notice in electronic form and value date of payment to suppliers transparent.	Send remittance notice separately to suppliers via Citibank and VAN chosen by suppliers.	Development of EDIFACT standards for remittance notices.

handling of money and its associated simplifications. However, like other large and successful systems, it has evolved over a considerable period of time.

Both Motorola and Citibank took a global strategic stance and had a clear vision of how they wanted to develop. Table 2 details the evolution of Motorola's cash management strategy, starting from the implementation of an internal global electronic mail system to the inclusion of external suppliers into the netting system. Citibank's main systems for the Motorola project are shown in Table 3. Citibank had been developing global computing banking systems for a long time. Like Motorola, its success in this field gave it confidence to continue major strategic developments in cash management payment systems.

Table 4 shows the growth in cash flows between Motorola companies from 1983 to 1991 and also the increasing number of companies that participate in the system. The payments settled column is the sum of the accounts payable of all netting companies. The net cash flow in 1991 was $2.4 billion, a reduction of $2.38 billion from the value of payments settled in 1991, which was $4.78 billion. The foreign exchange with banks is the total value of currencies bought and sold. Without netting, the figure for 1991 would have been $4.3 billion, a reduction of $3 billion worth of foreign exchange transactions, which equates to a direct annual savings of approximately $6.5 million in foreign transactions alone.

There are approximately 2,500 transactions per month. Only a small number of suppliers are currently receiving remittance notices electronically, but the great majority of suppliers will be linked in the next five years. Growth in the number of suppliers is expected to increase rapidly as the system gradually becomes seamless.

The information technology links between Motorola companies and the treasury function will improve. Most of the data are now entered manually at each factory; only aggregate payment data are recorded. Several of the leading-edge users have direct interfaces to the center, which enables treasury management to pull transaction data at an invoice level and vendor files directly off its accounts payable systems. This improves data accuracy and reduces administrative load on the factories.

Other Implementation Issues

Within Motorola, senior managers initially resisted and needed convincing that the proposed changes were both necessary and worthwhile. They were concerned about the new system's necessity, wanted to consider other options such as the cash management systems that external

Table 3 Evolution of Citibank's Cash Management Strategy

	Strategic Focus	Activities	Information Technology
1975	Gain experience in EDI payments services.	EDI payments link implemented between General Motors and its suppliers.	Development of standards and use of networks.
1989		Global interface with Motorola to collect payment orders.	EDIFACT standards and IBM's world-wide data network used to share data with Motorola.
1990	Ally strategically with Motorola to develop an EDI service for payments to their suppliers.	Develop interface with Motorola to communicate via a value-added network (VAN). Two proprietary on-line Citibank PC-based systems used to manually input payment details for checks and wire payments.	Host-to-host application with Motorola to collect extended remittance notices for check payments. PC software; direct link to Citibank payment service. Authentication and data encryption techniques developed.
1991	Focus on product innovation and improvement.	Direct downloading of payments data from customers' information systems to Citibank's EDI service.	Software interfacing and development of message standards for payment details.
1992	Enhance payments services.	Send remittance notice to suppliers, either electronically for bank transfers or printed on check for check payments.	Single file received from Motorola containing all payment types (bank transfer and checks), automatically split so that bank payments and EMS currency checks effected by London Citibank and U.S. dollars and rest-of-world check payments managed in Buffalo, New York. EDI remittance notices sent to suppliers through suppliers' chosen VAN.

companies offered, and wondered whether a new system could be justified, especially because the existing local arrangements for payments worked successfully. Their resistance caused a one-year delay and was overcome only when Motorola communicated the potential benefits through presentations, conferences, and discussions. Motorola also gained the support of users worldwide. In addition to organizational issues, some IT-related problems centered around the installation of a new currency netting system in parallel with older versions.

Once it had overcome the internal organizational and technical barriers to implementation, Motorola shifted its attention to negotiation and discussions with Citibank, which needed to be convinced that the volume of payments and the associated level of transactions justified a new approach. A Motorola treasury manager commented, "The implementation was hard work, but it forced me to understand my environment and convinced me that I was heading the right way. I would do it again." The cash management project manager at Citibank thought that the information technology barriers were simple to resolve because Motorola and Citibank had a common understanding of the project and both companies had good internal IT infrastructures that were supported by a high level of technical expertise. He felt that the most important problems were in persuading both organizations to commit considerable resources to obtain benefits from a highly visible project with a long lead time.

Another implementation issue involved the cultural differences between the treasury groups in the United States and Europe. The U.S. managers did not fully comprehend the issues and relatively high cost of moving funds across European country boundaries com-

Table 4 Growth of Motorola's Cash Management Netting System

	Value of Payments Settled (in $ millions)	Foreign Exchange with Banks (in $ millions)	Number of Motorola Participants
1983	600	229	38
1984	800	361	51
1985	1,100	391	53
1986	1,300	432	57
1987	1,800	415	65
1988	2,700	510	76
1989	3,000	650	85
1990	3,391	1,100	103
1991	4,780	1,281	106

pared to the relative simplicity and low cost of moving funds within the United States. The complexity of European treasury management means that it is more important to develop a close relationship with a bank to ensure that the payment system works effectively.

Also, there was difficulty in identifying all the relevant decision makers at Motorola, a complex multinational company, for a cash payments system that had an impact on a large cross-section of the organization. Another issue was the need to maintain momentum once the project had started in order to achieve wide-scale adoption of the new system and to ensure that the benefits were widely understood for each user group. The treasury group could easily identify and appreciate foreign exchange savings. But for the factory controllers, the main benefits were the increased accuracy of supplier payments, which meant that they did not have to spend time on resolving mistakes when they should have been discussing manufacturing strategy with suppliers.

Implications for Financial Relationships

A strong business vision coupled with the IT platforms of Motorola and Citibank have made possible a global cash management system that benefits both Motorola and its suppliers. This has been achieved through gradual innovation and is characterized by a learning process that has allowed the companies to become accustomed to technical and organizational change. The focus has shifted from an initial cost saving initiative to one that now yields significant strategic advantage. Information systems are used to tie together the financial processes of Motorola companies and their suppliers by integrating the cash supply chain of Motorola, Citibank, suppliers' banks, and suppliers. Although the process looks complicated, it simply uses EDI to its fullest extent. There are now no technical reasons why cross-border payments should not be made quickly and at a specified time. The Motorola case represents a move toward just-in-time money that will bring banks in line with manufacturing organizations. An electronic revolution in banking may eventually occur.

Information handling is no longer seen as a barrier to innovation and change in cash management strategy. Both Motorola and Citibank have internal global networks that allow them to transfer data relatively easily between any sites. The system also has many additional advantages, e.g., it allows managers to use applications that are located physically in another country. As a result, treasury management, currently based in London, could be anywhere on the network. Motorola chose Europe as a center because of the time zone, its strong manufacturing presence in Europe, and accessibility to London's financial markets.

The results of the Motorola system have implications for cash supply chains, financial relationships in business markets, and strategy evolution. Cash flows are brought in line with product flows. The coordinating mechanisms center around the transparency of information from the payer's transaction file and vendor database through to the supplier. The system has been achieved largely through cooperation between a global manufacturer, a global bank, and suppliers to Motorola. The payments system we describe here would be very difficult to implement with a group of national banks or with an adversarial supplier. It depends critically on organizations that expect to work closely with each other, i.e., they have a strong basis for trust and share common needs.

Motorola's cash management strategy has evolved over a long time, has delivered significant cost savings, and is now being exploited strategically to enhance supplier relationships. The cost savings are direct financial ones associated with reduced foreign exchange dealings worth approximately $6.5 million and administrative

savings associated with streamlining the treasury function, which is perhaps worth considerably more but is difficult to measure accurately.

Cooperation between Motorola and Citibank has enabled the development of a better payment system. It is therefore difficult to separate individual firm strategies, as Motorola and Citibank each benefit from the other's resources and expertise. We can describe this as a cooperative strategy to streamline the cash supply chain from customer to supplier. Both organizations see themselves in global terms and provide worldwide services; they speak a similar language.

Information systems form the backbone of the cash management strategy, but any problems being encountered now are organizational rather than technical. The limiting factors in implementation are the ability of the organization to learn and adapt to new treasury management ideas. Central to the implementation are resources for education and training for Motorola companies and their suppliers.

Motorola's Experience Compared with Theory

We viewed the implementation of a global cash management system between Motorola and its trading partners as an applied management/IS problem. In our managerial perspective, relevant IS theories were fragmented across many different disciplines but, in particular, strategy and the associated competitive advantage literature, marketing, economics, and organizational behavior. Given this complexity, we compared the principal results with management/IS theories connected with the evolutionary themes of interorganizational information systems (IOSs) and the emerging forms of business relationships and market structures.

The potential of IOSs to enable a company to achieve competitive advantage is now well documented.[7] However, there is considerable disagreement on the emerging forms of organizations, business relationships, and market structures. There is also the problem of strategy choice for individual organizations. General IS theories on the impact of IT on organizations all agree that organizational design and change are intimately related to IT's implementation.[8] For example, Bjorn-Andersen et al. argue that the impact of IT on organizations is principally a process of organizational design by managers and that, in general, IT does not have a predetermined influence other than to increase the transparency of information.[9] Their conclusion is significant because it highlights the role of managerial choice in IT implementation.

Keen gives a complementary view in an analysis of the application of telecommunications to assist organizational performance.[10] He asserts that telecommunications remove the dichotomy of centralization and decentralization, and "centralization with decentralization" is therefore possible. The organizational changes that have occurred in Motorola's treasury management function support the notions of managerial choice and centralization with decentralization. The treasury management function is evolving into a global, companywide, standardized business process. It is these internal changes that have provided the impetus and confidence for Motorola to make further innovations with suppliers and customers.

At an interorganizational level, the areas of interest are business relationships and market structure rather than single organizations. Rockart and Short observed the abundance of theories but lack of consensus in this area and conceptualized the problem as one of managing organizational interdependence.[11] They focus attention on the potential benefits to be gained at an interorganizational level and are supported by case evidence and theoretical models reported by Johnston and Lawrence, Konsynski and McFarlan, and others.[12]

A more extensive theory on the coordination mechanisms to control interactions between organizations is the theory of electronic markets, which makes several predictions.[13] In this scenario, multiple buyers and multiple sellers have equal and open access to all market data and are therefore able to search and evaluate competing product offerings of suppliers or competitors facilitated by the use of IOSs for sharing data. An important prediction is that organizations will not achieve long-term competitive advantages by tying customers in but instead by forming many loose and fragmented relationships. Johnston and Vitale, Johnston and Lawrence, and Konsynski and McFarlan argue that organizations will use IOSs for competitive advantage, which can, for example, lock customers in, lock competitors out, and control access to privileged information.[14] This suggests that organizations will choose to cooperate closely with important trading partners and develop IOSs for mutual benefit. The unit of analysis for competitive advantage becomes networks of organizations involved in the supply chain of specific product groupings rather than a single organization's activities. Access to data will be privileged, and competitors will develop competing systems. The resulting market structure is one of hierarchically arranged organizations integrated by IOSs — electronic hierarchies.

In the case of Motorola, the electronic markets theory is not supported, and the evolution of electronic hierar-

chies seems the most probable direction. Motorola's cash management system is characterized by several themes: cooperation, trust, and shared benefits with its customers, suppliers, and Citibank. Close relationships based on manufacturing ties with suppliers are being augmented by a tight coupling of financial transactions that align the cash flows with the product flows. Motorola has no intention of opening the system to competitors or involving a large number of competing banks. However, if the manufacturing relationships with suppliers were changed to an electronic markets arrangement, then the cash management system could support the new structure because new suppliers could be added quickly and easily to the payments system.

There are several possible explanations of the trend towards hierarchical structures instead of market ones that apply specifically to this case but also to business markets in general. A basic tenet of electronic markets theory is that it is possible to interchange suppliers quickly and easily. But business markets are characterized by stability, long-term relationships, and mutual adaptation to changing needs.[15] In most cases, it is neither possible nor desirable to change suppliers quickly. Instead, limited organizational resources are being allocated to manage fewer relationships better, and IOSs constitute a critical element of this strategic choice. The phenomenon of cooperative competitive strategies[16] make it clear that there is great potential for exploiting IOSs to support and enable cooperative business relationships, which depend on trust for their effective operation and long-term existence.[17]

The IT-impact theories we have considered make numerous, diverse predictions on the likely organizational and market forms and proffer different explanations. But they do not address directly the long time frames and processes of organizational adaptation and learning that are an integral part of Motorola's strategy. Our case work and recent research suggest that evolution over a long time is an important aspect of large-scale information systems.[18] It appears that static end points will not occur, but instead a process of continuous change incorporating innovation, cost reduction, and quality improvement over the life of a system.

Conclusion

We have shown that effective cash management can yield significant strategic benefits in both cost savings and better quality relationships with suppliers. In this paper, we have given an example of a currency netting model that has been applied on an interorganizational, global scale to reduce cash flows and foreign currency payments. The principle innovation that Motorola and Citibank implemented was to include Motorola's suppliers in the currency netting process. The coordination mechanisms for cash management between Motorola and its suppliers consists of two main processes: (1) Motorola's collection of payments data using an internal global e-mail system; and (2) Citibank's capability to receive electronic payments data, process it, and effect the relevant disbursements and communication with suppliers. The results have implications for banking, strategy implementation, business relationships and competition, and organizational change associated with the implementation of information systems.

The medium- to long-term implications for banks are that there will be reduced revenues from interest and a trend towards transaction-based charges because of increased information transparency throughout the cash supply chain. An example is Citibank's transmission of the value date of payments directly to the supplier, in addition to other value-added information such as the remittance notices that Motorola sends.

The payment system was not originally designed as a breakthrough system to give Motorola a competitive advantage but as a means of reducing costs and later adding value to first-tier suppliers. However, by gaining experience in currency netting between companies, Motorola was then in a position to extend the netting system to include suppliers. Citibank provided the necessary global expertise in disbursement that complemented Motorola's expertise in collection of payments data. Therefore, two evolutionary strategies have been merged cooperatively to achieve synergistic benefits. This process is ongoing, and further benefits are likely.

Competition in business markets takes place over a long time, and it is not necessary to be able to switch suppliers for sourcing and payments overnight. The global EDI cash payment system we described here signifies the trend toward increased financial integration between a manufacturing organization and its suppliers. It therefore represents the development of an electronic hierarchy in which cash flows mirror product flows.

Motorola's treasury management function is continually changing and improving in order to reduce costs and improve the quality of its information to Motorola companies and their suppliers for better planning. Information systems have had no predetermined impact on the design of treasury management except to make it location independent. It can operate from anywhere in the world, but the time zone differences make Europe more attractive. Motorola's capacity to change is limited only by its ability to learn, adapt, and influence trading part-

ners. Technology is no longer a significant problem in implementation. Managing innovation, strategic alliances, organizational learning, and change are now the critical issues. ◆

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5. In mathematical notation:
For company x,

Sum of accounts payables = $\sum_{j=1}^{4} M_{xj}$

Sum of accounts receivables = $\sum_{i=1}^{4} M_{ix}$

Net position = $\sum_{i=1}^{4} M_{ix} - \sum_{j=1}^{4} M_{xj}$

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Reprint 3613