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Anol Bhattacherjee
Arizona State University, Anol.Bhattacherjee@asu.edu

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Anol Bhattacherjee
Accounting and Information Management
College of Business
Arizona State University

Anol.Bhattacherjee@asu.edu

CASE STUDY

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Anol Bhattacherjee
Accounting and Information Management
College of Business
Arizona State University

Anol.Bhattacherjee@asu.edu

ABSTRACT

Faced with intense competition in the generics drugs industry, eroding margins, and continuous price pressures, Geneva Pharmaceuticals, the North American subsidiary of Novartis International AG, made a bold, multi-million dollar decision to reengineer all its demand and supply processes using the SAP R/3 system. This case describes Geneva's journey through the first two of three phases of R/3 implementation from mid-1997 to mid-2000, and the company's plans for Phase III (scheduled for completion by late-2000). It highlights initial mistakes during this journey, strategies that helped overcome those mistakes, and how R/3 delivered operational efficiencies and competitive advantage under difficult business circumstances. As the case illustrates, ERP implementation is much more than technology change, it also incorporates substantive process and people changes; and without appropriate change management strategies and experienced leadership, ERP projects are likely to fail.

Keywords: Enterprise resource planning, IS implementation, business process reengineering, project management.

I. COMPANY BACKGROUND

Geneva Pharmaceuticals, Inc. is one of the world's largest generic drug manufacturers and the North American hub for the generic drugs division of Swiss pharmaceutical and life sciences company Novartis International AG. Originally founded by Detroit pharmacist Stanley Tutag in 1946, Geneva moved its headquarters to Broomfield, Colorado in 1974. Subsequently acquired by Ciba Corporation in 1979, Geneva became a part of Novartis when Ciba merged with Sandoz Ltd. in 1996, in the largest ever merger in the healthcare industry until that time. Alex Krauer, Chairman of Novartis and former Chairman and CEO of Ciba, gave the rationale for the merger as:

> *"Strategically, the new company moves us into a worldwide leadership position in life sciences. Novartis holds the number two position [globally] in pharmaceuticals, number one in crop protection, and has tremendous development potential in nutrition."* (Annual Report, 1999).

The name "Novartis" comes from the Latin term *novae artes* or new arts, which eloquently captures the company's corporate vision: "*to develop new skills in the science of life*." Novartis inherited , a 200-year heritage of Ciba and Sandoz serving consumers in three core business segments (Table 1):

- healthcare,
- agribusiness, and
- nutrition.

Today, Basel, Switzerland based Novartis has 82,000 employees worldwide, runs 275 affiliate operations in 142 countries, and generates annual revenues of 32 billion Swiss Francs (as of June 2000, 1 Swiss franc equaled approximately 0.6 U.S. dollars). Novartis' key financial data for the last five years (1995-99) are presented in Table 2. The company's American Depository Receipts trade on the New York Stock Exchange under the ticker symbol NVS.

Table 1. Novartis' Divisions and Business Units

Divisions	Business Units
Healthcare	Pharmaceuticals
	Consumer Health
	Generics
	CIBA Vision
Agribusiness	Crop Protection
	Seeds
	Animal Health
Nutrition	Infant and Baby Nutrition
	Medical Nutrition
	Health Nutrition

Table 2. Novartis' Five-Year Financial Summary

	1999	1998	1997	1996	1995
Annual sales	32,465	31,702	31,180	36,233	35,943
Sales from healthcare	19,050	17,535	16,987	14,048	12,906
Sales from agribusiness	6,359	8,379	8,327	7,624	7,047
Sales from consumer health	7,056	5,788	5,866	5,927	5,777
Sales from industry	-	-	-	8,634	10,213
Operating income	7,056	7,356	6,783	5,781	5,714
Net income	6,659	6,064	5,211	2,304	4,216
Cash flow from operations	6,893	5,886	4,679	4,741	5,729
R&D expenditure	4,246	3,725	3,693	3,656	3,527
Total assets	65,527	55,375	53,390	58,027	50,888
Net operating assets	24,759	20,913	19,619	21,820	22,278
Number of employees	81,854	82,449	87,239	116,178	133,959
Debt/equity ratio	0.27	0.28	0.41	0.46	0.46
Current ratio	2.0	2.0	1.7	1.9	2.2
Return on sales (%)	20.5	19.1	16.7	13.9	-
Return on equity (%)	19.4	21.0	20.7	16.7	-

Note: All figures in millions of Swiss Francs, except otherwise indicated.
    1995 data is on pro forma basis, based on pooled data from Ciba and Sandoz.

Novartis' generic drugs division is Novartis Generics. This division is headquartered in Kundl (Austria), and its U.S. operations are managed by Geneva Pharmaceuticals. In 1999, Geneva had revenues of $320 million, employed nearly 1000 people, and manufactured over 4.6 billion dosage units of generic drugs. The Geneva portfolio currently includes over 200 products in about 500 package sizes, covering a wide range of therapeutic categories, including nervous system disorders,

cardio-vascular therapies, and nonsteroidal anti-inflammatory drugs. Its major products include ranitidine, atenolol, diclofenac sodium, ercaf, metoprolol tartrate, triamterene with hydrochlorothiazide, and trifluoperazine. Geneva's business and product information is shown on the company's web site at www.genevaRx.com.

Generic drugs are pharmaceutically and therapeutically equivalent versions of brand name drugs with established safety and efficacy. For example, acetaminophen is the equivalent of the registered brand name drug Tylenol[®], aspirin is equivalent of Ecotrin[®], and ranitidine HCl is equivalent of Zantac[®]. This equivalence is tested and certified in the U.S. by the Food and Drug Administration (FDA), following successful completion of "bioequivalence studies," in which the blood plasma levels of an active generic drug in healthy people are compared with that of a corresponding branded drug. Maintaining a continuous pipeline of new drugs, regular clinical trials, and FDA approvals are therefore keys for survival in this industry.

II. INDUSTRY AND COMPETITIVE POSITION

The generic drug industry in the U.S. is fragmented and highly competitive. Geneva is a leading player in this industry, ranked second in sales in 1996 and fifth in 1999. The company's competitors fall into three broad categories:

- Generic drugs divisions of major branded drug companies, such as Warrick (a division of Schering-Plough), Apothecon (a division of Bristol Myers Squibb),
- Independent generic drug manufacturers, such as Mylan Pharmaceuticals, Teva Pharmaceuticals, Barr Laboratories, Watson Pharmaceuticals, and
- Drug distributors that have vertically integrated into generics manufacturing, such as AndRx.

The industry also includes about 200 smaller players specializing in the manufacture of niche products.

Growth is particularly difficult, given the hyper-competitive nature of the industry. Geneva's business strategy emphasizes growth in two ways:

- Internal growth over a select range of product types, and
- Growth via acquisitions.

For Geneva, internal growth was 14 percent in 1999 (no acquisitions in that year), primarily due to vigorous growth in the penicillin and cephalosporin businesses. In pursuit of further growth, Geneva spent $52 million in 1997 to upgrade its manufacturing capacity (to 6 billion units annually) and another $23 million in 1998 for clinical trials and new product development. Unlike independent companies which typically use public stock markets to fund their growth strategies, Geneva relies on the financial strength of Novartis

About 45 percent of medical prescriptions in the U.S. are currently filled with generic drugs, a figure that increased throughout the 1990's. This trend toward generics is driven by their lower costs (generic drugs typically cost 30-50 less than equivalent brands) and the growth of managed care providers such as health maintenance organizations (HMO), who generally prefer low-cost generics to more expensive branded alternatives. However, no particular generics manufacturer has benefited from this trend, because of increased price-based competition and rampant "autosubstitution" in the industry. Autosubstitution implies that distributors and pharmacies view generic products from different manufacturers as perfect substitutes and tend to freely substitute products of one company with that of another, based on product availability, pricing, and other measures. Once substituted, it is very difficult to regain a customer account because pharmacies are generally disinclined to changing product brand, color, and packaging, to reduce confusion among consumers. In addition, consumer trust toward generics remains low, following a widely-publicized generics scandal in the early 1990's that did not involve Geneva. Margins in this sector therefore remained extremely low, and Geneva and its competitors are continuously faced with pressure to reduce costs of operations.

Opportunities for international growth are limited for two reasons:

- Consumers in some countries such as Mexico are culturally skeptical toward the lack of branding.

- U.S. generics manufacturers are often undercut by competitors from India and China, where abundance of cheap labor and less restrictive regulatory requirements makes drug manufacturing less expensive.

Continuous price pressures led to several mergers and acquisitions in the industry in recent years, as the acquirers seek economies of scale as a means of reducing costs. The search for higher margins also led some generics companies to venture into the branded drugs sector, providing clinical trials, research and development, and additional manufacturing capacity for branded drugs on an outsourced basis.

III. CORE BUSINESS PROCESSES

Geneva's primary business processes are manufacturing and distribution. The company's manufacturing operations are based at a 600,000 square foot facility in Broomfield, Colorado, while its two large distribution centers are located in Broomfield and Knoxville, Tennessee.

Geneva's manufacturing process is scientific, controlled, and highly precise. A long and rigorous FDA approval process is required prior to commercial production of any drug, the exact formulation of the drug or its "recipe" is documented. Raw materials are sourced from suppliers (sometimes from foreign countries such as China), tested for quality (per FDA requirements), weighed (based on dosage requirements), granulated (i.e., mixed, wetted, dried, milled to specific particle sizes, and blended to assure content uniformity), and compressed into a tablet or poured into a gelatinous capsule. Some products require additional coatings to help in digestion, stabilizing, regulating the release of active ingredients in the human body, or simply to improve taste. Tablets or capsules are then

imprinted with the Geneva logo and a product identification number. Following a final inspection, the medications are packaged in childproof bottles with a distinctive Geneva label, or inserted into unit-dose blister packs (aluminum foil wraps widely used for packaging drugs) for shipment.

Manufacturing is done in batches; however, the same batch can be split into multiple product types such as tablets and capsules, or tablets of different dosages (e.g., 50 mg and 100 mg). Likewise, finished goods from a batch can be packaged in different types of bottles, based on customer needs. These variations add several layers of complexity to the standard manufacturing process and require tracking of three types of inventory:

- raw materials,
- bulk materials (the intermediate stage prior to packaging), and
- finished goods.

In some cases, additional intermediates such as coating solutions are also tracked. Master production scheduling is focused on the manufacture of bulk materials, based on forecasted demand and replenishment of "safety stocks" (of finished goods) at the two distribution centers. Finished goods production depends on the schedule-to-performance, plus availability of packaging materials (bottles and blister packs), which are sourced from outside vendors.

Bulk materials and finished goods are warehoused in the Broomfield and Knoxville distribution centers prior to shipping. Since all manufacturing is done at Broomfield, inventory replenishment of manufactured products is done first at Broomfield and then at Knoxville. To meet additional customer demand, Geneva also outsources production to smaller manufacturers, who produce and package generic drugs under Geneva's label. Most of these outsourcing vendors are located along the East Coast; hence, their finished goods is shipped first to the Knoxville and then to Broomfield. Purchasing is simpler than manufacturing because it requires no bill of materials, no bulk materials management, and no master scheduling; Geneva simply converts planned orders to purchase requisitions, and then to purchase

orders, that are invoiced upon delivery. However, balancing manufacturing and purchasing is a difficult task, as explained by Joe Camargo, Director of Purchasing and Procurement:

> *"Often times, we are dealing with more than a few decision variables. We have to look at our forecasts, safety stocks, inventory on hand, and generate a replenishment plan. We don't want to stock too much of a finished good inventory because that will drive up our inventory holding costs. We tend to be a little more generous on the raw materials side, since they are less costly than finished goods and have longer shelf lives. We also have to factor in packaging considerations, since we have a pretty short lead time on packaging materials, and capacity planning, to make sure that we are making efficient use of our manufacturing capability. The process is partly automated and partly manual, and often times we are using our own experience and intuition as much as raw numbers to make a good business decision."*

Geneva supplies about 250 customers, including distributors (e.g., McKesson, Cardinal, Bergen), drugstore chains (e.g., Walgreen, Rite-Aid), grocery chains with in-store pharmacies (e.g., Safeway, Kroger), mail order pharmacies (e.g., Medco, Walgreen), HMOs (e.g., Pacificare, Cigna), hospitals (e.g., Columbia, St. Luke's), independent retail pharmacies, and governmental agencies (e.g., U.S. Army, Veterans Administration, Federal prisons). Distributors account for about 70 percent of Geneva's sales, with drugstore chains accounting for another 20 percent. Distributors purchase generic drugs wholesale from Geneva and resell them to retail and mail order pharmacies (some of whom are also Geneva's direct customers). The volume and dollar amount of transactions vary greatly depending on the customer. Distributors are sometimes willing to allow some lead time to fulfill a large order, but retail pharmacies are generally unwilling to make such concessions.

One emerging potential customer segment is Internet-based drug retailers such as Drugstore.com and PlanetRx.com. These online drugstores do not maintain any inventory of their own, but instead accept orders from retail customers and pass these orders to any wholesaler or manufacturer who can fill them on short notice. These small, customized, and unpredictable orders do not fit well with Geneva's

wholesale, high-volume sales strategy, and hence, the company decided against direct retailing via mail order or Internet in the near future.

Geneva uses a complex incentive system based on "rebates" and "chargebacks" to entice distributors and pharmacies to buy its products. Such incentives are fairly standard in the generic drugs industry. Each drug is assigned a "published industry price" by industry associations, but Geneva rebates that price to distributors on their sales contracts. For example, if the published price of a certain drug is $10 and Geneva agreed to rebate that drug by $3 to a given distributor, then the contract price paid by that distributor for this drug is $7. Rebate amounts are determined by the sales management based on negotiations with customers, and vary with customers, products, order volumes, and other considerations. Sometimes, customers receive offers to buy drugs at a cheaper rate from other manufacturers and ask Geneva to match or beat that discount. Depending on how badly Geneva needs that customer or wants to push that product, it may offer a new rebate or increase an existing rebate. Likewise, pharmacies ordering Geneva's products are paid back a fraction of their dollar purchases as chargebacks.

The majority of Geneva's orders come through electronic data interchange (EDI). These orders pass though multiple filters in an automated order processing system for error-checking (e.g., if the customer has an active customer number and adequate credit, if the item ordered is correct and available in inventory). Customers are then assigned either to the Broomfield or Knoxville distribution center based on quantity ordered, order expiration dates, and whether the customer would accept split lots. If the quantity ordered is not available at the primary center (say, Knoxville), a second allocation is made to the secondary center (Broomfield, in this case). If the order cannot be filled immediately, a backorder is generated and the Broomfield manufacturing unit is notified. Once filled, the distribution unit will print the order and ship it to the customer, and send order information to accounts receivable for invoicing. The overall effectiveness of the fulfillment process is measured by two customer service metrics:

- the ratio between the number of lines on orders that are filled immediately (partial fills allowed) to the total number of lines ordered by customers (called "firstfill"), and
- the percentage of items sent from the primary distribution center.

Fill patterns are important because customers generally prefer receiving all items ordered in a single shipment.

Matching customer demand to production schedules is often difficult because of speculative buying on the part of customers. Prices of drugs are typically reassessed at the start of every fiscal year, and distributors may place very large orders at the end of the previous year to stock up on drugs whose prices are expected to increase next year. Likewise, a distributor may place a large order at the end of its financial year to transfer cash-on-hand to cost-of-goods-sold, for tax purposes or to make itself look less attractive to a potential acquirer. Unfortunately, most generic drug companies do not have the capacity to fulfill such orders on short notice. Yet failing to do so may result in the loss of an important customer. While safety stocks help overcome some of these demands, maintaining such inventory consumes operating resources and reduces margins further.

IV. SAP R/3 IMPLEMENTATION DECISION

Until 1996, Geneva's information systems consisted of multiple software programs for managing mission-critical functions such as procurement, manufacturing planning, accounting, and sales. The systems infrastructure was predominantly oriented around IBM's technologies. The primary hardware platform was a mid-range IBM AS/400. The software platform was based primarily on IBM's DB/2 database. Desktop microcomputers were connected to the AS/400 via a token-ring (an IBM proprietary standard) local area network.

Business units funded and deployed applications as needed in an ad hoc manner, without concern for maintenance or enterprise-wide interoperability. For example,

- the manufacturing unit used the MacPac application for managing its materials requirements planning process,
- financial accounting used Software/2000 for general ledger and accounts receivable, and
- senior management used FYI-Planner for budgeting and planning.

Data shared across business units (e.g., accounts receivable data was used by both order management and financial accounting, customer demand was used in both sales and manufacturing) were double-booked and re-keyed manually. This configuration led to higher incidence of data entry errors, error processing costs, and data inconsistency. Further, data was locked within "functional silos" and did not support new, value-added processes that cut across multiple business units (e.g., end-to-end supply chain management). It was apparent that a common, integrated company-wide solution was required to improve data consistency and accuracy, reduce maintenance costs (e.g., data reentry, error correction), and enable value-added processes.

Toward this goal, in 1996, Geneva's corporate management initiated a search for technology solutions that could streamline its internal processes, lower costs of operations, and position the company strategically to take advantage of new value-added processes. It wanted enterprise resource planning (ERP) software that could:
- implement best practices in business processes,
- integrate data across business units (hence reduce re-keying and maintenance costs),
- enforce data standardization (to reduce software maintenance costs),
- integrate well with new technologies or systems of acquired companies,
- provide scalability with growing product and customer base, and
- be Y2K (year 2000) compliant.

The worldwide divisions of Novartis were considering two ERP packages at that time: BPCS from Software Systems Associates and R/3 from SAP. Branded drug divisions decided to standardize their data processing environment on BPCS, and generics decided to implement SAP R/3 (however, each generics subsidiary

proceeded with its own independent R/3 implementation; severely limiting data sharing across subsidiaries). A brief overview of the R/3 system is provided in the Appendix.

R/3 implementation at Geneva was planned in three phases (Table 3). Phase I would focus on supply side processes (e.g., manufacturing requirements planning, procurement planning), Phase II would be concerned with demand side processes (e.g., order management, customer service), and Phase III was aimed at integrating supply side and demand side processes to enable new value-added processes (e.g., supply chain management). Randy Weldon, Geneva's Chief Information Officer, outlined the goals of each phase as:

> *"In Phase I, we were trying to get better performance-to-master [production] schedule and maybe reduce our cost of operations. Our Phase II goals were to improve sales and operations planning, and as a result, reduce back orders and improve customer service. In Phase III, we hope to achieve end-to-end supply chain integration, so that we can dynamically configure our production schedules based on fluctuating demands from our customers."*

For each phase, specific R/3 modules were targeted for implementation. These modules along with targeted processes and implementation timelines are listed in Table 3. The three phases are described in the next three sections.

Table 3. R/3 Implementation Phases at Geneva

Phase	Business processes	R/3 modules	Implementation timeline (inception to go-live)
Vendor Selection			Mid-1997
Phase I: Supply side management	MRP, purchasing, inventory management	MM[1], PP, FI/CO[2]	Nov 1997 – Feb 1999
Phase II: Demand side management	Order management, sales, customer service	SD, MM[3], FI/CO[4]	Oct 1998 – Feb 2000
Phase III: Supply/demand integration	Sales & operations planning, supply chain management, data warehousing	APO, MES, BIW	Early 2000 – Late 2000

Notes: [1]MM: Raw materials inventory
[2]FI/CO: Accounts payable
[3]MM: Finished goods inventory
[4]FI/CO: Accounts receivable

V. PHASE I: SUPPLY SIDE IMPLEMENTATION

Phase I of R/3 implementation started on November 1, 1997 with the goal of migrating all supply-side processes (e.g., purchasing management, capacity planning, master scheduling, inventory management, quality control, accounts payable) from diverse hardware/software platforms to a common, integrated R/3 environment.

THE NEED FOR R/3

The application used previously to manage most of these processes was Macpac, which controlled shop floor operations, prepared master schedules, and performed maintenance management. Macpac did not integrate well with software packages used in other Geneva business units (e.g., Software/2000, FYI Planner), and was limited in its functionalities. For example, it did not have a simulation capability to run alternate production plans against the master schedule for "if-then" analysis, and could therefore not be used for estimation.

Materials requirements planning (MRP) was only partially supported in that Macpac generated production requirements and a master schedule but did not support planned orders (i.e., generating planned orders, checking planned order items against inventory or production plan, and converting planned orders to purchase orders or manufacturing orders). Consequently, planned orders were entered manually by sales personnel, which was expensive and left room for rekeying error. The system also did not support distribution resource planning (DRP). Instead it generated a simple replenishment schedule based on predefined economic order quantities. Macpac could perform capacity resource planning (CRP), but this feature was not used because it required heavy custom programming and major enhancements to master data.

The system had already been so heavily customized over the years, that even a routine system upgrade was considered unwieldy. Most important, the existing system placed Geneva at a disadvantage, since it did not accommodate new innovations in purchasing and procurement that could significantly impact costs

and service, such as consigned inventory, vendor-managed inventory, and paperless purchasing.

The objectives of Phase I were therefore:

- to migrate existing processes from Macpac to R/3,
- automate supply side process that were not supported by MacPac, and
- integrate all supply-side data in a single, real-time database that could exploit synergies across manufacturing and purchasing processes.

System integration was expected to reduce inventory and production costs, improve performance-to-master scheduling, and help managers make more optimal manufacturing and purchase decisions. Since R/3 would force all data to be entered only once (i.e., at source), it would reduce costs of data reentry, data reconciliation, and error correction. The processes to be migrated from MacPac (e.g., MRP, procurement) were fairly standardized and efficient, and were hence not targeted for redesign or enhancement. Three R/3 modules were scheduled for deployment:

- materials management (MM),
- production planning (PP), and
- accounts payable portion of financial accounting (FI).

Table A-2 in the Appendix provides brief descriptions of these and other common R/3 modules.

STARTING WITH R/3

Phase I of R/3 implementation employed ten IS personnel, ten full-time users, and ten part-time users selected from business units. Whitman-Hart, a consulting company with prior experience in R/3 implementation, was contracted to assist with the migration effort. The consultant team consisted of one R/3 basis (described in the Appendix) person (for implementing the technical core of the R/3 engine), three R/3 configurators (for mapping R/3 configuration tables in MM, PP, and FI modules to Geneva's needs), and two programmers for custom coding unique requirements not supported by R/3. These programmers were skilled in ABAP/4, R/3's proprietary programming language. The consultants brought in valuable experience and

expertise, which was vital, given that Geneva had no prior in-house experience in R/3 implementation at that time. Verne Evans, Director of the Integrated Supply Chain unit and a MacPac "super user", was assigned as the project manager for this phase. SAP's rapid implementation methodology called Accelerated SAP (ASAP) was selected for R/3 implementation, because of its promised implementation cycle of only six months.

Four months later, in February 1998, Geneva found that little progress had been made in R/3 implementation despite substantial investments in hardware, software, and consultants. System requirements were not defined correctly or in adequate detail; there was little coordination of activities among consultants, IS personnel, and user groups; and the project manager was unable to identify or resolve problems because he lacked prior R/3 experience. In the words of a senior executive, "The implementation was clearly spinning out of control." Consultants employed by Whitman-Hart were technical specialists, but had little business experience with the pharmaceutical industry. Though the ASAP methodology allowed a quick canned implementation, it was

- not flexible enough to meet Geneva's extensive customization needs,
- did not support process improvements, and
- alienated business users from system implementation.

CHANGE IN LEADERSHIP

To put the project back on track and give it leadership and direction, in February 1998, Randy Weldon was hired as Geneva's new CIO. Weldon brought in valuable R/3 project management experience from StorageTek, a leading manufacturer of magnetic tape and disk components also based in Colorado.

By virtue of his prior R/3 experience, Weldon knew that ERP was fundamentally about people and process change, rather than about installing and configuring systems, and that successful implementation would require the

commitment and collaboration of three stakeholder groups: business users, IS staff, and consultants. To solidify stakeholder commitment, the project management team was expanded from one person to three individuals: an IS manager, a functional manager, and a senior R/3 consultant. Weldon was not particularly in favor of Whitman-Hart or the ASAP methodology. However, for project expediency, he decided to retain Whitman-Hart and ASAP for the remainder of Phase I. To reduce dependence on external consultants, several R/3 basis personnel and Oracle database administrators were hired on full-time basis. Anna Bourgeois, with over three years of R/3 experience at Compaq Computers, was brought in to lead Geneva's internal IS team.

RESULTS OF PHASE I

By February 1999, the raw materials and manufacturing component of R/3's MM module was "up and running." But this module was not yet integrated with distribution (Phase II) and therefore did not have the ability to readjust production runs based on dynamically changing sales expectations. However, several key performance indicators such as yield losses showed significant performance improvement following R/3 implementation. For example, the number of planning activities performed by a single individual was doubled. Job roles were streamlined, standardized, and consolidated, so that the same person could perform more "value-added" activities. Since R/3 eliminated the need for data rekeying and validating, inventory control staff responsible for data entry and error checking were reassigned to other purchasing and procurement tasks. However, the realigned R/3 implementation did not lead to all customizations desired by business users. As Director of Purchasing and Procurement Camargo explained:

> *"Ironically, one of the problems we have with SAP, that we did not have with Macpac, is the inability to carry two due dates - the original due date and the current due date – for each order, that helped us track actual production schedules against the original due date. SAP only allows us to capture one single due date and we decided to retain our current due date, but that disrupted a portion of our planning process. Now, we have to check our order fulfillment against the*

original due date manually, offline, on a spreadsheet. We can't record that data either in SAP to measure performance improvements over time."

Bourgeois summed up the outcome of the implementation process as:

"Phase I, in my opinion, was not done in the most effective way. It was done as quickly as possible, but we did not modify the software, did not change the process, and did not write any custom report. Looking back, we should have done some things differently. We also had some problems with the consultants, and by the time I came in, it was a little too late to really make a change. The good thing is that we learned from these mistakes, which will hopefully help us improve our implementation in Phases II and III."

VI. PHASE II: DEMAND SIDE IMPLEMENTATION

Phase II implementation started in October 1998 with the goals of redesigning demand-side processes such as marketing and sales, order fulfillment, customer service, and accounts receivable, and implementing the reengineered processes using R/3.

Demand-side processes were much more complex than supply-side processes by virtue of their uniqueness and often had to be tracked manually. Figure 1 is a high-level illustration of Geneva's order management process. For example, Geneva's rebate percentages varied across customers, across product categories for the same customer, and across order volumes for the same customer and product combination. Such rebate structures could not be implemented using existing systems such as Macpac or FYI Planner. In addition, the same customer sometimes had multiple accounts with Geneva and had negotiated a different rebate percentage for each account. Implementing Phase II involved automating and/or redesigning these complex processes based on "best practices," and was therefore substantively more challenging than Phase I.
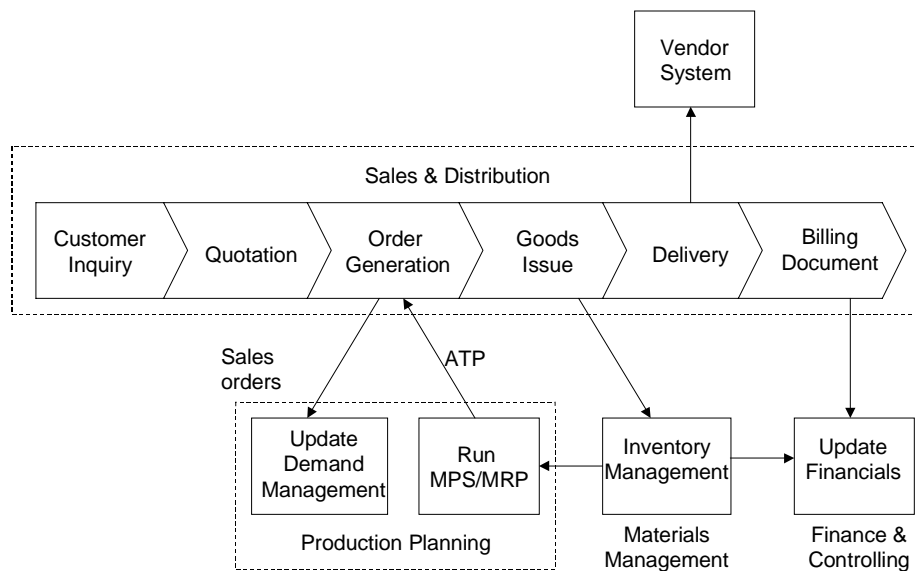
Figure 1. Geneva's Order Management Process

Further, because Geneva was undergoing major business transformations especially in customer sales and service, its prior systems were too inflexible to accommodate these changes. For example, in 1998, Geneva started a customer-based forecasting process for key customer accounts. It was expected that more accurate prediction of order patterns from major customers would help the company "smooth out" its production schedules, improve capacity utilization, and reduce missed orders. The prior forecasting software, FYI Planner, did not allow forecasting on a customer-by-customer basis. Salespeople often did not have prior accounts receivable data for a given customer to make an informed decision on how to proceed with a sales transaction; this process was also likely to benefit from R/3's data integration and real-time access capabilities. Mark Mecca, Director of Customer Partnering, observed:

> *"Before SAP, much of our customer sales and service were managed in batch mode using MacPac. EDI orders came in once a night, chargebacks came in once a day, and invoicing was done overnight, shipments got posted once a day; so you wouldn't know what you shipped for the day until that data was entered the following day. SAP*

will allow us to have access to real-time data across the enterprise. There will be complete integration with accounting, so we will get accurate accounts receivable data at the time a customer initiates a sales transaction. Sometime in the future, hopefully, we will have enough integration with our manufacturing processes so that we can look at our manufacturing schedule and promise a customer exactly when we can fill his order."

Bourgeois was assigned overall responsibility of the project, by virtue of her extensive knowledge of EDI, R/3 interface conversion, and sales and distribution processes, and her prior role as a technical liaison between application and basis personnel. Whitman-Hart was replaced by a new consulting firm, Arthur Anderson Business Consulting, to orchestrate Phases II and III of R/3 implementation. A second consulting firm, Oliver White, specializing in operational processes for manufacturing firms, was brought in to help redesign Geneva's sales and distribution processes using "best practices" prior to R/3 implementation. Weldon reflected on the rationale for hiring two different consulting vendors:

"Arthur Anderson was very knowledgeable in the technical and configurational aspects of SAP implementation, but Oliver White was the process guru. Unlike Phase I, we were clearly targeting process redesign and enhancement in Phases II and III, and Oliver White brought in 'best practices' by virtue of their extensive experience with process changes in the manufacturing industry. In Phase I, we made the mistake of hiring a consulting firm that had little experience in our processes, and that strategy backfired on us. We wanted to be sure that we did everything right this time around."

Technical implementation in Phase II proceeded in three stages:
- conceptual design,
- conference room pilot, and
- change management.

CONCEPTUAL DESIGN

In the conceptual design stage, key users most knowledgeable with the existing process were identified, assembled in a room, and interviewed, with

assistance from Oliver White consultants. A core team of 20 IS personnel, users, and consultants worked full-time on conceptual design for 2.5 months (this team later expanded to 35 members during the conference room pilot stage). Another 30 business users were involved part-time in this effort; these individuals were brought in for focused periods of time (between 4 and 14 hours) to discuss, clarify, and agree on complex distribution-related issues. The core team was divided into five groups to examine different aspects of the distribution process, such as:

- product and business planning,
- preorder (e.g., pricing, chargebacks, rebates, contracts),
- order processing,
- fulfillment (e.g., shipping, delivery confirmation), and
- post-order activities (e.g., accounts receivable, credit management, customer service)

Thirteen different areas of improvement were identified, of which four areas emerged as having the most impact on demand-side management and were therefore targeted for redesign. These areas were:

- product destruction,
- customer dispute resolution,
- pricing strategy, and
- service level.

Elaborate process models were constructed via the fish bone approach (a process mapping technique widely used in the industry for process analysis and improvement) for each of the four above areas to identify what factors drove these areas, what was the source of problems in these areas, and how could they be improved using policy initiatives. Process diagrams were constructed on Post-it® notes and stuck to the walls of a conference room for others to view, critique, and suggest modifications. The following areas were analyzed:

- scope and boundaries of existing processes,
- inputs and deliverables of these processes,

- system interfaces,
- suggested process customizations, and
- required level of system flexibility.

An iterative process was employed to identify activities that did not add value and generate alternative process flows. The goal was to map the baseline or existing ("AS-IS") processes, identify bottlenecks and problem areas, and create reengineered ("TO-BE") processes. This information became the basis for configuring the R/3 system during the subsequent conference room pilot.

CONFERENCE ROOM PILOT

During the conference room pilot, conceptual designs identified for the four key improvement areas were implemented as prototypes (by configuring appropriate R/3 modules) and tested. Prototype tests examined system impacts on core demand-side processes such as forecast planning, contract pricing, charge-back strategy determination, receivables creation, pre-transaction credit checking, and basic reporting in a simulated environment. The prototypes were modified several times based on test results and subsequent user feedback, and the final versions were rolled out using R/3's ASAP methodology described in the Appendix.

CHANGE MANAGEMENT

In the change management stage, five training rooms were equipped with computers running the client version of the R/3 software to train users on the redesigned processes and the new R/3 environment. A change management professional and several trainers were brought in to assist with this effort. An advisory committee was formed to oversee and coordinate the change management activity. This committee reported directly to the senior vice president level, and was given the mandate and resources to plan and implement any change strategies that they would consider appropriate. Multiple "brown bag luncheons" were organized to

chart out the course of change and discuss what change strategies would be least disruptive. Super users and functional managers, who had the organizational position to influence the behaviors of colleagues or subordinates in their respective units, were identified and targeted as potential change agents. The idea was to "seed" individual business units with change agents that business users could trust and relate to, and use them to drive a grassroots program for change.

To stimulate employee awareness, prior to actual training, signs were put up throughout the company that said, "Do you know that your job is changing?" Internal company newsletters enhanced the project visibility by highlighting key milestones and addressing employee questions or concerns about the impending change. A separate telephone line was created for employees to call anytime and inquire about the project and how their jobs would be affected. The human resources unit conducted an employee survey to understand how employees viewed the R/3 implementation and gauge their receptivity to changing job roles as a result of this implementation.

Training proceeded full-time for three weeks. Each user received an average of 3 to 5 days of training on process and system aspects. Training was hands-on, team-oriented, and continuously mentored. It was oriented around employees' job roles such as how to process customer orders, how to move inventory from raw materials to finished goods, and how to make general ledger entries, rather than on how to use the R/3 system. CIO Weldon justified this unique, non-traditional form of training as:

> *"Traditional systems training does not work very well for ERP*
> *implementation because this is not only a technology change but also*
> *a change in work process, culture, and habits. Changing attitudes and*
> *job roles that are ingrained in employees' minds for years and in some*
> *cases decades, are very difficult to change. Systems training tend to*
> *overwhelm less sophisticated users and they will think, 'Oh my God, I*
> *have no clue what this SAP thing is all about, I don't know what to do if*
> *the screen freezes, I don't know how to handle exceptions, I'm sure to*
> *fail.' Training should not focus on how they should use the system, but*

on how they should do their own job using the system. In our case, it was a regular on-the-job training rather than a system training, and employees approached it as something that would help them do their job better."

Several previously unknown factors were found during the training process.

- First, considerable confusion existed about what employees' exact job responsibilities were, even prior to R/3 implementation. Significant time and resources were expended in reconciling these differences and eliminating ambiguity about employees' post-implementation roles.

- Second, Geneva's departments were very much functionally oriented and wanted the highest level of efficiency from their department, sometimes to the detriment of other departments or the overall process. This has been a sticky cultural problem, and while Phase II was underway, the IS advisory committee was working with senior management to see if any structural changes could be initiated within the company to affect a company-wide mindset change.

- Third, Geneva realized that change must also be initiated on the customer side, so that customers are aware of the system's benefits and are able to use it appropriately. Customer education programs were created; however, in the interest of project completion, implementation of these programs was postponed until the completion of Phase III of R/3 implementation.

Phase II went live on February 1, 2000, as originally planned.

RESULTS OF PHASE II

The primary business metric tracked for Phase II implementation was customer service level. Additional metrics included days of inventory on hand, dollar amount in disputes, and dollar amount destroyed. Customer service was assessed by Geneva's customers as:

- Was the item ordered was in stock?

- Could Geneva fill the entire order in one shipment?
- If backordered, was the backorder delivered on time?

Based on these metrics, Geneva's average customer service level before R/3 was in the 80's (measured on a 1-100 scale), well behind its industry competitors (many of whom rated in the mid 90's). Geneva expected that the R/3 implementation would help the company achieve 99.5 percent service level by year-end 2000. Customer service dropped somewhat immediately following R/3 implementation, but, Joe Camargo, Director of Purchasing and Procurement observed that this decrease was not due to R/3 implementation but because of an unforeseen capacity shortfall that planners did not identify quickly enough to implement contingency plans. Camargo expected that such problems would be alleviated as performance-to-schedule and demand forecasting improved as a result of R/3 implementation.

VII. PHASE III: INTEGRATING SUPPLY AND DEMAND

Geneva's quest for integrating supply and demand side processes began in 1994 with its supply chain management (SCM) initiative. But the initiative was shelved at that time due to a lack of system integration, immaturity of SCM as a business practice, and budgetary constraints. The initiative resurfaced on the planning boards in 1998 under the leadership of Verne Evans, Director of Integrated Supply Chain. From Evans' point of view, R/3 promised accurate, consistent, and real-time data that was the lifeblood of SCM. Geneva's SCM goal was to implement "just-in-time" production scheduling, by dynamically updating manufacturing capacity and scheduling in response to continuously changing customer demands (both planned and unanticipated). The targeted process was manufacturing resource planning (MRP-II) and more specifically, the Sales and Operations Planning (SOP) process within MRP-II. SOP linked planning activities in upstream (manufacturing) and downstream (sales) operations. MRP-II and SOP processes are illustrated in Figures 2 and 3 respectively.
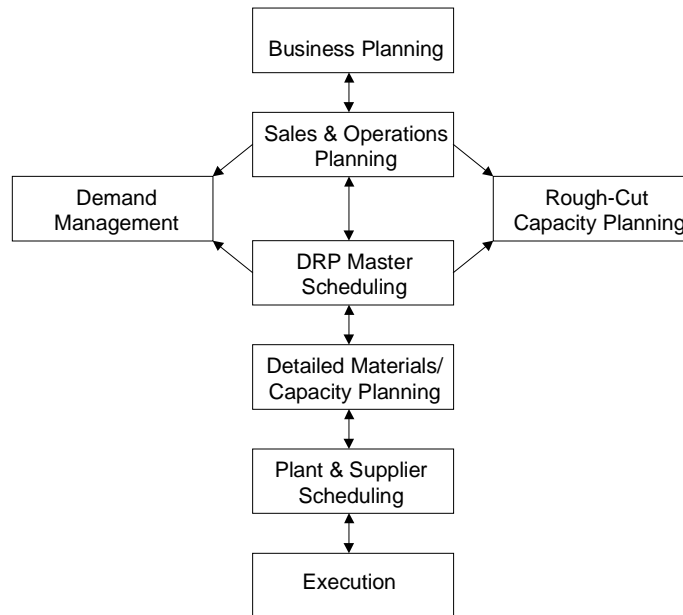
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│    Demand    │  │  DRP Master │  │    Rough-Cut     │
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                    │      Execution      │
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Figure 2. Geneva's Manufacturing Planning Process

Figure 3. Geneva's Manual Sales and Operations Planning Process

SALES AND OPERATIONS PLANNING

Until the mid-1990's, Geneva had no formal SOP process, either manual or automated.   Manufacturing planning was isolated from demand data, and was typically based on historical demand patterns. If a customer (distributor) placed an unexpected order or requested a change in an existing order, the manufacturing unit was unable to adjust its production plan to reflect this change. This lack of flexibility led to unfilled orders or excess on-hand inventory, and sometimes dissatisfied or lost customers.   Prior sales and manufacturing systems were incompatible with each other and did not allow the integration of supply and demand data, as required by SOP. In case production plans required changes to accommodate a request from a major customer, such decisions were made based on intuition rather than business

rationale, which often had adverse effects on manufacturing and inventory management.

To remedy these problems, Geneva started a manual SOP process in 1998 (Figure 3). In this approach, after the financial close of each month, sales planning and forecast data were

- aggregated from order entry and forecasting systems,
- validated, and
- manually keyed into master scheduling and production planning systems.

Likewise, production and inventory data from the prior period were entered into order management systems. The supply planning and demand analysis teams performed independent analyses of what the target production and target sales should be. These estimates, which were often different, were reviewed and reconciled in a joint meeting of demand analysts and master schedulers. Once an agreement was reached, senior executives (President of Geneva and Senior Vice Presidents), convened a business planning meeting to analyze the final production plan and demand schedule based on business assumptions, key customers, key performance indicators, financial goals and projections (market share, revenues, profits), and other strategic initiatives (e.g., new product introduction).

The purpose of this high-level meeting was not so much to fine-tune the master schedule, but to examine it in light of corporate assumptions and growth estimates to develop a better understanding of the corporate business. The entire planning process took 20 business days (one calendar month):

- the first ten days were spent in data reentry and validation across different corporate systems,
- followed by five days of demand planning,
- two days of supply planning, and
- three days of reconciliation.

The final business planning meeting was scheduled on the last Friday of the month, when production plans for the following month were approved. By the time the planning process was completed one month later, Geneva had a well-designed production schedule that was one month late (since one month was spent in the planning process). Given Geneva's dynamic business environment, the production schedule could vary significantly from one month to another, and hence the one-month delay was disconcerting. Moreover, if the corporate management decided to override targeted production plans to accommodate special customer requests, such changes threw the entire SOP process into disarray.

While the manual SOP process was a major improvement over the pre-SOP era, the manual process was time-consuming and constrained by errors in data reentry and validation across sales, production, and financial systems. Further, the process took one month, and was not sensitive to changes in customer orders placed less than a month from their requested delivery dates. Since much of the planning time was consumed in reentering and validating data across systems, Evans estimated that an automated system, that supported real-time integration of all supply and demand data in a single unified database, would eliminate ten days of data reentry and validation, thereby reducing the planning cycle to ten business days.

Though SAP provided a SOP module with their R/3 package, Geneva's R/3 project management team believed that this module lacked the "business intelligence" necessary for generating an optimal production plan from continuously changing supply and demand data, even when all data were available in a common database. The R/3 system was originally designed as a data repository, not an analysis tool to solve complex supply chain problems or provide simulation capabilities. When SAP introduced a new Advanced Purchase Optimizer (APO) module in 1999 to help with data analysis, the combination of R/3's SOP and APO modules was viewed as the answer to Geneva's unique SOP needs.

At the time of the case, in May2000, Geneva was in the initial requirements definition stage of SOP implementation. To help with this effort, Oliver White created a template for aggregating all relevant SOP data required from distribution, operations, purchasing, quality control, and other functional databases, and tie these data to their source processes. It was expected that the template would provide a common reference point for all business units participating in the SOP process and synchronize their decision processes.

EXPECTED RESULTS OF PHASE III

The primary business metric targeted for improvement in Phase III implementation is "available to promise" (ATP). ATP measured whether Geneva is able to fulfill a customer order within the promised time. It integrated customer service level with business performance, two key business metrics of the pre-SOP era. Customers often placed orders too large to be fulfilled immediately, and ATP was expected to provide customers with reasonably accurate dates for complete or partial order fills. Geneva believed that generating and meeting fulfillment dates would help the company improve its customer service levels more than not providing any dates at all. ATP is even more important in the context of thin inventories and just-in-time manufacturing that were expected to drive cost reduction and business success in the hyper-competitive generics industry as Geneva is forced to explore new means of cost reduction. Evans explains the role of ATP at Geneva as:

> "Most of our customers understand the dynamics of our business, and how difficult it is for us to fulfill a large order in short notice with limited production capacity. Many of them are willing to bear with backorders if we can promise them a reasonable delivery date for their backorder and actually deliver on that date. That way, we take less of a customer service level hit than defaulting on the order or being unable to accommodate it. In commodity businesses such as ours, customer service is the king. Our customers may be willing to pay a little premium over the market for assured and reliable service, so that they can meet their obligations to their customers. Customer service may be a strategic way to build long-term relationships with our customers, but of course, we are far from proving or disproving that hypothesis."

In May 2000, when this case was written, Phase III was still in the early planning stage. As indicated in Table 3 in Section IV, implementation is not scheduled until late 2000.

VIII. EPILOGUE

Despite initial setbacks, by May 2000, Geneva was back on the road to a successful R/3 implementation. Senior management, functional units, and IS personnel are all enthusiastic about the project and looking forward to R/3's deployment in all operational areas of business and beyond. R/3 implementation provided Geneva with additional means for survival in the intensely competitive generic drugs industry. CIO Weldon provided an overall assessment of the company's R/3 implementation:

> *"In my opinion, we are doing most of the same things as before, but we are doing them better, faster, and with fewer resources. We are able to better integrate our operational data, and are able to access that data in a timely manner for making critical business decisions. At the same time, SAP implementation has placed us in a position to leverage future technological improvements and process innovations, and we expect to grow with the system over time."*

In May 2000, the primary focus of Geneva's R/3 implementation is timely completion of Phase III by December 2000. Once completed, the implementation team plans to explore some of R/3's additional capabilities that are currently not planned for implementation. R/3 modules planned for future consideration include quality control and human resources.

ACKNOWLEDGEMENTS

coworkers at Geneva Pharmaceuticals, Inc. for their unfailing help throughout the course of this project. Figures 1, 2, and 3 were obtained courtesy of Verne Evans of Geneva.

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APPENDIX
WHAT IS SAP R/3?

SAP (Systems, Applications, and Products in Data Processing) AG is the world's fourth largest software company, and the largest enterprise resource planning (ERP) vendor. The company was founded in 1972 by Dr. H.C. Hasso Plattner and Dr. Henning Kagermann in Walldorf, Germany with the goal of producing an integrated suite of application software, that would run all mission-critical corporate operations, from purchasing to manufacturing to order fulfillment and accounting. This integration would help companies optimize their supply chains, manage customer relationships, and make better management decisions. As of year-end 1999, the company had annual revenues of $5 billion, annual growth of 44 percent, over 10,000 customers in 107 countries, 19,300 employees, and 36 percent of the ERP market. SAP brings in 26 years of leadership in process innovations and ERP, and invests 20 percent of its revenues back into research and development.

SAP's first breakthrough product was the R/2 system, which ran on mainframe computers. R/2 was called an ERP system, since it extended the functions of earlier MRP systems in manufacturing firms to include other business processes such as sales, accounting, and human resources. In 1992, SAP released the R/3 system, a client/server variant of the earlier R/2 system. Today, R/3 is installed in over 20,000 locations worldwide and R/2 in about 1300 locations. Initially targeted at the world's largest corporations such as AT&T, BBC, Deutsche Bank, IBM, KPMG, Merck, Microsoft, Nestle, Nike, and Siemens, R/3 has since been deployed by companies of diverse sizes, geographical locations, and industries. SAP software is available for 18 comprehensive industry solutions (called "verticals"), covering specific industry sectors such as banking, oil & gas, electronics, health care, and public sector.

R/3 is designed as an "open" solution, i.e., it can run on a variety of hardware platforms such as Sun, IBM, or HP servers, Intel-based servers, and IBM AS/400, and software environments such as UNIX, Windows NT, and OS/400. R/3 uses a

thin client and a three-tier architecture, consisting of database, application, and presentation tiers (Figure A-1). The database server provides a common, central repository of all organizational data, and supports a variety of relational back-end databases, including Oracle, Microsoft SQL Server, DB2, Informix, and ADABAS. The application server provides job scheduling, print spooling, user validation, and application programming interfaces (API) required for connecting any presentation server to any database server. The presentation server provides desktop graphical user interfaces (GUI) running on thin clients, makes data requests to the application server, and presents formatted data returned from the application server. Front-end GUIs supported by R/3 include Windows 3.1/95/NT, OS/2, Macintosh, and OSF/Motif. SAP requires a TCP/IP networking environment, but supports a wide variety of middleware such as remote procedure call (RPC), dynamic data exchange (DDE), and object linking and embedding (OLE) for client-server interaction. System functions supported by R/3 are listed in Table A-1.
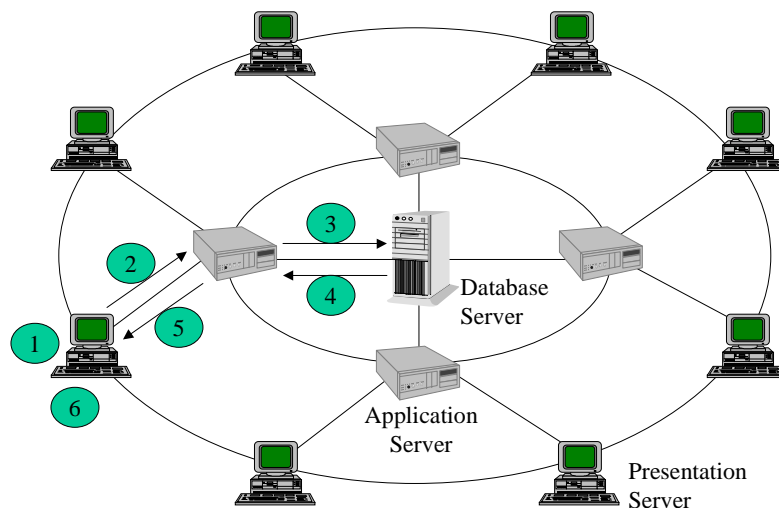
User request processing:
1. User requests data or transaction from presentation server via the GUI
2. Presentation server relays user requests to appropriate application servers via set of middleware
3. Application server creates appropriate SQL queries and transmits them to the database server
4. Database server processes the query and returns results to application server
5. Application server returns the data to the requesting presentation server
6. Presentation server formats data and presents it to the user.

Figure A-1. R/3's Three-Tier Client/Server Architecture

R/3 is organized in form of over 8,000 *configuration tables* that define how the system should function, how transaction screens should look like, and how users should use it. Although R/3 can be implemented as a "standard" application, generally some configuration is required to meet customer-specific business needs, which is done by changing settings within the configuration tables. Implementers first model how a business process should function, then map these models into "scripts," and finally translate scripts into configuration table settings. Implementing R/3's basic modules typically takes 18 to 24 months. However, SAP's rapid implementation methodology, *Accelerated SAP* (ASAP), promises implementation cycle time of six months. This methodology provides a detailed roadmap of the implementation life cycle, organized in five phases (project preparation, business blueprint, realization, final preparation, and go live), with detailed lists of activities to be performed in each phase. It also provides checklists, predefined templates (e.g., business processes, cut-over plans), project management tools, questionnaires (e.g., to define business process requirements), and a Question & Answer Database.

Table A-1. System Platforms Supported by R/3

	UNIX platform	NT platform	AS/400 platform
Hardware	Bull, DEC, HP, IBM, SNI, Sun	AT&T, Compaq, DEC, Dell, Data General, IBM	IBM AS/400
Operating system	AIX, Digital UNIX, HP-UX, Linux, Sinix, Solaris	Windows NT	OS/400
Database	Adabas D, DB2 for UNIX, Informix-Online, Oracle 7.1	Adabas D, MS SQL Server 6.0, Oracle 7.1	DB2/400
GUI	Windows 3.1, Windows 95, Windows NT, OSF/Motif, Presentation Manager, Macintosh		OS/2, Windows 95
Programming languages	ABAP/4, C, C++		
Communication protocols	TCP/IP		
Middleware	ALE, DDE, EDI, OLE, Mail, RFC, Q-API, CPI-C		

R/3 is packaged as a set of application modules plus the core system called the *Basis System*. Table A-2 lists common R/3 modules, their functions, and key elements The basis system provides the operating system, database, communications middleware, and technical infrastructure required by all application modules, and also manages the data dictionary, security, ABAP/4 programming workbench, operations, transactions, change requests, and administration. A customer may implement the core plus any combination of application modules, depending on specific business needs. These modules interact with business data defined as objects. R/3 configuration involves setting up "values" for these attributes, building custom forms to map business processes, building interfaces to transfer data across applications, and populating data from prior databases after appropriate data mapping, cleansing, conversion, and extraction (using SAP-supplied tools such as *BDC* or *IDOC*).

Although R/3 typically supports 80 to 95 percent of a large company's needs, certain unique functionality or specialized business processes may not be supported. This unique functionality can be obtained in four ways:

- interfacing R/3 to existing legacy systems using SAP-supported middleware,
- interfacing R/3 to third-party (SAP partners) solutions, typically written in C or C++,
- writing custom software in ABAP/4 (a proprietary fourth generation language) to extend R/3's functionality, and
- modifying R/3 source code directly (this approach is strongly discouraged by SAP and may lead to loss of after-sales support).

The broad scope and immense complexity of R/3 implementation require hiring of consulting firms (e.g., Anderson Consulting, Price Waterhouse Coopers, KPMG), for configuring the system based on business specifications, custom-coding additional requirements using ABAP/4, and planning and managing company-wide rollout, training, and change management. The R/3 software may cost between

Table A-2. R/3's Application Modules

	Module name	*Description*	*Key elements*
FI	Financial accounting	Designed for automated management and reporting of GL, A/R, A/P, and other sub-ledger accounts with a user-defined chart of accounts.	General ledger, Accounts payable, Accounts receivable, Treasury, Special-purpose ledger, Legal consolidation, Accounting information system.
CO	Controlling	Represents the company's flow of cost and revenue, and is a management instrument for organizational decision.	Cost/profit center accounting, Job order accounting, Project accounting, Product costing analysis, Activity based costing, Profitability analysis.
AM	Asset management	Designed to manage and supervise individual aspects of fixed assets.	Plant maintenance (repair, schedule), Inventory control, Traditional asset accounting (depreciation, etc.), Investment management.
PS	Project system	Supports the planning, control, and monitoring of long-term, highly complex products with defined goals, accelerates work and data flows.	Funds and resource management, Quality control, Time management, Project management.
WF	Workflow	Links SAP R/3 modules with cross-application technologies, tools, and services to automate business processes.	
IS	Industry solutions	Combines SAP R/3 modules with additional industry specific functionality.	Segments: Consumer packaged goods, Utilities/telecommunications, Healthcare, Process industries, Oil & gas, High tech/electronics, Automotive.
HR	Human resources	Supports the planning and control of personnel activities	Payroll accounting, Travel expense accounting, Benefits, Recruitment, Workforce planning, Training administration, HR information system.
PM	Plant maintenance	Supports the planning, processing, and completion of plant maintenance tasks, track maintenance costs, and make maintenance decisions	Processing of unplanned tasks, Service management, Maintenance planning, Maintenance bill of materials, Plant management information system.
QM	Quality management	Supports quality planning and control for manufacturing and procurement.	Quality inspection, Quality planning, Quality management system.
PP	Production planning	Supports planning and control of manufacturing activities.	Bill of materials, Work centers, Sales and operations planning, Master production scheduling, Material requirements planning, Shop floor control, Product costing, Kanban.
MM	Materials management	Supports the procurement and inventory functions in daily operations.	Purchasing, Inventory management, Reorder point processing, Invoice verification, Material valuation, External services management.
SD	Sales & distribution	Helps optimize all tasks and activities carried out in sales, delivery, and billing.	Pre-sales support, Inquiry processing, Quotations, Sales order processing, Delivery processing, Billing.

Note: This list of SAP R/3 modules is not complete. New modules were being added when this case was prepared in May 2000, such as BIW (Business information warehouse) and APO (Advance purchase optimization).

$50,000 and $10 million; hardware and accessories may cost approximately an equal amount and consulting typically costs at least twice that of software costs.

LIST OF ACRONYMS

ABAP/4	R/3's native programming language
API	Application programming interface
ASAP	Accelerated SAP (SAP's rapid development methodology)
ATP	Available-to-promise (a R/3 module)
BPR	Business process reengineering
CO	Controlling (a R/3 module)
CRP	Capacity requirements planning
DRP	Distribution requirements planning
EDI	Electronic data interchange
ERP	Enterprise resource planning
FDA	Food and Drug Administration (a federal regulatory agency)
FI	Finance (a R/3 module)
GUI	Graphical user interface
HMO	Health maintenance organization
MM	Materials management (a R/3 module)
MRP	Materials requirements planning
MRP-II	Manufacturing resource planning
PP	Production planning (a R/3 module)
R/3	Client/server based ERP package from SAP
SAP	Systems, Applications, and Products in Data Processing (the world's largest ERP vendor)
SCM	Supply chain management
SOP	Sales and operations planning (a R/3 module)

CASE QUESTIONS

1. What are the similarities and differences between ERP implementation and other large-scale information systems projects?

2. What went wrong with the Phase I of R/3 implementation at Geneva, and how were these problems corrected? What did Geneva do right in Phase II, which was considerably more complex than Phase I? Use your preceding answers to generate a list of critical success factors that can enable ERP project success?

3. What suggestions do you have for Geneva's management for managing the implementation of Phase III? Note that Phase III requires data and process integration of unprecedented scale, and involves novel processes not previously tried out at Geneva.

4. Currently, ERP vendors (e.g., SAP, Peoplesoft, Oracle) are being threatened by the advent of business-to-business electronic commerce players (e.g., Ariba, CommerceOne). In response to these competitive threats, ERP

vendors are themselves transitioning to e-commerce. Examine SAP's e-commerce portal MySAP.com and comment on the pros and cons of the e-commerce approach relative to the client-server based R/3 system.

ABOUT THE AUTHOR

Anol Bhattacherjee is assistant professor of information management at Arizona State University. He received Ph.D. and M.B.A. degrees from the University of Houston, Texas and prior B.S. and M.S. degrees from Indian Institute of Technology, Kharagpur (India). His research interests include behavioral issues in electronic commerce, information technology adoption and use, and technology-enabled organizational transformation. His research is published in *Information Systems Research*, *Decision Sciences*, *Journal of MIS*, *Data Base*, *Information & Management*, and *IEEE Transactions on Systems, Man, and Cybernetics*, among other academic journals.