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Cisco Systems, Inc.: Implementing ERP

Pete Solvik, Cisco Systems chief information officer (CIO), considered the last remaining line item of his ERP (Enterprise Resource Planning) implementation budget. Cisco had a history of rewarding performance with cash bonuses, but the amount allocated for rewarding the ERP team, over $200,000, was unprecedented. To be sure, they had delivered a lot in a time frame that no one had believed possible. It had not been easy either. The team members, Solvik included, had taken a risk in joining the project. Rewards should, and would, be generous. The size of the bonus pool, though, made Solvik think: they had done well, but how well? What had gone right? What had gone wrong? Given another project of this magnitude and risk, would they be able to do it again?

History of Cisco

Cisco Systems, Inc. was founded by two Stanford computer scientists in 1984 and became publicly traded in 1990. The company's primary product is the "router," the combination of hardware and software that acts as a traffic cop on the complex TCP/IP[1] networks that make up the Internet (as well as corporate "Intranets"). With the rise of Internet technologies, demand for Cisco's products boomed and the company soon began to dominate its markets. By 1997, its first year on the *Fortune* 500, Cisco ranked among the top five companies in return on revenues and return on assets. (See **Exhibit 1** for Cisco's financial performance.) Only two other companies, Intel and Microsoft, have ever matched this feat. Perhaps even more impressive, on July 17, 1998, just 14 years after being founded, Cisco's market capitalization passed the $100 billion mark (15-times 1997 sales). Some industry pundits predicted that Cisco would be the third dominant company—joining Microsoft and Intel—to shape the digital revolution.

Don Valentine, partner of Sequoia Capital and vice chairman of the board of Cisco,[2] was the first to invest in Cisco; he took a chance on the young company when other venture capitalists were more cautious. One way Valentine protected his $2.5 million initial investment was by reserving the right to bring in professional management when he deemed it appropriate.

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[1] Transmission Control Protocol and Internet Protocol, together known as TCP/IP, provided a robust standard for routing messages between LANs and created the potential to connect all computers on an ever-larger Wide Area Network (WAN).

[2] Don Valentine was previously the outside executive chairman of the board of Cisco. Cisco has maintained its chairman of the board as an outside director. Currently, John Morgridge serves as an outside director and chairman of the board.

Postdoctoral Research Fellow Mark J. Cotteleer prepared this case under the supervision of Professors Robert D. Austin and Richard L. Nolan. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

In 1988, Valentine hired John Morgridge as CEO. Morgridge, an experienced executive in the computer industry, immediately began to build a professional management team. This team soon clashed with the founders and, after Cisco's initial public offering in 1990, both founders sold all of their stock and left the company. This departure left Morgridge free to continue his plans to install an extremely disciplined management structure.

Morgridge believed that many Silicon Valley firms decentralized too quickly and did not appreciate the proven ability of the functional organization to grow without sacrificing control. Accordingly, Morgridge maintained a centralized functional organization. While Product Marketing and R&D were decentralized into three "Lines of Business" (Enterprise, Small/Medium Business, and Service Provider), the manufacturing, customer support, finance, human resources, IT, and sales organizations remained centralized.

History of IT at Cisco

Pete Solvik joined Cisco in January 1993 as the company's CIO. At the time, Cisco was a $500 million company running a UNIX-based software package to support its core transaction processing. The functional areas supported by the package included financial, manufacturing, and order entry systems. Cisco was "far and away" the biggest customer of the software vendor that supported the application.[3] Solvik's experience and the company's significant growth prospects convinced him that Cisco needed a change.

> We wanted to grow to $5 billion-plus. The application didn't provide the degree of redundancy, reliability, and maintainability we needed. We weren't able to make changes to the application to meet our business needs anymore. It had become too much spaghetti, too customized. The software vendor did offer [an upgraded version], but when we looked at it we thought "by the time we're done our systems will be more reliable and have higher redundancy but it will still be a package for $300 million companies and we're a $1 billion dollar company."

Solvik's initial inclination was to avoid an ERP solution. Instead, he planned to let each functional area make its own decision regarding the application and timing of its move. Keeping with Cisco's strong tradition of standardization, however, all functional areas would be required to use common architecture and databases. This approach was consistent with the organizational and budgetary structures that Solvik had installed upon his arrival. Solvik felt strongly that budgetary decisions on IT expenditures be made by functional areas while the IT organization reported directly to him. Solvik's objection to ERP solutions was also born out of concerns about the types of "mega-projects" that ERP implementations often became.

A Defining Moment

In the following year, little progress was made. Randy Pond, a director in manufacturing[4] and eventual co-leader of the project, described the dilemma facing the functional areas in late 1993:

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[3] Most customers of the software vendors ranged from $50 million to $250 million in revenue.

[4] Subsequent to the implementation Randy Pond was promoted to the vice president level in manufacturing at Cisco.

> We knew we were in trouble if we did not do something. Anything we did would just run over the legacy systems we had in place. It turned into an effort to constantly band-aid our existing systems. None of us were individually going to go out and buy a package. . . . The disruption to the business for me to go to the board and say "Okay, manufacturing wants to spend $5 or $6 million dollars to buy a package and by the way it will take a year or more to get in . . ." was too much to justify. None of us was going to throw out the legacies and do something big.

The systems replacement difficulties of functional areas perpetuated the deterioration of Cisco's legacy environment. Incremental modification continued while the company sustained an 80% annual growth rate. Systems outages became routine. Product shortcomings exacerbated the difficulties of recovering from outages.

Finally, in January of 1994, Cisco's legacy environment failed so dramatically that the shortcomings of the existing systems could no longer be ignored. An unauthorized method for accessing the core application database—a workaround that was itself motivated by the inability of the system to perform—malfunctioned, corrupting Cisco's central database. As a result, the company was largely shut down for two days.

Cisco's struggle to recover from this major shutdown brought home the fact that the company's systems were on the brink of total failure. Solvik, Pond, and a number of other Cisco managers came to the conclusion that the autonomous approach to systems replacement they had adopted was not going to be sufficient. An alternative approach was needed. Solvik described what they did:

> We said, "we can't wait casually by while Order Entry, Finance, and Manufacturing go out and make three separate decisions." It would take too long to get those applications in place. We needed to take faster action. At that point we got sponsorship from the SVP of Manufacturing, Carl Redfield. He was with Digital before Cisco, in PC manufacturing. He took the lead and said, "O.K., let's get on with this.... let's start from the manufacturing perspective, and see if we can get the Order Entry and Financial groups in the company interested in doing a single integrated replacement of all the applications, instead of taking a longer time doing separate projects." And so in February, about a month after the [company shutdown], we went about putting together a team to do an investigation to replace the application.

Redfield understood from previous large-scale implementation experiences at Digital how "monolithic" IT projects could take on lives of their own. He echoed Solvik's concerns about project size and had strong views about how Cisco should approach a large implementation project.

> I knew we wanted to do this quickly. We were not going to do a phased implementation, we would do it all at once. We were not going to allow a lot of customization either. There is a tendency in MRP systems[5] for people to want the system to mirror their method of operation instead of retraining people to do things the way the system intended them. This takes a lot longer. Also, we wanted to create a schedule that was doable and make it a priority in the company as opposed to a second tier kind of effort.

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[5] MRP represents a class of systems, often thought of as predecessors of ERP that focus on planning the material requirements for production. Forecast or actual demand is fed to MRP either manually or from other types of systems. MRP functionality is embedded in the offerings of all leading ERP vendors.

Selecting an ERP Product

Cisco's management team realized that implementing to meet *business* needs would require heavy involvement from the business community. This could not be an IT-only initiative. It was critically important to get the very best people they could find. Solvik elaborated: "Our orientation in pulling people out of their jobs [to work on the project] was if it was easy then we were picking the wrong people. We pulled people out that the business absolutely did not want to give up."

Consistent with the need for a strong Cisco team, the company would also need strong partners. Solvik and Redfield felt it was particularly important to work with an integration partner that could assist in both the selection and implementation of whichever solution the company chose. Great technical skills and business knowledge were a prerequisite. Solvik explained the choice of KPMG as the integration partner:

> KPMG came in and saw an opportunity to really build a business around putting in these applications. They also saw this as kind of a defining opportunity, to work with us on this project. As opposed to some other firms that wanted to bring in a lot of "greenies," KPMG was building a practice of people that were very experienced in the industry. For instance, the program manager that they put on the job, Mark Lee, had been director of IT for a company in Texas that had put in various parts of an ERP system.

With KPMG on board, the team of about 20 people turned to the software market with a multi-pronged approach for identifying the best software packages. The team's strategy was to build as much knowledge as possible by leveraging the experiences of others. They asked large corporations and the "Big Six" accounting firms what they knew. They also tapped research sources such as the Gartner Group.[6] By orienting the selection process to what people were actually using and continuing to emphasize decision speed, Cisco narrowed the field to five packages within two days. After a week of evaluating the packages at a high-level, the team decided on two prime candidates, Oracle and another major player in the ERP market. Pond recalled that size was an issue in the selection. "We decided that we should not put Cisco's future in the hands of a company that was significantly smaller than we were."

The team spent 10 days writing a Request For Proposals (RFP) to send to the vendors. Vendors were given two weeks to respond. While vendors prepared their responses, the Cisco team continued its "due diligence" by visiting a series of reference clients offered by each vendor. Following Cisco's analysis of the RFP responses, each vendor was invited in for a three-day software demonstration and asked to show how their package could meet Cisco's information processing requirements. Cisco provided sample data, while vendors illustrated how key requirements were met (or not met) by the software.

Selection of Oracle was based on a variety of factors. Redfield described three of the major decision points:

> First, this project was being driven pretty strongly by manufacturing and Oracle had a better manufacturing capability than the other vendor. Second, they made a number of

[6] The Gartner Group is a leading industry resource for information on ERP and other information systems and manufacturing related research.

promises regarding the long term development of functionality in the package.[7] The other part of it was the flexibility offered by Oracle's being close by.[8]

Cisco also had reason to believe that Oracle was particularly motivated to make the project a success. Pond provided his impression of Oracle's situation: "Oracle wanted this win badly. We ended up getting a super deal. There are, however, a lot of strings attached. We do references, allow site visits and in general talk to many companies that are involved in making this decision." The Cisco project would be the first major implementation of a new release of the Oracle ERP product. Oracle was touting the new version as having major improvements in support of manufacturing. A successful implementation at Cisco would launch the new release on a very favorable trajectory.

From inception to final selection the Cisco team had spent 75 days. The final choice was team-based. Solvik described how the decision was made and presented to the vendors:

> The team internally made the choice and informed the vendors. There was no major process we had to go through with management to "approve" the selection. We just said "Oracle you won, [other vendor] you lost." Then we went on to contract negotiations with Oracle and putting a proposal together for our board of directors. The focus immediately turned to issues of how long the project would take, and how much it would cost. The team decided "yes, we will do this and we ought to go forward with the project." So now at the very end of April we were putting the whole plan together.

Going to the Board

Before going to the board for approval, the team needed to answer two very important questions: How much would it cost and how long would it take? They knew their executives were worried that a big project might spin out of control and deliver sub-standard results. Despite the risks, the team took a pragmatic approach to estimating project requirements. Solvik described the process:

> Our quarters go August to October, November to January, February to April, and May to July.[9] So right here on May 1, beginning of the fourth quarter, we are asking "how long should it take to do a project to replace all of our core systems?" This is truly how it went. We said "you know we can't implement in the fourth quarter. The auditors will have a complete cow." If it takes a year we will be implementing fourth quarter, and that won't work. We thought it really should take 15 months, July or August a year later. Tom Herbert, the program manager, said there's no way we are going to take 15 months to get this done. That's ridiculous. So we started going in the opposite direction and said well can we do it in five months? That just didn't seem right. Understand we did not have a scope yet. In the end we basically settled that we wanted to go live at the beginning of Q3, so we would be completely stable for Q4. (See **Exhibit 2** for a summary of milestone ERP implementation dates.)

That took care of setting a target date. Next came the task of estimating a project budget. Once again, Cisco was aggressive: "After we set a date, we estimated budgets. We put this whole thing together without really being that far into this program. We just looked at how much it touched" (Pete Solvik). Instead of developing a formal business case (i.e., a financial analysis) to demonstrate

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[7] Redfield later noted that not all of these promises were met in the time frame agreed to during contract negotiations.

[8] Oracle and Cisco world headquarters are both located near San Jose, CA, approximately 20 miles from each other.

[9] Cisco's financial year end is July 31.

the impact that the project would have on the company, the team chose to focus on the issues that had sparked the analysis in the first place. In Solvik's view, Cisco had little choice but to move. He explained his approach to the situation:

> We said that we had this big outage in January. That we were the biggest customer of our current software vendor and that the vendor was being bought by another company. It was unclear who was going to support our existing systems and we needed to do something. The reliability, the scalability, and the modifiability of our current applications would not support our anticipated future growth. We needed either upgrades to the new version of the current application or we needed to replace it. If we replaced it, we could either do it in parts or do it as a whole. We evaluated those three alternatives, talked about the pros and cons of each alternative, and recommended that we replace our systems, big-bang, with one ERP solution. We committed to do it in nine months for $15 million for the whole thing. (See **Exhibit 3** for a breakdown of project costs.)

Although Cisco was, to some extent, compelled to implement ERP, proceeding without a formal economic justification was also a matter of management philosophy. As Redfield put it:

> You don't approach this kind of thing from a justification perspective. Cost avoidance is not an appropriate way to look at it. You really need to look at it like "Hey, we are going to do business this way." You are institutionalizing a business model for your organization.

At $15 million, the project would constitute the single largest capital project ever approved by the company. Members of the team prepared to take this number to senior management with some trepidation. The first meeting with CEO Morgridge did nothing to alleviate their concerns. Pond described the meeting with Morgridge this way:

> Pete Solvik, Tom Herbert, and I took the proposal to Morgridge and the reaction was pretty interesting. He made the comment "you know, careers are lost over much less money than this." Pete and I were as white as a sheet of paper. We knew that if we failed that we were going to get shot. Failure is not something the business took to well, especially with this kind of money.

But Morgridge okayed taking the project proposal to the board. Unfortunately for Pond and Solvik, the reception was not much warmer there. Pond described what happened:

> Before we even get the first slide up I hear the chairman speaking from the back of the room. He says "How much?" I said I was getting to it and he responded: "I hate surprises. Just put the slide up right now." After I put it up he said "Oh my God, there better be a lot of good slides. . . ."

There were and the board ended up approving the project.[10] In the weeks and months following the meeting, Morgridge did his part by making it clear to the rest of Cisco that the ERP project was a priority. The project emerged as one of the company's top seven goals for the year. "Everybody in the company knew this was happening and it was a priority for the business" Pond explained.

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[10] Pond adds that the cause for approval was aided by the fact that the legacy systems crashed on the day of the board meeting. "The day of the meeting, [the legacy system] went down. We were able to walk into the board meeting and say 'It's down again.' It was really a compelling story."

Building the Implementation Team

With board approval in hand, the core ERP team lost no time in setting up a structure for the implementation. One of their first acts was to extend Cisco's relationship with KPMG through the end of the implementation. This decision was made based on KPMG's performance through the software selection process, and the firm's continued commitment to staff the project with its most seasoned personnel.

Proceeding with implementation also meant that the team had to expand from its core 20 members to about 100, representing a cross-section of Cisco's business community.[11] Again, the team sought only the very best for inclusion on the project. One of the rules of engagement for those working on the implementation was that it was short-term in duration and did not represent a career change for those involved. The effort was framed to those who would work on it as a challenge, a "throw down the gauntlet sort of thing." By this time, getting people to work on the team was not a problem. Elizabeth Fee, an implementation team recruit, describes how the assignment was viewed: "They hand picked the best and the brightest for this team. To each person it was a career advancement possibility. People did it because it was something different, it was THE opportunity."

Team members from across Cisco were placed onto one of five "tracks" (process area teams). Each track had a Cisco information systems leader, a Cisco business leader, business and IT consultants from either KPMG or Oracle, and additional personnel from the business as team members (see **Exhibit 4** for a diagram of Cisco's ERP team structure). Tracks were managed from a "Project Management Office" which included Cisco's Business Project manager, Tom Herbert, and Mark Lee, the KPMG Project manager.

Sitting atop the entire project management structure was an Executive Steering Committee comprised of the VP of Manufacturing, the VP of Customer Advocacy, the Corporate Controller, Solvik, Oracle's senior VP of Applications, and the partner-in-charge of West Coast Consulting for KPMG. The presence on the steering committee of such high level executives from Oracle and KPMG was indicative of the importance these organizations placed on the project's success.

The ERP team's strategy for using the Steering Committee was to relieve them of the need to intervene directly in the management of the project. The committee's role was to provide high level sponsorship for the project, to ensure visibility, and to motivate the team. The team aimed to make steering committee meetings celebratory events. To ensure this, they focused on addressing steering committee member's questions before meetings.

Implementing Oracle

The team's implementation strategy employed a development technique referred to as "rapid iterative prototyping." Using this approach, team members broke the implementation into a series of phases called "Conference Room Pilots" (CRP). The purpose of each CRP was to build on previous work to develop a deeper understanding of the software and how it functioned within the business environment.

[11] Total employment at Cisco was estimated at the time to be 2,500 people.

CRP0

The first CRP (CRP0) began with training the implementation team and setting up the technical environment. Here the team worked in two parallel efforts. The first effort focused on getting the team trained on the Oracle applications. Cisco directed Oracle to compress its normal five-day training classes into two 16-hour days. In a two-week period the majority of team members participated in this "immersion" training for the entire application suite. While this was happening, a small "tiger team" was engaged in the second effort, getting the applications up and running.

Following training and setup of the system, the core team met in a session designed to quickly configure the Oracle package. Team members from all areas of the company were "locked" together in an off-site meeting to discuss and decide on the appropriate setting for the hundreds of parameters embedded within the software. Team members were joined by specialists from Oracle and KPMG. Solvik described the experience, its intensity and results:

> There are all these configurable options on how are you going to run the systems. You set literally hundreds of parameters in these applications. So we went off site two days, 40 people, and everybody's homework assignment was for that off site meeting, maybe three or four weeks into the project at this stage, was come in with an 80-20 recommendation on how to configure the system. We met all day and into the night for two days, going down to the "nth-degree" on how we were going to make this thing run for us. Oracle experts, with KPMG experts, with Cisco business people, Cisco IT people, let's talk about GL, let's talk about Chart of Accounts, talk about this and talk about that. I call it the 1% effort that gave us 80% accuracy on how we would run this application, as opposed to a typical ERP approach, where you go off for six months, and overanalyze it to death. We had this three to four weeks into the project and we ended up being about 80% accurate in terms of how we could do this.

One week after this meeting the team completed CRP0 with a demonstration of the software's capacity to take a Cisco order all the way through the company's business process (Quote-to-Cash).

An important realization coming out of CRP0 was that Cisco would not be able to adhere to one of its early goals for the implementation—to avoid modification of the ERP software. Avoiding modification was important because changes tend to be firm specific and make migration to future application releases difficult and time consuming. The team's experiences during the first phase of the project indicated that without a significant number of changes the software would not be able to effectively support the company. By the time one month had passed, it was clear that some changes would be required. Within two months after that it became clear that some of the changes would be substantial.

CRP1

Building on the lessons learned in CRP0, the implementation team immediately embarked on CRP1. With the team now fully staffed up, the goal of this phase of the project was for each track to make the system work within their specific area. As in earlier work, the emphasis was on getting the system to accommodate Cisco processes without modification. During CRP1, team members generated detailed scripts that documented the purpose for and procedures used to complete a process (see **Exhibit 5** for a sample business process script). In order to ensure that all contingencies were accounted for, business process prototype tracking sheets were developed (see **Exhibit 6** for a sample prototype tracking sheet). In contrast to CRP0, team members carefully documented the issues they ran across during their modeling. Issues were addressed in weekly three-hour meetings held by the Program Management Office. During these meetings the track leaders from each area

worked together to resolve the issues and push the project forward. Modeling during this phase confirmed the concerns about the software. There were huge numbers of business processes that the software could not support.

The implementation team's response to the gaps found in the system was to develop a means for categorizing and evaluating each one individually. "All modification requests were classified as Red, Yellow, or Green. Each one went to the track leads and anything that was a Red had to go to the Steering Committee for approval." There were few Reds (see **Exhibit 7** for list of "Red" modifications). In the end, 30 developers were needed for three months to modify Oracle to support the business.[12] Elizabeth Fee described the process.

> When we realized we were not going to be able to go live "vanilla," we began to work on our modification strategy. The months of July and August were focused on which modifications were we going to do? What's real and what's not. In some cases the user would be saying "you know, the date used to be the first thing you type and in Oracle it's the fourth." In other cases it was the realization that we would have to hire 100 people on the shop floor to open and close work orders if we did not figure out a way to automate it.

Discovery of the need to modify Oracle led to some unplanned changes in the project plan and budget. In addition to the identification of required modifications, the implementation team also determined that the Oracle package would not adequately support the after sales support needs of the company. As a result, the team embarked on a concurrent effort to evaluate and select a service support package. The package was selected and implemented on a schedule that matched the overall implementation schedule. Cisco planned to go live on both packages on the same day.

CRP2 and CRP3

As CRP1 turned into CRP2, and summer turned into fall, the implementation team found itself in the thickest, most difficult part of the implementation. Project scope had expanded to include major modifications, and a new after sales support package. One other major scope change also loomed. Because the downstream impacts of the project were much greater than expected, the team decided to tackle some larger technical issues. Whereas before systems had tended to communicate directly with one another (i.e., "point to point"), a new approach would now be employed in which all data communication would take place via a "data warehouse." Utilization of a data warehouse would allow all of Cisco's applications to access a single source for their information needs.

The scope changes meant further shifts in the utilization of Cisco's resources, especially for the company's 100-person IT department. The technical nature of most of the scope changes meant that this group bore most of the responsibility for the project additions. Solvik described the result:

> Basically all the rest of the IT group started decommitting from their other projects. They said "we have to spend our time just absorbing the fact that the core systems in the company are changing. We are needing to divert more and more energy, and more and more resources towards the project." IT did nothing else that year. We also decided not to convert any history

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[12] When designing the modifications required for the system, Cisco made a concerted effort to stay "out of the core application code." "Core" code is the central programming logic on which application processing is based. Core code modifications are often not supported by the software vendor and can complicate a firm's ability to upgrade existing software with new releases. In Cisco's case, most modifications avoided touching the core code, relying instead on the addition of database fields and technically simple screen changes. In those cases where the core code was altered (usually to bypass certain processing), Cisco personnel worked with Oracle consultants and software engineers to identify appropriate changes. In several cases, Cisco modifications were later incorporated into Oracle's core product.

as part of this project. Instead the data warehouse group created the capability to report historical and future in an integrated data conversion. We renumbered our customers; we renumbered our products; and we changed our bill-of-materials structure. We changed fundamentally all of our underlying data in the company and the data warehouse became the bridging system that would span history and future together.

By the end of CRP2, the first round of modifications was in place and running. During this time the implementation team continued to deepen its understanding of the Oracle and Service packages and to determine how to best make them work for Cisco. The final goal of CRP2 was to begin testing the system, both hardware and software, to see how well it would stand up to the processing load and transaction volumes required to run Cisco's growing business.

CRP3's focus was on testing the full system and assessing the company's readiness to "go live." A final test was conducted with a full complement of users to see how the system would perform, front to back, with a full transaction load. The implementation team executed these tests by capturing a full day's worth of actual business data and "rerunning" it on a Saturday in January. Team members watched as each track, in turn, executed a simulated day's worth of work. With this test completed to the entire team's satisfaction, everyone felt ready for cut-over in February. Pond described the ceremony that concluded CRP3:

At the end of CRP3 each one of the functional leads presented their piece of the process and said "yes or no" on whether they were ready to go. We did each of them separately and then put everyone in the same room and made them nod their heads and say "we should go." . . . And then we turned the damn thing on. . . .

Cutting Over to the Oracle

. . . [After cutover] I wouldn't say the company hit the wall, but I would say we had major day to day challenges that needed to be solved quickly to avoid significant impact to the company. For example, our on-time ship, shipping on the date we commit to the customer, fell from 95% to about 75%, it was still not miserable but it was not good.

—Pete Solvik

The initial success of Cisco's cutover to Oracle was, to say the least, something less than what was expected. Overall business performance plummeted as users attempted to deal with a new system that proved to be disturbingly unstable. On average, the system went down nearly once a day. The primary problem, as it turned out, was with the hardware architecture and sizing. Ordinarily correcting the deficiency would have required the purchase of additional hardware, thus increasing the total project expenditure. But Cisco had asked for, and gotten, an unusual contract from the hardware vendor. In their contract Cisco purchased equipment based on a promised capability rather than a specific configuration. As a result, the onus for fixing the hardware performance problems fell completely on the hardware vendor.

A second problem had to do with the ability of the software itself to handle the transaction volume required in the Cisco environment. The design of the application exacerbated hardware problems by inefficiently processing common tasks. In retrospect, it was clear where the company had gone wrong in its final testing of the system. As Pond put it: "Some things were seriously broken at big data volumes, . . . and we have a huge database. Our mistake was that we did not test the system with a big enough database attached to it." In testing the system, Cisco had run individual processes sequentially rather than at the same time. In addition, only a partially loaded

database was used. After cutover, when all processes were running together over a fully converted database, the system lacked the capacity to process the required load.

The next two months were some of the most trying of the entire implementation. This was particularly true for the IT staff as it tried to grapple with the technical difficulties brought on by bringing the new system up. Fee described what it was like at this time:

> It was tough, really stressful. This was a big thing, one of the top company initiatives. There was a lot of focus on getting it done. We were working really long hours; making decisions that would affect the company going forward. . . . We always knew we would make it. It was always a "when," not an "if." There were [many] things you did not like about [the software].

ERP project status became the number one agenda item for weekly executive staff meetings. Strong vendor commitment from Oracle, the hardware vendor, and KPMG lead to an eventual stabilization of the software and improved performance. Solvik described the environment:

> So for about 60 days we were in complete SWAT-team mode, get this thing turned around. For example the president of the hardware vendor was our executive sponsor. This vendor probably had 30 people on site at one point. They were all over it. They lost money on this big time. It was great for them to get such a great reference, but it was a tough experience for them. Remember we had bought a capability, so everything they did to add capacity was out of their own pocket.

After Stabilization

The technical problems associated with the Oracle implementation proved to be short lived. Over the course of the next three months Cisco and its vendors, working together, stabilized, and added capacity to the system. The implementation ordeal concluded with a celebration party for the team and company management. Several members of Cisco's Board of Directors also attended. Feelings were running high that the new information systems would fulfill the promise of supporting the rapid growth that the company was expecting.

As he signed off on his recommendation for the bonus distribution, Solvik thought about the approach they had taken toward the implementation. "Total systems replacement for $15 million in nine months, who would have thought we could do it?" He tried to think about the decisions he and the team had made during the course of the implementation. What factors had made the difference between success and failure? Where had they been smart? Where had they been just plain lucky? Could they do it again if they had to?

Exhibit 1 Financials and Other Cisco Statistics

Years Ended	July 25, 1998	July 26, 1997	July 28, 1996	July 30, 1995
Net sales	$8,458,777,000	$6,440,171,000	$4,096,007,000	$2,232,652,000
Income before provisions for income taxes	$2,302,466,000	$1,888,872,000	$1,464,825,000	$737,977,000
Net income[a,b,c]	$1,350,072,000	$1,018,679,000	$913,324,000	$456,488,000
Net income per common share (diluted)[d]	$0.84	$0.68	$0.61	$0.32
Shares used in per-share calculation (diluted)	1,608,173,000	1,551,039,000	1,490,076,000	1,425,247,000
Total assets	$8,916,705,000	$5,751,984,000	$3,630,232,000	$1,991,949,000
Stock price the Friday before fiscal year end[e]	$65.167	$35.417	$22.933	$12.458
Number of employees[f]	15,000	11,000	8,782	4,086
Net sales per employee	$563,918	$585,470	$466,409	$546,415
Net income per employee	$90,005	$95,334	$103,999	$111,720

Source: 1998 Annual Report and 1998 10-K Form.

[a]Net income and net income per share in 1998 include purchased research and development expenses of $94 million and realized gains on the sale of a minority stock investment of $5 million. Pro forma net income and diluted net income per share, excluding these nonrecurring items net of tax, would have been $1,373,788,000 and $0.17, respectively.

[b]In 1997, net income and net income per share include purchased research and development expenses of $368 million and realized gains on the sale of a minority stock investment of $139 million. Pro forma net income and diluted net income per share, excluding these nonrecurring items net of tax would have been $1,413,893,000 and $0.91 respectively.

[c]In 1996, net income and net income per share include purchased research and development expenses of $96 million. Pro forma net income and diluted net income per share, excluding these nonrecurring items net of tax, would have been $913,733,000 and $0.36, respectively.

[d]Reflects the three-for-two stock split effective September 1998.

[e]Stock prices reflect a two for one split effective February 1996, a three for two split effective November 1997, and a three for two split effective September 1998.

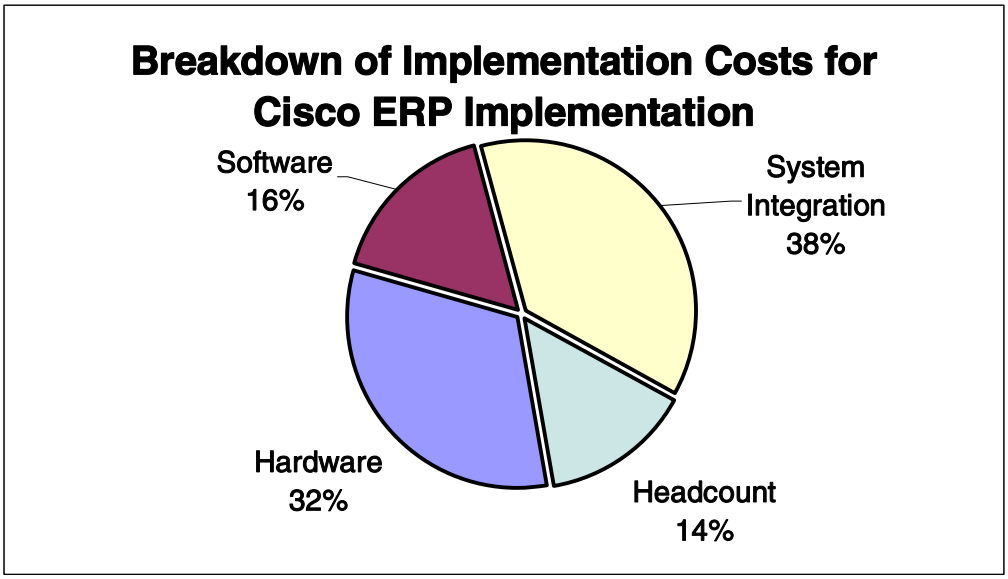
[f]Number of employees was taken from respective 10-K forms.

Exhibit 2 Summary of Milestone ERP Implementation Dates

Project Kickoff	June 2, 1994
Prototype Setup Complete	July 22, 1994
Implementation Team Training	July 31, 1994
Process, Key Data, Modification Designs Complete	August 31, 1994
Functional Process Approval	September 30, 1994
Hardware Benchmark and Capacity Plan Validated	October 15, 1994
Critical Interfaces, Modifications and Reports Complete	December 1, 1994
Procedures and End-User Documentation Complete	December 16, 1994
Conference Room Pilot Complete—Go/No Go Decision	December 22, 1994
End-User Training Beings	January 3, 1995
Data Conversion Complete	January 27, 1995
Go Live!	January 30, 1995

Source: Cisco ERP Steering Committee Report, October 20, 1994.

Exhibit 3 Breakdown of Implementation Costs for Cisco ERP Implementation[a]



Source: Cisco ERP Steering Committee Report, October 20, 1994.

[a]The project budget estimate did not include estimates of the cost of Cisco personnel time beyond some members of the core team.

Exhibit 4 Cisco ERP Implementation Team Structure

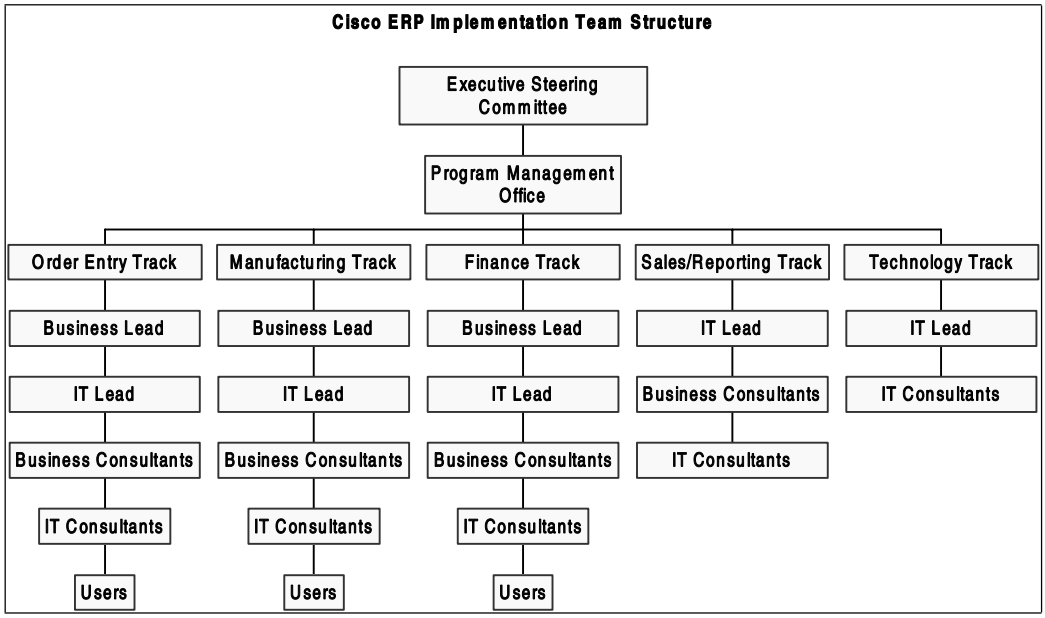


Exhibit 5 Sample Business Process Script

ATP Process:

Scope: This process will define how the Available To Promise (ATP) process will work. This process will include how to enter information into the ATP, how to maintain ATP, how to access ATP information and how the information should be used.

Policy:

All Sales Orders will be assigned as scheduled ship date based upon ATP dates
Master Scheduling will maintain ATP information
Request Date will be left blank if customer did not specify a request date
Schedule date will be entered one week our form today's date

Process for Order Scheduling:

CS Rep

1. Enter Order per Order Entry Process
2. Input Customer Request Date per Order Entry Process
3. If Order is Government Rated or Express complete order line items per Order Entry Process

Order Entry Process

a. After Booking of order, Hit Page Down
b. Choose Order …(Order Action Quick Pick)
c. Choose ATP Inquiry Order
d. When complete, hit page down again
e. Choose View Schedule Results
f. If ATP date matched Scheduled date and no failure reasons are listed below, go to step g. If errors exist, order must be scheduled into Group Available date or have parameters changed in order
g. Choose page down again and select Choose order…
h. Choose demand Order. System will state scheduling complete

4. If order does not follow above, Book the order per the Order Entry Process
   a. Order will be submitted to Demand Interface automatically
   b. If date is available, order will interface
   c. If date is not available order will remain in eligible status after demand interface has run.

Order Scheduler

5. Run Process Exception Report\Navigate Other Report Run
   a. Choose Report under Type
   b. Choose Process Exception Report
   c. Choose Demand Interface for Program Name
   d. Choose date range of order rejects
   e. Submit report (F5)
6. Run On-Line ATP process to determine first available date for order to ship
   a. Go into the Order/Navigate Orders Enter
   b. Query to bring up order that failed scheduling
   c. Hit page down key
   d. Choose order … (Order Action Quick Pick)
   e. Choose ATP Inquiry Order
   f. Choose View Schedule Results
   g. If ATP date matched Scheduled data and no failure reasons are listed below, go to step h. IF errors exist, order must be scheduled into Group Available Date or have parameters changed in order
   h. Choose page down again and select Choose Order…

Choose Demand Order: System will state scheduling complete

Exhibit 5 (continued)

ATP System Issues

1. Report for Process Exception currently requires the Demand interface Concurrent Manager ID to be used (due to bug)
2. Table read by Demand Interface is never purged or cleaned up. As a result, records of failure will not be purged after success has occurred. Need to clear the Demand Interface table prior to each run somehow.
3. Process Exception Report will need to sort by Order Request Date
4. Modifications to default promise date from the schedule date after Demand Interface has occurred once. Future changes to schedule date should not affect request Date.

ATP Process Issues

1. Who will own the decision to use product from another demand class? Under what guidelines?
2. Who will determine which orders will slip out in order to add an order to an ATP date? Under what guidelines?
3. How can we guarantee that when Master Scheduling increases an ATP, that the order that required that date receives it? (Hand-off issues)
4. How will DOA orders work so that they are shipped ASAP?
5. Should Customer Services be allowed to use the Buffer (DO NOT USE) demand class for any reservations?
6. What are exact definitions of promise date, schedule date and request date? How will they be populated?
7. How to control the use of Master Scheduling? Do Not Use/Buffer Demand Class?

Commentary: Process Issue Number 1
Responsibility for this lies entirely within Customer Service Organization for demand classes that service customer segments. CS not allowed to move available quantity from Non-Revenue demand class without an approval from Master Scheduling (to avoid impacting the revenue plan) or from the Buffer Demand Class.

Commentary: Process Issue Number 2
Open Issue: CS to own resolution on this

Commentary: Process Issue Number 3
Master Scheduling will change the demand class on the order and on line interface of the order if the product is available to avoid confusing communication issues (To be tested in Conference Room pilot)

Commentary: Process Issue Number 5
Elizabeth and Kevin will work on this with Master Scheduling to determine best way to handle.

Commentary: Process Issue Number 6
No

Commentary: Process Issue Number 7
Request date is customer's requested ship from Cisco date. Promise date is the date that Cisco has committed to ship the order to the customer. Schedule Date is the date used by Manufacturing to assign ATP and to notify CS of changes to the production date once an order has been missed.

Source: Cisco

Exhibit 6 Sample Prototype Tracking Sheet

	A	B	C	D	E	F
1	**Application**	**Type**	**Related Modules**	**Required**	**Comments**	**Status**
2						
3	**Financials & General Ledger**					
4	System Setup					
5	Accounting Flexfield Structure	Flexfield	All	Yes	5 segments	Done
6	Value set and values - Company	Flexfield	All	Yes	3 digit	Done
7	Value set and values – Department	Flexfield	All	Yes	6 digit	Done
8	Value set and values – Account	Flexfield	All	Yes	5 digit	Done
9	Value set and values – Project	Flexfield	All	Yes	4 digit	Done
10	Value set and values – Product	Flexfield	All	Yes	3 digit	Done
11	Calendar period types	Accounting	All		4-4-5- calendar	Done
12	Calendar periods	Accounting	All			Done
13	Currencies	Accounting	All		USD	Done
14	Sets of books	Accounting	All		14 sets of books	Done
15	**Functional Setup**					
16	Account Hierarchies and Rollup Groups	Accounting	All			Ongoing
17	Cross validation rules	Accounting	All			
18	Security rules	Accounting	All			
19	Shorthand aliases	Accounting	All			
20	Suspense accounts and Intercompany accounts	Accounting	All			Done
21	Statistical units of measure	Accounting	All			Done
22	Accounting flexfield combination	Accounting	All			
23	Daily conversion rate types	Translation	All			Done
24	Rates	Translation	All			
25	Summary accounts and templates	Summary	GL			
26	JE sources and categories	JE	GL	Yes		Done
27	**Functional Test Cases**					
28	Manual journal entries	JE	GL			
29	Recurring journal entries	JE	GL			
30	Mass Allocation formulae – Rent allocation	JE	GL			
31	Reversing journal entries	JE	GL			
32	Journal Import	JE	GL			
33	On-line inquiry	Inquiry	GL			
34	Translation	Translation	GL			
35	Define budget and budget organization	Budget	GL			

Source: Cisco

Exhibit 7 Cisco ERP Implementation List of "Red" Modifications

Packout:

- Creates a "traveller" (i.e. a list of items to be configured) for build purposes, queues travellers by production cell so that each cell can print their own documentation (and not some other cell's) on demand.
- At the time the carton is being filled, allows barcode scanning to record contents of each box. Assigns a box tracking number and prompts for product serial number entry. Serial numbers are stored for future use and to prevent issuance of duplicates.
- Backflushes inventory from the system when the carton is closed.
- Determines if the box is ready for shipment or waiting for consolidation with other boxes and routes it to correct shipping location. If box is ready for shipment, it is released. If box is ready for consolidation the carton is tracked through its receipt at a consolidation center.
- Identifies last box in a ship set (delivery set) as it is received at a consolidation center and flags personnel to prepare the shipment.

Canada:

- Created a separate installation of the General Ledger and Accounts Payables with a separate set of books and separate currency.
- Allows transfer of data for Cisco General Ledger consolidation.

Product Configurator:

- Enabled Cisco to input "rules" regarding orderability (physical and technical constraints on ordering) in a logical fashion rather than through code.
- Tied to Order Entry – as an order is booked, the order is validated against the configurator.

OE Form:

- Altered process for translating discounts from major order lines to subsidiary lines. Also changes manner in which pricing information is loaded into Oracle.
- Created the ability to allow for landed cost data to be entered on an order.
- Created the ability to allow for multinational orders—where the billing location is in the US but the shipment is out of the US
- Added new fields to capture additional sales order data.
- Added a trigger at bookings to call the configurator.

Net Change Bookings:

- Creates information "synopsis" of the bookings on a daily basis.
- Creates a log of all order activity (plus or minus), which then is used by multiple other systems for reporting.