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**Capturing Value from Technology and
Challenges to Past Successes:
The Case of NTT DATA**

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Abstract:

We identify key obstacles to coping with disruptive change among large Japanese IT firms through an examination of the challenges faced by NTT DATA. For Japanese firms, quality culture generally has been an asset for capturing value from existing technology but we show the conditions under which it interferes with adaptation to disruptive technological change. The private sector has been leading changes in market demand and technology. NTT DATA, however, has responded sluggishly to these challenges. We explore the role of a strong quality culture and how it operated to diminish innovative and creative activities. These practices grew out of its experience with mainframe computers in the public sector. They created an organizational culture that slows its pace of adaptation to the rapidly evolving new markets and technologies.

Capturing Value from Technology and Challenges to Past Successes:
The Case of NTT DATA

Robert E. Cole/ Tsuyoshi Matsumiya

Introduction

Disruptive technologies pose huge challenges to incumbent firms (Christensen, 1997; Tushman and Anderson, 2004). In our subsequent analysis, we identify key obstacles to coping with disruptive change among large Japanese IT firms through an examination of the challenges posed for NTT DATA and how it is responding to them. Some of their adjustment problems are common to any large incumbent firm, regardless of geographic location and industrial sector, while others stem from specific organizational norms and practices among large Japanese corporations and still others arise from market and organizational factors unique to NTT DATA. We focus on the challenges posed by rapidly changing market requirements associated with major changes in technology. First, we will devote our attention to documenting these changes. We will then examine the requisite skillsets and software development methodologies associated with these changes and examine how NTT DATA has responded to them. We further associate these responses with specific organizational norms and practices which encouraged some solutions and discouraged others.

We are particularly interested in the role of NTT DATA's quality culture in shaping their responses. An emphasis on quality has been a strong factor in Japanese industry's postwar success. Japanese manufacturing firms pioneered new approaches to quality improvement that involved raising quality while reducing costs by focusing on process improvement. They also stressed prevention by seeking to solve emergent quality problems upstream, especially in the design stage. One form this takes is locking in design requirements as early as possible to insure quality. In taking these approaches, Japanese manufacturing firms were better able to capture value from existing technology and raise their competitive strength. Superior quality, that is valued by customers, can translate into producers being able to charge higher prices, thereby enabling the firm to capture greater rents on given products utilizing existing technology.

In the rapidly evolving IT sector, however, we are starting to see documentation of cases in which a strong quality culture has served as a barrier to innovation and rapid market adjustments. Yunogami Takashi (2006) explores Japan's loss of competitiveness in DRAMs. He attributes it to a failure to link technology to rapidly changing market conditions, and hence as a failure in technology management. Probing deeper, he links it, in part, to the very factors which propelled the industry to prominence in the first place, an emphasis on quality. The main use for Japanese DRAMs during the 70's and 80's was large, mainframe computers and dominance was achieved largely on the basis of two closely associated variables: quality and yield. High reliability was an important factor in Japanese manufacturers winning market share from American producers. Durability targets (another major quality attribute) were especially stringent, with 25 year guarantees sought. Yunogami argues that these durability expectations were influenced by NTT because of NTT's need for a long-term guarantee for phone systems (cf. Nonaka and Nagata, 1995). This emphasis on durability is important because it arguably created a mindset equating rising competitiveness with improved quality, to which strong technological efforts were focused.

Past practices, in turn, set the standards for the succeeding generations. Production of high quality DRAMs became the norm for which engineers continued to strive, with strong support and guidance from a powerful quality assurance department. The idea of producing a DRAM inferior in quality to the preceding generation was inconceivable, and would have required significant changes to the way semiconductors were designed and produced. Korean semiconductor manufacturers, by contrast, had not established themselves in the age of the mainframe, but rather grew with the development of the PC market. They designed their semiconductors with sufficient but not excessive quality to meet the changing market requirements. They did not build in 25 year durability. These changes involved using standard equipment purchased from equipment makers, thereby reducing development costs, and the number of processes or steps and time.

The very fact that they had been so successful in the past no doubt made it harder for Japanese firms to change. Success validates certain ways of doing things and become norms which then become resistant to change. Top managers in the 1990s during the course of their careers had participated in creating the conditions for past success; therefore, not surprisingly, they were often the last to recognize just how much change was needed.[1]

Cole (2006) has shown how the strong reliability culture of NTT was a major factor in leading many key leaders of the firm in the early 1990's to dismiss TCP/IP Internet protocol as totally unacceptable technology and therefore miss its huge market potential. TCP/IP drops many messages and its solution for these dropped messages is to resend them, a "rework" solution that was anathema to quality enthusiasts. This hostility to TCP/IP was true at AT&T and other telephone companies around the world.

Japan was different because of two factors. The first was that key managers in the leading Japanese electronic firms were accustomed to following NTT's lead on technology. The second was that there was a very weak startup environment in Japan overall, which inhibited alternative organizational responses to the opportunities offered by the Internet. The net result, simply put, is that Japanese electronic firms were slow to embrace the Internet, lost first to market advantages that were enhanced by their competitor's ability to exploit the experience curve. As a result, Japanese electronic manufacturers were largely shut out of global exports in the network equipment industry.

Both of these examples share some common features. They both have a connection to NTT. They both show incumbents committed to a quality culture that stresses reliability and/or durability and stability over exploration and innovation. The mechanism for improvement is typically through slow process improvement.

Interestingly enough, research has been published recently in the U.S. which bears on these same issues. Mary Benner and Michael Tushman (2002) recently studied patenting activity in the photography and paint industries. They found that the more process management activities in a firm, of the kind associated with quality improvement activities, the greater the increase in both exploitive innovations that build on a firm's existing firm knowledge and an increase in exploitation's share of total innovations. They interpret these findings to mean that exploitation of existing technologies crowds out exploration of exploratory technologies. It is the latter which leads to highly innovative products and disruptive technologies.

We turn now to NTT DATA and how its quality orientation, along with related factors, inhibited its response to new market demands and technological changes. We begin first with a brief overview of its history and its evolving market environment.

Brief History of NTT DATA

In 1967, the Data Communication Bureau was established in Nippon Telegraph and Telephone Public Corporation as an internal bureau. . NTT DATA is now a publicly listed company owned 54.18% by NTT (holdings). As such, it is part of the NTT Group which currently encompasses 105 companies, with five core companies under NTT as holding company. NTT DATA is a member of this core group. The Japanese government, in turn, owns 33.8% of NTT, so we can say that NTT DATA is owned 18.3% by Japanese government and related organizations.
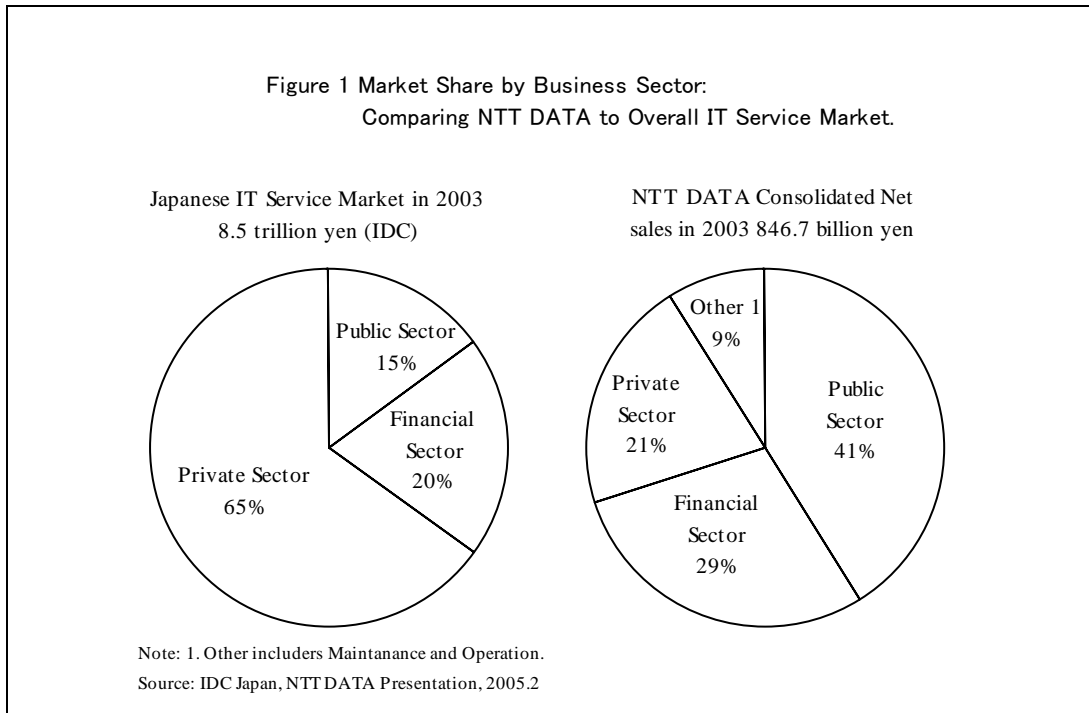
NTT DATA is the largest system integration (SI) company in Japan as well as the largest Japanese information services company. Their strength has been in developing large scale custom systems. Roughly 80% of its sales derived from system integration activities in 2005. In 2005, it had 18,720 (consolidated) employees and 78 subsidiaries and 22 affiliates. NTT DATA has a multi-divisional structure composed of industry-oriented divisions. Each division has strength and knowledge to develop the system related to a specific industry: its core sectors are financial, public, and the private sector.[2] Historically, these divisions have been relatively insulated from one another with little personnel mobility across sectors.

NTT DATA was the prime mover in building the Japanese information system infrastructure which in turn nurtured Japan's embryonic computer industry. They introduced the first nation-wide data communications service that enabled computers to connect to communications lines to exchange data. In 1968, it developed a payment system for the Regional Banks Association of Japan. NTT DATA has created many other large national information infrastructures such as the one which operates the national health insurance system (Fujita, 1994). High quality performance, especially as defined by reliability, was a critical element defining success in all these systems.

Challenges for NTT DATA

The development, installation and maintenance of large mainframes systems, especially in the public and financial sectors, were national projects for which NTT DATA took the initiative. NTT DATA came to be recognized as the design architect for these projects acting as "concierge". That is to say, they subcontracted implementation (software and hardware) to companies like NEC and Fujitsu and took

overhead on implementation and recurring maintenance fees. In Figure 1, we see that some 70% of NTT DATA's consolidated sales derived from the public and financial sectors in 2003 yet these sectors only accounted for roughly 35% of the total IT service market. This hints at a dilemma that we will be discussing shortly.

Figure 1 Market Share by Business Sector:
Comparing NTT DATA to Overall IT Service Market.

Japanese IT Service Market in 2003
8.5 trillion yen (IDC)

Public Sector 15%
Financial Sector 20%
Private Sector 65%

NTT DATA Consolidated Net sales in 2003 846.7 billion yen

Other 1 9%
Private Sector 21%
Public Sector 41%
Financial Sector 29%

Note: 1. Other includers Maintanance and Operation.
Source: IDC Japan, NTT DATA Presentation, 2005.2

In the period from 1990 to the present, three developments posed mounting challenges to many incumbent Japanese information services firms, accustomed to the long time cycles of system development for mainframes. The first challenge posed was technology downsizing. The second challenge was increasingly open architecture in both hardware and software, and an unexpected rise in the use of new kinds of software. The third was the saturation of its core market, the public sector market, and a reevaluation by public ministries and agencies as to their IT needs. We treat each of these in turn.
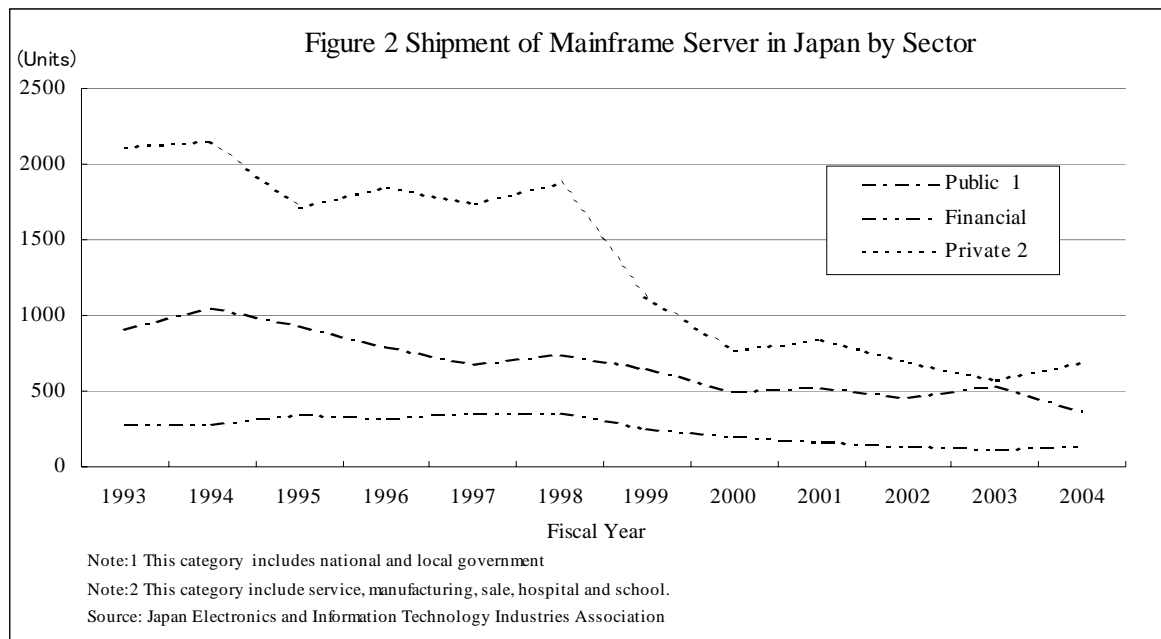
Technology Downsizing

In the 1980s, the prevalent model for information management systems was a centralized hierarchical database platform. Such databases, residing on a mainframe or minicomputer, offered high performance and tight security. But accessing and manipulating these databases was difficult, as well as prohibitively expensive. Firms

had to rely on their system integrator (SI) for many services. This created a huge information asymmetry between customer and system integration companies, allowing NTT DATA to introduce new technologies at its own pace. The 1980s saw the introduction of PCs that were used by individuals and departments within an enterprise to provide local, easy-to-use decision-making tools. Over time users became more sophisticated in their usage, their expectations rose and they increasingly wanted to communicate with others in their group and to have greater access to all corporate data. In 1990s, the solution was to link these PCs through Local Area Networks. This greatly reduced the information asymmetry of the mainframe era.

The Internet started to play a role from the mid 1990s in Japan with the number of Internet users reaching 40.78 million by the end of 2000 (Ministry of Internal Affairs and Communications, 2003: 14). Middle tier servers were mainly used by communication carriers to enable high speed database access and transactions to provide Internet connection services to the rapid growing number of Internet users and also came to be used for mission critical corporate internal systems.[3]
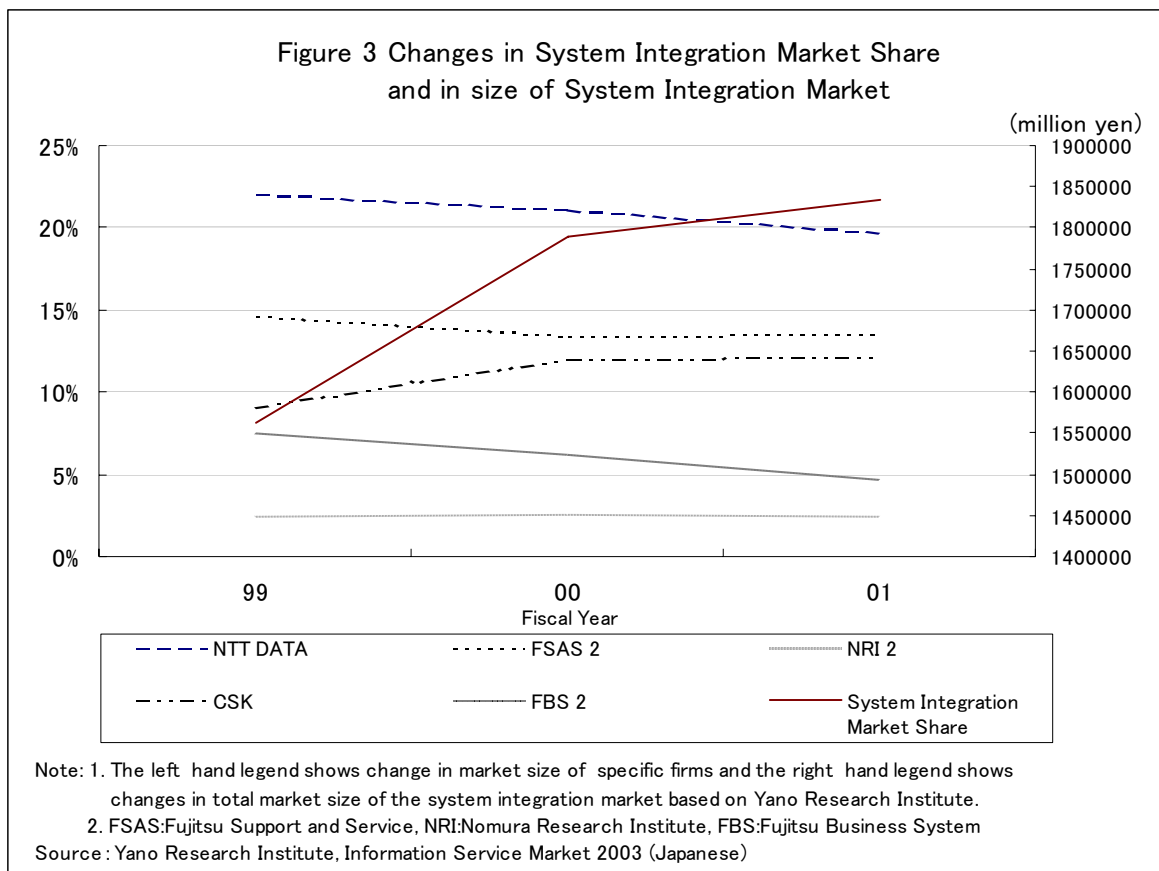
Technology downsizing manifested itself in the shift from mainframe computers to middle tier servers (includes Unix Servers, Network Operating System Servers, and Original Operating System Servers), based on open platforms. This started in the private sector from the early 1990s and arrived later in the public sector roughly from the year 2000. While both mainframe and middle tier servers suffered sharp sales declines with the bursting of the IT bubble in the year 2000, the decline in mainframe shipments was part of a long steady sales decline beginning in 1994 when shipments were running a little over 2000 units a year to less than 500 units a year in 2004. By contrast, middle tier server sales, after dipping for two years following the bursting of the IT bubble in 2000, started to turn up again in 2003 (Japan Electronics and Information Technology Industries, 1993-2004). If we examine the data more finely as shown in Figure 2, we see that shipments of new mainframe servers declined most precipitously in the private sector with a much more gradual decline seen in the public and finance sectors (JEITA, 1993-2004).

Figure 2 Shipment of Mainframe Server in Japan by Sector

(Units)

Legend:
- — · — · — Public 1
- — · · — Financial
- · · · · · · Private 2

Fiscal Year: 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004

Y-axis: 0, 500, 1000, 1500, 2000, 2500

Note:1 This category includes national and local government
Note:2 This category include service, manufacturing, sale, hospital and school.
Source: Japan Electronics and Information Technology Industries Association

By contrast, there is a significant rise in shipments of middle tier servers in the private sector after 2002, with much a more modest rise for the public and financial sectors (JEITA 1996-2004). [4] Thus, just those sectors showing the most modest shipment increases are those that represent NTT DATA's core strength. This being the case, we can envision two possible responses. The first is that because the technology changes were slower in NTT DATA's core business area, management had the opportunity to proactively prepare and respond to these changes before being overrun by them. The imagery is that of "the early bird catches the worm." The second possibility builds on the more gradual way in which these changes affected NTT DATA. Because their core capabilities revolved around mainframe development and maintenance in the public and finance sectors, NTT leaders could be expected to lack a sense of urgency. They therefore would react much more slowly and cautiously to new market opportunities than many of their competitors who were more dependent on the private sector. The imagery for this latter hypothesis is rather one of a lobster put in cold water with the temperature rising so slowly that it doesn't realize it is being boiled to death until it is too late. These two "hypotheses" represent extremes and we will explore how they track with what actually happened. The evidence will point more to the latter than the former hypothesis.

For now, we can examine trends in market share in system integration. We see in Figure 3 (right legend) that even though the size of system integration services has

been growing rapidly, NTT DATA's market share has been declining; it was 22.1% in 1999 and declined to 19.7% in 2001 and has held constant since then. A 2.4% loss of such a huge market of some 371 million dollar (calculated at 120 yen=$1) in 2001 is non-trivial (Yano Research Institute, 2003). This suggests a mismatch between NTT DATA as supplier and actual buyer needs. Furthermore, while NTT DATA dominates its rivals, we see how fragmented the industry is when the largest player in the industry only has 6% of the total market. Even more to the point, 668 of the some 7,111 information service companies, which have more than 8.3 million dollars (calculated at 120 yen=$1) of capital, hold only 59.7% of the market (METI, 2005a:5).

Figure 3 Changes in System Integration Market Share and in size of System Integration Market

Note: 1. The left hand legend shows change in market size of specific firms and the right hand legend shows changes in total market size of the system integration market based on Yano Research Institute.
2. FSAS:Fujitsu Support and Service, NRI:Nomura Research Institute, FBS:Fujitsu Business System
Source : Yano Research Institute, Information Service Market 2003 (Japanese)

It is indeed a fragmented market! There are roughly three types of system integrators, independent (multi vendors like NTT DATA, NRI, CSK and Fsas), software system integrators (have own software) and hardware system integrators (have own hardware). Software and hardware system integrators such as Fujitsu, Hitachi, NEC and IBM proactively cultivate the private sector. Thus, independent system integrators such as NTT DATA inevitably faces fierce competition as they try to grow their business in the private sector.

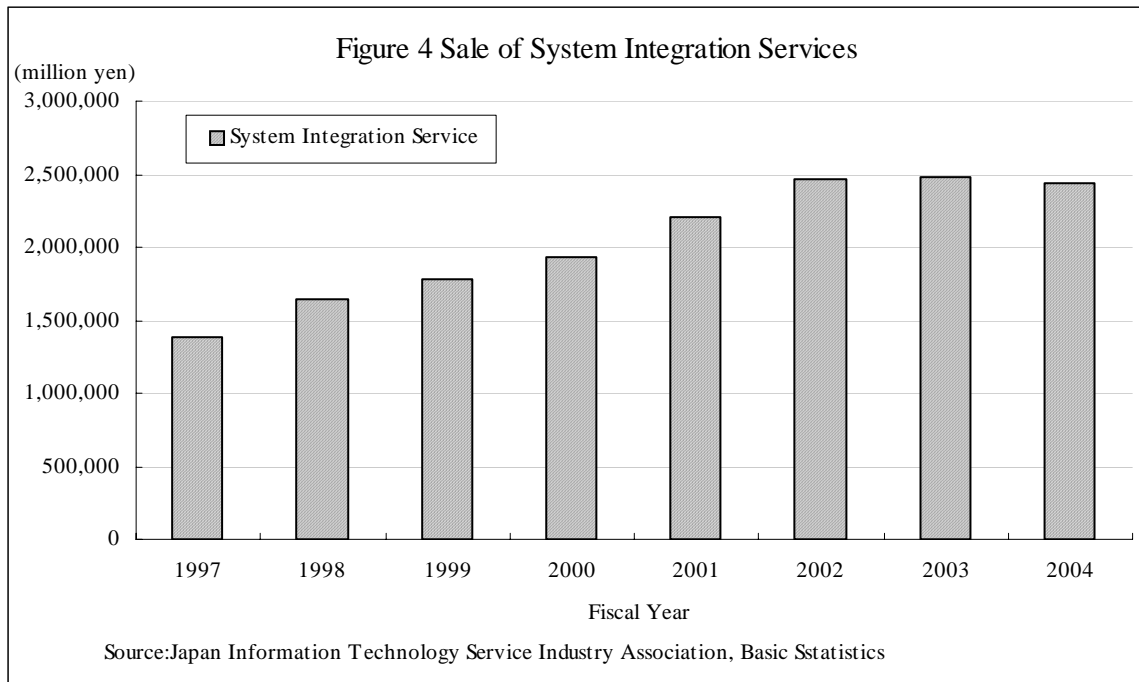**Open Architecture and Open Source Software (OSS)**

The second challenge is the unexpected emergent technologies based upon open architecture. This challenge is twofold: First there is open architecture in hardware, leading to downsizing and reducing the total cost of system development. Secondly, there is open architecture in software, leading more companies to enter into the IT service market. This is seen in the case of Microsoft with windows, Sun Microsystems with object-oriented software called JAVA starting in the early 2000s, and more recently it is seen in the accelerating adoption of OSS including Linux, Apache and PostgresSQL

Open Architecture also allows system integration companies to use a large variety of software and hardware to design a system based on each customer's specific needs. This was difficult in the mainframe era because of technological incompatibility. The main strength of system integrators at that time was around their own technology, their very size which provided assurance to potential customers that they had adequate resources to cope with unanticipated problems and, their brand names rather than the extent of their consulting skills.

Open architecture, by contrast enables any company having the requisite design capabilities, consulting skills and means of implementation to enter the market. In the mainframe era, providing system integration services helped users shift paperwork to computer work. In the situation, it is hard to differentiate one from another system integration firm by one's consulting skills. SI's were not asked to contribute to the users' corporate strategy. Not only have the new developments placed a premium on consulting skills but they have helped to break "vendor-lock in." These developments have also accelerated the pace of outsourcing to small-medium size software companies, even to China or India. The proprietary IT technology held inside a given company does not contribute as much to a firm's competitive advantage as it did in the mainframe era because system integration work has shifted toward a firm's ability to create valuable and complex business systems for its customers. This requires sophisticated consulting skills. Moreover there is increasing standardization, and commoditization, spurred in part by the advent of packaged software which simplifies the overall implementation of software. These developments directly impact the opportunities available to SIs. All of these environment changes lead to more equal relationships between customers, system integrators and to severe competition in the system integration market. Under these circumstances, users more easily change

vendors, if they are not satisfied with currently provided service. As a result, there is great pressure for cost reductions and the bargaining power of system integration companies has weakened vis á vis users.

As seen in Figure 4, system integration services, the focus of NTT DATA's business, experienced strong demand from 1997 to 2002, with growth flattening out as the affects of the bursting of the IT bubble were felt. The strong growth rate was largely the result of the previously mentioned transitions.

Figure 4 Sale of System Integration Services

Source:Japan Information Technology Service Industry Association, Basic Sstatistics

The bulk of increased demand came from the private sector. This market grew from 4 to 4.9 trillion yen from 1998 to 2001, a remarkable 22.5% increase, while demand in the public and finance sectors was almost flat from 1998 to 2003. (JISA: 2000-2004).

These transitions were ultimately to deeply affect the internal workings of NTT DATA, its strategies, and the utility of existing employee skills and mindsets. In the mainframe era, firms had the luxury of expending large sums on development (and the associated large R&D staff to support this development). When using middle tier servers with an open platform under conditions of: high levels of competition, smaller margins, strong pressures for rapid delivery of solutions, and shorter product development cycles, such high overhead costs become a huge burden. The development model shifted significantly, but complexity didn't disappear. Open

systems and downsizing also created a market for distributed systems and architectures, and enabled multi-tier databases for new entrants who did not have their own technologies, all of which were much more architecturally complex than previous mainframe systems. The communications infrastructures also became more complex. In this evolving environment, it became increasingly critical to adjust to the rapidly changing market conditions particularly in the private sector. High overhead costs borne by customers didn't disappear but rather were shifted from mainframe to distributed, open systems.

The market evolved through four simultaneous developments: new systems (open systems including open source) new deployment methodologies (distributed computing) and new business models (Internet-based). It seems that large incumbent system integrators like NTT DATA were unable to shift their focus fast enough to leverage these changes. In this sense, system development became a more risk-taking activity compared to the mainframe era. System integrators could not just sit and wait until they received orders. They needed to proactively develop the new market regardless of its initial scale. This involved assessing the probability of success of different new ventures which inevitably required them to create a more risk-taking culture in their organizations. It was a challenge for NTT DATA to develop such capabilities.
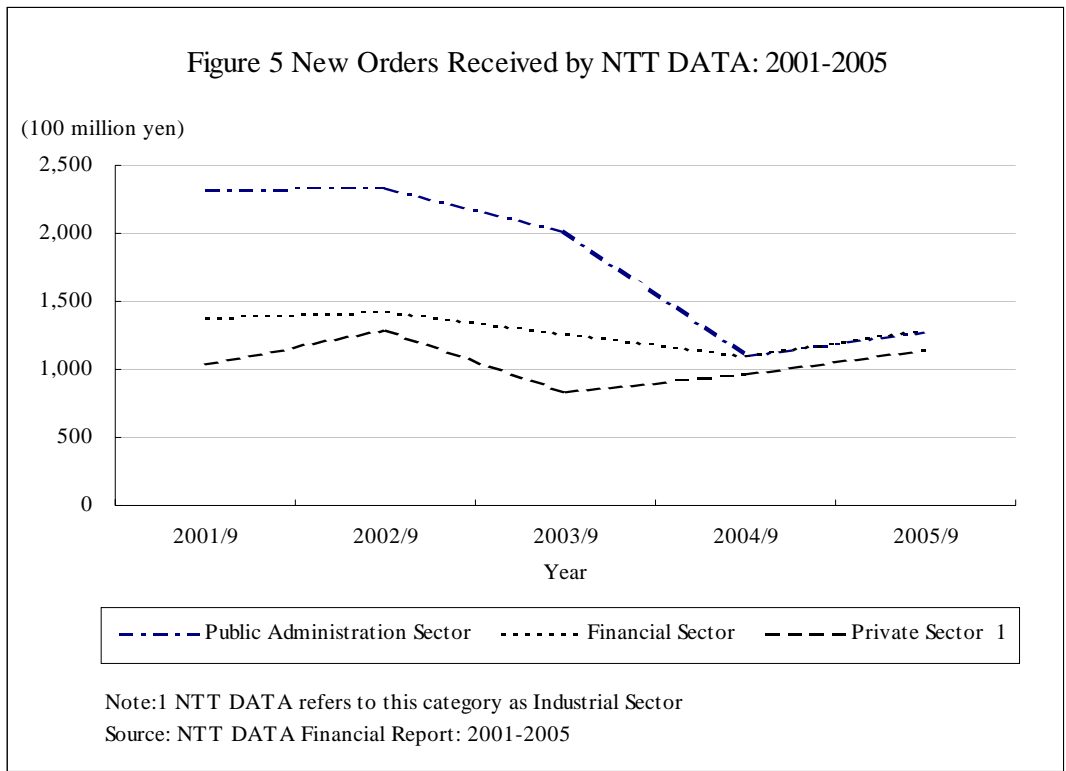
Changes in NTT DATA's Core Market

The third challenge for NTT DATA, and the most recent, was the saturation of its core public sector market and a re-evaluation by public ministries and agencies of their IT needs and costs. Government ministries and agencies have been spending huge amounts of taxpayer funds on IT system maintenance. Under strong cost-cutting pressures in the early 2000s, they eventually could not ignore the new opportunities presented by the changing technology. The Japanese government started reviewing its high IT cost structure with consulting companies in 2003.[5]

Each ministry committed to determining an optimization plan for the 41 major government legacy systems (e.g., social insurance online system), by the end of fiscal year 2005. In keeping with this objective, consulting companies reviewed these legacy systems and found that it was possible to greatly reduce costs by revising the kinds of contracts and system designs. As an example, IBM business consulting services reviewed the IT systems of the social insurance agency, which provides a significant

portion of NTT DATA's revenues. They pointed out that if the agency shifted from its mainframe systems to systems using middle tier servers running on open source systems, they could dramatically reduce the huge amount being paid in annual maintenance fees.

As a result of these examinations, many other government ministries and agencies realized that if they shifted from mainframe systems to systems using middle tier servers running on open source systems, they could also dramatically reduce the huge amount being paid in maintenance fees. It is estimated that if the government ministries and agencies act to implement the proposals contained in the various consultant feasibility studies NTT DATA will stand to lose 40 to 80 billion yen a year in sales (Nikkei Computer, 2005a:42). Already, we can see an impact on its sales.

Figure 5 New Orders Received by NTT DATA: 2001-2005

Note:1 NTT DATA refers to this category as Industrial Sector
Source: NTT DATA Financial Report: 2001-2005

In Figure 5, we see that NTT DATA sales based on new orders showed a strong downward trend from 2001-2004 with a modest uptick in 2005. The sharpest declines were in new orders received in the public sector and they were hardly compensated for by the modest rise in private sector and financial sector orders. This shift to both reduced margins from their public sector business and reduced sales growth in the

public sector represents a huge challenge to NTT DATA since the public sector has been, far and away, the most profitable of its three business sectors.

Obstacles to Change: Customer Orientation

A strong customer orientation is at the root of quality improvement activities. Changing markets and technologies can involve huge changes in customer preferences. When one observes the rapid changes in market demand and technologies reflected in the transitions discussed above, it is easy to understand that incumbent organizations with skill, mindsets and software development methodologies geared to conditions prevailing in earlier times, would find it hard accommodate these changes.

There is first the technical challenge of retraining system engineers who have been using main frame system development using programming languages such as COBOL and Fortran which are procedure oriented methodologies, to be able to effectively use Java or Perl (which are object oriented) for web applications. While the technical challenges are not trivial, an even bigger challenge is retraining system engineers to be business oriented engineers and project managers who can acquire new customers.

These outcomes require learning how to plan new solutions for customers coordinating multiple vendor (hardware and software) inputs. Legacy systems need to be connected to new emerging software systems, including OSS, and new technology using open architecture. Project managers need to show these connections to customers as a single integrated web-based system. Also depending on the phase of the project (IT lifecycle) such as sales, design, and implementation, a broad set of skills, both technical and customer oriented skills are required. There are not many people who can execute this role which requires strong planning and coordination skills, and close listening to and study of customer needs across customer departments in an iterative process and an ability to architect solutions.[6] System engineers need to be alert to sales opportunities and know how to work with others to frame solutions. With a service oriented architecture (SOA) serving as platform, firms need those who can draw on existing data and services to build unique new functionalities that add business value to a firm (Greenbaum, 2006).

NTT DATA's approach to acquiring these new skills involved using the R&D department to take the lead. The R&D department had many new staff in the 90s and

as necessary loaned personnel from NTT's research lab. They sought to acquire the needed skills, including software development skills, required for the firm to be more nimble and responsive. These personnel were then reassigned to directly teach their counterparts in each business sector organization. Rather than concentrating on teaching new programming languages, the focus was on overall project management capabilities which involves interfacing with customers to acquire their requirements and translate them to specifications.[7] In choosing this focus, they undoubtedly made a wise decision. Yet, at this time, unlike some other Japanese companies, they eschewed hiring mid-career employees from other companies who had deep experience in the needed business skills and mindset. Having newly trained R&D employees teach others --essentially a retraining strategy-- about the subtleties of providing the business skills associated with providing a service oriented architecture is a two step process that lost precious time in a situation of rapidly changing markets and technology. This methodology could not be expected to yield strong short term returns.

In most of the mainframe era, NTT DATA employees were civil servants. They waited whiole customers from different government agencies came to them. The government also wanted NTT DATA to play an important role to grow Japanese computer companies such as NEC, Hitachi, and Fujitsu. In this environment, NTT DATA had its own "kingdom" where they were the experts; this bred a certain arrogance. They didn't have the habit of going to the customer and cultivating their needs. Rather they were in a position, without real competitors, to shape customer expectations. They had a strong stance toward customers but quite different from the "listening to the customer" prescription as advocated by quality specialists. In one form or another, many of these old habits persist. Hamaguchi Tomokazu, the current president of NTT DATA, when interviewed recently, observed:
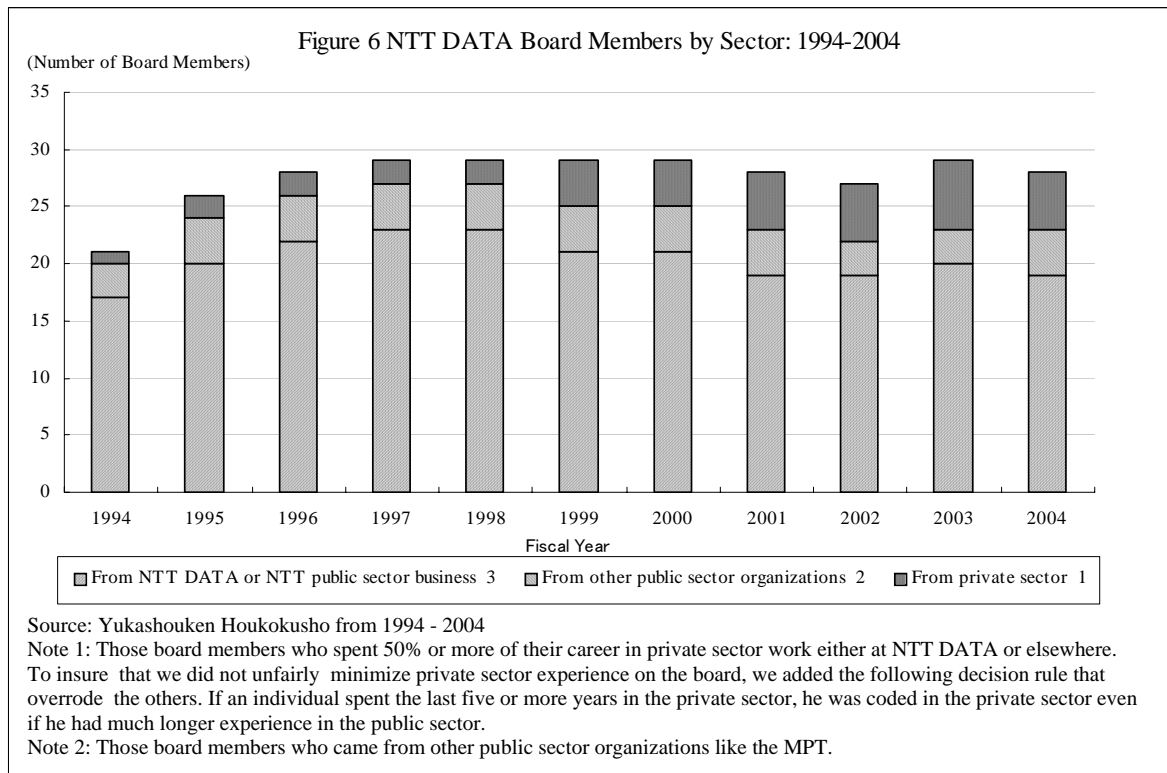
> We have been establishing a relationship of mutual trust with customers through our system engineers (SE's). SE's could make a proposal and take responsibility for a project. But, after spinning our company off from NTT, despite the passing of fifteen years. I feel that our company continues to do business from the perspective of the supplier rather than customer side. Now, we need to have a customer-oriented view and more consulting skill sets to satisfy customers." (NIKKEI Solution Business, 2003.6.30).

Fujita Shirou, NTT DATA's former president, made much the same observations in the early 1990s (Fujita, 1994). Yet, he proclaimed that the new TQC culture he had helped to install and which led to the company winning the Deming Prize in 1993, was leading to a renaissance of NTT DATA. This leads one to wonder why it is that NTT DATA has maintained such a corporate culture despite having adopted TQC in the early 1990s and having been awarded the Deming Prize in 1993.

A major cause for this state of affairs rests on the fact that public sector administrators are, on average, not terribly competent in articulating their IT needs. Because of this lack of competence, communication between NTT DATA system engineers and public agencies is poor, often leading to costly last minute specification changes and less than desired outcomes. These are the consequences of the information asymmetry pointed out earlier.

In this connection, Nishimura and Kurokawa (2004:25) found that government customers hinder information service firms' productivity. This is contrary to the proponents of the "e-Japan Strategy" who see the government sector playing a leading role in bringing Japan in the 21st century IT world. It follows from this discussion that firms like NTT DATA, which have been highly dependent on the government sector customers, would be at a considerable disadvantage when trying to penetrate the rapidly growing private sector. Private sector firms place a premium on rapid response to customer needs. One indication of NTT DATA's weak orientation to the private sector is that it still receives its largest number of orders in the private sector from one of its keiretsu companies, NTT DoCoMo. In the late 1990s, NTT DATA's system development service business with its parent company NTT was running between roughly 11 and 16% of its total system development revenues (NTT DATA Yukshouken Houkokusho, 1994-1999). Given that a majority share of its stock is owned by NTT, moreover, it is likely that NTT DATA has been under pressure to give priority to NTT-related business at the expense of pursuing other more profitable opportunities.

There is an additional underlying dimension to the problems created by NTT DATA's reliance on the public sector. It wasn't just a matter of waiting for government agencies to come to them with orders. NTT DATA also developed strong political skills in government circles to promote the kinds of projects it wanted to develop.

Figure 6 NTT DATA Board Members by Sector: 1994-2004

Source: Yukashouken Houkokusho from 1994 - 2004
Note 1: Those board members who spent 50% or more of their career in private sector work either at NTT DATA or elsewhere. To insure that we did not unfairly minimize private sector experience on the board, we added the following decision rule that overrode the others. If an individual spent the last five or more years in the private sector, he was coded in the private sector even if he had much longer experience in the public sector.
Note 2: Those board members who came from other public sector organizations like the MPT.

We see in Figure 6 first that the overwhelming proportion of NTT DATA Board members from 1994-2004 came from the NTT DATA public or financial sector businesses or to a lesser extent from its parent firm, NTT Corporation. The latter, a partially privatized company since 1985, still retains its "civil servant" culture and the government still retains significant ownership shares. The number of NTT DATA board members ranged from 24-29 from 1994-1999. During this period of explosive private sector demand, the number of those from the private sector business of NTT DATA or other private sector businesses never exceeded 7% of the total Board members. After 1999, private sector membership on the Board starts to grow annually reaching a high of 25% in 2004. In 2005, in keeping with recent trends in Japan to speed up corporate decision making processes, the board of directors was dramatically restructured with total membership going from 28 in 2004 to 11 in 2005. Those from the private sector (3) still accounted for only 27% of the newly reconstituted 11 member board.

The strategy of NTT DATA was to put on the Board ("hire") government officials to gain knowledge to advance their business in the public sector. However, NTT DATA did not take the same strategy in the private sector. It might be argued that because so much of their business and profit is still in the public and financial sectors,

it is only natural that these board members dominate given the assured revenues from government organizations and the high risk of private sector investment. But that is precisely the point. Trying to run an ongoing business and still provide full support for an emergent business involves the difficult task of trying to manage competing interests (Cooper and Smith, 1997: 141-155). Nezu Risaburo captures the broad application of this problem for Japanese IT incumbents in the late 90's. He notes that Japanese IT incumbents have been more interested in maintaining existing businesses, so long as they were generating income --and NTT DATA was a massive generator of income—than they were in trying something new and untested. As a result, he concludes they were too slow to take on new challenges (Nezu, 2006:85). Because of such competing interests, many companies spin off new subsidiaries to enter new business areas. By contrast, President Hamaguchi has stated that NTT DATA must not be divided into three different companies, because he thinks that it is possible to get synergistic effects with the current organizational structure (Nikkei Computer, 2005d:59).

President Hamaguchi, himself, has rich experience in the private sector. He has been taking a number of strong measures since he was assigned in 2003 to reorient the firm including the improvement of internally developed software, compulsory personnel exchanges across different divisions and learning from IBM to strengthen sales. In recent remarks, however, he acknowledged the firm's slowness in adapting to market and technology changes, which he attributed to employees not having a sense of urgency. (Nikkei Computer, 2005d: 59).

There is, however, as we have seen, another explanation for the firm's slowness. NTT DATA made growing its private sector business an important target since the 1980s. Yet, they were very slow to promote to the Board and as heads of the private sector division, managers who had deep experience in the private sector and who could provide the needed leadership. Former board members favorably cite the flexibility of managers with public sector experience taking a leadership role in private sector initiatives. However, flexibility without deep experience in meeting private sector customer needs is not an obvious recipe for success.

The reported distribution of board membership described above is predictable; it is commonplace that the departments and divisions of a firm, accounting for most of its sales, typically wield the greatest political power. The proportion of NTT DATA's sales revenue derived from Japanese government-related organizations never fell

below 40% from 1993 to 2005 (NTT DATA, 1990-2005). This greatly exceeded any other category. Moreover, its profits from the public sector, as noted earlier, were much higher than the other two sectors so its role was accordingly more important.

NTT DATA found itself in a situation in which just that group whose skillsets were becoming less relevant to future growth areas wielded the greatest power within the company. All things being equal, one would not see this as a successful formula for penetrating the rapidly growing private sector market. Rather, it was more likely that it encouraged an inappropriate business model to drive resource allocation decisions. Conversely, we have seen that those with private sector expertise and with knowhow regarding needed customer oriented content, for a long time, have been weakly represented in the key policy making levels of the firm. Seiichiro Yonekura and Hans-Jurgen Clahsen (1994:59) argue persuasively that, when dealing with a completely new technology, the top leaders have to be experts on the technology as well as on the conditions of the market in which the firm is operating. Perhaps NTT DATA managers initially didn't realize just how different the technology, the market and its requisite business model were. Those who view an emergent technology in a new sector through the lens of their experience in the established technology and market often see what is familiar in the new technology and market situation more clearly than what is different (cf. Cooper and Smith, 1997:154).

NTT DATA did see fit, however, in the 1990s to recruit Board members who had been employees of other public sector organizations. As shown in Figure 6, these "other public sector" individuals, from 1994-2004, totaled 3-4 seats on the board each year with a rotating system to include members from the MPT (Ministry of Post and Telecommunication) and MHW (Ministry of Health and Welfare). It is most plausible to believe that these board members were used to cultivate political ties with MPT and MHW with which NTT DATA wanted to continue to do business. It is said, for example, that this practice was closely related to the Social Insurance Agency annually increasing its payments to NTT DATA for the agency to be able to continue to use the social insurance online system without the agency putting the contract out to bid.[8]

While NTT DATA did chose to recruit Board members who had been employees of other public sector firms, they did not see the benefit of bringing in outsiders to the Board with private sector experience, As is characteristic of many Japanese companies (with some recent notable exceptions), NTT DATA seemed to prefer recruiting to the board from within rather than recruiting externally. Thus, even though an increasing

number of board members had rich experience in the private sector, few had experience outside NTT or NTT Data. These practices continue to exist. Yet, if the priority is to rapidly catch up with IBM or Fujitsu in the private sector, in a context of rapidly changing market requirements and technology, then NTT DATA would have benefited greatly in the 1990s from recruiting outside Board members (not to speak of high level managers) who had actively applied the skillsets and knowledge needed for success in the private sector.

Still another practice that NTT DATA maintained until 2004 was hiring retired government officials seeking private sector work in its subsidiary, Social Information Create. (Nikkei Computer, 2005b:48). This suggests the cozy political relationships that NTT DATA maintained to insure a continuing stream of business from public sector entities. With these kinds of customary practices, system engineers could just focus on system development without paying much attention to soliciting new customer orders. It was hardly an environment for teaching project managers and sales employees to aggressively seek out and build the business skills need for customer acquisition.

In summary, despite giving verbal commitment to growing its business in the private sector since the 1980s, NTT DATA's board membership suggests that it moved excruciatingly slowly toward this objective at a time of rapid market and technology changes and more importantly at a time of great opportunities.

Obstacles to Change: NTT DATA's Quality Culture

When NTT DATA functioned as part of NTT, it quite naturally developed a strong emphasis on quality. Since it earliest days developing mainframe computers, quality evolved as a key source of competitive advantage and market differentiation for NTT DATA. Dr. Tsuruho notes that from the beginning, NTT DATA focused on achieving high levels of reliability rather than low cost development per se. This tradition became central to NTT DATA's "corporate DNA." [9] This reputation for high quality is well recognized in Japanese business circles. When loss of confidence resulted from the malfunctioning of the Tokyo Stock Exchange (TSE) in 2005, the appointment of a former NTT DATA executive as Chief Information Officer (CIO) was designed to reassure the public and the business community of TSE's ability to effectively manage its trading system.

NTT DATA's quality strength was formally recognized in 1993 when it received Japan's Deming Prize, the first software development company so honored for quality management excellence. A summary of key elements in the award announcement by Nihon Kagaku Gijutsu Remmei (Nikagiren) states as follows:

NTT DATA COMMUNICATIONS SYSTEMS CORPORATION,
Deming Prize, December, 1993

After NTT DATA's privatization, a mounting challenge was posed by the need to shift from bureaucratic thinking, conservative thinking and activities, and rough estimate management to customer-oriented management style. Centralized computing shifted to a more popular distributed processing centered on PCs. To breakthrough this crisis situation, NTT DATA started to develop its "value creator movement;" in 1991. With strong leadership from top management, they introduced their TQC program seeking creation of a system with "warmth, foresight and creativity."

1. Developed STEAD (standardized system development process) and its support tools. As a result, it became possible to insure quality in the planning phase (by capturing customer needs).

2. The effective use of QUEST (quality management manual for implementing quality assurance procedures) and the My-Customer campaign (program in which one employee must be in charge of taking care of one customer to insure quality of service), has boosted quality assurance and customer satisfaction.

3. Using hoshin (policy) management enabled the company to implement the President's diagnostic (check and instruction from the top), and increased the goal attainment level. This has been an important contribution to the promotion of TQC.

As a result of all these activities, NTT DATA improved the quality of its systems and produced distinguished business achievements under a challenging economic environment.

In our analysis, we will focus on some key elements highlighted in this statement. First let it be said that competing for the Deming Prize did less to introduce a new consciousness of quality into NTT DATA than it did to standardize existing informal quality practices and institutionalize them within the company.[10]

As noted in the Nikagiren statement, underlying NTT DATA's approach to standardization was a system they called STEAD. Fujita Shirou, the first president of NTT DATA in 1988, had rich experience and deep commitment to Total Quality Control (TQC) (Fujita, 1997: xiv). He believed strongly in the value of standardization in system development levels as part of the standardization activities associated with its TQC initiative, NTT DATA broke system design work into 21 separate components and further sorted specific work items based on these 21 components and established a three layer system called "Work Breakdown Structure." Its application to system development for large mainframe projects was found to be correlated with higher quality (Fujita, 1997:105-107). Using highly skilled engineers and sophisticated quality management, we have seen that NTT DATA intensively developed a number of huge government-related mainframe systems from 1993 to 2005. Standardization underlay this success, contributing substantially to raising quality and performance.

The standardization movement within NTT DATA was well suited to the system development methodology employed in the mainframe era known as the "waterfall" model. The waterfall model strictly follows seven standardized sequential phases: 1. Requirements Specification, 2. Design, 3. Construction, 4. Integration, 5. Testing and debugging, 6. Installation, 7. Maintenance. Strictly enforced, as was the norm at NTT DATA, it meant that managers insisted on complete functional (specifying product features) and detailed specifications before programmers were to begin writing code and building system components. To help insure quality, no step was to be started before the previous ones were complete or largely complete. At the end, the components were merged in a large integration and testing phase with strenuous efforts made to eliminate bugs.

By focusing on fully incorporating customer requirements through a standardized process in the first two steps, it is expected that programmers will be more productive, technically speaking, since if they make fewer change during a project, the have less rework to do (cf. Cusumano et.al.2003:7). In this fashion, quality is largely assured at an early phase of the project, if implementation is done accordingly. This focus on solving quality problems in the design phase is, as we noted in our initial remarks, one of the hallmark themes of the Japanese quality improvement literature. It is in this context that a culture of zero defects was cultivated within NTT DATA and other large Japanese software developers (cf. Cusumano, 2004:148-149; 173-174).

This upfront standardization process also enabled NTT DATA to outsource the building (software and hardware) of the system to key vendors like NEC, Hitachi and Fujitsu. Standardization allowed NTT DATA to give clear guidance to vendors as to the precise specifications they needed to adhere to in efficiently and effectively implementing their building of the systems. Outsourcing the building of systems became a central element of NTT DATA's business model while they retained the "high end" design and planning phases.

These systems were traditionally built with a single vendor (IBM or Fujitsu or Hitachi or NEC) using original mainframe hardware, operating system, transaction protocol, database, and programming language (e.g., COBOL). These were closed technologies and because of their incompatibility, users could not compare the closed technology they were buying with other technologies. So, the user found it hard to question NTT DATA explanations. This enabled NTT DATA to spend the money and time it believed it needed to achieve and maintain high quality and train its employees in the technology. Moreover, all the needed technology was within NTT DATA or its group companies. In reality this model was counter to the quality improvement literature that stressed high quality and low cost. With its focus on the public sector, however, NTT DATA had no real competitors and they could build a product characterized by high quality and high cost.

The effectiveness of the waterfall development model is dependent on the ability of customers to clearly articulate and communicate their requirements in advance and for NTT DATA to be able to convert those to appropriate design specifications. In the 90's and thereafter, particularly in the private sector, user needs for different applications were becoming so complex and the market conditions so dynamic and the changes in hardware and software technologies so rapid, that it became increasingly dangerous to design software products and systems completely in advance. To do so, in this environment, greatly increases the probability of outmoded products arriving to the market.

The time a firm can take to develop the quality of its system depends on a customer's budget and deadline. Cost reduction became ever more important under the new market conditions of the 1990s. Customers were demanding shorter and more cost-effective system development and customer needs were often uncertain. At the same time, as noted above, it became important to be able to connect legacy systems (typically mainframe) with rapidly evolving software systems (some of which are open

source) with rapidly changing technology (often from different vendors) and to show it to customers as a web-based single integrated system, while providing one-stop shopping. In these circumstances, it became relatively difficult for NTT DATA using the waterfall model to be competitive in meeting these private sector needs. NTT DATA came to need more innovative system development methodology that was more responsive to customer needs in the turbulent 90's and thereafter.

Yet, their past success as applied to mainframes was associated with standardization, rigorous upfront requirements planning and design and high cost quality performance as measured especially by system reliability. This made it difficult for managers to envision an effective path forward when markets and technologies began to change radically in the 1990s. STEAD was created for large-scale system development; it was not directly applicable for smaller-scale and shorter-lifecycle system development projects of the kind common to the private sector.

In response to rapidly changing market conditions and technologies in the private sector, where locking customers into a specific design may not produce the best product for the customer, more flexible methods evolved, led by developments in the United States. These new approaches came to be called the spiral development model (agile model). The major distinguishing feature of the spiral model is that it creates a risk-driven approach to the software process rather than a primarily document-driven or code-driven process. (Boehm, 1988) To be applied effectively, the spiral method must still be planned methodically, with tasks and deliverables identified for each step in the spiral. While the spiral model generally will not do as well as the waterfall model in insuring reliability, it may do much better in providing, in a timely fashion, the features and functionality desired by customers. Quality is best understood not just as reliability or durability but as fitness for use as defined by the final user. Thus, it is the features and functionality of products which meet customer needs and provide customer satisfaction that is often critical to success in a rapidly evolving marketplace. (cf., Juran, 1998: 2.1).

Application of the spiral development model may involve skipping writing detailed specifications and going directly to writing code, soliciting early and continuous customer feedback, and carrying out rapid prototyping, parallel development of modules and concurrency in design and build activities. These approaches can in turn increase output and lower defects because continuous testing leads to earlier detection of problems (Cusumano et. al., 2003:7). More importantly,

this methodology may better meet customer needs in dynamic environments. Yet, it runs counter to traditional quality prescriptions of "doing as much as possible upfront." While this prescription still applies to many large scale system developments of the kind often found in the public and financial sectors, it is less valid in private sector projects characterized by dynamic markets and technologies and the importance of the customer user interface.

NTT DATA invested in R&D for developing Rapid Application Development (RAD), a spiral development methodology, Yet, Cusumano and associates (2003:6-7) found in their Japanese sample of software development projects from nine Japanese companies (including NTT DATA) that they were much slower to move away from the waterfall methodology than were firms in India or the United States. NTT DATA still shuns skipping the construction of detailed specifications and going directly to writing code as they believe it can lead to slackness in project management, greatly increasing the prospect of failure. These first steps are the one that can guarantee reliability per quality orthodoxy and NTT DATA finds it hard to relax their commitment to improving the quality by utilizing various tools including prototyping, and simulation. As Dr. Tsuruho Seishiro expressed it in our interview:

> Japanese software development firms like NTT DATA try to make the design phase as complete as possible given the constraints of time and money, even when they are trying to do some version of the spiral model. They know, of course, that it is not always possible to fully document specifications in the design phase, given the constraints of time and money but that is their aim.

What we see reflected here is a conservative risk avoidance bent that minimizes the probability of using a full blown spiral model for project design and development.

In NTT DATA's Annual Report for 2005, Fukuda Teramitsu, a senior manager in the Public Administration Systems Sector, reports some interesting developments regarding the firm's efforts to find less costly and speedier methods to develop medium size projects for the small and medium firm sector (Fukuda, 20005, 20-21). He announces NTT DATA's commitment to techniques like MOYA (already up and running at NTT DATA) and TOY. These are business modeling techniques and frameworks for improving he accuracy of defining requirements. TOY is a system modeling technique for the development of medium scale (WEB and rich client)

systems that facilitates downstream processes using certain elements derived from MOYA.

By doing a better job of defining requirements in the upstream design process, Fukuda reports that they were able to reduce the number of downstream steps in the development and trial phases. Furthermore, he notes that the application of these methodologies allow for more integrated management and standardization of all project steps. This, it is claimed, enables tighter control over development and thereby further enables the increase of outsourcing in the development phase, a central element in NTT DATA's traditional business model.

In short, NTT DATA is trying to respond to the challenges of speedier and less costly system development for medium size projects in the small and medium sector by an intensification of its traditional approaches of capturing customer and system requirements and converting them to detailed specifications in the upstream design phase. This, in turn, better enables them to outsource more and more of the development phase. This may be productive in relatively stable environments but is less so, we have argued, in dynamic private sector environments. In these environments, the spiral model has a number of advantages. But that is not where NTT DATA is putting the weight of their efforts.

Predictably, then, NTT DATA does not make systematic use of parallel development of modules and concurrency in design and build activities including "daily build" to synchronize and stabilize work. In short, it does not pursue a full blown version of they call the "agile model." As in the case of most Japanese software development activities in large firms, design is typically separated from development. This division thwarts efforts to have developers in parallel groups continuously cycling through design, coding, and testing activities, which are synchronized regularly through daily build. These practices lead developers to continually refine their understanding of customer requirements and to continually redesign the product accordingly. It is in this context, that the spiral model doesn't easily tolerate handing off development of the product to contractors. Implementation of the spiral model benefits greatly from co-location even in this age of instant electronic communication. [11] Notwithstanding, the 24 hour software factory, with iterative handoffs around the globe, suggests that parallel processing can be compatible with a highly coordinated approach to organizing OEM/supplier relationships. This does not appear, however, to be the direction in which NTT DATA is moving.
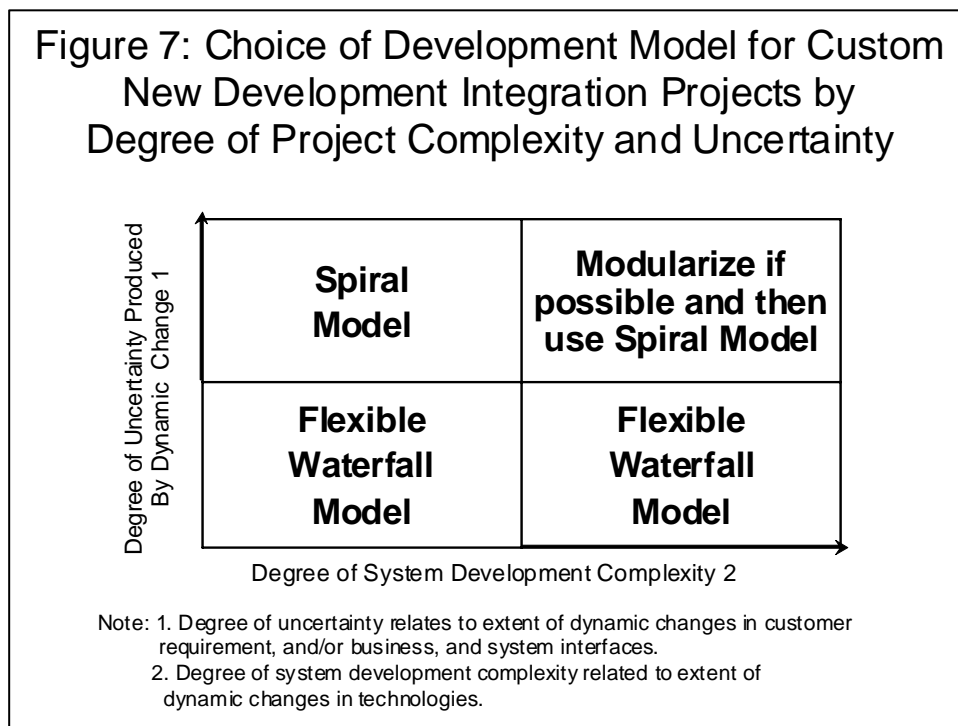
This is the nub of the dilemma that NTT DATA faces. As the waterfall model of software development evolved in the 70's and 80's at companies like NTT DATA, it became associated with a division of labor and business model in which NTT DATA did the planning and design and it subcontracted out the development of the system. As we saw, this strategy is premised on the ability of NTT DATA to acquire all the needed customer requirements up front so that they could do the functional and detailed design specifications in advance of any development, which can then be farmed out to subcontractors. Thus to fully accommodate the spiral development model, NTT DATA would need to change not just its software development methods but its whole business model with its sharp differentiation between the firm that conducts planning and design activities and the one which conducts development activities. They choose, however, to focus on developing methodologies like MOYA that further intensify their existing business model. Current differences in compensation for the two disparate functions, design and development, would also be called into question were they to dispense with the current business model, making it all the harder to pursue spiral model methodologies.

As a result, we see instead at NTT DATA is a kind of layering in of certain spiral development methodologies into the traditional waterfall methodology on a case by case basis in their private sector projects. By the late 1990s, NTT DATA developed a modified (flexible) waterfall mode of development where they abandoned the strict approach of never starting a sequential step without completing the prior step. In other words, they began using modest forms of parallel development to speed up the development process and reduce costs. They have also had to learn to work with moving targets as a result of constant changes in requirements. Prototyping was adopted on a case by case basis. With increased customer pressure for speeding up the development process, SE's found that it took too much time if they were to follow all steps of the waterfall documentation process, leading to higher costs and delayed completion dates. So, in ad hoc fashion, SE's often cut out unneeded processes and items on check lists to reduce the time. But this kind of "cherry picking" of what seem to be the must useful practices can be dangerous. As Cusumano and associates (2003:7) note: "development models are best regarded as a coherent set of practices, some of which are required to balance the potential performance trade-offs arising from the use (or absence) of others. Cutting the process is not enough to reduce the cost, nor does it insure that the quality of the product will not be sacrificed. In any case, these changes

fall far short of the more complete adoption of the spiral development methodology which occurred first in the U.S. private sector and later in places like India.

NTT DATA tends to see the full scale application of RAD as limited to projects in which customer interface is a key factor and the project is under 10 million dollars. There are larger projects, however, that could benefit from RAD where not only customer but also business, and system interfaces are dynamic. In these cases, implementing RAD would require more modular product architectures (Cusumano, 2004:167). More modular product architectures would allow parallel processing and make regular prototyping more feasible. But NTT DATA does not report making major investments in more modular product architectures.

We can capture the challenges facing NTT DATA in this regard in Figure 7. When system complexity is high and the degree of uncertainty in customer requirements, and business and system interfaces is low, then the flexible waterfall development model is an obvious choice. The flexible waterfall model is also a

Figure 7: Choice of Development Model for Custom New Development Integration Projects by Degree of Project Complexity and Uncertainty

Spiral Model	**Modularize if possible and then use Spiral Model**
Flexible Waterfall Model	**Flexible Waterfall Model**

Degree of Uncertainty Produced By Dynamic Change 1 (vertical axis)

Degree of System Development Complexity 2 (horizontal axis)

Note: 1. Degree of uncertainty relates to extent of dynamic changes in customer requirement, and/or business, and system interfaces.
2. Degree of system development complexity related to extent of dynamic changes in technologies.

workable choice when system complexity is low and uncertainty is also low. When system complexity is low but uncertainty is very high then the spiral model is an effective development model. NTT DATA has been slow to embrace this solution in these circumstances, but it has made significant progress in recent years. Where NTT DATA faces its biggest challenge to its conventional way of organizing, is where complexity is high and uncertainty is high. As shown in the top right cell of Figure 7,

this situation calls for embracing modular architectures thereby enabling the use of the spiral model for software development. NTT DATA, as noted, has been reluctant to make strong bets on this approach.

NTT DATA's emphasis reliability (especially elimination of software bugs) sometimes leads NTT DATA SE's to recommend to customers that they use older versions of applications rather than a newer ones offering more functionality. One observer concludes that NTT DATA has developed a "corporate DNA" that places the highest priority on creating system stability. This leads them to give preferential treatment to those products and techniques that have achieved satisfactory results in the past at the expense of the latest technologies (Nikkei Computer, 2005a: 44). This may be a wise choice when safety and stability are highly valued by their customers as is the case in banking and other large scale mainframe systems like the national air traffic control radar system. In the private sector, however, when dealing with smaller systems, innovation may often be more or just as valued as stability.

In the spiral model, we have seen that customers and system integrators need much more communication because it is an iterative process designed to speed up system development, reduce costs and clarify uncertain needs. In this environment, software continues to evolve such that different software components increasingly develop in different communities outside the company. Since the quality of the system is important and it depends partially on the software, it is important to have the necessary information to solve quality problems. With software developed and imported from outside communities, however, you may have to wait and work with those outside the company to solve the problem (e.g., cause of a bug). Moreover, it is very difficult to identify the nature of problems in complex systems developed with different software. It requires a systematic solution involving a large variety of skillsets to develop the system. You might need to gather some of those skillsets from outside of NTT DATA. In the mainframe era, all the needed skills for what it needed to do were within NTT DATA or its group companies. In short, it has become very difficult for NTT DATA to try to manage such innovative technologies within its divisions or group companies as it had been accustomed to doing. The insular nature of the company has led it to be slow in reaching out to participate fully in such communities at a time when customers increasingly value speed.

We have seen in this discussion that the strong quality orientation at NTT DATA, present as well in many of their Japanese competitors, has been infused through their

push for standardization and other activities into a very refined waterfall model. It has been further baked into their business model whereby they do the planning and design and contract out development to vendors. This is a model with some modifications that continues to work well with large scale projects. But growth in the more dynamic private sector often involves smaller projects that would benefit from the spiral model methodology. However, NTT DATA finds it hard to move strongly in this direction since it challenges the heart of its business model. What we see instead is a layering of partial spiral model approaches into the waterfall model to create a modified waterfall model with the degree of movement in this direction varying by project.
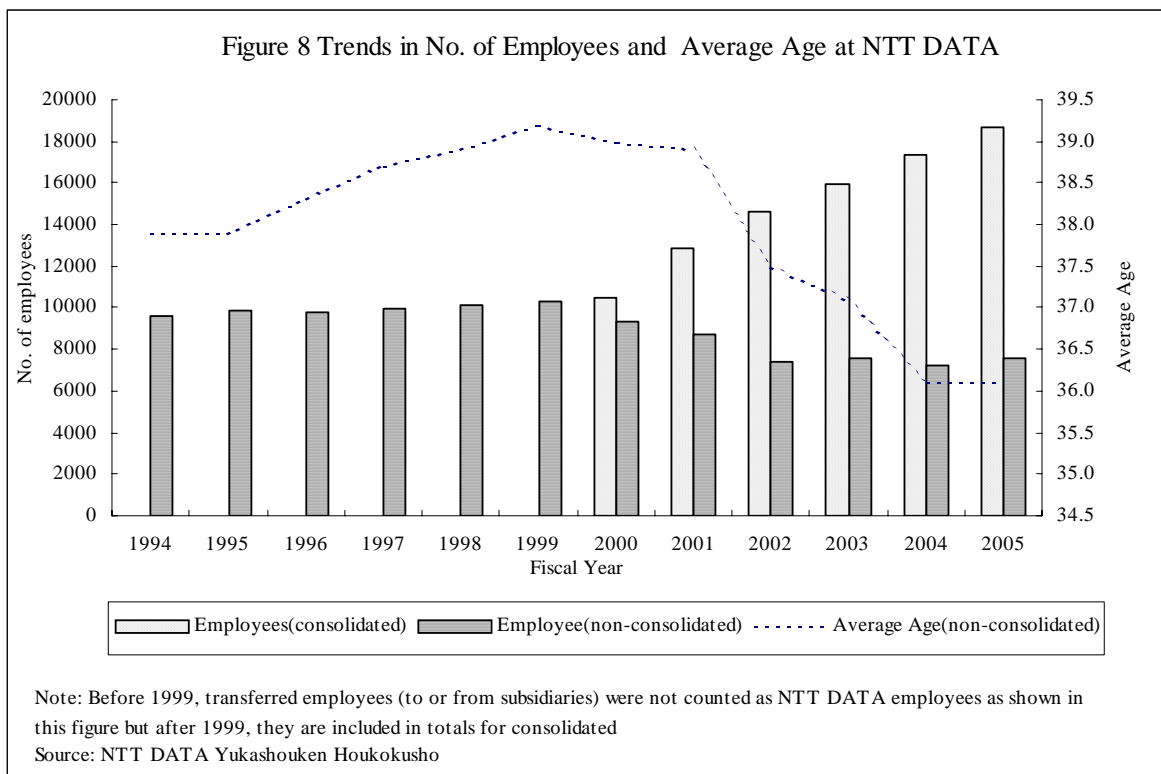
Obstacles to Change: Aging Employees and Mismatched Skillsets

An additional obstacle to creating a more responsive NTT DATA reinforced the company's weak customer orientation and strong quality culture. It was the age and skillsets of its workforce. As we see in Figure 8, the average age of its employees (non-consolidated) grew over the period from 1994 to its peak in 2000 from 38 to 39.5 (average length of service some 17.7 years) with overall employment showing just a slight increase (NTT DATA 2005 Annual Report, 2005:53). This raised its wage bill at a time of increasing competition with smaller more nimble firms in the private sector. Moreover, it is generally accepted in the information services field that young workers, unencumbered by work routines and knowledge instilled in them from working with older technology, are best able to grasp quickly and execute new technology. In comparisons to its average age of 39.5 in the year 2000, some of its most direct competitors in the private sector for which we have data, cite average ages of 35 for NRI and Fsas and 34 for CSK and Itochu Techno-Sciences in 2000 (Toyo Keizai, 2000, NRI Yukashouken Houkokusho, 2000; Fsas Yukashouken, Houkokusho,2000). When NTT DATA belatedly decided this was a problem, they were able, as shown in Figure 8, to fairly quickly reduce the average age but the method they choose created, as we shall see, still other problems.

NTT DATA has a strong union; one of the legacies of this history is that the union limited the wage spread, in keeping with the egalitarian philosophies of many Japanese unions. This means that the wage gap between high performing older workers and low performing older workers is very modest. In other words, NTT DATA was saddled with many older high-cost, low-performing employees with outmoded skills at

a time of intensified competition. Increasing age and experience (leading to organizational memory) can be a tremendous asset in organizations which are able to build on their cumulative assets. Organizational memory, can be a huge hindrance, however, when there are rapid technological and market changes that undermine the value of existing skillsets and organizational routines.

As we saw, NTT DATA's weak customer orientation based on its asymmetric information advantage, especially in its core public sector business had not been a significant problem in the era of the mainframe. Moreover, its strong internalized quality culture (producing highly reliable and durable products) had been a strong asset in its mainframe business. The underlying practices associated with these orientations, internalized by an increasingly older workforce, would lead us to expect that NTT DATA would be slow, however, in responding to the rapid changes taking place in the 1990s.

Figure 8 Trends in No. of Employees and Average Age at NTT DATA

Note: Before 1999, transferred employees (to or from subsidiaries) were not counted as NTT DATA employees as shown in this figure but after 1999, they are included in totals for consolidated

Source: NTT DATA Yukashouken Houkokusho

During the period 2001-2004, on average only 381 employees retired annually while on average 460 employees were being hired annually. In short, in a period of rapidly evolving technology and market demands in the private sector, NTT DATA was not hiring large number of new employees to meet that demand. An even faster solution to meet the growing new demand in the private sector, would be to hire

experienced mid-career employees. However, of those hired as late as 2001-2004, only 8.6% of the 1,841 employees hired in this period were experienced workers with the rest being new school graduates (NTT DATA Investor Relations: 2005). These new school graduates would be expected to acquire new skill and mind sets to meet emerging market demands. But, this would be a slow process taking a number of years since the needed skillsets, as we have seen, are quite complex. We note that these hiring decisions occurred in a period when readymade skills through mid-career hires were available on the open labor market. It is not until 2005 that NTT DATA starts strong systematic hiring of experienced mid-career workers (170 in 2005) (NTT DATA, Yukashouken Houkokusho 2005: 8).

The decline in average age of NTT DATA only employees from 39 to 36, along with the decline of total NTT DATA employees during the period 2001-2005 is accounted for by the transfer of many of its older employees to subsidiaries. Roughly 1,000 of its employees were already working in subsidiaries in FY 2000. An additional roughly 1,280 employees were transferred between FY 2001 and 2002 (NTT DATA, Yukashouken Houkokusho: 2002: 9). Thus, more than 2,000 NTT DATA employees were working in subsidiaries in 2002. As part of structural reform in 2003, 3,000 employees were reassigned. Of the employees reassigned, some 900 were reassigned to subsidiaries permanently (tenseki) with reduced wages and a one-time separation payment. Many of these employees were over 40 and had grown up in the mainframe era with mainframe skills and mindsets. Many felt pressured to transfer to subsidiaries in the Kansai area rather than take new assignments to NTT DATA in Tokyo. The others, numbering around 2,100 (zaiseki shukko), were assigned regionally to focus on expansion of new business (NTT DATA Investor Relation: 2003). This means by 2005, we can say conservatively that at least 3,000 NTT DATA employees were working in subsidiaries; this is almost 24% of the total of 12,400 NTT DATA subsidiary employees. While these efforts were aimed partially at getting important skills to the subsidiaries, they also were heavily aimed at reducing NTT DATA's cost structure by reducing its personnel costs and reducing the total cost of its system integration services (only the tenseki contributed to cost reduction).

Earlier we noted that the new era required a service oriented architecture (SOA) provided by IT architects as well as SE's who were alert to sales opportunities and knew how to work with others to frame solutions. We also noted that NTT DATA's approach to acquiring these new skills involved using the R&D department to take the

lead to acquire these skills and then to transfer them to NTT DATA employees in the business divisions with the focus being on overall project management capabilities.

Yet, there is reason to believe that system engineers accustomed to the waterfall methodology find it hard to understand how to work with customers to develop a system with vague system design and the kind of complexity described above. A number of reports from companies suggest that it is relatively ineffective to try retraining system SE's to acquire these new skills. Facing a similar challenge, IBM did reassign engineers with no longer needed skills but they also discharged or encouraged many others to leave. Between 1990 and 2001, roughly 120,000 IBM employees left the company (Gerstner, 2002:23). At the same time, they hired new talent who already had many of the readymade consulting and solution oriented skills they needed.

This solution to NTT's mismatch between its current employee's skillsets and the needed skillsets for the evolving market demands was not available to NTT DATA management. While they could transfer redundant employees to subsidiaries, discharge was not acceptable, especially to managers with a background of public sector employment. They could have more easily chosen, however, a more aggressive stance toward hiring mid-career employees but as we saw, it wasn't until 2005 they began to do so in earnest.

Strategies for Overcoming Obstacles

There are two core elements to NTT DATA's strategy for overcoming the challenges it faces (NTT DATA 2005 Annual Report, 2005:16). The first is to capture new customers by offering increased consulting and system development services, thereby expanding the volume of new orders. These initiatives in the rapidly growing private sector are centered on the activities of its rapidly growing subsidiaries. A second core element in NTT DATA's strategy was to expand market share in the private sector, through acquisitions initiated by its IT Business Partner's unit. To this end, it began forming equity based alliances with former information subsidiaries of corporate clients and converting them into NTT DATA subsidiaries. Thus, we see that expanding subsidiaries in one form or another formed the core of NTT DATA's strategy to build a stronger presence in the private sector. At the same time, they were eager to reduce personnel costs and find a way to have a more flexible labor force. Faced with a strong union, increasing the number of subsidiaries and the number of

NTT DATA employees assigned to them, was one way to gain more flexibility in the salary system. Enomoto Takashi, a current board member of NTT DATA, is quoted as saying "We could not develop our employees using the existing NTT DATA salary system which followed NTT's public sector practices" (NIKKEI Computer, 2005c:55). How reconcilable are NTT DATA's use of restructured subsidiaries and acquisitions as a means to create a more flexible salary system with the aforementioned two core strategic goals? We need to explore this issue further.

As shown in Figure 8, the number of NTT DATA employees grew very modestly in the late 1990s peaking at around 10,000 in the year 2000 and then declining to some 8,000 in 2005. In the year 2000, there are some 4,125 employees in subsidiaries, roughly half the total of the 8,700 NTT only employees. By 2005, there were some 12,400 employees in subsidiaries compared to 8,077 NTT DATA only employees. Thus all the growth in employment in this period was centered on NTT DATA subsidiaries. We have also seen that transfers from NTT DATA constituted at least 24% of this total. Between 1994-2000 the number of subsidiaries grew from roughly 27 to 40 but after 2000, the number increased rapidly, rising to 80 in 2006; some 20 affiliate firms as well were created after 2000 (Data calculated from NTT DATA, Yukashouken Houkensho, 1990-2005).

To evaluate the effectiveness of NTT DATA's subsidiary strategy, we will focus on three categories of subsidiaries and affiliates: there are those which have been subcontractors to NTT DATA. The second type are subsidiaries designed to provide consulting services for solutions. The third type are companies acquired by NTT DATA to give them access to new sets of customers. We will deal with each type in turn and discuss what they can tell us about NTT DATA's attempt to adjust to changing technology and market conditions.

Subcontracting Subsidiaries

This category of subsidiaries has traditionally not been given much autonomy nor the assets to take risks to develop new businesses and even if some of their managers might have aspired to innovation; they are constrained by their parent firm since their role has been largely to support their parent company. In this category are those subsidiaries engaged in system development for the parent firm and those engaged in the operation and maintenance of existing systems, those with CS (Customer Service) or

SMS (System Management Service) in their names. NTT DATA employees who were permanently transferred to these latter firms can expect significantly lower wages, if not immediately, then over time. One could imagine that such reassigned workers could function reasonably well within these traditional job assignments. Such subcontract firms have been common among Japanese information service firms that have historically often been offshoots of large IT hardware and financial sector companies.

This structure for providing software services in Japan tended to stunt the development of independent software houses in Japan. The IT hardware spinoffs and user spinoffs, as keiretsu firms, grew expert and quite comfortable at churning out code to strict contractor specifications, instead of learning how to develop products for corporate customers (Hamilton, 1993: B4). These corporate spinoffs seldom challenged incumbents with innovative software applications. Their focus was on achieving current usability for customers and not innovation (Baba, Takai and Mizuta, 1996:108).

Nishimura and Kurokawa (2004:21) found that the higher the rate of outsourcing to sales ratio in the information service industry, the lower the total factor productivity (TFP). They point out that outsourcing can have a positive effect on productivity if it is based on modularization. In the Japanese information service industry, however, they see outsourcing as based on the remnants of the traditional subcontracting practices in this industry. The prime contractor (who gets the contract from a government agency or a large firm) outsources much of the work not to promote efficiency or innovation in software development but rather to use their subcontractors as buffers for economic fluctuations to reduce costs of adjustments resulting from these fluctuations. Moreover, "over outsourcing," they note, may result in programming expertise not being properly retained in these general contractors. At the same time, these subcontractors typically manifest weak financial conditions and weak human capital and physical capital investment (Nishimura and Kurokawa: 2004 21). This makes sustained innovation unlikely.

Recent estimates suggest that NTT DATA has an extremely high level of outsourcing to its subcontractors (88.1%) relative to major competitors like NRI (77.2%) and CSK (60.2%) (Nikkei Computer, 2005:43-44). This means a greater part of its revenues are being paid to its subcontractors, Much of NTT DATA's incentive to subcontract can be explained by its high overhead costs (administrative, especially personnel costs). With these high costs, it has strong incentives to shift work to subcontractors with lower per employee cost rates.

We can return to the performance of this category of subsidiaries as well as whether these subsidiaries are developing a stronger external customer focus. NTT DATA has been pushing a number of these firms to take a more active role in capturing new customers by offering consulting system development and outsourcing services. Let us consider the case of NTT DATA Kansai, a firm of 700 employees. NTT DATA Kansai resulted from a merger of NTT DATA Kansai Tecsys Corporation, NTT Data Communications Systems and NTT DATA Kansai Branch in 2003. NTT Kansai Tecsys' business was system design and development to support NTT DATA while NTT DATA Communications Systems' business was in sales and marketing of packaged software. NTT DATA Kansai Branch specialized in system operations and maintenance support for those firms wanting to outsource those operations. With the merger, NTT DATA Kansai became the largest subsidiary targeting the middle system integration market in the Kansai area.

Our interview at NTT DATA Kansai suggests that notwithstanding the call for employees to engage in capturing new customers, most are engaged in the same work as they did prior to the amalgamation with the three groups often working in different places. Most NTT DATA Kansai employees were engaged on Systems Engineer Service (SES) contracts directly with NTT DATA to work on NTT Data public and financial sector projects. That is to say, NTT Kansai did not have direct control over many of its "own employees." Clearly, the admonition that employees should somehow be engaged in acquiring new business was not very consistent with this arrangement and predictably had not yet been well accepted or implemented. Many of the temporary transfers (zaiseki shukko) into NTT DATA Kansai continue to do work on jobs for the parent company and in that sense NTT Data Kansai again had little control over the employees who were ostensibly working for them. The temporary transfers are typically paid on a different scale. These transfers have little interest or incentive to help NTT DATA Kansai build their own business line. The company did get some new customers in recent years because they are able to trade on the name of their parent company but got little direct help in strategies, tactics and resources for customer acquisition.

In short, the three categories of employees seem to have relatively little in common, are preoccupied by their existing duties, most of which relate to fulfilling obligations to NTT DATA, and are certainly not working as a cohesive team to acquire new business. Beyond that, our interviewee described the biggest problem of exploring

new business lines as lack of experience. "It is easy to run on an existing train track but hard to run where there are no tracks." While NTT DATA Communications Systems had a sales department, they weren't all that successful selling packaged software and, in any case, those skills don't translate to creating sales for systems development or getting companies to outsource the operation and maintenance of their IT system to NTT DATA Kansai. Nor is the firm hiring experienced mid career employees with the skills to attract new customers. None of this is to say that over time, the company won't be able to better integrate the diverse labor forces and create a uniform thrust toward acquiring new businesses on it own. As yet, however, there is little sign that this is taking place.

With regard to those personnel transferred to NTT DATA Kansai from NTT DATA, Japanese managers often make the assumption that the seconded engineers can be relatively easily retrained or adjust on their own to respond to the new market needs. There is an assumption that it makes good sense (kill two birds with one stone) to solve the problem of what to do with redundant engineers and how to fill a new job need by retraining. This assumption is deeply imbedded in Japanese institutional arrangements and corporate culture. It rests on the need to preserve the firm and one of its principal stakeholders, current regular employees. Retraining redundant employees in areas where firms are experiencing skill deficits can be an effective corporate strategy and make a valuable contribution to society by smoothing the transition process for individual employees. It is most likely to be successful under certain conditions. These conditions are as follows: where the gap between current skill sets and desired skillsets is not too large, where the required skill sets are not too complex, and when technology and market requirements are moving slowly so that the firm doesn't suffer any competitive penalty during the transition period in which employees are retrained. Lastly, it is likely to be successful when the organizational culture provides a hospitable environment for the new skill sets. When we look at these conditions in the light of our previous discussion, none of them seem to hold for NTT DATA's situation. Nor is it even clear that NTT DATA was making much effort at retraining. Rather, employees assigned to the new subsidiaries were somehow expected to figure out how to develop new business.

Moreover, experience reported at companies like IBM facing a similar situation reveals poor success at efforts to transform system engineers into business oriented engineers who know how to acquire customers.[12] In short, it seems like most of the

transferred NTT DATA employees and most of the previously employed NTT DATA Kansai employees would have a most difficult time making strong contributions to recruiting new customers. Of course NTT DATA Kansai is acquiring new employees by hiring new school graduates and they could be expected to eventually make strong contributions. But given the complexity of the skillsets required, as discussed earlier, it could take several years for employees to function effectively to provide the kinds of service oriented business skills that is called for. In the mainframe era, the development time was long enough and the contracts lucrative enough that it allowed for personnel development of the needed skills. In the current market, the demands are for lower cost and short delivery times so that the firm cannot afford to nurture personnel development.

In this environment, it is as if NTT DATA Kansai is "coming to bat" on this new initiative with one of its hands tied behind its back; it is being saddled with significant costs in the form of many transferred employees who are not likely to be able to make a strong contribution to recruiting new customers, and who are pressed to work on NTT DATA projects, while the company will have to wait years before newly hired school graduates can make a strong contribution. That is not a recipe for near term success.

Subsidiaries as Solution Providers

A second set of subsidiaries was accounted for by a set of strategic subsidiary companies designed to provide consulting services consistent with the strategy noted above. These include: NTT DATA POP designed to share successful consulting skills for public sector firms throughout NTT DAta group companies, and NTT DATA Institute of Management Consulting, designed to provide similar services for, but not limited to, the finance sector firms. Their consultation ranges from corporate strategy, HR management, IT strategy, risk management, e-government, and new business creation. Other firms in this category include NTT DATA System Design Corporation designed to provide consulting service for the automotive and electronic industries with capabilities in areas like supply chain management and Zaccati Consulting (Capgemini, Japan) designed to provide access to overseas markets, especially servicing Japanese firms abroad. These are all relatively new or recently reconstituted firms with small numbers of employees and not much of a track record yet to evaluate.

These efforts can be seen as initiatives directed to the same end as IBM's large and highly successful Business Consulting Systems unit. NTT DATA's efforts so far, however, have been rather feeble in terms of the combined capabilities these subsidiaries currently represent. NTT DATA's reputation is that it is good at system integration but not at higher levels of framing proposals to management. These new strategic efforts, designed to remedy that deficit, may suffer from being "too little too late."

M&A Activities: Acquiring Subsidiaries

A third category of subsidiaries were those which NTT DATA acquired. These represent a strategic initiative to enter the new growth markets in the private sector. Between 2002-2005, NTT DATA acquired interests in seven system subsidiaries of user-related companies. They acquired 80% of NTT Data Wave from Japan Tobacco, 50% of NTT DATA Sanyo from Sanyo (manufacturing); 70% of NTT DATA Business Brains from Nippon Sheet Glass (manufacturing), 60% of NTT DATA ITEC from Seiko Instruments (manufacturing), 60% of NTT DATA Sekisui Systems from Sekisui Chemical (manufacturing), 51% of NTT DATA Bell System Solutions from Suzuyo (logistics) and 86.4% of Sumisu from Seiyu (retail). In each of these cases, the remaining shares were held by the original owner of the company. These deals were predicated on the newly acquired subsidiary continuing to be a supplier of information services to its old parent firm with the strong possibility of developing a long-term relationship with the parent company. Such efforts could be expected to be facilitated by employees in the acquired subsidiaries who have rich knowledge about the former parent's business. These new subsidiaries were also expected to seek new business from other companies and thus contribute to NTT DATA's growth in the rapidly expanding private sector market.

There are some concerns about this approach. First, motivation and morale in acquired companies often gets lowered after acquisition as such firms often face restructuring. Second, service levels to customers may decline because of new operations introduced by NTT DATA. Third, each of the acquired companies had a large part of its business accounted for by its former parent. They had little or no experience seeking out new customers.

To try to eliminate these above three concerns, starting in 2005, NTT DATA gave each of the seven newly acquired companies the right to decide their own business policies and payment systems to give them a greater degree of flexibility in hiring and utilizing mid-career employee (Nikkei Computer, 2005:52). To insure that the companies would move in the right directions, NTT DATA transferred some board members and shukko to each company. NTT DATA is trying to go beyond the still strong norms cultivated in the mainframe era, some of which are still strongly supported by the NTT DATA union. In the context of trying to get these new acquisitions to perform better, they are experimenting with looser controls over the new subsidiaries compared to their past practices of exercising tight control over subsidiaries. They are also allowing the subsidiaries to set their own wage payment systems so that they would not be bound by the traditional NTT DATA's union policy of opposing widening the gap between high and low performers. To be sure, by appointing their own representatives to the Board of these companies, they are also making clear that there are strong limits to the autonomy they are proposing. Moreover, in the light of our overall discussion, we see that structural reform for not only these acquisitions but the whole company is still only partially completed. How to better utilize mid-career employees and know-how in those companies along with creating an effective corporate strategy by giving enough autonomy is much more important than just hiring mid-career employees and instilling know-how into those companies. The still broader challenge is to create synergies among NTT DATA group companies.

The danger is that, without much experience in acquiring new customers, these new acquisitions may well perpetuate NTT DATA's existing weaknesses rather than offering complementary capabilities. While it is reasonable to think that NTT DATA would hold on to the former parent's business if they can demonstrate strong performance, it is not clear that these new acquisitions would directly lead to new business growth in the private sector. The rationale for these acquisitions is that they were targeted for their technologies that NTT DATA believed would be still more valuable if deployed across the relevant industry sectors. Because the firms acquired were subsidiaries to specific manufacturing companies, the technology had remained "bottled up" in that company. In other words, NTT DATA believes that such technology will be valuable to others and therefore can be leveraged across the relevant industry sectors. But technology doesn't sell itself; they will need the business skills to make the case. It is interesting that NTT DATA choose not to acquire

companies with a wide base of customers like a CSK. It is just such companies that would bring to NTT DATA the personnel with a strong capability to acquire new customers in the private sector. In short, it remains to be seen whether their approach to encourage these new acquisitions to hire and better utilize mid career experienced workers in the context of greater autonomy for these firms, and encouraging them to create forward looking strategies, will bear fruit. We can say for sure, however, they have been slow in coming to these more forward looking policies.

Conclusion

If one looks over the pattern of NTT DATA's financial performance over the last five years as measured in growth in sales and return on sales, it appears to be one of stable growth but it is hardly on a growth trajectory. Yet, the market treats it as a growth stock as measured by its stock performance (its share price has outperformed the TOPIX since 2004) and its price earnings (PE) ratio in 2006 stood at a remarkable 70 which is well above the TOPIX average of some 30 times earnings.

The only explanation for this strong evaluation is that investors believe that NTT DATA is first in a growth industry so that its future prospects are strong and second that it has laid the groundwork for a giant leap forward in the future. Our analysis does not rule out this outcome but is far less confident of this outcome given the history of the past 15 years. NTT DATA has enormous assets. For building large scale IT infrastructure projects with high quality, it has no Japanese peer. This is NTT DATA's core competence but it was a competence acquired in the context of mainframe system development. That context still limits its ability to respond to new market demands today.

A great deal of current and future growth in the information services field is in the private sector and middle market, just where NTT DATA has been the weakest. As we have documented, these sectors have been the leading edge of the changes in market demand and technology. It is in these sectors that NTT DATA does have real competitors, many of whom appear more nimble and capable than NTT DATA. Moreover, we have tried to demonstrate that NTT DATA with a leadership drawn from the public sector, has responded sluggishly to the challenges and strong market opportunities which its own leaders recognized already in the early and mid-1990s (Fujita, 1994).

Part of this sluggishness we attributed to a weak customer orientation that grew out of its dependence on the public sector. These customers tended to have a weak understanding of what they needed and what would satisfy their needs. Without real competitors, NTT DATA could shape their expectations and in that limited sense, they were quite customer oriented. But if so, it is a customer orientation that ill fit the rapidly evolving private sector IT market of the 1990s and subsequently. It is also in its work in the public sector that NTT DATA developed a commitment to stability and quality over innovation. They could introduce innovation at their own pace oblivious more or less to any market demand. Its mode of developing IT systems for mainframes conditioned their subsequent practices. The difficulty they are having in moving away from the waterfall to the risk-oriented spiral model, which is more suited to market demands in the private sector, reflects these ingrained mindsets.

Two of their core strategies to jumpstarting the company to enhance their presence in the private sector rest on building up their consulting activities to provide customers with solutions and in related fashion, enlarging the mission of subsidiaries. While not without merit, their execution thus far seems weak and ambiguous. In the case of building up their consulting capabilities, they have resisted until very recently adopting a more systemic approach to recruiting experienced mid–career employees with the needed readymade skill sets.

Their selection of subsidiaries as the major mode for attracting new customers in the private sector appears hobbled by their use of subsidiaries as a final resting place for many older workers with little experience in the skillsets useful for attracting new customers. The strategy of making acquisitions in the private sector of existing customer subsidiaries to unlock their technology and leverage it across industry sectors shows much more promise, however belated it is, though in fact, the sales growth due to these acquisitions has yet to make significant contributions to profits (Oya, 2005:2). The acquisitions do not solve the problem of how to quickly develop a cadre of employees with more customer- oriented capabilities such as the strategic/consulting and related business skills that are critical to meeting the specific IT needs of private sector firms.

Finally, they have not taken the route of spinning off subsidiaries and giving them full autonomy to hire their own talent and explore whatever market opportunities they themselves see. This is what Fujitsu did with Fsas and it has made them a significant competitor in the market for information services (Yonekura and Clahsen, 1994; Ikari, T.

and Aoshima, Y. 2000:132-145). Another example is NS Solutions spun off from Nippon Steel in 2001 and already approaching 100 billion yen (1 billion dollars) in sales. This firm specializes in system life cycle total solutions ranging from planning, construction, and operation to maintenance and legacy re-engineering. Apparently if you have the right talent, skillsets, and strategy, acquisitions are not needed to enter and prosper in this growing sector. While it is clear that spinoffs are a solution that many large incumbent Japanese companies have chosen for entering rapidly growing new markets, NTT DATA has not seen fit to pursue this avenue. Perhaps their failure to pursue creating relatively autonomous spinoff(s) is related to their being part of the NTT group and therefore still partially a public company. As such, they would still have legal obligations toward a spinoff that might limit the amount of autonomy they would be prepared to grant. Whatever the reason, the failure to pursue this option further limits their choice of solutions.

NTT DATA is a strong company. It has "deep pockets" and can anticipate a continuing strong revenue stream from its still considerable mainframe businesses. It has strong R&D capabilities that are capable of developing new products of great scale and broad applicability. It also can anticipate a continuing revenue stream as a member of the NTT group through which it has access to some rapidly growing customers like NTT DoCoMo.

Yet, it has a history of building IT systems for mainframes with a strong emphasis on a methodical approach to building in quality over innovation. We can add to this their self imposed constraint, widely shared by other large Japanese companies, of not discharging workers who no longer have valuable skillsets and who could not be easily retrained to acquire them. It has also not seen fit to pursue spinoffs as a viable approach to capturing the private market. It seems to be a bit of wishful thinking to assume that many of these employees will be transformed in aggressive salesperson able to relate sales to bottoms up system development. It has foregone numerous opportunities to participate in the growth of the private sector market by virtue of its sluggish response to acknowledged challenges and market opportunities. The evidence presented in this paper indicates that the legacies and constraints discussed above, have slowed the pace of their adaptation to the dramatically changed markets and technologies they now face. Recently, they have increased the pace of their activities designed to attack the private sector market. How effective these actions will be, remains to be seen.

Notes:

[1] This section has drawn entirely on Yunogami's analysis (Yunogami, 2006).

[2] We use the term private sector instead of the term industrial sector as used by NTT DATA so as to include the service sector. Technically speaking, the financial sector is of course also in the private sector but as we have noted, NTT DATA treats it as a separate sector.

[3] Middle tier server includes all computers between mainframes and PCs or work stations. Middle range servers have multi-task and multi-user functions and are used as a server for network Client Server System.

[4] Before 2003, Intel Architecture (IA) server was counted in the category of PCs. Because it has the same specifications as other middle tier servers, however, it came to be included in middle tier server category from 2003.

[5] This section draws heavily from Nikkei Computer, 2005.

[6] We are indebted to Yamagishi Hideyuki, Oracle Japan, for his discussion of this topic.

[7] This accounts draw from our interview with Dr. Tsuruho, Seishiro, President of the Software Engineering Center at the Information Technology Promotion Center, June 2, 2006.

[8] Under the Data Communication Service (DCS) contracts that NTT DATA has with government ministries and agencies, they own the hardware, software and applications developed for the system and provide the functions of the system to the client They provide in essence, a hosting service.

[9] Interview with Dr. Tsuruho, June 2, 2006.

[10] Tsuruho Interview, June 2, 2006

[11] It is widely believed that the American practice of outsourcing development to Indian firms is far less cost effective than it initially appears as a result of quality failures that result from the difficulty of conducting iterative development without the benefit of co-location.

[12] Communication with Eugene Kawamoto, IBM, Japan Jan 4th 2006.

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