IV.1 Xerox: The Global Market and Technology Innovator*

1 Xerox, the Document Company

The Document Company, Xerox, is a leader in the global document market, providing document solutions that enhance business productivity.

A global company in the document processing business, Xerox Corporation offers the widest array of products and consulting services in the industry: publishing systems, copiers, printers, scanners, fax machines and document management software, along with related products and services. All Xerox products and services are designed to help customers manage the flow of information from paper to electronic form and back again. The Xerox customer is anyone who uses documents: Fortune 500 corporations and small companies; public agencies and universities; and home businesses.

Xerox started the office copying revolution with the introduction of its 914 copier in 1959. Today, Xerox stands poised for the continued expansion of the global document processing market, a large and growing market. Xerox Corporation's revenues in 1997 were US$ 18.2 billion. Fuji Xerox, whose revenues are unconsolidated with Xerox Corporation, had revenues of US$ 7.4 billion, yielding a combines US$ 25.6 billion in revenues for the Xerox Group. Fuji Xerox, a 50/50 joint venture between Fuji Photo Film Company, Limited and Xerox, is the hub of Xerox operations in Japan and the high-growth markets in the Pacific Rim. In 1997 Xerox's organizational structure was set up as pictured below.

Business Operations

Xerox Corporation had five business groups organized around the five broad segments of document processing marketplace. The business groups worked closely with each other and with Xerox customer operations around the world to guaran-

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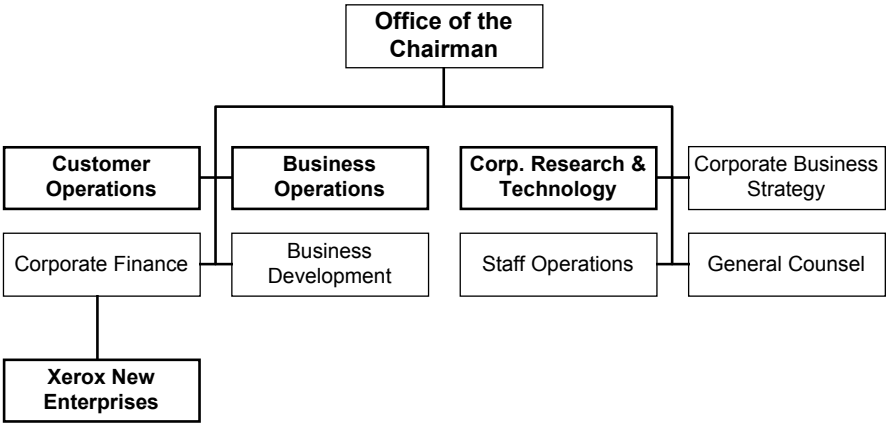

Fig. IV.1.2. Organizational structure at Xerox.

tee an integrated marketing strategy (Fig. IV.1.2 and IV.1.1). The Production Systems Group focused on the high-end printing and publishing needs of large enterprises. The Office Document Products Group handled the company's broad line of office copiers, the products that had been once synonymous with Xerox and which remained a core Xerox business. Also within this group are Document Center Systems, the family of digital networked multifunction devices for work groups, and the Xerox line of full-color digital copiers/printers.

The Channels Group focused on retailers, resellers and distributors, where a growing number of customers were turning for their small office/home office needs. The Document Services Group delivered a broad range of document services, all designed to help customers harness technology to improve document production, from creation and storage to distribution and printing. The Supplies Group had been created to meet increasing demand for various document products, including paper, toner, inks and cartridges.

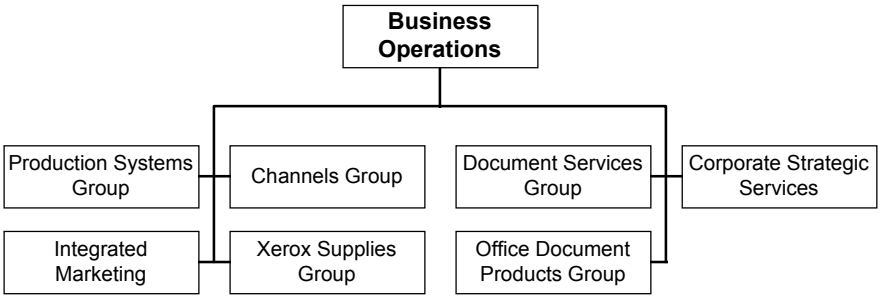

Fig. IV.1.1. Xerox business operations.

Customer Operations

Customer Operations**,** organized geographically, were responsible for the marketing, sales and servicing of Xerox products and services throughout the world (Fig. IV.1.3).

United States Customer Operations sold and serviced Xerox products and supplies to major accounts and other commercial customers throughout the United States. Americas Customer Operations (ACO) marketed Xerox business products, systems and services through subsidiaries or distributors in more than 30 countries throughout Canada, South and Central America, as well as in the Caribbean. Its largest operating companies were Xerox do Brazil with headquarters in Rio De Janeiro, Brazil; Xerox Canada Inc., with headquarters in North York, Ontario; and Xerox Mexicana with headquarters in Mexico City. Xerox Limited manufactured, marketed and serviced Xerox products in more than 80 countries in Europe, Asia and Africa.

Corporate Strategic Services

Corporate Strategic Services (CSS) were responsible for the manufacturing of Xerox products and consumables. The manufacturing operations had two primary focuses, product/component and supplies/consumables manufacturing. The largest manufacturing site for both product and supplies manufacturing was located in Webster, NY. CSS had sites strategically located worldwide to leverage local resource and distribution as well as trade requirements. Sites were located in Latin America, Canada and Europe.

The Manufacturing Support group (MS) was responsible for worldwide manufacture of all end products and critical components within the Xerox Corporation. Products designed and manufactured by Fuji Xerox further augmented the product portfolio distributed by Xerox Corporation. In addition to its Webster, NY site,

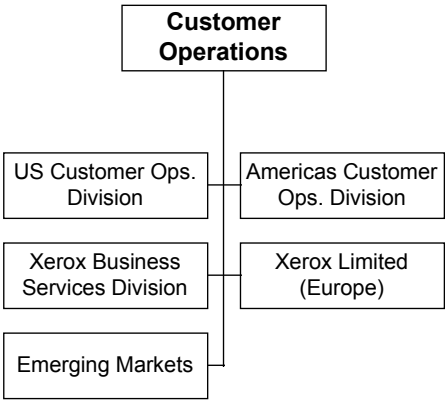

Fig. IV.1.3. Xerox customer operations.

MS had sites in El Segundo, California; Mitcheldean, United Kingdom; Venray, Netherlands; Cairo, Egypt; Toronto, Canada; Rampur, India; Resende, Brazil; Manaus, Brazil; and Aguascalientes, Mexico.

The Supplies Development and Manufacturing Services group (SD&MS) had both the development and manufacturing responsibility for Xerox supplies. These include photoreceptors, toners and developers. In addition to Webster, NY, SD&MS had sites in Oklahoma City, Oklahoma; Oakville, Canada; Salvador; Brazil; Shanghai, China; Venray, Netherlands and Coslada, Spain.

CSS was also responsible for the Integrated Supply Chain with primary responsibility for supply/demand management and forecasting and worldwide distribution services.

Corporate Research and Technology

Corporate Research and Technology had central responsibility for research and technology development in support of existing and emerging Xerox businesses. Its research extended beyond traditional physical and computer sciences to include all aspects of organizational effectiveness, including work practices, customer engagement, and institutional learning. Research was conducted at laboratories and technology centers in the United States, Canada and Europe, in collaboration with research conducted by Fuji Xerox.

CR&T was also home of the Corporate Engineering Center (CEC). The CEC was responsible for defining, developing and maintaining the product development competency within Xerox including work practices, training and development, and tools. The CEC had overall responsibility for the product development process.

Xerox New Enterprises

As the business development arm of Xerox Corporation, Xerox New Enterprises (XNE) was responsible for identifying and bringing to market promising technological breakthroughs that emerge from research and development done by Xerox but fall outside the core business of Xerox Corporation. Xerox New Enterprise Companies were created as independent companies, but with a privileged role under the Xerox corporate umbrella. The companies could tap into established Xerox resources, including corporate engineering, marketing support and professional services - support that was beyond the reach of most start-up companies. Ultimately, XNE companies would either be merged into Xerox Corporation, become majority-owned, publicly traded subsidiaries, or sold. XNE reported to the New Enterprise Board, comprised of senior Xerox executives. At year end 1997 there were eight companies within Xerox New Enterprises:

- Chrystal Software;
- Document Sciences;
- Documentum;
- DpiX;

Most important drivers for globalization:

1. Low cost communications;
2. Globalization of markets;
3. Growth of third world economies;
4. Growth of information economies.

- InConcert, Inc.;
- Inxight;
- Semaphore Communications Corporation;
- XE Systems.

Strategic Alliances

In rapidly changing business environment, where strategic collaborations had emerged as a primary means of conducting business, Xerox had continued and strengthened its commitment to the use of alliances to achieve economic success. The largest and most significant example was the strategic partnership with Fuji Photo which had given Xerox a strong market position in Japan and Asia. Xerox recognized early on that the world was being shaped along economic boundaries and that business alliances often would provide the keys to success. They were critical to the future growth of Xerox, they increased its competitive position and they improve the company's ability to meet customer needs.

Xerox' Corporate Alliance Program Directors managed a small number of corporate-wide alliances that provided Xerox with complementary business and product strengths. These alliances included a broad exchange of intellectual property, joint development or joint marketing. Joint strategic planning was conducted on a regular basis.

Examples of these alliances included Adobe, Digital Equipment, IBM, Microsoft, Novell and Sun Microsystems. As both Xerox and the marketplace moved forward, Xerox would identify new alliances to bring added value to its products and its customers. Xerox also had many alliances managed at the Group or Division level that provided similar capabilities for specific product lines.

Competition

Xerox had two sets of competitors. Xerox had traditional Japan-based competitors in the reprographics business such as Canon, Ricoh and Sharp, which were major manufacturers of light-lens copiers. The second set of competitors was focused on the growing domain of network document services. In the production market, there were IBM and Siemens-Oce; in the personal and workgroup markets, there was Hewlett-Packard.

In the United States, large dealer organizations, such as Danka and Alco Standard, which didn't manufacture their own products, were increasingly influential in the marketplace.

2 Research and Development

Since its beginnings as The Haloid Company of Rochester, N.Y., Xerox had always invested a significant portion of its revenue back into basic and applied research. Many of the technologies people then took for granted had their roots in Xerox research laboratories. In 1997, Xerox spent US$ 1.1 billion on research and development, or about 6 percent of its this time US$ 18.2 billion in document processing revenues. The US$ 612 million spent by Fuji Xerox on research and development raised the total Xerox Group commitment to more than US$ 1.7 billion in 1997 alone.

2.1 International Sites of Research and Technology Development

The history of Xerox research dates from the early 1960's. Its growth had been modeled along the lines of the great centralized research organizations such as GE, AT&T, IBM, and DuPont. Meanwhile, the organization had become inherently more decentralized. Geographically distributed centers had embraced the missions, values, and cultures that reflect their particular areas such as imaging sciences in Rochester, digital systems in Palo Alto, chemistry in Canada, information sciences in Cambridge, UK and Grenoble, and low cost design and manufacturing in Japan.

Research and Technology Development at Xerox was centrally managed under the Corporate Research and Technology group with direct line-of-site to the CEO. CR&T had an average annual headcount of 1,320. There were five research sites worldwide, Wilson Center for Research and Technology (WCR&T) in Webster, NY; Palo Alto Research Center (PARC) in Palo Alto, CA; Xerox Research Center of Canada (XRCC) in Mississauga, Canada and the Xerox Research Center Europe (XRCE) with two locations, Grenoble, France, and Cambridge, United Kingdom. Each site had a specific research focus and was strategically located to leverage area industry and academic competencies relevant to that region and research focus.

Technology centers had the primary responsibility for Technology development and delivery to the Business groups. Although management of the technology centers was centralized, resources were located to align with the development groups and manufacturing sites they deliver to. There were three primary technology centers within CR&T. The Digital Imaging Technology Center (DITC) and the Architecture and Document Services Technology Center (ADSTC) had offices in El Segundo, CA; Webster, NY; and Palo Alto, CA; and the technology center within the Wilson Center for Research and Technology had offices in El Segundo, CA and Palo Alto, CA.

Major issues for global R&D management at Xerox:

1. Adapting R&D Management to a worldwide extended enterprise;
2. Adequately trained human resources in systems and software;
3. Creating the 21st century information infrastructure to support seamless worldwide communications.

The *Palo Alto Research Center (PARC)* had been established in 1970. PARC had an average annual headcount of 300. PARC was focused on fundamental research in computer science, document hardware, electronic materials, information sciences, systems study and workgroup practices, that would influence and define the Document Market over the next 10 years. PARC had been responsible for some of the seminal inventions of the computer age: The prototype of the personal computer (Alto). The first Local Area Network for linking office computers (Ethernet) and the first commercial laser printer (the Xerox 9700). Innovations such as icon-based computing - the system of on-screen symbols and a „mouse" pointer to issue commands - and windows-based computing itself also had came into being at PARC. The XNE businesses heavily leveraged PARC technologies as a competitive advantage in their markets. Many of that time XNE businesses were based entirely on technologies developed at PARC.

The *Wilson Center for Research and Technology (WCR&T)* had been established in 1962 in Webster, N.Y. The Wilson Center had an average annual headcount of 424. The center focused on research and technology development that enables digital reproduction of images, known as marking technologies. Scientists at the Wilson Center concentrated on developing better ways to deliver high-quality, permanent images onto paper, with increasing speed, across networks, in black-and-white and color. Their work encompassed the entire scope of document production: the capture of images (from originals in both paper and electronic form); the transfer of images onto paper (marking); paper handling and transport

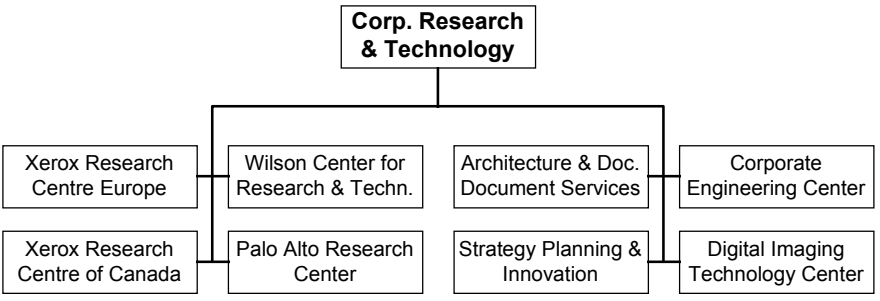

Fig. IV.1.4. Corporate research and technology organization.

(through the copier or printer) and finishing (collating, stapling, binding). The marking technologies developed at the Wilson Center constituted the heart of all Xerox copiers, printers and fax machines. The Wilson Center defines and develops next generation marking technologies 5 to 10 years prior to market realization.

The *Xerox Research Center Europe (XRCE)* had been established in 1993 with laboratories in Grenoble, France, and Cambridge, the United Kingdom. XRCE specialized in the study of human-computer interaction and in technologies for the on-line translation and storage of documents in several languages. XRCE was charged with expanding Xerox' R&D activities in Europe and addressing European-specific issues, a significant proportion of which focused on linguistics. The linguistics technology had a direct market connection via Inxight, one of the XNE companies. XRCE headcount was approximately 75.

The *Xerox Research Center of Canada (XRCC)*, established in 1974, focused primarily on materials research. Staffed by Chemists, Chemical Engineers, the research accomplished at XRCC primarily supports the development and manufacturing of marking materials, such as toner, inks, photoreceptors and developer. The site collaborated closely with the Supplies Development and Manufacturing Services group within CSS. The site included a pilot manufacturing facility that enabled the validation of designs through scale up. Although materials research in support of Xerox consumables was a primary focus of XRCC, research extended to novel materials study in the area of display media (electroluminescent materials, film, etc.) XRCC headcount was approximately 110.

The *Architecture and Document Services Technology Center (ADSTC)* had the primary responsibility for defining the Xerox product architecture. This includes the definition of the Network Document Environment which will define the standard network interfaces, capabilities and relationships of Xerox networked products both as the interface externally via standard communications protocols and as the interoperator with each other. The technology center defined standards internally and seeks to influence the development and publication of external standard bodies. A recent example was the development of the Digital Property Rights Language, which had been adopted by IBM. The adoption and standardization of Xerox developed protocols and standards provided significant advantage to Xerox. ADSTC had an average annual headcount of 125.

The *Digital Imaging Technology Center (DITC)* provided imaging and computational platform technologies in support of Xerox network printers. Focused primarily on Imaging Science, DITC provided Xerox with a significant competitive advantage by enabling benchmark RIP (raster image processing) time through proprietary algorithms and encoded VLSI designs. As Xerox focused primarily on full color images, DITC research in area of color image compression/decompression and color management from creation to storage and print, was increasingly critical. DITC had an average annual headcount of 210.

Xerox research was further extended by leveraging the Fuji Xerox relationship. Fuji Xerox had two research locations in Japan and had recently located a research facility in Palo Alto, CA. Research at Xerox and Fuji Xerox was co-managed by the Technology Executive Committee (TEC). The TEC seeks to leverage research and technology activities within the Xerox Group to deliver a full range of prod-

ucts across the international market. The TEC was composed of senior research and engineering managers as well as senior mangers of strategy and planning.

2.2 Engineering and Product Development

Management of development was decentralized to align with the five business groups. Each business group had direct control of development management, spend and focus to address its specific market requirements. Development teams were geographically collocated with the primary manufacturing sites serving their respective product markets. The largest manufacturing site was in Webster, NY responsible for approximately 65% of Xerox manufactured end products (excludes products manufactured by Fuji Xerox). Development teams located in Webster were primarily responsible for the design and development of digital reprographic and network printing products. The second largest manufacturing site in the United States was El Segundo, CA, responsible primarily for component/electronic manufacturing including ASIC and the Raster Output Scanner (ROS) manufacture. Development teams located in El Segundo were primarily responsible for design and development of components as stated, in addition the development resources responsible for the centralized printing products were also located in El Segundo. These resources were predominantly electrical, software and systems engineers. Although there were no manufacturing facilities in Palo Alto, CA, this site was the third largest development center in the United States. Development in Palo Alto focused primarily on Software product development.

Organization of development resources varied by and within business groups (Fig. IV.1.5). Each structure seeks to balance the benefits of a vertical competency based structure (e.g. Mechanical Design and Engineering, Software Engineering, Systems Engineering and Program Support) and a horizontal Product/Program based structure (e.g. Product Team A, Product Team B, etc).

Many groups had evolved a development infrastructure that was a hybrid of these two structures. These groups had established business teams and competency centers to manage their product development and delivery requirements. Large vertical competency centers had been established with appropriate subcompetencies (e.g. Client Applications and Operation System S/W within the Software Engineering competency center). These subcompetencies were then organized by product program. Business teams have been established to address specific segments of the business group market. These business teams were comprised of a product/program management team with product support personnel reporting directly and appropriate development resources ‘matrixed’ in from the vertical competency centers.

In the case of large multiyear product programs usually surrounding a product platform introduction, supporting development and engineering resources reported directly into the product program team. These programs are large enough to enable vertical competency alignment and resultant benefits within the program team structure.

3 R&D Coordination

3.1 Management of Research and Technology

The senior vice-president of Corporate Research and Technology, was responsible for the corporation's technology management process. As a core member of the corporation's central Strategy Committee the leadership of CR&T had shared responsibility for the corporation's overall strategic intent, direction and resource allocation.

The *Technology Decision Making Board (TDMB)* which was comprised of senior R&D managers from CR&T, the Business Groups, Manufacturing, and Corporate Strategy was a key governance facility in the technology management process. The TDMB oversees the corporation's technology investments. Chaired by the senior vice-president of CR&T, the board established a community of senior managers who held a common understanding of and perspective on technology issues over the entire range of businesses.

The heads of Corporate Research and Technology and the Corporate Strategy Office had provided recommendations to the Corporate Strategy Committee on the level of investment for the corporation's research, development, and engineering operations over a three-year strategic timeframe

Research and technology investments had become a key part of the corporation's strategic planning process. There had been four types of investments in the central research and technology organization: pioneering research, identification of emergent markets and technologies, strategic capability development and core technology.

Investment in pioneering research, funded centrally by the corporation, was characterized by high levels of uncertainty. It had the purpose of discovering emergent technologies that could shape the company's strategic vision and generate future options. Areas of investment were determined by the technical vision of the research management.

Investment in the *identification of emergent markets and technologies* permits the exploration of opportunities and uncertainties associated with markets that were presently outside the scope of existing business divisions but could expand

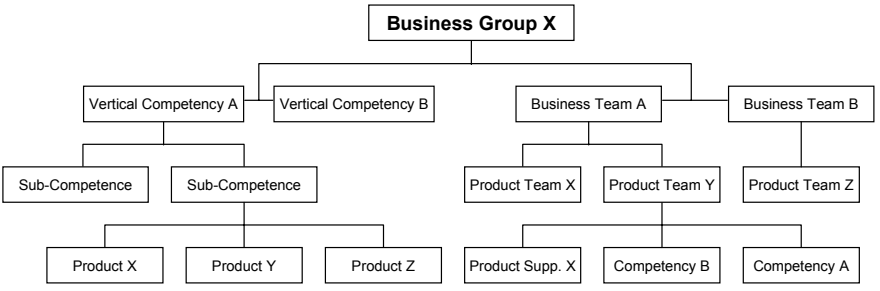

Fig. IV.1.5. Organization of development resources varied by and within business groups.

the company's vision of its role as the document company. Protobusinesses were centrally funded by the corporation and employ technology developed by the research centers.

The third type of investment - investment in *strategic capability* - had the purpose of establishing new technology platforms and skills that were of recognized importance to the company. Strategic capability was responsive to the Technology Decision Making Board. Major technology investments were shared across divisions and charged collectively to them in proportion to the size of their product development and engineering investments. This type of investment was clear on the possibilities of a specific emergent technology but could be uncertain about its technical feasibility and timing.

The fourth type of investment was in *core technology.* This was technology that was ready for use in existing or emerging businesses. Investments were contracted with the responsible business entity and charged to the cost of engaging the opportunity. This type of investment, often premised on learning and experience derived from the foregoing types of investments, has had the lowest level of uncertainty.

Research and Technology investments account for approximately 22% of the total R&D investment. Approximately 50% of that investment was allocated to pioneering research and identification of emergent markets and technology; 25% was allocated to strategic capability, and 25% was allocated to core technology.

3.2 R&D Projects per Site

Research project selections were determined by the Corporate Research and Technology senior management team. Each research site had a broad mission that defines the scope of its projects. Projects were selected within those broad missions as they aligned with the strategic direction of the company, emerging technologies both internally and externally developed, and emergent market requirements. For pioneering research overall strategic vision from the corporate level defines emergent market and technology domains of interest. Three to five year goals were defined within CR&T which were refreshed and restated as annual objectives based on the intersection of the three forces (corporate strategy, market needs, emerging technologies). Within the boundaries of these goals and objectives the local technical contributors have defined specific areas of research. For core technology, projects have been initiated by and aligned with the requirements of business divisions.

Development programs were selected to address the unique market requirements of each business group. Each business group managed a portfolio of products in various stages of development and continuing engineering to meet profit and revenue growth objectives. As there were often competing priorities coupled with resource limitations to support multiple programs, the group presidents and senior VP for manufacturing were the ultimate decision makers for the selection and prioritization as well as the cancellation of product programs.

3.3 Project Rview

Within Corporate Research and Technology, the laboratory site management, the technology platform managers and the senior VP for research and technology (depending on the scope and scale of the program) provided overall review and inspection of projects. Technologies that had been contracted to one or more business groups undergo a rigorous structured review process lead jointly by the appropriate technology center and business group management teams. Review structure and content for projects that had not been contracted was dependent on the phase of research and technology development the project was in.

The transition from research to technology development and finally product integration has occurred in three phases:

- Map the concept space for future options;
- Define Markets and commitment for emergent options;
- Mature and deliver committed technology platforms.

Map the Concept Space for Future Options

In the first phase, the pure research stage, concept space was mapped and scanned for opportunities that would ultimately be leveragable in the market. The mapping of the concept space involved a review of emergent markets and technology and feasible intersections with Xerox Corporation's market and strategy. For example, the intersection of the Internet and resultant capabilities (e.g. electronic commerce) and the document life cycle. Options were defined, studied and matured, however only a small percentage of these options would hold future value for the Document Company. Only these options, following some early validation of concept and definition of broad alignment with strategic vision, would move into the next phase. It was also in this phase of research that predictive concepts of the future were defined, studied and tested.

Define Markets and Commitment for Emergent Options

In the second phase, the option were further matured and tested. Market concepts were defined and early indicators of economic value were measured. The objective of this phase was to develop the concept and technology sufficiently to obtain business sponsorship for further development and ultimately product integration. Options emerging from this phase were of two types: Research that supported and sustained existing businesses and technologies and research that seek to expand existing markets or create new market opportunities for Xerox. The research that supported and sustained existing business and technologies was supported by a well-defined business model and supporting business processes. This research seek to improve upon or completely replace existing technology by uplifting one or more critical parameters. The key questions to be addressed were: Would it work and does the business opportunity support the development schedule and expense? Positive responses to these two questions signaled the transition to tech-

nology development. 'Does it work' was usually demonstrable at a lab level with supporting feasibility studies. The business groups determined the business opportunities. When a business group contracted a research project, these questions had usually been answered positively and the research project was formally considered to have moved into the technology development stage.

Research that seek to expand existing markets or create new market opportunities was focused on Xerox broader strategic vision. Business models supporting these research initiatives were undefined; relationships to existing businesses were only loosely mapped. To support the transition from research to technology development the key questions to be addressed were what's the business model and business case, how does that business fit within the Xerox existing businesses and strategic vision and, of course, does it work. The business model definition and business plan development was the primary determinant of transition. The markets and technologies addressed by these research initiatives were still emerging. Therefore, the task of defining and validating business models was significant. Business skills required to support these analyses were traditionally resident to the business groups and were focused on existing businesses. To address this gap CR&T had defined a small group of business principles focused on new business development. Once the key questions were answered and funding was secured the research project was considered to have moved into the technology development stage. Although some were formally contracted with a business group or groups, technologies could also be spun out as new businesses within Xerox New Enterprises, sold or licensed out.

Mature and Deliver Committed Technology Platforms

Technology delivered to the business groups was primarily integrated with existing and commercial technologies to develop new product concepts. The focus of this phase was to mature and demonstrate the technology platform within the context of a system. This phase occurred within the define phase of the Time to Market product development process. During the define phase responsible scientists and engineers from CR&T collaborated with the product development engineers from the business groups to integrate and mature the technology. Prior to entering the Design phase, all products must evaluate technology readiness. This review focused primarily on the new technologies as they integrated to define the product. Technology latitudes, critical parameters, producibility, failure modes and manufacturing/sourcing positions must be well understood and demonstrated before the program could proceed to the design phase. Successful demonstration of technology readiness served as the 'handoff' from technology development to product development. Although the technologists continued to participate as consultants the level of participation greatly reduced as the product matured.

In addition to technology readiness, there were several review intervals or checkpoints required in the Time to Market (TTM) product development process. The primary reviews occurred at major phase-gates in the development process; Define, Design, Demonstrate, Deliver and Delight (customers). These major assessments included a team of subject matter experts, external to the program, who

reviewed the program progress to determine readiness to move into the next development stage. Criteria to 'pass' each gate were clearly defined within the TTM process.

4 R&D Instruments and Procedures

By far the most important tool in use was the Xerox Time to Market (TTM) core process. The TTM core process represented a structured approach to product development and delivery from market planning, through product concept, design, development and delivery. Two key elements of the TTM core process were a common phased product development and delivery structure used throughout the corporation and a market oriented front end for developing the Market and Product Strategy Visions and Market Attack Plans with supporting technology and value chain strategies and plans. The TTM program addressed several critical enablers in support of its goals of UMC reduction, New Product Revenue Ratio (NPRR) growth, and of course, reduced Time to Market. These included a focus on the engineering environment both from a skills and tools perspective. The focus on the growth and development of engineering competency had led to the development of the Xerox Engineering Excellence Institute. This program recognized developmental requirements of the engineering community in design practices, systems engineering, critical parameter analysis, etc. that were often not included in the College Curriculum. Previously these basic tools had been acquired 'on the job', which had led to uneven understanding and practice as well as limited competencies in areas of system engineering and design. In addition to the Engineering Excellence program, Xerox was focusing on rapidly maturing its software development environment through the introduction and implementation of the Carnegie Mellon program in Software Process Improvement (SPI). The program includes an assessment of current capability and a structured maturity growth model. SPI was increasingly important to Xerox as the digitization and networking of the Xerox product family required an increasing investment in Software Development.

The selection and standardization of the engineering design environment (CAD/CAM) was the second element of the overall focus on the engineering environment. Prior to this effort each development team had selected their toolset based on program requirements and internal assessments. The result of this method had been often incompatible environments across Xerox and Fuji Xerox. Sharing of engineering files across programs for reuse required additional time for 'translation' of files often manually between the two systems. The standard CAD/CAM toolset, selected in 1997 provided an integrated environment for design analysis through drawing release. The selection of a standard environment enabled the development and maintenance of the engineering database which in turn enabled knowledge sharing across communities, organizations and worldwide. Reduced time benefits were anticipated in multinationalization of products, tooling costs and error reductions.

5 An International R&D Project: XTRAS

The Xerox Palo Alto Research Center (PARC) and Xerox Research Center Europe (XRCE) – Grenoble, were both active in the development of linguistic technologies. PARC had a long research tradition in this area, and XRCE had made linguistic technologies a strategic component of its investment.

It had been natural for the two centers to organize a technical cooperation. Based upon preliminary results of a development project conducted in XRCE, a team had been put in place to develop a product and service offering, a business case and business plan, engaged early customers and found a home for the to-be-created business: this was the project XTRAS (Xerox Translation and Authoring Systems).

Seeking New Opportunities

The XTRAS project had fallen into the category of research that 'seeks to expand existing markets or create new market opportunities'. The technology results, and early customer feedback (internal to Xerox: Xerox Business Services provider of translation services, Xerox Inxight provider of linguistic tools and the internal translation center) from the initial research project had provided indication that a business might be viable. Funding had been required to

- Define the business model and business case;
- Define any alignment with existing Xerox businesses and appropriate organization and;
- Demonstrate the technology ('does it work').

The required funding had been requested from a corporate fund specifically targeted at cultivating research and technology initiatives that extended beyond the scope of existing Xerox businesses. This fund was managed by the Corporate Innovation Council (CIC) co-chaired by the Sr. Vice-President of CR&T and the Executive Vice-President of Corporate Strategy with participation from the Business Group Strategy officers and the Xerox New Enterprises. To gain support of the Innovation Council, a small core team involving the two research centers, the internal business customers, internal business development consultants and external consultants had been formed. This team had been expanded with a number of technologists after CIC approval and a formal project was launched.

Managing the Project

The project had been organized in a straightforward manner: a project leader, a business team and a technical team. No less than seven Xerox organizations had participated in the project distributed across four sites in the United States and Europe. The majority of the management team had participated on a part time basis only, however the distributed nature of the project had offered the most significant management challenges.

Major innovative break-throughs at Xerox (last five years):

1. Digital Reprographics;
2. Low cost and high quality color;
3. Internet enabled documents and work practices.

The main issues to be dealt with in managing the project had been threefold: managing an internationally distributed team; coordinating and collaborating with potentially competing teams (the business to be created could be seen as competing with current product and service offerings, as well as internal translation services); and validating the product / service concept and business models. The management coordination had been done through the use of collaborative tools such as video conferencing, significantly reducing the requirement, frequency and cost of 'face-to-face' meetings. The technical team had been co-located in Grenoble, with the project leader.

Objectives and enablers had been defined from the beginning: available funding, customer engagement requirements and target dates for business proposal delivery. Key actions had been conducted in parallel to enable rapid time to market. An intense effort to recruit early customers had helped to understand the business model and build a business case. These had lead customers contracted with the Xerox Professional Document Services team, the consulting arm for Xerox, with support from the technical team.

The success of the project had been due to the tight coordination between the technical and business teams. It had been key to the evolution of the concepts on which the business was created.

Lessons Learned

The major learning surrounded international project management in a large corporation. In the XTRAS case the establishment and maintenance of multiple collaborations at appropriate levels of decision authority was critical. While at the working level a large number of collaborations were established between the various camps, the business teams management was not engaged early enough through their respective participants in the project, contrary to the assumptions made by the project management team. This gap could have led to delays in decision making and ultimately the launch of the business. The XTRAS management team, recognizing this shortfall, organized a crash program to get the appropriate management levels involved.

The distributed aspect of the project, both geographically and organizationally offered the most significant management challenges however the richness brought by the various viewpoints of the different cultures and organizations was a key to its success.

Lessons learned for organizing R&D at Xerox:

1. Mastering the confluence of emerging business opportunities and emergent technologies;
2. Fast time to market;
3. Architecting technology in order to create new revenue and profit streams in new markets.

6 Conclusions

The challenge to Xerox R&D and to all traditionally established organizations was the rapid change of the underlying technologies of the business and the impacts of global shifts in the economy. Xerox, a relatively young company with a world-wide presence and a strong technology leadership tradition, was better positioned with respect to this challenge than many companies. It remained a challenge never the less.

The changes that we were experiencing occurred in timeframes that were relatively short in comparison to traditional organizational growth and human career development. In this environment, the winning organization would be highly innovative across parts of its business and would be a highly adaptive and rapid learning.

Over the next decade the challenge would be the creation of R&D organizations, that serve highly networked and globally distributed inter and intra enterprises, which excel at the creation, development and acquisition of technologies, products, and core competencies and serve customers on a world-wide basis.