

# INDUSTRY–UNIVERSITY RELATIONSHIPS AND THE CONTEXT OF INTELLECTUAL PROPERTY DYNAMICS: THE CASE OF IBM

Marietta L. Baba

## ABSTRACT

*Jelinek has developed a multi-level model for conceptualizing the contextual influences through which intellectual property (IP) is “understood, interpreted and made sense of” by key parties to IP “deals.” This commentary reflects upon that model through a historical examination of industry–university relationships in one case – specifically, IBM. Since the late 1920s, IBM has encouraged multifaceted relationships with universities. From the start, IBM sought relationships with academia not only because of the market potential represented by university campuses, but also because Thomas Watson Sr. viewed academic customers as potential research collaborators, a novel idea at the time that later proved instrumental in the development of the corporation’s successful research enterprise. IBM’s university relationships have continued to evolve over time, reflecting shifts in the corporation’s business strategy, and changes in larger macroeconomic structures. The case of IBM reveals complex*

---

Multi-Level Issues in Social Systems

Research in Multi-Level Issues, Volume 5, 301–319

Copyright © 2006 by Elsevier Ltd.

All rights of reproduction in any form reserved

ISSN: 1475-9144/doi:10.1016/S1475-9144(06)05015-6

*interactions among governmental, corporate, and academic actors and their policies at different points in time, providing support for Jelinek's multi-level approach to framing IP dynamics, and suggesting possible refinements of the model for the future.*

## OVERVIEW

This commentary examines industry–university relationships in historical perspective, focusing on a single case – IBM. The case provides a means to explore Jelinek's claim that “local culture, past history, and experience” of the firm establishes a background that frames industry–university relationships and the overall context of IP dynamics. A historical view reveals multiple contextual influences on IBM's long-standing and sophisticated relationships with universities up through the present, providing support for Jelinek's multi-level model and suggesting additional contextual factors that could be considered in future refinements.

## INTRODUCTION

Drawing upon adaptive structuration theory (DeSanctis & Poole, 1994), Mariann Jelinek examines the contextual influences through which intellectual property (IP) is “understood, interpreted and made sense of” by key parties, with emphasis upon ways in which respective industry and university actors' understandings may complement or contrast with one another at three contextual levels; specifically, the institutional, sectoral, and “deal” levels. Importantly, Jelinek's model postulates interactions across these levels, and the influence of interactions on outcomes. The greatest influence is assigned to the institutional context, with secondary influence deriving from the sectoral level. For the sectoral context, Jelinek argues that both the type of industry or academic institution, as well as the *specific characteristics* of the firm or university in which IP is situated, will be highly influential in shaping the actors' perceptions of one another, expectations for IP outcomes, and the overall relationship between the parties, which in turn will affect IP dynamics. Here is Jelinek on the sectoral context:

The short version of the story is that industry matters. Industry partners come to a negotiation with important differences in viewpoint, perspectives and expectations, depending on what industry they come from. These differences profoundly affect how industry parties will interact to their university counterparts' demands for IP payments, ownership control, and other terms ... One level down, firm- and university-specific

differences also play a role. Size, prior research and patent experience, and focus of expertise can be anticipated as factors for both university and industry partners. Particular firms successfully license again and again, sponsor research repeatedly, and express enormous satisfaction with their IP relationships. Others, by contrast, are frustrated and vituperative at what they perceive as unfair treatment. Firms differ in how much and what kind of research they do in-house – from much to none, and from very fundamental to very applied and developmental. Firms and universities also differ in local culture, past history and experience.

One of Jelinek's key observations is that IP exists within an overall framework of motivational influences that are complex and multi-dimensional. Generally speaking, neither party is engaged with the other strictly for IP purposes; each has other goals in mind. Indeed, IP is not the only or even the primary mechanism by which universities transfer technological innovation to industry. There are many other linkage mechanisms, some potentially more productive than IP (e.g., hiring of graduates, collaborative research, access to data and equipment, and so forth). Thus, it is important to consider the background – why are the firms or universities in question getting together, what else is going on in the background, and what is the relative role of IP in the relationship? IP may or may not be the thing to focus on if technological innovation is the outcome of interest.

This commentary reflects upon Jelinek's argument concerning sectoral influences by considering one firm's (IBM) relationships with universities and how these have changed over time. In general, the commentary affirms Jelinek's observation that the “local culture, past history, and experience” of the firm establishes a background that frames industry–university relationships and the overall context of IP dynamics. Throughout its history, IBM has been a leader in forging innovative relationships with American universities (Bashe, Johnson, Palmer, & Pugh, 1986; IBM Research, n.d.). Its current program for encouraging collaborative education and research with universities is robust, multifaceted, and responsive to dynamic changes in the company's business strategy (e.g., Perelgut, 2004; [www.research.ibm.com/ssme/](http://www.research.ibm.com/ssme/)). At the same time, the company also displays strong performance in technological innovation and patenting (Chandler, 2001). For each of the years between 1994 and 2004, IBM was granted more U.S. patents than any other American company. During that period, IBM received 29,021 U.S. patents (3,248 in 2004 alone). The company holds a portfolio of 25,000 active patents in the United States, and over 40,000 patents worldwide. The patent portfolio reflects an annual investment of approximately \$5 billion in research, development, and engineering (each year since 1996; [www.ibm.com/ibm/licensing/patents/portfolio/shtml](http://www.ibm.com/ibm/licensing/patents/portfolio/shtml)).

Both IBM's collaborative relationships with universities and its sizable patent portfolio are outgrowths of an enduring corporate legacy of innovation, one that is rooted in the firm's history and culture; the two aspects of this legacy (i.e., university relations and patenting) reinforce one another in mutually beneficial ways. Yet, viewed within the context of IBM's ongoing and substantial R&D investment, universities probably must be seen as making relatively modest contributions to IP overall. Still, relationships with universities are vital to IBM, not necessarily because of IP, but because of the many ways in which universities support "innovation" writ large (i.e., something new within the context of IBM's many markets, which in turn advance the firm's long-term business interests). This commentary reflects upon the historical and contextual framework surrounding IBM's interest in university relationships, now and in the past, and the current role of universities in IBM's transformation to a high technology services company. The final section of the commentary draws upon the discussion of IBM's historical experience with universities, both to confirm, and to suggest possible revisions for, Jelinek's multi-level model of I-U IP relations.

### IBM'S EARLY RELATIONSHIPS WITH UNIVERSITIES

Thomas J. Watson, Sr., the company's president at the time IBM adopted its current name in 1924, had a reverence for education, and as a result he supported various activities at Columbia and Harvard since the late 1920s, especially donations of punched-card equipment and IBM machines to establish scientific and technical facilities on those campuses (Bashe et al., 1986). Watson was motivated to pursue these activities because of a business philosophy that recognized a duty to society (e.g., IBM benefited from science, and should contribute to science), and a recognition that IBM's product line traditionally had been enhanced and broadened through suggestions made by customers. The university scientists that used automatic calculators represented one type of customer. Watson was prescient in conceptualizing academics as potential partners in research, even though most industrial firms at the time thought of academia primarily as a means to establish benchmarks for excellence and as a stimulus for creative thought (IBM Research, n.d.). A colorful illustration of Watson Sr.'s vision is depicted in a story told about the head of the Bureau of Collegiate Educational Research at Columbia University, who approached the leaders of ten office supply companies in 1929 to ask for help in automating the analysis and scoring for large-scale testing.

Only Watson set up an appointment to meet with the Columbia professor, after which Watson hired him as a consultant. Later, Watson ordered three truckloads of equipment to be delivered to the campus, and eventually this became the University Statistical Bureau (IBM Research, n.d.).

In 1939, Watson signed an agreement with Harvard to establish an automatically operating assemblage of calculating machines, as proposed by Professor Howard Aiken of Harvard. While Aiken had the concept, IBM carried out the detailed design work, provided the components, engineered the technology, and delivered it to Harvard in 1943. This device, known as the Mark I (or Automatic Sequence Controlled Calculator, ASCC), was the first of four wartime projects that evolved to become the modern computer (Chandler, 2001). According to Chandler (2001), Aiken (who had been inducted into the Navy) took over the project, but Watson and Aiken quarreled, and the Mark series ultimately had little impact on modern computer technology. It did, however, help expose graduate students and academics to the complexities of inventing the computer.

Bashe et al. (1986) postulate that it was Aiken's snub of IBM at the ASCC's dedication in 1944, and his plan to build an even larger automatic calculating machine without IBM's involvement, that prompted Watson to invite Wallace Eckert, Director of the Nautical Almanac at the U.S. Naval Observatory, to join IBM and form a new Department of "Pure Science," which would be charged with the mission of becoming the premiere organization in the country for developing and using automatic calculating machines in science. The "purity" of this department was meant to distinguish it from the advanced engineering activity that Watson referred to as "science." Continuing Watson's philosophy of service to education and science while also advancing IBM's business, the new department's facilities were to be made available to scientists, universities, and research organizations throughout the world (Bashe et al., 1986). Eckert became the first scientist with a doctorate to be hired at IBM, and Watson encouraged him to maintain his standing as a scientist.

Less than 1 year after joining IBM, Eckert became concerned about the number of competing projects being sponsored by the federal government at various universities, and he noted that "several commercial concerns in addition to IBM have been developing electronic computing machines" (Pugh, 1995, p. 133). The Army and Navy were financing independent projects on electronic computing at the University of Pennsylvania, the Institute for Advanced Studies at Princeton, MIT, and several other places, some of which involved significant milestone projects in the history of computing. These developments presented IBM with an IP dilemma. The

company traditionally had a policy of secrecy and attempted to maintain all required electronic capability internally, which meant that it might fail to keep pace with companies that used government funds to support their own development efforts (Bashe et al., 1986). On the other hand, if IBM were to become involved in some of these government-backed efforts, it might forfeit some of its patent rights. As these issues were debated internally, IBM was dis-invited to participate in an 8-week course at the Moore School of the University of Pennsylvania held in Summer, 1946 on the "Theory and Techniques for Design of Electronic Digital Computers," jointly sponsored by the Army and Navy. Invitees included representatives from Columbia, Harvard, Princeton, MIT, AT&T, Eastman Kodak, General Electric, National Cash Register, and government agencies. Universities, in the meantime, had their own patent issues to contend with. The Moore School at the University of Pennsylvania, for example, (which was the birth place of one of the most fruitful projects in the early history of computing, the ENIAC; Chandler, 2001) had a policy that required all employees to assign their patent rights to the university as "works for hire." The intent was to ensure the "intellectual purity" of university work, but the effect was to drive J. Presper Eckert and John W. Mauchly, the two faculty inventors of the ENIAC, out of the university and into their own company (Pugh, 1995).

In the meantime, consistent with Watson's philosophy, Wallace Eckert established IBM's new laboratory in a renovated fraternity house on the Columbia University campus in Manhattan, where there could be ample access to university scientists. The lab was known as the Watson Scientific Computing Laboratory at Columbia University (IBM Research, n.d.). Besides serving as director of the laboratory, Eckert also was appointed Professor of celestial mechanics at Columbia in 1946, and joint appointments with Columbia became a common practice for scientists at the lab (Bashe et al., 1986). Teaching was not to be used as salary supplementation; appointments were conceptualized as a means to enhance the intellectual life of IBM scientists. Eckert commented:

The relations of IBM with the Columbia University are unprecedented and ideal. There are no formal agreements or regulations; the entire arrangement is based on Mr. Watson's statement that the Laboratory is for Pure Science. We collaborate on matters of mutual interest. The University makes no inquiries concerning our relations with our customers, members of IBM, visitors from elsewhere, or our development work. Our staff is free to use all the facilities of the University, and we try to reciprocate where we can be of use (Eckert, undated; cf., Bashe et al., 1986, p. 530).

Within this open environment, the laboratory contributed to the development of scientific computation techniques, the design of new computers, and

to the education of people inside and outside IBM in the use of automated computation methods over the next decade. Technical project groups (e.g., the Naval Ordinance Research Calculator project group) trained many people who worked on programming and the development of machine languages (e.g., FORTRAN). The Watson Laboratory developed a "Three-Week Course on Computing" in 1947 to teach others how to use punched-card equipment for sophisticated calculations (Bashe et al., 1986). It is estimated that this course was attended by 1,500 people from over 20 countries, and was influential in IBM's decision to establish computer instruction centers throughout the country in 1957. At this point, the academic discipline of computer science did not yet exist, although Chesbrough (2005) notes that Columbia offered the first course in computer science (probably automatic computing) during this same period (1946), while Thomas Watson Sr. was serving as a Columbia trustee.

World War II brought a significant shift in IBM's research orientation. Fundamental technological advances in basic science supported by collaboration among government, industry and academic scientists during the war were so impressive that IBM decided to charge its research laboratories with ensuring that IBM would not be caught off-guard by disruptive technologies in the future. The labs were given the mission of anticipating and even creating these breakthroughs (IBM Research, n.d.). Eckert was quoted as saying that the role of the labs was to "carry out scientific research where the efforts are dictated by the interest in the problem, and not by any external considerations." This sounds more or less comparable to a university (basic) research environment, something that IBM's scientists were well prepared to emulate, given their close association with a university over the years since the founding of the Department of Pure Science. It should be noted that the 1960s generally represented a low point for industry support of academic research (2.4% in 1966; National Science Foundation, 1985). The federal government was providing the lion's share of academic research funding at the time (73.5% in 1966), and top academics were less likely to be interested in "applied" research in those days.

IBM's approach to basic research was extraordinarily successful for decades, and highly instrumental in enabling IBM to recruit some of the top talent in many scientific and engineering fields. Yet, the basic research orientation of the laboratories was not without controversy. There were tensions and overlaps between Eckert's "pure science" approach and the more applied development orientation of the engineering group at Poughkeepsie, New York (Bashe et al., 1986). There was uncertainty regarding how research and development should be managed, and whether it should be

carried out in the same group, or in two separate groups. If they were to be separate, then how should research be defined, and what should be the relationship between the groups? Two different management philosophies regarding research and development continued to be present at IBM from the 1950s onward, with the basic research approach achieving dominance after World War II and up through the 1960s, until setbacks in the marketplace called it into question. Consequent shifts in the orientation of the research division will be discussed in the next section of the commentary.

### IBM RESEARCH AND UNIVERSITY RELATIONS

Given the importance of its role, IBM Research became a full-fledged division of the corporation in 1963, and today it is the largest industrial research organization in the world, with approximately 3,000 scientists and engineers based in seven research laboratories and institutes worldwide. IBM scientists have been awarded five Nobel prizes, 20 memberships in the National Academy of Science, and 57 memberships in the National Academy of Engineering. They also have received five U.S. National Medals of Technology, five U.S. National Medals of Science, and four Turing Awards.

This intellectual productivity both contributed to, and was supported by, the remarkable achievement of IBM's products and services. In 1966, the IBM System/360 was launched, a hugely profitable product that set the standard in the computing industry for many years, and established IBM as an excellent technology company. The business model for this product was built upon "internal innovation, proprietary control over the architecture and all its key elements, and extremely high switching costs for clients" (IBM Research, n.d.). Patenting was a core component of this successful business model, and an integral element of IBM's in-house research effort.

At about this time, computer science was emerging as a distinctive academic discipline, with major universities beginning to offer advanced degrees in the new field. IBM offers this interpretation of the relationship between the emergence of the new academic discipline and its business interests:

According to a National Academies report, IBM played a key role in the creation of computer science as an academic discipline in the 1950s. At the time, IBM was the industry leader in computing technology and provided systems to universities for research and educational purposes. As the leader in this area, IBM had the most resources to share with universities, and it made good business sense for IBM to help establish an academic field that would contribute to its business growth and value ([www.research.ibm.com/ssme/workuniv.shtml](http://www.research.ibm.com/ssme/workuniv.shtml)).

We have already seen the way in which IBM established a pattern for interaction with universities such as Columbia, with Watson's provision of technical equipment and facilities, Eckert's establishment of the Watson Laboratory on the Columbia campus, and lab scientists intermingling with university faculty, including collaborative teaching and research. IBM's claim that its contributions of resources to campuses helped a new academic field to grow is not an unreasonable argument. One can detect the pattern through which such activities would bring major benefits to IBM, both in the short and long terms, by providing well-trained graduates for hire, faculty for research and development collaborations and consultancies, and a growing market of users for IBM's equipment. Indeed, these emergent outputs from the firm's contributions to universities could very well have helped to create a new discipline (computer science), which then played a role in building a new industry (the computer industry), which in turn IBM dominated for much of the latter half of the 20th century (Chandler, 2001). One could argue that IBM's university investment and the full range of returns from this investment (of which university-related IP is only one) are integral components of what Chandler (2001) has called the "learned organizational capabilities" through which IBM gained a commanding stance within the marketplace. According to Chandler (2001), learned organizational capabilities – the foundation of an industrial firm's competitive strength in a market-based economy – are grounded in three types of knowledge, including technical (scientific or professional), functional (product-specific), and managerial (business-related) knowledge. All of these would be strengthened through multifaceted relationships with universities.

The "pure science" orientation of IBM Research shifted substantially in the 1980s, toward closer collaboration with the product divisions, following two disappointments related to lost opportunities. Scientists at IBM conducted groundbreaking work in relational databases (Edgar F. Codd) and Reduced Instruction Set Computing (RISC; John Cocke), but IBM was largely unrewarded in the marketplace for these innovations, as it was unable to nurture the core ideas into innovative products. It remained for other firms to pick up the innovations and carry them through to product realization (i.e., Oracle and Sun). These painful discoveries led IBM to realize that its research model, in which scientists focus on "pure science" and then rely on developers to figure out how to spin the science into new products, was no longer working. As a result, the corporation began to devise ways to strengthen links between its research and product divisions. Several formal mechanisms have been developed, beginning in the mid-1980s

(IBM Research, n.d.):

- *Joint Programs* – Product groups collaborated closely with researchers during the 1980s to define a range of work to be undertaken, including projects contributing to near-term product and market needs, as well as exploratory work meant to support future products or break-through technology (e.g., integration of copper wiring into microchip manufacturing).
- *Internal Centers for Competency* – Researchers and developers worked as a team in the 1980s to tackle difficult technical problems on aggressive timelines.
- *First-of-a-Kind (FOAK)* – These are partnerships between IBM and clients that turn promising research into market-ready products (created in the mid-1990s). The program helps to match researchers with client firms for the exploration of innovative technologies in emerging opportunity areas. Researchers obtain instant client feedback to enhance their projects, and clients gain access to a research team to help solve problems that need solutions.
- *On Demand Innovation Services (ODIS)* – Researcher–consultants partner with consultants from IBM Global Services on client engagements to explore new ways to increase clients' flexibility and provide market advantages and solutions (initiated in 2002).

All of these programs strengthen relationships among research scientists and the IBM product and/or service divisions, and also bring researchers into closer contact with IBM clients, either directly or indirectly.

The corporation also has continued its university relations program, which is now global in scope. A priority of the current program is “collaboration to develop the technical talent pipeline,” with an emphasis on creating mutual value with the academic community (Perelgut, 2004). Echoing themes that have been noted previously throughout this commentary, the program focuses on developing *skills* that are required in IBM's business (i.e., courseware development, training, certifications, programming contests), pursuing *research* with selected institutions (shared university research awards, faculty awards, fellowships, centers for advanced studies), accelerating *recruitment* of top talent (internships, post-docs, co-ops, full-time hiring), and increasing *sales*. IBM's long history of university relationships endows it with sensitive and sophisticated views of faculty concerns related to industry–university relationships. In a recent presentation at Concordia University oriented toward a computer science audience, IBM's University Relations Manager emphasized that in research collaborations “publication approval is very fast, based only on protecting existing rights and trade secrets” (Perelgut,

2004). Another statement in the presentation stressed that protection of information in IBM sponsored research would utilize “best of breed” policies for collaborative work. It is possible that these approaches have been influenced by the corporate environment created through IBM's strategic commitment to open standards, which in turn are related to the services-oriented (or “client solutions”) business strategy developed under CEO Lou Gerstner's leadership in the 1990s (see Gerstner, 2002, pp. 128–135). As noted in IBM's 2004 Annual Report:

The broad adoption of open standards is essential to the computing model for an on demand business and is a significant driver of collaborative innovation across all industries. Without interoperability among all manner of computing platforms, the integration of any client's internal systems, applications and processes remains a monumental and expensive task. The broad-based acceptance of open standards – rather than closed, proprietary architectures – also allows the computing infrastructure to more easily absorb (and thus to benefit from) new technical innovations. IBM is committed to fostering open standards because they are vital to the On Demand Operating Environment, and because their acceptance will expand growth opportunities across the entire business services and IT industry. There are a number of competitors in the IT industry with significant resources and investments who are committed to closed and proprietary platforms as a way to lock customers into a particular architecture. This competition will result in increased pricing pressure and/or IP claims and proceedings. IBM's support of open standards is evidenced by the enabling of its products to support open standards such as Linux, and the development of Rational software development tools, which can be used to develop and upgrade any other company's software products (2004, p. 17).

This statement suggests that a services-oriented business strategy, and the open standards approach that it fosters, could create an even more favorable environment for collaborative university relationships with IBM far into the future. [It should be noted that, historically, IBM has not included computer programs and procedures within its patent policy (Pugh, 1995).]

### IBM'S TURN TO SERVICES AND THE EMERGENCE OF “SERVICES SCIENCE”

IBM appears to be in the midst of a major expansion of its university interface beyond the traditional scientific and technical fields with which it has been associated (e.g., computer science and engineering), and into the business administration and social science fields that are linked to the rise of a service economy in the 21st century (e.g., business strategy, management science, cognitive science, economics). This shift in IBM's university relationships is interesting because it points not only to the efforts of a major

corporation to improve its situation in the marketplace (i.e., by developing the knowledge and skill base from which it may draw technical talent), but also to a much larger and more ambitious goal – to alter the marketplace itself (as happened previously with computer science) by creating a new academic discipline called Services Sciences Management and Engineering (SSME). This is the name that IBM has given to the budding interdisciplinary enterprise that it is working to birth, with the help of business and engineering professors based primarily in the United States and United Kingdom. This phenomenon illustrates the complex nature of industry–university relationships within the context of particular companies, and highlights the ways in which these contexts can overshadow the role of IP, at least in the near term.

IBM Global Services, founded in 1991, is the world's largest information technology services and consulting provider, employing approximately 190,000 professionals in some 160 countries. Global Services includes IBM Business Consulting Services (BCS), which was created in 2002 following the acquisition of PriceWaterhouse Coopers (PWC). PWC was merged with IBM's existing Business Innovation Services group to form BCS, which employs approximately 60,000 consultants. Beginning in 2001, IBM's revenue from Global Services, which had been growing over the past decade, began to top that from its largest product division (i.e., Hardware), whose revenue had been experiencing a long-term decline. In 2004, the revenue from Global Services was \$46.213 million; this represents more than half of the corporation's total revenue. The table shown immediately below identifies revenue as a percent of company total from each of IBM's major divisions since 1998. All data shown in the table was drawn from IBM Annual Reports, which are available on-line. For consistency, the percentage for each year was taken from the Annual Reports for *that* year, not from those of a subsequent year, where the percentages often had been recalculated (and thus may be different).

Service	2004	2003	2002	2001	2000	1999	1998
Global services	48.0	47.8	44.8	40.7	37.5	36.7	35.4
Hardware	32.3	31.7	33.8	38.9	42.7	42.3	43.4
Software	15.7	16.1	16.1	15.1	14.3	14.5	14.5
Global financing	2.7	3.2	4.0	4.0	3.9	3.6	3.5
Enterprise investment/other	1.3	1.2	1.3	1.3	1.6	2.9	3.2
Total	100	100	100	100	100	100	100

One issue that emerged with Global Services' growth was the fact that the gross profit margin in Global Services was less than that of IBM's other divisions, as shown in the table below (IBM Annual Report, 2004, p. 19):

Service	2004	2003	Year-to-Year Change
Global services	25.1%	25.2%	(0.1) pts.
Hardware	29.6	27.8	1.8
Software	87.3	86.5	0.8
Global financing	60.0	55.8	4.2
Enterprise investment/other	40.3	43.4	(3.1)

A growing revenue stream from a huge division with a smaller profit margin was of concern to the entire corporation and its shareholders, and especially to IBM Research, which had been supported by close relationships with the product divisions since the 1980s. The potential paradox opened up new challenges and opportunities for IBM. Two kinds of challenges are noteworthy in the present context: (1) engaging IBM scientists and engineers in services-related research that can drive innovation within Global Services, thereby improving profitability for IBM and its clients; and (2) engaging universities to support IBM in transforming itself into a 21st century high technology services provider. These two challenges are related; for example, the engagement of universities can enable IBM to bring new kinds of technical talent into its labs, and thereby support innovation and services transformation. The first challenge is beyond the scope of this commentary, although, see for discussion Kirkpatrick (2004); ODIS, mentioned previously is a key part of this effort. The remainder of this commentary will focus on the second challenge.

As IBM once helped to lay the groundwork for the eventual birth of the computer science discipline in the 1950s and 1960s by providing universities with new computing equipment and systems, and through collaboration in teaching and research, so IBM now hopes to stimulate the emergence of a new interdisciplinary "services science" that likewise could contribute to the company's business growth and value ([www.research.ibm.com/ssme](http://www.research.ibm.com/ssme)). Here is an IBM statement on the subject:

Just as computer science emerged as a new discipline in the 1960s, we believe an academic discipline focused on computing and information services will soon emerge. It will draw on a variety of existing areas – computer science, management science, operations research, and business administration – and will generate specific academic

programs, degrees and refereed journals. It will be at the forefront of business innovation, and will help us find ways to integrate advances in underlying technology (drawing on the physical sciences), mathematics and computer science and apply them to evolving business opportunities. It's a research discipline of the future, one which we are committed to help launch, much as we did computer science a few decades ago (IBM Research, n.d., pp. 36–37).

The rationale for this effort is the realization that 80% of the U.S. Gross Domestic Product (GDP) now derives from services, while 60–80% of the GDP in other advanced economies also is service related. Yet, the American higher education establishment still appears to be organized around the “dominant logic” of goods production and commodity exchange that has been inherited largely from neoclassical economics (Vargo & Lusch, 2004). There are few, if any, business or engineering departments organized on the basis of examining services or the service economy. Courses related to services are scattered about in many different departments, so that there is no coherent view of “services” per se (Chesbrough, n.d.). On the other hand, there are departments related to “industrial engineering,” “manufacturing engineering,” and “marketing,” which presumably are dominated by the viewpoint of the tangible goods producer. A focus on services, which capture value through provider–client interactions, would need to focus on intangibles that are produced and consumed simultaneously through a collaborative exchange. As a result of the lag between economic reality and academic organizational structure, there is a critical skills and knowledge gap in higher education training related to services, since the theoretical paradigm and underlying knowledge base required for a services-centered education is quite different from that intended for the world of traditional goods production. There also are a series of intellectual “grand challenges” related to service innovation that are not being addressed as rapidly as their urgency requires (Chesbrough, 2005). These include the problems of productivity improvement and innovation when the focus is an intangible (i.e., most services involve intangible exchanges rather than tangible goods), and the difficulty encountered when attempting to transfer tacit knowledge across cultural boundaries during service encounters (i.e., most service delivery requires the producer and consumer to exchange some degree of tacit knowledge with one another). These problems are likely to become more urgent given the rapid worldwide labor force migration toward services, and the process of globalization.

As noted earlier, IBM is answering this challenge by launching a new university-facing effort called “Services Sciences, Management and Engineering” (SSME). This effort will bring IBM into collaborative relationships

with areas of the academic establishment that have not played an especially important role in the past (i.e., business administration and social science). As SSME contributes to the development of a “science of services,” it also can help to support IBM’s goal of grounding its services more firmly in the full spectrum of sciences, and thereby better systematizing them, in much the same way that software was transformed some 15 years ago (see Milunovich, 2004). Toward this goal, IBM offers to provide its experience and technology in partnership with a variety of diverse academic disciplines to drive the development of new SSME courses and curricula for student training, to collaborate with academics in research and development on projects to solve complex service delivery problems, and to provide a dynamic testing ground for emerging SSME theories and practices. An example of a services problem that IBM is interested in solving with academic support lies in the area of Business Performance Transformation Services (or BPTS), which involves understanding the core value that a company offers, and removing obstacles preventing the company from focusing on its primary business. BPTS has the potential to increase a company’s business process effectiveness by combining in-depth knowledge of a particular industry (e.g., industry dynamics, business models, and expertise in specific domains such as logistics, procurement, or finance) with enabling technologies (e.g., real-time data analytics, optimization tools, massive computing power). IBM claims that it can deliver this combination with economies of scale (IBM News (2005), accessed from: [http://www.ibm.com/news/us/en/2005/08/2005\\_08\\_04.html](http://www.ibm.com/news/us/en/2005/08/2005_08_04.html)). BPTS is estimated to represent a \$500 billion market opportunity (see Milunovich, 2004). Some additional examples of potential SSME collaborations include development of methods and skills to create reusable assets; sponsoring centers, journals, and conferences; honoring the innovative work of faculty members and students; serving on curriculum and research advisory committees; and offering joint programs with IBM Research, BCS, and Global Services.

Some of the academic activities that IBM has been supporting under the rubric of SSME include IBM faculty awards and sponsorships, and IBM sponsored programs and papers, as well as hosting 30 university representatives at a Faculty Summit on SSME in May 2004 ([www.research.ibm.com/ssme/workuniv.shtml](http://www.research.ibm.com/ssme/workuniv.shtml)). Several universities have hosted their own workshops on services science, and are linked in to IBM’s website (e.g., Oxford; <http://researchweb.Watson.ibm.com/ssme/oxfordworkshop.shtml>). IBM has set up a steering committee to develop strategies, definitions, and initiatives related to SSME, and a tactical team to coordinate SSME related activities taking place across the company. More recently, IBM has been



engaged in discussion with university and industry representatives about the possibility of supporting a National Academy of Engineering study on the subject of higher education in the area of services. Generally speaking, academics who have been pioneers in services research for decades welcome the spotlight IBM is shining on service innovation, and the company's call for more systematic approaches.

True to its historical roots, IBM is mining the university as a rich vein of intellectual resources, in pursuit of innovation within the service economy. Certainly, the potential exists for IBM to discover creative people, new ideas, and novel solutions to client problems, as well opportunities for the sale of new products and services, through its expanded relationships with universities. IBM has the historical legacy, knowledge base and cultural traditions that should enable it to succeed with this agenda. Whether SSME proves to be the analog of computer science, ushering in a temporal parallel to the "electronic century" (the services century?) in which IBM is a grand master, remains to be seen. But whatever transpires, this corporation's academic partners probably will find a welcoming industry context for years to come, with the potential for more innovative IP arrangements as IBM pursues its policy of collaboration and open standards in fields across the spectrum of academic disciplines.

## DISCUSSION

The long-view provided by the case study highlights larger contextual factors (i.e., above the institutional level) that act upon government, corporations, and academia, motivating changes in both public and private policies that ultimately are influential "on the ground." For example, World War II introduced momentous technological disturbances via novel collaborations among government, industry, and academia, and this in turn prompted new public and private policies, and institutional vehicles for funding of research, which in turn modified industry-university funding patterns. On the public side, there were government-university research projects in which strict industry control of IP was in question. The federal government also launched the National Science Foundation and other research funding agencies, which had the consequence of reducing university dependency on industry relationships. On the private side, IBM created its own "internal university" where, one assumes, patent protection could be better assured. For many years, IBM successfully pursued a policy of "proprietary control over the architecture and all its key elements" (i.e., a

product model grounded in the industrial 20th century). More recently, however, we have observed the macro-economic shift from an industry-based to a service-based economy, and IBM's adoption of an open standards policy to complement its service-oriented business strategy. Thus, when the macro-economic structures shift so that the corporation's revenue and bottom line are dramatically affected, its business strategies and policies seem to follow suit. It might be postulated that such changes would affect IP deals involving universities.

Shifts in larger contexts and policy arenas take a long time to unfold, but it is useful to observe them, since they remind us of an important reality. Industry-university relations involve three sectors – industry, academia, and government. The government is a policy actor in these relationships, albeit at times a "slow motion" one (i.e., there may be long periods of stability), whose changing patterns of influence are best seen in longitudinal perspective. In the context of a given IP deal, the government is not visibly present "on the ground." But the case study suggests that the government is not only an implicit constructor of the institutional context; it is also a potential actor whose policy stance could change, bringing with it significant consequences for the other actors – as when Eckert suddenly found the government sponsoring competing projects on electronic computing machines. The tendency for the government to intervene and/or change its stance over time, and the significance of such moves when they happen (however rare they may be), could be another reason why some corporations are nervous about "march in" rights (besides risk aversion), even though such rights have not been exercised on them in the past (i.e., they might yet be acted upon in the future). Organizations and their members "know" that government policies shift over time. Thus, what is public policy "truth" in the institutional context today might not be so tomorrow, and the government cannot be controlled by any contract. These observations suggest that Jelinek's multi-level model might be modified by inclusion of a larger context involving economic and political forces, and a restructuring of sectors to include the government as a policy actor. A means to represent the temporal dimension may also be useful, since sectoral interactions are dynamic, and understanding them requires a longitudinal perspective.

The case of IBM also brings to the fore the role of agency, which could be viewed as a force that operates at multiple levels within the model. Agents act to structure deals, and they also structure corporations; in the case of IBM, an argument could be made that entrepreneurial agents structured industries and disciplines, at least in their formative years. Historical "deals" (that may or may not have anything to do with IP) become the

institutional and sectoral contexts of today when key agents are involved (e.g., “deals” related to Thomas Watson Sr.’s business philosophy regarding universities, Watson and Aiken’s arguments, Aiken’s snub of IBM, Watson’s decision to compete with Aiken). While agents’ actions always appear to be grounded in the context of a particular deal, ultimately their consequences move up and out over time to (potentially) influence the sectoral and institutional contexts. Thus, Watson Sr. made IBM a pioneer in developing deep, long-lasting, and sophisticated relationships with universities, these relationships helped to shape the company’s future, and IBM was a dominant firm in its industry for decades.

The IBM case raises an interesting point regarding agents. Typically, a single corporation or university would not be sufficiently influential to shape an entire sector, or an institutional structure. However, the case of IBM is an exception, and there are other exceptions of this type. Some firms, and possibly some universities, are so large or so influential, that they are able to create their own industries or markets, and in doing so, they can structure the behavior of others in their sector and in other sectors. IBM is not just another firm; it is a dominant firm, a world maker. In such cases, there could be an argument for considering the firm as an agent in its own right, and for representing such a force more explicitly in the model, perhaps at the sector level. Possibly, in cases such as IBM, an extraordinary agent in one sector might influence actors in another sector in a way that has a bearing on IP deals across the entire sector (e.g., this might be a possibility for open standards and Linux). Such potential configurations require additional empirical investigation.

Jelinek has argued, and the IBM case affirms, that industry–university relations cannot be understood without a broader conceptualization of forces operating beyond the local players in question. Her multi-level model goes a long way toward providing us with a framework for conceptualizing these forces, their interactions, and the consequences for IP dynamics. Consideration of a temporal dimension, economic and political forces, a government sector, and extraordinary agents, could enable the multi-level model to more fully represent dynamic changes over time.

## ACKNOWLEDGMENTS

The author expresses her appreciation to Mariann Jelinek, Jeanette Blomberg, Paul Maglio, and Keri Brondo for insightful comments and critique on an earlier version of the manuscript. Thanks also are due to Loretta

Knutson for invaluable technical support. Any errors are entirely the responsibility of the author.

## REFERENCES

- Bashe, C. J., Johnson, L. R., Palmer, J. H., & Pugh, E. W. (1986). *IBM's early computers*. Cambridge, MA: The MIT Press.
- Chandler, A. D. (2001). *Inventing the electronic century: The epic story of the consumer electronics and computer industries*. New York: The Free Press.
- Chesbrough, H. W. (n.d.). A failing grade for the innovation academy.
- Chesbrough, H. W. (2005). Breakthrough ideas for 2005: Toward a new science of services. *Harvard Business Review*, 83, 20–21.
- DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science*, 5(2), 121–148.
- Gerstner, L. V., Jr. (2002). *Who says even elephants can't dance*. New York: Harper Collins.
- IBM News. (2005). Business performance transformation brings meaningful change. Accessed from: [www.ibm.com/news/us/en/2005/08/2005\\_08\\_04.html](http://www.ibm.com/news/us/en/2005/08/2005_08_04.html)
- IBM Research. (n.d.). The evolution of innovation at IBM. Retrieved November 26, 2005, from <http://www.research.ibm.com/about/message.shtml>
- Kirkpatrick, D. (2004). Inside Sam's \$100 billion growth machine. *Fortune*, 149(12), 80–90.
- Milunovich, S. (2004). *Services as a science*. Merrill Lynch Report on IBM. June 21, 2004.
- National Science Foundation. (1985). *Academic science and engineering: R&D funds. Fiscal year 1983*. In: *Surveys of science resource series*. Washington, DC: National Science Foundation.
- Perelgut, S. (2004). IBM university relations: Overview and programs of interest. A presentation delivered at Concordia University on June 7, 2004.
- Pugh, E. (1995). *Building IBM*. Cambridge, MA: MIT Press.
- Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, 68, 1–17.