In 1951, the partnership Richard Bolt, Leo Beranek and Robert Newman moved into two apartments and the basement of a six apartment building at 16 Eliot Street in Cambridge. We also opened an office in Los Angeles. In the next few years we took over additional apartments and by 1955 we occupied the entire building. In 1956 we boasted 50 fulltime employees plus several part-time employees or consultants.

In December of 1953, BBN incorporated. Bolt was named Chairman of the Board, I was President and CEO, Labate was Executive Vice President, Newman Vice President and Baruch Treasurer. The five partners owned all the stock in equal amounts and constituted the whole Board. This created a concern on our part that the high level people we were employing would become restless if the financial profits from their work all accrued to five people. Thus several, somewhat novel, means were devised to alleviate this worry.

The “K-factor” plan was instituted. The senior and major contributors to the company’s earnings were invited to join this plan, voluntarily. The K-factor was formulated by determining the ratio “R” of the company’s total gross income to its total salaries and inserting it in a formula for $K = 0.66 + 0.33R$. The basic salary of each participant was multiplied by the K factor. The value of K was limited to the range 0.75 to 1.5. For many years the K factor varied from 1.1 to 1.2.

The second means of reward was to establish a stock purchase plan. The Board of Directors determined annually who would be invited to participate and to what extent. The purchase price was set at the beginning of a year by the book value of the company and the participant had to pay for the stock within 12 months. This led to a handsome gain when the company went public in 1961.

The third means was to establish a promotion structure for technical personnel that paralleled the conventional corporate ladder e.g., for the latter, from unit head, to
division head, to group head, to vice president, to president and CEO. The first step in the parallel technical ladder was the title “consultant”, “engineer” or “scientist” (C, E or S). The next step was “Senior” C, E or S. Third, was “Principal” C, E or S. In 1969 the title of “Chief” C, E or S was established. Salaries at the various levels were commensurate with the salaries of the administrative heads. Also, a pension plan was established that benefited everybody.

Above all, I insisted that the motto of the company was, “Each new person hired should raise the average level of competence of the firm.” This became an operating creed that kept us from hiring anyone whom we believed was not as smart as ourselves. In about 1955 I began seriously to consider the long-range directions of the company. I visualized a potential growth region for BBN as “man-machine” systems—machines that efficiently amplify human labor. J. C. R. Licklider was hired in the spring of 1957 to fill this desire.

Licklider had been on staff only few months, the fall of 1957, when he told me that he wanted BBN to buy a digital computer for his group, a then state-of-the-art machine produced by the Royal-McBee Company, the LGP-30. “What will it cost?” I asked. “Around $30,000.” I asked, “What are you going to do with it?” “I don’t know,” Lick responded, “but if BBN is going to be an important company in the future, it must be in computers.” Lick brought BBN into the digital era.

Within a year of the computer’s arrival, fall of 1958, Ken Olsen, the president of the fledgling Digital Equipment Corporation, stopped by BBN, ostensibly just to see our new computer. After chatting with us and satisfying himself that Lick really understood digital computation, he asked if we would consider a project. He explained that DEC had just completed construction of a prototype of their first computer, the PDP-1, and that they needed a test site for a month. We agreed.

This prototype won us all over, so BBN arranged for Digital to provide us, in 1960, with their first production PDP-1. Once we had it, Lick brought two MIT consultants into BBN’s life, John McCarthy and Marvin Minsky. McCarthy had conceived of time-sharing of computers. At BBN, he found response in Lick and, in particular, Ed Fredkin. Fredkin insisted that, “time sharing could be done on a small computer, namely, a PDP-1.” “I kept arguing with him,” McCarthy recalled in 1989. “I
said that in interrupt system was needed.” And Fredkin said, ‘We can do that.’ McCarthy continued, “Also needed is some kind of swapper.” The answer, “We can do that.” (An interrupt enables an external event to interrupt computations that are in progress and a swapper has to do with swapping among computational streams.) The team, largely led by Shelden Boilen, created a modified PDP-1 computer divided into four parts, each assigned to a separate user. In the fall of 1962, BBN conducted a public demonstration of time-sharing, with one operator in Washington, D.C., and two in Cambridge. To augment the small memory of the PDP-1, BBN acquired the first FASTRAND rotating drum, made by UNIVAC, with 45 megabytes storage capacity and an access time of about 0.1 sec.

The client brochure of 1963 listed new activities in engineering psychology as follows: A NASA/USAF contract had been received: to determine the capacity of pilots to perform and adapt under flight conditions that change quickly and in complicated ways; to recommend display requirements for information essential in Apollo Manned Space Vehicle System; and, to teaching via computers. In Artificial Intelligence, the ongoing work involved recognition of patterns, memory organization and machine language. Finally, in a later bulletin, Swets studies on Socratic teaching method were presented, and Baruch’s work on the Massachusetts General Hospital time-shared system was reviewed.

**Thoughts on Managing BBN**

A novel management feature, applicable to a research organization, but not a manufacturing company, was inaugurated by me in about 1957. It had been my observation that a lot of time can be spent by a researcher or a consultant on problems related to money. Also, it was becoming essential to have tighter controls on chargeable time, billing of clients, and better communication with the financial office. To satisfy these growing demands, I set up a financial arm parallel to the research organization.

Under this scheme, each technical department had assigned to it a financial person from this new arm. This person, whom I called a “facilitator,” had two bosses, the head of the department and the company’s chief financial officer. If a person in a department wanted to buy a piece of new equipment or set up a new research facility, he would sit
down with the facilitator and outline his needs. The facilitator would work out with him the specifications on the apparatus and the space needs. Then, after obtaining approvals from the management, the facilitator would attend to the purchasing of the equipment and the location and modification of the desired space. If appropriate, the facilitator would solicit competitive bids. In addition, he made sure that each employee in his department submitted a weekly time sheet and he kept track of sick and vacation times. He also followed the progress of each work in comparison with its contract and checked against deadlines and penalties. He drafted bills to clients based on the time sheets and the terms of the contract.

The facilitator was required to consult with the chief financial officer and would make sure that the department was following the financial rules of the company and the government. Obviously, he was working both for the department head and the financial officer, which meant that his salary was reviewed by both. In my opinion, this arrangement allowed the technical person more freedom to tend to his activities and not be bothered by red tape. From the financial side, contract provisions and deadlines were being met and billings went out correct and on time. Also, savings arose from competitive bidding. This financial arm remained in place until the company got into manufacturing.

My own management style needs analysis. At the start I was senior in age and experience to all employees, except for Bolt. Through my research and the research of graduate students at MIT, I was a source of new knowledge. This meant that I took leadership in a number of key projects and acted as a close partner with the consulting staff. During this period, Bolt and Newman tended to the architectural acoustics projects that kept pouring in. Labate, was responsible for the day-to-day management and I talked with him every day.

I worked with the staff whenever possible, treated the staff as equals, and made them aware that BBN was a highly professional organization. Licklider exemplified this same style. In writing, I encouraged our staff to become members in appropriate professional societies and to write papers for publication. BBN authorized attendance at technical meetings. This attitude then carried over into the computer work that followed.
My tenure as President ended in the fall of 1969 and I remained for two years as Chief Scientist. Samuel Labate became President and CEO, John Swets was named General Manager of BBN, and Ray Nickerson assumed his position as Director of the Information Sciences Division. My leaving the office of President was the result of an unexpected development. In December 1962, I had joined a group of 30 men and women who were interested in obtaining a license for the operation of Channel 5, in Boston, a large network-affiliated television station. In 1963, on the application to the FCC, I had agreed to be the President with the expectation that the Executive V.P., Nathan David, would take over the title if BBI were to get the license. David was caught in an illegal case of stock dealing and he had to resign. So, I was stuck with a new career and, following extensive newspaper publicity about the station, which identified me as BBI’s president, I was pressured by BBN’s Board to resign BBN’s presidency immediately.

After a year and some months of hiring and construction, BBI went on the air in March 1972 as WCVB-Channel 5-Boston, with ABC as its affiliated network. Actually, this was a good development for BBN. I could not have managed the digital network business as well as Presidents Stephen Levy and George Conrades, and the stockholders did much better under them. In conclusion, WCVB-TV was also a great success, and the New York Times in a lengthy article, Sunday, February 15, 1981, carried the headline, “Some Say This Is America’s Best TV Station.” WCVB achieved that status through the application of my long-stated premise that “Each new person hired should raise the average level of competence of the organization.”