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Karl Schwarz

HP-Grenoble: Case Study in Technology Transfer

The transfer of a product or process from one location of an organization to another may be proposed for a variety of reasons: a need to increase corporate presence in a given market area, a desire to spread risks, or a requirement to free congested facilities for other purposes. Technology may be transferred to areas with lower operating costs or tax structures for obvious profit motives. Occasionally, the purpose may be to seed new operations or to simply balance production. Besides these stated considerations, transfers usually involve some interdivisional competition, which often leads to significant innovation. The consequent attitudinal and profit benefits frequently exceed those originally projected and extend to other products, processes, or people. The motives for any two transfers are never quite the same, even within the same company. But in any technology transfer, there are enough common elements to make a single case study instructive.

In the late 1960s, the Hewlett-Packard Company, a then $300 million manufacturer of electronic measuring and computational equipment, began to question the wisdom of continuing to focus all of its European manufacturing growth on its two existing facilities. Would greater benefits accrue if a third factory were opened? The idea did not stem from a lack of confidence in either the ten-year-old German factory or the slightly newer unit in Scotland. These European divisions had historically been a great source of pride to HP. By almost every measure, they had consistently shown outstanding performance. But the question as to whether or not a broader presence in the European community would better serve the total European marketing effort was one which had to be objectively answered.

A task force consisting of senior members of the German factory management team studied the issue. For a variety of reasons, they concluded that establishment of a third facility in Europe—specifically, in France—would provide the best balance for marketing and manufacturing Hewlett-Packard electronic products there.

One major virtue of having a European team develop such arguments was that they were bound to be supportive of any new venture resulting from the study. This proved to be a critical element in maintaining harmonious relationships between all the factories under the demands of some subsequent intra-European product line rationalizations.

In 1969, HP contacted the French authorities concerning its interest in establishing a manufacturing facility in France. The company, its products and policies, were well known to the government; a wholly owned sales organization employing over three hundred people had been established in France several years earlier. Within the next year, HP visited several areas in which the French wanted to encourage foreign investment.

None of the products manufactured by HP at that time imposed major geographic constraints. The raw materials were easily transported, as were the finished instruments. Proximity to international airports (one to two hours by truck) and customs clearance facilities were the only logistic considerations. The primary factors in the site selection process involved people: the availability of trained or trainable personnel and the appeal of the region to those who would have to move there. Cultural activities, housing, educational facilities, and recreational opportunities were all important; the quality of life was an issue that was discussed frequently, even at that time. And of course, the site had to be an easy and attractive place for customers to *visit!* Labor costs were scarcely considered.

Rather quickly, the international vice-president and his *staff determined* that the city of Grenoble held the greatest appeal for HP. This was in spite of generous government incentives to locate in other parts of France. HP made it clear that investment plans would be developed if a suitable building site could be agreed upon. Grenoble easily met HP's criteria because of the existence of local centers of high technology — academic, governmental, and industrial— which could ensure a good supply of skilled and talented people, and because of its beautiful setting, which would be especially important to professionals and their families.

The city of Grenoble, for its part, was anxious to attract high technology companies and had established a liaison office specifically for that purpose. An excellent, forty-acre parcel of land in the adjoining town of Eybens was made available to the company, and an agreement to purchase this land, enough for a plant site capable of ultimately employing up to three thousand people, sealed HP's commitment to the region.

In mid-1979, I was asked to manage the start-up of HP's factory in France, and the following twelve months were dedicated to working out the details of the program. It was not a propitious year for new investments. A major recession had forced the company to reduce production schedules to a four-and-a-half-day week. Although there were no layoffs, most managers were not enthusiastic about expanding abroad when there was a shortage of work in the American factories.

Nevertheless, it was felt that since a long-term strategy was involved, planning should be continued. An investment proposal was developed by the HP European headquarters in Geneva to meet the requirements of the French government. This outlined, in a general way, the financial nature of the investment, the timetable for such a program, the activities planned, and a manning schedule. Great care was taken to ensure that the company, its philosophy, and its plans were honestly represented and that its need for flexibility in the product program was preserved.

The French government, for its part, wanted a rather specific itemization of products to be produced. However, the very rapid model changes characteristic of the electronics busi-

Karl Schwarz was trained as a mechanical engineer, receiving his B.S. from Stanford University in 1955. Following a three-year assignment on a Navy destroyer as an engineering officer, he returned to Stanford for a year of graduate work in mechanical engineering and in 1959 joined the Hewlett-Packard Company in Palo Alto as a development engineer. After holding various research-and-development and manufacturing positions, he was transferred to Hewlett-Packard's Japanese affiliate in Tokyo, where he held management posts in research and development, manufacturing, and marketing. In 1970, following a five-year stay in Japan, he was asked to establish the new subsidiary in France, HP-Grenoble. In 1976, he returned to the United States and his present assignment as general manager of the Scientific Instruments Division of Hewlett-Packard.

ness required that HP forsake none of its product options, After considerable negotiation, the government consented to HP's request for permission to manufacture most items in its line. This proved to be a critically important decision. As it turned out, of the two product technologies actually transferred, one was a commercial failure, the other succeeded beyond anyone's most optimistic projections.

The investment proposal was submitted to the government on February 8, 1971, and approval was granted on April 9, 1971. There was only one major stipulation: that a research activity be started within the year following the commencement of manufacturing operations. This turned a statement of intent in HP's investment proposal into a requirement, but one that was , consistent with the company's operating philosophy: to have a product development laboratory associated with each manufacturing division.

In June, in spite of continued concern regarding the unfavorable economic climate, HP gave the final go-ahead for the start-up of operations in leased facilities. Two product lines were selected for transfer to the operation, which was to be known as HP Grenoble. These were products which would complement existing European manufacturing activities and, in addition, would present a good opportunity to train a technical staff. One product was an electronic distance measuring instrument (DMI) for the surveying market. The other was a scientific minicomputer for use in automatic measurement and data systems, systems which were being integrated by the other two European factories. One product, therefore, was destined for direct sale to European customers, the other for sale to HP's existing European factories and subsequent resale. Since the Grenoble production was to be only a small fraction of worldwide requirements, adequate backup for Europe was available should there have been technical difficulties during the start-up or should demand have exceeded the rather tight capacity limits.

Within the general framework of the investment plan, a specific set of one-year targets was developed. The finance manager of HP's Japanese joint venture, Yokogawa-Hewlett-Packard, was in the United States on special assignment, and he volunteered to work out the targets for the new Grenoble facility. He was an ideal person for this task since he had an excellent grasp of international finance and manufacturing, It was quickly determined that a September 1, 1971 start-up was a realistic goal, and that first-year shipments of about $2 million at 8 percent net profit would be reasonable. This could be accomplished with a total employment of forty-five persons by year's end. Actual unit production would average about ten minicomputers per month and twenty of the distance measuring instruments. An initial capital investment of $1 million had been agreed to with the majority of the capitalization earmarked for the purchase of land.

Later targeting iterations determined what kind of manpower levels could be dedicated to training. It became dear that in order to maintain a good balance between desired profit margins and training investments upon which solid growth could occur, the division could not afford a large team of expatriate trainers. Ultimately, only four expatriates were brought into the operation, two Americans, a Swiss, and a German. In addition to major training responsibility, each of these individuals held a key management assignment. This concept of a working manager/trainer worked well during the first years of operation and evolved naturally into the permanent organizational structure. Research and development and marketing managers were not initially assigned, as these functions were only scheduled to be implemented following the complete transfer of manufacturing technology. Table I describes the individuals on the start-up team, their responsibilities, and backgrounds.

The objective in staffing was to. ultimately utilize local nationals for the entire operation. In its years of international activities, HP had continually reinforced its good experience in using nationals to operate and manage its overseas facilities. It was with considerable pride that the company pointed out in 1971 that even with an employment level of 17,000 and international sales at over 40 percent of the corporate total of $378 million, less than two dozen U.S. employees worked overseas! Only those

Table 1. HP-Grenoble Start-Up Team

Manufacturing Manager: Pierre 011ivier, a French citizen, electrical engineer, nine years experience in HP's R&D labs, responsible for manufacturing systems, production engineering, personnel and community liaison.

Production Manager: Gary Mueller, a U.S. expatriate, technician, five years of HP experience in minicomputer fabrication, responsible for all test and technical training, on a two to three year assignment.

Materials Manager: Ludwig Ott, a German citizen, ten years international manufacturing with HP, responsible for importation, scheduling of materials, and inventory control, on a nine month assignment.

Finance Manager: Christoph Beck, a Swiss citizen, five years experience in HP's Geneva headquarters, assigned to manage all financial systems and financial reports, on a two to three year assignment

Line Leaders: Francois Fouladoux and Jackie Porcher, French citizens, technicians with broad experience in customer service activities in the French sales company, primary recipients of technical training, assigned to build up teams of technicians and assembly personnel, permanent.

General &tanager: Karl Schwarz, a U.S. citizen, eleven years of HP experience, five years in international, general responsibility for policy and planning on a three to five year **assignment.**

who had a particular technical or managerial expertise were given a chance to go abroad and then usually only during the early phases of a new activity.

It was standard HP practice to hire talented, English-speaking nationals and to provide opportunities for them to travel widely to other locations, to learn specific tasks, to interact with their counterparts, and to understand the personality of the company. This supplement to formal on-the-job-training ensured that within a period of two to three years, the culture of the corporation could be successfully transplanted. The fierce local pride that developed as a result of these policies ensured some of the most productive, quality-oriented units in the corporate system:

In June 1971 a 9,000-square-foot building, which had been used to manufacture furniture, was leased. In September the first expatriates (myself and my family) arrived. During the next three months, the leased buildings were cleaned, painted, and outfitted with lights and power. Competitive bidding was carefully managed to gain experience with local subcontractors for the construction of the permanent building. Banking relationships were established, customs clearance procedures worked out, and about ten people were hired. Parts began to arrive in December, and assembly and test work began immediately. In February 1972, five months after the first personnel arrived in Grenoble, the first minicomputers had been completed and shipped. Much of the work was straightforward. The soldering and assembly skills were similar to those required for making the hi-fi kits popular during the 1960s. Transfer of these skills was facilitated by reference to standard practice documentation available generally throughout the company, with interpretational backup provided by the technical managers. Components and many fabricated parts were purchased from *the* parent U.S. divisions. Some of the electronic modules had been prebuilt, although most of the printed circuit assemblies were made in France.

The real challenge lay in the final test of the product. Unlike the parent division, which relied on highly automated test equipment to locate circuit faults, the Grenoble management elected to use only very simple manual diagnostic tools. This was intended to force the development of high-level troubleshooting skills among the French technicians. They were equal to the task. Rather than have automatic testers to logically trace, identify, and locate faults, the technicians themselves were required to understand the entire circuit function and, by reasoning alone, to find and fix defective components. Because of the complexity of many of the circuits, this game of digital hide-and-seek demanded superb understanding of the operation of the product. The production manager worked alongside the technicians to ensure that their understanding was accurate and complete. Success was easy to measure. Either the computers passed their diagnostic tests or they didn't. More than any other decision, this policy ensured the building of great technical strength within the work force and offered an important reason for the French team's pride in its skills and in its product quality. At the time the first units were shipped, capital equipment costs were a modest $28 thousand.

Shortly after the first assembly work was started, two young engineers were hired to work on the production line as technicians. Both were ultimately destined for production management. But by transferring the technical details to engineers as well as technicians, much greater understanding was transplanted than had only the technicians themselves been exposed to the nuts and bolts of the business. This redundancy in skills, of course, generated widespread management confidence in the operation.

In June, with more technicians on board, and the work beginning to spedalize, a training course on the fundamentals of HP minicomputers was started. It was to run about six months at four hours per week. The instructor was the production manager.

Little by little, more complex assemblies were transferred to the operation. All of these subsequent transfers were accompanied by visits to the American parent facility by a key French technician or engineer so that the technology as well as a sense of the process and its problems could be assimilated.

During the same period, but shifted by two months, a similar program was proceeding on the DMI. However, sales soon began to fall well below forecast and it became apparent that the product was not matched to the requirements of the European market. Forecasts had not been based on any European sales history since it was a new instrument. It was a metric version of a successfal U.S. model which had made an enormous technical contribution to the surveying art. Sales plans had been based on extrapolating the U.S. experience. However, the Europeans used slightly different measurement methods which neutralized some of the technical advantages of the device, and the primary competition was Swiss, which, because of duties, neutralized HP's price advantage. After a year of effort and some innovative marketing, it became apparent that this particular model of the DMI could not sustain the necessary investment levels in marketing or manufacturing. Although the technology was exciting and had been well mastered, production of the DMI was abandoned in mid-1973.

Meanwhile, the minicomputer production was evolving smoothly. At the end of 1972, the factory employed forty-eight people in the following categories:

- Manufacturing: direct labor, twenty; overhead, three; manufacturing, engineering and quality assurance, seven; materials, eight.
- Product development, three.
- Finance, seven.

Manufacturing efficiency was respectable. Efficiency was simply measured by comparing French labor times to the U.S. times for similar operations. No allowances were made for the production volume differences, but the U.S. volume was normally at least ten times greater than France's. For the minicomputer activities, the French unit-labor times were only 32 percent higher than the U.S. times after twelve months of operation. For the DMI, Grenoble times were 12 percent higher, and for printed circuit assembly and test, 24 percent higher.

Since great stress was placed on quality rather than quantity during the learning phase and since much of the test equipment designed to increase productivity was not available to the French team, the first year's performance was considered remarkable. Profit figures from 1972 and subsequent years corroborated this judgment. Warranty rates were also excellent, with the French warranty costs being 35 percent lower than the U.S. costs for identical products.

During 1973, three peripheral products were added to broaden and balance the operation. The same basic transfer methodology was followed for these products: training of a single technician (in the United States), with emphasis on manual testing and logical troubleshooting. Growth to eighty people was projected, of which thirty-four were to be direct labor (wire, assembly, and test personnel). Twenty-five computers and forty-seven peripheral instrumenu per month were forecast. By the end of that year, shipments were to have reached an annual rate of about $5 million.

As it turned out, business boomed. Lace 1973 saw unit sales at double the forecast, and personnel hiring was obliged to keep pace. The year ended with the divisional payroll standing at 122 employees. The U.S. fabrication back-

stop was removed, and the French factory acquired full responsibility for meeting the entire European marketing demand.

Although the number of additional people was not large in the absolute sense, growth of over 150 percent in one year represented a significant training challenge. It caused the team to realize that for the first time the division's growth, now being determined exclusively by market factors, would be much more dynamic than the carefully controlled situation which had characterized the first year and a half of its experience. The real world meant that fast footwork was required to manage this kind of business. Although the change of pace was tough on some people, the great majority of the team accepted the frequent scheduling and targeting modifications as natural and normal business challenges.

During the first year, it became clear that the technicians, production engineers, and production managers would easily master the problems of understanding how to manufacture American designed products. Their accelerated apprenticeship, built upon the universal language of electronics and computer engineering, would be soon completed and they had demonstrated that they were capable of adapting their skills to the fabrication of practically any product in the Hewlett-Packard line. But manufacturing of this type still called for great dependence upon the parent U.S. facility. Product improvements, component substitutions, tooling, pricing, marketing strategies were still the responsibility of the parent.

To be a truly viable entity, to complete the transfer of technology, a research and development or product development capability had to be established. The transfer of some technical responsibility along with a dear product line charter was necessary. Such a move would provide tangible evidence to the corporation, to the division's employees, and to the government agencies monitoring the facility's progress of HP's confidence in the completeness of the technology transfer. Manufacturing is the first step in a transfer of technology, successful research and development is the final one.

The original research and development charter for the division involved development of unique applications software for European customers. As with manufacturing, a nucleus of highly talented people was assembled. It consisted of two French engineers who had recently completed graduate work at the University of California, Berkeley and Stanford, the French manager of the HP Paris Data Center, and two Americans, a computer scientist, and an electrical engineer. The team began to come together in 1972 and started work almost immediately on its first project—an applications program to manage data in a clinical laboratory environment.

After a year's work, a change in U.S. product group management led to a redirection of effort away from the applications softw are toward a more traditional HP hardware effort. Much of the previous year's work was saved and built upon. The year of focusing Grenoble's development efforts at a specific problem in the clinical laboratory served well to guide the engineers' thinking as a general purpose data collection system was planned. The division's charter was appropriately modified. It would be responsible for the worldwide data collection activity of Hewlett-Packard.

In many ways, this aspect of the research-and-development technology really wasn't transferred; it grew. It was nourished by support from the product group management in the U.S., who also made sure that unnecessary competition didn't develop in domestic U.S. divisions, and it was shaped by the French team working within what they perceived to be the spirit of the company's research-and-development philosophy. Dozens of liaison trips were made in the succeeding several years between France and the U.S. to ensure that the French product would be complementary to and compatible with the other products in the HP computer group family. As the supporting technology evolved, the *new* product was modified. The process was analogous to the architectural design of a new building: frequent checks with the commissioner to make certain that there were no surprises and that the commissioner's technical ideas were being used and good sense of freedom in the "architect's office," that it might do what was necessary to design and build the structure.

A unique large-scale integrated circuit critical to the project was developed in conjunction with EFCIS, one of the leading custom integrated circuit fabricators in France. Special-purpose mechanical tooling was adapted from other HP products to simplify the design effort, and slowly the team grew in size. In 1976, it numbered fifteen.

Concurrently, full worldwide manufacturing and marketing responsibility for two products which had been produced by other HP divisions but which were related to the data collection area were transferred to Grenoble. This was to encourage growth of the marketing team in preparation for the time when the facility would have its own product. Profits from these two products were to be used to finance the research-and-development efforts of the division. This provided a mechanism to gage and manage the size of the research-and-development budget. The data collection"product line" had to stand on its own feet financially, including the new research-and-development investments. Initial levels would be set by profits of the existing two products in the line. Growth would be possible in proportion to the success of the locally developed product.

Again, an apprenticeship was served by the division and its managers under the eye of the parent division and the product groups. Among the individual engineers, it was more of a weaning and growing process. Four years and thousands of decisions later, the first Grenoble product, the HP 3070 Data Collection Terminal, was announced.

Throughout the rest of the division, other activities were developing. The personnel program had been innovative and marked an extension of HP's established policy of "being among the leaders of the industry." Competitive pay, flexible working hours, liberal vacation, holiday and sick-leave policies keyed to regional standards contributed to excellent employee morale and enthusiasm for the operation. Above all, an interested and supportive top management team (comprised of Hewlett, Packard, the international vice-president, and several executive vice-presidents and group managers), displayed continued support by frequent visits. They cemented a sense of pride among the new HP Grenoble employees by confirming their importance as contributing members of the HP family. Not only were the managers supportive on every visit, more significantly, they continued to issue positive reports upon their return home.

By the end of 1973, when there were enough statistics to be meaningful, absenteeism was averaging 1.9 percent, and annual attrition was 5 percent. Both of these were considered useful indicators of good employee attitudes. The company's reputation was solidly established. The acceptance rate for employment offers was 95 percent and 3,300 job applications had been made to fill the 122 positions occupied in the fall of 1973. Clearly, HP had had the opportunity to be selective and used it to acquire an outstanding group of men and women.

During the early planning stages in 1971, some top-level concern was expressed that the socialist and communist parties in Grenoble would cause major problems for the operation. The citizens of Grenoble had, after all, played a major part in the beginnings of the French revolution and more recently, in 1968, had elected a socialist mayor. The suburb in which the facilities were located had a communist mayor, and most of the companies in the region were involved with either the communist CGT or the more pragmatic socialist CFDT unions.

The political worries turned out to be only worries. The mayor of Grenoble, in fact, proved to be one of the most articulate supporters of Hewlett-Packard within the local community as well as in Paris where his *savoir faire* proved critical on several occasions.

Concerns about socialist-backed unionism were another matter, however. Two years after the start-up, and in spite of the fact that there were no early problems with leftists, U.S. management once again became anxious about the implications of the government-mandated "committee d'entreprise" (employee council) and the "delegues du personnel" (shop stewards). There was considerable confusion about the union's powers and rights to represent the employees. Most U.S. managers imagined the French system to be similar to that in the U.S. or worse, the U.K. But French law and practice are far more subtle. With reasonable sensitivity,

good managers can achieve excellent working relationships with the multifaceted groups that the employees elect to represent them. While French labor law is heavily weighted in favor of the employee, it is pragmatic. If legal recourse is necessary, the mechanism is logical and the outcome usually predictable.

In 1973, the year after the employment level reached fifty, elections were held. By law they had to be structured to give the inside track to union representatives. About three employees sought sanctioning by the local CFDT and a minority of the employees supported them. This minority did so largely out of feelings that it was the norm in France to have a counterbalance, a loyal opposition, to management. The majority of the employees voted for independent candidates. Regardless of whether they were elected from the union or the independent ticket, the individuals who made up the first employee council were remarkably free of doctrinaire or disruptive attitudes. They all worked hard for the improvement of the operation.

Because the benefits program already in place was extremely progressive, there was little leadership that union representatives could offer. During subsequent years, what small interest there was in union-inspired programs withered away. For their part, top management generally came to feel that the *elected* employee representative structure had made a positive contribution to divisional communications, a contribution that may serve as a model for other facilities in the future.

By 1975 employment had reached 250 people, a new 120,000-square-foot building had been completed, and operations in three rented buildings were consolidated. A metal shop was beginning to fabricate parts for the locally produced instruments and the research-and-development operation had completed its first prototype. In addition, profits of 8.5 percent were close to the corporate average.

In September 1975, the new facility was dedicated, almost exactly four years from the time the first members of the start-up team began their work in France. The division had earned responsibility for the worldwide production and technical support of an important family of minicomputer peripherals. This charter would ensure an opportunity for the division to contribute its own technology to the corporation, and in a sense, it would complete the cycle of the technology transfer. In late 1976, the first new product designed in the Grenoble labs and produced by its manufacturing activities was announced and technology began to flow west across the Atlantic. A different type of technology transfer began. HP-Grenoble embarked upon the most important phase of its existence, a new era of shared rather than simply transferred technical collaboration with the rest of the Hewlett-Packard Company.