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# **"If only HP knew what HP knows": the roots of knowledge management at Hewlett-Packard**

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## **Abstract**

While the term "knowledge management" is relatively new, many of the concepts have deep historical roots. Hewlett-Packard's strong culture and traditional business practices established an environment that encouraged innovation and the sharing of knowledge throughout the company. However, the reliance on local and informal approaches eventually became a weakness when the company had to deal with rapid growth and increased competitive pressures. The growing gap between the potential and actual value of HP's collective intellectual assets was reflected in a widely quoted management complaint from the 1980s, "If only HP knew what HP knows." However, the need for more explicit and deliberate strategies for managing knowledge has only recently become clear, as the disruptive technology of the Internet and the World Wide Web triggered an explosion in the availability of information and knowledge, but did nothing to expand our limited attention capacity.

The acceptance of a new management concept follows a predictable trajectory from "that's a crazy idea" to "maybe we should give this a try" to "this could solve all our problems" to "this is no different than what we've always done." In part, this trajectory reflects the consultants' hype cycle, which begins by emphasizing how new and revolutionary the concept is (even to the point of inventing new words and terms to describe it), and ends, if successful, by blending the concepts into everyday business practices. In part, however, the trajectory also seems to reflect some basic truths about the way new insights get internalized by people and by organizations. When we look at old realities through a new lens, we are often surprised at the things we suddenly see and excited by the opportunity to understand and manipulate these "new" things. Early adopters may get a dramatic jump on their competitors by moving quickly (thereby encouraging the perception of a revolutionary breakthrough), but the concepts with real staying power will inevitably enter the mainstream of management thinking after some of the more extreme rough edges have been sanded off.

Knowledge management seems to be the latest concept to follow this path. Dismissed by some as a frivolous fad, embraced by others as a transforming movement, it is first and foremost a new way of looking at and understanding old realities, triggered by some truly significant changes in our business environment. By looking at knowledge management within the context of a single business organization, Hewlett-Packard, it may be easier to understand both the historical roots of the concept and its likely impact on the future.

## **HP's traditional approach to knowledge management**

HP is well known for its strong culture, established by its two founders, but outliving their active involvement in the company in the form of a set of values and beliefs known as "The HP Way." When looked at through the lens of knowledge management, that culture led to a whole set of business practices that encouraged innovation and the sharing of knowledge throughout the company.

- Small, autonomous business units. As the company grew, it adopted a cellular model of growth, splitting the largest units into smaller autonomous units so that the benefits of hands-on management, of face-to-face

relationships, and of physical co-location would not be lost. An RandD lab of more than a few hundred people was considered too large to manage effectively for innovation.

- **Management by walking around.** Managers were expected to live among their people, and to be both visible and accessible. They never had closed offices or special sections of a building or separate facilities of any kind. They kept in touch with what was going on by wandering around and talking to people, by holding public coffee talks at which anyone could ask questions and raise issues.
- **Open office environment.** Even high-level managers had modest cubicles with limited privacy. Most people worked in open office landscapes with no or low partitions so that everyone could see who was there and could absorb what was going on around them. Office space shared the same facilities used by manufacturing lines, machine shops, and shipping or receiving docks, so everyone had a sense of the whole business.
- **Sharing, high-trust culture.** Founded on the premise that people want to do a good job, the environment minimized the use of rules, bureaucratic procedures, and internal security. Information about the business was shared widely and openly.
- **Loyal, empowered people.** The company took its commitment to employment security very seriously, even to the point of turning away business that would require a "hire and fire" approach, like government contract work. When individual business units suffered downturns, people were offered opportunities elsewhere. When the whole company went through down cycles, the pain was spread evenly by everyone taking 10 percent unpaid time off, rather than having a 10 percent layoff. In more normal good times, everyone shared equally in a profit sharing program. Overall, the company has enjoyed extraordinarily low attrition rates for its industry.
- **Permission to experiment and fail.** Truly empowered people will try things out, and not everything they try will be successful. To ensure the survival of open communication and high trust, managers must accept, rather than punish, well-intentioned failure.
- **University towns.** Even when it came to such things as site selection, the company seemed to have an instinct for good knowledge management principles, usually

choosing sites near mid-sized cities with major university engineering programs. The locations offered high quality of life, while encouraging close relations with a local academic community that could provide future recruits.

Of course, at the time no one thought of these things as knowledge management strategies. To Bill Hewlett and Dave Packard, this was just good people management. Nevertheless, they laid the foundation of what was, and still is, a corporate culture that encourages both knowledge creation and knowledge sharing.

However, the knowledge management lens also allows us to see the limitations of this traditional culture. While superbly tuned to encourage the informal management of knowledge in localized, face-to-face environments, the culture also had its weaknesses when viewed from a larger knowledge management context. As Table I suggests, the culture could actually become a hindrance when growth and competitive pressures called for more formal or more global knowledge management strategies.

Even at a local level, the formalization of knowledge capture and sharing would often be resisted as a form of creeping bureaucratization. Why document things, when it seemed much easier to simply ask for help when it was needed? Why adopt formal methodologies and follow formal procedures, when work could be made more interesting by allowing more individual creativity and initiative to be applied?

It was also not natural to share local knowledge on a more global basis. It is not that anyone was trying to hoard knowledge for their own self-interest, but the same small units that fostered entrepreneurial spirit and intense business focus also fostered a myopic disregard for the benefits of more global sharing. The potential provider of knowledge already had a full platter, and was rewarded for solving his own problems, not for spending his valuable time helping other business units solve their problems. On the receiving end, the same pride in creativity and innovation that energized the local unit also created "not

Table I Traditional approaches

	Informal	Formal
Global	Provider: not my problem Receiver: NIH	Centralization Corporate meddling
Local	Traditional HP strengths	Bureaucracy

invented here" barriers to learning from the experiences of others (who were, after all, in a "different" business).

And if anyone dared to suggest solutions requiring both formal and global management of knowledge, the autoimmune response of the culture would immediately react to the unwelcome invasion of foreign ideas that could only be viewed as centralization or corporate meddling.

### Early coping strategies

During the late 1970s and early 1980s, HP's business environment changed significantly. The continuing rapid growth of the company made it increasingly difficult to rely exclusively on informal processes and face-to-face relationships. By 1980, the company had passed \$3 billion in revenue and had 57,000 employees. International operations had become significant, and managing product lines as global businesses became essential. During the same period, the company had moved from a heavy concentration on a market it dominated (low-volume electronic test and measurement instruments) into a market in which it was a second-rank player (computer systems and support). The competitive pressures to innovate quickly and manufacture efficiently placed enormous strains on the traditional culture. Local, informal management of the company's knowledge assets was no longer sufficient.

The quality movement transformed the manufacturing environment at HP. Inspired by Japanese examples, including the example of our own Japanese joint venture, managers throughout the company embraced the data-driven discipline and formality of total quality control (TQC). Seen through a knowledge management lens, TQC forced the tacit process knowledge of manufacturing to become painfully explicit, with walls covered by control charts and problems attacked through fishbone diagrams and root cause analysis. Local learning was accelerated, and learnings were explicitly locked into processes through careful documentation and constant monitoring. Unfortunately, the power of TQC to accelerate local learning was also its weakness, because it meant that each manufacturing unit went through its own discovery process, often rediscovering solutions that had already been found and implemented in other places in the company.

Although TQC also had some positive impact on repetitive administrative processes, attempts to apply similar techniques to more unstructured, informal processes in R&D or marketing met with limited success. In these areas, knowledge capture and sharing relied more on loose organizational structures and incentives. A matrix management structure was put in place to encourage the flow of knowledge within various functional communities of practice that spanned the business unit boundaries, such as engineering, manufacturing, marketing, finance, information systems, quality, and personnel. Functional councils, newsletters, face-to-face management meetings, internal conferences, and central staff activities were all designed to encourage the adoption of common strategies and the implementation of best practices, but in most cases participation and compliance was voluntary. For most people, best practice sharing meant an opportunity to brag about the good things you were doing rather than an obligation to abandon your own approaches in favor of someone else's better idea.

There were few examples that fell into the area of formal and global solutions. In an early example of business process reengineering, there was a reluctant acceptance of a more centralized procurement process that sought to leverage the collective intelligence of a highly decentralized manufacturing and engineering environment. Elaborate systems were put in place to capture and consolidate companywide information about vendor performance, quality, part usage, and manufacturing schedules in order to manage vendor relationships on a companywide basis. In this case, the large and easily documented savings overcame the cultural resistance, but most forms of centralization were still considered largely off limits during this stage of the company's history.

### The case for change

By the late 1980s and early 1990s, the need for more fundamental change was inescapable (see Table II). The small, autonomous business unit was becoming extinct. To gain economies of scale or take advantage of lower cost labor overseas, most manufacturing and distribution operations were moved to larger, more specialized organizational units. The most important product lines were now multi-billion dollar businesses of their own that could no longer be managed from a single location.

Table II The case for change

	Informal	Formal
Global	Increased size and complexity of business units	Not able to do everything locally and still focus on business issues
Local	No longer the dominant model	Pace of change and competition requires faster response

As a result, business units became larger, more specialized, more geographically distributed, and more dependent on a web of complex relationships both inside and outside the company. In this environment, you couldn't just walk over to your neighbor to find out what was going on. Knowledge had to flow effortlessly across time and space, and between people who might not even know each other.

In the highly competitive computer industry, which now represented 80 percent of the company's revenue, the greatest growth was coming from high volume, lower margin products like printers and PCs. Product life cycles were greatly compressed and profit margins were squeezed. Speed became the management mantra, since the only way to gain competitive advantage seemed to be the ability to run faster and react more quickly than your competitors. With this kind of pressure, local relearning and rediscovery was a luxury that no one could afford. Knowledge available in one part of the business had to be immediately leveraged by the entire business.

The combined pressures of competition and globalization also forced most businesses to reexamine their traditional preference for controlling all aspects of their business. Vertical integration maximized control, but it could also reduce flexibility and slow down response times. Lean competitors, relying heavily on outsourcing, were able to move more quickly, both in seizing new opportunities and in abandoning old practices. If a business was willing to give up its manufacturing, why would it want to run its own data center or manage its own financial transaction processing?

These challenges did not come all at once and did not affect all HP businesses with equal severity, but the cumulative effect was profound. Although no one would have characterized these problems as "knowledge management" problems, looking at them through that lens does add to our

understanding. In fact, it was at the beginning of this period that John Doyle, who at various times was the top R&D and HR executive at HP, began using the phrase, "if only HP knew what HP knows," to describe one of the greatest challenges facing the company.

To support the global sharing of informal information and knowledge, HP invested heavily in a technology infrastructure that provided universal connectivity for all employees. By the mid-1980s email was pervasive, and voice mail was on its way to becoming so. HP was one of the first businesses to adopt Internet protocols for its internal wide area network, and to insist that local LAN implementations be seamlessly interconnected across the entire company. Before the term "Intranet" was even coined, HP had shared document repositories, on-line reference databases, and automated software distribution and installation procedures that were available throughout the company. By the early 1990s, we were implementing a standardized and fully automated desktop-computing environment that was voluntarily adopted by more than 95 percent of our PC users, greatly facilitating the personal sharing of documents, presentations, and other forms of local knowledge. Widespread implementation of groupware (Lotus Notes) also supported the formation of many communities of interest and practice, providing them with a convenient context for making their collective knowledge more visible and sharable.

This infrastructure, in turn, made it relatively easy to build and maintain more formal knowledge repositories to support specific business needs. Policy and procedure manuals from finance and personnel were quickly replaced with on-line document collections. The inefficient and ineffective direct distribution of hard-copy product information from 50 different business units to several thousand sales people was replaced with a single knowledge base containing most of the information sales people needed to do their job. Instead of being bombarded with fragmented distributions from multiple, uncoordinated sources, the salesperson could retrieve only what was needed, when it was needed, and be sure that it was up-to-date.

In other cases, the more formal capture of knowledge actually enabled the consolidation and centralization of processes that had formerly relied heavily on the personal, and often inconsistent, knowledge of local agents.

Customer response centers created sophisticated and voluminous databases of known problems and solutions, replacing the routine troubleshooting activities of individual support engineers. Accounting created a single transaction-processing center for the USA, while personnel established an employee service center capable of handling all US employee inquiries and transactions regarding benefits programs. To support the high volume activity levels of these consolidated processes, it was necessary to capture and embed much of the knowledge directly into performance support systems.

Although knowledge management terminology was still largely unknown and unused, the concepts were being widely applied. During this period, most paper repositories were replaced by on-line repositories, which were far more accessible, more timely, and more accurate. Fragmented sources were consolidated and organized for ease of use. Tacit knowledge was increasingly captured and made available to larger groups of interested people. The sheer volume of communication between employees exploded as individuals became connected to larger and more dispersed networks of colleagues.

### **Disruptive technology as a catalyst**

The increased demand for better management of HP's intellectual assets reflected the gradual, but inexorable forces of internal growth and external competition. But in the mid-1990s, the disruptive technology of the Internet and the World Wide Web suddenly changed the supply side of the knowledge management equation.

Because of its previous investments in infrastructure, HP was able to implement newly commercialized Web technology almost literally overnight. In April 1995, Web browsers were distributed as a new component of the PC common operating environment, giving almost every desktop user in the company immediate access to both the internal and external Web environments. Although in some sense a natural progression of previous infrastructure investments, the sudden appearance of the World Wide Web and its universal browser interface had a revolutionary impact on the way information and knowledge was viewed within the company.

The most obvious change was that every desktop could now directly access the cumulative information resources of the World Wide

Web, which were growing at an exponential rate. Although technically savvy Unix users had long enjoyed access to Internet documents, now even the most unsophisticated PC user could tap into the power of the Internet through the user-friendly interface of a Web browser. At first the experience was exhilarating, but it soon became overwhelming to many users, as the volume of available information far outstripped anyone's ability to keep up.

The second change was a result of the incredible popular hype surrounding the growth of the Web. Everyone was bombarded constantly with information about this new resource. Every ad, every article, every brochure contained a URL that promised more details for the curious. Every hyperlink followed produced ten more links that just might contain valuable information. Every search began to generate thousands, then tens of thousands of "hits". Although the "information explosion" was nothing new to publishers and librarians, there was something fundamentally different about this phenomenon. The thought of a million books sitting mostly unread in a library does not produce a sense of information overload in most people, but the feeling that information vital to your job and your company could be just a few clicks away on the Web is much more disconcerting. With the arrival of the Web, information overload went from a theoretical concept to a visceral everyday reality for many knowledge workers.

The third change was more subtle, but in some ways more profound. Suddenly, everyone could become a publisher. Everyone could share their knowledge with an audience that was potentially much larger and broader than what had previously been accessible to them. Within a couple of years, HP's Intranet had over two million documents residing on thousands of locally managed Web servers. Less than 5 percent of these documents represented the kind of official organizational communication that dominated our pre-Web internal repositories. The Web, both internal and external, became the world's largest vanity press, encouraging an explosive growth in information that was, at least in theory, accessible to all.

This explosion in the supply of information, which in the right minds could be turned into useful knowledge and applied broadly to critical business problems, seemed to be a perfect technological response to the increasing demand for useful and leveragable

knowledge to run the business. Unfortunately, nothing has increased our personal capacity to absorb information and create new knowledge. Our "attention capacity," the number of hours in the day times the rate at which we can absorb information through our sensory channels, has remained relatively unchanged, and has, in fact, become the scarcest resource in the emerging knowledge economy.

This mismatch between our personal attention capacity on the one hand, and the rapidly growing supply of information and demand for usable knowledge on the other hand, has essentially created the "knowledge management" problem of today's business environment. Unlike the first knowledge management revolution of the nineteenth century, which was about designing organizational structures and management processes to overcome the scarcity of both information and knowledge, this current revolution is about managing the overwhelming flow of information and knowledge through and around the permanent bottleneck of our limited personal attention and learning capacity.

### The knowledge management response

As awareness of the knowledge management problem grows, responses to the business challenges mentioned above are taking on a more explicit knowledge management flavor (see Table III). Although local, face-to-face relationships are no longer the dominant mode of doing business, the physical work setting is still a very important component of collaborative knowledge creation and sharing. Two years of deliberate experimentation with more open office environments has raised serious questions about recent trends toward "ice cube tray" floor layouts of small, individual cubicles with high partitions and very little shared space. In fact, what seems to encourage and stimulate spontaneous collaboration is a combination of

physical co-location in an open office landscape with low or no internal partitions, ample team space with provisions for persistent information displays, and special enclosed areas for occasional privacy and concentration. Such an environment is filled with visual information cues and almost subconscious awareness of group activity, so that knowledge sharing becomes a spontaneous, effortless, and continuous activity and, in the words of the management sponsor, "not collaborating becomes impossible."

Such findings fly in the face of a rapidly growing trend toward alternative work environments and geographically distributed teams. Although this trend is probably irreversible, it seems increasingly clear that the short-term gains (in terms of accommodating employee preferences and reducing demands for expensive office space) have not been properly weighed against the long-term costs (in terms of cultural cohesion, group effectiveness, and collaboration). At the very least, it requires far more conscious effort and attention to achieve a comparable level of communication and collaboration in a distributed environment. Because of this, distributed teams should be embraced only when the distribution itself adds significant value (e.g. by encouraging broader, more representative participation in a project) or when there is no feasible alternative (e.g. because needed resources are not available in any single locality). Technology support for distributed teams needs to go beyond the conventional thinking of groupware environments and video conferencing capabilities, in order to restore some of the "casual proximity" that is lost in remote interactions. Examples might include passive monitoring of workspaces by network cameras (so one could easily see when a teammate was available and interruptible), a "buddy list" and chat capability (so one could see which other team members were currently on-line and able to respond to quick, direct notes), and a telephone system that provides direct intercom-like connections among team members (so frequent, short verbal exchanges are encouraged).

It is also becoming increasingly clear that our pervasive connectivity infrastructure (e-mail, voice mail, Intranet, Internet) is a double-edged sword from a knowledge management perspective. In general, such technologies have had a very asymmetrical impact on the flow of information. They have made it far easier to create and distribute information very broadly, but

Table III Knowledge management responses

	Informal	Formal
Global	Filters, profiles, agents, alerts Communities of practice Expert directories	Knowledge maps Reusable knowledge objects Structured intellectual capital
Local	Open office experiments Support for distributed teams	"Active" knowledge repositories

they have done very little to help the receivers digest and use the information more effectively. With some 3,000,000 Intranet page views, 2,000,000 email messages, 500,000 telephone calls, and 200,000 fax pages every working day, plus nearly 2,000,000 daily page views on our external Web site, it is clear that these critical tools have become part of the problem as well as part of the solution.

The receivers need more control over what and how much they receive. One example is an on-line catalog of special purpose subscription lists that gives the individual the ability to review what is available, and then add or delete himself at will. Various search agents and filters can also help control the volume of information received, but usually only by tightening the criteria to create a narrower and narrower topic space. What we really need are filters that can understand the meaning and evaluate the importance of content across broad topic spaces, so we only see the things that really matter. But sensemaking is still essentially a human function, so new organizational roles are emerging for people who can scan and summarize large volumes of specialized material, analyze and interpret complex subject matter, and make connections across a variety of topic spaces. These new knowledge intermediaries are a direct result of our need to conserve attention capacity while dealing with ever increasing volumes of information.

HP's culture has always supported the spontaneous formation of communities of interest and communities of practice, but in today's competitive environment the formation of such knowledge sharing groups can no longer be left to chance. The HP Consulting Organization, which has little to sell beyond its collective knowledge, has embarked on an aggressive program to create and nurture dozens of "learning communities" around the subject areas most critical to its business. HP's central research lab has sponsored the development of an expert yellow pages application that lets individuals register themselves and describe their areas of expertise and special competency. The profiles can then be searched by anyone in the company to help find and make direct connections with people who might be able to help them.

Other areas are trying to turn their existing passive knowledge bases into more active environments that directly support communication and collaboration among their users. For example, the application that delivers just-in-time product and competitor knowledge to

the sales force now also allows a sales team to create and manage its own private collection of documents so that customer knowledge can be added to the mix. Another application that has traditionally brokered and consolidated proprietary market research on an internal Web site now supports active alerting of users based on personal interest profiles. It also enables internal analysts to add value to the content by creating customized collections and commentaries targeted at very specific audiences.

The Consulting Organization has also recognized the need to invest more directly in the management of its formal knowledge repositories, creating a new organizational unit responsible for structured intellectual capital. Knowledge maps are created to help people understand what knowledge is needed and what is available at each step in a particular consulting process. A central knowledge desk will formalize a new intermediary role to accelerate the process of locating and delivering just-in-time knowledge to the consultants. By managing both the formal and the informal aspects of their knowledge environment, by carefully analyzing the relationships and interplay between their human intellectual capital and their structured intellectual capital, the organization hopes to design and institutionalize a holistic system in which all the energy and all the feedback loops reinforce a pervasive knowledge culture.

As we move forward, it seems that knowledge management represents both continuity and change for HP. While the core values needed for knowledge management may be "no different than what we've always done," the strategies and practices represent more fundamental change. Knowledge management is, in fact, one important way of helping the traditional, and still very valued, HP culture adapt to new competitive pressures and organizational stresses. In keeping with the deep roots of that culture, it is unlikely that HP will have a chief knowledge officer or a centrally managed KM initiative any time soon, but there is increasing awareness that the emerging practice of knowledge management is critical to the future success of the company. In the words of HP CEO Lew Platt, "Knowledge management is all that there is in our company. We live and die on our intellectual property...acquiring knowledge quickly...moving it around the company very quickly...it's all about knowledge transfer; starting with the customer."