Culturally-Induced Information Impactedness: A Prescription for Failure in Software Ventures

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Abstract

The impact of effective information flow in software ventures is analyzed through a recent case in which a hot, lucrative technology was lost on its way to the marketplace. The failure occurred despite the fact that the venture had many components crucial to success, including a proprietary intellectual property position, enormous market demand, a well-qualified, committed team and sufficient funding. One reason for this failure is the lack of information flows among several parties critical to the success of the venture. This case suggests that in software markets which operate at breakneck pace and have short development cycles, effective information flow is a first order priority. These blockages in information flows can stem from the nature of the cultures that are created to produce software ideas, especially proprietary technologies. The case also suggests that information can become impacted by the clash between US software market characteristics and Japanese business culture. Fortunately, there are inexpensive solutions that can substantially improve the return on investment, especially foreign investment, in new software technologies.

1. Missing the Mark: A Lost Proprietary Security Technology

The explosion in digital media technologies and the Internet has catalyzed a shift in creative assets from the analog to the digital realm. These multimedia assets: images, audio, video, text and software, have new creation tools and distribution channels that allow them to reach vast new markets. Yet these digital assets also face unprecedented exposure to theft. Mechanisms to protect these assets are in great demand.

From a research laboratory owned by a global Japanese corporation came a hot new technology for multimedia asset protection. The technology was to be embedded in software products. A software venture was slated to commercialize the new technology. The venture had many things going for it: an extraordinary team, financial backing, huge market demand, and a proprietary intellectual property position. Despite this, the technology failed to reach its commercial potential.

This case explores one important reason for the failure: the inability of critical information to flow between the venture and the consequential governing parties. The communication channels were insufficient: to the market, to the funding agent, to the parent and to the research subsidiary management. The result was a significant loss of revenues, investment resources, human capital and technology.

This case illustrates how cultural issues can impact information. First, the commercialization process had to enlist the cooperation of two cultures, a research culture and the culture of a Japanese parent corporation. These cultures have attributes that clash with the demands for commercialization of software in the domestic market. In particular, they did not facilitate the high bandwidth information flows that the software venture needed. Software ventures demand large information flows because the field changes rapidly and development cycles are short. Also, the juxtaposition of two different cultures created a boundary that acted as a barrier across which information had to flow in both directions. The discontinuity created by the different cultures slowed information flow.

Since these cultural juxtapositions (research integration and strategic Japanese alliances) will likely endure in the process of technology development, it behooves vested interests to better understand how to enable critical communications channels. This is particularly important for software technologies that have high information demand. Fortunately, this case also suggests that reasonably simple strategies may exist for alleviating such culturally induced blockages.

The larger objective of this study is to better understand the critical role information flows play in the commercialization of proprietary software technology. This will not only help maximize potential gains, but help reward many millions of dollars of research investment and lifetimes of scientific work.

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Digital Fingerprinting: A timely, lucrative and sexy technology

The recent explosion in digital technologies has created a large volume of valuable digital assets including films, photographs, audio recordings, text and software. Powerful economic forces are driving the conversion from analog to digital: fast, accurate, inexpensive copying, more creative production processes, lower inventory requirements and instantaneous, global, and inexpensive distribution. But with these economic opportunities come heightened risks. Digital content is much easier to steal; one can make an exact reproduction and send it around the world instantly.

This heightened exposure to theft has generated great demand for security mechanisms to guard content. Cryptography, the process of scrambling content during transmission, has been the traditional form of security. However, the security provided by the best encryption methods ends when the content is decrypted. Digital fingerprints complement cryptography. Digital fingerprinting embeds information imperceptibly and permanently into content. The information could be the owner, the origin, or the recipient of the content. Digital fingerprinting can be used to track misuse or enforce copyrights. Fingerprinting extends the perimeter of protection beyond transmission: wherever the content goes, the fingerprints go too.

Mise en Scene: Discovery

Digital fingerprinting is a nascent field. No competitors and no single technique are entrenched. Recently a group of scientists at a Japanese-owned, U.S. based, research laboratory, *NoSe*[1], developed a new digital fingerprinting technique. Fingerprints embedded using the NoSe technique appeared not to degrade content fidelity and could not be removed or destroyed even by a malicious attacker. Denkidyne, NoSe's huge global parent, is primarily a hardware manufacturer, earning most of its revenues from semiconductors and telecommunications equipment.

NoSe is one of many labs that Japanese global corporations have built to leverage non-Japanese research talent. The idea was to establish an American subsidiary to conduct basic scientific research to feed to the parent ideas for new generations of products over the next few decades. The subsidiary consists of approximately one hundred scientists, and is organized according to traditions set by AT&T Bell Laboratories. NoSe has no formal processes for commercializing technology. Functionally, NoSe reports to the research division of Denkidyne in Japan. Funding flows from Denkidyne Research to NoSe; intellectual property flows back. Denkidyne Research feeds technology to various product divisions (see figure).

The Market Speaks

Approximately one year after discovery, NoSe scientist Forman Tagit, one of four early inventors, wrote a press release about the fingerprinting technology. The press release succeeded in generating public interest, and informally catalyzed an effort to further explore commercialization efforts from within NoSe. At this time, the fingerprinting team consisted of four male researchers with no business experience including three people from NoSe and one academic scientist. At this point, Dr. Leah Atherton, a female NoSe researcher, with formal business training and small business experience, joined the team. Atherton's primary role was to shape the technology into a commercially viable state and to implement a business plan. Shortly after this, NoSe researcher Andre Tiger, a world-renowned computer scientist, became interested in the technical issues surrounding fingerprinting and joined the project.

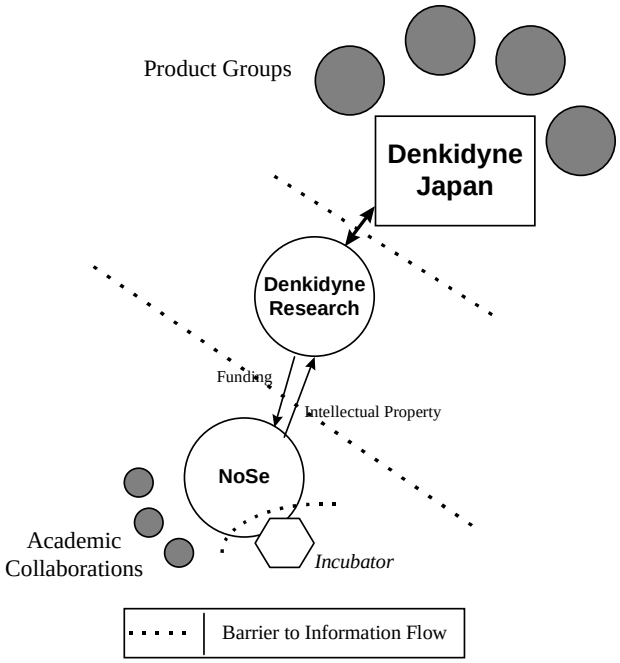
The addition of Atherton and Tiger brought critical mass to the group. Within a short time Atherton concluded that the market potential for fingerprinting was vast after conducting market research and talking to key strategic players. These players included large content providers and global database companies. Atherton determined that the market was nascent: no entrenched competitors or accepted product designs existed and aligning Denkidyne with a few strategic partners was critically important. Such relationships could help communicate the demands of the market to guide research and development. They could also provide leverage for development, marketing, and funding.

An Incubation Proposal

Catalyzed by commercial interest, the fingerprinting team developed an incubation plan. They proposed the plan to NoSe's management first and later to the Japanese management of the parent lab and several Japanese business units. The process spanned 3-4 months. After rounds of consensus building, NoSe management accepted the plan, but with no clear direction or mandate from Japan.

The incubation plan was to establish a small number of relationships with large strategic partners, including a very large, global entertainment conglomerate and Informix Technologies, Inc. a global database company. The objective was to learn about the markets and shape the

[1] The names in this case have been disguised pending the outcome of legal proceedings.



technology to fit market demand. This plan involved the critical aspects of software technology transfer, strategic research, software engineering, and business development. The partners were a key component: feedback from the strategic relationships would help determine important technology characteristics, guide product design and provide leverage in the marketplace. The proposal was for a six-month period, with goals including a software prototype, patents, and showcase applications. After this period a better decision about how to proceed could be made; for example, a software venture could be spun out; if the incubation were successful, funding would be plentiful.

A Commercialization Structure, Self-Organized

During the previous months the fingerprinting team had been functioning like a small independent start-up. Decisions were made in a participatory style and roles were defined fluidly to meet the needs of the project. This worked well, as it tends to work well in early stage software ventures. However, both NoSe and the parent Denkidyne were accustomed to hierarchical cultures.

Management-Imposed Structure

US Management was uncomfortable with the flexible, participatory management of the fingerprinting team. Although US management had no clear understanding of the Japanese parent's wishes, they guessed that the Japanese management would be more comfortable with a hierarchical organization for the fingerprinting venture. So they imposed one. Unfortunately, this backfired. Given an opportunity to take control, Tagit insisted on being leader. Tagit had no management skill and the team did not respect his abilities. The team rebelled; Tagit resigned from the project, creating deep-seated ill will. Ultimately, Solomon Meringue, a vice president of the research subsidiary, was appointed titular head. Meringue, a benevolent but indecisive man, was a titular head beneath which the team proceeded to continue operating in its former matrix management mode. Temporarily everyone was appeased (except Tagit). But the seeds of disaster had been laid: Meringue was now the principal point person through which information had to flow from the software incubator to NoSe management and to the rest of Denkidyne.

The Bunker

Capitalized, the fingerprinting software venture thrived. The team grew to approximately a dozen people and cemented several lucrative deals. One deal was to produce a software module to be embedded in a new multimedia database product by a large global database company. Another deal was to solve an asset-tracking problem for a very large global entertainment content provider. Development moved along rapidly; research continued concurrently; business, marketing and funding efforts progressed.

As in many software ventures, the workload was heavy, the atmosphere was charged and the team banded together. Unfortunately, the faster the pace, the more difficult it became to keep management informed. Meringue did not proactively seek out information and was almost always out of the loop. The result was a highly focused, successful team connected to the market, but disconnected from US management. Interactions with management grew aggravating because management usually did not understand the needs of the venture. NoSe management came to refer to the team offices as "the bunker."

Global Recognition

The fingerprinting venture was starting to bring Denkidyne global recognition for producing an exciting, high-quality emerging technology. The database product was proceeding on schedule and had been announced at a press conference in Europe. The press release, translated into twenty-seven languages, generated articles in news-

papers all over the world including three prominent Japanese business journals.

Tagit on the Side

Tagit, now estranged from the main team, worked his own. He built a narrow application of fingerprinting, working with a Denkidyne business unit directly. Tagit's operation was facilitated by his frequent trips to Japan, and direct contacts with individuals on the Japanese side of Denkidyne.

A Team Leader Appointed: Gray Hair and Girth

Communicating with Japan had always been difficult for NoSe employees, for many cultural reasons. One NoSe scientist, Dr. Willard Silverhead, understood the power of controlling interactions with the Japanese and had made a career out of making Japanese contacts. Atherton, realizing that the software team was cut off from Denkidyne, thought Silverhead could help open communications between the team and Japan to help the team spin-out a separate company. The spin out idea was regarded widely by Japanese management as the organizational solution to the fingerprinting venture, freeing the venture from less appropriate Japanese business protocols [1].

Silverhead quickly realized the fingerprinting project was important to the Japanese and that he could use his contacts to further his own career. Within two months Silverhead was appointed head of the fingerprinting venture. Silverhead, despite the spectacular success of the team and his complete lack of small business managerial or multimedia technical experience, had convinced the Japanese that he was critical to the success of the venture. His head of gray hair, however, did lend the appearance of expertise and Silverhead, who was portly, claimed his girth aided his ability to drink with the Japanese, and to advance in the company.

Project Shut Down

Unfortunately Silverhead, who had spent all his time controlling communications with the Japanese and with the US management, did not have the loyalty or respect of the rest of the team. The team told management that Silverhead was not acceptable as head. US management, fearful of transgressing Japanese wishes, shut down the rest of the team. US management perceived that the Japanese wanted Silverhead to head the project - they did not know this first hand. Ironically, it was Silverhead who had engineered this perception. As the primary communicator to the Japanese, and between US management and the Japanese, he nurtured the perception that the project needed him as head.

Denouement

About the time of the US shutdown the Japanese had already decided to spin out a fingerprinting company. NoSe management and Silverhead turned to the only scientist left in fingerprinting, Tagit. Unfortunately neither Tagit nor Silverhead wanted to risk their jobs to a start-up and so it was launched without a team and without technical talent. Eventually Silverhead was appointed acting CEO and Tagit a senior consultant, but both were only on loan to the company: even the secretary was a temporary employee.

Work stopped entirely on the incubator's research and development. A critical defect in the technology found prior to shutdown was left uncorrected. Most of the team left Denkidyne. Several prominent members of NoSe quit, including Andre Tiger and went to work for a potential competitor. Atherton, the only female employee, is suing the company for gender discrimination. Most of the software team has extremely bad relations with NoSe and NoSe continues to receive bad publicity within the scientific community.

2. For Software Ventures, Several Information Flows are Critical

To be competitive, software ventures must be able to react quickly to new market demands and technical innovations. Thus, communication channels to the market, clients, customers and vertical integration allies are critical to success. In proprietary software technology ventures, interactive feedback is extremely important. When the technology is new and the markets are nascent, the right product attributes cannot be determined without good relationships with strategic customers.

In addition to wide channels to the market, software ventures need efficient internal channels to management. Regardless of where the venture sits in the hierarchy of organizations: project, subsidiary, stand-alone company, clear, effective paths to all levels of management and to funding agents need to be developed that can handle the pace of information flow needed in software ventures. Without effective paths to management and funding agents, the right organizational structure, allocation of resources, and incentives are impossible to establish.

Wide, efficient internal communication channels within the venture itself are also extremely important to a new software venture. To preserve a reasonable scope, we do not consider these here.

3. Cultural Disparities Block Critical Information

Research Cultures Nurture Ideas

Few things are as important to new software ventures as new ideas. To nurture new ideas, especially deep, proprietary ideas, research environments need to preserve creative freedoms and provide support. Research laboratories are designed to provide this kind of environment. Indeed, many large technology companies including Hewlett Packard, AT&T, IBM, Microsoft and Xerox, have produced successful research environments. Traditionally when a technology is developed in a research environment it is moved out into a business unit or spin-out company. Yet the process of incubation can often be critical to the success of the technology in the marketplace. Frequently, scientists are needed to work on the technology during commercialization to make sure it meets the needs of targeted applications.

The fingerprinting case provides a good illustration of why it can be very important to incubate technologies using the inventors themselves. The first fingerprinting technique developed at NoSe required the unfingerprinted original document to extract the watermark from a copy believed to contain a watermark. Feedback from the content providers quickly suggested that they wanted to be able to remove fingerprints without having to retrieve the original video from an archive. This would allow them, for example, to obtain the name of the last legitimate viewer from an errant copy found on the Internet without the policing agent having to carry around the video. Once the scientists understood this they quickly produced algorithms that did not require the original for extraction.

Research Cultures Induce Blockages, From Several Causes

Throughout the processes of incubation and commercialization, inventors need to remain involved. Unfortunately the research culture does not promote this involvement. In fact, aspects of the research culture work against turning ideas into products. From our perspective, the mechanisms to handle information flows within a research culture are woefully insufficient, by design, for commercialization processes such as incubation and software development.

1. Insulated From the Market

In particular, research environments tend to be insulated from the market. The objective is to enhance creative freedom by liberating researchers from short-term commercial distractions. Many believe that insulation can promote the development of deeper, proprietary technologies. As a result few, if any, communication paths to the market exist.

2. External Communication Channels are Narrow, Technical and Slow

The external communication channels that do exist in a research environment are designed for promulgating scientific information, usually to other scientists. Technical reports and formal seminars are the main forms of communication out of the research environment. Unfortunately these paths are completely useless in the communication process needed for commercial applications. Technical papers and seminars are not comprehensible to laymen who might have a market application for the technology. Furthermore such communication tends to happen only a few times a year.

3. Narrow, Slow, Formal Internal Communication Lines

In a research environment internal communication tends to be kept to a minimum to preserve creative freedoms. Evaluations of employee performance trigger internal discussion of works-in-progress. These happen infrequently, generally annually or semiannually. In research environments formal communication with management is through infrequent technical reports and seminars.

4. Scientists Control Channels

Not only are the only external and internal channels narrow, technical and slow, but scientists control them. Research cultures, in general, do not value communication skills highly. They tend to promote solely on the basis of research achievement. Without incentives, scientists are rarely able to articulate the commercial potential of new technologies. Since management of research environments tends to consist of senior researcher who have been promoted on the basis of research, information about commercial opportunities gets blocked, both into and out of the research environment.

5. Functional Separation of Business Units and Research Units

Many companies that support research do so in a subsidiary that is separated from any business unit. Usually no established contacts between any business units and the research unit exist and information is expected to travel up to the management of research, over to the upper management of the business units and down into them. This may take a very long time given the research reporting mechanisms. More likely, it will not happen at all.

6. Rarely are Channels Controlled by the Inventors.

In the case where a technology from a research culture has demonstrated commercial promise, the inventors are often the first to be removed from the communications

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process. Usually research management, or a senior researcher when the inventor is junior, is called upon to articulate the potential and the status of the technology. Rarely can another scientist understand the technology well enough to voice this accurately. Usually this degree of separation simply introduces noise into the channel, and valuable information gets impacted.

Strategic Foreign Investment Promoting Software

Foreign funding of US domestic research has been increasing dramatically for the past two decades. This is particularly true of Asian funding, including Japanese and Korean. Japanese global giants including Mitsubishi, Panasonic, NEC and Matsushita have spent many millions of dollars over the past decade on research subsidiaries in the US. Much of the effort has focused on generating strategic ideas for global software businesses. Yet the juxtaposition of distinct cultures, Japanese, for example, and US, produces serious barriers in the technology transfer chain. Primary among these are barriers to effective information flow. Without knowing what potential opportunities are being generated in their research labs, foreign companies cannot begin to capitalize on them.

Cultural Differences Induce Blockages

1. Hierarchical Organizational Structure

We believe that fast-paced technology markets tend to reward fluid, participatory organizations rather than rigid hierarchical organizations. Yet this clashes acutely with the traditional hierarchical Japanese style of management. From the standpoint of information flow, channeling information up and down a hierarchy slows and filters information, blocking some of it entirely. In software, the need for high bandwidth information flow is thwarted by a hierarchical organization, creating small overloaded articulation points that do not exist in a distributed, adaptive system.

2. Senior-to-Senior, Junior-to-Junior

In Japanese companies, protocol tends to require that senior managers speak to senior managers, junior employees speak to junior employees. In the case of an emerging software technology, this can cause information impaction, for several reasons. First, since those that end up in new software ventures are often young, the people at the heart of the project cannot talk to those who control the venture. Second, Japanese business cultures promote primarily based on seniority or history with the company [2]. In a market where young employees are on the front lines, and a lot of information must travel quickly internally, this protocol probably impacts a lot of information by forcing communications through another articulation point blocks and filters information.

Junior-to-junior communication tends to be a back channel for information sharing. While this channel does provide communication across levels of the hierarchy, junior communications are not potent. Younger employees do not have access to decision-making powers.

3. Window Person

Another Japanese protocol that can constrain crucial flows of information is the demand for a “window person.” In Japanese business cultures a window person is the communication point for an organization, such as a subsidiary. All communication must travel through the window person on its way to other organizations, such as the parent or other business units. In an environment with a need for high information communication bandwidth, window people introduce an impenetrable bottleneck in the flow of information. One person must communicate the needs of the entire project to anyone who controls resources. In addition, it is highly likely that the window person is not the optimal person to control communication. Such a person is usually chosen on the basis of seniority not merit. In addition the character of the window person plays a critical role in information flow. Controlling the window imparts tremendous power. A window person can use the channel to further his/her own career goals instead of the goals of the venture.

4. Communication Tends to Be Formal, Slow

To further complicate matters, communication tends to be formal, especially between US management and Japanese management. For any substantive meetings between US and Japanese management, the agendas for meetings tend to be set weeks or months in advance and drafts of presentations need to be sent weeks in advance. As substantial deviation from the agenda happens infrequently, this limits what can be communicated. Weeks old information in a software venture can be seriously out of date.

5. Individual versus Company

A disparity in expectations, rooted in cultural differences, prevents effective communication. US high-tech employees taking risks expect to be compensated well and to retain some decision rights. Japanese employees expect to sacrifice for the company now to obtain rewards based on seniority later. When issues are discussed under such different assumptions, critical points never get addressed, such as how to maintain appropriate incentives and decision rights.

6. Other Cross-Cultural Chasms

Many cultural differences impede efficient information flows. Among the acknowledged ones are customs associated with gender, language barriers, geographical separation, and social protocols. Some of these prevent or retard the establishment of information channels while others introduce misunderstanding.

4. The Effects of Impacted Information

◊ *Interface Between Cultures Becomes the Main Bottleneck*

We have seen that cultural effects can impact information flow severely. Research labs may slow, even eliminate, channels intentionally to maintain a creative environment. Foreign cultural influences tend to narrow channels and filter the information flow that crosses cultural boundaries. In particular, several Japanese cultural influences tend to reroute information flow rigidly through a few articulation points, some of which lie on the boundary between cultures.

◊ *Information that Crosses Cultures Tends to be Filtered Poorly*

The interface at a cross-cultural boundary not only limits information flow but can cause the information that does get across the boundary to be misinterpreted. Facilitating communication between two cultures requires knowledge and expertise about each culture as well as about the subject to be communicated. In the absence of export facilitation, information can become garbled. Those who control the channel can also cause information to be misinterpreted intentionally. Control of this channel can be very dangerous since it provides bad incentives for use of the channel to the advantage of the controller rather than the advantage of the company.[2]

In the fingerprinting venture, when Silverhead was appointed "window person" he realized that he controlled the channels to Japanese management and to the funding agent, and he reinterpreted information to further his own career goals. He represented that the venture would fail without him at the helm, so that he could get career credit for spinning out a hot new software technology. His interests were not aligned with either those of Denkidyne or those of the fingerprinting venture: since Silverhead wanted career credit for spinning out the venture, his incentives were to get this accomplished as quickly as possible without regard for the long-term prospects for success of the venture itself.

◊ *Impacted Information Produces Ambiguity, with Costs*

With disparate cultures present and constricted information flow on objectives, status, and process, the ambiguity produced tends to exacerbate risk averse behavior and produce influence costs (costs to the mission incurred by parties with vested interests attempting to assert their agendas). The focus of decisions changes from objective, based on what is best for the overall success of the venture to subjective where one party is trying merely to guess the preference of the other. Employees tend to focused on risk aversion and valuable time is diverted to creating the appearance of individual success [5].

Examples of trying to guess what the Japanese wanted instead of making objective decisions based on the success of the project happened repeatedly. One small example was running meetings "Japanese style." When the Japanese management visited, the venture was forced to observe Japanese protocols such as senior to senior communication. In several meetings US management refused to let Atherton talk to the Japanese about the status of various business deals, instead forcing Tiger, a scientist, to do it. A bigger example was the appointment of Silverhead of the venture because US management thought the Japanese wanted him, as opposed to whether or not he was qualified for the job. Examples of influence costs abound also. Tagit in the face of no commercialization first tried to appoint himself project leader, splitting the team and then co-opted, patented and marketed ideas of other scientists as his own, selling himself directly to the business units. The availability of Tagit as an alternative to the original technical team (Tiger, et al) that appeared to be attractive to the Japanese ultimately destroyed the team that had produced the high quality technology.

◊ *Misallocation of Resources*

Without external information channels to the market and internal lines of communication, to management, to a parent, or to funding agents, the effectiveness of resource allocation degrades. In the fingerprinting venture, external and internal blockages were bi-directional: not only did US management not know what the Japanese management wanted but Japanese and US management did not know what the venture needed. As a result, for example, US management was highly reluctant to spend money on travel so that the fingerprinting team could meet with clients to learn about their applications. Yet feedback about

[2] Presented with the opportunity to control a powerful channel of information a US employee would have a much greater propensity to filter the information towards his own perceived ends. In Japan this would be less likely to happen, because the incentives of the individual tend to be much more aligned with company needs. This is because of a variety of business practices such as permanent employment and transferring employees among many different parts of the company [2].

the fingerprinting technology and security drove research and product design. For example in one meeting a West Coast client described a simple method that would completely obliterate the fingerprint in an image simply by using a popular desktop software tool. This meeting pointed out a flaw whose discovery was invaluable. US management was opposed to funding such meetings. On the other hand, US management was willing to spend hundreds of thousands of dollars on unneeded computing hardware.

◊ *Non-optimal Organizational Structure*

With limited information about the markets, the intellectual capital at hand and the status of the technology, designing the correct organizational plan becomes difficult. In environments that are turbulent and innovative *organic structures* that are flexible and adaptive and emphasize lateral rather than vertical communication are considered to be more effective [3, 7] In the fingerprinting venture, US management had little such information. Instead of designing a structure that optimized resources usage by letting employees respond to new demands as their abilities allowed, a hierarchical structure was imposed. For example, one member of the team who was in charge of software development, Graham, had a tremendous talent for marketing. With his stentorian voice, his evangelizing talents were an invaluable marketing tool. He and Atherton handled tasks efficiently such as writing press releases and giving marketing presentations. The flexible structure allowed him to switch hats as needed.

◊ *Bad Funding Decisions*

The source of funding for a software venture is critical to its success. Funding means more than money in a bank account: sophisticated, deep pocket financiers can mean access to management talent, connections to key market players, strategic expertise for a board of directors, and a vested interest in the success of a venture. Today, smart capital attracts top talent to software ventures. Without information flowing from the venture to management about funding needs, the markets for talent, and the needs for strategic business alliances, non-optimal funding decisions may be made.

For the fingerprinting venture funding offers were plentiful. West Coast venture capital firms and strategic partners had expressed very strong interest in the project. Japanese management, however, never knew this. Silverhead controlled the channel to them. He choose the fastest way to get the venture funded, not the best. Money was available internally from a small internal division with spare funds. Silverhead propagated the perception that the Japanese wanted to use internal funding. US management, in the face of perceived Japanese wishes, supported Silverhead. The spin-off experienced great difficulty in attracting a CEO.

◊ *Misdirection of Incentives*

Without knowing who is taking risks and accomplishing critical tasks, and what remuneration they expect, it is virtually impossible to incorporate the right employment incentives [MG92]. In the fingerprinting venture neither US nor Japanese management understood the value of the fingerprinting team. The group that had organized spontaneously to develop the technology had a vested interest in its success and worked extremely well together. Because the tradition in Japanese firms is for fewer expectations of short-term personal gain, the importance of this vested interest was never understood [MG92]. Many dialogues with the Japanese management suggested this. Furthermore, a Japanese vice president repeated the story that as a young scientist he managed to demonstrate commercial promise in one of his inventions and as a result the invention was passed off to a product division. He presented this as a success story for himself although he received no great financial reward for his efforts. The removal of financial incentives and decision rights caused the team to lose interest and chose to quit rather than work under Silverhead, without what they viewed as adequate compensation.

◊ *Financial Loss: Technology, Revenues, Investment, and Intellectual Capital*

The tangible losses that result from blocked information flows in software ventures can be devastating. Business opportunities are lost; product quality plummets; strategic long-term investment in research is not exploited. But perhaps the greatest loss is in intellectual capital. Frustration and poor relations that result from bad information fester, employees leave and with them go years of accumulated knowledge and potential strategic future relationships. This in turn hampers the firm's ability to recruit more talent. In short, blocked information flow can cause a software venture to fail, waste resources, lose talent and ruin professional relationships.

5. Avoiding Impacted Information in Software Ventures

We focus here on suggestions to avoid impacted information when disparate cultural influences are present. Fortunately, inexpensive, reasonably simple solutions exist to help alleviate the most common problems. In general, constructive solutions need to be based on expanding information channels, especially those that cross cultural boundaries, and elevating the quality and status of channel transmissions.

◊ *Define Commercialization Processes*

Research cultures, including those at large industrial labs such as Xerox PARC, often have very ambiguous processes for commercialization or lack any formal processes. Well-defined procedures for commercialization would formalize lines of communication. These lines would allow new ideas with possible commercial value to flow to management.

◊ *Keep the Inventors Involved*

Direct involvement by the inventors can help move ideas into valuable products. The original inventors can greatly facilitate the adaptation of technologies to market demands through the expertise they bring. They also are the most likely to be able to infuse old products with fresh ideas. Furthermore, interested inventors serve as potential evangelists for their technology and are its most likely champions. Replacing the inventors with an *entirely new* cadre will also jeopardize continuity as expertise must be integrated from stage to stage during the incubation-product cycle.

Old models for technology transfer have become far less effective. Inventors now need to become a critical part of the commercialization teams and processes [4]. Thus it is important from the standpoint of information flows to keep inventors informed, motivated with appropriate incentives, and retaining some decision rights.

◊ *Promote Channels to Markets*

To facilitate the commercialization of new ideas, contact between technical players and the market (or business units) should be supported. Such contact could not only educate researchers about what aspects of a given technology may be valuable, but interest from the market may catalyze efforts and excite researchers. These channels can and should be adaptive, growing and shrinking as project needs dictate.

◊ *Promote New Communication Channels to Management*

To commercialize new technologies born from a research environment, new communication mechanisms to management need to be set up. Communications need to become regular and disciplined. Previously unused mechanisms include meetings, status reports and informal presentations. More channels need to be set up to bypass the constrictive articulation points of traditional research reporting.

◊ *Promote Cultural Sophistication on Channels*

Turning ideas into products usually means working with a matrix of different cultures, be they research, commercial or foreign. Boundaries between cultures must be information-permeable. Those who need to communicate on the boundary must seek to understand both cultures with facility. This understanding extends to business protocols, expectations, and social biases. The value of cross cultural communication skills needs to be elevated in organizations. Instead of language courses, for example, which are so common and so ineffective, companies could educate about salient aspects of different cultures.

◊ *The Interface Between Cultures is Critical*

⇒ *It Must Be Neutral*

In a situation where information must flow across a cultural boundary (either internal or external to the company), individuals whose role is to specifically communicate across the boundary should have minimal vested interests in specific outcomes. They should function primarily as facilitators or liaisons. The interests of those on the interface should be the same as those of a facilitator: the generation of a win-win for both sides. To accomplish this the value of the facilitator should be recognized and promoted.

⇒ *It Must Be Broad*

Use a medium-sized group rather than one or two interface people. This would guard against information blockage through information manipulation or limited abilities. The interface should include a wide variety of functional expertise including technical talent.

⇒ *It Must Facilitate Information Flow Not Attenuate It*

Information must flow *through* not *to* the interface layer. The members of the interface should direct information to appropriate individuals on either side. Sources and receivers should be matched according to compatibility and to problem solving potential. At worst, interface members should *interpret* for players on either side. They should never re-articulate.

⇒ *It Must Be Adaptive*

Information channels must grow with the project. The interface must adapt to the changing needs on both sides. The interface should adapt to channels that spring up naturally, facilitating them rather than forcing flows through fixed articulation points.

In the presence of disparate cultures, especially in situations where the demand for information is very high, as it is with emerging technologies, information can become impacted easily. If this happens, the result can be

large financial and intellectual capital losses. The case suggests that when information must cross a cultural boundary, such as a US-managed subsidiary of a foreign parent, or in research arm of a commercial venture, the integrity and management of that boundary is critically important. The majority of the information blockages happen at the boundary. Expanding the boundary channels and populating the boundary with skilled, incentive-neutral communication facilitators could significantly reduce the amount of information that gets impacted. These small investments in raising the information flow could substantially increase the payoffs from investments in US research or other foreign strategic positioning.

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