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RAPID ICT CHANGE AND WORKPLACE KNOWLEDGE OBSOLESCENCE: CAUSES AND PROPOSED SOLUTIONS

Henrik Schneider*

ABSTRACT

The ICT (Information and Communication Technology) revolution is surrounding us everywhere. The workplace is no exception. Learning challenges originating from frequent ICT changes cannot be considered just a generational issue as these technologies possess cognitive characteristics that make learning them a non-trivial effort. Frequent changes witnessed presently add another layer of difficulty with almost constant knowledge obsolescence and knowledge update requirements. Corporate knowledge management initiatives are an essential way to overcome these problems, sometimes as a complement to training, other times even as a substitute. But corporate knowledge management has a great deal to learn from the experiences of online communities, which increasingly organize knowledge in wiki and blog environments, and utilize tags, feeds, aggregators and links to better connect the pieces. In addition to solutions which originate from within companies, governmental policy makers can play a critical role in successful ICT adaptation in the workplace. These policy actions and their success in an environment vary with the political attitude of a regime and the level of influence it chooses to wield; still, such actions can play a key role in helping both employees and employers at this critical time of ICT changes.

Keywords: Workplace, ICT, Knowledge, Obsolescence, Management, Policy

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Introduction

ICT changes are visible in many aspects of our lives. It is changing how we communicate, learn and seek entertainment. Our work environments are no exception. There might be differences in the level of impact at various sectors, but the changes are apparent everywhere. This article aims to describe the fundamentals of why and how this constant change in the workplace ICT environment causes knowledge-related problems (obsolescence and frequent updating) and what efforts can be successful in overcoming these obstacles. To analyze this phenomenon one must not focus only on the individual who suffers these problems. The role of company as the technology adapting organization must also be taken into account as many of the possible solutions lie within those boundaries. But there is one additional participant: the governmental policymaker. Although *laissez-faire* theorists would claim that employers and employees should solve these without any policy intervention, I'll argue and attest with case studies that governmental involvement can indeed prove to be successful for both other parties (employees and companies) in these processes, but only if those means are well chosen for the specific environment they are applied in (showing cases of failure also). The above described relations among the key stakeholders are shown on figure 1:

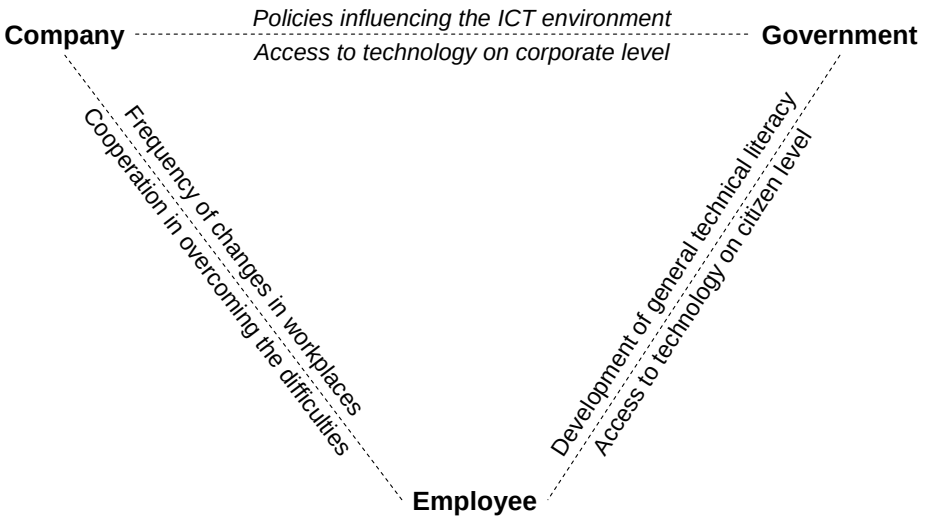

Figure 1: Key players in workplace technology adaptation

The first chapter will introduce the origins of the difficulties involved in mastering new ICT tools and processes at workplaces, then describes the general reactions from employees and finally discusses the methods (focusing on knowledge management in detail) available to employers to overcome the obstacles created by ICT infrastructure changes.

The second chapter follows by investigating what corporate knowledge management can learn from the experiences of online communities. How these are better at certain fields of flexible knowledge organization and enhancement of participation. Also how the interrelation and linkage of such developed knowledge pieces is contributing to their value and success.

And finally, the third chapter outlines (using case studies from different locations and regimes) how policymakers can help in the workplace adaptation to rapid ICT changes. Showing also how much the results of policy actions are dependent on the political attitude of the regimes and the level of influence the governments are aiming to take on the ICT environment.

1. General principles of acquiring ICT knowledge at workplaces

1.1 What makes ICT hard to learn?

The advancements in electronics and computer technology made the use of computers affordable and useful to companies decades before the Internet age of the 90's. But early adaptations were only used for high-volume, robust data processing and archiving tasks. The real breakthrough at the employee level only arrived with the rapidly spreading use of the World Wide Web and email. These technologies soon become the target of scientific analysis of learning and adaptation. Dr. Anne Russell (Russell, 1995) identified six stages in the learning of new technologies in her case study of "naïve" adult email users:

1) Awareness;
2) Learning the process;
3) Understanding and application of the process;
4) Familiarity and confidence;
5) Adaptation to other contexts;
6) Creative application to new contexts.

The length of these phases depends on the individual's capabilities, previous experiences and, of course, personal feelings about new technologies. Two separate attitudes dominate the reactions in the first phase, when the user is aware of the technology but does not use it yet: interest in the new, or deliberate avoidance of technology. Differences in the initial reaction change the subsequent process, but do not determine success or failure on their own. Problems and frustrations are not rare in the second and third phase, and the fourth phase brings a breakthrough, when the user moves beyond step-by-step instructions. In the final two phases the technology becomes almost invisible and the acquired knowledge becomes the source of new creative applications of the new tool. The identification of these processes has been very important, because as Russell says: "*naïve*

email users appreciate knowing these six stages" as it helps them *"realize that understanding will come in time,"* especially in the first stages when frustration and failure are common. Other early studies concentrated more on the overall changes in the corporate educational environment, like "The future of work in the digital diaspora" by David N. Cooper (Cooper, 1997). There Cooper emphasized the increasing importance of distance learning and argued that learning will cease to exist as a separate process, but will be integrated into the everyday business activities. He also argued that technology will not be used just to solve first-level problems, but will provide a continuous opportunity to learn. According to Cooper, this also increases pressure upon higher educational institutions to equip students with a readiness for lifelong learning and critical problem-solving skills. Finally he argues that employees at all levels will have to have a better sense of technology outside of their own profession.

One of the industries most affected by ICT change is telecommunications (Hwang, 2003), as it is not only subject to workplace modernization, but also provides ICT services to other organizations and individuals. The rapid technological advancements in the last two decades in this sector have put great pressure to adapt on employees in all organizational areas (from field technicians to administration staff, from subordinates to top management). All segments of the industry are affected, though from different perspectives. For example, the two most prominent segments have faced the following challenges:

- Wireline segment: this has been on the scene for the longest period, so the biggest challenge here is to update the knowledge of people who had worked in an almost constant environment (using basically the same methods, tools and technologies for more than 15-20 years) before the rapid changes of this decade occurred.
- Wireless segment: digital mobile service providers have experienced ICT changes from the beginning of their operation, so the changes do not affect them as drastically. Their problems mainly lie in short technological life-cycles and endless innovation (both technological and in service).

(The challenge of adaptation to new technologies has affected other telecom segments in very similar ways to the two above, e.g. challenges facing broadcasting have been similar

to those in wireline, and ISPs have struggled with the same issues that confront the wireless segment.)

The original stages of knowledge adaptation defined by Russell might not apply to the present telecom sector, because:

a) Here we can no longer consider the average employee "naïve". In addition to the generally high computer literacy (often as a result of hiring criteria) in such a high-tech sector, it is also safe to assume that at the technology-focused organizational units there are a lot of so-called "technological-focused expansive professionals", a type described by London and Diamante (London & Diamante, 2002) with the main attributes of *"high self-directed energy"*, *"continuous learning"* and *"action orientation"*.

b) The technology used in telecommunications is much more complicated than email. The cognitive demands of the new ICT advancements are not understood well enough (Torraco, 2002), but certain cognitive characteristics of complex technologies have been identified (as summarized by Torraco): contingent versus deterministic tasks, distancing technologies, stochastic events and systemic interdependence.

- *Contingent versus deterministic tasks*: decreasingly routine work with more complex and contingent tasks (Pentland, 1997). It is impossible to give a manual for every possible situation and even a certain task might have to be executed through different means. This requires high self-guidance and problem solving, based on a limited set of system information and training.
- *Distancing technologies*: physical separation (i.e. through controls, sensors, displays) from the actual monitored phenomena (Woods, O'Brien, & Hanes, 1987; Zuboff, 1988). It is not intuitive to process the information provided on a screen compared to the previous era when hands-on experience (e.g. visible signs right on the machine or actual sounds of equipment) provided the basis for mental reconstruction of what was happening. Such an inner model provides the foundation for decision making, so a flaw in mental reconstruction can lead to wrong decisions.

- *Stochastic events*: randomly occuring events (Weick, 1990) and flexible system operations (Norros, 1996). Errors and unexpected events can arise from incomplete tests or from incompatibility between different hardware or software environments. The challenge is to overcome strong initial emotional reactions (which anyone who has ever seen a so-called "blue screen of death" has experienced) and to find the way back to logical course of actions. The goal is to avoid premature task determination, rushed by an emotional outburst.
- *Systemic interdependence*: working in a chain or network configuration both from human and technological standpoints (Adler, 1986). No employee knows all of the information used within the company. Not only because of the large amount of data, but also because there is no need to do so. Everyone in a corporate environment must learn to fulfill his or her own role in the information flow, to know where to find the inputs and where to put the outputs. It is important for each employee to learn to depend on the work of coworkers who precede him or her in a process and to understand the dependencies of and responsibilities to the employees who follow.

c) In addition to the initial obstacles of acquiring technological knowledge in the workplace, it is also critical to adapt to the constant change and subsequent knowledge obsolescence that occurs. These changes can further reduce one's willingness to adapt and thus decrease efficiency of learning.

The telecommunications industry is highly competitive, both in the global marketplace and between employees within each firm. Throughout the world today, telecom companies are preferred targets of job seekers, but to be successful – once they are inside - they have to adapt frequently to new technological environments.

1.2 Employee reactions to the introduction of new technologies

There are two distinct behaviors exhibited by employees facing new technological challenges: acceptance and rejection. (For purposes of this paper, ignorance is considered as a special form of rejection, as it either leads to loss of job or high personal dissatisfaction, which will in turn lead to rejection or a forced acceptance to avoid the

marked consequences). The choice is made considering many factors, e.g. personal interest, ambition, capabilities, opportunities and even the overall suspected economical situation of the firm (i.e. whether layoffs can be expected or not).

The support of employees is highly dependent on the type of new development the company tries to introduce (Zwick, 2002). Previous studies (Daniel, 1987; Daniel & Hogarth, 1990) have already shown that changes in the organization of work alone (independent of technological investment) trigger higher resistance than the introduction of technological innovation alone. Based on survey responses from a large pool of firms introducing innovations, Zwick has proven the validity of the following three main hypotheses:

1) *Employee resistance is higher in firms that face negative business prospects;*
2) *The impact of expected employment reduction on internal resistance against innovation is stronger for lower qualified employees than for higher qualified employees;*
3) *Employee resistance is higher in firms that plan to introduce other innovations or organizational changes.*

The first effect is especially critical in the telecommunications sector not just internally, but externally (from a customer perspective) too; in a non-, or slowly-growing global economy many new services struggle to achieve the required scale of business. Also, the telecom industry worldwide has been heavily prone to layoff waves in the last decade (e.g. even the prospering wireline incumbents have reduced staff by more than 50% in the last decade, and such reductions may be expected in regions like Eastern and Southeastern Europe, where this process is still at an early stage and where overstaffed companies are a heritage of communist regimes.).

The possibility of job loss raises resistance toward ICT change so it is especially interesting that the two groups most prone to layoffs are those holding highly routine and middle management positions, according to the findings of Landry, Mahesh and Hartman (Landry et al., 2005). In the case of highly routine jobs, the automation of work poses the

threat. For middle management the danger of headcount reduction originates from the fact that with more and more skilled and self-guided subordinates, the main tasks of a manager shift from controlling and informing to enabling and coaching. This can eliminate entire levels from the traditional "chain of command" and increase the number of employees supervised by one manager (i.e. broadening of the span of control).

Another important factor in terms of reaction to changes in a technology environment is the level of education. The correlation between education level and resistance is not surprising as it is usually easier for higher qualified personnel to find a new job if the introduction of new technologies finally result in headcount reduction; higher-qualified employees are better at accommodating to such changing environments. This conclusion can also be supported by the regularly detected negative correlation between unemployment rates and qualification levels (Acemoglu & Pischke, 1999). As Zwick also points out, enhanced knowledge requirements can be considered to require an investment from the affected employees, and rationally the expected investment should match the expected benefits. If the benefits are not clear, the relevant investment cannot be expected either. This investment is not mainly monetary (as the company usually pays the associated expenses), but the significance – from the perspective of the employee - of the cognitive efforts and the sacrifice of some relaxation/family/personal time must not be underestimated. Workers also experience great loss of value when their knowledge becomes obsolete. There are five main types of skill obsolescence (Loo et al., 2001): wear, atrophy, job-specific, obsolescence by market and company specific. In the case of workplace ICT environment changes, job-specific obsolescence is the most significant as radical changes occur in the individual work processes. Atrophy might also show up in the telecommunications industry since in the event of a technology change the "old" environment does not get discarded in its entirety, but might operate parallel with the new one for a period of time (e.g. as seen with the changes between analog, digital, GSM and 3rd generational mobile networks). In these cases, atrophy-type obsolescence can show up when knowledge of the previous-generation ICT environment may still be required in rare instances, but without practice those skill erode or in extreme cases even become extinct.

London and Diamante describe another important factor in their aforementioned study: personal differences in handling technology changes. “Technological-focused expansive employees” will enjoy the variety of new ICT enhancements, but will be bored during periods of long-term constant operations. On the other hand, technological non-expansive professionals will tend to value a non-changing technological environment and can easily be frustrated by the challenges of knowledge-updating activities.

Handling the above-outlined employee reactions is not an easy task for companies. The following section describes the basic toolset available to firms facing that challenge.

1.3 Ways for employers to handle employee reactions

There are various instruments a company can use to help its employees overcome the difficulties of learning new technologies and to make them interested in doing so. The training and knowledge management efforts described below are the most common areas. Training, new forms of e-learning, and so called “blended learning” are much better covered in the wide literature on the subject so this section gives only a few examples in that area and will put greater emphasis on the practices of knowledge management. The main reason for this is that knowledge management is generally seen more as a tool to better utilize status quo knowledge assets and less an aid in change. I’ll argue that the latter function can be equally important and prove it with examples in the forthcoming sections.

The most obvious means of effecting knowledge update is corporate training. From classroom training and workplace coaching, to (increasingly internet-based) self-studies, to non-orthodox initiatives, any method can work, depending on the requirements of the new technology and associated knowledge required. An example of a telecommunication firm applying new techniques in acquiring required skills is the case of British Telecom (BT) in partnership with the Communication Workers’ Union (CWU) and the London University’s Queen Mary and Westfield College (Stoney, 2002). As a response to

deficient skill levels at certain technological areas of its employee base, BT collaborated with the university to start a (mostly online) course for BT employees, during which they are to remain in a full-time work schedule and are expected to study 16 hours each week on their own. The course is especially aimed at non-management employees without previous access to higher education and at "*helping members to overcome any resistance to learning they may have built up because of age, low self-esteem or having had an unhappy time at school*". There are different results at different BT organizations, highly dependent on present management dedication and believe in the program, but overall the initiative is considered to be successful. There is a growing number of strategic partnerships between corporation and higher educational institutions (Elmuti et al., 2005), where the educational programs outlined above can be extended with technology transfers and joint projects. Another unorthodox example is the telephone-based training of call centre staff at UK-based Nationwide, that has not only reduced costs ("*up to 40% of the cost of a tradition training course is taken up by travel and accommodation*"), but also better simulates real-life call centre experiences (Pollitt, 2004) through the deeper involvement of the new technology itself.

Another important tool is knowledge management (KM). In the early stages of learning and adapting to new technologies, users will, in most cases, need support and assistance. Experience-sharing, expert directories, discussion opportunities and codified knowledge repositories are all effective in overcoming periods of frustration and in solving arising problems. An example that resulted both in easier adaptation of new technologies in various fields (from field technicians to legacy system users) and, as a consequence, measurable financial improvements, can be seen at Bouygues Telecom (Peltier and Meinganat, 2002).

The overview of a KM model can be seen in Figure 2, based on the research findings of Hall and Andriani (Hall and Andriani, 2002):

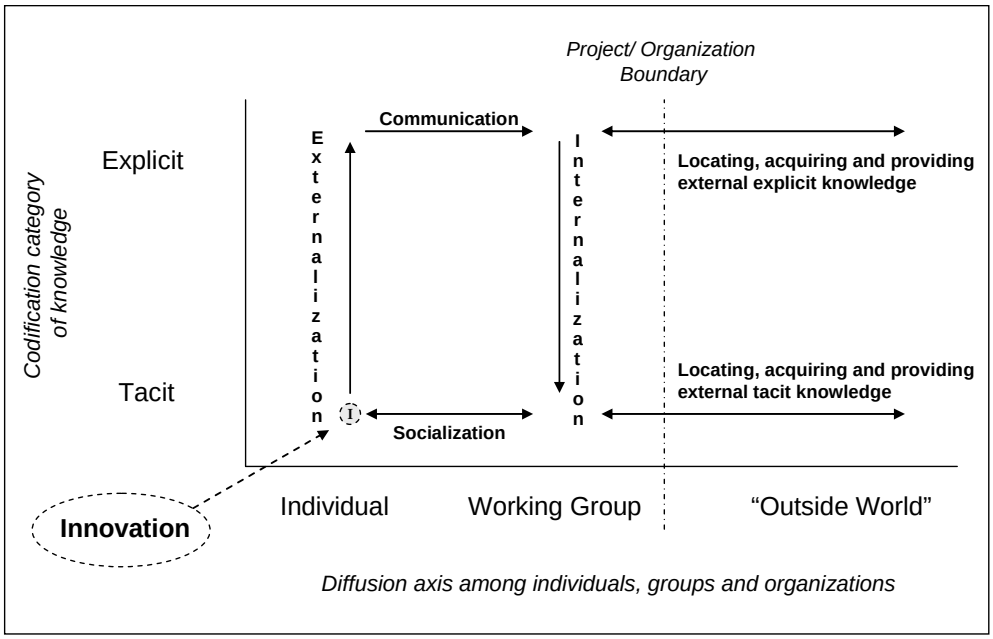

Figure 2: Knowledge management process model
(based on Hall and Andriani, 2002 - Figure 2)

The horizontal (diffusion) axis is more self-explanatory and simply refers to the extent to which the knowledge is shared among internal and external groups. The vertical (codification) axis represents the capability to communicate knowledge in the form of written or verbal language, based on the concepts of Polányi (Polányi, 1974). "Tacit," in this sense, means knowledge that consists of particles of experience and routine that is hard to precisely describe or share. Passing on of tacit knowledge thus requires more personal working relationships and communications, learning by doing, and working in groups. Explicit knowledge, on the other hand, is easy to express simply using written language, even without direct personal connection.

These are not IT system-specific concepts. For example, if you think about a conference, you can easily recognize the same patterns: the writing of proceedings and talks are examples of *externalization*, reading and listening to these are *internalization*, lunches are an obvious form of *socialization*, and so on.

Different companies require highly different balances of the KM processes pictured in Figure 2 depending on various corporate characteristics, such as:

- the industry they are active in,
- the business processes they focus on,
- the extent to which technologies are used to produce the products and services,
- the number of patents and licenses that have to be handled,
- the amount of innovation (research and development) produced inside the company,
- the fluctuation of employees,
- and the geographical separation of business units.

Knowledge management has had its hype cycle as have many other such business practices. In its early days many saw a new miracle tool in its practical applications, largely based on the theories of Polányi. The prospect of capturing, storing and reusing not only explicit, but tacit (sometimes referred to as implicit) knowledge raised high expectations. New knowledge related executive positions were created and much energy was dedicated to the development of the necessary IT infrastructures. Big consulting firms have become classic case studies of knowledge management practices (not surprisingly, as many of the KM authors worked at these companies), because the success of these organizations is highly dependent on the efficiency with which they transfer experiences from one engagement to another, and from one continent to another (Davenport and Prusak, 2000).

The definition of knowledge management varies from author to author. Here are two very different points of view:

- *A management perspective*: “Knowledge Management is a systematic and organized approach to improve the organization’s ability to mobilize knowledge to enhance performance” (KPMG, 2002).
- *Information theory perspective*: “Knowledge management is the systematic use of data to test a hypothesis. De facto, it is the formulation of a likelihood function.” (Singpurwalla, 2003:363).

Beside being susceptible to multiple definitions, this diverse research area has also inspired various overview summaries in the literature (a few examples are: Fehér, 2002; Liao, 2003; Schneider, 2004). KM has not delivered the expected results in every case, sometimes because lacking technology, and sometimes because of the slow pace of human contributions. With the rapid advancements in IT environment, the computational environment is rarely an obstacle anymore, thus more efforts can be allocated to handle the human participatory side (Scholl et al., 2004). There are two traditional ways to handle contributions. The first is a repository model that retains the submitted documents (whatever the media) and offers retrieval capabilities to make use of them. Usually there is a way to add descriptions and keywords and the structure is generally a predefined categorization based on the business (e.g. market units), practices (e.g. type of services) and culture (e.g. type of documents) of the company. Rating and evaluation of items is also a common feature to help future users and give feedback to owners. The second way to handle contributions concentrates on enhancing employee discourse, often through intranet-based electronic forums and bulletin boards. Each discussion thread is organized around one topic and users submit their messages (questions, answers, opinions) one after another.

The initial enthusiasm over KM led some companies develop separate organizational units to plan and manage KM initiatives, and sometimes even to establish a new board membership position: the Chief Knowledge Officer (CKO). In other cases different organizational units developed tools and policies that supported their unique requirements and this led to separate (sometimes even silo-type) systems, each of which could support only one dedicated unit. The latter approach can be easy to implement and manage from the perspective of the individual units, but may create the result that dozens of parallel, very similar projects are difficult or impossible to connect and these use much more corporate resources than would a centrally led project. A fully centralized KM initiative is also not optimal, because the very different requirements of units can only be solved with one system if it is very complicated and robust, and as a result expensive to build and difficult to successfully implement. One could easily come to the conclusion that the optimal solution could be between the two models and that firms are looking for this

"golden path". A very recent Delphi study on the future of KM shows that it is not the case (Scholl et al., 2004). Companies are more and more integrating the KM into their standard business process, without real central control. This signals strong preference for one extreme of KM modeling, but the real change in attitude is with regard to resources. It shows a shift from the original, highly IT-centric KM approach to a state where human aspects rank higher on the stakeholder's agenda than ever before for knowledge management.

1.4 Incentives for change

As with every initiative that is launched to help employees, it is always important to make sure the employees understand what can be expected during the process, as knowing what is ahead enhances acceptance and success rate.

As discussed in the previous section, employers must not forget that they are not the only ones making an investment, though in most cases they are the only ones to invest monetarily. It is clear that monetary investment does not pay off if it is not accompanied with the cooperative efforts of the employee. This is the point where incentives to change become a key focus area. These incentives can be any combination of the following categories:

- Direct: incorporating instant rewards in the process of knowledge update in such a way that employees will want to participate and not feel as if it is an unnecessary burden. Elements can range from bonuses tied to completion, through training requirements built into career progress, to selection of attractive venues for learning and knowledge sharing.
- Indirect: making sure that the introduction of the innovation gathers the least possible resistance, by addressing issues of rejection (listed in previous section). For example: assurance of job safety and openness of communications concerning upcoming innovations.

It may be feasible to show the tangible benefits of knowledge updating and upgrading through data analysis, if the necessary wide-range statistical data is available. Such deep and long term data lines are hard to find, an example study successfully observing them has been conducted in Switzerland (Wolter & Weber, 1999). Interestingly, these findings show that in the long run, wage structure is linked more directly to years of service than to level of education. They also provide statistical evidence that an increase in education level among elder workers does not pay them back the invested time and money. (It is important to remark that the data series used in the research of Wolter and Weber are mainly from 1996 and that the last decade could have brought many changes in this perspective.)

And as proved by the research of Russell quoted at the beginning of this chapter, for every initiative launched with the goal of helping employees it is always important to make sure they understand what can be expected during the process, as knowing what's ahead enhances acceptance and success rate.

2. What can corporate knowledge management learn from online communities?

In the first chapter the two most traditional ways of managing knowledge were introduced: storage and retrieval, and community connection. These possess different strengths and weaknesses and target different types of knowledge. The development of corporate knowledge has many routes, from content integration to the new concept of complex adaptive systems (Manville, 1999). Recent initiatives by Internet communities offer new perspectives on knowledge sharing using the relatively recent innovations of blogs, wikis, tags and feeds. The following sections discuss how these can be used in a workplace environment for knowledge management purposes.

2.1 Blog: The personal point of view

According to Wikipedia (the free online encyclopedia, see the next section for more on wikis), "A weblog, web log or simply a blog, is a web application which contains periodic time-stamped posts on a common webpage". Subjects can range from a personal life journal to personal journalism intended to complement or sometimes even challenge the mainstream media. A blog may be published by one person or a group of people, but regularly will reflect a consistent point of view through a series of entries. Topics within a given blog can be wide-ranging and cover different phenomena or can be narrowed down to a niche discussion (e.g. a highly specialized technical blog).

What good can blogs do for a business? They present a personal point of view in a conversation that is usually structured for publishing and archiving opinions and commentary in a continuous flow, and as such, blogs offer limited capabilities for easy retrieval of past stories (barring a lucky Google search, when you are fortunate enough to find a blog entry that relates to what you were looking for). Firms can also get disturbed by the perceived questionable quality and authenticity of the information in personal

blogs. Still, it seems companies are starting to realize the potential in blogs. For example, recently the cover of BusinessWeek declared in a bold message that “Blogs will change your business” (BusinessWeek, 2005). There are two dominant ways apparent currently for businesses to justify the use of blogs in the context of corporate knowledge management. The first is the value of employee blogs that focus on a very narrow topic, thus making them an easy source to search on that issue, without having the burden of trying to crawl through thick layers of off-topic content. These employee blogs already exist on various topics, from technology to financial management to journalism (Ives and Watlington, 2005; Nagel, 2004). If reserved for internal use, these can aid in communication between different organizational units within a company. Thus, effective project management is highly important. If the employee blog is available to everyone, the firm might give away freely part of its valuable gathered knowledge, but when more professionals in different environments join the online discourse, a whole new set of valuable knowledge might emerge.

The second way a company can use blogs in its KM system relates not to internal knowledge organization, but to customer relations. Blogs can facilitate the acquisition of customer knowledge and experiences, to be internalized into business processes and product development. Blogs are also a very effecting marketing and PR tool, and may be having a bigger effect on those fields than on knowledge management (BusinessWeek, 2005).

Individuals, not companies, have driven (and continue to drive) the rapid growth of the blogging phenomenon. Thus, early adaptors of blogging as a business tool were individual professionals or consultants. What are the advantages for them in having a blog instead of just a frequently updated web page? First, blogs offer a personal point of view, using, referring to, and analyzing materials (e.g. work or blog entries of others) that otherwise would not be appropriate on a business home page (e.g. because of the too casual style or perspective). Second, a blog offers an opportunity for discourse with the outside world, including potential customers, competitors and totally anonymous surfers. Third, the blogging model may simply be used to get attention. Most of these one-person

blogs are not branded all over with their own business advertisements (at least not obviously), and this is a wise way to avoid losing authenticity. The savvy consultant-bloggers know that if they are able to build their reputation by smart and interesting entries, this could lead to actual paid projects.

A blog can also help an author realize a book idea, first by gathering early comments and reactions at a peer level, later by getting attention from publishers and helping in the book proposal phase, and finally by generating hype when the book is already out.

Large companies are also slowly getting up to speed with blogging. Examples are official corporate blogs written by individuals inside organizations, such as Microsoft [blogs.msdn.com], Sun [blogs.sun.com], IBM [www.ibm.com/developerworks/blogs] and GM [gmblogs.com]. There is stronger-than-usual control over these blogs in term of language and content and there is an efficient incentive for blog contributors to stay within those boundaries, as none of them want to lose their job, but even in this form blogging offers a great means for customer-company interaction, gathering ideas and comments, and answering questions.

2.2 Wiki: The voice of the many

A wiki is almost an inside out blog, containing well defined articles that can be edited by all members of a particular online community. This structure allows an in depth and continuously evolving view on these articles. (See Wikipedia [wikipedia.org] as a free, successful example online). When one needs help repeatedly within a certain field, a wiki makes it easier to identify electronic locations to revisit to check out the current state of shared knowledge and to articulate one's own ideas or questions. This format recalls the way a Frequently Asked Questions (FAQ) document works, but in this case the changes are instantaneous, and the tasks of editing and distribution are not in the hands of a dedicated group of people but shared among all users. A wiki can also be used in conjunction with information developed outside of the wiki. For example, a wiki-double may be used to gather notes and comments on the draft of a document. The reason for

this setup is that in many corporate knowledge sharing environments (e.g. a repository of project deliverables or a collection of policies) it might be undesirable to let users directly edit the original content, but it is still useful to give a concise overview of opinions. Also, a wiki is a great way to build and share meeting minutes as everyone can add information; if one thinks there are incomplete or misleading parts in the most current version contributed by others, he or she can change those parts. This provides a tool for reaching a consensus that is valuable to refer to later.

There are two dominant theories of how mutually agreed-to (knowledge) content evolves in a wiki environment (Wales, 2005). The first is a pseudo-Darwinian emergence theory that in the long run, with the contribution of many users who do not know each other but contribute according to their own knowledge and have equal power, “articles will eventually reach a steady state that corresponds to the highest degree of accuracy”. The second theory says that the development of articles is mainly the work of a small community of thoughtful users, who through their interactions earn a higher reputation that entitles them to have special editing privileges. The second theory has been proven to work by Wikipedia. Thus when companies try to implement wiki environments to pursue the externalization of employee knowledge, they should consider facilitating the development of heavily contributing smaller communities, rather than trying to force each and every employee to participate. This is somewhat different from the old fashioned model where, for example at some companies, all employees are rated on the level of their contribution to the shared company knowledge base (Davenport and Prusak, 2000). Also, because it is hard to pre-select the best people to regularly contribute to the wiki, companies have to take the risk sometimes of waiting for the emergence of the right contributors. Hiring specifically for this job will not solve the problem either, as the purpose is not the existence of the wiki; it should not be a full time job to be a wiki knowledge champion, but rather it should be a small everyday activity of those who like to do so. This does not mean employees cannot or should not be compensated for the extra efforts, but making the wiki a small piece of the everyday business puzzle game is more effective than setting up a new, separate puzzle with new pieces.

2.3 Tag: A more natural way of organizing and retrieving knowledge

Both blog and wiki solutions concentrate on the contribution side of knowledge sharing, but retrieval is equally important. This is where tags can play a role, even in the traditional KM environment. “Tagging” means attaching small descriptive chunks of information (generally a few words) to a document submitted to the repository. Similar theoretical approaches were proposed in the late 1990s for use in knowledge management initiatives. Then, the reason behind this movement was the realization that static predefined categorization is too rigid and ambiguous for large-scale use (Manville, 1999). The original idea in Manville’s article was to consider the corporate knowledge management system a Complex Adaptive System (CAS), and thus to use the CAS principle of “tagging” to organize knowledge by letting the original contributors label the items themselves. This bottom up organization, Manville proposed, would make it easier to use and retrieve the required knowledge.

The real strength of contemporary “tagging mechanisms” can be best demonstrated by the social bookmark sites del.icio.us [del.icio.us] and technorati [www.technorati.com]. In these systems, people with similar interests can share resources in an easy and organized fashion, each user submitting URLs with his/her own description of tags. If different URLs are added with the same tag (by the same or different users) it adds a new axis of linkage between the submitted items via the shared tag(s). Also, when users add URLs with their own tags, if any other user later adds the same URL with new tags, these add up to enrich the descriptive information pool related to that URL. Thus, I would argue that what makes tagging different from regular keyword information is that tags can be attached to items not only by the owner or publisher of the piece (as suggested by the Manville’s work), but from the readers or peer contributors too.

The functionalities of categorization and attaching keywords to data have been available for a long time and both are regularly incorporated into search functionality. What difference can tags make in this field? The predefined categories of traditional KM systems are good for very specialized materials, but if topics overlap categories, the

decision of which way to categorize them inserts a bias (or unnecessary redundancy) in the system. To use the case of a big consulting company again, it is almost impossible to create a categorization deep enough to fit all of the wide variety of engagements. However, if tags were added to these knowledge items by readers as well contributors, a more practical and natural method of categorization could emerge from the dynamically evolving tag pool. These new categories would most probably fail to comply with the "mece" (mutually exclusive and collectively exhaustive) criteria, but could organize the knowledge to much more nearly approximate practical experience, and could also provide the possibility of continuous evolvement for the categories.

With keywords the situation is a little different, as they offer the author the freedom to enter whatever information he or she feels is important. As opposed to in online communities, in corporate knowledge management systems it is rare that users would add the exact same materials (like project deliverables) as someone else previously. Thus such methods of additive enrichment as the keyword or tag pool cannot work. The alternative would be to later simply add tags to an already submitted knowledge item, based on the reader's experiences with it. If an employee retrieves an item and finds that it was not what he or she has been looking for because of the lack of proper description, additional information can be added to increase the future usefulness of that piece. What is the incentive to make this contribution? If others do it as well, the reward is a better description and thus better search results for everyone, as proven in open online communities (e.g. del.icio.us). A somewhat similar traditional solution in knowledge management systems is the functionality for users to rate knowledge items after retrieval and usage, but that again might lead to a dead end; in a professional environment most employees might not want to conflict with a co-worker by submitting low ratings since it is impossible to know what influence that might have on their career. Employee trust in anonymity can often also be low enough that they do not feel safe causing such conflict.

2.4. Feeds: let them come to me

Feeds (e.g. RSS, or OPML) and aggregation of different sources also offer great contributions to the corporate knowledge management world. These are methods to get messages about what is new at a selected Internet page (either a well respected newspaper, like the New York Times, or just a personal website), without constantly have to return to check for updates. By using dedicated feed readers and aggregator services, one can select the sources from which they are interested in receiving updates.

The amount of information in company legacy systems and data warehouses is tremendous. The ability to customize and focus the view on that information is critical. Feeds and aggregators offer an easy and personally customizable way to construct that view. When personal requirements change (certain sources lose importance, while others emerge), it is easy for individuals to modify their preferences to best fit their current needs. Best of all, the feeds themselves can be integrated. One person may be better at collecting and arranging sources and data about a particular topic, while others are better in different areas. If participants have access to the collections of their peers too, everyone will have much better overall access to the best sources than they would if everyone had organized everything separately. In a corporate knowledge management environment this way of leveraging a social network has great potential. According to studies, most people find business knowledge through other people in their social network and not directly from the system (Ives, 2005 quoting Anklam, 2005). Aggregating news and information from existing external knowledge sources can aid business intelligence efforts, and creating collective pieces of data about internal knowledge items helps employees more quickly locate required knowledge and keep informed about interesting new submissions.

2.5 Differences to consider between online and corporate communities

Can every experience of online communities be directly applied in a corporate knowledge management environment? The answer is “no” and there are at least two important reasons for this: management decision-making and differentiated levels of access to items. First, in a corporate environment there is always a top level of management which will shape (or at least have the ability to shape) the business path and the internal environment of the company. The operation of an internal knowledge management practice can be democratized to a great extent, but at the end of the day the decisions are still made in the board room, without the presence or vote of lower-level employees. What is important or what is irrelevant to the company is decided there. There is often a somewhat similar (although reputation-based) structure and hierarchy in online communities, but the in the truly open online group the power of individual users is far more equal than in the typical business organization. The second reason originates from the fact that not all employees have equal rights to access all company information. Certain figures, performance indexes, technology and process descriptions, or even customer feedback could be considered valuable corporate secrets, accessible only by a select few authorized users. Online community knowledge sharing on the other hand is specially built upon the basis of equal right to information for everyone. One of the most important purposes of these initiatives is to enable people to find and use information, which otherwise would be very hard to locate in the practically infinite dimensions of the Internet. Overcoming the problems originating from the above differences between online communities and corporate environments is not trivial and is definitely not an easy task. Both management structures and access controls are fundamental parameters in the relevant systems of operation.

For both wikis and blogs, it is also important to remark that the links between items possess another layer of power regularly missing from classic knowledge management solutions. These links offer an opportunity to aid the reuse of earlier experiences, by directly connecting related items. They also give more authenticity to references by

actually pointing to the facts and reasons from which they originate. Links are not an exclusive feature of blogs and wikis and could be implemented even in traditional knowledge management environments. Thus further research would be required on a) to what extent community-based corporate knowledge management systems require such massive cross-linking; b) what is the balance of relevant internal and external links in those knowledge items.

Another theme yet to show its true potential in business environments is podcasting, that is, audio information made available via blog distribution methods. Is there a justification for providing voice-based information (as opposed to a much more quickly searchable and scrollable text) in already over-scheduled workplaces? Might companies want their employees to listen to audio feeds on their commute to their job? Or will podcasting stay at the level of personal activities: entertainment and self study?

Knowledge management has started to mature from a buzzword and an IT-centric concept into a real, useful, human-centric business capability. There is a lot companies can learn from the successful and widespread applications of online communities, even though there is inherent risk in applying these more or less self-regulated and democratic models to their own internal processes. On the other hand, modifications to lower or eliminate risk can destroy the core value of these activities. There are reasons to believe that tools such as blogs, wikis and tags could add value to corporate KM environments. We don’t yet know that companies will fail if they don’t leverage these possibilities, but they will certainly miss an opportunity to get smarter, and markets tend to punish that attitude.

3. Policy aspects of rapid workplace ICT changes

3.1 Introduction to policy aspects of ICT development

So far I have discussed the employee and employer roles in solving the knowledge-related problems of rapid workplace ICT changes. I described how workers generally react and what effective means exist for firms to respond to these reactions. In the real world, there is another factor to consider: the policy framework and the general intentions of governmental policy makers. In most cases, policy makers have neither the ability nor the intent to stop the adaptation of new technologies, but they may try to limit the uses. They can help to protect employees, but in doing so interfere with market conditions by introducing more regulation.

There are many studies available discussing the positive effects of ICT business introduction and how it can drive growth in economic welfare. For examples, see the literature review of Galloway and Mochrie (Galloway, et al., 2005) and the studies of Nesson, Maclay, Moore and Palfrey (BOLD, 2003). These prove that policy interventions to advance the ICT supply side and to increase ICT awareness through education have great positive affects, especially in rural areas where equivalent private efforts are slow to gain momentum (due to clear risks related to return on investment). As argued by Galloway (Galloway et al., 2004), policy steps must not stop at simply investing in physical ICT infrastructure; it is also vital to achieve the necessary ICT skill base and to encourage reasons for and commitment to using new technologies. On-site help and "consulting" to aid business is also important, beside aid, investments and rhetoric delivered from a distance.

History also provides examples of when governments have tried to limit the development and power of other nations by denying them access to selected technology. The most prominent 20th century case is the Cocom (Coordinating Committee on Multilateral Export Controls) list of the Cold War. This initiative was a cooperation of 16 nations

worldwide (Belgium, Britain, Canada, Denmark, the Federal Republic of Germany West Germany , France, Greece, Italy, Japan, Luxembourg, the Netherlands, Norway, Portugal, Spain, Turkey, and the United States) and was aimed to prevent military-related high-technology innovations (covering basically any advanced ICT at that time) from getting to the Eastern Bloc ruled by the Soviet Union. The restrictions officially ended in 1994, but already in 1999 new, similar recommendations were proposed by the Cox report (Cox report, 1999) in response to the threat of nuclear secrets stolen by China. Limited access to the newest advancements in technology is a great disadvantage on the military side, but it is important to recognize that these barriers reach far beyond the targeted military sector, as the same technology would be used in other areas too (e.g. industry, education, health care).

Do policy makers and governments have a necessary role in overcoming the obstacles of workplace knowledge obsolescence? In the next sections I will argue that, despite instinctive resistance by many stakeholders to governmental intervention in this area, there are helpful steps that policymakers can take to create an environment for a healthy economic system and to provide opportunities for development. One option is to centralize separate low-level ICT development actions to achieve better results through an integrated and coordinated program. Central control and coordination might not be the best way in all cases (especially if the centralization reaches an undesirable rigid and slow reaction state), but it can still help to ensure that the initiatives of the highest development priorities (which vary from state to state) get the necessary resources and attention, and to minimize redundancy between the separate projects. It is important to assess who should set development priorities, how they should set them, and why. These steps are not the same for all regions, so I propose an approach to analyzing the differences and also use case studies to describe both successful and less successful policy approaches. In this way I also support the argument that it is not only important for a policy to promote the use of ICT, but also to handle the possible disruptions created by rapid advancements (Benner, 2003). My proposed overview framework is not intended to compete with the Networked Readiness and similar indexes (e.g. Geoffrey et al., 2002) for evaluating the state of a national network or the surrounding enabling

factors. Nor do I try to revolutionize the current theory of information policy or information society policy (summarized by Audenhove, et al., 1999 and Duff, 2004). Instead, I try to complement these methods by further exploring the policy level, using traditional policy areas (not distinguishing information policy as a new entity) and showing differences in governmental attitudes. This approach adds a new dimension to the methods of fighting the problems of rapid ICT workplace changes.

3.2 Is there really a role for policy makers?

There is no simple yes-or-no answer to this question. My analysis employs two axes to analyze policy options: 1) the ICT scope of the policy, and 2) the general political attitude of the governing regime in terms of control centralization. I use three levels for both of these dimensions:

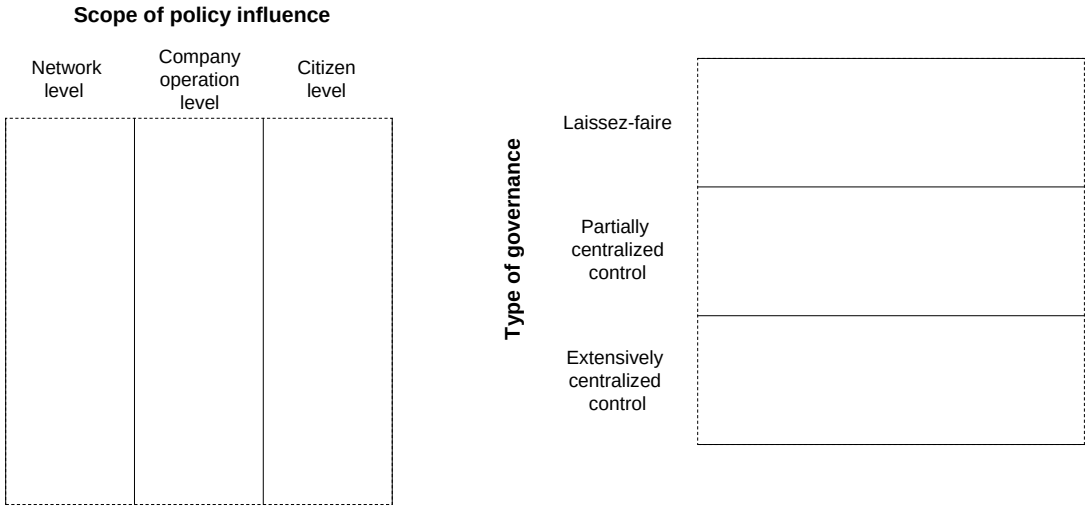

Figure 3: the two axes of the analysis framework

The different scopes of policy influence are categorized as:

- *Network level*: how the networks are built; the regulation of parallel, same technology networks and access to those (e.g., local loop unbundling) and associated network-level competition regulation; network interconnection (i.e. roaming, sharing); service provider obligations.

- *Company operation level*: subsidies, incentives or limits on the introduction of new technologies in workplaces; workplace safety and health regulations; company and employee privacy regulations.
- *Citizen level*: aiding (e.g., tax incentives) or blocking individual citizens' access to certain technologies and networks; programs to educate people to use available technologies and networks; citizen privacy regulations.

Not all ICT-related policy areas have equal effects and importance in all three layers. The following chart (table 1) describes the relevance of different policy areas at these layers, with some remarks explaining the rankings assigned. (These substantive areas are based on the categorization of Moore and Palfrey in their educational module on "Digital business ecosystems and the Law" (Moore, et al., 2003)). For clarity, the chart includes only very brief descriptions for the high-level relevance scores. These scores (represented by the empty, half-full and full spheres) indicate the amount of direct impact a policy area can have at a certain ICT level. Bear in mind that:

a) While policy systems are interrelated − each policy will have effects on multiple areas − this analysis considers just the main purpose and goal of a policy when determining which policy area to categorized it in. (For example, network interconnection regulation is primarily a Communications policy item, but can have secondary effects on the Competition policy area; hence, it is considered under the main category of Communications.)
b) The level of impact of policies at the different ICT levels does not mean that each regime of regulation would have the same focus and results. I will also use case studies later in this chapter to illustrate country-level differences. The scores in the charts are a generalized overview to show possible differences in the interrelation of triggers and impacts. They are not intended to be exhaustive, but rather as examples for better understanding.

ICT Policy Area	Network Level	Company Level	Citizen Level
Communications	● • Regulation of network development • National interconnection rules	◑ • Regulation of corporate private networks • Access to different networks	◑ • Regulation of private networks • Personal access to networks
Enterprise, Tax, e-Commerce law	○ • Mainly administrative, no direct effect on network	● • The whole business administrative environment	◑ • Personal taxation (e.g., tax deduction) policies affecting ICT affordability
Labor law	○ • Mainly administrative, no direct effect on network	● • Workplace ICT regulation (e.g., health and safety) • Contract regulation	● • Job safety • Health • Equal chances
Antitrust and competition	◑ • Competition can be influenced by the network architecture	● • Equal playing fields • Dealing with exchange providers and incumbents	◑ • Strength as an individual • Bargaining power as a consumer community

ICT Policy Area	Network Level	Company Level	Citizen Level
International	● • International network interconnection • Roaming	● • Cross-border electronic transactions • International markets • Export / import restrictions	○ • Travel and related ICT regulations • Export / import restrictions
Civil Liberties	◑ • Network components of filtering	◑ • Protection of corporate and employee information and communication freedom	● • Personal access and blocks • Freedom of speech via various forms of ICT
Intellectual Property (I.P.)	◑ • Technology solutions to solve I.P. regulatory problems	● • Ownership and copyright • New means of I.P. product distribution	◑ • Ownership and copyright • Fair use doctrine • Piracy

○: small or insignificant relevance
◑: moderate relevance
●: great relevance

Table 1: Impact relevance of policy areas at different ICT levels

This three-layer categorization is introduced to show an overview map of possible policy influence arenas. This article will mostly focus on the second tier (the company operation level).

The three general types of governmental structure discussed here range between the extremes of laissez-faire to extensive central control, with a variety of partial mixtures of the two in the middle.

- *Laissez-faire*: trying to limit the governmental and policy influence to the least possible extent. This approach views free market forces as the most important driver to reach a beneficial balanced state of the markets (sometimes referred to as "sweet point") for companies, citizens, and society.
- *Partially centralized control*: while trying to maintain the benefits of a free market, this approach is more open to deploying regulations to stop social or corporate distortions believed to stem from inefficient markets. This type of government would also be more ready to use tax revenues to fund public causes, such as social security, public pension systems, or to ease access to higher education by underwriting tuition.
- *Extensively centralized control*: a centrally-controlled economy, ideology, and in some cases even personal life characterizes this type government. While not all are tyrannical, the western sense of democratic freedom is much weaker and sometimes nearly non-existent.

To add a new perspective to the original question of how to solve the knowledge-related problems of rapid workplace ICT changes, the next part of this chapter will concentrate on identifying the differences between the company operation-level policy influences of different governance types.

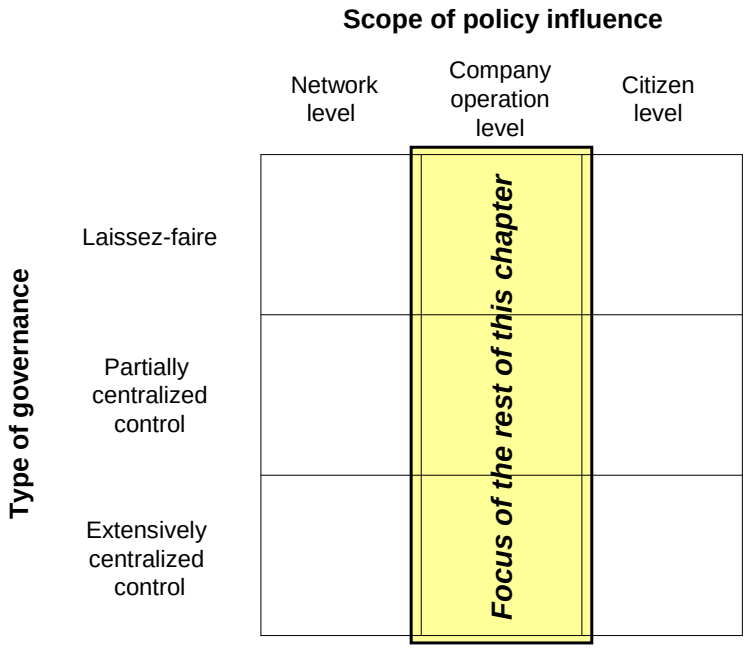

Figure 4: scope of policy action discussed in this chapter

This does not mean that overall network-level (e.g., mobile roaming pricing) or citizen-level (e.g., easier access to a home computer) policies would not affect this process. But my main focus is on the effects of policymaker actions aimed more at the corporate sector.

3.3 Cases from different regimes

Can a government that imposes normative values both in business and personal spheres lead a successful path into the knowledge economy? There are some success stories in this area. One example is Singapore. (Haley and Low, 1998). In the heart of Singapore's ICT development rests the Singapore ONE network (a fiber-optic backbone network) that reached almost all households, governmental institutions, and schools by 1998 (this accomplishment resulted in large measure from Singapore's compact geography). Policy actions have not only been taken to fill the gaps of the related educational system, but the state has put direct pressure on the labor market. For example, Singapore uses incentives and restrictions to increase the labor force's education level through reducing taxes for skilled workers and increasing the levy on unskilled workers. Furthermore, direct governmental actions (e.g., tax incentives) have been taken to make the ICT sector more attractive for venture capital funding and also to aid directly the growth of

start-up companies. But Singapore shows the negative side of the autocratic model too. A well-paid public workplace structure emerged to support the centralized governmental functions that were more attractive to many than the more risky, but productive, entrepreneurial lifestyle. Economic controls also had negative effects on the amount of innovation produced. Together, these two components weakened the small- and medium-scale entrepreneur community, which in the knowledge economy is a necessary source of innovation.

The introduction of new ICT developments to workplaces is a priority also in the biggest autocracy of all, China. Beside the fact that the Chinese government invests tremendous efforts to filter the information access to citizens (OpenNet, 2005), beginning in 1998 a strategically developed and executed program called the "four golden projects" was put in place. These four projects were (Tang, 2000):

a) Developing backbone infrastructure and linkage of information centers across China (Golden Bridge);
b) Facilitating information exchange among international and central national trade corporations, banks and bureaus (Golden Duty);
c) Advancing computer connection in financial services (Golden Card);
d) Reducing tax evasion by utilizing information systems (Golden Tax).

China is investing enormous resources in its effort to move its economy into a competitive position in the global marketplace, but its challenges are greater than those of Singapore due to its extremely large rural areas and population. It is not surprising then that the main source of innovation and ICT development is the large costal cities like Shanghai. Rural workplace ICT development is a question raised not only in China, but in many countries (Galloway, et al., 2005). In some cases the positive involvement of governments at the supply side is a necessity (not just with ICT, but at more basic levels such as electricity or water networks). The question is whether an extensively centrally controlled country might be in a better position to solve problems on the supply side as opposed to a country with a laissez-faire approach, as the latter would likely not achieve adequate short-term return on investment in these projects. However, central resource allocation always raises distributional questions. Optimal distribution depends on the priorities set by the central controlling bodies. It seems China is dedicated to ICT development on all fronts, but also attempts to keep the current ideology and regime in place by

using the same ICT infrastructure to "filter" information that is viewed as inappropriate or as threatening to the Chinese Communist Party's monopoly on political control (OpenNet, 2005).

Both China and Singapore have achieved remarkable economic progress in recent years. The odds of imminent changes in these countries' political regimes seem narrow. Only time will tell if the introduction of new ICT in the economy will have a farther-reaching effect on the democratization of these societies, or whether we will see continued state control prevail in a symbiotic relationship with the economic and technological advancements.

Unique examples of partially centralized governments can been found in the young democracies of Central and Eastern Europe (CEE). These behaviors originate not only out of habits developed under the former Communist regimes, but also from the existence of strongly centralized governmental institutions in these countries (e.g. in health care, social security and education), which make policy intervention at other fields (including ICT) less controversial compared to a laissez-faire environment. The following case also illustrates that, even with the best intentions, results of policy interventions will not meet expectations if different projects are separated and not integrated into a larger-scale approach. In 2003, the Hungarian Ministry of Informatics and Communications initiated a program to increase the competitiveness of local firms through the introduction of Hungarian language business ICT applications (mainly in Enterprise Resource Planning – ERP). The budget was 2 million USD, which is small compared to the scope of the project and the number of enterprises that could have participated (according to the application description, this program is aimed at the small and medium enterprise (SME) segment, with 50-250 employees and annual revenues of 3-20 million USD). Normally, one would assume that this seemingly unrealistic budget would be exhausted by the applicants, and those who were left out would accuse the Ministry of creating an unfair competitive advantage for competitors by giving "free money" to selected companies. Neither of these happened. The total amount the companies that applied was even less than the already low budget would have covered and there have been no publicized competitive accusations against the initiative. Industry experts claimed that one of the main reasons for the low interest was that Hungarian SMEs do not yet understand the importance and advantages of a modern ICT business infrastructure (Magyar Hírlap, 2004). Other reasons could be found in the initiative's payout policies. The funding is not a loan, but a

direct nonrefundable subsidy; however, it requires a minimum matching company investment of 50% and a maximum subsidy of 75,000 dollars per applicant. Those restrictions clearly favored companies that already had a program underway and were less attractive for those just considering moving toward more sophisticated ICT workplace environments. The maximum size of the subsidy could also be debated compared to the higher expected costs of a new ERP system implementation (Koch, 2002). (It is not clear whether the advertising and communication for the program affected the small response rate; this would require further analysis. It would be also interesting to know if the scope of the initiative (Hungarian language systems) had any effect – either positive or negative - on participation.) The original goal and intention of the policy was sound, notable, and achievable, and time will probably show that the winners of the funding do benefit from it. Still, it is far from a success story because of the outlined drawbacks and the resulting low level of interest from the target SME sector. Many CEE countries also have tax deductions for buying personal computers and corporate financial incentives to aid employee computer use. These policy steps not only help to increase the otherwise below-EU-average home PC penetration, but increasing computer literacy also helps the use of new ICT infrastructures in workplace environments, aiding the change and advancement processes.

Other interesting case can be seen in Caribbean countries, for example the Cyberpark established in the Dominican Republic (The Financial Times, 2000). The main idea follows a generic business incubation model, but incorporates the goal to educate businesses in the use of the Internet, which can be a critical competitive advantage for narrow economies such as those of Caribbean countries. While the Caribbean has not became the Silicon Valley of the Americas yet, these initiatives have helped countries with limited economic resources to gain foreign investment momentum and to educate their corporate sector on the use of ICT at workplaces (Foreign Direct Investment Magazine, 2005). Such government-funded business incubators might seem unnecessary if private venture capital could perform the same function. However, venture capital access is limited in the developing world, as investors are reluctant to risk private investment; thus, the role of governments to fill this gap is critical and necessary. This also leads to the development of the general economic climate (resting on the shoulders of the new generation of entrepreneurs funded by state incubators), which later leads to increased outside confidence and higher willingness to invest in the region. By no means does this example imply

a universal solution of economic and investment growth through governmental incubation can succeed everywhere, but this approach proved to work well in developing countries with partially centralized governmental regimes.

Even western democratic governments can display strong subsidizing attitudes. An ICT example is the French videotext system "Télétel/Minitel" (Cats-Baril, et al., 1994). The underlying principles originate from a study conducted by two French researchers (Simon Nora and Alain Minc), the final results of which were published in 1978 (Nora, et al., 1978). Minitel is a videotext system (using specialized end-user equipment with a screen and simple controls) allowing access to many services over the public packet-switched network provided by the state owned "Direction Générale des Télécommunications" (DGT, as France Telecom was called at that time). There are several different types of end user terminals, but the simplest was given away free of charge. The number of users and services increased rapidly, with the number of customer terminals growing from 120,000 in 1983 to 6.2 million in 1992 and the number of services from 1,899 in 1985 to 20,112 by 1992. Main revenue streams came from revenue sharing with service providers and advertisements. The wide variety of services (from directory services to chat channels) and the continuous advancement of the system made it akin to a French Internet predecessor. Based on the analysis of Cats-Baril and Jelassi, the success of the system depended mainly on the following factors (see also Housel and Davidson, 1991):

- Continuous dedication to a long-term vision and strategy (even with change of governments or DGT leadership) both in terms of network investment and shaping a policy environment supportive to the Télétel initiative.
- Building an infrastructure that was easy to develop (with the constant cooperation of hardware manufacturers) and easy to use both for service providers (with billing handled by DGT they could concentrate on the core service provision) and customers (with ready availability of many services).
- The government protected the initiative by actions that would not be available in a true laissez-faire environment. It allowed DGT to cross-subsidize the operation of Télétel/Minitel with revenues from other lines of services in the initial years when Télétel was not yet self-sufficient. Similarly, the ease of price changes and the option for state-owned DGT to do the billing was a great advantage. This came under attack from

different fronts (e.g. why not have billing handled by a third party, private company; critics also claimed there are certain services - e.g erotic chat - for which it is inappropriate to have billing conducted by a government owned entity). The French government still always protected the initiative from those attacks.

- Despite its protected status, Télétel did not try to capture the service and information provision market, it became (with the exception of directory services) only a provider of infrastructure (network, access, and billing), thus leaving opportunities for even small entrepreneurs to leverage the system to provide value-added services.

Even with the lower success of the later-launched international version and with the revenue decline of recent years (unsurprising given the advancement of Internet services since the mid-1990s), Télétel is considered a hugely transformative, but geographically limited, success story for a government policy-driven ICT infrastructure development. As shown in the aforementioned analyses, the financial success of the system has been debated (because of ambiguous cost allocation), but, reaching more than 6 million citizens with diverse and rich information services and providing free end user terminal equipment, Télétel was a clear social success.

The final example shows in a much more laissez-faire economical environment the confrontation of a governmental entity (trying to shape the local ICT infrastructure) with the corporate sector. Although it fits best in the Communications policy / network level influence cell, the development of the case (and also part of the policy intent) introduced strong ties to the corporate layer. In mid-2004, the city of Philadelphia announced plans to invest 10 million dollars to provide municipal wireless broadband (Wi-Fi) access. This would provide a broadband access options for those businesses and individuals who otherwise would not be able to afford it. (At the time of the original announcement it was unclear if it would be free or would have a lower-than-market-price fee.) The proposal produced two dominant reactions (both in media sources and in individual opinions): 1) it was an exciting, forward-looking approach to spending tax revenues to bridge the digital divide in Philadelphia; or 2) tax revenue should not be used for governmental involvement in an already well-developed, competitive market. Broadband access providers in the area strongly opposed the idea, fearing the loss of a significant market (The Wall Street Journal, 2004). A recent analysis (Ellison, 2005a) concludes that Philadelphia might not have been the best ground on which to start these “wars” as the city already had good broadband

access. Thus, a rural area would have been a better place to start such an initiative, where proving the gap-filling nature of the project is hardly a problem. The articles also reflect fights in the political arena around the case. Further complicating the picture, Pennsylvania Governor Ed Rendell signed House Bill 30 on November 30, 2004. This new law requires municipalities (any "political subdivision") to request the development of any "advanced or broadband" network from the local exchange telecom company serving the area before that city can move to offer such services. If the company agrees to provide the requested (specified by speed) services, they must do so within 14 months, but the "political subdivision" may not act as a service provider. Unsurprisingly, Philadelphia sought a mutually agreed-upon solution with local telecom company Verizon. Philadelphia CIO Dianah Neff was already negotiating with Verizon officials on November 30 (EtopiaMedia, 2004). The next day, the Washington Post reported that the negotiations reached agreement that Verizon would waive its right of first refusal, and the city's business plans would be modified to ensure that the interests of Verizon are not harmed (Washington Post, 2004). As a result of the settlement between the municipality and the profit oriented telecom service providers, the current proposed model of operation (as described by the Mayer's Office of Information Services in documents published between February and April 2005) is somewhat changed from the first version:

- The Wi-Fi infrastructure built will only serve as a wholesale option. It would be owned and contracted by a non-profit organization. The private sector would be able to buy wholesale access at low cost to provide services at low retail prices. Parks and public spaces would be free access zones.
- The contracted private firms (ISPs) would provide retail access to customers. Estimated access prices would be below $20.

While much of the original goal of giving an affordable broadband access option to businesses and individuals is still achievable, the influence of strong market players over the municipality plans is clearly visible. It is also clear that – at least in Pennsylvania – broadband access to Internet is not a considered a public utility such as road maintenance or street lighting. Despite one settlement in one town, this "battle" is far from over, and in other cities and with other stakeholders the outcome could easily be the opposite (Ellison, 2005b). It is an interesting contrast to the situation in the 1950's, when there were houses in Northern California without water, gas or even electricity, but which already had a telephone connection. The universal

service obligations served there as the justification for the otherwise very expensive connection, which is much closer to the partially centralized control than to the laissez-faire approach. The future progress of municipal broadband access will also be especially interesting to watch compared to the experiences of the Télétel/Minitel case, where there was clear governmental involvement in public telecom infrastructure development. There have also been claims that by taking a vote on a certain technology, the municipalities limit the future adaptation to the continuously advancing technologies. So while town hall was concentrating on affordability and access, the service provider was focused on continuous development and also on the projected threat to their network investments.

Based on these examples, we see that while there is no clear yes-or-no answer to whether there is a role for policymakers, there are specific cases where local characteristics (government regime, economic advancement, state of the ICT network or even geography) have provided opportunities for state policies to aid the ICT change process, if governmental intentions are clear and actions are shaped according to an overall strategy. There is no single winning strategy. But these examples are convincing arguments that policy influence can be an effective and in some cases (especially for developing nations and in rural areas) even necessary way of supporting the development of both the network and corporate level of ICT infrastructure. As countries rarely occupy either extreme of full laissez-faire or central control, the unique combinations everywhere determine what initiatives can emerge victorious. When adapting best practices from peer nations it is critical to keep these differences in mind and evaluate the potential effects (outlined by the cases presented in the chapter).

Conclusions

The problems originating from rapid ICT workplace changes can be overcome in various ways. Some are undertaken inside the company and address the employee knowledge difficulties internally. In addition to the usual first choice of training, knowledge management has evolved into an effective and practical solution. There are still many ways these corporate initiatives can be enhanced using the experiences of Internet communities. On the other hand the role of

governments in the overall ICT landscape is unavoidable. Their movements can enable or restrain companies or even entire sectors. The advancement in ICT seems to continue and the effects indicated in the first chapter will accompany these changes as well. The right combination of these solutions to fight workplace knowledge obsolescence is critical for competitiveness. The diversity of solutions in the cases discussed indicates that it is impossible to put together a one-size-fits-all, universal program that can be summarized in a few action points and put to effective use in every country. So when companies decide on which path they choose they must consider the opportunities offered by the policy environment, and governments also have to consider the state of the corporate sector when developing new policies. This balanced approach to ICT change can lead to both corporate and national competitive advantages in the 21ST century.

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