Innovation as knowledge and learning.

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Abstract: Innovative small and medium enterprises now play a vital role in the economy, but their survival often depends on being at the leading edge of their field. Without an abundance of time or money for education or training, they rely heavily on obtaining knowledge informally through a variety of channels.

Introduction

Workplace learning takes many forms, the most obvious of which is formal qualifications obtained through continual upgrading of professional or vocational skills. Short workshops on- or off-site are another way to gain 'soft' or 'hard' skills at all levels of the workforce. But the majority of learning takes place every day, informally, incidentally, implicitly, or even tacitly. It is usually unplanned and unorganized, it may be haphazard or serendipitous, and often remains unacknowledged. This vast amount of informal learning is now getting some of the attention it deserves for the role it plays, both as a foundation upon which more formal education can build, and as a relatively unexplored wealth of knowledge in its own right. It is this informal and often incidental learning that forms the focus of this paper.

Background

Research for this study took place in sixteen small and medium enterprises from four industrial sectors in the Lower Mainland of British Columbia, where both management and employees were interviewed in depth about their learning and its relation to the innovative products or processes with which they were involved. The criterion for defining 'small' and 'medium' was total workforce per firm of 10 – 100. The four sectors chosen were secondary wood manufacturing, engineering, computer consulting and telecommunications. These last two categories are somewhat nebulous, with indistinct and constantly shifting boundaries, but this does not affect the way they work, or the type of learning occurring within each enterprise.

Learning and innovation

Innovation does not generally result from a sudden flash of inspiration, it is a process of many iterations, much reflection, and feedback both within the firm and from customers and end users. It is the result of constant appraisal and re-appraisal, adding and subtracting bits and pieces until the product is right for the job. However, life never stands still, and the answer to today's problems may very soon be obsolete when facing tomorrow's challenges. Innovation, in both product and process, therefore has to be seen in the light of constant change, with the next generation of a product rapidly replacing the previous one. Those working in innovative enterprises must therefore be on the leading edge, be flexible, and prepared to be lifelong learners within a learning organization.

As in any workplace, personal learning and organizational learning are hard to separate from one another. A firm is its workforce, wherein the knowledge resides, and the loss of an individual is a loss of expertise to the firm as a whole. However, careful documentation of core knowledge can safeguard information for future access, but 'knowing what' is not the same as 'knowing how'. As a rope is made of many short strands, intertwined for strength and continuity, so organizational knowledge is the collection and retention of individual learning threads, woven together over the life of the enterprise, to form the competencies upon which its survival depends. But individuals still retain a wealth of implicit and tacit knowledge that cannot be written down, which has been learned experientially by working with others, or even alone, on a variety of projects. Newcomers to the situation may read the 'blueprints', but may not have the same feel for the work as one who knows the product, and understands the conditions in which it will be required to function. Nonaka (1995) suggests that this type of learning is exchanged through the process of socialization, both at work and beyond.

Visible and Invisible Learning Within the Company

Those working in innovative enterprises recognize the value of learning in all its forms, and create as many opportunities as possible for visible and invisible knowledge to flow in all directions. At the visible level, creation of innovative practices and products requires reflection-in-action (Argyris, 1977), creative and flexible thinking, problem solving skills, and the persistence and patience to work the bugs out of a system before it gets beyond the prototype stage. This frequently means creating 'quick and dirty' ways of doing things, rather than going by the book, which Brown & Duguid(1991) refer to as creating a 'community of practice' and Argyris & Schon (1978) call theory-in-action. However, in high-tech situations there often is no book of precedents to consult, as innovative products develop very rapidly. Consequently creative problem solving skills are an essential part of the workplace 'toolkit' every employee requires.

Small firms often do not have time or money to provide off-site learning opportunities as deadlines have to be met, and workloads are heavy. However, many places hold informal talks or

seminars where topics of interest are discussed, or people report on work-related off-site activities. Occasionally there will be time for representatives to give papers at conferences or attend trade shows, where networking and between-session socializing often is more productive than the formal presentations. Surfing the net, or reading trade or professional journals are other sources of individual information which may be shared through in-house discussion.

Internal dynamics in many high-tech companies may seem fluid, and even chaotic to new graduates joining the workforce for the first time, and they need to acquire many invisible coping techniques which are rarely taught in school. Moving from the more controlled order of the lab or classroom into a hectic, real-life situation requires adaptability, flexibility, and careful management of time, all vital survival skills which have to be picked up 'on the run'. New employees from whatever background also have to absorb, and fit in with, the company culture. If the move has been made from a large, hierarchical organization, to the flatter administrative structure favoured by small companies, this may involve more personal autonomy and greater participation in creating the end product. It may also be as simple as observing a totally different dress code, moving from formal to casual, and feeling comfortable in very different surroundings. But for everyone, the importance of self-directed lifelong learning is paramount.

Most learning in small and medium enterprises occurs on the job, working in project teams, or participating in day to day life within the organization. In many high-tech companies, project teams are very flexible, dissolving at the end of one job and re-forming differently for the next, depending on the expertise required. In some cases one individual may be working on two teams at once, and be pulled off both from time to time for specific 'firefighting' skills if an emergency arises. In other workplaces, such as small secondary wood manufacturers, the whole workforce is one team, where specific jobs might be rotated in order to increase individual abilities. This still creates overall flexibility within the system, but there is not the same fluidity as would be found in the computer consulting, engineering or telecommunications sectors. However, with increasing computerization of machinery, and ever-changing skill requirements, the necessity for constant learning is equally important in every type of workplace.

Invisible learning in the workplace is especially difficult to bring to the surface and make visible, simply because such processes are unnoticed. Learning takes place through all the senses. Knowing how a finished product should look, feel, smell, taste, or that it is making the right kind of noise, is often as important as knowing how to put it together correctly. Very often 'gut feeling' plays a large part in knowing whether something is right or not. Often such intangibles cannot be put into words, but can be passed on from one person to another through sharing experiences, working together, or through some form of apprenticeship.

Because tacit and implicit knowledge is seen to have a very important role to play in the creation of innovative products and processes, many companies like to work closely with end-users or customers in order to understand what they need, and how they will be using a product. One high-tech firm making innovative navigation aids for commercial shipping tries to send their engineers out to ride boats from time to time, to understand what a mariner <u>really</u> wants, rather than what an engineer <u>thinks</u> a mariner wants. Elegant keyboards demanding manual dexterity and typing skills that work well on land may be difficult to use on a ship pitching and tossing in high seas, whereas a trackball and a few simple keystrokes can be managed by even the most

computer-illiterate mariner coping with a crisis. This same company also installs prototypes in its own boat, then takes employees out for a day on board. Everyone is encouraged to try all the gizmos and gadgets in the hope that someone who knows absolutely nothing about how to operate the system will uncover hidden bugs, which a more knowledgeable user would never discover through routine testing. This is not only a fun day for most people, such prototype field trials provide valuable experience from which much can be learned that would be hard to re-create in a laboratory. In this way engineers can not only find out what might go wrong and correct it, they can reflect on why it went wrong in a double loop learning process (Argyris, 1977), and improve the next iteration of the product accordingly.

Managerial Learning

It is not only upon non-administrative employees that innovation depends. Often those who manage small and medium enterprises started out on their own as entrepreneurs because they have a skill upon which they wish to build. Very quickly they discover the need to hire helpers, both in administration and in the skill itself, and in order to survive, the product must be marketed. Without adequate administration or marketing, small firms soon get mired in problems and go out of business.

Managers, especially those who own their company, find themselves from necessity moving further away from the skills they enjoy using, into organizational and administrative matters. They neither have, nor require, an MBA, but they, like their employees, are learning on the job through the school of hard knocks. Managers have to be a jacks of all trades, and masters of all, if their company is to survive and be successful. At the same time it is very hard to learn from others because there are few administrators in the same office to consult, and they may all be equally new to such positions. There are few courses for non-MBA managerial skills, and even if there were more, time and money for attending such programmes are often unavailable. Employees, especially in software engineering, can change jobs fairly frequently in order to access further on-the-job learning, so that knowledge is shared throughout the community, but managers do not have that same freedom, and need to acquire their knowledge by other means. Thus, it appears that learning appropriate managerial skills is somewhat more problematic than gaining trade or professional abilities, but without good management, innovative small firms cannot survive.

Visible external knowledge

The networks with which small and medium enterprises surround themselves are as much horizontal as they are vertical, and some see them as spherical, interlocking, and complex, rather than two-dimensional representations of dependencies or peer relationships. These networks are vibrant fora for the exchange of knowledge, information, products, skills, and even personnel. Some of the larger enterprises that have developed sophisticated internal structures may allocate information gathering capabilities to certain administrators who scan the surroundings, make

outside contacts, and generally select and disseminate knowledge which is thought to be useful. In other cases, usually the smaller firms, everyone keeps their eyes and ears open, and shares whatever they think might be of interest to others. This may bring some surprising tidbits into the knowledge base, as people have their own individual networks and outside interests which may provide a vital piece of information that had seemed apparently trivial at the time. In browsing the web, talking to a friend, or walking down the street something may have been noticed which triggers thought, reflection, or is by chance immediately relevant and useful.

Constant communication with members of one's network provides feedback on product acceptance, customer needs, marketing, competitors' activities, knowledge and skill resources, and managerial networks share administrative knowledge and information. Because many networks are somewhat specialized in nature, where industrial 'birds of a feather' flock together, a gathering of CEOs is fruitful ground for finding other administrative personnel who are known to the group either through work, university, business or professional contacts. Personal recommendation, combined with a little gentle headhunting through the grapevine, is often a preferred way for hiring new senior or middle management, rather than by advertising on the open market. This practice is fairly important to small firms in particular, for although academic, professional and technical qualifications are essential, equally important is the matter of fit. In small firms there is little room for individuals who do not share the same ideals, philosophies, values and attitudes, and one manager went so far as to say that if Einstein himself applied to that company for a job he would not get hired, he wouldn't fit! The matter of fit is equally important for both employees and managers, as the well-being of small firms depends greatly on co-operation and reasonably friction-free internal dynamics.

Networks are also a way of sharing knowledge which allows for the development of expertise. Each firm within a such a network of specialization will act as a resource for other members, providing complementary skills as needed, so they fit together like jigsaw puzzle pieces. Research & Development firms may liaise with manufacturers and marketing companies, or end users who field test prototype products. Service companies may provide outlets for high-tech devices which are not sold directly to end users, but are embedded into the product which eventually goes to market. There are many examples of such symbiotic interdependencies occurring, where each member of the network may add to, and in turn benefit from, a pooling of available skills and resources. In these circumstances power relationships are equal, regardless of company size, and knowledge of many kinds flows back and forth continually. This leads to the interesting observation that firms large and small have learned that success in today's changing economy more often depends on co-operation, not competition, and this, in turn, has quietly revolutionized the way business is being conducted today.

Another valuable form of knowledge and learning comes through co-op students. Many small and medium enterprises seek out these students for internships for many reasons, not least of which is the fact that they bring with them the latest thinking and research at their universities. There is also ongoing contact with university departments and faculty through the students themselves, and while making arrangements for the provision of co-op experience in the workplace. Like the hiring of personnel through the CEO network where recommendation plays a large part in the process, co-op semesters can provide what is seen by the employer as an extended interview. In a two-way flow of information, those working with co-op students can

decide how well an individual will fit into the firm, and over a period of two or three months can also discover how that person works under stress or participates socially, which an interview alone is unable to ascertain. At the same time, students can use the opportunity to create a niche into which they will be welcomed back upon graduation if they so wish, benefiting both the company and the individual concerned.

Implications for research in Adult Education

While formal and non-formal learning opportunities for obtaining workplace skills are well established, there has been little research on the informal flow of information and knowledge within the workplace, and within the wider network surrounding firms of all sizes. Attention has been paid to individual aspects of the firm environment, such as networks, culture, or markets, and to the conditions creating job satisfaction, motivation and innovation from an organizational viewpoint. Educationally, these elements have not been linked in a map charting the flow of knowledge through the various segments to ascertain conditions facilitating innovation and creativity, factors encouraging or inhibiting learning in the workplace, or to analyse what type of learning takes place. Not every form of learning in the workplace is for the good of the company. Some implications of management action can lead to misinterpretation by employees, who then react accordingly. Equally, employees can send the wrong message to management, resulting in unfortunate remedies being applied.

The workplace must not only be viewed holistically from within, it must also be seen as a small part of a larger world beyond, and all aspects of learning, from the obvious to the unobserved, must be investigated and charted in order to make a useful contribution to the present knowledge base. Informal and incidental learning at work often just happens as a result of getting the job done. If more could be discovered about how, where, when and why it happens it might be possible to create appropriate learning opportunities, rather than letting them occur haphazardly, serendipitously, or sometimes even slipping by unnoticed.

References:

Argyris, C. (1977). Double loop learning in organizations. Harvard Business Review.

Argyris, C. and Schon, D. (1978). Organizational learning. London: Addison-Wesley.

Brown, J.S. and Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning and innovation. Organization Science 2(1), 40–57.

Nonaka, I. and Takeuchi, H. (1995). The knowledge creating company: How Japanese companies create the dynamics of innovation. New York: Oxford University Press.