Using Serendipity for ICT Development

Anil K. Saini[1]*, Vijay Kumar Khurana[2]

[1]* *Professor, USMS, GGS Indraprastha University, Delhi; aksaini1960@gmail.com*

[2] *Professor, MAIMS, Rohini, Delhi; dr.vijay.kr.khurana@gmail.com*

Abstract

In today's global marketplace, characterized by the ever-increasing pace of competition, ever-increasing & changing demands of customers, and explosion of knowledge and technology, all organizations require creative out-of-the-box thinkers and approaches for survival and growth. It is indeed survival of fittest and fastest these days. Better & faster idea generation holds the key to long term survival and growth of the organization. Organizations use variety of techniques for stimulating creativity and generating new ideas. While traditional creativity techniques do not focus on using accidental discovery for tapping new ideas, these days serendipity i.e. accidental discovery is also being explored by organizations like Yahoo & Google etc for generating new ideas.

This paper highlights the importance of serendipity for idea generation and its contribution for ICT development. The paper explores the challenges likely to be faced in using serendipity for idea generation. Finally the paper suggests a framework for meeting such challenges for harnessing the potential of serendipity for idea generation.

Keywords: serendipity, creativity, organization, idea, ICT

1. Introduction

"Creativity is seeing what everybody else has seen but thinking what nobody else has thought" – Albert Szent-Györgyi

Technology develops through a process of Creativity, Invention and Innovation. Creativity/Creative thinking/Inventive thinking is thinking up new things. According to Oxford English Dictionary–Creativity means - to use/involve one's own thought or imagination to create something new as work of art, an invention. According to Boden (1998), there are three main types of creativity, involving different ways of generating the novel ideas:

a. The 'combinational' creativity that involves new combinations of familiar ideas.
b. The 'exploratory' creativity that involves the generation of new ideas by the exploration of concepts.
c. The 'transformational' creativity that involves transformation of some dimension of the structure, so that new structures can be generated.

Creative thinking plays an enabling role in innovation. According to European Commission Report (1998), "Creativity and innovation are normally complementary activities, since creativity generates the basis of innovation, which, in its development, raises difficulties that must be solved once again; with creativity… It is not possible to conceive innovation without creative ideas, as these are the starting points."

In the present era, which is characterized by ever-increasing pace of competition, ever-increasing & changing demands of customers, and explosion of knowledge and technology, all entities need creative out-of-the-box thinkers and approaches. In a survey of 1500 Chief Executive Officers conducted by IBM in the Global CEO 2010 study, it was found that CEOs believe successfully navigating in an increasingly complex world requires creativity.

According to Khurana (2007), In fact, creativity plays a significant role in the growth and long-term survival of an organization. To cite few examples: Initial use of computer was for data processing, now it is used in almost all activities viz. CAD, CAM, FMS, e-CRM, e-SCM; Shift from manual accounting system to ICT based system in banking sector viz. ATMs & Credit Cards; Online trading, Online shopping etc.

* *Address for correspondence:*
Anil K. Saini
Professor, USMS, GGS Indraprastha University, Delhi

aksaini1960@gmail.com

Similarly creativity can contribute significantly towards national growth by finding newer ways of solving macroeconomic and social problems, by finding better ways of macroeconomic and social management. To cite few examples: Using ICTs for e-governance; Replacement of manual ballot voting system by electronic voting machines in the elections; Running mass transport system like Tube in UK or Delhi Metro (DMRC) in India by using ICTs etc. There are numerous such examples, where creative solutions have been used for improvement of macroeconomic and social management.

While traditional creativity techniques do not focus on accidental discovery for tapping new ideas, these days serendipity i.e. accidental discovery is also being explored for generating new ideas.

2. About Serendipity

In the English language, the word 'serendipity' was first used by Horace Walpole, the Earl of Oxford (1717–1797). In his letter dated 28 January 1754 addressed to Horace Mann, he mentioned that he created it from the children's Persian fairy tale, "The Three Princes of Serendip," whose heroes were always making discoveries, by accidents and sagacity, of things they were not in quest of. Thus the word was derived from Serendip, an old name for the island nation of Sri Lanka (Ceylon).

'Serendipity' is commonly used in reference to 'the happy accident' (Ferguson, 1999; Khan, 1999), the finding of things without seeking them (Austin, 2003), and as synonymous with 'any pleasant surprise' (Tolson, 2004), fortuity, chance, randomness, or luck. The New Oxford Dictionary of English defines it as "the occurrence and development of events by chance in a happy or beneficial way." It also defines chance as any event happening in the absence of any obvious design (randomly or accidentally), one that is irrelevant to any present need, or one of which the cause is unknown.

Thus Serendipity means a happy accident or pleasant surprise; a fortunate mistake; specifically the accident of finding something good or useful while not specifically searching for it.

As per Walpole, serendipity is a process by which a discovery is made. This process has two necessary elements: chance and sagacity. Sagacity is the mental discernment or the cognitive capacity that is necessary to recognize that an observation has an important meaning. While conducting experiments on a particular topic, multiple researchers may observe a common accidental event that is significant to understanding some phenomenon. While one researcher may perceive the significance of the event, another researcher may not. The former makes a discovery by serendipity. Thus sagacity makes the difference between a serendipitous discovery and a non-discovery in the presence of important accidental information.

The term Serendipity has been used as a sociological method in Strauss and Glaser's (1990) Grounded Theory who built on ideas put forth by sociologist Merton, (1949) in his Social Theory and Social Structure (1949) referred to the 'serendipity pattern' as the fairly common experience of observing an unanticipated, anomalous and strategic datum which becomes the stepping stone for developing a new theory or for extending an existing theory.

Nonaka, (1991) points out that the serendipitous quality of innovation is highly recognized by the Japanese managers and he links the success of Japanese enterprises to their managers' ability to create knowledge not by processing information but rather by tapping the tacit and often highly subjective insights, intuitions, and hunches of individual employees and making those insights available for testing and use by the enterprise as a whole.

M. E. Graebner describes serendipitous value in the context of the acquisition of a business as "windfalls that were not anticipated by the buyer prior to the deal," i.e. unexpected advantages or benefits realised due to positive synergy effects of the merger.

Serendipity is a key concept in competitive intelligence used as one of the tools for avoiding blind spots (Blindspots analysis).

3. Typology of Serendipity

The study of various case studies on serendipity provides meaningful insights about typology of serendipity. When it came to the discovery of polymerase chain reaction (PCR) and DNA, researchers found what they were looking for but by way of chance. By contrast, in the discoveries of sildenafil citrate (Viagra) and penicillin, researchers discovered something different from what they were looking for. The former can be labelled as 'pseudo-serendipity' (Roberts, 1989), also known as 'serendipity analogues' (Diaz de Chumaceiro & Yaber, 1995). In these cases, the objective remained unchanged, but the route towards achieving this objective proved unusual and surprising. By contrast, the latter can be labelled as 'true serendipity', or 'serendipity proper' (Diaz de Chumaceiro et al., 1995), as there was a change in the objectives as a result of the discovery process.

A further distinction can be made between chance as the unintended consequence of research design, and chance as pure random variation. Serendipity can also come about as the unintended consequence of innovation, where products are discovered to have uses other than those for which they were originally designed. Well-known examples include aspirin, intended as an anti-inflammatory but widely used as a preventative measure against heart attacks, and minoxidil, developed to treat high-blood pressure but prescribed against hair loss.

In the sildenafil citrate and PCR examples, opportunities arose as a direct consequence of the way the study was designed i.e. the unintended consequence is causally related to the research design process. The unintended side-effects of sildenafil citrate appeared precisely because Phase 1 clinical trials generally used healthy male volunteers (rather than females); the idea of PCR relied entirely on Mullis' imaginative efforts at recombining a set of existing technologies. Mullis (2000) acknowledged that there was not a single unknown in the scheme and every step involved had been done already. Mullis' sagacity resided not in seeing what no one else had seen before, but in thinking what no one else had yet thought of.

By contrast, the discoveries of penicillin and DNA benefited from random chance occurrences; the spore in Fleming's dish had most likely wafted in from the mycology labs located one floor down. Fleming was sagacious to construct a meaningful connection between two random occurrences and observations made by others before him. Similarly Crick was fortunate to share his office with a crystallographer (an advantage not shared by Wilkins and Franklin) and thus was able to make serendipitous discovery. Either event was causally unrelated to any research design – i.e. a-causal.

Thus serendipity can happen following ways:

- Serendipity by way of random variation (A-causal): Penicillin
- Serendipity as the unintended consequence of research design (causal): Sildenafil citrate
- Pseudo-serendipity by way of random variation (A-causal): DNA
- Pseudo-serendipity as the unintended consequence of research design (causal): PCR

The typology of serendipity is shown in figure 1 below.

Figure 1. Typology of Serendipity
Source: De Rond, M (2005), "The Structure of Serendipity," WP 07/2005, University of Cambridge, UKFigure 1

4. Role of Serendipity in ICT Development

According to Kahn Bob (2011), Serendipity will significantly alter the future of ICTs and internet in coming years. Coping with serendipity is a major challenge for all the participants in the ICT sector as it will throw up sudden and new challenges.

These days, the Silicon Valley is obsessed with serendipity, which was also the reigning buzzword at Southwest Interactive Festival of January 2013. When Yahoo banned its employees from working from home in February 2013, it gave the following reason that some of the best decisions and insights come from hallway and cafeteria discussions, meeting new people, and impromptu team meetings. Thus the message is clear that doing the best work solo cannot compete with lingering around the coffee machine waiting for an inspiration - in the form of a colleague - to strike.

In the same month, Google provided details of its new campus in Mountain View, California. In this new campus, buildings resembling bent rectangles have been designed, such that no employees in the complex will be more than a two and-a-half-minute walk away from one another. The underlying idea is to maximize casual collisions of the work force. Rooftop cafes will offer additional opportunities for close encounters. The Google is encouraging large social interactions amongst employees, because in the past the idea & concept development of projects like Gmail, Google News and Street View took place while the software engineers were having fortuitous conversations at lunch.

The approach of Yahoo and Google clearly suggest that serendipity is largely a by-product of social networks. Close-knit teams do well at tackling the challenges in front of them, but they lack the connections to spot complementary ideas elsewhere in the organization. Bonabeau (1999) reasons that our world is becoming so complex that it cannot be comprehended by any single human-being alone. According to Gloor (2006), Swarm intelligence offers an alternative way of designing intelligent systems in which autonomy, emergence, and the ability to distribute tasks replace control, pre-programming, and centralization. While swarm intelligence is based on equal sharing of information, swarm creativity is founded on sharing ideas openly. People come at the projects from different backgrounds and they can add more facts, figures, concepts, ideas and vision to a particular project than what a standalone individual will be able to do. Their occupation, where they were born, what their background is, what their education is, are they a crafter or a business person,

these dimensions can significantly influence the vision, mission, plans and their execution by bringing different viewpoints and various talents to the projects. It's another variant is Collective Intelligence which involves pooling of the aggregated knowledge, insight and expertise of a diverse group for generating new ideas, solving old problems, disaggregating and distributing work in new and innovative ways, and making better, more informed decisions about the future. Foster and Ford (2003) also emphasize that serendipity was widely experienced amongst inter-disciplinary researchers, where it was categorised by reinforcing an existing problem, taking the researcher in a new direction, or by the location of the information: known valued information in an unexpected location, or unexpected finding of information that also proved to be of unexpected value.

In the 1960s, Allen, Thomas J (MIT), observed that colleagues who are out of sight are frequently out of mind. According to him, we are four times more likely to communicate regularly with someone sitting 6 feet away from us as compared to someone sitting 60 feet away, and almost never with colleagues working in separate buildings or floors. Whenever we meet individuals in person, we get a particular intellectual charge by sharing of ideas.

The University of Chicago sociologist, Burt (2004) calls these organizational distances/gaps as "structural holes." In a 2004 study of 673 managers at the defence contractor Raytheon, Burt found that managers who serendipitously bridged such gaps were more likely to generate good ideas and make more progress professionally. In such cases, serendipity is the spontaneous plugging of these holes, over which good ideas flow. As per him, this is not creativity born out of genius; rather it is creativity as an import-export business.

In 2012, researchers at Arizona State University used sensors and surveys to study creativity within teams. Participants felt most creative on days that were spent in motion meeting people, not working for long stretches at their desks. Thus the impact of social interaction on stimulating serendipity & creativity is summarized in figure 2.

5. Challenges in using Serendipity

In the 1930s, Rossman, pointed out that many stories have been told of accidental discoveries and inventions. However, a careful study of these stories will reveal the fact that lucky accidents only happen to those who deserve them. Thus there is the need for an individual to be 'sagacious' enough to link together apparently innocuous facts in order to come to a valuable conclusion.

The Serendipity has been defined as a happy accident etc. This happy accident may occur today, tomorrow, in next one year and may be after decades. Thus timeframe of occurrence of happy accident is uncertain and could be very long.
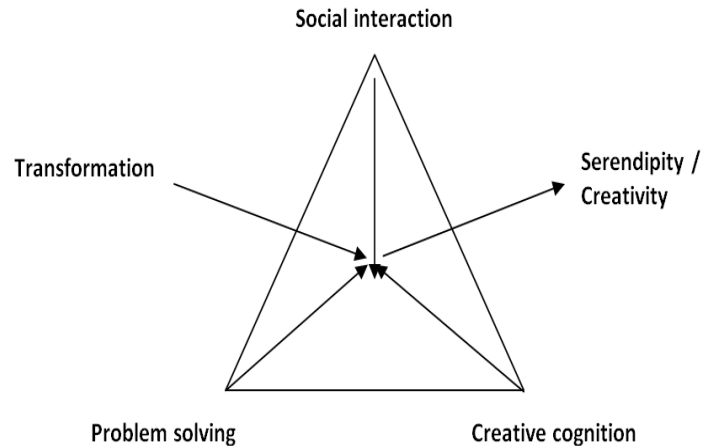
Figure 2. Using social interaction for stimulating serendipity
Source: Adapted from Wheeler S, Waite S J and Bromfield C (2002), "Promoting Creative Thinking through the Use of ICT," Journal of Computer Assisted Learning

According to Makri and Blandford (2010), the notion of 'designing for planned serendipity' by engineering it into a system is an oxymoron. Organizations can merely design tools, create conducive conditions and opportunities through which higher chances of early and more occurrence of happy accidents can be realized.

So as to ensure early and larger occurrence of happy accidents, organizations like Yahoo & Google have started pursuing 'Planned Serendipity,' in addition to other creativity techniques.

Planned Serendipity is complimentary to collaboration rather than a collection of how-to-do tips. It aims to capture the voices of the explorers who bear witness to the power of ideas, the possibility of change, and the uncharted territory in our midst. Planned Serendipity is very complex exercise and difficult to attain. Its success depends upon variety of factors like organizational culture, support of leadership, level of trust in the organization, attitude of employees etc.

Studies have shown time and again that organizational culture is more critical source of business success or failure than the organizational strategy and leadership. It does not mean that strategy does not matter; rather a particular strategy which an organization employs will succeed only if it is supported by the appropriate cultural attributes. A study by Booz and Company (2011) shows that the ways R&D managers and corporate decision-makers think about their new products and service—and how they feel about intangibles such as risk, creativity, openness, and collaboration - are highly critical for success. Organizations saddled with both poor goal alignment and poor cultural supports perform at a much lower level than well-aligned companies. On

the other hand, organizations whose strategic goals are clear, and whose cultures strongly support those goals, possess a huge advantage.

Most successful organizations concede the difficulty of maintaining the cultures that led to their success. According to Palensky (3M), it is very difficult to build and sustain good organization culture as it is built up a brick at a time, a point at a time, over large number of years. If it is not nurtured properly, then it can be lost very quickly.

Some problems are associated with the Top Management. Autocratic functioning of the top management, lack of respect for individual initiatives, intolerance for honest mistakes, etc adversely affect degree of the Serendipity & creativity in the organization. Some CEOs may not be willing to give flexibility or may be risk-averse by nature. Sometimes there are over-expectations from the CEO when he/she may be perceived to be solely responsible for technology development and other senior managers may not participate adequately in technology development. Another problems is that of managing in the light of corporate restructuring & transient senior management. Whenever some senior leader leaves the organization, its innovative culture is adversely affected. For example, after the departure of Mr Steve Jobs, performance of Apple has somwhat stagnated.

Another important problem is that of trust and the attitude of employees, who bring it to their organizations based on their prior experiences. Our education system emphasizes individual accomplishment and learning in a highly competitive environment. Students, who outperform others, get higher grades and ranks. Thus the desire to dominate over others gets embedded into our mental framework from childhood itself. Once these former competitors are employed by the organizations, they find themselves in a similar environment of competition. In the organizations, they are required to compete with their co-workers for more important, prestigious and higher salaried positions. They quickly discover the fact that personal knowledge and information is power, and that if they wish to advance their careers it is probably better to keep the information with them. Thus the employees are usually not keen to openly share their views & opinions fearing that credit for their ideas may be taken over by others.

Not only does the competitiveness of the employees add to an environment of mistrust, the organization itself, through its actions, adds to the level of mistrust. This is partly due to the nature of a free market economy in which the organization is continuously required to defend itself from its competitorsbytakingvarietyofaggressivemeasuresincludingcost-cutting measures. Some organizations try to maximize short term profits by ignoring ethical considerations, corporate governance and corporate social responsibility. Some organizations are frequently found to pursue downsizing. All such actions contribute to employees' mistrust of their employers. As a result, employees often put their own personal career goals way ahead of the needs of their company. This is reflected in the large staff turnover that many organizations experience. The lack of trust operates in both directions. Because of the difficulty in retaining staff, organizations many times create and exacerbate, a vicious cycle of mistrust by not investing enough in the training and professional development of employees. The lack of trust, endemic in the culture of most organizations, is a great obstacle to harnessing full potential of planned serendipity.

Thus a variety of factors can affect the degree of usage of serendipity for technology development.

6. Managing the Challenges

Serendipity is routinely but mistakenly used as synonymous with chance events, luck or providence. The fact is that serendipity remains comparatively under-researched. Recently a £1.82m project – Seren A: Chance Encounters in the Space of Ideas, has been funded by the Engineering and Physical Science Research Council (EPSRC) of UK. Few similar projects are also underway. The key challenge is ... how can one unlock the 'black box' of chance? Rather than being synonymous with chance, serendipity results from identifying 'matching pairs' of events that are put to practical or strategic use. Thus serendipity implies a capability, not an event. It is the human agency, and not the probability, which should be the proper focus of attention. According to Louis Pasteur, "Chance favours the prepared mind." Thus appropriate education and training needs to be given to employees to develop sagacity capability to capture ideas from happenings around them. New ideas can be inspired by anything, anytime, anywhere. Employees need to have their "idea antennae" up at all times and they should be always on the lookout for bits and pieces of inspiration that can be used for serendipitous discovery.

Erdelez (1999) found that people were able and willing to discuss experiences of serendipity, or - bumping into information, during discussion. She found that the following elements are useful in understanding such an experience:

- the information user who encounters the information – ranging from on-encounterers to super-encounterers;
- the characteristics of the information encountered – both problem-related and interest-related;
- the characteristics of the information needs that the encountered information addresses – either a current, past, or future need;
- the environment where the information encountering occurred – from libraries, bus stops, to the Internet.

A right supportive environment is needed for stimulating serendipity & creativity. According to Higgins (1999), factors for encouraging the creative work climate are:

- A secure environment with minimal administrative interference.
- An organisational culture that makes it attractive and easy for people to discover and solve problems.
- Rewards for employee performance and enhancement of intrinsic motivation.
- Managerial willingness to take risks for creativity and innovation, as well as an open and flexible attitude on the part of management.
- Providing people with formal and informal training.

A variety of strategies and steps can be used by the organizations to harness serendipity and creativity. Some of these are discussed below:

According to Leach (2001) the social dimension of creativity has been largely ignored by traditional accounts of creativity. Organizations need to develop Collaborative Innovation Networks (COINs) to encourage social interaction, whereby knowledge workers can collaborate and share in internal transparency. In a COIN, they can communicate directly rather than through hierarchies. They can innovate and work toward common goals in self-organization instead of being ordered to do so. COINs are becoming the most productive engines of innovation ever. COINs have produced some of the most revolutionary drivers of change of the Internet age, such as the World Wide Web and Linux. The structure of a COIN may appear chaotic, like a bee or ant colony, but it is immensely productive because each team member knows conceptually what he or she needs to do. Organizations can successfully promote COINs by giving up central control in favour of self-organization in swarm creativity, developing an ethical code, and setting up a social network connected by hubs of trust.

For speeding up serendipity, Organizations should provide strong integration & orchestration of cross functional activities. Organizations should encourage movement and combination of people from different perspectives to allow for creative combinations. Communication systems should be continuously improved to cope up with changing business requirements. Cross functional teams can play a great role in integration. This will also ensure better communication across different functions.

Organizations should pursue non-linear, open and flexible innovation process with continuous interaction with customers, business partners and employees for attaining success. Organizations also need to focus on collaboration with customers so as to meet their needs.

Organizations need to nurture appropriate culture and improve it continuously to meet the ever-changing requirements of business environment. According to Mr Palensky (3M), so as to develop and sustain a conducive organizational culture, organizations need to show consistency & persistence in actions and ethics; and the Management should extend gentle, behind-the-scene encouragement to innovative culture.

According to KPMG 2012 study, the CEO is not the only one responsible for innovation leadership. Only 29 percent of respondents believe that the CEO is solely responsible for spearheading organizational innovations. This is despite the contribution of the great business leaders like Jobs, Gates and Ma, who imagined and then churned out continually new and improved products and breakthroughs to give their organizations a competitive edge. At the top a team should be put in place under a team leader so that if some person leaves the organization, then others can take the innovative culture forward. This way capability can be developed to manage in the light of frequent corporate restructuring & transient senior management.

Exceptional productivity is concentrated among a few people. Organization should employ, develop and retain exceptionally talented inventors. Combining the right people with an appropriate innovation process could lead to a 5–10 times productivity improvement. Organization should seek maximum participation of all employees. Strategic organizational structures should be developed to engage the employees to the organization's benefit. Depending upon the nature and complexity of the project, organization can use variety of incentives and rewards for motivating employees and seeking their maximum participation.

According to Malone, (2004), for using planned serendipity, organization should hire and retain committed, smart, and aggressive people with requisite qualities. Getting the right personnel is the key driver to success. An organization with plenty of ideas will reach nowhere if it does not possess requisite talents to make things happen. The managers need to shift their thinking from command and control to coordinate and cultivate – as the best way to gain power is sometimes to give it away.

Thus by adopting variety of strategies and steps, challenges can be met; and planned serendipity can be harnessed on long term basis for technology development.

7. Conclusion

If the 1980s were about quality and the 1990s were about reengineering, then the 2000s are about velocity. The world is changing rapidly so are the world's businesses. It is indeed survival of fittest and fastest these days. Better & faster idea generation holds the key to long term survival and growth of the organization. Over reliance on traditional creativity techniques does not suffice today. As a result organizations like Yahoo & Google etc have started using Planned Serendipity

for idea generation, in addition to traditional creativity techniques. It must be noted that notion of 'designing for planned serendipity' by engineering it into the system is an oxymoron. Organizations can merely design tools, create conducive conditions and opportunities through which higher chances of early and more occurrence of happy accidents can be realized. Organizations are using increased social interaction & social networks for speeding up serendipity. Planned Serendipity is very complex exercise and difficult to attain. Its success depends upon variety of factors like organizational culture, support of leadership, level of trust in the organization, attitude of employees etc. To harness larger potential of serendipity, organizations need to pursue variety of strategies and steps … like…. nurture appropriate organizational culture, provide education and training to employees to develop sagacity capability, develop Collaborative Innovation Networks (COINs), strengthen social interaction, pursue non-linear, open and flexible innovation process with continuous interaction with customers, business partners and employees and so-on. Serendipity i.e. idea generation through happy accidents will significantly alter the future of ICTs and internet in coming years.

References

Allen, T. J. (1984). *Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization*, Cambridge, MA: MIT Press.

Austin, J. H. (2003). *Chase, chance and creativity: the lucky art of novelty*. London: The MIT Press.

Boden, M. (1998). Creativity and artificial intelligence. *Artificial Intelligence*, *103*(1–2), 347–356.

Bonabeau, E. (1999). *Swarm intelligence: From natural to artificial systems*, Oxford University Press.

Booz & Company, Global Innovation 1000 Survey 2011.

Burt, R. S. (2004). Structural holes and good ideas, *American Journal of Sociology*, *110*(2), 349–399.

De Rond, M. (2005). *The structure of serendipity,* WP 07/2005, University of Cambridge, UK.

Diaz de Chumaceiro, C. L., & Yaber, O. G. E. (1995). Serendipity analogues: approval of modifications of the traditional case study for a psychotherapy research with music, *The Arts in Psychotherapy*, *22*, 155–159.

Erdelez, S. (1999). Information encountering: It's more than just bumping into information, *Bulletin of the American Society for Information Science*, *25*(3), 25–29.

European Commission (1998), *Innovation Management Techniques in Operation*, European Commission Report, DG XIII, Luxembourg.

Ferguson, A. (1999). The lost land of serendip, *Forbes*, *164*(8), 193–194.

Foster, A., & Ford, N. (2003). Serendipity and information seeking: An empirical study, *Journal of Documentation*, *59*(3), 321–340, doi: 10.1108/00220410310472518, Publisher: MCB UP Ltd.

Graebner, M.E. (2010). Organizational Identification and Serendipitous Value Creation in Post-Acquisition Integration, *Journal of Management*.

Gloor, P. A. (2006). *Swarm Creativity: Competitive Advantage through Collaborative Innovation Networks,* Oxford University Press.

Higgins, L. F. (1999). Applying principles of creativity management to marketing research efforts in high-technology markets", *Industrial Marketing Management, 28*, 305–317.

IBM, Global CEO Study 2010.

Kahn Bob's Interview at ITU Telecom World, 2011, as recorded in the video "*Coping with serendipity_ the future of ICT.flv*"

Khan, M. H. (1999, June 15) Quest for serendipity. *The (Bangladesh) Independent.*

Khurana, V. K. (2007). Management of Technology & Innovation, Delhi: Ane Books.

KPMG Technology Innovation Study 2012.

Leach, J. (2001). A hundred possibilities: Creativity, community and ICT, in *Creativity in Education* (eds. A. Craft, B. Jeffrey & M. Leibling) pp. 175–194. London: Continuum International Publishing Group Ltd.

Makri, S., & Blandford, A. (2010). *What is serendipity?,* A workshop report, UCL Interaction Centre, London.

Malone, T. W. (2004). The future of work: How the new order of business will shape your organization, your management style, and your life, Boston: Harvard Business School Press.

Merton, R. K. (1949). *Social Theory and Social Structure*, New York: Free Press.

Mullis, K. (2000). *Dancing naked in the mind field*, New York: Pantheon Books.

Nonaka, I. (1991, Nov- Dec). *The knowledge creating company: how Japanese companies create the dynamics of innovation,* pg 94.

Palensky's interview as published in Global Innovation 1000 Survey 2011 by Booz & Company.

Roberts, R. M. (1989). *Serendipity: Accidental Discoveries in Science*, New York: John Wiley & Sons.

Rossman, J. (1931). *The Psychology of the Inventor*, Washington D. C.: W. F. Roberts & C0., pp: 117-118.

Strauss, A. L., & Glaser, B. G. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. SAGE publishers.

Tolson, J. (2004) A word's eventful journey. *U.S. News & World Report*, 136(4): 51

Wheeler, S., Waite, S. J. & Bromfield, C. (2002). Promoting Creative Thinking through the Use of ICT, *Journal of Computer Assisted Learning*, *18*, 367–378.

Retrieved August 16, 2013, from http://www.steegle.com/about/google-101-facts/76-101-googles-work-culture

Retrieved August 16, 2013, from http://en.wikipedia.org/wiki/Serend-ipity

Retrieved August 16, 2013, from http://p2pfoundation.net/Collaborative_Organization

Retrieved September 1, 2013, from http://www.ucl.ac.uk/news/news-articles/1210/121004-serendipity-more-than-a-happy-accident