IT INNOVATION FOR ADAPTABILITY AND COMPETITIVENESS

IFIP – The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within member countries and to encourage technology transfer to developing nations. As its miss statement clearly states,

> *IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.*

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

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IT INNOVATION FOR ADAPTABILITY AND COMPETITIVENESS

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Message from the Organizing Chair

IT Innovation for Competitive Advantage and Adaptiveness

Martin Curley,
Director, IT Innovation, Intel Corporation

Achieving competitive advantage from Information Technology or at least proving the business value of IT has long been a holy grail for both CIO's and academic researchers. The statement by Robert Solow in 1987 "I see computers everywhere except in the productivity statistics" initiated a more than decade long debate on the business value of IT. This became known as the "IT productivity paradox" which stated that despite enormous improvements in the underlying technology, the benefits of IT spending have not been found in aggregate output spending. A summary report of all related research in this area, published by the Centre of Information Technology and Organizations (CRITO) at UC Irvine (Dedrick et al, 2003), came to the conclusion that the Productivity Paradox had at last been refuted and that investment in IT leads to increased value and improved productivity. Indeed increasingly evidence is available to show that when viewed over a longer period, investments in IT can significantly outperform other kinds of investments. (Brynjolfsson 2002).

In a study from the University of Groningen (2002) on ICT and Productivity, van Ark et al linked the slower adoption of ICT in Europe (compared to the US), to the productivity gap between the US and Europe. This was particularly prominent in the ICT intensive industries where the US saw a rapid acceleration of productivity growth in the second of the last decade, whilst growth in Europe in general stagnated. There is a consensus

growing that investment in ICT leads to productivity growth elsewhere in the economy, particularly in the service sectors.

Innovation is crucial to growth and survival of national economies. In this context IT Innovation is emerging as a substantive approach and tool for driving productivity and growth. The combination of IT enabled business process re-engineering coupled with the increasing flexibility of IT solutions development enabled by web services, means that transformational IT solutions which can transform a firm, industry or indeed a country are becoming more commonplace.

Additionally the ever improving economics of IT infrastructure performance driven by Moore's law, means that IT Innovation as a sub-discipline of information technology will become more substantial and compelling. Who would have imagined in 1976, when a Cray C1 computer costing $5million delivered 0.16 Gigaflops, that desktop PC's many times more powerful would be commonplace in 2004. Today a PC based on a 3GHZ Pentium ® 4 microprocessor delivers computing power of 6 Gigaflops at a price of approx $1400. With this kind of power available to millions of users worldwide, the sweet spot for IT innovation has forever shifted from the mainframe to the PC client. Dale Jorgenson (2001) summarized the impact of Moore's Law when he said "Despite differences in methodology and data sources, a consensus is building that the remarkable behavior of IT prices provides the key to the surge in economic growth!"

IT innovation really means IT *enabled* innovation as any innovation requires the co-evolution of the concept, the IT solution, the business processes and the organization. Transformational success is achieved when these four entities are co-evolved in parallel. However when dissonance occurs between the evolution paths across a major transition then significant problems occur. Organizations that succeed at a major IT enabled transformation typically have a compelling vision, a determined credible champion, a well developed IT capability and momentum which is built through early quick wins.

Rapid Solutions prototyping is a key experimentation process for furthering innovation as new or modified concepts are rapidly made real in a solution or environment that can be experimented with. Fast iteration of the rapidly developed prototypes can lead to order of magnitude improvements in functionality and capability and decreased time-to-market.

Within Intel we have used IT enabled Innovation and rapid solution prototyping to deliver new capabilities. For example in our engineering computing activity, we rapidly migrated a suite of design tools from a Unix/Risc platform to a Linux/Intel Architecture platform and have achieved more than $500 million savings in capital avoidance in three years while meeting computing demand which is growing by more than 100% annually.

Another example of IT Innovation is using individual PCs for caching of rich media content to deliver new capabilities such as eLearning and video to the desktop to tens of thousands of employees worldwide at almost zero incremental cost.

One way of describing the impact of IT innovation are improvements in efficiency, effectiveness or transformation. Typically efficiency and effectiveness improvements drive incremental business improvements, however IT enabled transformation can drive structural changes and advances. Let's look at some public sector examples.

At Westminster City Council in the UK, Peter Rogers the CEO and the council Leader Simon Mallet have developed a vision of how the city could be transformed using wireless technology, enabling delivery of better services to citizens at lower cost – for example the use of wireless WiMAX technology with IP camera technology can reduce CCTV installation cost by 80% dramatically advancing the crime-free agenda of the city.

In Portugal each third level campus is being unwired using WiFI technology and the government, working with private industry is promoting the adoption of wireless notebooks by all third level students, helped by low interest loans provided by the major banks. In this way the Portuguese government hopes to transform learning in Portugal and ensure the Portuguese information society has one of the fastest learning velocities in Europe.

At the National Health Service in the UK, more than £9 billion is being invested in ICT to transform the UK health service. Against a backdrop of a mission "saving lives, cost effectively" these ICT investments will introduce better solutions such as decision support systems for doctors, improved administration systems to enable easier appointment booking and mobile point of care solutions, based on wireless tablet technology to in-hospital staff and district nurses.

All of these solutions are transformational, involving a lofty vision and elements of public-private partnership. In an increasingly complex world with pervasive computing looming in the horizon, those countries which embrace IT enabled innovation will lead as the transition from the resource based economy to the knowledge based economy continues unabated.

This conference discusses the many aspects of IT innovation, including high technology adoption, innovation diffusion in firms and industry/public sector and the business value of IT Innovation. I hope it contributes to the evolution of IT Innovation as a discipline and improved solutions for citizens and customers everywhere.

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Preface

IT Innovation for Adaptability and Competitiveness

Eleanor Wynn
Brian Fitzgerald

IFIP WG 8.6 has as its focus diffusion of technological innovation. In this conference we have solicited papers on the topic of IT innovations that can further an organization's ability to adapt and be competitive. Thus we address the problem at an earlier starting point, that is, the emergence of something innovative in an organization, applied to that organization, and its process of being diffused and accepted internally.

A further extension of this would be the propagation of a successful innovation outside the originating organization as a product, service or example of technology use that builds the firm's markets. In this discussion we are supposing that said innovations are indeed a contribution. In reality, an idea is only labeled an innovation once it is accepted. Before that time, it can be just an idea, a crackpot idea, a disturbance, obsession, distraction or dissatisfaction with the status quo. Many innovations are of course deliberately cultivated in research labs, but again their success is the determinant of their eventual designation as "innovative".

Conversely, some ideas really are crackpot concoctions or technologies in search of a use that linger in the environment as potential innovations long after their use is discredited. Case in point: voice recognition software, which does have some applications but has been over hyped and over applied for about 20 years. Today some call centers won't let users punch a single button on their telephone sets; they MUST tell the voice recognition program what they want. Some of these systems will revert to an operator if

the voice recognition system doesn't understand, while others will just hang up. We were relieved to note the following title in the March 5 *Financial Times*: "To speak to an operator, start swearing now." Someone has developed an innovation to recognize user frustration and bypass the prior innovation of persistent automated voice "response"!

It is the matching of a capability to a need that is the innovation, and the uptake of this match that is the adoption or diffusion. In a large organization, this process can be long, challenging, and fraught with possibilities for failure, frustration and financial loss.

What makes something an innovation is its eventual utility. In IT, the case is even stronger. Innovation in IT is what helps the firm to survive, adapt and compete on operating costs, on production, on coordination of resources and in the marketplace. Necessity is said to be the mother of invention. As Chesbrough (2003) starkly declares: "Most innovations fail. And companies that don't innovate die". With this in mind, we suggest that innovation in the organization is not a luxury, but a critical means of keeping up with changing circumstances and opportunities. The organization that doesn't innovate at least in parallel with its industry or markets, can be doomed.

Let's take the example of the American steel industry (Tiffany, 2001; Christensen; 2003). Japanese steel makers began using highly efficient production technologies in the 1970s. They also focused on particular markets for steel products utilizing "mini-mill" technologies that could be efficient using scrap rather than ore and in smaller production batches. Meanwhile the American steel industry, with its installed base of foundry equipment, could not see the rationale for paying the price of upgrading their technology. By the time they did see the rationale, they could no longer afford to make the purchases. The markets had been undercut by superior Japanese products that cost less. Had they considered innovation as essential to survival, or conceived that the day would arrive when this major US industry would even see foreign competition within their own markets, they would have acted differently.

Innovation in industry and in technology are "nothing new". Technology innovations have revolutionized civilizations, trade and economies for millennia. Iron implements, gunpowder and antibiotics all made indelible marks on history and culture. There is a proposed parallel with adaptation in species, in the sense that adaptation to the environment that make individuals more successful become adaptations to the gene pool. However, environments in nature do not stay static, and so adaptation continues, given normal cycles of natural change. Cycles of historical change are potentially more turbulent than change in nature, and we are in a particularly turbulent historical period now, both socially and technologically.

So, innovation really is part of the normal life cycle or life process of a business or an industry. Innovations arise as responses either to new needs or to perceived failures, inefficiencies or obstacles in the current process. Innovations tend to beget more innovations. This is especially true of information technology. Indeed, we can go so far as to state that information technology innovation is insufficient unless leveraged successfully in a business context, either for adaptability or for improved competitiveness. As computing power increases and computing devices shrink, more can be done. Large mainframes gave way to minicomputers, which led to desktop computing. The "real" origin of the Internet was a patch to a network set up by two computer scientists at Stanford and UCLA. A professor in Santa Barbara wanted to be on the file transfer system and he "invented" TCP/IP as a way to avoid a "party line" effect (everyone talking at the same time) when he tapped into the wire that went through Santa Barbara on its way from Stanford to UCLA. The next phase in an innovative process like that one is of course to refine, to begin to see new possibilities arising from the leap that has just been made, and successful examples then beget exponential growth.

This is one reason why we are cautious about the idea that diffusion of innovation is a problem to be solved independently of the contextual validity of the innovation.. Innovations that make an impact, providing they are made within a context of immediate application, tend to be self-propelling to some extent.

However, there is something that stands in the way of the adoption even of valuable innovations and that is the worldview or formative context of the environment (Weick, 2001). Innovations are made in the context of institutional embeddedness. That is, the object of innovation does not stand alone, but is set within an economy, a set of cultural and business practices, a set of values and perhaps most important, a set of interests. Some innovations do in fact defy all of the above and succeed in spite of circumstances. Other inventions need only contravene one of the embedding conditions, let's say interests, in order to meet with failure or to be delayed by decades until the use is absolutely compelling. The case of the American steel industry should be a lesson in that regard: when the use becomes compelling, will it still be possible to employ the innovation, or is there a window of opportunity beyond which too many changes in the environment make adoption, though necessary, impractical?

Hence the focus on innovation and innovation processes as a value in and of themselves. The tendency to entropy is as endemic as the tendency to change and adapt. Nature doesn't really care whether species adapt to climate changes or other conditions. It is up to the species to permute themselves accordingly. Within social systems, then innovation must be

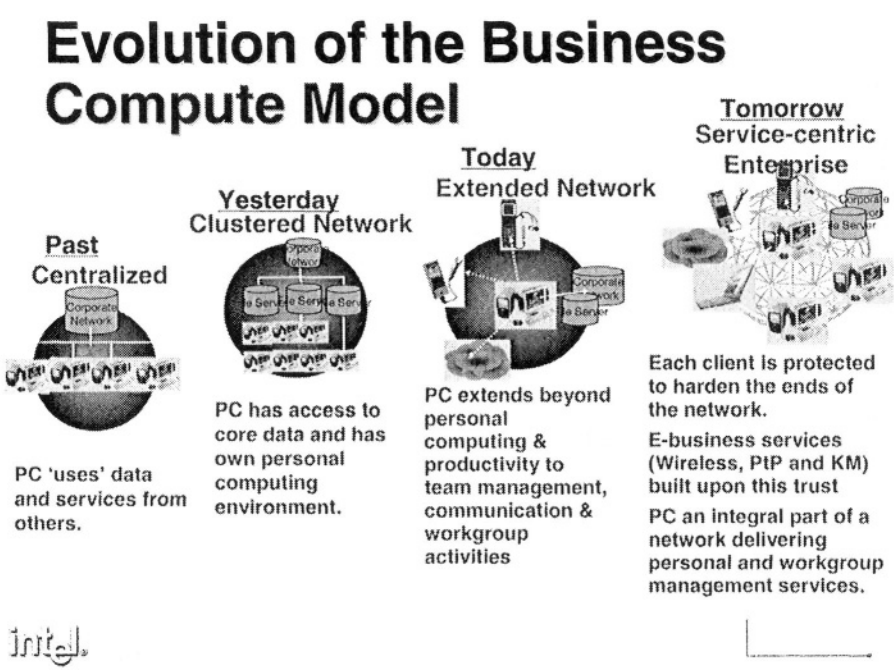
conscious, even self-conscious. It requires an ontological reflection as to who are we, why are we here and how do we plan to survive given uncertain futures? None of this is imperative day-to-day, so it is possible to go for some time without innovating until a point of crisis is reached.

A coherent innovation strategy would anticipate many possible scenarios and have innovations available that can be tailored to meet the needs. If innovation only comes up when the crisis is at hand, it is likely to take too long. This is partly because of the reflective process we referred to earlier. The process of organization reflection, suggestion, problem-setting, differentiation, concept testing and then product testing can take three years from start to finish, with the best of intentions. Innovation by definition is not the familiar, but the unfamiliar. Many stakeholders have a hard time telling a viable innovation from frivolity or waste; the problem must be perceived in order for a solution to be apparent as such, and so forth, in a fairly deep and emergent social process (Nonaka and Takeuchi, 2001).

Planning in an organization can easily be bounded by the familiar. It can be based on assumptions that are linear with today's environment, e.g. assume a certain growth rate in the market, assume a certain amount of incremental change in the environment, and prepare for that Weick, 2001). But history tends not to be smooth and linear but to contain major disjunctures (can also be referred to conversely as "conjunctures" per Fernand Braudel (1995) and discontinuities. It is safe to say that the present period is exemplary of such a disjuncture. Therefore, nonlinearity in the rate and kind of change should be expected, and multiple innovations should be encouraged to meet a range of possible near term future needs.

An IT department, which after all is the focus of the conference, tends to be pulled strongly towards first of all, stability and reliability, which can be seen as contradictory to innovation. IT organizations in many corporations today are still seen as commodity functions that constitute a necessary cost of doing business, but not as a strategic option for radically increasing profits. There are many contrary examples in the literature (Jelassi and Ciborra 1994), but the fact remains that most chief executives are as happy to raise IT costs as the ordinary householder would be to have his or her electricity bill increase. There is no perception that an increased electricity bill would change the quality of life (unless it is feeding a hot tub).Similarly, IT costs are seen as something that needs to be "kept down". In addition, nobody wants to take risks with something as basic as IT. No electricity is a huge disruption and network downtime can bring a company to its knees. Risk aversion is therefore endemic to the concept of IT. Innovation is constantly needed but also threatens to disrupt, and being innovation, the return on the risk is usually uncertain. Indeed, given the two constraints

above, innovations in IT tend to be incremental rather than radical. But let's take a look at the steps that have already happened within the domain of IT.



Graphic courtesy Chuck House, Intel IT

These are order of magnitude changes in capability. Costs are discontinuous with a maintenance or gradual improvement approach. Benefits tend to be exponential, though given that new capabilities are involved, baselines often don't exist. Opportunities, however, become obvious after the fact.

Often the actual opportunities that emerge are different from the opportunities that were anticipated. As we know, many software projects fail or are abandoned. There is a constant process pushing toward innovation, not always successfully. Part of the problem is the mismatch between vested technical expertise and the ability to envision the organization as a social environment. Users tend to be held treated as a mystery, ignored, force-fitted or indulged with superficial adjustments. Some innovations are not in fact really innovative, precisely because, although they address one piece of a corporate problem, they ignore the institutional context. They serve only one stakeholder, not the chain of stakeholders that are impacted. They represent a technological capability for which there is no use at the moment, or whose use has not yet been married to the capability. Actually fostering, creating

and implementing innovation requires a systemic view of the organization and how it works.

This systemic view can be the most difficult part of the innovation process or innovation artifacts.

In his book Hidden Order, Holland (1996) described the features of a self-organizing system in nature or in any system that takes on properties of self-organization, i.e. where there is a certain degree of agency, autonomy, complexity and interdependence, as follows:

- Aggregation
- Nonlinearity
- Flows
- Diversity
- Tagging
- Internal models
- Building blocks

This is not the place to discuss the features at length. Suffice it to say that a self-organizing system consists of a certain amount of mass, has emergent properties that are non-linear (ie can "take off" or "collapse" depending on key elements), has independently interacting elements, is diverse in its forms, possesses some kind of communication mechanism, has type consistencies with expected behaviors, and can grow organically by means of higher level entities than the units of each type.

The feature to be called out here is diversity. Diversity would work in nature by means of sufficient variety in an ecosystem that the system can rebuild itself in case of a collapse. For instance, trees are cut, birds have no more habitat, insects proliferate, etc. as one set of cascading effects. In fact, this system can eventually regenerate itself by the same mechanisms that enabled it to exist in the first place, a property of robustness that depends on diversity. Seedlings of trees sprout, weeds provide some cover for water retention (assuming they don't choke out the seedlings), growth creates shade, shade helps retain water, trees get bigger, leaves or needles compost, and eventually, if they aren't extinct, birds can come back. It isn't guaranteed that an ecosystem can rebuild, but if it does rebuild it does so by means of diversity. Not every species or element is equally affected by environmental circumstances. Some can survive to begin a process of regeneration.

Organizations try to build some of this robustness into network systems. Indeed part of that robustness can be generated by inadvertent diversity in the accumulation of historical artifacts that make it less than a perfectly rational system. New systems for network security against viruses may rely on a biological model of immunity, where there is sufficient slight diversity

in operating systems to slow a virus down, just as nature protects against extinction through biodiversity. .

So, diversity is a survival strategy and an adaptation strategy. And innovation in technology provides ample diversity. Neil Smelser (1995) in his economic sociology has referred to stages of innovation during a given historical period. For instance in the early stages of the industrial revolution there was a high degree of diversity in the types of inventions devised for a particular usage. This was also evident in medieval science as Kuhn describes it, with individual scholars inventing whole nomenclatures and models for systems that eventually became defined as optics or chemistry once established. At the point of paradigm convergence or stability, whole lines of research fell by the wayside that once had flourished when no common agreement existed about how to define this realm.

However, even though conventional wisdom suggests that diversity is an important survival and adaptation strategy for innovation, the IT sector is one in which there are no absolutes. For example, when MicroPro who produced the once-dominant Wordstar word processing package sought to diversify into other product offerings, this allowed their main competitor, WordPerfect, to usurp their dominant position. Yet, several other companies failed to survive because of a lack of innovation and diversification. RCA, once the dominant pioneer in consumer electronics failed precisely because of their lack of diversity as they bet all on vacuum tube technology which was completely superceded by transistor and solid state electronic technology.

Likewise, the future trajectory and potential of innovation is by definition unpredictable. Gordon Moore, founding CEO of Intel, has admitted that when IBM awarded Intel the design win for their 8088 processor in the IBM PC, it was not seen as one of the top 50 market applications for the 8088 product. Yet, today most of Intel's revenue and profits stem from the Pentium microprocessor range descended from the 8088 used in the IBM PC. Hidden within novelty, therefore, are different models, even though they appear to perform similar functions. Models carry implications and have more or less extendibility or scalability. When technologies are new, it is less likely that any one observer will be able both to understand the underlying technological model and to understand the social model implied in it.

During the computer era, change, including paradigm change, has happened so rapidly that invention seems not only normal but obligatory. It is an engine of economies and as new possibilities become apparent on the horizon of current capabilities, innovation continues to be spurred forward towards that next thing. Innovation makes gaps apparent, gaps that never

existed because no solution was at hand, no basis for noticing an absence was evident.

What we know as the current era of globalization (Friedman, 2004) is a product of convergence or *conjoncture* of a combination of technological capabilities that together add up to a critical mass phenomenon resulting in a state change in world labor markets. In a recent New York Times editorial, the columnist Thomas Friedman wrote from Bangalore, India about the circumstances that enabled the current economic vibrancy of that city. Although there are downsides to be noted (Madon & Sahay, 2001), as well. Friedman writes:

> Globalization 3.0 was produced by three forces:…first, massive installation of undersea fiber optic cable and the increased bandwidth (thanks to the dotcom bubble), that have made it possible to globally transmit and store huge amounts of data for practically nothing. Second is the diffusion of PCs around the world…third is the variety of software applications….that when combined with all those PCs and bandwidth, made it possible to create global "workflow platforms".

Thus a series of innovations and breakthroughs in separate technology areas combined with geopolitical and economic circumstances to create a large threshold effect of offshore outsourcing of knowledge work.

Let's take the example of distributed collaboration within an organization. Again, first came the mainframe, then came dedicated lines between mainframes, then came minicomputers and their networks, then came the desktop and networked computing, giving rise to e-mail, e-mail attachments, then the web with graphics, etc. etc. Some of these changes early on made it more possible for a company to operate with remote offices and still have some kind of real-time coordination, or near-real time. That ability led to the need to communicate different kinds of material remotely, not just data but documents, documents with graphics, documents from different operating systems and so on. Most of us have lived through these transitions. So, technology enabled corporations to operate remotely, which led to more remote office, which led to overseas outsourcing, people not having to move to follow a job within the company (a major population mover for the middle classes during the 50s and 60s). But the more distributed the more desire for something like real time communication and the "experience" of collocation. So many elements go into this movement of being distributed because you can, then wanting it to be better, then relying more on remote communications therefore needing better tools, that the solution is still in the process of being devised. Remote collaboration takes a combination of key technologies, interoperability among them, a compelling

social experience and graphics and usability stickiness at the top level. Many different "solutions" are individually invented around these needs.

Such a complex area of inquiry and invention practically creates an ecosystem of its own, in terms of infrastructure, technical capability and choices (e.g. objects, content management, instant messaging, and imaging of members), connection speeds, standards, graphics elements, design, selection among key features, all hanging together without overcomplicating the interface. In a case like this, eventually one small innovation can become the enabling factor; or else, one small perception of the situation. In our recent work at Intel (Lu, Wynn, Chudoba and Watson-Mannheim, 2003), we discovered that 2/3 of employees, including all job types and geographic regions, work on three or more teams at any given time. This observation had not previously been embodied in any well known collaboration suite on the market. As a result in existing tools, each team is allocated a partitioned space.

The growth in number of separate teams or projects requires more and more overhead on the part of the user to manage across these teams. Indeed, it becomes almost impossible to see a roll-up of all one's responsibilities.

Hence the single observation of multi-teaming could lead to a key innovation in collaboration environments. At the same time, once we conceive of teams as interlocking or clustering in like-minded networks, the requirement for security and permissions on the individual team sites becomes a more complex problem. Indeed when a group at Intel working on the development of new enterprise collaboration tools showed our collaboration concept at an internal invention fair, the most ardent of the admirers were two security gurus who saw at last a user model for technical work they had developed over the years. Thus innovations interact and encounter each other in a cumulative process. That is what happens assuming the "flows" in the self-organizing system framework are fluid enough for innovations to encounter one another in a social or professional network.

In recent years, the open source software (OSS) phenomenon is one where emergent properties reveal innovations beyond those planned or intended. While the concept of free software had been around for years, the coining of the term "open source" didn't radically change the core definition. At heart, free software and open source software are equivalent concepts. However, the free, as in unfettered rather than no cost, access to source code is not what makes the open source phenomenon so innovative. Indeed for many organizations, it is the free as in beer that is attractive, and they are as likely to deploy closed software provided it is zero cost (Fitzgerald & Kenny, 2004). However, the open source term is far more business-friendly and less ambiguous than free software. Certainly, Wall Street and the stock

market embraced it enthusiastically, with VA Linux and Red Hat achieving record-breaking IPOs. Also, despite some claims, access to the source code is not the key factor in itself, but rather how this facilitates the collaborative development model of truly independent pan-globally located developers which allows for a rapid evolution of 'killer applications'. The OSS phenomenon has also elicited a great deal of interest beyond the domain of software. It provides new business models and innovative modes of work organisation which have been extremely successful. For example, rather than stifling a local software industry as has been suggested, it appears that small companies and SMEs (small to medium sized enterprises) can treat OSS products as an infrastructure, akin to the rail, highway, electricity networks, and bootstrap a lucrative service model on top.

Furthermore, it has been suggested that the OSS principles of openness and inclusiveness, provide an exemplar for the future of society, and help point the way to addressing the 'Digital Divide'. However, this picture is not so straightforward as it seems, as attempts to stimulate open source communities in Africa have failed to take off there, largely due it seems to a basic mistrust that there can be any value in initiatives that are provided for free.

In brief, the selection process, otherwise known as adoption or diffusion, exists in a complex environment of prior inventions, known needs, encounters among participants in different disciplines, and ultimately in the perception of the need within the context of the new capability. Without some kind of self-examination, in the one case an internal survey, arising from self-reflection (professionals asking themselves: "do other Intel employees work the same way we, the professionals looking at the situation, do? If so, what does that imply for return on investment in exploring collaboration tools from the point of view of our needs rather than from the point of view of what is out there?")

What does this imply for corporate governance, control systems or infrastructures that would support innovation? One provocative writer (Obstfeld, in press) has drawn out a relationship between types of personal networks supported within an organization and the propensity to innovate. Pursuant to Watts' description of the two extreme types of networks, completely closed and redundant vs. completely open and random, Obstfeld describes network bridges that enclose "holes" in a network as particularly fruitful patterns for the creation of innovation. While it is beyond the scope of this preface to fully describe the type of corporate structure that would support innovation, we feel that it lies in such a direction: internal communications systems and methods of social signaling across boundaries where self-organizing networks produce adaptive systems. Many of the

papers for the conference support similar scenarios for the support of information technology innovation.

In earlier paragraphs we discussed the diversity of innovation as an indicator of a time of rapid innovation, before a pattern of usage and institutionalization sets in to a new type of technology. Our conference papers are reflective of this diversity. While information systems innovation has been proceeding apace for about fifty years, we still find ourselves in formative stages of new capabilities, as well as new circumstances. Currently, wireless technology and globalization in the capabilities and conditions sectors respectively, are driving a large array of invention. The papers submitted to the conference reflect that branching.

We have divided the papers into the following sections. It was not initially obvious to us what the clustering pattern was. The papers seemed so diverse. Brian Fitzgerald took one cut at clustering them, which gave us a structure. After that, Eleanor Wynn re-sorted them and then renamed the clusters. We believe this may resemble the pattern for innovations in the corporation in the marketplace. At first, innovations defy classification. Or, they are placed in the wrong category and compared on the wrong terms. This has happened recently in the so-named knowledge management sector. Nonaka and Takeuchi 2001) brought us a very robust definition of corporate knowledge and how it is co-created. Then a consulting industry arose. In that process, many approaches aggregated based on some kind of relationship to the concept of knowledge. But underlying approaches varied widely in both their technological and their sociological assumptions.

Library and information science professionals and academics eagerly undertook the complex problem of classifying, tracking and understanding the cognition of knowledge-seeking. People with a social science or interactionist bent, whether academics or practitioners, focused on social networks and how to utilize them. In the middle many sophisticated technologies arose that went around the problem of classification and subtly addressed the sociological side using patterning matching and inferencing technologies like collaborative filtering or Bayesian networks. Looking at the situation from a participant observer or action research perspective, it became clear that the field had divided itself into “technology solutions” and “people-to-people solutions”. This division is inherently spurious but it comes easily to hand in many environments. (Bloomfield & Vurdubakis, 1994)

Interimly the result of that was to overlook those sophisticated technologies that did not match any prior conceptions of “knowledge” or “management”, that instead were quite risk-taking in terms of where they penetrated the problem: by trying to make sense of tracking the behavior of participants and objects in a knowledge-based environment. The risk on the

technology side was the confrontation with Protestant ethic of "management must be orderly" or the Cartesian ethic of reduction to basic terms. Alas, those basic "terms" are unstable in an organization just at the point where their content becomes interesting. Organizational "knowledge" is unlike scientific knowledge in its volatility and time-dependency for relevance. In other words, organizational knowledge is actually highly innovative, but very hard to keep up with. Trying to box into a classification scheme, unless a natural classification already exists or the field is defined by its classifications and terms, e.g. natural science, software, etc. is a guarantee of instant irrelevance. Also classification simply cannot anticipate what will happen in a turbulent environment. Does this mean that classification and taxonomic systems for content are wrong? No it does not. But they do not keep pace with the dynamics of language that actually drive innovative thinking in the organization, in an industry and in the policy and political environments in which these exist.

The tracking process, which comes in various forms, but notably Bayesian systems and collaborative filtering, does not anticipate the content, terminology or behavior, but by various means clusters it into statistical patterns that are then interpreted and labeled by people, who understand through recognition when a relevant relationship has been made. This is especially important for quality filtering, Collaborative filtering simply points out what others who chose one object in common with a user, also chose.. It uses the object of knowledge or the choice as the basis of comparison. This choice then can predict other choices across domains based on similarities implied in the users just because they made these choices. It is incredibly efficient. It does not rely on labeling or classifying but tracks far more subtle evaluations made by individuals as they act.

The "people" vs. "technology" polarity breaks down completely here because the technology is sophisticated but reflective rather than predictive. We believe that a key aspect of innovation is to break down older dichotomies, to search for new frameworks and to implement those frameworks into the adaptive organization. In this process "who are we?" – *that* type of ontological question-- is just as important as "what shall we do/how shall we proceed?"—the epistemological question.

In short, thanks to our illustrious authors, who defy classification, we have discovered a clustering of the conference papers along the following lines and have labeled and relabeled them accordingly. We were very pleased with both the quantity and the quality of papers received. Given that our call for papers on adaptability and competitiveness was, we hope, not squarely in any one conventional topic area, we were gratified that authors found a way to match their interests with our theme in a way that we see as productive and imaginative.

THE ROLE OF IT IN ORGANIZATIONAL INNOVATION:

Ghada Alaa and Guy Fitzgerald, Evolving Self-Organizing Activities: Addressing Innovative & Unpredictable Environments

Shaila Miranda and Robert Zmud, Enriching Views of Information Systems within Organizations: A Field Theory

Steven Alter, IT Innovation Through A Work System Lens

Tom McMaster and David Wastell, Success and Failure Revisited in the Implementation of New Technology: Some Reflections on the Capella Project

Brian Donnellan, It Systems to Support Innovation

INNOVATING SYSTEMS DEVELOPMENT & PROCESS

Helle Damborg Frederiksen and Lars Mathiassen, Assessing Improvements of Software Metrics Practices,

Ivan Aaen and Jan Pries-Heje, Standardising Software Processes - an obstacle for innovation?

Anna Börjesson and Lars Mathiassen, Organisational Dynamics In Software Process Improvement: The Agility Challenge

Richard Vidgen, Sabine Madsen, Karlheinz Kautz, Mapping the Information System Development Process

Björn Lundell, Taking Steps to Improve Working Practice

ASSESSING INNOVATION DRIVERS

Carl Magnus Olsson and Nancy L. Russo, Evaluating Innovative Prototypes: Assessing the role of lead users, adaptive structuration theory and repertory grids

Keith Beggs, Applying It Innovation: An empirical model of key trends and business drivers

Malvina Nisman, IT Business Value Index

Cindy Pickering, Using IT Concept Cars to Accelerate Innovation: Applied research and iterative concept development for sharing a vision

Linda Levine and Kurt M. Saunders, Software Patents: Innovation or Litigation

INNOVATION ADOPTION

Edoardo Jacucci, Temporal Disclosedness of Innovations

E. Burton Swanson, How is an IT Innovation Assimilated

Pernille Bjørn and Ada Scupola, Groupware Integration in Virtual LearningTeams

Helle Zinner Henriksen, IOS Adoption in Denmark Explanatory Aspects of Organizational, Environmental and Technological Attributes

Jim Brown, Lifting the Barriers to Innovation: A Practical View from theTrenches

Björn Johansson, Diffusion Of Application Service Provision Among SMEs

NEW ENVIRONMENTS, NEW INNOVATION PRACTICES

J. P. Allen and Jeffrey Kim, Digital Gaming: Organizing for Sustainable Innovation

Michael Ney, Bernhard Schätz, Joachim Höck, Christian Salzmann, Introducing Mobility: The mPolice Project,

Tony Salvador, Kenneth T. Anderson, Supporting the Re-emergence of Human Agency in the Workplace

Audrey Dunne and Tom Butler, Learning Management Systems: A New Opportunity

Chris Barry, Web-Based Information Systems - Innovation or Re-Spun Emperor's Clothing

PANELS

Piero Bassetti, ICT Innovation: From Control to Risk and Responsibility

Frank Land et al., PANEL TITLE: The Darker Side of Innovation,

V. Sambamurthy, Panel: IT as a Platform for Competitive agility,

Esther Aleman: Innovation in academe

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