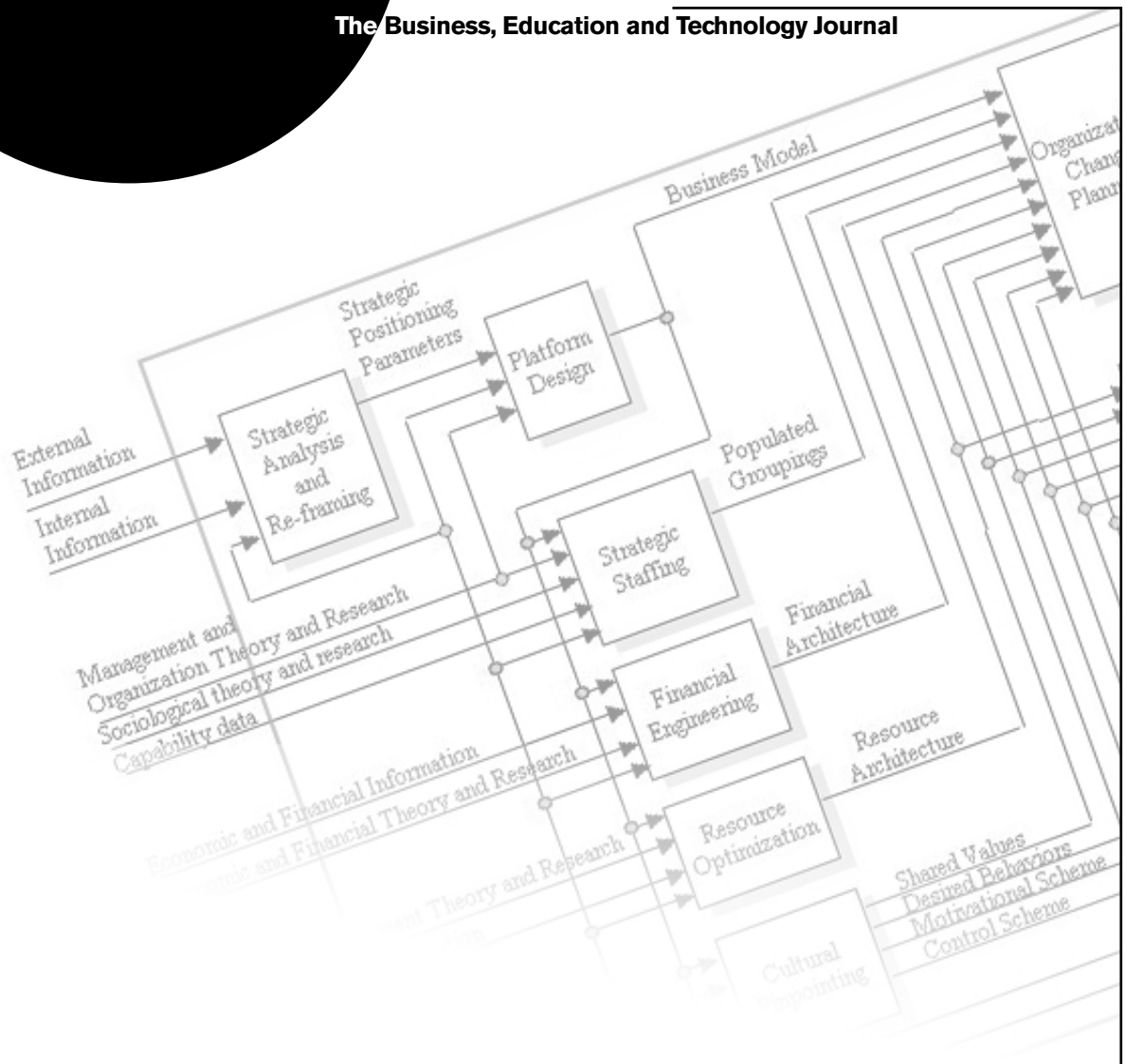
BETJournal

The Business, Education and Technology Journal



Volume 3, No. 2

Fall 2001

A publication of The School of Technology and Industry

Golden Gate University

Table of Contents

About the Journal

The Business, Education and Technology Journal is a peer-reviewed publication of the school of Technology and Industry at Golden Gate University, San Francisco, CA. The Journal is devoted to the study of the relationships among the disciplines of Business, Education and Technology. It aims to publish papers that investigate commonalties, convergence, best practice, conceptual thinking and research findings in these areas.

Manuscripts describing original research, analysis and application of research and theory, perspectives, development and application of programs in business and educational settings are welcome for consideration.

Submission Guidelines

Your work should not be under consideration for publication in other venues, and should be free of copyright restrictions. You'll agree that if the work is subsequently published in whole or in part, you'll credit the BET Journal as the original source.

For further submission and copyright information, contact journal co-editor

Dr. Robert Fulkerth, Associate Professor
School of Technology and Industry
Golden Gate University
536 Mission Street
San Francisco CA 94105
415 442 6556
bfulkerth@ggu.edu
http://internet.ggu.edu/~bfulkerth

From the Editors

Welcome to the Fall 2001 edition of the Business, Education and Technology Journal. The Journal publishes articles on theoretical and practice-oriented topics impacting professionals in the disciplines of technology, business and education. This edition features an eclectic mix of articles, with a general focus on doing business and education in a world mediated by electronic technologies.

In our Fall 2001 introduction, Co-Editor Constance Beutel interviews Christine Crandell, President of New Business Strategies, a consulting firm with a forward-looking approach that aims to help progressive businesses look both inward and to the future, as they engage in strategic planning.

In "Not Only a Vision, a Common Vision," Sophia Bekelee, CEO of CBS International, a California-based IT company affiliated with SbCommunications Network plc in Ethiopia, discusses the status of electronic technology development in various African countries, with an emphasis on the need for an organized vision for technology development in Ethiopia.

Chan Komagan is a consultant with Scient who specializes in wireless technologies. His expertise includes WAP, BlueTooth and mobile eBusiness. In "Extending eBusiness to the Wireless World," he provides readers with both a primer on wireless terminology, and an overview of technologies that are either here, or just around the corner.

There is always interest in teaching a wider range of subjects in online settings. More diverse courses and course types find their way online as people continue to translate traditional teaching skills to online settings. In "Teaching Applied Business Forecasting Over the Internet," Thomas Bundt discusses a variety of issues of interest to anyone considering mounting a financial/quantitative course online. While including a review of pedagogical and practical questions, he discusses at length the use of vendor-supplied resources and case studies in his course.

In "Working Technology: Issues in the Design of Information Systems to Support Work Practices," Arnold Chandler reviews a wide range of theoretical and applied material as he discusses consideration for the design of effective information systems.

The editors thank Dr. Anne Carlisle, Contract Administrator for the School of Technology and Industry and adjunct faculty member at Golden Gate University, for her contributions and assistance in the preparation of the Journal.

You can see the journal online at http://betj.ggu.edu. A call for papers is found elsewhere in this edition.

Dr. Robert Fulkerth, Co-Editor
bfulkerth@ggu.edu
(415) 442-6556

Dr. Constance Beutel, Co-Editor
cbeutel@ggu.edu
(415) 442-6543

Open Call for Papers

We are happy to invite you to submit papers to be published in the Business, Education and Technology Journal (ISSN 1528-1256). The Journal is published in paper and on the Web. Please visit us at http://betj.ggu.edu or http://internet.ggu.edu/~bfulkerth.

Business, education and technology professionals are invited to submit papers relevant to their own or related fields. The Journal is a peer-reviewed publication of the School of Technology and Industry at Golden Gate University in San Francisco.

For educators, we are particularly interested in new developments in teaching business and technology subjects.

Topics should be of interest to multiple readerships in areas of business, education and technology. Papers that address discipline-specific topics as well as those that have applications across disciplines are valued. Conceptual, developmental and theoretical /applied research articles are appropriate.

We seek articles of approximately 4500 words. The Journal will also consider publishing shorter papers (2000-3000 words) based on in-progress research, innovative practices, or work that actively connects the Journal's primary emphases.

Interested authors are requested to send their papers to either co-editor listed below. Please e-mail submissions with the article attached in Rich Text Format. For initial submissions, papers with extensive graphics should also be submitted in paper form.

Robert Fulkerth, Co-Editor
School of Technology and Industry
(415) 442-6556
bfulkerth@ggu.edu

Constance Beutel, Co-Editor
School of Technology and Industry
(415) 442-6543
cbeutel@ggu.edu

Golden Gate University
536 Mission Street
San Francisco CA 94105

Foreword: Interview with Christine Crandell

Constance Beutel

This Summer I had the opportunity to interview Christine Crandell, President of New Business Strategies. New Business Strategies is a future strategy consulting firm that helps enterprise software technology vendors dominate their chosen markets. Because one of the many factors of leadership has to with vision and action, I wanted to see what Christine and her company were thinking about, and the ways she put handles on the future. What she has to say may provide us with new thinking, and tools for using emerging energies and trends to your business and personal advantage.

BETJ: Christine, tell us about yourself, your background, education and life passions.

Christine: Let me begin by saying that I am honored to be interviewed. I grew up in Europe as an Army brat. Our family moved around a lot, and so I was exposed to numerous cultures and value systems. I consider Turkey as my favorite country as it was so far outside my normal upbringing. Turkey excited me about cultures and diversity as well as archeology, and things like marine biology. My mother is German and I am bilingual in German and English. We moved back to the U.S., to Florida when I was 17 years old. I took my bachelors degree and went on to do my MBA from Florida Atlantic. I minored in computers.

After graduation, I worked for 7 years at Price Waterhouse in their management consulting group doing systems development and implementation. I then moved to SAP America, which then became SAP AG followed by a move West to work with ASK Group, and then on to a marketing position in Oracle. SAP was the ultimate startup company, and we made the rules up as we went along.

These were the early, defining days of what is now called Customer Resource Management (CRM). At Oracle I ran the strategic marketing activities worldwide. These early positions convinced me that I am not a corporate person and that I needed to go back to consulting, which is when I started New Business Strategies with my husband.

My life's passions have always been centered on intellectual stimulation and trying new things in order to grow personally. I have to be challenged and learning all the time and helping people to grow by coming up with new ideas.

There are two things that I zero in on in my thinking about business strategies. The first is what will happen to the new architecture stack for new applications, and secondly, how will this architecture come about and what will it look like in the future? This, of course, involves thinking about the evolving nature of management decision making in the future. How will people actually tackle decision making under new and future conditions? For instance, U.S. and European decision making are different. Add to this mix of processes and styles a globalized and diverse workforce, then the complexity of decision making becomes much more unclear, and to me, a more intriguing problem to work on. The factors of culture and technology are huge areas with big problems. So, I'm acting almost as a sensor, detecting new rules of the game. As we resolve these types of issues, we need to work on how to help people transition to the new environments and platforms for business.

BETJ: Are you writing about these issues?

Christine: Not yet. As much as technology continues to innovate and evolve, it will take a backseat to dealing with our relations with one another. We have spent millions of dollars on applications. The buying of applications has stopped, or at least been slowed as of mid-2000 and the buying of infrastructure has begun. What businesses are realizing is that they have people issues. How people relate to each other is a very big component of doing business.

BETJ: Do you think the new technologies and systems will help us to relate to one another?

Christine: Those who want to relate will take advantage of these technologies. We have a long way to go as a society to learn how to relate and value one another. From space there are no boundaries. Yet we are dealing with all sorts of boundaries to keep people apart. Over time we will have to deal with it, but I don't see us making much progress over the next ten years.

BETJ: Describe what New Business Strategies does.

Christine: We are a future strategy consulting firm that helps enterprise software technology vendors dominate their chosen markets by synthesizing their vision and competencies with emerging market opportunities to set courses for achieving market dominance. In essence, we help companies understand what the future may look like, and determine how they can le-

verage emerging trends and anticipated market shifts to their advantage. So, we are with a business at the early stages of setting its vision and market strategy. We frequently work with them on evolving their strategy and marketing as they and their business models mature. I often say that we are more in the relationship business than anything else, and that depth and breadth of our client relationships is one of our unique trademarks.

I see my role as similar to Lucy in the Peanuts strip. I'm a guide, a future guide. I don't consider myself a futurist, but more like a guide on a Himalayan trek.

BETJ: What does the future mean to you? To your business, to the businesses you consult with?

Christine: To me the future means two things, the time or situation that is to come, and secondly, the opportunity. I believe that we cannot change today but we can change tomorrow. It really is up to us the collective industry and beyond that, society, to shape what can be coming down the road.

For a business, the future does mean possibilities. For some, it means the time when they will become leaders, and for others it means another chance at getting the business model right. The sixty four million dollar question for clients is, how can we understand what the future will look like and see the realistic possibilities for success? And, just as importantly, how will we get there? What's our plan? At New Business Strategies, it is critical that we are able to develop a realistic view of what may happen for a business within a realistic timeframe. It's helpful for our clients to visualize the emerging world and what they need to do to become market leaders. Very few leaders take measurements, keep score about how they are doing.

We help clients do that with what we call inflection points. For example, we have a client in the East Bay for whom we've set 3 inflection points in rolling out their strategy. An inflection point is the shift between customer satisfaction to that of managing a customer's experience. In essence, we wrap their strategy around these inflection points. So, the strategy up to the first inflection point is A, and after that point, it becomes B, and so.

BETJ: What do you see as the key factors and driving forces influencing and shaping the emerging business models?

Christine: Well, within the context of our enterprise class software technology clients, here's my view. The key factors and driving forces include Big Picture areas of the economy, environment, the market and society. Additionally, technology maturation and new innovation in the pipeline, software technology buy cycle, the evolution of management principles, technology adoption and value creation. Within technology innovation is the degree of a technology's disruptive effects. The evolution of management principles is important because these principles and philosophies drive technology acceptance and adoption. Along with new technology innovation is the need for specialized services to support the technology. Finally, value creation is an important factor because it requires that the business problem or condition that is being addressed is painful, acknowledged by the business and it's widely felt.

A big lesson that I learned early on was to not get enamored with any single factor, driver, technology or model, but to view all these things on a continuum.

BETJ: What are your strategies for assessing trends and influences shaping the future?

Christine: We look for patterns and trends. Our strategy is centered on a premise that software markets do not control their destiny. Rather, they are influenced by their own products and the driving forces and factors of their tangential market. Now, a tangential market is a related market. For example, supply chain management is a tangential market to customer relationship management. Then we look at the driving forces and their condition within each of the markets including end user markets. Where it's possible, we research the opinions on the evolution of these forces and markets.

BETJ: Many forecasting and scenario planning processes are more like weather predictions that describe changes in the weather and from which people take action, for example postponing a picnic if rain is predicted, and so on. Do you feel it's possible for business and individuals to influence the forces that shape the future? If so, how is it done, that is, how do you do it?

Christine: Do I feel it's possible to shape the future? Absolutely. Many people who have gained a lucid understanding of the emerging future build a plan or an organizatio n that takes advantage of the driving forces and thereby, influence the driving forces. And, there are many examples of this. Siebel is a good example. Tom Siebel saw a business need and went after it. He not only became the leader in the market, he became the bellwether for where that market was going. In many ways he shaped the future of CRM. Apple is another company that revolutionized the User Interface with the Mac. But, let's be clear, these are not easily sustainable positions. As organizations become large, they lose their nimbleness and willingness to take risks. They stop hiring rule breakers and start hiring rule followers. And many along the way lose their edge.

And this ability to shape the future isn't limited to companies. Individuals can also impact the forces of the future. I'm watching the impact a few individuals have had in redefining and changing the role of philanthropy on social engineering. If we look at the work of Catherine Muther, for example, we see a people like her using her fortune and energy to change the world to be a better place. She is changing how foundations are formed and operate in order to have a more dramatic effect on various social issues that need to be addressed. How is all this done, whether individually or as a business? The first ingredient is to see and understand the opportunity and to have a vision on how to address it. Then comes the passionate conviction to make it happen.

BETJ: What is your forecast for the next 10 years in the realm of computing, information and communications exchange?

Christine: For me, the future becomes foggy at the 5 year point. Remember, I'm the guide. If I look outward in time, I see that change management philosophy is big, up to and beyond the 5 year mark. Technology won't be so apparent because it will be integrated into our processes. We'll have talking walls; I'll manage the business off a threshold basis, with more interaction, much like the way we humans interact normally. As we look at the future, we see an era of compressed business cycles and integrated technologies. The mundane will disappear in business. What will be needed are the human, business relationships.

I do believe in the nature of digital workspaces, where a truly collaborati ve environment is created. And in this environment collaboration and trust will have an advantage.

BETJ: Are you a futurist?

Christine: I don't see myself as a futurist. To me, a futurist is a truly out of the box thinker. One who can envision a new world with new ways of doing things. I see New Business Strategies more like future guides who look out in time and see what we think is going to happen, and then work on ways to get there to capitalize on those trends. As guides we have responsibilities to our clients that futurists don't have. We must carve a path that can be done by the client. Each of our clients is different and has unique core competencies strengths and weaknesses. So, we must also keep an eye on the health of the client along the way to the future. Strategy is as much about implementation and execution as it is about the vision and the Grand Plan. In our opinion, we haven't served our client well if we don't take an active interest in their health along the way.

BETJ: What is your greatest hope for education and learning for the future?

Christine: The methods, techniques and principles are developed that enable all people to realize their greatest potential. Our future depends on effective learning, before people are on the job, while they are working, and apart from their work, that is, their personal interests.

With a client, we are always looking for learning points. I really think of learning as happening everywhere, on the job, outside of the job, next to the job. I see the greatest potential for the world's society to come from continuous learning that is individual-centric and individual-guided. Along the way, I believe that as people learn more and are exposed to diversity—and that's diversity in concepts, value systems, ideas, cultures—they become richer individuals. Through diversity comes tolerance and acceptance, and as importantly, more possibility, which is critical for agility. And these are individuals who are in a position to give back to their communities, to make informed decisions about their lives, environments and futures.

Not only a Vision—A Common Vision

Sophia Bekele

A Common Vision

Vision can be thought of as a foresight, a conceptual framework whereby one articulates her/his thoughts to arrive at an end result as envisaged. A common vision is then a unified view of this framework and complimentary ideas that reinforce the vision, shared by many.

Recently, an Information and Communication Technologies (ICT) conference was organized by the British Council in Addis Ababa at the UNECA conference facilities. I think well-organized forums such as this are important to building consensus of community understanding of issues and to create a shared framework. The uniqueness of this conference was that it called for an ICT vision in Ethiopia. To successfully implement such a vision, the conference further called for a National ICT task force led by the Prime Minister himself. This is an ambitious vision, but I believe it is a practical one.

It is a known fact that Ethiopia needs a vision in ICT; perhaps the deployment of ICT could be an impetus for the economic development of the country. None other than the government could also bring about the changes that will embrace and enable this vision.

Why the government? Considering that most of the country's key institutions and resources are still under government management and driven by the government agenda, the success of Information and Communication Technologies development is still dependent on government policies. Because of this, private sector involvement in ICT in Ethiopia is currently quite limited. Thus, its vision is nearsighted or hampered by the bureaucracy that is associated with the implementation of the public sector policies.

The technology sector in Ethiopia, much like other countries, is characterized by computer products and services companies. The most popular services provided by computer services businesses have been limited to sales of hardware/software and maintenance, training, software development, consultancy and network implementation. While there are about 50 companies that are engaged in this business, few do it well, and even fewer earn a profit from it, particularly sustainable profit.

The reason behind not attaining sustainable income is associated with the high cost of imports, including computing goods and accessories and telecommunication costs. Whereas the limitation and lack of differentiation in the product and services could be directly tied with the telecommunications policy, a government-owned body has a monopoly on the services that could be used to support the deployment of ICTs.

Policy changes that foster enabling environments, such as low taxation on Information Technology (IT) products and liberalizing the telecommunication sector, will allow for competition. This competitive environment can result in economies of scale leading to fair prices, specialization, innovation, and new products and services.

Additionally, to have an equitable distribution of services and to resolve some of the key issues mentioned, government institutions need to be sensitized about private sector business, its development and contribution to the economy. Many capacity-building seminars by the donor communities to the government institutions should also discuss the value and participation of the private sector for a sustained development of the economy.

Many IT and communications companies have been successful globally as a result of liberal economic policies that include the empowerment of the private sector. However, deploying ICT on itself might widen or narrow the digital divides. Therefore, the public policy environment is important in securing positive outcomes. The right public policy environment would allow suitable initiatives by the public and private sectors and by civil society organizations, individually or in partnership, to contribute to relevant development and set the context in which enterprise and other initiatives would be channeled in the right direction.

Let us look at some examples close to home:

- Nigeria has over 4-5 mobile operators, whose businesses initially started as a joint venture with the government. Several Internet Service Providers (ISPs) exist, and communication and broadcasting are deregulated via the franchise model.
- Senegal has over 8 ISPs.
- Kenya possesses a similar environment.
- Ethiopia, on the other hand, has a single ISP only, providing insufficient Internet access and hosting services to an overcrowded market.

The Ethiopian Telecommunication Corporation (ETC) can forge partnerships initially with the private sector to improve its service delivery capacity, and also to encourage private sector penetration where the service will be efficient and profitable. The benefit to government will be through receiving royalties and fees.

It is worth noting at this point as we also talk about vision for an information society at a country level, the UNECA, as one of the pioneer organizations in ICT advocacy in Africa, has put a lot of effort not only in advising its member states, but also by investing and advocating the use of ICT for the speedy entry to the information age. In order to speed the continent's digital inclusion, the UNECA has initiated the African Information Society Initiative (AISI), a guiding framework on which to base information and communication activities in Africa. This initiative was adopted by OAU Council of Ministers meeting in its Sixty Fourth Ordinary Session held in Yaounde, Cameroon, in July 1996.

The AISI action framework calls for the elaboration and implementation of national information and communication infrastructure (NICI) plans and strategies involving development of institutional frameworks; human, information and technological resources in all African countries, and the pursuit of priority strategies, programs and projects which can assist in the sustainable build-up of an information society in African countries. It has been recognized by our leaders now that building an information society will help our continent to accelerate its development plans, stimulate growth and provide new opportunities in education, trade, healthcare, job creation and food security, helping African countries to leapfrog stages of development and raise their standards of living.

The ECA has also conducted the first edition of the African Development Forum (ADF 99) under the theme "The Challenge to Africa of Globalization and the Information Age", held in Addis, Ethiopia, in October, 1999, in order to evaluate the progress made in the implementation of the AISI initiatives.

The implementation of AISI is well underway in Africa. Some of its achievements are seen in the area of policy awareness, democratization of access, connectivity, and project initiatives such as the UNECA's Technology Center for Africa, that have been successfully launched. Additionally, with a view to monitoring the progress and results of AISI, the UNECA has appointed an African Technical Advisory Committee. In their role as the African vision guiding the AISI, the 10 members of the committee provide technical guidance and advise the ECA Secretariat on issues related to the implementation modalities of AISI.

The recent meeting of the advisory committee resulted in a successful completion of identification of the key issues of ICT in Africa, concluding with a Common Position on Africa's digital inclusion to the G8's Digital Opportunities Task Force (Dot Force) created by the G8 Heads of Government. The discussions focused on the need to have an African voice and that a common vision already exists through the AISI framework and the political endorsement and commitment, and the need to form synergies among similar initiatives.

With the AISI framework, we could say that an African position is now in place, and Africa has its own agenda. The emergence of global initiatives aiming at reducing the digital divide between Africa and the developed countries, such as the United Nations' ICT Task Force and G8's Dot Force, and other similar initiatives of development agencies and multilateral organizations, also reinforces the AISI framework. The implication of these initiatives for Africa is that it needs to redefine its position in light of the AISI framework to put ICTs to the service of development and to enhance the inclusion of Africa into the global digital world. Towards this end, Africa will be able to prepare an African Position to the Dot Force, UN Economic and Social Council (ECOSOC) United Nations Task Force, Economic Forum, and other International foras on the digital divide.

Another development initiative that Africa is committed to is the Millennium Partnership for "African Recovery" Program (MAP), which describes the "determination of Africans to extricate themselves and the continent from the malaise of underdevelopment and exclusion in a globalizing world." The key areas (among which the investment and use of information technology and communications is covered) emphasize that "Africa is marginalized in the world economy, it is hyper-marginalized in the information economy."

The common vision for ICT can be supported by the birth of African Union (AU). Jump-started with a new and ambitious Interim Secretary General, Amara Essy, and modeled on the European Union, the AU envisions common institutions such as a parliament, a court of justice and a central bank.

Conclusion

Ethiopia, like any African country, is facing tremendous and critical development challenges ranging from improving governance, achieving economic recovery, structural and debt restructuring and repayments, ensuring competitiveness, and enhancing macroeconomic performance, not to mention the

fight against AIDS. A response to these challenges should start with acknowledgement of the need to have access to information, whereby we create an informed society. In due time, this information society transforms itself into a knowledgeable society as information can become knowledge production. Each individual then, in his or her own capacity, contributes to constituencies, be they government, private sector or civic society, in a political, economic and social context.

In light of these voices for a united African technology infrastructure, continental and international collaborations, efforts, and commitments, and agendas, it is timely and appropriate to urge our government to set priorities toward creating an information society, by first endorsing an ICT vision for Ethiopia, and also by upholding a common and shared vision from the initiatives and programs to be implemented at continental, national, sub-regional, and regional levels within the global milieu.

About the author

Sophia Bekele is the President/CEO of CBS International, a California- based IT company represented by Sb Communications Network plc, in Addis Ababa, Ethiopia. She is also one of the ten elected members of the Technical Advisory Committee advising the UNECA in the implementation of the African Information Society Initiative (AISI).

Extending eBusiness to the Wireless World

Chan Komagan

eBusiness that offers consumer products and services electronically require rapid time-to-market solutions. Because companies need a breakaway strategy that will use emerging distribution channels and extend current business to new marketplaces, they are starting to embrace emerging technologies such as wireless. The wireless platform acts as a channel for continuous connectivity, transactions, and interactions, which will be crucial as businesses respond to the imperative of global expansion. There is a huge potential for commerce in the business-to-business (B2B) model because it transports across regional boundaries. But businesses need also to consider how well they fit into the local market, and how easy it will be to extend the models into the wireless medium.

Japan and the U.S. as an example use different ways to transport wireless data. Successful mobile eBusinesses must address these variations in the technology and provide a common infrastructure to support them. Mobile eBusiness harnesses the variety of delivery platforms and devices, and thereby further extends eBusiness opportunities on the Web. However, delivering mobile eBusiness to different marketplaces in a time-independent and location-sensitive manner is a challenge.

Mobile eBusiness gives a compelling value proposition to a company that wants to differentiate itself from its competitors. Although the dynamic nature of the technology is a challenge to building a strong brand in mobile eBusiness, by offering the same level of services, dynamic technology can be an advantage when building customer relationships. The mobile eBusiness allows

- enhanced communication
- improved facilitation
- secure mobile transactions

The promise of the Internet is personalization and connectivity of people. Mobile eBusiness lets customers and sellers conduct business in a time - and location - independent manner. Mobile customers can reach sellers anytime; and sellers and/or service providers can know in advance the customer's location, which offers a great opportunity to streamline commerce-related information and services.

The customer is in control of the transaction, the relationship, and the connectivity across devices, channels, and touch-points. Customers inform the business, business informs design, and design informs technology and standards.

The customer needs a consistent experience, regardless of the communication channels. The experience should be same whether the customer connects via a PC, a smart phone, or walks into a bricks-and-mortar retail store.

Mobile eBusiness is the extension of the current Internet model of community—commerce, collaboration, and content—to a diverse set of Internet-enabled tools such as palm devices, mobile phones and web appliances. Successful mobile eBusinesses will use these new media as a full extension and improvement upon the traditional desktop Internet experience as a way to attract new customers and to greatly expand the service offerings delivered.

If they are to take advantage of the emerging markets, then, eBusiness firms must rethink the strategy of their offerings to extend support to net-enabled devices. There is a large potential in the mobile wireless world, and currently there are limited players in the market.

The eBusiness firm having an international presence must address another challenge. If a mobile eBusiness is to meet the local wireless market, it is required to understand the local wireless technology, standards, consumer interest, and the revenue model. Individual mobile solutions will have to be developed to address different wireless markets.

If the business spans continents, a strategy needs to be developed that will address varied wireless markets. The popular Wireless Application Protocol (WAP) standard is being widely used in European and North American markets, but not in Japan and other parts of Asia.

In Japan, the success of I-mode technology is indisputable and still growing. So, to extend the current eBusiness to a Japanese wireless market, an I-mode solution must be developed. The point is that whatever varied holy-grail devices and networks are in place, the eBusiness system that is developed must adequately address them.

m-Commerce

The buzzword in the mobile industry right now is m-Commerce (wireless commerce). Industry experts are

convinced that the mCommerce will be a "killer application" and that it will extend current business offerings to mobile phones. The significance of mCommerce lies in the compelling advantages of buying goods and value-added services over mobile technologies.

Transactions, geography, and security form the core of mCommerce. Mobile content is a different proposition and it gives a whole new experience to the customer when accessing the electronic world through the mobile device. Ericsson predicts that by 2004, there will be 600 million mobile Internet users.

Europe has taken a distinct lead in the development of mobile commerce, just as they lead in the mobile phone market. The reasons for their giant leap in this area include the following:

- common standard, GSM
- standardized pricing structures
- technological innovation
- mutual understanding / agreements between carriers across boundary
- increased competition
- value-added services

Certainly the U.S. is catching up in mobile commerce, with players like Motorola and Lucent making a significant investment in the infrastructure for the next generation.

Voice, Data, and Multimedia-Enabled Commerce

Imagine a user going to an online retail site to shop for music CDs. Now, most of the eCommerce Web sites provide the ability to test, hear, and experience sample music. But, how about being able to browse the same site using a wireless device, downloading the sample music content, getting a sneak peek of the music video and, finally, buying the CD, using a voice-activated menu? This is not far from reality.

The technology is almost here. The 3G (third generation) and associated technologies are expected to address these issues. 3G will transform customers' perceptions of wireless devices. No more will wireless be a voice-centric device. The high data-transfer rate support of the 3G network will enable the devices to retrieve multimedia content such as digital music, photos, and video content. Some companies are already working on voice-activated eCommerce over the wireless medium.

Motorola's VoXML (Voice over XML) is the next-generation voice service over the Web. VoXML will revolutionize the user interface by providing speech recognition capability for both navigation and input. The end-user's voice and output is produced via text-speech technology. VoXML is untested in mobile commerce, but it definitely has a large potential in to make commercial transaction processes easier. Some mobile phone manufacturers are adding VoXML features into their handsets, in addition to other features.

Carriers are readying 3G infrastructure before they figure out the applications and business models that will drive future growth and profitability. Customers want thin, mobile, and simple applications that are personalized, action-oriented, and location-relevant.

At this time, the profit model remains vague for content providers. Some vendors, like AvantGo, are already offering solutions to push location-sensitive banner advertisements to customer handhelds. With the limited screen size and bandwidth, the delivery of banner advertisements to those devices will be challenging.

The four aspects of mobile eBusiness that must be addressed if the offering is to be robust and reliable are these:

- mobile network connections – always on, cross-boundary
- solid wireless security, authentication and certification services
- management and support for multiple devices
- true integration with existing online services.

Security Considerations

Wireless security is naturally dependent on the wireless networks. Security is as important in a wireless world as it is for a regular online service. Because wireless spans multiple networks, standards, and technologies, such as CDMA, GSM, iDEN, GPRS, and CDPD, security must be addressed before implementing a full-scale wireless eBusiness. Some of the current wireless networks lack an open standard, and mostly use a proprietary standard.

As wireless standards (hence the wireless networks) vary across different wireless markets, a security solution will have to be designed to take this into account. Wireless Application Protocol (WAP) defines an open standard of security for wireless communication called WTLS. WTLS is a slimmed-down version of SSL (Secure Socket Link) which is targeted for memory-constrained devices like wireless / smart phones. Standards such as this will help the mobile eBusiness to provide end-to-end security from the device level to the application server.

Device Limitations and Bandwidth Bottleneck

Skeptics question whether, because of memory and screen size, wireless devices can satisfactorily support 3G features such as video and audio capabilities. There are already a lot of announcements from wireless (handset) manufacturers like Nokia, Ericsson, Sony & Samsung about how well their new devices support 3G. However, analysts expect it will take at least one year to see devices that can take advantage of any new 3G services. These new devices should be designed to transmit and receive bandwidth-intensive applications. Wireless heavyweights like Ericsson and Nokia are working on addressing user interface and bandwidth issues in their future version of handsets.

Three mobile device types dominate the market: Palm/HandVisor (all types) based on the Palm Operating system, Symbian/EPOC devices (like Communicators), and smart phones/mobile wireless phones (mostly proprietary OS and browsers). An increasing number of products can deliver pages, including ads, to smart phones and handheld screens.

There is a lot of potential in B2C and B2B markets. How does eBusiness capitalize on this opportunity and develop systems for high bandwidth? The B2B market is exploding at an enormous rate in the U.S. and rest of the world. Already, we are seeing a huge potential in B2C mobile eBusiness markets. Examples include Amazon and Buy.com.

Forrester predicts that online business trade (B2B marketplace) will hit nearly $3 Trillion in 2004, a significant part slated for the wireless medium.

We are seeing an explosion in the number of wireless devices offering different features, and a major challenge will be to deliver uniform content and transactions to multiple wireless devices with different features and standards. The wireless phones use WAP-based browsers like UPLink, and Palm devices use PQA to present the content. The standards implemented by different wireless Internet browsers are:

- WML 1.1 & 1.2 browser from WAP Forum
- HDML from Phone.com
- PQA (for Palm Devices), a subset of HTML for Palm Platforms
- A subset of HTML for Internet browsers on 2-way pagers and some Wireless Personal Digital Assistants

Phones from various manufacturers implement their own micro browser interfaces differently, so WML implements a very abstract navigation metaphor. If you've been used to using hyperlinks and navigation buttons in your HTML pages, you'll need to take a good look at what WML requires you to do.

Mobile eBusiness should take these circumstances into consideration when implementing the infrastructure. An electronic business provider (seller) can choose to outsource the application to an ASP or to an outsourcer, which will provide significant value to the business in terms of

- Expandability
- Faster time to market
- Targeting multiple devices and platforms
- Smoother upgrades
- Easy back-end integration

The mobile devices described above support three primary access paradigms that Web sites designed to support mobile users must consider. Jupiter emphasizes that although live, two-way wireless access from a smart phone or a PDA best approximates browsing from a PC, for some mobile data applications other access methods may offer better reach, better performance, and greater Web site leverage.

The Mobile Value Chain

There are three primary groups that form the value chain for mobile business growth: infrastructure providers, those who provide the medium, and services and content sellers.

Infrastructure Providers

The infrastructure providers include players involved in building the underlying network infrastructure and players that manufacture innovative devices. They are at the top of the value chain. The three major providers are Ericsson, Nokia and Motorola.

These players are heavily investing in the next-generation services, both in Europe and rest of the world. Many industry-watchers believe that mobile commerce will be realized only when the bandwidth for communication improves. There is a smooth transition undergoing from the current 2G (second generation) to 3G services. 3G service will provide an always-on (permanent) connection to the Internet, allowing commerce to be conducted seamlessly. The mobile devices manufacturers are coming up with are innovative devices that will support advanced features such as wireless Internet, multimedia, color screens, and voice-activated menus.

Mobile Operators

Mobile operators form the core of the mobile revolution by providing a reliable network, enhanced customer relationships, and aggregation of devices and services. They leverage the network value and increase the marginal profitability. In addition, they can en-

hance the customer relationship by providing customized services and by bundling value-added services.

Content and Service Providers

Content and service providers play the same role as a traditional Web industry by providing personalized, timely content to users and service providers. Content providers will fine-tune their content to deliver to multiple channels.

Applications that are served over the Internet are information, news, media, weather, sports, business/purchase activities. Typically, content providers work with the service provider or a portal in developing customized wireless data and advertisements. Then the portals and mobile operators will perform customization and aggregation of the content.

The service providers work with other players to create market awareness, identify pricing modules suitable for specific demographics, conduct market research, and develop location-dependent advertising messages.

Conclusion

To summarize, mobile eBusiness leverages current distribution channels and provides a transparent medium that connects buyers and sellers in a time, location independent manner. Different mobile players make the mobile value chain. They include infrastructure providers, mobile operators, content and service providers. Together, they provide a seamless environment for the mobile eBusiness environment to operate. Although the environment is really conducive for the players, the validity of consumer adoption for the mobile eBusiness market still needs to be tested.

Glossary, Acronyms

Wap: The Wireless Application Protocol (WAP) is an open, global specification that empowers mobile users with wireless devices to access and interact with information and services instantly.

Refer to *Is Wap Under Pressure?* For more recent information on WAP

http://www.anywhereyougo.com/ayg/ayg/wireless/Article.po?type=Article_Archives&page=26435

GPRS: The General Packet Radio Service (GPRS) is a new non-voice value added service that allows information to be sent and received across a mobile telephone network. It supplements today's Circuit Switched Data and Short Message Service.

Refer *GPRS Wins Converts in High-Speed Wireless Market* for more information on GPRS

http://www.allnetdevices.com/developer/white/2000/09/29/gprs_wins2.html

2G: Second generation Wireless standards and technologies (includes, GPRS, EDGE protocols). Refer to *GPRS Wins Converts in High-Speed Wireless Market* for more information on GPRS.

http://www.allnetdevices.com/developer/white/2000/09/29/gprs_wins2.html

3G: Third generation Wireless standards and technologies (include 1xrt, 3xrt, W-CDMA, CDMAOne etc)

Refer to *Wireless 3G: The future of Wireless* for more information on 3G related technologies.

http://www.allnetdevices.com/developer/white/2000/06/30/wireless_3g.html

GSM: 2nd generation Wireless standard that replaced legacy TDMA; technology agreed upon by most wireless operators in Europe

CDMA: Code Division Multiplex Access. CDMA is a "spread spectrum" technology, which means that it spreads the information contained in a signal over a much greater bandwidth than the original signal.

CDPD: Cellular Digital Packet Data, a data transmission technology developed for use on cellular phone frequencies. It allows transmission of data in digital packets. This technology offers data transfer rates of up to 19.2 Kbps, quicker call set up, and better error correction than using modems.

iDEN: Integrated Digital Enhanced Network is a wireless technology from Motorola combining the capabilities of a digital cellular telephone, two-way radio, alphanumeric pager, and data/fax modem in a single network. iDEN operates in the 800 MHz, 900MHz, and 1.5 GHz bands and is based on time division multiple access (TDMA) and GSM architecture.

WML: Wireless Markup language, WML (Wireless Markup Language) is a markup language based on XML, and is intended for use in specifying content and user interface for narrowband devices, including cellular phones and pagers.

WML is designed with the constraints of small narrowband devices in mind. These constraints include: 1) Small display and limited user input facilities; 2) Narrowband network connection; 3) Limited memory and computational resources.

About the Author

Chan Komagan is a consultant with Scient® and he specializes in the cutting-edge wireless technologies. His expertise includes WAP, BlueTooth and mobile eBusiness.

Teaching Applied Business Forecasting Over the Internet

Thomas P. Bundt

Abstract

The burgeoning "virtual university" made possible through the Internet poses financial educators with the challenge of providing high-quality web-based instruction to meet the demands of the growing market for web-based learning. Financial educators are being challenged to create the multi-media resources and pedagogical content required to facilitate web-based learning of quantitative business courses. The purpose of this paper is to present some insights gained from teaching a course in applied business forecasting over the Internet. Particular challenges in providing a web-based quantitative business course are addressed as well as recommendations for those seeking to take their courses online.

Teaching Applied Business Forecasting Over the Internet

Today, with high-speed network connections and software startups supplying colleges and universities with sophisticated distance learning software, the Internet has added a new dimension to graduate education. Indeed, higher education's "virtual university" is just the latest manifestation of the explosion of information technology on the Internet. Today, most colleges and universities offer online courses and Web-based distance learning degree programs, some even accepting credit for online courses maintained by other institutions.[1] The rewards can be great: New York University's School of Continuing and Professional Studies earns revenues in excess of $90 million and Harvard's Extension School earns over $150 million. The important question is, Does it work? Although students and administrators seem imbued by this new technology, faculty members remain divided. In fact, a faculty report at the University of Illinois concluded that providing high-quality distance instruction is more costly and time-consuming than in the traditional classroom.[2]

As colleges and universities are pressured by competitors to supply Web-based distance learning programs, this new form of teaching/learning raises concerns over quality. Can graduate or professional students actually learn as much in the "virtual classroom" as in the traditional classroom? How should universities decide upon a distance-learning program given the increasing number of Internet distance-learning software providers? How will regional colleges and universities overcome the "Wharton brand," available any time all the time on the Internet? These and other issues are becoming increasingly important as the market for Web-based education matures.

I. Background

Using my experiences in teaching over the Internet, this paper explores important issues related to quality distance learning, and provides guidelines for those seeking to develop Web-based quantitative business courses. Accordingly, this note is of interest to those who currently or in the near future wish to develop a quantitative business course over the Web. Section One outlines my personal experience in teaching a graduate level quantitative business course over the Internet. Section Two discusses recent trends in distance learning in graduate and professional education. Section Three discusses selection of the Web-based learning software and Internet course development issues. Section Four presents a summary of the course in applied business forecasting stressing pedagogical issues. Section Five presents student comments and reactions as well as suggestions for improvement. Finally, Section Six discusses faculty experiences and issues regarding online education at the graduate and professional level.

The background for this paper is based on my experiences in teaching a graduate-level course in applied business forecasting over the Internet at Oregon Graduate Institute [OGI] over a three-year period. The three-credit course on practical aspects of business forecasting was organized into 10 weekly modules centered on interactive case studies using the SORITEC™ professional forecasting software.[3] The course stressed a multi-media approach using (1) printed materials (downloadable text and instructional materials including lectures notes, detailed interactive case studies, and end-of-chapter exercise solutions), (2) Internet technology (course interaction and delivery software), and (3) the SORITEC' forecasting software (student version bundled with the text). Students were evaluated on a weekly basis

based on multiple-choice exams and written critiques of module case studies, all facilitated through email.

II. Why Teach a Course Over the Internet?

By now, most educators have been involved in some activity regarding distance learning, if nothing more than contemplating their future as teachers. Some of us remember previous attempts at distance learning based on videotapes, satellite-distributed classrooms, and videoconferencing. While these early attempts at distance learning paved the ground for today, many of these programs failed. What is new today? The answer is the Internet, which is a whole new paradigm for distance learning.

Until recently, regional colleges and universities have been aggressive players in the "virtual university" market, while "elite" institutions have been slow to respond. This has changed with the emergence of several "strategic alliances" among top-ranked business schools and new online degree programs. Of particular note is the recent agreement between the London School of Economics and top U.S. business schools like Stanford and the University of Chicago to distribute management education over the Web. A university administrator comments, "Business schools are now faced with the need to internationalize, develop strategic alliances and use technology effectively while protecting their intellectual property (i.e., curriculum)."

What is driving all this strategic posturing among providers of higher education? The answer is simple: distance learning over the Internet is a profitable growth industry. Estimates predict there will be more than 2.2 million students enrolled in Internet courses in 2002 (paying up to $4,000 in some cases). Web-based courses allow universities to compete for a whole new clientele: the so-called "busy professional" who seeks convenient high-quality supplemental education paid for and/or required by his or her employer and as a prerequisite for advancement. Whiddon (2000) reports that $70 billion is spent annually on corporate training, much provided by organizations not in the realm of traditional universities in the past. Roberts (1998) argues that most of this corporate training will soon take place on the Internet due to "cost savings, timeliness, and efficiency." Phillips (1998) predicts the future MBA degree will be primarily Web-based. In addition, Wall Street venture capital is pouring into the "virtual university" with several software startups soon to become the newest "hot" Internet IPO. The point is that the Internet learning market is an important potential source of tuition revenue for colleges and universities as evidenced by the "rush" to provide distance-learning courses and degrees. Accordingly, Deans and Administrators, behaving like any savvy investor, are likely to pressure their faculty to be leaders in this growth industry, knowing the potential losses if left behind!

Given the flurry of activity in Web-based learning, one can identify three reasons why administrators are likely to promote Web-based learning activities. First, Internet technology can enhance traditional educational activities allowing faculty to better serve current students in traditional classroom settings. Second, colleges and universities seeking to provide working professionals with continuing and professional education are using Web-based learning as their primary vehicle to accomplish these goals. Third, many regional business schools are now supplementing their curriculum with Web-based learning courses offered by other universities. Finally, administrators are likely to assert "putting courses on the Web is quick, easy, and profitable." Accordingly, in addition to faculty seeking innovation in their teaching, a real incentive for Web-based learning is likely to be economic as colleges and universities compete in the new "virtual university."

III. Web-Based Learning Issues

Once you decide to participate in the "virtual university," unless computer science and HTML are your hobbies, you are likely to seek professional help in developing and delivering a Web-based course. Fortunately, there are plenty of people willing and ready to help. Numerous distance-learning software vendors ranging from content-neutral platforms to customized CDs bundling both content and delivery are available.[4]

My ten-week Web-based course in applied business forecasting was delivered over the Internet using the Web Course Tools [WebCT] distance-learning software. A spin-off from the Computer Science department at the University of British Columbia, WebCT boasts more than 3.6 million student users in 97,000 courses at over 800 colleges and universities in more than 40 countries. In addition, several major publishers use WebCT to build Web-based courses to compliment their course textbooks.

Why did I choose WebCT? Designed for a broad audience of users, WebCT integrates several tools such as a file manager and built-in editor that allow instructors with limited programming experience to

build a Web-based course in a relatively short period of time. In addition, WebCT supports a threaded bulletin board and logged chat areas for student-student and student-faculty asynchronous and synchronous interaction. WebCT also has administrative tools including on-line quizzes, grading and student progress tracking. In addition, leasing the WebCT program on a remote server was quite cheap: $150 for 25 student accounts. As an added benefit, use of the remote server eliminates hardware and security issues surrounding using a local server. Accordingly, for reasons of support, industry leadership, and cost, I chose WebCT to deliver our graduate-level course in applied business forecasting.

IV. Pedagogical Issues

Given the highly statistical nature of a graduate-level course in applied business forecasting, the challenge is how to effectively teach such a course over the Internet. Typically, in Web-based learning, students download course materials and study them like a text. This approach stresses passive learning and tends to require a high degree of student motivation. Discussions are largely handled through chat rooms for courses in which student interaction is a major component. My dilemma: Would these techniques work for a highly quantitative subject like forecasting?

Given the lack of a content-based course in applied business forecasting from "new economy" vendors, I sought to develop a practitioner oriented course stressing "hands on" forecasting applications over the WWW. Accordingly, the goal was to find a pedagogical approach requiring students to actively participate in the forecasting process. Here the goal was critical thinking and learning by experience. How do we obtain this over the Internet? Given the subject matter (mainly statistical inference and regression analysis), my focus was finding the pedagogical approach that would most facilitate students' mastery over the course material. Thus, how course content is presented over the Internet is a major issue requiring some degree of thought, as opposed to simply moving lectures and problem-sets to a Web site.

I considered three pedagogical approaches: a self-study readings course; a discussion-based approach centering on group chat sessions; or a case driven modular approach in which the chief pedagogical tool would be case studies. A readings-course approach was dismissed as being too dependent on individual student backgrounds and motivation. Simply discussing solutions to end-of-chapter exercises was clearly not enough. In addition, the highly statistical and computational aspect of the course was not conducive to chat room discussions, although students were encouraged to consult with their peers as part of the educational process using the WebCT bulletin board. Therefore, the case approach was adopted as the chief pedagogical tool.[5]

The case studies were developed to utilize the SORITEC professional forecasting software, which conveniently generates forecasts and statistical analysis using a wide variety of modern forecasting techniques including regression analysis, data smoothing models, time series decomposition, and ARIMA models. In addition, all text examples, end-of-chapter exercises, and sixteen sample case studies have SORITEC programs as resources available to faculty from Irwin McGraw-Hill Higher Education. A sample case study is found in the appendix to this paper.

V. Student Comments

The applied business-forecasting course was offered three times over the three-year period 1998-2000 with over 25 students in total. Most students were enrolled in OGI's MS in Computational Finance program or the MS in Management in Science and Technology program. Several students had jobs that involved some aspect of business forecasting for such firms as Boeing, Pfizer, and Paramount Studios.

Student comments were grouped into three areas: First, how much did students think they learned? Second, how did students function in the non-traditional self-motivated world of Web-based distance education and how did they evaluate the WebCT course software? Third, how did students evaluate case studies as the major pedagogical tool? Could a case approach work over the WWW?

While a true objective examination of student comprehension in the "virtual university" is beyond the scope of this paper, I was able to obtain substantial subjective student comments, which in my experience, tend to be directly related to objective learning measures when dealing with graduate or professional students. Most students cite the usual distance learning benefits of (1) not having to travel to a central location, and (2) greater student-directed time management including choosing where and when they access the course. Indeed, time is a key issue because Web-based learning not only offers greater time flexibility, but also saves time — some students report learning at a faster pace than in traditional settings.

First, did students really learn using Web-based techniques? While there is little disagreement about the convenience benefits of Web-based learning, there

is concern about a tradeoff between convenience and comprehension. Accordingly, the primary issue of concern in Web-based distance learning is student comprehension and retention relative to the traditional classroom setting. Several students found the experience quite positive, with some students reporting they actually learned more than in a traditional course. For example, a Computational Finance student with substantial experience in graduate-level econometrics commented, "I would definitely take another Web-based course in the future even if I probably work more than for the other courses. But I have also probably learned more." An apparent reason for student satisfaction with Web-based learning is that some students find traditional classroom settings challenging. Three-hour night classes can be especially tedious for students who have already spent a full day on the job! Others cite the ability to discuss in detail issues with the instructor without having to take up others' time.

Second, student motivation, important in any course, can surface as an important risk factor for some students in the seemingly relaxed atmosphere of the typical distance learning course, as expressed in this comment from a software engineer: "Web was convenient, however can procrastinate more." So the course was divided into ten weekly modules to prevent students from getting behind or, in some cases, getting ahead of the rest of the class.

Another important issue is the quality and quantity of interaction among students and faculty. One student commented, "Getting answers to questions about the course material is only an email away." Unfortunately, several students reported problems interacting with the instructor and other students. One student commented, "It usually takes too long to settle an online 'Forum' discussion, or to get any response back." Another noted, "It was tough to get questions answered or even asked well." Another student noted, "Lack of face to face contact decreases the ability to get understanding." Indeed, despite instructor efforts to stimulate interactive discussion through the WebCT bulletin board, too many students did not actively participate in this aspect of the class. Several students suggested that some form of introductory class session in which students and instructors could meet would encourage student interaction.

How did students react to the WebCT distance-learning software? Most students found WebCT easy to use, but others suggested that a tutorial on how to use WebCT would benefit students. As for Internet reliability, some students experienced delays and minor compatibility problems. Posting documents in PDF format, which avoids formatting problems when converting files into HTML, solved most of these problems.

Third, how did students evaluate course content, notably the SORITEC case studies? This was an important issue for the instructor, who hypothesized that case studies would be a particularly useful pedagogical tool in the distance learning context, because it would force students into applying course materials and lead to active learning. A software design engineer commented, "The SORITEC cases were very useful for a solid understanding of materials covered." An operations technician stressed that the cases "were essential to the understanding of the material." A consultant commented, "Overall, I was happy with the course. Specifically, the text worked well with the delivery; the case studies were vital to the success of this course." The comments above support further research on case studies as an effective option in the delivery of a quantitative business course over the Web.

VI. Faculty Issues

Stakeholder analysis can be an effective way to uncover principal-agent issues in any business endeavor. Following this paradigm one can identify three sets of stakeholders: students, faculty, and administration. While students and administrators have been quick to embrace Web-based distance learning, faculty vary in opinion. Some faculty embrace Web-based learning as effective, touting its convenience, and predict its widespread acceptance. For instance, Sonner (1999) found those students with a relatively high exposure to basic business courses through distance learning tended to perform better relative to their peers in the business capstone course. Yet others express concern about distance learning effectiveness, credibility of so-called "virtual degree mills," and vendor interference and control over curriculum issues. Indeed, I have found some "content" providers make quality and curriculum decisions, which are not necessarily in the students' interests. Fortunately, with WebCT, this is never an issue. These and other issues regarding faculty support have surfaced as administrators embrace distance learning as the new growth industry in academe.

First, some faculty report clear advantages to the virtual classroom: students are more likely to have read the material; student discussions are livelier and well informed; and time is no longer an issue. Students master material at their own pace and some seem to thrive in their apparent anonymity. On the other hand, instructors may miss the feedback of body language,

not knowing whether a point has been made. This brings up the common issue of lack of effective student faculty interaction. An interesting example of the diverse views on the issue of student/faculty interaction came from Supreme Court Justice Ruth Bader Ginsburg who criticized the distance learning J.D. program at Concord University Law School. Ginsburg commented, "I am troubled by ventures like Concord, where a student can get a J.D. without ever laying eyes on a fellow student or professor. We should strive to ensure that the Internet remains a device for bringing people together and does not become a force for isolation."

Over the longer term, an unforeseen consequence is lack of intellectual satisfaction from the delivery of a good lecture, which "true" teachers claim to seek. Unfortunately, I have concluded that Web-based courses are "exciting" to develop, but "boring" to teach. Another important issue for faculty is their time commitment, both in getting started and in monitoring a Web-based course. First time instructors will likely find the experience quite time consuming, depending on their knowledge of HTML. While the WebCT package makes life quite easy, instructors should plan to spend significant time getting started. In monitoring the course, a teaching assistant can be quite helpful, depending on the number of students. In addition, be prepared for flurries of emails, all requiring detailed and sophisticated responses. The burden in time is likely to be significant, and sometimes underestimated by administrators. In general, faculty support (financial, technical, promotional) for their efforts is a crucial issue for the eventual success of any Web-based learning program.

VII. Adminisrative Issues

As university Administrators make the case for getting on the distance-learning bandwagon, important issues arise such as marketing support, quality control, and accreditation. Some faculty argue that the costs of internet-based learning is often understated, leading to lack of long-term investment and commitment for distance learning programs. In addition, administrators are likely to have to deal with issues of intellectual property used on the Internet, accreditation standards for online courses, and revised promotion standards for faculty. "We have a long way to go before we get the support at a level that will help organizations learn enough to create sustaining programs," says Ray Steele, the former president of the U.S. Distance Learning Association.

Another issue surfacing in the debate over distance learning is the role of software vendors in curriculum decisions. Are the numerous for-profit vendors seeking influence over course content a threat to faculty control over the curriculum? Will vendors shy away from unprofitable programs and controversial subject matters? I have already encountered this with a particular vendor who was skeptical that a Web-based course in applied forecasting would meet their payback criteria. Are administrators and/or faculty operating under "false" assumptions and listening too much to the vendors, i.e., listening to the "on-line canon"? These issues and others are likely to play a major role in determining winners and losers as the market for distance learning matures. The lesson for Administrators is that distance learning, or the lack thereof, is yet another risk factor to be managed in today's "virtual university."

VII. Conclusion

Is this all necessarily a good thing? While this question may be more metaphysical than practical, it does deserve discussion because distance learning will likely progress at a faster pace than our understanding and acceptance. While distance learning may have the potential to produce many unemployed Ph.D.'s, it also promises to be an inevitable part of the future. Professionals who wish to work full time while taking classes or seeking an advanced degree will continue their demand for convenience, flexible schedules and "learning on demand." In fact, we can all count on the fact of this expanding market, choosing not whether, but how we will respond. The lesson to faculty is to look at the changes regarding distance learning as inevitable and plan their future accordingly: that is, to view distance learning as a real option on the future!

Footnotes

1. For some links to distance learning sites and programs see Rottenberg (1999).
2. For an excellent internal review of distance learning see "Teaching at an Internet Distance: the Pedagogy of Online Teaching and Learning," University of Illinois Faculty Seminar, December 7, 1999.
3. Full Information Software, Inc., the vendor for SORITEC, is found at http://www.fisisoft.com/index.htm.
4. Some notable vendors include UNext.com, Pensare, University Access, Cardean. Many of these vendors have entered into cooperative arrangements with top universities to bundle content with course delivery software in an attempt to gain market share in the "virtual university."

5. The text chosen for the applied business forecasting course was Wilson and Keating's Applied Business Forecasting, 3rd edition. Besides being written for a broad audience and stressing "hands on" forecasting, the text is bundled with a student version of the SORITEC professional forecasting software.

Appendix

The following is a sample case study designed to facilitate web-based student interaction with the SORITEC forecasting software. Other case studies are available upon request.

Case: Are Stock Rates of Return Normally Distributed?

Goal: This case introduces various descriptive statistics generated by SORITEC to make statistical inference on monthly rates of return for the Dow Jones 30 Index. Specifically, students will test whether monthly stock returns follow a normal probability distribution and make probability statements about the behavior of stock returns. Specifically, this case introduces

- How to access stock price data in SORITEC
- Using the SYNOPSIS command to generate Descriptive Statistics
- Testing whether sample rates of return are Normally Distributed
- Making Statistical Inference using the Standard Normal Distribution
- Forecasting losses on the Stock Market.

Accessing the Data: Open the ECONDATA.SDB using the file menu. (See Case #1 of Chapter One for detailed instructions on how to access the ECONDATA.SDB databank).

For this assignment we will access a standard portfolio of 30 stocks — the Dow Jones 30 Industrials, coded as FSDJ. To store this data into the current memory type:

```
copy fsdj
```

We now close the ECONDATA.SDB file by typing:

```
close econdata
```

For this assignment we will examine rates of return on the Dow Jones 30 data over a sample period from 1980M1 through 1997M4. This is accomplished by typing:

```
use 1980m1 1997m4
```

Since the focus in finance is on the rate of return, we next convert our stock price data into rates of return by use of the COMPUTE command:

```
compute %fsdj = log(fsdj) - log(fsdj{-1})
```

This creates a new series titled %FSDJ that is the proportionate change in the Dow Jones 30. Once again we are using continuously compounded rates of return, which is the default way to measure rates of return in the finance literature.

To check current memory and the range of our data type:

```
symbols(full)
```

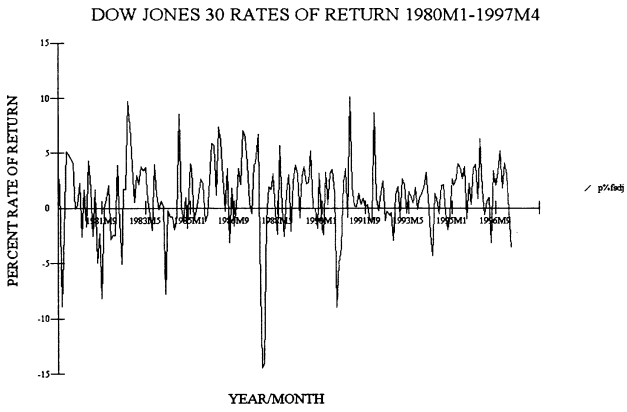
Stock Returns and the Normal Distribution

Financial economists have long sought to define the return generating process of asset prices. Specifically, are monthly stock returns normally distributed? If so, all the information we need to make probability statements about future stock returns is the mean and variance using the standard normal distribution.

We can plot the monthly %FSDJ series using the graphics menu. For convenience we first transform the data to percent by multiplying through by 100:

```
p%fsdj = %fsdj*100
```

A time-series plot of the transformed series is shown below.



Note that while monthly percentage rates of return are quite random, they appear to average slightly above zero and cluster around the mean.

To check this assertion further, we can generate a frequency distribution of P%FSDJ using the FREQ command in the STATS menu. This graph above will also help us identify the interval endpoints for the FREQ command. Specifically, stock rates of return very rarely go above or below 5 percent in a given month. Accordingly, when you are prompted to insert a vector of interval endpoints, type the following vector into the Matrix Input dialog box:

-10 -5 -3 -2 -1 0 1 2 3 5 10

The result is the following frequency distribution of Dow Jones rates of return:

Frequency Distribution and Breakdown Analysis

Variable = P%FSDJ

From	To	Count	Mean	Std. Dev
-14.464	-14.464	1.000	-14.464	.000
-14.109	-14.109	1.000	-14.109	.000
-10.000	-5.000	6.000	-7.336	1.808
-5.000	-3.000	7.000	-3.710	.690
-3.000	-2.000	14.000	-2.445	.257
-2.000	-1.000	13.000	-1.528	.361
-1.000	.000	31.000	-.468	.295
.000	1.000	28.000	.506	.330
1.000	2.000	26.000	1.567	.294
2.000	3.000	27.000	2.403	.297
3.000	5.000	37.000	3.709	.426
5.000	10.000	16.000	6.719	1.363
10.115	10.115	1.000	10.115	.000
Total Sample		208.000	.997	3.382

Considering the reported frequency distribution, stock rates of return cluster around the average monthly rate of return of .997%, and can therefore be *approximated* by the normal probability distribution.

Before we proceed to formally test our return data for normality, we can explore some of the implications of *assuming* stock rates of return are normally distributed. The key benefit is simplicity, in that if we know the mean (measure of location) and variance (measure of dispersion) of a normally distributed random variable then we know completely the behavior of such a variable from its probability distribution function. To see this point we will make a simple forecast regarding the probability of a loss, in any given month, on the Dow Jones 30 Industrials Index.

To proceed we first estimate some sample descriptive statistics of P%FSDJ using the Synopsis command:

synopsis p%fsdj

Question #1: Based upon the estimated monthly mean rate of return, calculate the mean annual rate of return over the ten-year period noting that your data is monthly.

ANSWER: Using SORITEC, the following descriptive statistics for P%FSDJ were estimated.

Summary Statistics for %FSDJ

Total Obs =208 Missing=0
Median=.119359E-01 Lwr Bnd=.609340E-02
Upper Bnd=.169556E-01
Minimum=-.144645 Maximum=.101153 Range = .245798
Mean=.997453E-02 Variance=.114392E-02
Std Dev=.338219E-01
Coef Var=3.39082 Skewness =-.938687 Kurtosis=3.75964
Mode is undefined. All values are unique.

Quartiles:	-.622513E-02	.116913E-01	.306789E-01
Deciles:	-.254760E-01	-.112851E-01	-.303167E-02
	.292151E-02	.116913E-01	.189666E-01
	.251968E-01	.355167E-01	.405474E-01

The annual rate of return is found by multiplying the mean monthly return by 12. The mean monthly return on the Dow was .009974. Accordingly, the annual return is 12 times the monthly average, which is 12(.009974) = .119688 or about 12%. This reflects the historical rate of return earned on the Dow over the 1980M1-1997M4 periods.

Question #2: Given that annual standard deviation is the preferred measure of risk in finance, how risky is the Dow Jones index?

Answer: We first find the annual variance by noting that the variance of a sum is the sum of the variances.

Monthly Variance of %FSDJ = .001144
Annual Variance = 12(.001144) = .013728
Annual Standard Deviation = $(.013728)^{1/2}$ = .117166.

Accordingly, the average squared variation about the mean is 11.7% and serves as a measure of price risk in the stock market, i.e., the expected variability

about the mean is 11.7%. It is useful to note that the risk of the Dow Jones portfolio is less than the average risk of stocks in the portfolio. This is because of the financial risk benefits of portfolio diversification.

Forecasting Stock Rates of Return

On way to examine stock market behavior is in the context of classical statistics. Specifically, if stock rates of return follow a normal probability distribution, all behavior is summarized in the mean and variance. Accordingly, using the standard normal probability distribution we can make probability statements about the behavior of stock rates of return.

Question #3: Given the descriptive statistics reported above, what is the probability that, in any given month, the Dow Jones 30 industrials composite index realizes a loss? Specifically, find P (%FSDJ < 0).

Answer: Since, %FSDJ is normally distributed with mean .009975 and variance .001144, and the Dow-Jones 30 is an observable population, we can make inference about the Dow using the standard normal distribution. Accordingly, we transform the data by subtracting the mean and dividing by the standard deviation to create a standard normal variable denoted as Z.

Using the standard normal transformation, the appropriate Z value for %FSDJ = 0 is given by:

$$Z = (0 - .009975)/.033822 = -0.295.$$

Hence, the problem can be re-stated as finding P [Z < -0.295].

Using the Standard Normal Table and interpolating we have:

$$P[Z < -0.295] = P[Z \leq 0] - P[-0.295 \leq Z \leq 0]$$
$$.5000 - (0.1141 + 0.1179)/2 = .5000 - .116 = 0.384.$$

Accordingly, there is about a 39 percent chance that, in any given month, the Dow Jones composite has a negative rate of return, i.e., a loss. Not to worry, there are 12 months in a year and we didn't say how much the loss was.

Some Tests of Normality

To formally test for normally distributed returns, we examine two parameters that characterize a normal distribution. The first parameter is SKEWNESS, which measures the symmetry in a distribution and is defined as the normalized third moment of a distribution. For distributions that are normally distributed, the skewness parameter is zero. Accordingly, we can test our returns data for normality by testing the null that are returns data have a skewness parameter of zero.

Another parameter used to define a normal distribution is KURTOSIS, or the normalized fourth moment, which characterizes the shape of a normal distribution. The normal distribution has kurtosis equal to 3, but fat-tailed distributions with extra probability mass in the tail areas have higher kurtosis. Accordingly, we can test our returns data for normality by testing the null that returns have a kurtosis parameter of 3, i.e., reject in favor of excess kurtosis.

Question #4: Report the estimated skewness parameter. Test the null hypothesis, at the approximate 95% level of confidence, that the skewness of our returns data is zero using the result that the sample skewness parameter estimator is normally distributed with mean 0 and variance 6/T, where T is the sample size.

Answer: The estimated skewness parameter is -.938687. Following the analysis in Chapter Two, we can reject the null of normality if:

$$\text{Reject } H_0 \text{ if } \left|\frac{\hat{S}}{\sqrt{6/T}}\right| > 1.96.$$

Given T = 208, the calculated value of our test statistic is 5.527 allowing us to reject the null of normality with regard to the skewness parameter. Specifically, our test results show that our return series is asymmetric, i.e., skewed to the left tail.

Question #5: Report the estimated kurtosis parameter. Test the null hypothesis, at the approximate 95% level of confidence, that the kurtosis of our returns data is 3; we employ the result that the sample kurtosis parameter estimator is normally distributed with mean 3 and variance 24/T, where T is the sample size.

Answer: The estimated skewness parameter is 3.75964. Following the analysis in Chapter Two, we can reject the null of normality if:

$$\text{Reject } H_0 \text{ if } \left|\frac{\hat{K} - 3}{\sqrt{24/T}}\right| > 1.96.$$

Given T = 208, the calculated value of our test statistic is 2.236, allowing us to reject the null of normality with regard to the kurtosis parameter. Specifically, our test results show that our returns displays excess kurtosis, i.e., fat tails relative to a normal distribution.

Question #6: What do our skewness and kurtosis test results imply about the distribution of daily returns on the Dow 30 over the period 1980M1-1997M4?

Answer: Very simply, our returns data are non-normally distributed. Specifically, our return data are skewed to the left and have fat tails relative to a normal distribution. Accordingly, inference about stock returns based upon the assumption of normality will produce misleading results.

Finally, to see why testing for normality is an important empirical issue, we will next show how the assumption of normality can be a powerful analysis tool for the stock market.

Student Programming Questions

Question #7: What does the finding of excess kurtosis imply about our results in Question #3 above?

Question #8: Explore alternative ways to graph our return data using the SORITEC graphics utilities. Which graph best represents the relative frequency of the return data?

Question #9: Try redoing the case with a different sample period and see the "robustness" of the results.

A SORITEC program for this case:

```
! soritec program to chapter two case one: are stock rates
! of return normally distributed?
! access econdata.sdb using file button
copy fsdj
close econdata
symbols(full)
use 1980m1 1997m4
compute %fsdj = log(fsdj) - log(fsdj{-1})
symbols(full)
p%fsdj = %fsdj*100
vector vecqq  -10 -5 -3 -2 -1 0 1 2 3 5 10
freq (class=vecqq) p%fsdj
synopsis %fsdj
synopsis p%fsdj
```

Contact Information

Thomas P. Bundt
Department of Computer Science and Engineering
Oregon Graduate Institute of Science & Technology
P.O. Box 91000
Portland, Oregon 97291-1000
bundt@cse.ogi.edu

Working Technology: Issues in the Design of Information Systems to Support Work Practices

Arnold Chandler

Abstract

Understanding the implications of computer and telecommunication technologies for work and organizing requires balancing "materialism" and "agency" in theories of social change. Techno-rationalist assumptions often underlie "technological frames" of managers who commission the design of information systems within business organizations to improve "efficiency" and eliminate "redundancy". These conceptualizations, however, are materially determinist and focus on reifications of "system" and "process" that treat work, the foundation of organizing, as merely a set of discrete and identifiable tasks captured in a job description that can be automated or made supportable by information systems.

A "canonical" notion of work, therefore, is reified in the material assumptions embedded in new information technologies. This representation of work, as it becomes embodied in system design, serves to constrain, obstruct, or otherwise undermine the noncanonical work practices responsible for carrying out the actual business of the organization.

An alternative approach to conceptualizing work and technology, captured largely in the work of ethnomethodologists and especially in the work of Lucy Suchman, treats the interaction of people and information systems within working contexts as distinctly "situated". Situated action is tied inextricably to the context in which it occurs. Moreover, situated interactions with information systems in the course of work are often made meaningful within an emergent "community of practice" that serves as a locus of learning and understanding that shapes the lived moment-to-moment experience of work life. Information system design, to support work as work is done, must utilize representations of work that capture both its "visible" and "invisible" elements. To do this requires forms of user involvement and "participatory" or "cooperative" design that enable representations of work to be employed as reified "boundary objects" that can help translate between the work practices of intended system users and the work practices of those who design the systems.

Introduction

In his 1996 book, *The Rise of the Network Society* , Manuel Castells marveled at the credibility given by the media to the central claim set forth in a 1995 book written by Jeremy Rifkin titled *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era*. He was critical of a major flaw with Rifkin's theory which argued that computer and telecommunications technology would lead to the elimination of "formal work" and the creation in America of a "jobless society" (Castells, 1996). Rifkin was announcing an impending world without work in a country whose economy, led by high-tech growth, had experienced the creation of 8 million new jobs from 1993 to 1996 (Castells, 1996). That such a claim could gain currency in light of rather clear evidence to the contrary is an illustration of the pervasive influence that determinist theories of techno-social change have on popular thinking. Rifkin's thesis offers a compelling illustration of materialist determinism writ large. He depicts computer technologies in an abstract way —as uniformly substitutable for certain types of labor (i.e. "automation" of discrete tasks) — and then generalizes upon this abstraction to ascribe an immanent societal logic to the techno-social changes computers are to induce — such as the broad-scale elimination of all "formal work". Treating "information" technologies in this way is characteristic of a number of theories offering to explain the implications of technology for social change, and especially the more popular theories concerning techno-social changes in work and organizing (Orlikowski and Barley, 2000, p. 16-17).

This paper, echoing similar criticisms elsewhere (Kling, 2000) will elaborate a critique of such theories calling for a more nuanced perspective concerning the relationship between technology and human action that balances the concepts of "agency" and "materialism". It will argue that digital technologies must be understood as having material "constraints" and "affordances", such as those imposed and allowed by electrical and software engineering, as well as "interpretive" malleability in use which in turn helps

shape how people use the technology in practical working situations. Therefore, digital technologies must be understood as both fixed and malleable and subject to the shaping forces of important communities of actors during phases of their requirements specification, design, production, implementation and, finally and most importantly, their use. The communities of actors (e.g. managers, system analysts, designers, programmers, consultants, and users) within and around an organization interpret a technological project through the frames of reference that are shaped within their communities of practice.

Exploring the interchange between these communities in the process of the creation and use of digital technologies is where, this paper argues, the key to designing technologies that better serve the wishes of their designers and the needs of their users can be found. Moreover, it is the starting point for better understanding the dynamics of techno-social change.

To develop this argument, Section I of the paper will explain why a balanced perspective with regard to "materialism" and "agency" is important. Section II of the paper, titled "Process and Practice", will argue that work should be understood as being organized into communities of "practice" where so-called "lateral ties" inform work practices carried out collaboratively in "situated" contexts by individual workers. Section III of the paper, "Representing 'Invisible' Work", will expound further on the matters of agency and materialism by exploring how conceptions of work, or their "representations", bear the markings of those groups directly responsible for their formulation. The notion of "canonical", or institutionally legitimized, "visible" work practices will be contrasted with that of "invisible", or "noncanonical", situated work practices that occupy the interstices between "official" descriptions of work and the daily demands of the working environment.

Capturing this practical world in the representations of work practice that become embodied in material digital technologies depends on how communities of practice, each with their own visible and invisible practices, can translate and convey their respective tacit understandings about their work into forms that other communities can intuitively grasp.

I. Technological and Social Change: Balancing "Materialism" and "Agency"

Many popular theories assessing the implications of information technologies for work tend, like *The End of Work*, to privilege "materialism" over "agency" in how they conceptualize techno-social change. Social changes are argued to proceed directly from the technical properties of a particular technology such that the nature of work or the structure of an organization are transformed along identifiable dimensions *a priori*. Technology is assumed to act exogenously upon an organization or society to produce predictable direct "impacts" whose transformative logic is teleologically driven (Fischer, 1992, pp. 1-32). The elimination of formal work due to the ability of computers to automate a set of discrete tasks is one such teleological argument. This determinist approach effaces the role of "agents" whose actions serve to shape the actual design and use of technologies. "Agency" in this context, although subject to various treatments in the sociological literature (Taylor et. al., 2001, pp. 64-73), is to be understood as the capacity for choice and intentional action by individuals or groups. Human agency with respect to digital technologies is reflected in the fact that the specifics of an artifact's technical design are the materializations of a set of "choices" that subsequently shape but do not determine how that artifact is used.

Two sets of theories that illustrate this type of agency-effacing material determinism are those which concern the so-called "skilling" or "deskilling" of work. These contrasting sets of theories heavily privilege the material properties of technology over agency in arguing one of two propositions: 1) That information technologies will render some human labor redundant, and will, therefore, "deskill" workers while increasing managerial control; or 2) That information technologies will generally improve worker skills in the form of "upskilling" adding to the autonomy of the worker vis-à-vis managers (Barley, 1988). Both of these theoretical traditions feature a teleological bent that posits social change induced by technological change as having a clear and uniform trajectory either to the detriment of or in favor of worker autonomy and power. Organizational studies theorist Stephen Barley, who is critical of such teleological determinism, has noted that both "skilling" and "deskilling" theoretical traditions have relied on selective evidence to support their claims by "artificially homogenizing both technical and social diversity"(Barley, 1988). Neither tradition has accounted for, and has avoided acknowledging, instances where an *identical* technology produces *different* social changes in work and organizing across different organizations and, conversely, for instances where *different* technologies tend to produce the *same* social changes within different organizations.

Deterministic theorizing of this sort persists largely because it serves an agenda of developing generalizable theories of techno-social change that reflects the influence of organizational studies on information technology research (Orlikowski and Barley, 2000). In service of generalizability, organizational theories have traditionally conceptualized technology abstractly and treated it as a material cause of social change. They have tended, therefore, to overlook the importance of "agency" in shaping both the design and use of technologies (Orlikowski and Barley, 2000, p. 6). For example, contingency theorists in organizational studies have argued that different types of technologies are "consistently associated with different approaches to organizing," such that the contingency researcher's agenda became to "devise a set of principles about (if not an actual theory of) technology and organization that would hold across all organizations and all technologies" (Orlikowski and Barley, 2000). The pursuit of an encompassing theory of this sort to explain social outcomes across all contexts leads ultimately to a dead end. It fails empirically because it must assume that technological artifacts have a uniform logic in their development, application, and use across all social contexts. Such an assumption, however, is sufficiently contradicted merely by the clear diversity of implementations of any particular information technology alone. Theory that exhibits similar tendencies towards determinism, by abstracting away from the technical specifics of design or ignoring the role of agency in shaping technological change, include the recent body of "media richness theory". This type of research "tries to explain individuals' choices of communication media in terms of a medium's properties, for instance, its bandwidth, whether transmission is synchronous or asynchronous, and so on" (Orlikowski and Barley, 2000, p. 8). As such, despite the fact that it moves closer to the concrete in its treatment of the actual design properties of the technology, media richness theory's desire for generality endorses a determinism that fails to predict what choices people actually make in different contexts. By attempting to generalize on a communication medium's technical properties as the material cause of social action, media richness theory treats technology with less abstraction but nevertheless preserves a determinist outlook.

A more recent theoretical approach in organizational studies that has moved away from materialistic determinism towards the inclusion of "agency" in theories about the nature of technological change leads to a better balance of the two concepts . This approach, loosely described as the "social construction of technology" (Bijker et. al., 1994), views technological artifacts as constituted substantially as "social objects". In other words, the interests and perspectives of individuals and groups in an organization are the source of "technological frames"(Orlikowski and Gash, 1994) or "workplace visions" (Kling and Zmudimas, 1994) that shape the meaning in design and use of information systems. To elaborate, Wanda Orlikowski et. al. define "technological frames" and what they suggest for the social shaping of technology:

> We use the term technological frame to identify that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes not only the nature and role of the technology itself, but the specific conditions, applications, and consequences of that technology in particular contexts. (Orlikowski and Gash, 1994, p. 178)

These technological frames, Orlikowski continues,

> have powerful effects in that people's assumptions, expectations, and knowledge about the purpose, context, importance, and role of technology will strongly influence the choices made regarding the design and use of those technologies [Noble 1986; Orlikowski 1992a; Pinch and Bijker 1987]. Because technologies are social artifacts, their material form and function will embody their sponsors' and developers' objectives, values, interests, and knowledge of that technology. For example, views of how work should be done, what the division of labor should be, how much autonomy employees should have, and how integrated or decoupled production units should be are all assumptions that are consciously or implicitly built into information technology by systems planners and designers. (Orlikowski and Gash, 1994, p. 179)

Because technological frames form within delimited communities of practitioners (i.e. mangers, consultants, IT technical staff, software developers, clerks and professional workers) and because technological artifacts come to embody a set of "choices" by actors relevant to their design, conflicts or inconsistencies in the technological frames between communities of practice arrayed relative to the design process (i.e. managers/sponsors, developers/designers, and professionals/users) may then imply serious differences between anticipated and actual use. Users' knowledge

of their own work practices, or perceptions of the intent behind a technology's introduction, may be in stark contrast to the understanding held by either managers or designers. This may lead to a situation where a technological artifact is interpreted differently in use and possibly invoked at cross-purposes across social groups within the organization. To illustrate, Orlikowski notes how "technologists" may have an "engineering perspective of technology, treating it as a tool to be designed, manipulated, and deployed to accomplish a particular task". Managers on the other hand, may have a "more strategic understanding of technology, expecting it to facilitate certain ways of doing business and providing financial returns". Both of these frames, moreover, may be in contrast or, perhaps, contradiction with "users" who "may take a more focused or instrumental view, expecting immediate, local and task-specific benefits" (Orlikowski and Gash, 1994, p. 180). These incongruent technological frames may go a long way toward explaining why technologies fail to achieve the results anticipated in a particular context.

The concept of technological frames usefully integrates an appreciation of the role of agency in how technology is interpreted and meaningfully applied within an organization to demonstrate that techno-social change is substantially more complicated than the circumscribed view material determinism allows. It is important, however, as Stephen Barley rightly points out, not to take "social construction" of technology to such an extreme that technological change is viewed as socially determined (Barley, 1988). The material properties of a technology do matter in technological change just as social factors such as "technological frames" are important. A balanced perspective with regard to technological change must account for how both agency and materialism interact to shape work and organizing. Agency must be understood to operate through both the set of design "choices" that come to embody any material technology as well as the multiple ways in which that technology may be applied in use. Correspondingly, a technology's material technical properties must be understood to influence agency by providing a set of "affordances" for use as well as imposing a set of "constraints" on use (Norman, 1988). Understanding both the fixity and malleability of information technology requires weaving together "human action and choice, the functions and features of specific technologies, and the contexts of a technology's use in a way that attends to the micro-dynamics of situated practice (Orlikowski and Barley, 2000, p. 12). The next section of this paper will explore these "micro-dynamics of situated practice" to unveil how "situated" work practices are the proper focus of analysis for understanding how information technologies are implicated in techno-social change. This perspective is shown to be in marked contrast to the techno-rationalist approach to information technologies, which tends to obscure actual work practices in the name of system-driven notions of "process".

II. "Process" and "Practice"

"Techno-rationalist" assumptions and materialist-driven "technological frames" held by technologists or managers encourage reasoning about work and organizing in terms of abstract reifications of "process". "Systems" thinking informs a process-based method for interpreting how interdependencies between functional competencies within an organization are managed. Such as perspective has been characterized as the "organizational view" of working activity in which, as Patricia Sachs explains,

> work is seen as a discrete set of tasks that serve a highly focused purpose (creating the product through a specified set of business functions). The range of activities that workers must employ to actually get a job done, however, extends beyond the strict limits of a task into the less visible and more complex world of problem-finding, problem-solving, deciphering, decoding, understanding, and collaborating. These aspects of labor involve high-level thinking within particular work worlds. (Sachs, 1995: p. 42)

An organizational view, in contrast to an "activity-based view", glosses the details of actual working activity for the sake of constructing a "global" view of the end-to-end process of production. For that reason, it deprecates the importance of "knowing" in working activity that is indispensable to troubleshooting problems that arise in all work places. Such activity, referred to as "exception handling" (Klein and Delarocas, 1999), deals with the problems, breakdowns, and malfunctioning of processes that require ingenuity and resourcefulness within a community of knowledgeable actors. This depends on localized understandings of working environments where work "practices" are the actual means by which the business of an organization is carried out. In other words, there is a distinction between "workflow", the process-based depiction of working activity, and "the flow of work" which is filled with contingencies, interrup-

tions, mistakes, corrections and the providing and enlisting of help to and from others (Randall et. al., 1994).

John Seely Brown provides an insightful description of the distinction between a "process" focused reification of organizational dynamics and one that addresses the issue of "practice" in an argument he poses surveying the pitfalls of "business process reengineering" (BPR). He explains that "business processes", as they are conceived in reengineering theories, are well defined and feature clearly specifiable inputs and outputs whose processing proceeds in a linear fashion. Under such a view the "longitudinal links" between each stage in the process are given primacy, while the "lateral" ties among people engaged in similar functional competencies, or "stages" in the process, are regarded as non-value adding and therefore not an area of analytical focus in reengineering design (Brown, 2000). Inadequate attention, therefore, is directed toward information flows within the inner-workings of the process stages themselves. Although process-based conceptions of work and organizing have proven successful in operational areas like procurement, shipping, receiving, warehousing, fulfillment and billing, they are demonstrably less successful for improving activities such as management, marketing, research and development. In these areas "life is less linear; and inputs and outputs are less well defined; and information is less 'targeted'" (Brown, 2000). Moreover, for these types of work, as well as other functional competencies like customer service and sales, interpreting and understanding meaning and knowledge are critical activities (Sachs, 1995). The members of these groups, or "communities of practice," (Wenger, 1998; Brown and Duguid, 1991) must toe the tension-filled line between the "demands of process and the needs of practice" where the "process-focused need for uniform organizational information" is pitted against "the practice-based struggle for locally coherent meaning" (Brown, 2000).

Ignoring this reality results in an obscurant simplification of the actual workings of an organization and increases the need for the development of "workarounds" among workers who confront the dysfunctional impediments to working activity created by information systems designed to support an abstract process. "Tunnel visions" of process, featured in design methodologies like structured "information architectures", have been unsuccessful largely because, "enterprise models of information-types, uses, and responsibilities are too broad and arcane for nontechnical people to comprehend — and they can take years to build" (Davenport, 1994, p. 42). They fail, therefore, to reflect how workers actually use information. Rather the information used by different practice groups within an organization should be seen as having variable "meanings" that fit appropriately into each separate context. Thomas Davenport illustrates this notion in the following excerpt:

No matter how simple or basic a unit of information may seem, there can be valid disagreements about its meaning. At Digital Equipment Corporation, for example, a "sale" to the indirect marketing organization happened when a distributor or reseller ordered a computer; but to direct marketing, the sale occurred only when the end customer took delivery. Even within direct marketing, there were differences in opinion: salespeople recorded a sale when the order was replaced, manufacturing and logistics when the product was delivered, and finance when it was paid for. (Davneport, 1994, p. 44)

The fact that "information" is variable in its "meaning" to users within an organization defies a simplified understanding of information systems using "process" as the central analytical precept. A striving towards "information globalism"(Davenport, 1994), where an effort is made to force information into uniform categories company-wide, should be viewed as problematic when it involves attempting to integrate, in a top-down fashion, the information of "localized" groups of practitioners for whom certain meanings may be locally specific and highly valuable. Hence, there exists an inherent tension between "information globalism" and "information particularism" that marks the tension between "process" and "practice" in how work is "represented" in the design of information systems.

"Representing" work involves abstracting away from the specifics of end user work practices to create representational artifacts employed in system design practice. The next section of the paper will take up this issue and will warn against relying on abstractions of work practice, like "job descriptions" or manager's descriptions of employee work roles, as the basis for system design choices. Rather, it is important to uncover "noncanonical" or "invisible" work "practices" that constitute the "situated" action responsible for carrying out the day-to-day, moment-by-moment, business of the organization.

III. Representing "Invisible" Work

In her landmark book, *Plans and Situated Actions* (1987), Lucy Suchman contrasted the "planning model" of human action with an understanding of human action as "situated" to illustrate the erroneous assumptions, prevalent in cognitive science theo-

ries at the time, that underlie methods for designing "intelligent" computer systems. The "planning model" of human action was built on the premise that humans devised, in advance of action, "plans" which subsequently guided that action in particular contexts. Information systems designers, therefore, had only to make these deductively derived "plans" the basis for designing intelligent systems to be used by those human actors. In contrast, Suchman argued that action is not planned but distinctly "situated" — located inextricably within a space and time and configured within a set of circumstances — squarely confronting previously held assumptions about human-machine interaction. She explained that

> Every human tool relies upon, and reifies, some underlying conception of the activity that it is designed to support. As a consequence, one way to view the artifact is as a test on the limits of the underlying conception. In this book I examine an artifact built on a *planning model* of human action. The model treats a plan as something located in the actor's head, which directs his or her behavior. In contrast, I argue that artifacts built on the planning model confuse *plans* with *situated actions* and recommend instead a view of plans as formulations of antecedent conditions and consequences of action that account for action in a plausible way. As ways of talking about action, plans as such neither determine the actual course of situated action nor adequately reconstruct it. (Suchman, 1987, p.3)

Contrary to the presuppositions of the planning model, Suchman proposed that we look at "situated action:"

> I have introduced the term *situated action*. That term underscores the view that every course of action depends in essential ways upon its material and social circumstances. Rather than attempting to abstract action away from its circumstances and represent it as a rational plan, the approach is to study how people use their circumstances to achieve intelligent action. The basic premise is twofold: first, that what traditional behavioral sciences take to be cognitive phenomena have an essential relationship to a publicly available, collaboratively organized world of artifacts and actions, and secondly, that the significance of artifacts and actions, and the methods by which their significance is conveyed, have an essential relationship to their particular concrete circumstances. (Suchman, 1987, p. 50)

Suchman's argument revealed an important insight about how human action is to be understood as a foundation for the design of technological artifacts such as computer-based information systems. If working action is not planned, but "situated", then an approach to designing systems to support work should be addressed, as Barley noted above, "to the microdynamics of situated practices". It should be addressed to the exigent actions of workers rather than abstract stereotypes of work roles. However, because technological artifacts are reifications of a set of choices, which include assumptions about the "action" involved in work, they may not, for various reasons, support work how work is actually done. In other words, they may not support situated work "practices". How those choices and assumptions are constituted to guide the design of information systems is reflected in the work "practices" of system designers themselves.

Therefore, exploring the work practices of designers is a way of unveiling the manner by which certain assumptions about the work practices of so-called "users" become embodied in system designs. This is at the heart of another of Suchman's discussions of the use of "representations" in the work practices of system designers (Suchman, 1995). The importance of grasping the representational nature of software construction and the role of representation in creating the artifacts for the design process itself cannot be overstated. Creating software is, at its heart, a process of representation. Paul Dourish explains,

> Software design and development is fundamentally a representational process. Computer programs are formalised representations of complex behaviour, and they achieve this behaviour through the manipulation of data structures which are themselves representations of entities beyond the scope of the software itself. Looking "under the hood" provides us with no escape from the representational. Programming languages are mapped onto processor instruction sets (more representations) which are implemented using digital (representational) logic. (Dourish, 1998)

When it comes to the computerization of work, representations, Suchman contends, are "interpretations in the service of particular interests and purposes, created by actors specifically positioned with respect to the work represented (Suchman, 1995). Much like maps are not really the land and geogra-

phy they represent, representations of work in system design are not work practices, but selective depictions of those work practices that reflect the perspective of the representations' author(s). Simply put, "the problem with most design efforts is that their representations are artificial and idealized accounts of action as it should occur from the point of view of someone not doing the action" (Jackson et. al., 2001).

Fundamentally, therefore, representations serve interests, whether those of managers, designers, technologists, or some other select groups of users such as professionals. They stereotype behavior so that it may be encoded in technological artifacts for the purpose of controlling work. For that reason, how representations of work come to be constituted, namely, in the work practices of designers, has determinative implications for the reified vision of work that a technological artifact will embody. This becomes a problem when information system designers fail to obtain a densely textured understanding of the actual work practices of individuals and instead rely on "canonical" descriptions of work. Canonical work practices (Brown and Duguid, 1991) encompass such representations as "job descriptions" or formalized work "plans" which serve as reifications of "roles" that have been institutionally legitimized within the organization's formal authority structure.

These generally described "roles", or abstract depictions, fail to account for what Barley earlier described as the "micro-dynamics of situated practice". They don't provide a "thick description" (Geertz, 1973) of how "actual practice involves tricky interpolations between abstract accounts and situated demands" that include, "improvised strategies that [workers] deploy to cope with the clash between prescriptive documentation" and "the changing conditions of work and world" (Brown and Duguid, 1991). Hence, canonical work descriptions, which may involve a Tayloristic decomposition of work into tasks and sub-tasks, provide, first, a weak resource in the actual practices or "action" of individuals within situated contexts, and, second, a poor resource for representational artifacts employed in the work practices of system designers who are designing technologies to support actual work. Rather, designers should rely on more detailed descriptions of "noncanonical" or "invisible" work practices to inform system design. Noncanonical work practices should be viewed as being located within "communities of practice" (Wenger, 1998) that are composed of the "lateral ties" that link those similarly situated in a stage of an organizational business "process" described by Brown earlier. It is within these communities that meaning is "negotiated" and socially shared tacit understandings are developed through work practices. Learning, within these communities, is a "shared history of participation" that is the basis for sense-making in a shared enterprise (Wenger, 1998; Sachs, 1995). These social processes define a "community of practice" that must reconcile the canonical demands of the company with the exigencies of "situated" practice.

Designing information systems to support these sorts of "situated" noncanonical work practices requires understanding how work is actually done rather than stereotypical representations of work based upon its perceived location within business "processes". It is important to note, returning to Suchman's discussion of situated action above, that simply asking workers what it is they do is not enough to grasp the situated nature of their working activity. Worker descriptions of their own working activity constitute "plans" that, according to Suchman's argument, serve as post-hoc rationalizations of activity that gloss the concrete reality of action anchored to a particular set of circumstances (Suchman, 1987).

Understanding situated work practice, therefore, requires the integration of some means of careful observation of actual working activity into the work practices of system designers (Crabtree et. al., 1998). Toward this end, an ethnomethodological theoretical perspective applied in conjunction with ethnography as a field research tool can provide the foundational basis for transforming system design practices along a course where "thick descriptions" of user work practices are the basis for creating information systems (Button and Dourish, 1999). The representations used to depict these work practices in system design must be critically examined on an ongoing basis. The process requires, as Suchman explains,

> deepening our resources for conceptualizing the intimate relations between work, representations, and the politics of organizations. More specifically for system design, this argument implies a reflexive engagement in our work as designers both with images and accounts of work practices that are provided to use by organization members and with those that we ourselves create and use. The aim is a design practice in which representations of work are taken not as proxies for some independently existent organizational processes but as part of the fabric of meanings within and out of which all working practices—our own and others'—are made. (Suchman, 1995)

In fact, Morten Kyng, an early proponent of "cooperative design", has argued that end users must be directly involved in the design process with hands-on explorations in the form of "mock-ups" and "prototypes" (Kyng, 1995, p. 50). This involvement, he argues, should extend to the practice of creating the artifacts for *representing* work practices themselves. This is because, as Kyng emphasizes, the work of users cannot be effectively mediated through representations without "being frozen at the level of explicit understandings" where substantial "tacit" (Nonaka, 1995) knowledge of work practices is obscured. Tacit knowledge, as opposed to explicit knowledge, can be critical to working practice but unconscious to the knower. In other words, people may not be fully aware of what they actually know about the activities in which they engage (Nonaka, 1995).

To share these latent understandings, therefore, not only must work practices be studied minutely, but workers themselves must be involved in directly constructing and modifying the "representations" of work used in system design practice. Kyng explains that this requires developing a "shared practice" in which not only does the designer attempt to grasp the end users' noncanonical work practices by acquiring an "insider's" perspective, but the designers themselves must open up their own practices at the periphery to allow users to gain an inside understanding of *designers*' work practices (Kyng, 1995). The representations that emerge out of this shared practice can serve as "boundary objects", or reifications, around which Etienne Wenger explains, "communities of practice can organize their interconnections" (Wenger, 1998).

A boundary object, in this case representations of work constructed out of a shared practice, can serve as a vehicle for communicating the tacit understandings of the work practices of end users into terms and forms amenable to the tacit understandings implicated in the work practices of system designers and vice versa. Traversing the boundaries of these communities and their tacitly held understandings of their own work is the central dilemma in information systems design to support working activity (Suchman, 2000). Morten Kyng provides some practical methodological tips for enabling this type of exchange by distinguishing between "representations of the system being designed" and "representations of work" that are adjusted and readjusted by both designers and users in a shared practice of system design. His research is a promising avenue worth exploring for more practical specifics in system design strategy that are beyond the scope of this paper (Kyng, 1995).

III. Conclusion

The arguments in this paper cohere around three central claims. The first is that an understanding of the implications of information and communication technologies for changes in work and organizing requires a perspective which balances both "materialism" and "agency" to acknowledge that, while "agency" shapes technology in both its design and use, the "material" properties of technology influence agency in use by providing "affordances" and imposing "constraints". This claim has important ramifications for the second central claim of the paper, which argues that "techno-rationalist" accounts of work and organizing as "process", within which material determinism often finds much expression, fail to capture the reality of work as "situated" practices in which "plans" or "canonical" work steps are but weak resources in actual human action.

Understanding "situated", "noncanonical" work practices requires supplanting a "process-based" view of work with a "practice-based" one to allow "agency" to become more transparent for designing systems to support actual work practices. Agency or "situated action" is implicated both in the design of information technologies—system designer work practices — as well as in the use of information technologies — end user work practices. Reconciling these two types of agency to produce technologies which allow more enabling "affordances" rather than more dysfunctional "constraints" is the central mission of "cooperative design" as described by Morten Kyng.

The nature of this "cooperative" design is the essence of the third central claim. For designers to create information systems that effectively support working activity, it is necessary that end-users and design practitioners "share a practice" that can serve to translate not only the "explicit" but the valuable "tacit" understandings between workers and designers who inhabit two different "communities of practice". Mutually constructing representations of work as "boundary objects" between these two communities appears the most promising conceptual approach to effective design. In sum, understanding the role of information technology within organizations means recognizing agency in techno-social change, appreciating the importance of a "practice-based" view of work, and identifying how the interchange between "communities of practice" is vital to effectively "representing" working action in the construction of technological artifacts.

Bibliography

Barley, Stephen R. (1988) "Technology, Power and the Social Organization of Work: Towards a Pragmatic Theory of Skilling and Deskilling." *Research in the Sociology of Organizations*. Volume 6, pp.33-80.

Bijker, Wiebe E., Hughes, Thomas P., & Pinch, Trevor F. (Eds.) (1994) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*. Cambridge, MA: MIT Press.

Brown, John Seely and Duguid, Paul (1991) "Organizational Learning and Communities-of Practice: Toward a Unified View of Working, Learning and Innovation." *Organization Science*, 2(1).

Brown, John Seely (2000) 3/1/2000 "Practice Makes Process." *CIO Magazine* taken from http://www.cio.com/archive/030100_process.html on 3/15/2001.

Button, Graham and Dourish, Paul (1999) "On Technomethodology: Foundational Relationships Between Ethnomethodology and System Design", Working Paper, Xerox PARC.

Castells, Manuel (1996) *The Rise of the Network Society*. Malden, MA; Blackwell Publishers.

Crabtree, Andy, Nichols, David, O'brien, Jon, Rouncefield, Mark & Twidale, Michael (1998) "The Contribution of Ethnomethodologically-Informed Ethnography to the Process of Designing Digital Libraries". Technical Report CSEG/5/98, Computing Department, Lancaster Unviersity.

Davenport, Thomas H. (1994) "Saving IT's Soul: Human-Centered Information Management." *Harvard Business Review*, MA, Harvard University Press.

Dourish, Paul "Reconsidering Software Representations", Working Paper, Apple Computer Inc. Taken from http://www.ics.uci.edu/~jpd/publications/representation.html on October 1, 2001.

Fischer, Claude (1992) *America Calling: A Social History of the Telephone to 1940*.Berkeley: University of California Press.

Geertz, Clifford (1973) *The Interpretation of Cultures.* New York: Basic Books.

Jackson, Michele H., Poole, Marshal S., Kuhn, Tim (2001) "The Social Construction of Technology Studies of the Workplace". In Lievrouw and Livingstone (eds.) *Handbook of New Media*. Thousand Oaks: Sage Publications.

Klein, Mark and Delarocas, Crysanthos (1999) "A Knowledge Based Approach to Handling Exceptions in Workflow Systems," Working Paper, Center for Coordination Science, MIT Sloan School of Management.

Kling, Rob and Zmuidzinas, Mary (1994) "Technology, Ideology, and Social Transformation: The Case of Computerization and Work Organization," taken from http://www.slis.indiana.edu/kling on 4/01/2001.

Kling, Rob & Crawford, Holly & Rosenbaum, Howard & Sawyer, Steve, & Weisband, Suzanne (2000, August) *Learning from Social Informatics: Information and Communication Technologies in Human Contexts*. Center For Social Informatics. School of Library and Information Sciences, Indiana University.

Kyng, Morten (1995) "Making Representations Work." *Communications of the ACM*. 38(9):46-55.

Nonaka, Ikujiro (2000) "The Knowledge-Creating Company." *Harvard Business Review on Knowledge Management* Boston, Mass.: Harvard Business School Press.

Norman, Donald A. (1988) *The Psychology of Everyday Things*. New York: Basic Books.

Orlikowski, Wanda J. and Barley, Stephen R. (2000) "Technology and Institutions:What Can Research on Information Technology and Research on Organizations Learn From Each Other?", Working Paper, Center for Work, Technology and Organization; Department of Management Science and Engineering, Stanford University.

Orlikowski Wanda J. & Gash, Debra C. (1994) "Technological Frames: Making Sense of Information Technology in Organizations." *ACM Transaction on Information Systems* 12(2): 174-207.

Randall, D., Bentley, R. and Twidale, M. (1994, October) "Ethnography and Collaborative Systems Development II: Practical Application in a Commercial Context". Paper presented at the biennial conference of Computer Supported Cooperative Work, Chapel Hill, NC.

Sachs, Patricia (1995, September) "Transforming Work: Collaboration, Learning and Design", *Communications of the ACM*, Vol. 38(9).

Suchman, Lucy (1987) *Plans and Situated Actions: The Problem of Human-Machine Communication*. New York, Cambridge University Press.

Suchman, Lucy (1995) "Making Work Visible." *Communications of the ACM*, September 38(9): 56-64.

Suchman, Lucy (1999) "Located Accountabilities in Technology Production." In Mackenzie, D. and Wacjman, J. (Eds.) *The Social Shaping of Technology, Second Edition*. Buckingham, UK: Open University Press, pp. 258-265.

Taylor, James R., Groleau, Carole, Heaton, Lorna, & Van Every, Elizabeth (2001)*The Computerization of Work: A Communication Perspective*. Thousand Oaks: Sage Publications.

Wenger, Etienne (1998) *Communities of Practice: Learning, Meaning and Identity*. New York: Cambridge University Press.

Contact Information

Arnold Chandler
Golden Gate University
arniec1@hotmail.com

Appendix: Golden Gate School of Technology and Industry Faculty and Staff

Earl N. Austin, Associate Professor, Hotel, Restaurant, and Tourism Management Program.
B.S., University of Denver
M.B.A., Golden Gate University
Professional focus areas: Consultant to ATA @ Brazil for Contract Food Service; Import/Export of *sous vide* products from France, NFA; Contributing Editor to CHRIE Educator, a refereed journal.
Courses: Food, Beverage & Labor Cost Controls; Human Relations & Motivation; Worldwide Tourism; Special Event Tourism; Institutional Management, Club & Resort Management.

Constance M. Beutel, Associate Professor, Chair, MS e-Commerce, Co-Chair, Telecommunications Management.
B.A., University of Minnesota
M.P.A Golden Gate University, Telecommunications
Ed.D., University of San Francisco
Professional focus areas: Futures, Adult Higher Education, Women and Leadership, Enriching teaching and learning through technologies, International and Multicultural Education with special emphasis in Participatory Educational Return on Investment, Corporate professional education and development, Scenario Planning.
Courses: Technology & Society; The Futures of Telecommunications; Professional Practice in e-Commerce; Science, Technology & Cultural Change.
Selected Publications, Presentations, Papers: Knowledge is Power: Women as Leaders @ Stanford; Corporate Broadcast: Imagine your Future; Worklife to Lifework: The role of Self-Directed Education, with Mae Jean Go, Ph.D.; Reaching Learners through Telecommunications; Longman Group, UK Ltd, 1994; Conference Chair, Corporate Universities Conference, International Quality and Productivity Center; Presenter, Quality Assureance in Distance Education, Open University, Cambridge University, England; Radio interview, KQED Forum: The Changing Workforce; Co-author: Participatory Research, A Dialogue for Action.

Anne Carlisle, Contract Administrator.
B.A., Lake Erie College
M.A., Case Western Reserve University
Ph.D., Case Western Reserve University
Assistant Professor of English at Case Western Reserve University, Pennsylvania State University, Florida Keys Community College.
Professional focus areas: Communications consultant to industry; Executive Director for trade associations; Public Relations Director for the hospitality industry.
Selected Publications, Presentations, Papers: Published widely in magazines as feature writer and editor; Textbooks and topselling seminar delivered nationally on the subject of business/technical writing.

Min Chiang, Adjunct Professor.
B.A., Tunghai University, Taiwan
M.A., University of Washington
M.S., Ph.D. candidate, Illinois Institute of Technology.
Manager, Network Design, TransAmerica Information Services.

Cathi Colin, Chair, Database and Web programs.
B.A., Brooklyn College
M.A., St. Johns University
M.S., San Francisco State University
Ph.D., UC Santa Cruz
Areas of Specialization: Scientific and data visualization; object oriented programming languages; design and analysis of algorithms; instructional technology; database and web development.
Courses: Fundamental Programming Concepts Using Java; Data Structures, Simulation and Modeling; Unix Programming; Operating Systems Concepts.

Miro Costa, Associate Professor of Information Systems; Chair, Information Systems Department.
B.S., M.S., Rio de Janeiro Federal University, Brazil
M.S., University of Texas
Ph.D., University of Texas
Areas of Specialization: Artificial Intelligence Applications in Business and Statistical Databases. Advisor for the Information Systems concentration in the Doctor of Business Administration (DBA) Program. Active member of the San Francisco Institute of Finance and Technology. Author of articles in Management Information Systems. Consulting experience in private and federal organizations in Brazil and in the USA.
Courses: Artificial Intelligence; Decision Support Systems; Database Management Systems; Systems Analysis & Design.

Gary Crutchfield, Adjunct Professor of Information Systems.
B.S., M.S., Illinois Institute of Technology
Areas of Specialization: Java and Linux. Consultant to companies using Java and Linux to develop web-based applications.
Courses: Client-Server and Distributed Objects, Operating Systems Concepts.

Bob Fulkerth, Associate Professor of Information Systems.
B.A., M.A., Chico State University
Ed.D., University of California at Berkeley
Areas of Specialization: Technology; Communications; Instructional Technology and Training. Recipient, Golden Apple Teaching Award, 1995. Author/presenter of articles and presentations on technology, diversity, and online instructional design. Design and teach online Business Writing courses. Design and teach multimedia courses.
Courses: Management Information Systems; Computer Applications for Business Communication; Designing and Deploying Databases for the World Wide Web; Doctoral Writing & Research.

James W. Koerlin, Associate Professor, Telecommunications Management and Dean, School of Technology and Industry.
B.A., San Francisco State University
M.B.A., Golden Gate, University
Ph.D., Walden University
Areas of Specialization: Telecommunications Management.
Courses: Telecommunications Management; Telecommunications Technology & Society; Corporate Telecommunications Strategy; Operations Management.

John Moreno, Chair of Information Technology, Silicon Valley Region.
B.A., University of Connecticut
M.Eng., Yale University
Areas of Specialization: Technology and Information Management, Web Operations Management.
Courses: Electronic Commerce, Computers for Small Businesses, Statistics.

John T. Self, Ph.D. Associate Professor and Chair, Hotel, Restaurant, and Tourism Management Program.
B.S., Auburn University
M.Ed., University of North Texas
Ph.D., University of Alabama
Areas of Specialization: Management retention; Customer service, and Food and Beverage Operations; Expert witness on cases concerning hospitality management liability; Workshops on management coaching; Weekly online columns on customer service for Nation's Restaurant News and The Sideroad.
Courses: Hospitality Law; Computer Operations; Global Trends.

Roger Smith, Co-Chair Telecommunications Chair, Technology Management Programs, Director, Corporate Programs, Adjunct Associate Professor.
B.S., San Diego State University
M.S., Golden Gate University
Areas of Specialization: Multimedia, Web Page Development, Web Page and Database Integration, Telecommunications Management.
Courses: Multimedia and Wireless Communications Technology, Developing and Deploying Databases on the World Wide Web.

Lynette C. Webb, Faculty, Computer Information Systems.
B.A., University of Pennsylvania
M. A., Golden Gate University
Courses: Beginning HTML and Web Pages, Advanced HTML and JavaScript, Introduction to Web Page Design, Effective Web Searching.

Rudiger Wysk, Assistant Professor, School of Technology and Industry, Chair, Information Technology, Sacramento.
B.S. EE Pontifical Catholic University of Rio Grande do Sul, Brazil
B.A. BPA Federal University of Rio Grande do Sul, Brazil
M.S. IS Federal University of Rio de Janeiro, Brazil
Ph.D. MIS University of Arizona
Experience: systems analysis & design, project management, and IS planning in public sector; training/consulting in private and public sectors; stint with a software house; junior partner in 2 start-ups; before teaching at University of Arizona, Northern Arizona University, and University of Baltimore, taught at three major universities in Brazil and at IBM's LASRI.
Articles: Systems Analysis & Design, Knowledge Systems, Computer Supported Meeting Environments, and Management of IS.
Areas of Specialization: Knowledge Systems/Management, Systems Analysis and Design, Computer Supported Meeting Environments.
Courses: Systems Analysis & Design and e-Commerce.

Golden Gate University
536 Mission Street
San Francisco CA 94105

ISSN 1528-1254