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ICIS 2010 Panel Report: Technologies that Transform Business and Research: Lessons from the Past as We Look to the Future

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Abstract:

What are the technologies that will transform business and drive the research agenda for the IS field in the years to come? Which innovations, platforms, and paradigms will become dominant, and which others will ultimately pass into obscurity? Thoughts on these questions are provided by those with a unique and unmatched perspective. The leaders who have witnessed the birth and development of the IS field during the past forty to fifty years draw on their experiences and their deep knowledge of the field to identify the characteristics of technologies that have changed business in the past. They also explain how and why today's innovations will change both research and practice going forward. Their insights have the potential to identify topics for researchers to examine now and in the years to come.

Keywords: innovation, IS research agenda, future of IS, history of IS

Editor's Note: The article is based on a panel presentation at the International Conference on Information Systems, held in St. Louis, Missouri, December 2010.

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I. INTRODUCTION

What are the technologies that will transform the business world and drive the research agenda for the IS field in the years to come? Over the past fifty years, mainframes, PCs, and wireless devices have changed the way business is transacted. Similarly, software innovations ranging from decision support systems (DSS) to enterprise resource planning (ERP) to customer relationship management (CRM) have changed business processes. Infrastructural technologies—most notably the Internet—have made a wealth of data available and have enabled the widespread sharing of that data.

Unsurprisingly, the technological advances of the past have spurred research in a variety of areas. For instance, the development of decision support systems during the 1960s has been mirrored by an emphasis on this topic in elite journals from that time through the late 1990s [Banker and Kauffman, 2004; Sidorova et al., 2008]. Similarly, the emergence of the Internet as a tool for business in the 1990s has led researchers then and now to focus their attention on electronic commerce and website design [Sidorova et al., 2007]. And the use of Information Systems, such as ERP and SCM in the current decade, is helping shape the emerging topic of services science [Barrett and Davidson, 2008; Horn, 2005].

Which of today's heralded innovations have the potential to transform business and drive a portion of the IS research agenda in the coming decades? And more broadly, how might research on innovations evolve and change? For instance, will researchers continue to focus primarily on innovations, their adoption, and their organizational impact, or will the emerging design science paradigm [Hevner et al., 2004] change the nature of innovation-related research?

In this article, leaders who have witnessed the birth and development of the IS field during the past forty to fifty years will draw on their experiences and their deep knowledge of the field to explain how and why today's innovations will change both research and practice going forward. Their insights have the potential to identify topics for researchers to examine now and in the years to come. Four specific research questions are the focus of this article. Of these four, two initial questions seek to provide a historical perspective on IS research. First, we ask, "Historically, has the IS research agenda been driven by technological innovation—or vice-versa?" And second, "In what ways is IS research retrospective and in what ways is it prospective? Who reaps the benefits of each approach?" After these initial two questions, we present a more forward-looking perspective. Questions for this portion of the article include, "Over the next decade, what technology, platform, or paradigm has the potential to transform the IS function in public sector organizations? In private sector organizations?" And a fourth and final question is, "In light of the answers given here, what themes do you see emerging in research in the next decade?"

In Section II, we begin by providing perspective on the past, and then move in Section III to a description of specific research themes that may emerge in the future. And finally, in Section IV, we provide a prospective framework for forecasting how technology may evolve in the future. By applying our framework, researchers may be able to identify approaching trends and innovations. In spite of the vast growth of the IS field over the past fifty years, a host of questions remain outstanding. And with technology constantly evolving and changing, new questions will certainly be asked for years to come.

II. THE ROOTS OF INFORMATION SYSTEMS RESEARCH

The starting point of the IS discipline can be traced to the emergence of technological innovation that made use of electronic machines for data processing. Using these machines, large amounts of structured information could be processed in a cost-effective fashion. The implementation of this technology raised a variety of organizational issues, and early IS research endeavored to investigate and address these issues using scientific methods.

Since that time, IS research has expanded in response to the rapid development of technological innovation. Technological changes have resulted in new systems and new applications in organizations. They have also led to societal changes, infrastructural changes, and changes in individual technology use. IS research has done much to develop best practices for technology use, to disseminate information about the process of innovation adoption, and to apply technology to support decision making. As technology continues to propagate into more and more aspects of business and daily life, IS research will continue to evolve and change in response to these waves of innovation.

So far, research on IS and IT-related phenomena has been conducted in two distinct but parallel tracks. One track has emerged from social science reference disciplines such as management, organization studies, and the behavioral sciences. The social sciences are predominantly descriptive and driven by a search for explanation of a phenomenon. Thus, much research conducted within this paradigm can be broadly characterized as retrospective. The other track has been based on technical sciences such as engineering and computer science. In contrast to the social sciences, the technical sciences are predominantly prescriptive and driven by search for a new design or point of view that can drive change. Such research is more prospective in its outlook and aims. We observe that where IS research has been based in the social sciences, it has aimed to strengthen and deepen the theoretical foundations of our knowledge base. However, IS research that has been based in the technical sciences has aimed to drive innovation and to extend technical capabilities. Table 1 juxtaposes these two main perspectives on Information Systems research.

Table 1: Two Main Perspectives on Information Systems Research

Reference Discipline	**Social sciences**	**Technical sciences**
Research Drive	Descriptive, seeks explanation	Prescriptive, seeks change
Perspective on IT innovation	Retrospective, driven by innovation	Prospective, driving innovation
Key Contribution	Strengthen the foundations	Renewal and boundary spanning
Focal Point	Root-based	Generative-based

The apparent dichotomy between the two camps presents an opportunity for scholars who cannot only bridge them, but also create a dialectic engine that harnesses their driving forces to reinforce one another. Early attempts to follow this modus operandi are exhibited by action design research scholarship [Sein et al., 2011] and attempts to build on engaged scholarship [Van de Ven, 2007]. These attempts share a common orientation to economic, social, and environmental values.

III. RESEARCH THEMES FOR THE FUTURE

After noting the past emphases and evolution of the IS field, it is possible to gain perspective on new research areas and themes that may develop. In light of what has been studied, and noting the topics that are emerging at the present time, five key themes for further research are presented here.

Embeddedness and Sociomateriality

The concept of embeddedness was first introduced in sociology to describe the degree to which individuals or firms are enmeshed in a social network [Granovetter, 1985]. While this idea originally was developed to explain how economic rationality is “embedded” within social relationships, it is being extended into a host of other areas. In IS research, we observe that Information Systems are embedded in the background and artifacts of everyday use [Weiser, 1991]. We also observe that sociality and culturally-induced meaning is embedded in technology as well as in artifacts and services that are enabled by information technology [Dourish, 2001]. Technologically-enabled organizational capabilities become embedded within firms. Such embedded systems and embedded competencies are potential sources of competitive advantage for firms because they are difficult for other firms to duplicate or acquire [Wade and Hulland, 2004].

As technology becomes more ubiquitous, and as business processes become more reliant upon technology for their effective execution, technology and business processes become interwoven in a way that examining a system within its unique organizational and social contexts will become more important. New perspectives on research that investigate Information Systems without attempting to separate those systems from their organizational and social context will be needed to understand how technologies work and further transform the way humans interact with one another.

We concur with those who argue that further scholarly work is required to theorize the fusion of technology and work, where technology is embedded in practices and sociality is embedded in artifacts and services [Orlikowski and Scott, 2008]. To this end, the emerging perspective of sociomateriality challenges the assumption that technology and sociality should be conceptualized separately. Instead, this perspective promotes the view that there is an inherent inseparability between the technical and the social.

Generative Design

Information Systems research has been long concerned with improving task-related performance, focusing on evaluation criteria tied to task efficiency, accuracy, or other measures of productivity. Productivity gains, however, are no longer the only important criterion for individual and organizational evaluation. Subsequently, Information

Systems are also expected to support creativity, reveal opportunities, and open new vistas of uncharted frontiers [Avital and Te'eni, 2009]. When systems have this generative capability, opportunities for innovation and value creation are more broad than when the focus is simply on productivity gains.

An emerging area of inquiry relates to generative design, that is, to the design of generative systems that are conducive to stimulate the production of creative outputs, which underlie innovation and boundary spanning. In general, being generative refers to having an evocative power or aptitude that results in producing or creating something, or tapping into a source of innovation. Generative systems refers to technologies of all sorts and at all scopes and scales that support and enhance generative capacity—that is, systems that are conducive to one's or a collective's ability to produce new configurations and possibilities, to reframe the way we see and understand the world, and to challenge the normative status quo [Avital and Te'eni, 2009]. Researchers working in this area seek to provide guidance for systems designers and architects who aim to enhance creative work, promote unstructured syntheses, stimulate serendipitous discoveries, and facilitate any other form of computer-aided tasks that involve unexplored outcomes.

Sustainable Innovation

Researchers have begun to call for and focus on research that addresses “green” and “sustainable” IT [Jenkin et al., 2011]. Green IT focuses specifically on environmental impact, and sustainable IT is a broader term that emphasizes the use of technology and resources in responsible ways that take into account not only the financial performance of the organization using the IT, but also the wellbeing of the planet and its inhabitants [Malhotra et al., 2010]. Sustainable innovation involves the development of supportive social and normative frameworks that complement and reinforce the adoption and diffusion of sustainable technologies. Sustainable innovation can be understood and leveraged by adopting a broader set of considerations that account for the sociomaterial nature of the subject matter. Sustainable value is a twofold construct that denotes value as worth and value as norms. Hence, rather than dealing with ecological sustainability alone, sustainable IT should support and promote sustainable attitudes, behaviors, and practices across systems, organizations, industries, and economies. Sustainable innovation focuses on creating positive solutions to environmental and social challenges in addition to reducing and managing the IT footprint. Sustainable innovation is thus about creating social, environmental, and economic value for all stakeholders [Van Osch and Avital, 2010].

The Knowledge Paradox

One of the themes with a firm place on the IS research agenda is Knowledge Management. As a topic it has developed its own journals, conferences, and research agenda. Indeed, today’s society has been labeled “The Knowledge Society.” In spite of the vast amounts of data that are available and searchable, and in spite of living in a society where information and knowledge are widely available, a paradox may be emerging where knowledge must compete with what has been described by some as a growing body of “un-knowledge” or “counter-knowledge” [Thompson, 2008].

Many in the IS field remember the research and discussions fuelled by the so-called productivity paradox—the problem that researchers were unable to find a positive link between investments in IS and productivity growth. It seemed on a macro scale that investment in IS had actually reduced the productivity of white-collar labor. Improved research methods and more data seemed to resolve the productivity paradox to the extent that investment in IS outperformed all other investments [Brynjolfsson and Hitt, 1996; Brynjolfsson and Hitt, 1998].

In the midst of the Knowledge Society, however, do we now have an emerging Knowledge Paradox? Despite huge investments in knowledge management systems, despite advances in databases, despite powerful search capabilities, is our knowledge being drowned by counter-knowledge? The technology which can and does store and deliver knowledge is also used to store and deliver counter-knowledge. Conspiracy theories, inaccurate history, and questionable science are parts of this counter-knowledge. Similarly, *opinion* and *belief* masquerade as *knowledge* in the blogosphere.

In the area of knowledge, we have a host of topics to research. Scholars need to explore the way social networking is used to disseminate counter-knowledge and the way counter-knowledge is accepted by society. Others need to investigate how the channels through which knowledge is delivered influence the believability of that knowledge. Still others can investigate the way that firms make use of technology to hide inconvenient knowledge. The “Knowledge Paradox” and its consequences may emerge as topics on the IS research agenda.

The “Dark Side” of Information Systems and Innovation

IS research is driven by the notion that technological innovation is for the benefit of society. This benefit is often expressed in business school terms such as *competitiveness* and *shareholder value,* but is also expressed in

societal terms such as *improvements in the quality of working life.* Nevertheless, we live in a complex universe. And not all those involved with IT and IS share the values that have traditionally driven the IS research agenda. Restated, not all IT and IS innovators intend for their work to benefit society.

Some of the most successful entrepreneurs and innovators who have played an important, but often unsung, part in helping the technology evolve are among this group who do not intend to improve or provide benefit to society. These innovators are represented by a variety of very different groups. At one extreme are the hobbyists who take pleasure from "invading" cyberspace and disrupting ordinary businesses or governmental practices for no other reason than to demonstrate their own capability. They are the hackers who obtain entry to well-protected and secret systems.

A closely-related group are those who use similar means to disrupt business and governmental functions. They may invent malware which can disrupt systems and networks. They may subvert information systems for financial gain. They may make private, secret, or "classified" content available for public consumption, as does Wikileaks, often for political or ideological reasons. While different perspectives on the value of such disclosures exist, most would agree that when such "leaks" harm one's own interests, or one's nation's interests, these innovators are regarded as criminals.

Still other innovators are those who engage directly in criminal activity such as identity theft and credit card theft. And others engage in legal, but dubious activities, such as the distribution and sale of pornography over the Internet [Coopersmith, 2006]. The "value" in pornography has been described in the following way:

> *"... porn has proven to be a reliable, highly profitable market segment that has accelerated the development of media technology [and] ... the demand for porn has driven the development of core cross-platform technologies, for data compression, search, transmission, and micro payments" Shorn of the word "porn" the industry could be used as a case study of successful innovation and entrepreneurship in a Business School or IS application class.* [Dines, 2011]

Despite the importance attached by businesses, governments, and citizens to the problems of security, privacy, morality, cyberwarfare, and cybercrime, the activities of this alternative world of entrepreneurs and innovators have played only a minor role in the IS research agenda. Where research has surfaced, it has been reactive in the sense that research has concentrated on finding ways to counter the activities, mainly by building protective mechanisms. And most of that research has taken place outside the domain of the IS discipline. Understanding the counter culture in the way criminologists study the criminal world has not been part of the IS research agenda. Yet the impact and potential damage of using technology in this way is growing all the time and is regarded as a major threat. Perhaps it is time that we put the "dark side" of IS and IT innovation firmly on the research agenda.

IV. FORECASTING FUTURE TECHNOLOGIES

A key idea that researchers would do well to grasp is that *technique lags behind technology*. An understanding of this maxim can provide guidance for researchers who are trying to anticipate new technologies and new research themes. When new technologies become available, they are often used in old ways. There is a clear historical pattern of this dynamic. For example, when rifles were first developed (a new technology) soldiers for decades still lined up shoulder to shoulder several layers deep in brightly colored uniforms and marched onto fields of combat (which was an old technique based on sword and shield technology). The old technique was ridiculously obsolete, given the new technology. Seeking protection behind safe objects and wearing camouflage uniforms that helped soldiers blend into the terrain did not become best practices for infantry for some time.

We see this phenomenon of technique/perception lagging behind technology particularly present in computing technology. Consider automatic teller machines (ATMs). The first ATMs were located inside banks. Why? Because it was an automated teller station without the teller. Initially, many bankers were concerned that customers would rather deal with a human teller. Accordingly, banks placed ATMs originally in bank lobbies as a "self-service alternative" to waiting for a human teller. However, the real value from ATMs came when they were available to customers twenty-four hours a day outside the bank. This was not an easy adjustment to the banking business model. Taking cash and leaving it unattended in, say, shopping centers, was not an easy innovation for most bankers to embrace. To many, when the idea was first mentioned it seemed like a joke. In fact, the perception of most real innovations in the first stage is that they are jokes. The second stage is denial (i.e., "No way we are doing that"). The third stage when technique catches up to technology is "accepted and best practice."

Another example of this is that when word processing technology became available, many executives viewed word processing as a technology to make secretaries more productive. The notion that an executive would have a

keyboard in his or her office was initially seen as a "joke." It took several years for the placement of a computer and keyboard in an executive's office to evolve to accepted and best practice.

Future Perfect

So, how can we become better at recognizing when an innovation is not a joke? And how can we become better at forecasting new technology development and implementation? And how can we not let technique lag unnecessarily behind technology? An excellent partial answer is provided by Stan Davis in *Future Perfect* [Davis, 1987]. His forward-thinking book provides a powerful means to establish a vision of the future and how technology will play a role in it. The fundamental assumption to do this is to accept that technology is going to get better and better. If technology is going to get better and better, it follows that proper utilization of it will allow us to do things better. When there is no room left for improvement, then we have achieved perfection. Accordingly, the way to see to the future in advance is to develop a vision of what perfect looks like. We then realize we are on a journey toward getting closer and closer to that perfect vision until it is achieved.

What does perfect look like? It is when people can get what they want—any time, any place, in any way. For example, if an individual could stand anywhere and say, "I want $1000 from my account" and it immediately appeared in his or her hand, that would be achieving their request anytime, anyplace, anyway. That would be "perfect." If this individual could say, "Make it $2000 and convert it to Japanese Yen," that illustrates an additional degree of perfection. In contrast, if someone is required to go to their bank during banking hours in the city where they live, that is far from perfect. So when the bank put twenty-four-hour ATMs outside the bank and allowed individuals to get money in $20 increments, that was closer to perfect than before. When those same ATMs were located around the country or around the world, it became closer yet. If individuals can get money in the exact amounts they want, that is closer again.

One variable that *Future Perfect* does not specifically address, but one that is crucial to consider, is what a customer is willing to pay for functionality that is closer to perfect. As a simple example, if one lives in Minneapolis, having a newspaper delivered on one's front porch may be literally worth twice the cost of having it delivered in a mailbox seventy-five yards from one's front door.[1] In sub-zero weather it is unpleasant to retrieve a newspaper in a bathrobe and slippers. Front-porch delivery is not a service the newspaper offers, but it is possible to make a special arrangement with the newspaper carrier to pay twice the price of the newspaper to have it delivered "where" one wants it. The newspaper carrier achieves a profit margin far exceeding that of the newspaper publisher by providing "anywhere" service. Because customers are often willing to pay an additional fee to achieve one of the *any time*, *any place*, *any way* criteria, a useful addition is *appropriate price*, where this price is simply defined as what it's worth to the customer.

In sum, the idea of perfection, that is, *any time*, *any place*, *any way*, and at an *appropriate price*, can be a guide to researchers who are looking for ways to predict how technology will evolve.

Customer Resource Life Cycle

An additional tool we can use for forecasting the future is the Customer Resource Life Cycle (CRLC). The CRLC explains that customers complete a series of steps as part of having a relationship with an organization [Ives and Learmouth, 1984; Vitalari and Wetherbe, 1994]. With an understanding of these steps we can apply the principles of *Future Perfect* and get a vision of where future technology is to be best applied. This insight can help forecast the future and gain competitive advantage. The steps of the revised CRLC [Wetherbe, 1998] include:

- Indentify/Research/Profile
- Educate/Advertise/Market
- Establish Requirements/Select
- Price/Order/Deliver/Payment
- Test/Accept
- Integrate/Monitor/Upgrade
- Maintenance/Dispose/Account for
- Feedback/Network

[1] It was worth it for one of the authors of this paper.

Framework

The pieces of the puzzle can now be organized into a straightforward framework that can be used to not predict future technology *per se* but to determine what new technologies are needed and how they can be used. If we construct a simple matrix using the constructs of *Future Perfect*, the CRLC, and appropriate price we have the matrix shown in Table 2. Organizations can consider if each of the steps in the CRLC (shown on the left side of Table 2) can be executed any time, any place, any way, and at an appropriate price. If any step cannot be executed in these ways, a potential area for improvement and innovation can be identified.

An organization can thus use any one cell or combination of cells to predict the future and make competitive decisions. Complete perfection is generally not a realistic goal. Rather it is simply to be closer to perfect than the competition within the cells that matter most to customers. Few successful products remain unchanged for great lengths of time. Instead, it is likely that some individual or firm will find a way to make an improvement in the product and or the way that it is delivered.

Table 2: A Framework for Forecasting Future Technologies

	Any Time	Any Place	Any Way	Appropriate Price
Indentify/Research/Profile				
Educate/Advertise/Market				
Establish Requirements/Select				
Price/Order/Deliver/Payment				
Test/Accept				
Integrate/Monitor/Upgrade				
Maintenance/Dispose/Account for				
Feedback/Network				

As an illustration, consider the scenario of shopping on the Internet for an artist bench for a grand piano at 10 PM in the evening. After searching several websites, perhaps one feels uncomfortable making a selection because it is not apparent what the value proposition is for the wide range of prices and features. Finally, at one website, an instant message pops up on the screen and a customer service representative asks if she can be of assistance. After an instant message dialogue pertaining to features and benefits of different models, one's questions are resolved and one feels confident enough to place an order.

Of significance is that this is the only vendor able to provide CRLC functions of education, requirements determination, and selection in addition to what others could do, which was only pricing, ordering and delivering. The ability of this vendor to provide additional functionality at any time (10 PM), any place (at one's home), any way (with a knowledgeable salesperson speaking your language), for an appropriate price (in this case, the additional service was free), is closer to "perfect" and provides additional value to the customer.

Summary

Though we may not always be able to forecast accurately what new technological innovations are forthcoming, using the framework presented above gives a clearer picture of the destination. Using the matrix, organizations can work with customers to identify the best value propositions as new technologies emerge. By exploring each cell in the CRLC/Future Perfect matrix, ideas for the innovative use of technology can be explored. "Closer to perfect" improvements that are cost effective can be made to sustain competitive advantage.

One final example may illustrate this point. Over the years, one of the authors has traveled extensively to give keynote addresses. As part of the travel ritual, he has to check into hotels, sometimes up to 100 times a year. The transaction leaves much to be desired. First of all, he has to wait in line to check in and out. Hotels have a "technique lags behind technology" rule about check-in and checkout times that are archaically based on the principles of horse and buggy travel when people conducting personal travel would travel all day, stay in a hotel and travel all the next day. Today, however, most hotel guests are business travelers whose schedules are determined by airline schedules.

If a hotel were to evolve toward the future perfect ideal, several changes might be made. First, when making a reservation via Internet or phone, information needed would be provided, including arrival and departure times. What about fixed check-in and checkout time? Hotels generally explain that they need time to clean rooms, but obviously they can't clean all rooms at noon. Business travelers usually arrive late in the evening and depart at various times during the day depending on their schedules. This schedule is generally known when the traveler makes the reservation, and many travelers will be willing to share it. Second, when arriving at the hotel, one could skip the

counter and swipe a credit card through a kiosk which would explain where one's room is and how to get there. Third, the kiosk could activate one's credit card as a hotel key. When checking out, one could put the credit card in the kiosk and have it print out a bill which would be more current than the one that slid under the door early in the morning. At that point, the credit card could be deactivated as a room key. A hotel could provide flexible check in/ checkout and more efficiently clean the rooms by getting the arrival and departure schedule up front and scheduling cleaning staff accordingly. Innovative use of information technology allows an organization to accomplish the feat of reducing cost and increasing service if they minimize technique-lagging technology and innovatively see and implement the future as a market leader.

V. CONCLUSION

In the past fifty years, we have lived through incredible changes in information and communications technologies. Technology changes have resulted in new systems and new applications in organizations. They also lead to societal changes, infrastructure changes, and changes in individual technology use. The technology innovations and new systems and applications do not happen overnight. The time delay from technology innovation to significant impact on organizations, individuals, and society is the time when organizations can recognize changes in the making, prepare for the changes by selected trials, and innovate with new applications and system. Recognizing future technologies and the changes that will occur and making appropriate changes in strategy can make the difference between success and failure for an organization. They can also make a career difference for individuals who are in career-preparation educational programs or who have opportunities for job changes.

In the past, it has been difficult to forecast changing computer and communications technologies. In early 1960s and 1970s textbooks, chapters on current and prospective developments in computer hardware, software, and applications focused on individual developments. That meant that during the life of the textbook, students were reading about possible developments but were not being taught how to identify them on their own. What was missing was the description of underlying principles of forecasting technology development, adoption, and system implementation that might have helped students to evaluate new technologies, systems, and products that they would see in their careers. These principles were missing simply because they were not well understood.

While IS research has done much to help understanding, explaining, evaluating, and codifying best practices; to disseminate information about innovations and how they are applied, and to provide leadership in the areas of applications such as decision support, auctions, and requirements determination, we still need to invest our research talents in the area of forecasting future technologies, applications, and systems.

We understand the importance and difficulty of forecasting and evaluating the importance, value, and impact of new technologies, new applications, and new systems. We also understand that it is difficult to organize principles and teaching modules that will help students apply them effectively. The question is how to do it. We can start with educational goals that are reasonable and achievable relative to this topic. We can first teach students to carefully, thoughtfully consider new technologies and new applications and imagine their use and their advantages and disadvantages. Second, we can teach students methods to go deeper and analyze the affordances provided by new technologies and new applications and to imagine how an organization may use the affordances to create new products, services, and systems. We can also teach students simple methods of reasoning about experiments and trials with *promising* new technology that will result in reasoned decisions about adoption. Additionally, we can teach students some ideas about timing relative to new innovations. Too soon can be just as bad as too late. And finally, we can prepare case studies that illustrate good principles and practices relative to forecasting, trials, and adoption.

Starting with goals such as these, and by incorporating some of the forward-looking ideas contained in this article, we can, through research and trial and error, advance the practice of predicting technological innovation.

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REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
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Avital, M. and D. Te'eni (2009) "From Generative Fit to Generative Capacity: Exploring an Emerging Dimension of Information Systems Design and Task Performance", *Information Systems Journal* (19)4, pp. 345–367.

Banker, R.D. and R. Kauffman (2004) "The Evolution of Research on Information Systems: A Fiftieth-Year Survey of the Literature in Management Science", *Management Science* (50)3, pp. 281–298.

Barrett, M. and E. Davidson (2008) "Exploring the Diversity of Service Worlds in the Service Economy" in Barrett, M. et al. (eds.) *Information Technology in the Service Economy: Challenges and Possibilities for the 21st Century,* Boston: Springer, pp. 1–10.

Brynjolfsson, E. and L. Hitt (1996) "Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending", *Management Science* (42)4, pp. 541–558.

Brynjolfsson, E. and L. M. Hitt (1998) "Beyond the Productivity Paradox", *Communications of the ACM* (41)8, pp. 49–55.

Coopersmith, J. (2006) "Does Your Mother Know What You Really DO? The Changing Nature and Image of Computer Based Pornography", *History and Technology* (22)1, pp. 1–25.

Davis, S. (1987) *Future Perfect,* Reading, MA: Addison-Wesley.

Dines, G. (2011) "Porn: A Multibillion-Dollar Industry That Renders All Authentic Desire Plastic", *The Guardian*, Jan. 5, p. 27..

Dourish, P. (2001) *Where the Action Is: The Foundations of Embodied Interaction*, Cambridge, MA: MIT Press.

Granovetter, M. (1985) "Economic Action and Social Structure: The Problem of Embeddedness", *American Journal of Sociology* (91)3, pp. 481–510.

Hevner, A.R. et al. (2004) "Design Science in Information Systems Research", *MIS Quarterly* (28)1.

Horn, P. (2005) "The New Discipline of Services Science", *Business Week,* Jan. 21, http://www.businessweek.com/technology/content/jan2005/tc20050121_8020.htm (current Apr. 26, 2011).

Ives, B. and G. Learmouth (1984) "The Information System as a Competitive Weapon", *Communications of the ACM*, (27)12, pp. 1193–1201.

Jenkin, T.A., J. Webster, and L. McShanea (2011) "An Agenda for 'Green' Information Technology and Systems Research", *Information and Organization* (21)1, pp. 17–40.

Malhotra, A., N. Melville, and R.T. Watson (2010) "Call for Papers: MISQ Special Issue on Information Systems and Environmental Sustainability", *MIS Quarterly*, http://www.misq.org/skin/frontend/default/misq/pdf/CurrentCalls/GreenIS.pdf (current Apr. 26, 2011).

Orlikowski, W.J. and S.V. Scott (2008) "Chapter 10: Sociomateriality: Challenging the Separation of Technology, Work and Organization", *The Academy of Management Annals* (2)1, pp. 433–474.

Sein, M.K. et al. (2011) "Action Design Research", *MIS Quarterly* (35)1, pp. 37–56.

Sidorova, A., N. Evangelopoulos, and T. Ramakrishnan (2007) "Diversity in IS Research: An Exploratory Study Using Latent Semantics", *Proceedings of the 28th Annual International Conference on Information Systems*, Paper 10.

Sidorova, A. et al. (2008) "Uncovering the Intellectual Core of the Information Systems Discipline", *MIS Quarterly* (32)3, pp. 467–482.

Thompson, D. (2008) *Counterknowledge*, New York, NY: W.W. Norton and Company.

Van de Ven, A.H. (2007) *Engaged Scholarship: A Guide for Organizational and Social Research,* Oxford, England: Oxford University Press.

Van Osch, W. and M. Avital (2010) "From Green IT to Sustainable Innovation", *Proceedings of the 16th Americas Conference on Information Systems (AMCIS),* Lima, Peru.

Vitalari, N. and J. Wetherbe (1994) *Systems Analysis and Design: Best Practices*, St. Paul, MN: West.

Wade, M. and J. Hulland (2004) "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research", *MIS Quarterly* (28)1, pp. 107–142.

Weiser, M. (1991) "The Computer for the 21st Century", *Scientific American* (265)3, pp. 94–104.

Wetherbe, J. (1998) "Time and Technology: Competing for Customers in the Future", *Journal of Cycle Time Research*, (4)1, pp. 1–13.

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