MIS Quarterly

ISSUES AND OPINIONS

IMPACTFUL RESEARCH ON TRANSFORMATIONAL INFORMATION TECHNOLOGY: AN OPPORTUNITY TO INFORM NEW AUDIENCES[1]

Henry C. Lucas, Jr., and Ritu Agarwal
Smith School of Business, University of Maryland,
College Park, MD 20742-1815 U.S.A. {hlucas@rhsmith.umd.edu} {ragarwal@rhsmith.umd.edu}

Eric K. Clemons
The Wharton School, University of Pennsylvania,
Philadelphia, PA 19104 U.S.A. {clemons@wharton.upenn.edu}

Omar A. El Sawy
Marshall School of Business, University of Southern California,
Los Angeles, CA 90089 U.S.A. {omar.elsawy@marshall.usc.edu}

Bruce Weber
Alfred Lerner College of Business and Economics, University of Delaware,
Newark, DE 19716 U.S.A. {bweber@udel.edu}

Information technology has arguably been one of the most important drivers of economic and social value in the last 50 years, enabling transformational change in virtually every aspect of society. Although the Information Systems community is engaged in significant research on IT, the reach of our findings may be limited. In this commentary, our objective is to focus the IS community's attention on the striking transformations in economic and social systems spawned by IT and to encourage more research that offers useful implications for policy. We present examples of transformations occurring in four distinct sectors of the economy and propose policy-relevant questions that need to be addressed. We urge researchers to write papers based on their findings that inform policy makers, managers, and decision makers about the issues that transformational technologies raise. Finally, we suggest a new outlet to publish these essays on the implications of transformational informational technology.

Keywords: Transformation, strategy, disruptive technology, research policy, academic journals

Introduction: Ritu Agarwal and Hank Lucas

It should be obvious even to a casual observer that information technologies (IT) are transforming organizations, markets, industries, societies, and the lives of individuals. As might be expected, the information systems (IS) discipline is vigorously investigating aspects of IT-enabled transformations, documenting them in research in our academic journals, and disseminating insights and findings to other researchers. What is less clear to us, however, is the extent to which our research is having an impact that extends beyond the circumscribed confines of academia. Does the IS field have insights

[1]Detmar Straub was the accepting senior editor for this paper.

to provide to decision makers who are confronted with a major transformation in their industry or firm? Can we advise government policy makers about technology issues facing societies such as broadband expansion, net neutrality, or intellectual property? Can we offer recommendations to executives in a firm struck by a massive technological discontinuity, such as Kodak, now in bankruptcy because it did not understand the digital world even though it invented the digital camera? The answer to these questions is in the affirmative: Yes, our collective research efforts equip us to provide meaningful advice to decision makers.

Despite the ability to do so, it is our opinion that as a community we have been negligent in effectively communicating the fruits of our research to external stakeholders. Straub and Ang (2008) identify two purported "gaps" in relevance: the choice of what to study and the mechanisms for knowledge dissemination. They underscore the need to move our research to more "evidence-based management prescriptions" (p. viii). Assuming that one viable means of communicating relevant knowledge is through publications (albeit perhaps not a very effective way of transferring knowledge to practice; Straub and Ang 2008), we lack print venues that are committed to this principle. It is highly unlikely (and appropriate) that we would ever see such papers in our top scholarly journals. Scholarly journals are committed to communicating to scholars (rightly so), but the dissemination of the policy implications of transformational technologies for society and for practice does not currently have a dedicated venue.

Certainly prominent among the stakeholders of the IS community are IS practitioners and managers who need to be informed about IT developments. But equally, to the extent that IT transforms both organizations and societies, key policy-makers in government and in the private sector also need to be well informed. Moreover, as we will suggest below, academic articles tend to be focused on silos of knowledge. Yet society at large and businesses/nonprofits/government agencies that span these silos call for the integration of academic findings. Not being offered publications for such work, the groups of which we speak are, therefore, poorly served.

Our objective in this commentary is threefold: first, we seek to underscore the significance of IT-enabled transformations and encourage IS researchers to purposively identify research questions that explore these transformational impacts and their concomitant policy implications. As examples of the types of phenomena that merit investigation, in subsequent sections of this paper, we describe some of the important transformations taking place in four diverse areas of economic activity and offer suggestions for research topics with important policy ramifications. The topics we identify speak directly to the "know-how" criterion for impactful research (Straub and Ang 2008). Second, we urge researchers investigating transformational phenomena enabled by IT to consider writing papers based on their findings that go beyond what they would write for a scholarly journal and inform managers, decision makers, and policy makers on the issues that transformational technologies raise for business and the economy.[2] This is an important way in which our scholarship, which has much to offer, will be effective in informing policy and business decision making. Finally, we recommend the creation of a new outlet, tentatively entitled *IT Policy Letters,* to publish essays on the implications of our completed research and research in progress in a timely manner.

What Constitutes an IT-Enabled Transformation?

Our position is constructed on the notion of an IT-enabled transformation—that is, a change precipitated by a transformational information technology. What defines a transformational technology and how can a transformational change be distinguished from an incremental adjustment? A number of scholars have wrestled with this question (see Table 1, which highlights various dimensions that can be used to analyze transformational technologies). Chandler and Cortada (2000), for example, characterize a transformation as something that will shape and reshape the economy. The literature on radical innovation also offers suggestions, observing that to be radical, an innovation has to be novel and that it has to be adopted (Dahlen and Behrens 2005).

Dehning et al. (2003, p. 654) listed a number of criteria for a technology to be transformational:

1. "[It] fundamentally alter[s] traditional ways of doing business by redefining business capabilities and/or (internal or external) business processes and relationships.
2. [It] potentially involve[s] strategic acquisitions to acquire new capabilities or to enter a new marketspace.
3. [It] exemplif[ies] the use of IT to dramatically change how tasks are carried out…is the move recognized as being important in enabling firm to operate in different markets, serve different customers…gain considerable competitive advantage by doing things differently."

[2]Our argument is distinct from the rigor versus relevance dichotomy that has been debated in the literature for some time. The discussion on rigor versus relevance has largely focused on the question of whether research should address one or both criteria, and has not tackled the issue of the dissemination of findings.

Table 1. Transformation Criteria and Examples

	Individual	Firm	Economy/Society
Process	A change in a personal process of more than half the steps (e.g., digital photography)	A change in a business process of more than half the steps (e.g., book publishing vs. e-books)	
New organizations		Creation of a new organization with a value of at least $100 million (as in Amazon, Facebook, and Google) or multiple organizations (as in Health Information Exchanges)	Creation of a new organization that changes at least two hours of individual behavior a day (mobile communications and web)
Relationships	A change in social relations affecting at least half of one's contacts or doubling the number of contacts (e.g., Facebook)	A change affecting at least half of relationships with other organizations or a doubling of the number of relationships (e.g., iTunes for Apple, e-books for Amazon)	A change affecting at least two hours of individual behavior a day related to social relations (e.g., Facebook, Twitter)
User Experience	A change in user experience involving at least 2 hours per day (e.g., Facebook)		
Markets	A change in at least half of one's vendors in a particular market (e.g., iTunes vs. CD purchases)	Entering or leaving at least one market served by the firm (a.k.a. idevices)	Creation of a new market with at least $100 million of transactions a year (such as music downloading, search advertising)
Customers		A change in which the firm serves at least 50% more customers (e.g., Amazon e-books, iTunes)	
Disruptive impact		A change that forces at least one competitor to move from a profit to a loss, exit a market, enter into a merger or declare bankruptcy (e.g., Neflix vs. Blockbuster, e-books vs. Borders, digital photography vs. Kodak)	Reduction of at least $100 million in transactions a year in a market (e.g., print newspaper circulation)

These ideas on what constitutes a transformation[3] are very broad and require a great deal of judgment and consideration of context. It is quite possible that in using these criteria there would be disagreements among different raters as to whether a technology is transformational or not.

As shown in Table 1, we propose seven specific dimensions of a transformation and delineate the ways in which these dimensions can potentially influence individuals, firms, and societies. *We propose that to be classified as transformational, an information technology must exhibit the impact described in three or more of the cells in Table 1.* Given the centrality of the concept of a transformational technology for the IS discipline, we hope others will progressively refine and sharpen this proposed definition. Refinements may take the form of additional theorizing (e.g., by expanding the dimension space) or empirical enhancements (e.g., research that sheds light on the appropriate level of changes in each cell or describes alternative ways of operationalizing measurement).

Writing about Transformations

Research on IT and transformation can yield publications that cover a wide spectrum of formats and outlets. It is unlikely that a traditional research paper published in a top IS journal will be crafted solely to offer actionable recommendations to decision and policy makers. We suggest, instead, that researchers combine the results of several studies, both their own and of others, to develop the implications of a major IT-

[3]From this point on we use the term *transformation* to connote an IT-enabled transformation

enabled transformation. Furthermore, we believe that IS researchers should prepare such analyses while their research is in progress given the length of time it takes to collect data, analyze it, and produce a peer-reviewed, publishable paper.

Our example of the type of paper we envision is a modification to a published paper by Sunstein in the *Communications of the ACM* in 2004 entitled "Democracy and Filtering." The article expresses the author's opinion that it is important in a democracy for voters to be exposed to both sides of the important issues confronting the country. Sunstein argues that the Internet provides a remarkable amount of information relevant to a voter, but, equally, it makes it easy to only look at information one agrees with already. To the degree that people have a systematic tendency to filter information and attend to only that which agrees with their existing views, sophisticated search mechanisms on the Internet facilitate visits to sites that are consistent with their belief structures.

To fit our vision of an "impactful" paper on transformational IT, we would recommend the following additions and changes to this otherwise stimulating article:

1. A brief review of the literature on selective perception and filtering to support the contention that people will filter their choice of web sites.

2. Some evidence that filtering is actually occurring. For example, by finding a study that analyzes the past year of ComScore data, classifying news sites and a sample of blogs according to the amount of political news they present and their conservative or liberal bias. We imagine a paper that would have developed a distribution of the time spent on the sites to see if Internet users spend more time on balanced or biased sites.

3. An expanded conclusion about the dangers of this trend for democracy and recommendations on how to mitigate it.

The type of essay we describe would have a different structure than the traditional IS academic journal article. It would not contain much theory or many hypotheses, and it would be written in an accessible style with less formality than a typical journal article. More importantly, it would rely more on the author's informed judgment and analysis than typical IS publications. Scholars would be encouraged to offer solutions to the problems they identify and to speculate on the plausible policy implications of their research. Such policy implications could be at the firm level, the national level, or the international level. These characteristics are common in disciplines such as the humanities where it is methodologically appropriate and expected that the researcher will interpret events and draw implications in the absence of models, large data sets, or regressions on historical data.[4]

In the sections of this paper that follow, we describe how technology is transforming different sectors of the economy: the financial industry, health care, the consumer experience, and media. These discussions demonstrate the transformational impact of IT across four very distinct domains and raise policy questions which the IS field is well equipped to address. If the four diverse areas discussed are undergoing a transformation, then very few aspects of our lives are immune to IT, and the questions raised here will proliferate.

The Role of IT in Transforming Financial Markets: Bruce Weber

Transformational Impacts

Today, market users are integrating the once disparate steps in the investment value chain to create portfolio models that combine asset selection with trading optimization. The result is better investment performance for fund managers that integrate investing and implementation into a consolidated process that can be managed and monitored via software linked to market data feeds. Despite the benefits, there may be a downside to market technology.

The solvency of even the largest financial institutions was suddenly challenged in 2007 by growing mortgage defaults and declining home values in the United States. Did IT play a role in the financial meltdown? In February 2007, HSBC wrote-down $11 billion in assets backed by subprime loans. In August 2007, overnight and short-term lending among financial institutions dried up as lenders' doubts about borrowers' ability to repay grew, and concern over the value of collateral increased. Mortgage lender Countrywide Financial Corporation expressed concerns over liquidity because of the decline of the secondary market for securitized mortgage obligations, and in September had exhausted its entire $11.5 billion credit line from a group of banks. In March 2008, concerns that investment bank Bear Stearns would collapse resulted in its fire-sale acquisition by J.P. Morgan Chase. The

[4]Transformational research is related to, but not the same as, technological forecasting. For example, Straub and Wetherbe (1989) offered a technological forecast for the 1990s relying on interviews with key expert informants. Because technological forecasts have to cover a broad range of technologies, they tend not to discuss specific industries and certainly not specific firms.

financial institution crisis hit its peak in September 2008. Several major institutions either were acquired swiftly (Merrill Lynch, Washington Mutual, Wachovia, HBOS), failed (Lehman Brothers), or were bailed out and taken over by the U.S. or U.K. government (Fannie Mae, Freddie Mac, AIG, RBS, Lloyds-HBOS).

At the heart of these collapses were portfolios of investments whose assets had been derived from bundled home mortgages. Exposure to these mortgage-backed securities, or to the credit derivatives used to insure them against failure, caused the collapse or takeover of major firms such as Lehman Brothers, Merrill Lynch, and AIG. While mortgage underwriting and securitization were enabled by the computerization of many of the business processes, the speculative bubble in home prices developed and peaked in 2006 independently of the role IT played in the industry. At the peak in late 2006, the average U.S. home cost about four times the average family income compared to a historic average of 2.5 times. Without IT support, the number and sophistication of mortgage loans available, and the volume of related trading activity, would have been much less damaging. However, the underlying cause of the crisis was human error and hubris in the form of overconfidence and speculative excess.

What happened during the "flash crash" on May 6, 2010? Was IT culpable in some way? Commentators, citing statistics that 70 percent of exchange volume in the United States is from trading algorithms, used the incident to criticize the short-term trading strategies that appear to disadvantage long-term buy-and-hold investors (CFTC and SEC 2010). When the unusually large number of sell orders for NYSE-listed stocks hit, the NYSE went into "slow mode," which required it to send its orders to other markets. Many of these markets are relatively new alternative trading systems such as the BATS and Direct Edge markets, which do not have as many orders in their books. That meant too few buy orders existed to satisfy the growing number of sell orders. IT, and specifically the ability of computer-driven traders to route vast numbers of buy and sell orders to markets, did lead to the flash crash. Exchanges and their participants could not handle the flood of orders and buying interest fell away as the unusual conditions led many to cancel liquidity-supplying strategies. Previously, trading halts would have been called and orders would have been delayed. Clearly, these events and the role IT played in them, represent the dark side of IT dependency.

Today, exchanges can process and match millions of orders with only millisecond delays and disseminate immediate trade reports with prices and volumes. Orders are entered by systems colocated in data centers with the markets' matching engine, and are cancelled and reentered with no discernible delay. While market systems operate at cyber-speed, vulnerabilities arise because electronic market makers, who supply liquidity by placing limit orders to buy, have software designed to remove orders and reduce risk when conditions are abnormal (CFTC and SEC 2010, p. 23). Other trading software places orders without considering whether liquidity suppliers may be out of the market or less willing to trade. The result today is poor synchronization across the stages of trading and high variation in the quality of markets. Until trading algorithms and software become more robust, sudden changes in liquidity and prices are possible.

Where Is the Transformation?

Referring to the criteria for a transformation technology in Table 1, IT has fundamentally altered the traditional way of investing in stocks. The user experience has moved from making phone calls to a full-service broker to placing electronic orders. More than half the steps in the process of managing a portfolio have changed as have the vendors with whom one deals. IT has created new organizations including electronic stock exchanges and electronic brokers like e-Trade that easily exceed $100 million in annual turnover Major stock exchanges have been forced into mergers changing the structure of the industry. To a great extent the New York Stock Exchange of the 1990s does not exist anymore. It has totally changed its ownership structure, purchased the Archipelago electronic market and merged with Euronext, and is still experiencing a dramatic loss of market share.

Policy Questions

Transformations in the financial markets raise fundamental questions for investors, the financial sector, the economy as a whole, and the U.S. federal government as well as many other governments worldwide. These questions involve technology, economic and regulatory policy issues, and questions for the management of firms in the industry.

- What is the impact of high-speed, algorithmic trading on market volatility? How can future flash crashes be prevented through enlightened policies? Should the SEC institute regulations to prevent high frequency traders from entering a large number of orders and then cancelling them seconds later?

- How can regulators keep up with the new products and speed of execution in the financial industry enabled by IT? How can they keep track of the risk from newly

created investment vehicles, especially derivatives? Can new policies funnel their efforts so that future "Great Recessions" are avoided or their adverse consequences diminished?

- To what extent is technology a part of the multibillion loss at J. P.Morgan Chase? Does IT facilitate or exacerbate the challenges of implementing some form of the Volcker Rule? Again, can policy be reconfigured so that losses will not make a firm "too big to fail"?

- Should the United States (and other countries) establish a National Academy of Information Technology similar to the other national academies to advise the government on IT issues of critical national importance?

Transforming Health Care with Information Technology: Ritu Agarwal and Hank Lucas

Transformational Impacts

Despite having one of the highest total health care expenditures ($2.3 trillion) as a percent of gross domestic product (17% in 2007), the health status of the U.S. population lags behind other developed countries. The U.S. infant mortality rate is 6.9 per 1,000 live births, the third highest among OECD countries. On the cost side, premiums for policies offered by employers have risen more than 57 percent since 2000 and it has been suggested that the noncompetitiveness of U.S. products in the global marketplace can partially be attributed to the high cost of healthcare that employers must bundle into pricing their products. The system has taken its toll on citizens: every 30 seconds someone files for medical bankruptcy, and nearly 46 million individuals were without insurance in 2010. Poor quality of care and compromised patient safety are endemic in the system: it has been estimated that more than 1 million serious medication errors occur every year in U.S. hospitals, and 44,000 to 98,000 Americans die in hospitals each year as a result of medical errors (Bates et al. 1998).

By providing capabilities such as facilitating the exchange and flow of patient information across multiple episodes of care in healthcare delivery, reducing the need for duplicate tests and procedures, providing clinicians with real-time access to new knowledge about the efficacy of treatments, reducing medical errors by providing relevant information on drug interactions at the point of care, and enabling the creation of large data repositories for clinical research, health information technology (HIT) is envisioned as the foundation for developing a safer and cheaper healthcare system. Although the domain of HIT encompasses a broad range of technologies, the focal artifact is the electronic medical record (EMR) system, a major digital and transformational innovation in the health care field. An EMR *system* consists of the core electronic patient information, together with the software applications that enable required workflow functionality.

There are few standards in place for EMRs and there are many proprietary data formats that make interoperability a challenge, reducing our ability to leverage HIT. The U.S. health care system is highly fragmented with many entities originating transactions. The majority of physicians in the U.S. practice in groups of five or fewer doctors. For the most part, coordination is by market with a large number of markets (physician–patient, physician–payer, lab–payer, patient–hospital, hospital–payer, etc.). The market is characterized by adversarial relationships where parties attempt to reject requests to reimburse the originator of the transaction: each party tries to pass costs on to someone else. There is also well-documented and rampant fraud and abuse.

The greatest success with EMRs has occurred in clinic settings at places such as Kaiser-Permanente. Kaiser doctors are on salary, the clinic operates its own health plan, and doctors can make decisions about hospitalization without needing authorization from a paying entity (Chen et al. 2009). However, the majority of doctors in the United States are compensated on a fee-for-service basis.

The adoption of electronic medical records and a national health information network for sharing them has the potential to transform the practice of medicine in the United States. First, EMRs should, in theory, reduce the administrative cost of medical care through a reduction in errors and duplicate testing. However, the greatest impact of EMRs and their associated networks and software will come in improving the quality of care and encouraging more preventive medicine.

The data captured in EMRs provides the opportunity to learn from the past and practice evidence-based medicine. It will be possible to compare different treatments and choose the one that has proven the most effective for a particular diagnosis. As a doctor at the Mayo Clinic told us in an interview, he should know everything the clinic knows about his diagnosis of a patient at the time he is treating the patient. Information from EMRs can be combined with genetic data to develop personalized medical treatments that are specifically tailored to the needs of individuals, in much the same way as products and services are customized in other industries (Hamburg and Collins 2010), opening up enormous opportunity not only for improvements in health, but also

entrepreneurial ventures in bio technology, data manipulation and analysis, etc. Such personalized medicine would clearly transform the way in which health care is delivered; it is a complete paradigm shift from our current, modern medical practice.

Where Is the Transformation?

A transformation in health care from IT has not yet occurred in the United States at the time of this writing (based on the criteria in Table 1), although there are encouraging signs that it is underway. Electronic medical records change at least half the steps in the process of providing health care for both the physician and the patient. Health information exchanges, which represent new organizations, are being created across the United States. We expect them to exceed $100 million worth of transactions in the near future if they have not already done so. The costs of technology are forcing physicians to form larger medical organizations to attain scale. The organization that is a single physician practicing medicine is disappearing in the industry. An IT-enabled transformation of health care is just beginning, and it cannot happen too fast.

Policy Questions

Medical costs in the form of Medicare benefits are a major contributor to huge U.S. federal budget deficits projected for the future. HIT has profound implications beyond technology and the quality of care; it is a key component of the larger health care ecosystem that includes a diverse and sizeable number of players such as physicians, insurance companies, federal and state governments, device manufacturers, pharmaceutical companies, and, of course, patients.

- To what extent can health information technology improve the quality of care and reduce its cost? What kind of changes in the U.S. health care industry would facilitate benefits from HIT, for example, a single payer, the end of fee-for-service, physician compensation for prevention, etc.? What role, if any, should government policy have in this transformation?

- What are effective ways to implement health IT? Should there be a single U.S. federal agency responsible for HIT or is there an alternative set of institutions to accelerate diffusion? What are the issues for public and health policy as HIT advances?

- What steps will mitigate consumer concern about the privacy of electronic medical records? What technology solutions are there to reduce privacy concerns? How can patients be incentivized to become more engaged in their health and wellness using HIT tools?

- What approaches are available to be sure that different medical records systems interoperate? Can international standards be formulated and adopted? What are the technical, financial, and organizational impediments that need to be overcome?

Information Technology and Changes in the Consumer Experience: Eric Clemons

Transformational Impacts

Information technology is creating four major changes in consumers' experience, whether shopping for goods or for services, and whether shopping online or in a traditional environment. These four trends are

- ***Consumer informedness***: Consumers *know* the full range of offerings, who supplies them, and at what price. They know their product attributes with near certainty.

- ***Enhanced choice***: When consumers can find whatever they want and can decide whether or not they are willing to pay for it without manufacturers' needing to invest in expensive advertising campaigns, then many of the barriers to new product launch are eliminated. Consumers now enjoy a wider range of options from which to make their selection. A supplier can easily find consumers anywhere in the world, and they can match items in limited supply to the small group of consumers who want them, reducing other barriers to entry.

- ***Consumer empowerment***: Consumers can order online, can check the status of their orders online, and can resolve many service problems online, all without assistance from or delay caused by corporate service representatives.

- ***Consumer frustration***: When so much works well, consumers are frustrated by service breakdowns. Paradoxically, the moves toward informedness, choice, and empowerment all increase the potential for frustration. When consumers encounter problems that they cannot resolve themselves using online support systems, the problems often are so complex that service personnel are overwhelmed as well.

Thus, ***consumer informedness*** means that consumers just ***know*** what is available to them in the marketplace, with accurate and precise understanding of price and of the exact set of attributes that each good or service offers them changing consumers' behavior. The natural result of this is the following:

- The ***competition discount*** has never been higher. If a product or service offering can be viewed as a commodity, with more or less equivalent offerings from other suppliers, then its price plummets.

- The ***compromise discount*** likewise has never been higher. If a product or service is not exactly what a consumer wants, the consumer knows this and is willing to pay less for it.

- In contrast, the ***uncertainty discount*** has been virtually eliminated. When considering a new or an unfamiliar product or service offering, if a customer knows that there is a *range* of attributes the offering might actually possess, the customer rationally *discounts* his willingness to pay so that it reflects the *average* of the range. With nearly perfect information, the consumer can boldly go where he has not gone before, and buy unfamiliar offerings confident in the certainty that they will indeed be perfect for himself. Note that this is not ***trading up***, or the pursuit of generic luxury, but ***trading out*** and the pursuit of individual perfection.

Next, we see greatly increased ***consumer choice***, both online and off. When the uncertainty discount punished the introduction of new product offerings, and when compromise and competition discounts were lower, companies focused on huge mass-market "fat spots." Budweiser, Coke, Pepsi, and Holiday Inn were kings. Today, when consumers can find out anything they want about any product of interest, entire industries have been transformed, and consumers have more choice than at any time since the start of the industrial revolution. From beers and soft drinks to consumer electronics, and from financial services to travel, manufacturers have moved from mass-market fat spots to highly focused high margin "sweet spots."

The third trend is self-service and ***consumer empowerment***. One no longer needs a travel agent to recommend a property or book a hotel. One no longer needs a sales person to explain or recommend a camera, and one no longer even needs a service representative to deal with problems with purchases.

The final trend is ***consumer frustration***. The nature and complexity of customer service requests have changed. Customers can themselves handle easy and straightforward requests, such as balance inquiries, payments, seat assignments, and fund transfers. But when the customer cannot handle the request, it is often complex enough that most service representatives cannot handle it well either. Likewise, the range of offerings has increased and the average service representative's familiarity with them has decreased because of the move from few a fat spots to a large number of individual sweet spots.

Where Is the Transformation?

Electronic commerce has fundamentally altered traditional ways of shopping and has redefined the relationship between the merchant and the customer. Looking at Table 1, the shopping process is different by at least half the steps for the consumer and the vendor. Comparison shopping electronically is far easier than in person, and exposes consumers to possible lower prices especially for commodity items. A number of new, online merchants have entered the marketplace, many with sales of over $100 million a year. Online bookstores, especially Amazon, forced the largely "bricks" firm Borders into bankruptcy. Electronic publishing is also changing the relationship between authors and publishers as well as the process of producing and publishing a book.

Policy Questions

Retailing is a major sector of the economies of developed countries. The U.S. economy is particularly dependent on consumer spending. The significant changes engendered in the retail experience by IT raise policy questions for the economy and for regulators.

- How has IT changed the consumer experience? What are the implications of these changes for the retail industry and the economy? Should firms adopt new strategies and policies to adapt to these changing circumstances?

- To what extent does consumer empowerment threaten the traditional model of retailing? For what types of markets? What are the long-term prospects for traditional physical stores? How can bricks and mortar retailers prevent shoppers from scanning products and ordering them from Amazon while in the store?

- What are the likely impacts of increased consumer frustration given the visibility provided by IT? Will consumers force changes in corporate and national policies in future cases similar to forcing Bank of America to roll back a proposed debit card fee?

Transforming the Media, Entertainment, and Telecommunications Industries: Omar El Sawy

Transformational Impacts

The spread and advances of broadband digital networks, wireless communications, digital media, and consumer electronics have resulted in transformational change across media, entertainment, music, online gaming, consumer electronics, software, computing, and telecommunications. *We identify seven key phenomena associated with this transformational change.*

First, the advancement and convergence of digital platforms has led to cross-boundary disruptions (XBDs) that are unprecedented (Burgelman and Grove 2007). The evolving morph of media, entertainment, telecommunications, gaming, and consumer electronics has been termed the *networked digital industry* (NDI) to capture the convergence (and collisions) of these various industry business models.

Second, there has been a transformation on both the supply and demand sides. Health care, retail, and financial services are but a few examples where the transformation is viewed primarily on the demand side. However, the networked digital industry is undergoing major changes on the supply side as it offers new converged products and services through digital platforms.

Third, the transformation of the networked digital industry tracks the transformation of the Web platform. The evolution of the mobile web is driving new kinds of consumer and enterprise applications, and radically new ways of working. Advances in mapping, GPS, search, and telematics applications will further transform the NDI. With the three-dimensional web, the nature of search changes, creating more robust and facile virtual worlds further transforming the nature and scope of NDI. The enablement of mass collaboration has transformed the way new products and services can be designed, and social networks have become factors of production.

The transformation of the NDI has been so far triggered by the "Internet of business processes" that captures B2B and B2C e-commerce and transactions, as well as digital workflow. There is also an "Internet of people and social networks" that captures all the Web 2.0 phenomena and communications. Embedding communicating chips into all types of devices and infrastructure will cause an explosion in the "Internet of things."

Fourth, new disruptive business models for new market spaces are driving the transformation. As new digital platforms become available for delivering new products and services in the NDI, they enable and induce new business models. Examples include prosumer business models in which consumers can also be producers and generators of content. They include business models that take advantage of mass collaboration through digitally enabled social networks. They include "pay-as-you-go" business models where sensors measure usage from objects like truck tires.

Fifth, the consumerization of IT is driving industry growth. The last few years have brought enormous advances in consumer electronics and the use of mobile technologies. Thus it is quite likely that many of the innovations in consumer and home technologies will find their way into enterprise applications.

Sixth, personalization, emergence, and self-service are transforming hallmarks of the services provided by networked digital industries. Similarly with the rapid fire appearance of new services that cannot be conceived by consumers until they use them (YouTube is the classic example), the value of new services in the NDI is increasingly being identified through "emergence" and intelligent deployments.

Finally, information technology has become both fabric and fusion. The conception of how we relate to IT has evolved in the last 30 years from a view of *connection* to one of *immersion* to one of *fusion* (El Sawy 2003). The relationship between IT and business has fused such that IT is indistinguishable in our perception, and forms the integral *fabric* of an enterprise. In this view, IT is intimately woven into the fabric of the enterprise such that IT and work cannot be separated, and into personal life such that it is *fused* with life experiences. IT becomes *fabric* and *fusion*.

Where Is the Transformation?

The process of acquiring and listening to recorded music has changed by more than half the steps, altering the user experience by more than two hours in many cases. A few years ago, Apple was a second tier computer company; now it is a media powerhouse through iTunes, iPods, iPhones, and iPads serving vastly more customers, at least 50 percent more than before these innovations. Video content producers and distributors are in the middle of a transformation and seem to lack a clear strategy. New firms like Hulu have been created and have entered the market for streaming video. The consumer has a variety of content providers, and increasingly can choose where, when, and on what device to view videos. IT

has dramatically changed the process of obtaining and enjoying content, for much more than two hours a day for many consumers.

Policy Questions

Media provide entertainment, but they also play an important role in educating the public in democratic societies. Shifts among media outlets and content have implications beyond technology; they raise issues of where citizens will obtain information needed to participate in government and on the potential for bias in that information.

- How does technology interact with organizational structure to create services like Hulu, where owners are both competing with themselves and with other co-owners? Does corporate policy play a role in encouraging (or discouraging) such entitities?

- What is the future of network television as the media industry changes? What role does it play in the economy and society? Should government policies be enacted to encourage media industries to move in certain directions?

- How will consumerism and personalization change the operations of the networked digital industry? How will consumers purchase and enjoy digital media? What devices will they use? How does the mobile experience differ from traditional habits?

- Where are voters finding political news and what are the biases in what they consume? Should new government policies be considered to ensure that all voices have a chance of being heard?

Summary and Conclusions: Ritu Agarwal and Hank Lucas

Why should researchers in information systems be interested in writing about the impacts of transformational IT? The simple answer to this important question is because it matters and we could play a major role in the greater society if we choose to address such key questions. Organizations are confronting disruptive technology every day, and may well be forced into bankruptcy if they are unable to respond to innovators using new technology and processes, as recently witnessed in the case of Borders and Blockbuster. Nations and firms across the globe are making important policy decisions about technology; transformational research could help develop technology policies that would guide these important decisions, and contribute to the national good. IS researchers could make a significant contribution to this effort, especially if we had a forum in which to communicate our findings.

Creating an Outlet for Research on Transformational IT

These stories of IT-enabled transformations in four areas paint a picture of striking changes that are dramatically impacting organizations, industries, society, and the economy. We suggest that our field needs a new online publication, *IT Policy Letters,* to which authors contribute well-written and researched essays that document the current impact of IT and engage in informed speculation about what this impact means for the future. Although such essays would draw on the author's research and that of others to provide more evidence for their assertions than a single study could support, they would be more compelling if they were not simply literature reviews. The papers would explicitly discuss the implications of the scholarly findings for managers and government decision makers. The data that authors draw on will range from empirical studies to analytic models to carefully documented news stories. Papers could be reviewed by one editor and one policy-knowledgeable referee, with a goal of acceptance or rejection within a month, and no more than one revision. The objective would be to inform managers, decision makers, and policy makers about IT-enabled transformations. The IS field is in a unique position to offer expertise on this topic based on our stock of research and our knowledge of technology.

To illustrate further, we believe that a 2009 article in *Health Affairs* could provide the foundation for a possible policy essay on the implications of transformational IT. This report by Carleen Hawn describes the use of social media in medicine. While it is too descriptive and informal to fit an academic journal, it nonetheless offers a number of interesting ideas. The purpose of using social media in health care is to change the locus of control from the doctor to the patient, that is, to empower the patient with information. The end result should be a more educated and a more meaningful engagement with the physician: a new type of patient–provider relationship that has the potential to be transformative.

One possibility for researchers who wanted to slant their work in this direction would be the study of the use of social media to help with the self-management of chronic diseases. An IS researcher offering recommendations for encouraging the use of social media for chronic disease management could draw

on the results of past studies. For example, it is estimated that 366 million people worldwide have diabetes, that the disease kills one person every seven seconds, and that treatment runs up an annual health-care cost of $465 billion (*Businessweek*, October 3-9, 2011). A researcher, working with a foundation such as the American Diabetes Association, could enlist a group of patients and randomly assigned volunteers to use social media in managing their disease and to a control group that made no changes in management. The researcher could measure outcomes after six months or a year, looking at both attitudes and medical data such as blood sugar levels, A1C values, weight, blood pressure, and other indicators. The focus in an essay describing the results of this study would be less on theory and statistical testing and more on practical outcomes and policy implications.

This essayist might also reference a *Scientific American* article that reports on a portal resembling Facebook that teenagers with Crohn's disease use to collaborate on medical research. The site turns doctors and patients into researchers; with each therapy change, the doctor and patient conduct a mini clinical trial. The patient records symptoms through daily reports, and the doctor uses the information to make real-time treatment decisions. An early test found that the rate of remission for patients using the network rose from 55 percent to 78 percent with no new medications.[5] The IS researcher preparing a policy essay for health IT decision makers could combine these two sources with other research on social networks to explicate the advantages and disadvantages of employing social media in disease management, and suggest implementation approaches and policy implications.

Exactly how *IT Policy Letters* could be implemented is an open question that needs to be debated and discussed further. One avenue would, of course, be a separate, standalone online journal. Alternatively, implementation could be in the form of a new section in an existing journal like *Communications of the AIS*, *MIS Quarterly*, or *MISQ Executive.* The challenge with the latter approach is the likelihood that only academics read our journals (Straub and Ang 2008). If policy makers and practitioners do not read academic journals, would they be drawn to a special section that is a small part of the journal's content? Would they go to a journal web site to read white papers? Our goal in creating this new avenue would be to reach an audience that is not primarily IS academics with impactful articles of high quality that are published with minimal delay. Another possibility would be to spin off a new journal from an existing one like *MIS Quarterly*. We are open to suggestions on how to accomplish this objective.

Via this new venue, IS research could have a direct connection to policy makers and top managers through a dedicated channel. We need to think and reason beyond the narrow boundaries of our publishable research models, examine questions that are important to more than a small group of scholars, and disseminate findings while they are still relevant. *IT Policy Letters* offers one solution; hopefully there will be others. The IS field has knowledge of great value to policy makers around the world; the challenge is to make that knowledge accessible to everyone affected by transformational technologies.

[5]"*Facebook*-Like Portal Helps Teens with Crohn's Collaborate on Medical Research," *Scientific American,* November, 2011.

Acknowledgments

The authors thank former Editor-in-Chief, Detmar Straub, and the anonymous reviewers for their helpful and constructive comments and suggestions for improving this paper.

References

Bates, D. W., Leape, L. L., Cullen, D. J., Laird, N., Petersen, L. A., Teich, J. M., Burdick, E., Hickey, M., Kleefeield S., Shea, B., Vander Vliet, M., and Seger, D. L. 1998. "Effect of Computerized Physician Order Entry and a Team Intervention on Prevention of Serious Medication Errors," *Journal of the American Medical Association* (280:15), pp. 1311-1316.

Burgelman, R. A., and Grove, A. 2007. "Cross-Boundary Disruptors: Powerful Inter-Industry Entrepreneurial Change Agents," *Strategic Entrepreneurship Journal* (1:3-4), pp. 315-327.

Chandler, A., and Cortada, J. (Eds.) 2000. *A Nation Transformed by Information*, New York: Oxford University Press.

CFTC and SEC. 2010. "Findings Regrading the Market Events of May 6, 2010," Report of the Staffs of the CFTC and SEC to the Joint Advisory Committee on Emerging Regulatory Issues, Washington, DC (http://www.sec.gov/news/studies/2010/marketevents-report.pdf).

Chen, C., Garrido, T., Chock, D, Okawa, G., and Liang, L. 2009. "The Kaiser Permanente Electronic Health Record: Transforming and Streamlining Modalities of Care" *Health Affairs*, (28:2), pp. 323-333.

Dahlin, K., and Behrens, D. M. 2005. "When Is an Invention Really Radical? Defining and Measuring Technological Radicalness," *Research Policy*,(34:5), pp. 717-737.

Dehning, B., Richardson, V., and Zmud, R. 2003. "The Value Relevance of Announcements of Transformational Information Technology Investments," *MIS Quarterly* (27:4), pp. 637-656.

El Sway, O., A. 2003. "The 3 Faces of Information Systems Identity: Connection, Immersion, and Fusion," *Communications of the AIS* (12), pp. 588-598.

Hamburg, M. A., and Collins, F. S. 2010. "The Path to Personalized Medicine," *New England Journal of Medicine* (363:4), pp. 301-304.

Hawn, C. 2009. "Take Two Aspirins and Tweet Me in the Morning: How Twitter, Facebook, and Other Social Media Are Reshaping Health Care," *Health Affairs* (28:2), pp. 361-368.

Straub, D., and Ang, S. 2008. "Editor's Comment: Readability and the Relevance Versus Rigor Debate," *MIS Quarterly* (32:4), pp. iii-xiii.

Straub, D., and Wetherbe, J. 1989. "Information Technologies for the 1990s: An Organizational Impact Perspective," *Communications of the ACM* (32:11), pp. 1328-1339.

Sunstein, C. 2004. "Democracy and Filtering," *Communications of the ACM* (47:12), pp. 57-59.

About the Authors

Henry C. Lucas, Jr. is the Robert H. Smith Professor of Information at the Robert H. Smith School of Business, University of Maryland. He received a B.S. from Yale University and an M.S. and Ph.D. from the Sloan School of Management, Massachusetts Institute of Technology. Hank's research interests include IT-enabled transformations, disruptive technologies, the impact of information technology on organizations, IT in organization design, and the value of information technology. He is the author of a dozen books and more than 70 articles in professional periodicals on the impact of technology, information technology in organization design, the return on investments in technology, implementation of information technology, decision-making for technology, and information technology and corporate strategy. He was the vice president of publications for the Association for Information Systems (AIS) from 1995–1998 and editor-in-chief of the AIS electronic journals, *Communications of AIS* and *Journal of AIS*, from 1998–2002.

Ritu Agarwal is a professor and the Robert H. Smith Dean's Chair of Information Systems at the Robert H. Smith School of Business, University of Maryland. She is also the founder and director of the Center for Health Information and Decision Systems (CHIDS) at the Smith School. She has published over 90 papers in journals such as *Information Systems Research*, *MIS Quarterly*, *Management Science*, *Communications of the ACM*, *Journal of Management Information Systems*, *Decision Sciences, IEEE Transactions,* and *Decision Support Systems*, and has made presentations at a variety of national and international conferences. Her current research is focused on the use of IT in healthcare settings, digital information privacy, and evidence-based decision making in health.

Eric K. Clemons is a professor of Operations and Information Management at the Wharton School of the University of Pennsylvania. His education includes an S.B. in Physics from MIT, and an M.S. and Ph.D. in Operations Research from Cornell University. His research for the past 30 years has involved the systematic study of the transformational effects of information on the strategy and practice of business. More recently, he has begun studying blogging and social media, cloud computing and cloud computing standards, and the challenges to applying current antitrust law to online business models. He has published over 100 scholarly articles and regularly publishes online in Huffington Post, Business Insider, and Tech Crunch.

Eric is the founder and project director for the Wharton School's Sponsored Research Project on Information: Strategy and Economics within the Program for Global Strategy and Knowledge Intensive Organizations. He participated in the World Economic Forum in Davos, Switzerland, in February 2009, and in the Beijing Forum in 2011. He is currently studying the processes needed to create innovative consumer products in China and to create consumer trust and brand loyalty, and has a monthly column on this work for China's *Long March of Quality Review*. He is also active in regulatory and technology policy work in Japan, Korea, and the EU.

Omar A. El Sawy is a professor of Information Systems in the Information and Operations Management Department at the Marshall School of Business, University of Southern California, where he has taught since 1983. He specializes in digital business strategy in turbulent environments, and business models for digital platforms. Omar is the author of over 100 papers, serves on several editorial boards, and is a six-time winner of SIM's Annual Paper Award. He is a senior editor of *MISQ Executive* and is a coeditor of the 2013 *MIS Quarterly* Special Issue on Digital Business Strategy. He served as Director of Research for Marshall's Institute for Communications Technology Management from 2001–2007. He holds a Ph.D. from Stanford University, an MBA from the American University in Cairo, and a BSEE from Cairo University. In 2008, he was inducted as a Fellow of the AIS. He is the coauthor of the 2012 book *Business Modeling in the Dynamic Digital Space*.

Bruce W. Weber is dean of the Lerner College of Business and Economics at University of Delaware. From 2002 to 2011, he was professor of information management and served as area chair for Management Science and Operations at London Business School. Previously, he was on the faculty at the Stern School of Business at New York University and the Zicklin School of Business at Baruch College. He codeveloped the trading simulation used in NASDAQ's "HeadTrader" and later in "TraderEx," an educational market platform used in leading business schools. Bruce's research on IT strategy, financial sector computerization, and compliance systems appears in over 50 publications in leading academic journals and edited books. He analyzes the economic advantages of digital markets, and highlights the new challenges facing traders, managers, and regulators in computerized financial exchanges. His work has been cited in *The Wall Street Journal*, *BusinessWeek*, *The New York Times*, and *The Financial Times*. His recent books are *The Equity Trader Course* (with R. Schwartz and R. Francioni), and *Mastering Equity Trading through Simulation* (with R. Schwartz and G. Sipress). He holds a Ph.D. in Decision Sciences (1991) from the Wharton School of the University of Pennsylvania and a bachelor's degree in Applied Mathematics from Harvard University (1984).