UNIVERSITY OF MARYLAND
ROBERT H. SMITH SCHOOL OF BUSINESS

THE TRANSFORMATION AGE
Surviving a Technology Revolution with Robert X. Cringely

Educator's Guide

The Transformation Age, a documentary co-produced by the University of Maryland's Robert H. Smith School of Business and Maryland Public Television, highlights the power information technology has to enable transformations in firms, markets and industries. It is about the pervasive impact of a technology revolution that has brought us virtually unlimited computing capacity and connectivity.

As educators look to prepare students for a fast-changing, global and networked economy they are challenged to provide students with frameworks to help them identify and cope with these disruptive technologies.

This guide, used in conjunction with the Smith School's Educators' Web site at www.transformation.rhsmith.umd, provides educators with ideas on how to bring *The Transformation Age* to the classroom. It can be used by both university and high school educators to help develop and integrate material on information technology transformations into their teaching. Seven lessons covering major themes include suggestions for student exploration as well as links to video segments from the documentary that can be downloaded from the Web site for classroom viewing. *Inside the Future: Surviving the Technology Revolution,* a companion book by Hank Lucas, chair of the decision, operations and information technologies department at the University of Maryland's Robert H. Smith School of Business, is an educational supplement and provides further material for discussion.

Lesson 1: Transforming the Design of Organizations

Information technology (IT) provides new ways to design and structure organizations. With tools like e-mail, virtual groups, teleconferencing, and transactions systems that help coordinate organizational subunits, it is possible to create organizations where time and place no longer matter. For better or worse, IT has facilitated the outsourcing and offshoring of work. For many entrepreneurs and firms a physical location is of secondary concern.

Segment 1: Office of the Past

Host Bob Cringley visits an office of the early 1900s to show how dramatically technology has changed the way we work. Many of the tasks that subordinates performed for the knowledge worker are automated; we no longer have secretaries to type memos or to take phone messages. Organizations have adopted technology to dramatically increase office efficiencies and in doing so have changed the nature of work.

Segment 2: Anina

Anina, a fashion model and entrepreneur without a home base or an office, started by using a cell phone that she programmed herself to manage her business. Anina runs a virtual company, 360 Fashion, which provides information and insight on fashion using her cell phone camera and a laptop to manage her Web site. The lesson here? IT is all about mobility; about being untethered from a physical location. The technology makes it possible for a single person to create a business that can be accessed by hundreds of millions of people over the Internet. As WiMax and 3G technologies are implemented, there will be an explosion of content and communications that will impact businesses such as Anina's.

Segment 3: Point B

Point B, a consulting firm with no offices has turned conventional organization design upside down. Instead of sending consultants to clients where ever they are located, Point B takes on clients where its employees live in seven different markets. It has no headquarters, no building of its own, and its employees work at client sites, coffee shops and in their cars. Point B rents hotel offices so that it can have meeting rooms when needed. But as we see in the segment, Point B consultants can work almost any place they can connect to the Internet. Will our conventional concept of an office disappear? Will work become more local to avoid the lost time and frustration of air travel? Virtual firms, teams and companies without offices remove some of the social interaction that most of us find at work – which raises the question of how managers will bring this aspect of work to employees.

Segment 4: Halo

Hewlett-Packard's Halo system and other telepresence systems like those marketed by Cisco are great enabling technologies. The quality of the video in these systems makes it look as if someone a thousand miles away is sitting across

the table. E-mail is not a particularly rich media, and face-to-face contact that is almost real is considerably better for communicating. The price of these systems is high, but as with all IT, prices will fall. Imagine being able to meet with different people around the world, almost in person, without having to get on an airplane! In the future systems like this will allow the design of organizations that consist of many far-flung locations connected through lifelike video systems. Technology will also help manage this distributed firm by collecting data and making it available to managers who must coordinate projects and monitor budgets. Every process is becoming digital, virtual and mobile.

Lesson 2: Transforming Knowledge and the Way We Compute

The Web contains a vast treasure of information and recent efforts promise new ways to retrieve information based on meaning, not just finding words and phrases in documents. Combine this with the movement to mobile computing, and a huge amount of knowledge will be available at any time and any place. What are the implications for education? For how we work?

Segment 1: Google Apps

Google is trying to transform the way people compute with its Google Apps. Google's chief executive officer Eric Schmidt believes that 90 percent of computing can be conducted on the Internet vs. running on individual PCs. What are the implications of this model for organizations? For Microsoft? How should Microsoft respond?

The World Wide Web is a huge repository of information and knowledge. It has changed the way we search for information and the nature of the relationship between buyers and sellers. Google illustrates the impact of consumers reducing information asymmetries with sellers. As an example, infomediaries like Edmunds.com have changed the nature of automobile retailing as they provide customers with product and price information.

This model also illustrates transformations in education. Today's student needs to learn how to search for information and to synthesize the results, giving proper attribution to sources. Instead of the age-old lecture approach to teaching, the instructor may become a facilitator helping the student learn how to seek out and utilize information that is on the Web.

Lesson 3: Leveling the Playing Field with IT

In the early days of technology, large companies had the resources and the greatest need to invest in technology. In those days computing was on mainframes and most applications were developed to save labor. Today the technology does much more – it is a pervasive part of an organization and our daily lives. Technology has become faster, better, cheaper, and more accessible. Instead of differentiating the large and well-financed organization from the small firm, information technology (IT) serves to level the playing field. The one-person firm can have access to hundreds of millions of potential customers by setting up a simple Web site.

Segment 1: Storereport.com
IT and the Internet are great levelers – the small firm and the individual entrepreneur can have the same technology capabilities as the giant corporation. An application service provider in Mississippi offers sales and inventory control for gas station convenience stores. The technology itself is not leading edge; grocery stores have employed scanners for decades. However, until the Internet and the application service provider model, the technology was too expensive for a low-margin convenience store. The convenience store owner employs a PC and a few hand-held devices to use the system with minimum training.

It is interesting to note that this model was the same one suggested by time-sharing companies prior to the invention of the PC. Computing should be like a utility – plug it into the wall and use what you need. How viable is this concept? Is there a certain size of firm where you should have your own IT department and staff? At what point does the relatively fixed cost of an IT installation become cheaper than the variable costs of the applications service provider?

eBay offers a further illustration of leveling the playing field. Hundreds of thousands of individuals make a living buying and selling on eBay. The auction site provides a way for an entrepreneur to reach millions of potential customers. One person can start a business with a ready-made online advertising and sales distribution system courtesy of eBay and/or Amazon.

Lesson 4: Revolutionary New Technologies

Radio Frequency Identification (RFID) is an example of a technology that facilitates mobile computing. At a toll booth RFID is what initiates a transaction to automatically debit your travel account. In doing so it dramatically speeds up the process of paying a toll, and it expands capacity virtually rather than physically. Think about taking inventory by riding a bicycle through a warehouse with a portable reader, or as host Bob Cringley does in the documentary, on a Segway. We are also just beginning to understand the potential of virtual worlds. It is possible that sites like Second Life will revolutionize business meetings and commerce. Maybe someday we will offer our classes in a virtual world!

Segment 1: RFID
RFID is a technology that is early in its lifespan. Its potential is great as new ways to use it are discovered. An early application was toll collection – E-ZPass-type systems sped up toll collections and added capacity to bridges, tunnels and roads electronically rather than through physical expansion.

RFID is being promoted for all types of applications from inventory control to custom messaging. RFID is a focal point for discussion of innovation, the role of standards, interoperability, and the problems of adopting a new technology.

Segment 2: Second Life
Second Life offers an example of an application that began much like a game, but has evolved into another platform to reach consumers and to conduct business. Second Life opens the discussion of virtual worlds and virtual organizations. Now that there is a virtual world, will you go to the virtual mall on your PC to meet friends? Will you buy goods at the virtual mall, which is not much different than online commerce?

Lesson 5: What Happens When You Miss a Transformation?

A quotation from Carly Fiorina, former CEO of Hewlett-Packard, in Chapter 14 of the book *Inside the Future: Surviving the Technology Revolution* captures the management challenge of seeing a transformation coming. "One of the big challenges, of course, is how do you see what's coming so that you can lead an organization to adapt. A colleague of mine once said a leader's job is to sense danger and opportunity and to lead their organization to adapt to both. And I think it's a wonderful definition. So to see things, you have to be open to a whole bunch of different points of view. Which is to say, in another way, one of the things businesses do sometimes is start listening to themselves a lot. They get internally focused," said Fiorina.

Segment 1: Kodak
Kodak is an excellent and tragic example of a firm that missed the technology revolution. It will be surprising to many that Kodak invented the digital camera and that it holds many patents pertaining to digital photography. The company was an "analog" one, with one hundred years' history of success with film. Kodak made film in a chemical process that is far from being digital. Senior management could not marshal forces for change as middle managers resisted a new, unproven technology. Kodak seriously underestimated how quickly customers would adopt digital cameras, and has suffered greatly for it. Peak employment at Kodak is down by 100,000 employees.

Segment 2: **Craigslist**
The newspaper industry is in trouble. It makes good margins, but investors have bid down newspaper stocks over concerns about the industry's future. Where have the readers gone? To the Internet and Web sites that can give constantly updated news. Young consumers appear not to be reading newspapers anymore.

Where has the classified advertising gone? Craigslist says that many items it advertises would not appear in a newspaper because of their low value. But some local papers provide free advertisements. Many ads that would have appeared in newspapers now are found on Craigslist and Monster.com.

Where has business advertising gone? It has gone to sponsored search. Why is sponsored search so much better for the advertiser than the broad approach of an ad in a newspaper?

E Ink has just demonstrated a color version of its electronic reader that should be in devices within two years. E Ink's investors, not surprisingly, are newspapers looking for a new medium that will keep them alive. How can E Ink save the industry? Imagine a reading device like Amazon's Kindle that would contain the contents of a newspaper, and that could be updated constantly with breaking news. How would this change the appeal of newspapers? What would it do to their cost structure? Will E Ink readers change the way we access and read information? Will all information be available to the mobile reader?

Lesson 6: Transformations in Process

To some extent all information technology (IT)-enabled transformations are in process because we find new and innovative approaches to applying technology every day, and these innovations regularly threaten existing business models. We are in the middle, or maybe even the beginning, of the transformations of the financial industry. The technology has dramatically impacted brokerage firms and markets, and there is more change to come. The potential for transformation in this industry was clear. Will it be as obvious in other industries? Will they be prepared for massive changes in their business models?

Segment 1: Lime Brokerage and LimeWire

Information technology (IT) is associated with speed and efficiency. In no place is this better illustrated than within the securities industry. Retail brokerage has been transformed through online brokers, which forced full-service brokers to unbundle trade execution from other services like research.

IT has also transformed the nature of the markets themselves. Lime Brokerage illustrates how traders use computers to execute arcane strategies that require extremely fast trade execution. Such fast execution is only possible in electronic markets. Physical markets simply take to long to trade. Lime Brokerage's chief executive officer contends that the large number of people doing algorithmic trading help to make the markets more efficient. Is this claim correct?

The huge changes in the industry from technology led the New York Stock Exchange (NYSE) to merge with an electronic exchange, Archipelago, and to go public. After years of expansion, the exchange is now reducing its physical space. The technology has also been instrumental in the consolidation of exchanges. The NYSE purchased EuroNext as it builds a global presence.

LimeWire opens discussion about peer-to-peer (P2P) file sharing and the issues it raises. How does P2P differ from the client server model, and are there intellectual property concerns? This discussion can go back in history to the file-sharing company Napster to cover how the recorded music industry responded with lawsuits rather than a forward-looking strategy. The story continues to video content, the phenomenon of YouTube, and how video providers are taking a more enlightened approach to distributing content than lawsuits.

Segment 2: Mayo Clinic
Healthcare needs a revolution. Moving to the use of electronic medical records (EMR) is a national priority in the U.S. It represents one of the most difficult implementation challenges the profession has encountered. The Mayo Clinic raises a number of points including the complexity of the medical records systems, and how the EMR system is really a layer that sits on top of other systems in the clinic. There are problems with interfacing the EMR system to legacy systems that include the issue of legacy systems in general and the need to keep information technology (IT) infrastructure up-to-date.

Among the barriers to adoption have been the behavioral changes required of physicians and staff to use the system. Problems with encouraging use in the medical setting include:

- The complexity of the medical records systems, how the EMR is really a layer that sits on top of other systems in the clinic
- The problems of interfacing the EMR to legacy systems
  - The issue of legacy systems in general
  - The need to keep ones IT infrastructure up to date
- Behavioral changes required of physicians and staff to use the system
- The problems of encouraging use in the medical setting
- The advantages of the clinic where doctors are on salary-
- The national pressure for an EMR system, and the problems of rolling one out
- The need for any EMR systems to interoperate so that the data are available anyplace, any time
- The opportunities for evidence-based medicine based on the database of EMRs
- The future possibility of treating people based on evidence and their genetic profile

Electronic medical records are but one part of how technology can transform medicine. Other areas under transformation include administrative systems, and how the process of payments to the physician from third-parties like insurance companies and government agencies could be simplified and accelerated.

Segment 3: MyLifeBits
Jim Gemmell concludes this segment with a great line about the "promise of digital immortality;" future generations will be able to interact with the virtual you. MyLifeBits is a research project, but everything it contains is or could be available today at an affordable price. Imagine being able to record and recall all of the major (and even minor) events in life including people, documents, e-mail messages, books read and more. Search-storing everything is the first step. The harder part is figuring out how to retrieve the memory you are seeking to find. How will we cope with this vast trove of data and information?

Lesson 7: Conclusions

The documentary concludes with some thoughts on transformation. An important message is that individuals and organizations have to be adaptable – as Fiorina points out, "it is not always the strongest of the species that survives, it is the most adaptable." Think about new technologies and their likely impact. Predict how an emerging technology will impact life and career. Formulate a strategy, not just for survival, but to flourish in *The Transformation Age.*

About this guide:

The Transformation Age Educator's Guide is authored by Hank Lucas, chair of decision, operations and information technologies department at the University of Maryland's Robert H. Smith School of Business, and a co-writer for *The Transformation Age,* as well as author of the book *Inside the Future: Surviving the Technology Revolution.*