

An Introduction to Information Systems

Michael S. Lapke, PhD

Do Not Copy - Draft

Chapter 1: Introduction to Information Systems

1.1: What are Information Systems?

“Information Systems” (IS) is a concept that has been defined different ways through different perspectives since its inception. The date of this inception is generally agreed upon to coincide with the origins of computer science in the 1940s and ‘50s. People usually see IS as the junction of technology and data. From the perspective of data, technology takes the form of computers.

This leads to the so-called traditional definition of IS. Silver et al. (1995) provided the view on IS that includes software, hardware, data, people, and procedures. This is the sandwich model of IS that places data in the middle. Surrounding it is the technology on one side and the human aspect on the other. While this is a technically correct way to define an IS, it is actually superficial. It describes what it is and not how it works or how it affects organizations and society.

Before discussing the deeper interpretation of the concept of an information system, it is important to note that the general, superficial perception of information systems discard a critical contextual piece: the inexorable tie between technology and data is actually false. Information systems existed long before computers were invented and put into use. At its very base, an information system is simply a system in place to handle, control, create, query, access, or manipulate information. Considering the fact that organizations and businesses cannot exist in the long term without record keeping or information, it should be obvious that they always had to have a system to manage their data. There is a centuries long rich history of information systems in accounting, inventory management, taxation, and other fields.

With that said, the introduction of technology radically changed the nature of how information systems worked within organizations. Aggregating and summarizing raw data into meaningful

Information Systems

information went from a weeks or months long activity to an instantaneous click of a button. Monitoring the real time flow of data through an organization went from an impossible pipe dream to a reality. Globally connected organizations that work seamlessly changed the very nature of what businesses could do. The information system itself became a tool of competitive advantage that companies could use to move ahead and expand their operations.

Considering this context, a deeper interpretation is possible. Information Systems are much more than just hardware, software, data, people, and processes. From a historical context, it is important to remember that they are just social systems that have been technically implemented. One hundred years ago, databases were implemented with filing cabinets. Email was sent via written letter. Financial records were kept in a vault and could be accessed by very few within the organization.

Of greater importance is the concept of “mutual transformation.” While it is tempting to simply rely on the thought that modern information systems simply replicate long established social systems and record keeping, the reality is far more interesting. What many organizations find is that they, themselves, actually mutate and evolve after introducing an information system. The increases in efficiency affect the need for personnel. A team of 200 auditors manually reviewing records might no longer be needed. At the same time, the lack of an in house tech team might be a much-needed addition. The ability to make dramatic decisions based on real-time data can lead the organization in unexpected directions. New services such as online purchases, or record keeping might be a new service they could offer their customers. Suddenly, they have an unexpected competitive advantage.

The mutually transformative relationship between Information Systems and organizations is the deepest and most important way to look at Information Systems. Most organizations understand that the creation and implementation of information systems side of the equation but fail to understand or

acknowledge the other side of the equation: the realization that the very implementation also changes the organization itself.

One last thing to consider when defining “information systems” is that the concept is often conflated with other fields. One of the most common mistakes is to assume that Information Technology (IT) and IS are one in the same. IT usually refers strictly to the hardware and software being used to implement an IS. Another field that is sometimes used interchangeably with IS is Computer Science (CS). CS typically refers to the field where the infrastructure for building IT is created. They, along with Electrical Engineers, build the motherboards and peripherals in the hardware. CS also builds the software infrastructure, including code compilers and operating systems. The last two overlapping fields are Computer Information Systems (CIS) and Management Information Systems (MIS). It is difficult to make a clear distinction between both CIS and IS and MIS and IS. However, CIS generally focuses more on the hardware and software side of the IS spectrum and MIS focuses more on the people and processes side.

1.2: Information Systems in the Wild

The previous section of the chapter described the dense and often difficult to decipher different interpretations of Information Systems. This nebulous grasp on the theory and concept is reflected in “the real world” as well. One of the most important questions being grappled with is whether or not IS is a true business discipline or if it is just a utility for other business fields.

The confusion stems from the fact that IS is prevalent in every other discipline. From accounting (Accounting Information Systems) to marketing (Customer Resource Management Systems) to management (Decision Support Systems), IS has become truly embedded within every other field. This begs the question as to whether or not IS is an independent field.

This author argues that it is indeed an independent field. Its prevalence across other fields only indicates the critical nature of the study of information systems. Understanding best practices, efficient and effective IS implementation, and how to use IS towards competitive advantage is critical. Without an independent eye towards understanding the field, none of these things would be studied and analyzed.

Besides its application in industry, another aspect of the use of IS is its public perception. At its inception in the 1950s, it was seen as a critical but esoteric field. It was strictly under the purview of engineers with limited application. Though its application in business grew steadily in the 1960s and '70s, this perception did not change much. It wasn't until the advent of Personal Computers in the 1980s that this perception began to evolve.

Personal Computers (PC) changed the landscape of computing in businesses. Computers were originally "dumb terminals" connected to a central computer where people shared computer time. They were not user friendly and had a very steep learning curve. They were often seen as hindrances to work instead of facilitators of work. With PCs, each person had their own computer and could have it tailored it to their specific work function. People began to see the potential and opportunity presented by these machines.

The next revolution in computers occurred in the 1980s and 90s. Since PCs were becoming more and more common, organizations found that their power could be increased exponentially by connecting them to each other. Thus computer networks became prevalent. Though the Internet had been around for decades by this point, it was only in these decades that organizations began to connect their computer networks with the greater Internet.

This, along with the advent of the World Wide Web in the early '90s, led to the "dot-com boom" in the mid to late '90s. The amount of money, growth, and investment in Information Technology was

beyond anything that anybody could have imagined in the preceding years. IT had always been seen as a tool for real business before this. Now, people were investing directly in the field. It had come into its own.

Of course, this didn't last. As Alan Greenspan said in 1996, the over investment in IT and the Internet was symptomatic of "Irrational Exuberance." The phrase was interpreted as a warning that the market might be somewhat overvalued. He was clearly correct as the dot-com bubble popped in 2000 and the ensuing recession has been reverberating to this day. This led to a dampening of public perception of the field as a whole.

IT and IS companies were going out of business. Organizations were shrinking, outsourcing, or eliminating their IS departments. Innovation ground to a halt. A few years after this started, less and less students decided to major in related fields. We're still seeing the effects of this today as the United States is actually experiencing a shortage in IS and IT graduates. We have to import many people from out of the country to take these jobs. With all of this said, what is the current job situation for IS and IT?

1.3: Jobs in Information Systems

There are many opportunities in the IS field for jobs. On the "hard," or technical side, there are developers, network engineers, database administrators, system administrators, and infrastructure implementers. On the soft side, there are systems analysts, project managers, and mid to executive level management.

The prospects for jobs in the field are varied depending on geographical location and what specific subfield you desire. As an example, the northern Virginia area is ripe with opportunity given the presence of the federal government in neighboring Washington DC. You might not have such luck if you were to try to find a job in a small town in the Midwest though.

Information Systems

A better method by which to determine job prospects is to examine the data collected by the Bureau of Labor and Statistics (BLS). The BLS is a unit of the United States Department of Labor. It is the principal fact-finding agency for the U.S. government in the broad field of labor economics and statistics and serves as a principal agency of the U.S. Federal Statistical System. According to the BLS¹, between 2012 and 2022, every IS or IT field will see dramatic increases in employment. Developers (particularly web developers) will see a 20%+ increase. Database Administrators will see a 15% increase. Systems administrators will see a 12% increase.

On the soft side of IS and IT, the employments gains are projected to be even greater. Systems Analysts should see a 26% increase. Project Managers should see a 15% increase. One of the most profound increases will be in the area of Information Security. The BLS projects a 36% increase in employment in this particular field. It is considered one of the fastest growing of all fields, technical or not. In the specific area of hacking and penetration testing, the US government has projected a “critical shortage” of skilled people in the next 10 years. There is tremendous opportunity.

One last thing to consider with regards to working in IS or IT is the pay. It is generally higher than most other fields but there is considerable variation. The variation is dependent on geographical location as well as the specific subarea the person is working on. For example, the average pay, according to the BLS, for an Information Security person is \$95,000. They might actually only see \$60,000 in Des Moines, Iowa or \$130,000 in Alexandria, Virginia. Either way, the average pay for this particular position is well above average pay and would put someone in the top 10% of earners in the United States. In application development, someone could expect a pay range of \$60,000 to \$200,000. On the lower end of the spectrum, graphic design might demand a range of \$30,000 to \$120,000. Corporate Training has a similar range of pay.

¹ Retrieved from the BLS website at http://www.bls.gov/emp/ep_table_102.htm

1.4: Impact on Daily Life

As almost anyone reading this already knows, computers, IT, and IS impact their lives on a daily basis. Students interact with backend databases when they register for classes, take online exams, or check their grades. Someone might initiate a complex set of operations when they pay for an App on their Smartphone. Bursts of information might be sent to Apple's iTunes servers which then initiate another server to start uploading the data that makes up the App. At the same time, a transaction is sent to the user's Credit Card issuer to request a charge. The issuer then sends a confirmation back that the charge was successful. All of this happens as the user stares at their screen and waits for the App to finish downloading.

These complex interactions are repeated for a myriad of different activities that consumers and organizations interact with on a daily basis. From reserving airline tickets, to paying bills through a bank, to buying a set of corn-on-the-cob holders at Wal-Mart, most people are affected by computers and IS on a regular basis. Like the App download described in the previous paragraph, the act of simply buying products at a typical large store is amazingly complex behind the scenes. The Point of Sale (POS) device communicates with an Inventory Management System, an Accounting Information System, and a Credit Card System. All have different objectives but all must work together for the organization.

Of course, the sociological changes are hard to miss. With the explosion of Social Networks, people have adopted odd and counter productive behaviors. One might have hundreds of friends on Facebook but be physically isolated. Another might be obsessed with "selfies" or Vines or Instagram. It is not uncommon to see a group of friends out together where every person has their phone out. They stare at the screen and unconsciously tap at the glowing window in front of them. The idea of being present is losing its importance. On the positive side, these social networks have provided the opportunity for those with geographically dispersed family and friends to stay in touch.

The digital revolution has had a major impact on intangible industries such as music, print, and film. These industries have scrambled to keep up the rapidly changing technology. Electronic distribution methods for music, such as iTunes and Pandora have sprung up and old physical distribution methods, such as CDs have withered. Every major newspaper has a website presence and are slowly scaling back their physical print. Online film distribution has rocked the movie world with Netflix and Amazon leading the way.

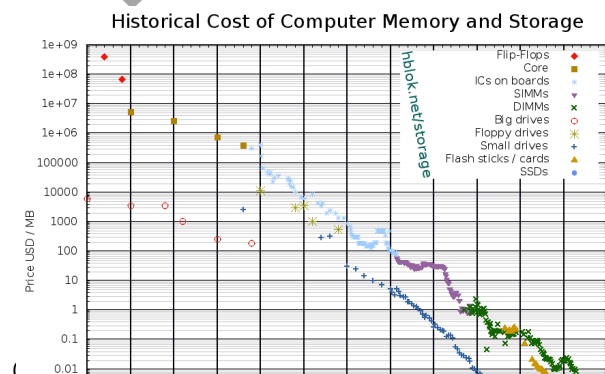
Of course, one cannot mention these without considering the impact of copyright violation. The downloading and streaming of copyrighted material is often known as “pirating,” named after the infamous website. The open Internet makes music, film, software, and ebook pirating very easy. Websites such as piratebay.org and kat.ph facilitate the seeding and downloading of all of these media types. These websites get around the legal aspects by not storing the actual files. They only store pointers to individuals that have the files. The respective industries have claimed billions of dollars in loss but most agree this is an overstatement. Other studies have shown that those that pirate copyrighted material typically spend more on legitimate digital purchases than those that do not pirate.

1.5: Future Directions for IS

The future of IS can be determined based on some obvious trends. Gordon Moore predicted one clear trend in 1965. This prediction, known as Moore’s Law, indicated that the number of transistors in integrated circuits would double every 18 months. This, in effect would double the speed and capacity of computers over that same period. Moore’s prediction has proved accurate over the ensuing 50 years

and we have seen speed and capacity increase at a logarithmic scale.

While not as regular as the increase in speed, the price of Information Technology (IT),



computers and peripheral equipment, adjusted for quality and inflation, declined 16% per year on average over the five decades from 1959 to 2009.² This commoditization of hardware has contributed to the explosion of computers in everyday life. This rapid decrease can be seen in the figure to the left which illustrates the cost of memory in computers.

Another change that will affect the future direction of IS and IT is the gradual demographic shift as the Baby Boomer generation passes the torch to Gen X and Y. The integration of computers into government, the private sector, and as a part of life will likely accelerate. Some mistakes, such as the Stop Online Piracy Act (SOPA), data caps, and lagging digital infrastructure might fade into the past. The generations that grew up in a digital world will not likely put up with such shenanigans.

One troubling trend that has emerged in the last decade is the continued attack on individual privacy. This attack on liberty has stemmed from two motivations: profit and security. Private companies are embracing data analytics as a way to maximize their profit. Knowing what consumers plan to buy is of great value to marketers and advertisers. The best way to know this is to collect all of the data available about consumer behavior. Two companies that notoriously and aggressively collect this data are Facebook and Google. In their business model, it is you, the consumer who is their product. You are what they are selling. The data they collect about your behavior is quite valuable. While this is not necessarily harmful to consumers, many see it as a violation of privacy.

Of potentially much greater harm is the privacy violations that come about as a result of the federal government's need to protect us against terrorists. Terrorists are effective at blending into a society like ours so agencies such as the National Security Agency (NSA) have had to bend the rules to collect intelligence on them. The easiest way for the NSA to collect data on unknown suspects is to collect data

² "Private fixed investment, chained price index: Nonresidential: Equipment: Information processing equipment: Computers and peripheral equipment". Federal Reserve Bank of St. Louis. 2014. Retrieved 2014-05-12.

on everybody (emails, phone calls, etc) and weed out suspicious behavior through algorithms. Almost all of this is done automatically through software that does the analysis and data mining.

Some claim that this intrusion by the federal government is a violation of the 4th Amendment of the United States Constitution. In short, the NSA is not obtaining warrants to search the data of US citizens. The NSA and US government counter with the fact that they are literally collecting the data but rather the metadata of individuals. So they might not record an actual phone call of an individual but they would record what number was called and when the call was made. If there is a pattern of calls between that person and a person with a known terrorist background, then they might become a target.

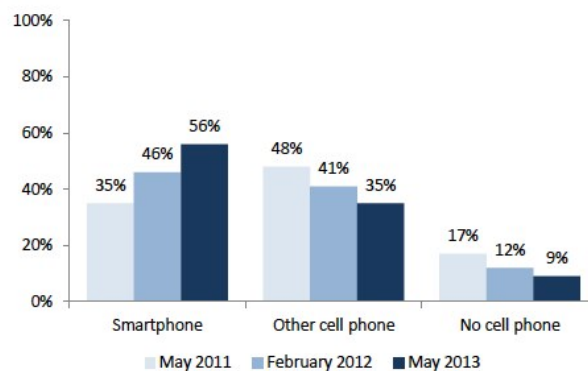
With all of this said, it is quite likely that continued reductions in privacy is likely. People have not stopped using Google or Facebook. The populace is not marching on Washington to demand the reversal of the Patriot Act and warrantless wiretapping by the NSA. Since this data collection is effective for the organizations that do it, it will

likely continue.

A final area with a clear trend is the increasing mobility of technology. Most readers of this chapter are well aware of the proliferation of smartphones and tablets. This has had far reaching effects on both consumer behavior and organizational technology strategy. An

organization without a mobile app or a mobile site is likely to wither away in the coming years. The figure to the right shows the increasing ownership of smartphones among U.S. adults. It is clear that

Changes in smartphone ownership, 2011–2013
% of all U.S. adults who own...



Source: Pew Research Center's Internet & American Life Project April 26-May 22, 2011, January 20-February 19, 2012, and April 17-May 19, 2013 tracking surveys. For 2013 data, n=2,252 adults and survey includes 1,127 cell phone interviews. All surveys include Spanish-language interviews.

this trend will continue to affect how consumers use IS and how they access the networks that link all ISs together.

Do Not Copy - Draft