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The Essence of I-Work

As the twenty-first century opened "...The world was producing between 1 and 2 exabytes of unique information per year, which is roughly 250 megabytes for every man, woman, and child on earth. An exabyte is a billion gigabytes, or 10^{18} bytes. Printed documents of all kinds comprise only .003% of the total."[1]

All this information creates noise and threatens organizational paralysis. To remedy this problem, businesses need to structure information and streamline information work (I-work) to facilitate productivity. In the last half century, technology has not only generated a vast storehouse of data, but has also caused a geometric explosion of new information and knowledge. Within many organizations, data are being recorded at unprecedented speed and granularity, often without usable structure or defined goals. By harnessing information, the lifeblood of business today, we enable people to turn data into insight, transform ideas into action, and turn change into opportunity.

DEFINING THE INVISIBLE FACTORY SPACE

In 1959, when Peter Drucker looked at the emerging work world, he saw the revolutionary change from an industrial society to a more office-based society of people who rely on technology to perform their jobs.[2] The technology-based revolution Drucker envisioned promised to open our vision, unburden our backs, and free our minds for more productive work.

The concept of knowledge work and knowledge workers has certainly flourished since the 1950s, but, as Drucker noted in 2002, we have not yet mastered the challenge of fully defining knowledge work.[3] If we are to manage work, we need to have a measure of success. If we are to measure something, it is necessary to define it. The expanding definition of information-centric work has now exceeded Drucker's definition of highly paid scientists and professionals on one side and transaction workers (inputting data) on the other. Over the past 20 years the technology revolution has achieved a great deal of notice, drawing attention away from the more subtle changes in the workplace. The transformation that is perhaps less noticeable, but just as important, is the growing intensity of information use in nearly every type of job category—from call center representatives to truck drivers and, yes, even industrial factory workers.

The changing nature of work has brought a new tension to the workplace. The routine nature of manufacturing has given way to the mental stress of managing ever-increasing streams of complex information. The degree of information intensity follows the increase in work complexity and environmental uncertainty, as shown in Figure 1.1. As computers multiplied across workstations and desktops, the geometric increase in the amount and volume of information has increased the complexity of our work. The more routine transaction work, prevalent in the

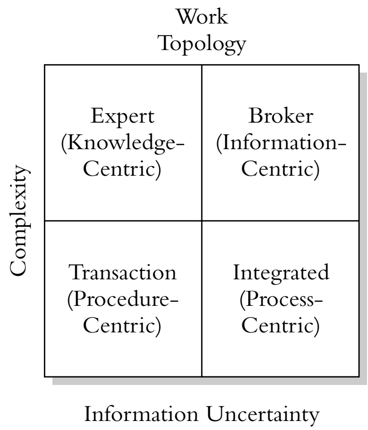

FIGURE 1.1 Work Topology

early days of office computing, has been replaced by the information coordination performed by increasing numbers of managers and supervisors. The increase in work complexity brings with it the more subtle, and often more stressful, impact of information multiplication that has led to the increase in work uncertainty. Decisioning (the process of making, approving and executing decisions), along with information, is rapidly migrating across and downward through increasingly flattened organizations. It is this dual pressure, as opposed to technology, that is rapidly changing the nature of and the requirements for interconnected workplace technologies.

The wide variety of solutions and the growth of technology options over the past five years is a testament to the varied communication requirements and information processing needs of the different types of information workers (I-workers), as indicated in Figure 1.2. Business situations have different information requirements. Consider the different types of computer support required by aircraft designers and data center operators. Aircraft design requires expert I-workers who are highly independent (low uncertainty) and who are capable of highly complex work. Data

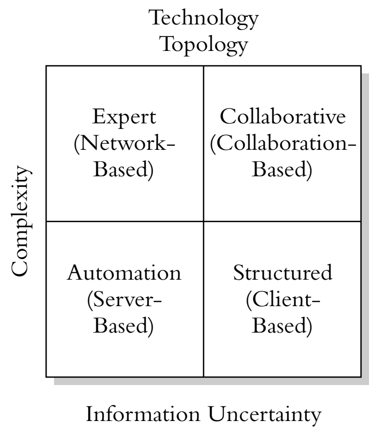

FIGURE 1.2 Technology Topology

centers, with their focused workload, require less complex work. Both have work that is highly independent (low uncertainty) requiring infrequent synchronization and coordination by the players. The big difference is that aircraft design is also highly complex, requiring workers to manage information in volatile and somewhat less structured conditions. The differences in the work modes provide an insight into the changing drivers within the information-centric workplace. While office productivity and basic communication applications may suffice for the data center, or transaction work, the more complex invention/innovation work of designers is best served by network connectivity—the ability to safely store, manage, and share from common locations with minimal interrupt. Other work scenarios will have other challenges. A structured workplace, such as a service center, with an uncertain work demand but low complexity is best serviced by client-server technology. This allows for the input and update of work orders as technicians complete jobs and an end-of-day reconciliation. Finally, coordination work, of executives, managers, or salespeople, is characterized by both high complexity and high interdependence. Though all three classes of technologies may be useful here collaborative technologies are emerging to support these complex synchronous needs.[4]

The growth in information complexity and work interdependence has driven the need for more collaborative and enabling technology solutions. The better the fit between the technology and the type of I-work, the more likely the technology is to improve output.

The evolution of information-centric work has incorporated knowledge work as a subset of the much broader occupational category: *information work*. In the leading edge economies, the great majority of workers constantly use data, information, and knowledge—each to varying degrees—in their jobs. They create, manage, share, receive, and/or manipulate information. To compensate for the change in the nature of work, the U.S. Bureau of Labor Statistics (BLS) redefined and reclassified its major categories of work in 2000. The 2000 Standard Occupational Classification (SOC) System was developed in response to a growing need for a universal occupational classification system. Such a system allows government agencies and private industry to produce comparable data. Federal agencies collecting occupational data use the SOC, providing a means to compare occupational data across agencies.[5] Although this system helps in our understanding of the number and types of workers involved in I-work, we still were not able to measure the tempo, or flow, of this work.

The need to define and measure effectiveness and efficiency in the think factory became apparent in the early stages of its evolution. The continuing I-work evolution is driving a redefinition not only of the measurement of work but of the impact of work enablement. Despite a massive infusion of information technology into think factories over the past 30 years, a corresponding growth in work productivity did not seem to materialize. As MIT economist Robert Solow quipped in 1987, "You can see the computer age everywhere but in the productivity statistics."[6] Solow later wrote that it was not that he doubted that technology could contribute to productivity but rather that we still have no effective way of measuring or verifying its impact on I-work. The simple fact that the average U.S. productivity has risen over the last 50 years at twice the rate of the average hours of work would seem to indicate that the technology-based changes in the workplace have had a significant impact on our ability to cope with information-intensive work. Technology continues to flow into the workplace and businesses continue to struggle with quantifying the impact of the investment.

Productivity is a well-established economic concept, but the equations used to generate productivity numbers are tuned to industrial work. It is generally recognized that traditional productivity calculations seek to measure tangible assets, such as physical capital and labor measured by product output. This thinking still rules the majority of economic calculations. We continue to count physical products (production) and time spent (labor) as the basis of business value. Some forms of I-work still produce or move around physical assets, but often information, or knowledge itself, is the output. In such businesses, we have few means of recording and measuring the outputs, so productivity is ill defined at best.

While information technologies appear to be useful, as Solow pointed out, their productivity and quality impacts are far from clear. Call center workers can answer more customer calls with highly scripted workflow systems, but are their customers satisfied enough to buy more products? Managers certainly can know more about the activities of truck drivers or traveling salespeople with global positioning systems (GPSs), but have these advances improved productivity? Managers clearly can create more documents with their word processors and presentation tools, but what is the bottom-line impact? Even though I-workers employ many different tools in their jobs, these tools remain fragmented and can be disruptive to the workflow. No improvement comes without a cost. New concepts, products or services as well as the tools used to produce them often require an investment in training and workflow redesign.

Information by itself provides little advantage. It has been 20 years since *Megatrends*[7] author John Naisbitt warned, "We are drowning in information but starved for knowledge." As information becomes the foundation of economic wealth, the phenomenon that Naisbitt noted is rapidly becoming a legal and logistical nightmare for many companies. To benefit from information as a value-generating mechanism, businesses must adopt and apply methods that will connect I-workers across all areas of the organization so that they may put this treasure trove of information to work—without adding substantial amounts of labor. Companies with structures that align and organize information to their strategies and I-work processes will succeed in this new environment. Every service provider seems to have a solution to this paradigm, but most do not address the fundamental changes required to truly enhance and mobilize I-work.

Six types of performance measures reflect the correct balance of the impact of technology and procedure improvements on:

- Cycle time
- Cost
- Quality
- New product innovation
- On-time completion
- Customer satisfaction

Studies indicate that effectiveness clearly has a significant positive impact on all six performance measures.

Efficiency, however, has a *significant* positive impact only on the cycle time, cost, and on-time completion measures. [8]

RIGHT ANSWER, WRONG SCENARIO

To promote productivity, information-centric enterprises need to make changes to both procedures and technology in order to maximize performance and financial outcomes. Not only do these changes need to be compatible with the work; they also must resonate with the culture of the enterprise. Earlier we discussed the problems of misaligning technology and work, such as adding structured technology to highly volatile and complex work. The same logic holds true for organizational structures, as outlined in Figure 1.3; introducing highly collaborative technology into an automated (transaction-based) organization could actually reduce productivity (throughput). In 2004 a leading pharmaceutical firm complained that it could not get its product development teams to embrace collaborative technologies such as instant messaging (IM). The root of the

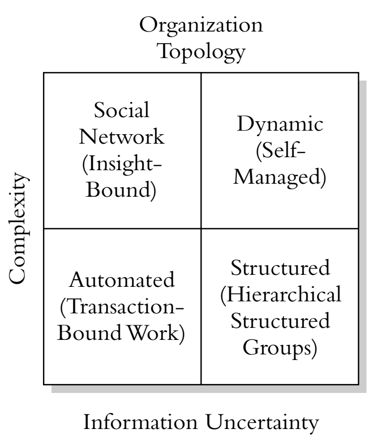

FIGURE 1.3 Organizational Topology

problem was a misalignment between the (expert and broker) work and a hierarchical organization structure bound by tradition and government regulations. To make the technology work in this situation, the organization needed to see the necessity of changing its structure and the technologists needed to meet the demands for tracking and transparency required by the regulatory agency. Other examples of organizational constraints are easier to visualize: In data entry centers, we can envision in our mind's eye the inefficiency of people trying to hold virtual meetings on data input issues that are better handled by a simple request to the supervisor for resolution. Organizations will not realize significant performance improvements if technology is used only to improve the quantity of outputs and inputs, ignoring the effectiveness and quality of the outcomes.

Economists and management scientists have conducted hundreds of studies and written thousands of words attempting to provide some guidance to the business community on what might be influencing productivity in the information-centric economies. Many observers have noted the large gains made in the U.S. economy as opposed to the apparent decline in productivity in Europe and Asia. One common theme in these studies and presentations has been the extent to which the environments have embraced technology and supported workers in using that technology to change how they work. Professor Dale Jorgenson of Harvard University has summarized some of the forward thinking on what enables an information-centric environment. He states: Investment in information technology leads to the growth of productive capacity in technology-using industries. He further explains that:

- Average labor productivity (ALP) growth [in the United States] from 1948 to 2002 increased 2.23 percent per year while hours worked increased only 1.23 percent per year.
- Output growth is the sum of growth in hours and average labor productivity.

Given these facts, Jorgenson concludes:

- ALP depends on capital deepening—that is, appropriately placed information technology investment to underpin labor capability.
- 30 percent of output improvements can be attributed to improved labor quality.
- Labor quality is a correlation of the enablers that allow workers to produce faster, better, cheaper:
  - Technology
  - Training
  - Procedures[9]

The fact that in 1994 the BLS released a new multifactor productivity measure adding (to hours worked) a constant quality index of labor input reinforces Jorgenson's argument on the quality of labor.

Improving I-work productivity requires measuring the degree to which enablers (procedures, technology, and training) support the speedy delivery of quality products and services. These criteria have guided the development of the Productivity Impact Framework (PIF) methodology and the associated Productivity Impact Measures (PIMs) discussed throughout the book that are meant to support the business community in assessing and improving information-centric work. Part II of this book outlines the assessment process and describes in more depth the components of I-work that can be strengthened to improve its productivity. The essential measurement goal is to deepen the quality of I-work through investments in technology, training, and/or procedural improvements. The goal is not to develop a complete business value model but rather establish the statistical signposts for a summary-level business case where improvement is needed.

REAL-WORLD EXAMPLES

Theory is wonderful but real-world examples make concepts actionable. PIF has been applied to a variety of organizations in a variety of industries, each with its own unique challenges and work scenarios. The first two cases introduced here involve the U.S. Air Force Senior Leadership Management Office (AFSLMO) team led at the time by Colonel Steven Kwast and the Korean Air team sponsored by chief information officer Mr. S. M. Lee. Both organizations have been kind enough to share their recent experiences with PIF.

CASE STUDY 1: U.S. AIR FORCE SUCCESSION PLANNING (JULY 2005–JANUARY 2006)

Col Kwast's AFSLMO team was responsible for executive (Colonel) succession planning. The task Kwast had taken on was to streamline an overtaxed and operationally outdated function. The goal was to create a high-performance team able to deliver a quality service while reducing the overtime required in accomplishing the work scenarios.

The team began by taking a top-down view of the work required to meet customer needs. The AFSLMO customers included both promotion candidates and general officers seeking to fill positions around the world. The team identified three key work scenarios: game planning, contender management, and colonel action board (CAB). The Productivity Opportunity Map (POM) process, which is explained in detail later in Chapter 5, revealed potential opportunities for improvement in all three of the identified work scenarios. Three challenges crossed all functional areas:

- Data transparency
- Content sharing
- Information aggregation

Although these discoveries were not astonishing, the statistical exposure of the challenge areas validated the group's gut hunch about what they needed to fix. Group members narrowed down the procedures, activities, and technologies that were indeed challenged and that were a major contributing cause of the productivity gap. By using a focused approach and setting improvement targets, the leadership could clearly see that success would be achieved through reducing the work effort by improving collaboration and reducing rework. The group not only succeeded, achieving a 14 percent reduction in work effort, but exceeded the original target by 9 percent. As we discuss how to build an assessment program, we will review how the Air Force team designed the data collection, analyzed the results, and achieved its goals.

CASE STUDY 2: KOREAN AIR (JUNE 2005–ONGOING)

Measuring the success of enterprise-wide productivity improvements is very challenging. Lee's team at Korean Air needed to identify productivity opportunities to target for the 11,000+ headquarters and region information-centric workforce. First, using the PIF methodology, the team worked through a top-down opportunity mapping exercise. This exercise interviewed subject matter experts in eight major functional areas and established common opportunities across this diverse I-worker audience focusing on two targets:

- Communications
- Wait time for approvals

The team found sufficient potential improvement opportunities in personal (asynchronous) communications across all eight functional areas within the headquarters organization. It also discovered strong indicators of challenges in the approval time throughout the same organization. One unit was chosen as a vertical study to highlight these challenges as part of the baseline assessment. When the baseline assessment was completed, the team was able to narrow the improvement target to four focal areas:

- Reduce the data transfer latency (elapse time) encountered when requesting information (content management).
- Expend less effort to update documents (content sharing).
- Improve person-to-person information delays (collaboration).
- Expend less effort to receive approvals (communications).

The executive steering committee now felt it was able to make a rational business decision about technology upgrades, procedure changes, and plan training to improve enterprise productivity. The gains recommended were a modest 3 percent measured at the functional unit level. However, a gain of 3 percent across an organization of this size is a considerable savings in terms of process cycle efficiency. Beyond the obvious labor cost is the potential improvement in customer satisfaction resulting from faster, higher-quality delivery of services in a very competitive and financially challenged industry.

Throughout our discussion of building and analyzing productivity impact studies, we will make reference to both case studies.

As we saw in the Korean Air case study, improvement estimates on enterprise-wide projects can be difficult to rationalize from the top down. Looking at the potential of such a project from the individual up gives us some perspective. Many enterprises have recently launched productivity projects aimed at gaining back at least 8 to 16 hours a month for each employee. The theory is that people will have time to put quality into the work they do, accomplish more while reducing overtime, and generally become more satisfied with their jobs. Keeping such goals in mind, we try to analyze the impact of changes to individual behaviors on the larger enterprise. In the Korean Air study, we asked questions such as What is the potential result of an organization reducing the total average number of meetings by one per week (returning one hour of work per week per employee)? Based on the average hourly cost of labor, the enterprise has the potential of improving its bottom line by $56,000 in recovered time. If we add employee time in these meetings, the firm might recover an additional $300,000 to $500,000 (taking into account the additional time spent on managing information now received at the desktop). While substantial, the real savings for Korean Air is not in the minutes saved per day per employee but in the overall improvement of process cycle efficiency and through people achieving higher-quality output through better utilization of information and technology. Based on these and other similar analytics, Korean Air leaders chose an improvement project that included changes in communications (messaging and collaboration) and content-sharing (content management) technology and related procedures. Since the improvement cycle for such a large project is long—one year in this case—the results are not yet in. We are looking forward to benchmarking their success in the coming months.

These case studies and other examples discussed in later chapters provide a way to visualize the impact of PIF on an organization at both the enterprise and the functional level.

CONCLUSION

The Solow Paradox—we see computers everywhere but in the productivity statistics—has been displaced by the economics of the Information Age. Just as the assembly line changed the twentieth century's industrial landscape, information technology has indelibly changed, and will continue to change, the economic landscape of the twenty-first century. Business investment strategies must be balanced between technology acquisition and the deepening of labor capital. Deepening the capability and ability of the work force allows managers to, as Fredrick Taylor[10] noted nearly 100 years ago, find the right challenge for each person, provide the guidance and means of production, and pay well for increased output. Deepening the investment in people and procedures to capture the advantage offered by technology is the key to economic success in the coming decade. Restructuring the work environment to facilitate the flow of information opens the door not only to productivity gains but to the information transparency required by recent regulatory rules relating to corporate governance.

ENDNOTES

1. Hal Varian, "How Much Information?" University of California at Berkeley, www.sims.berkeley.edu/research/projects/how-much-info/summary.html.
2. Drucker, Peter, *Landmarks of Tomorrow,* Transaction Publishers, New Edition, 1996.
3. Peter Drucker, "Managing in the Next Society," St. Martin Press, NY, 2002.
4. Vish Krishnan and Indranil Bardhan, "The Impact of Information Technology on Information Work," Information Work Productivity Council (IWPC) Annual Research Report, September 27, 2004.
5. The SOC is designed to cover all occupations in which work is performed for pay or profit, reflecting the current occupational structure in the United States. The 2000 SOC is the result of a cooperative effort of all the U.S. federal agencies that use the occupational classification system to maximize the usefulness of occupational information collected by the U.S. Federal Government.

   All occupations are clustered into one of 23 major groups. Within these major groups are 96 minor groups, 449 broad occupations, and 821 detailed occupations. Occupations with similar skills or work activities are grouped at each of the four levels of hierarchy to facilitate comparisons. For example, "Life, Physical and Social Science Occupations" (19-0000) is divided into four minor groups,

"Life Scientists" (19-1000), "Physical Scientists" (19-2000), "Social Scientists and Related Workers" (19-3000), and "Life, Physical and Social Science Technicians" (19-4000). "Life Scientists" contains broad occupations, such as "Agriculture and Food Scientists" (19-1010) and "Biological Scientists" (19-1020). The broad occupation "Biological Scientists" includes detailed occupations such as "Biochemists and Biophysicists" (19-1021) and "Microbiologists" (19-1022).

6. Robert McGuckin and Kevin Stiroh, "Computers Can Accelerate Productivity Growth," *Issues in Science and Technology* (Summer 2000).
7. Naisbitt, John, Megatrends, Wagner Books, NY, 1984.
8. Krishnan, ibid.
9. Dale Jorgenson, "Accounting for Growth in the Information Age," Harvard University (2005).
10. Frederick W. Taylor, in 1911, published his principle work, The Principles of Scientific Management. This work outlined the application of scientific methods to the management of labor. Scientific management calls for the optimizing of the tasks workers perform and simplifying the jobs enough so that workers can be trained to perform their individual tasks in a sequence of motions that quickly and efficiently complete the work required. Prior to scientific management, work was taught through the apprenticeship programs—where workers learned the 'appropriate' method of completing their tasks.