Process Management for Knowledge Work

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Abstract In this chapter, the topic of using process improvement approaches to improve knowledge work is addressed. The effective performance of knowledge work is critical to contemporary sophisticated economies. It is suggested that traditional, engineering-based approaches to knowledge work are incompatible with the autonomy and work approaches of many knowledge workers. Therefore, a variety of alternative process-oriented approaches to knowledge work are described. Emphasis is placed on differentiating among different types of knowledge work and applying process interventions that are more behaviorally sensitive.

1 Introduction

Knowledge workers are the key to innovation and growth in today's organization.[1] They invent products and services, design marketing programs, and create strategies. In sophisticated economies, they are the horses that pull the plow of economic progress. If our companies are going to be more profitable, if our strategies are going to be successful, if our societies and economies are going to become more advanced – it will be because knowledge workers did their work in a more productive and effective manner.

In the early twenty-first century, it is likely that a quarter to a half of the workers in advanced economies are knowledge workers whose primary tasks involve the manipulation of knowledge and information. Even if they are not a majority of all workers, they have the most influence on their companies and economies. They are paid the most, they add the most economic value, and they are the greatest

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[1]This chapter draws from several published sources, including Chaps. 1–3 of Davenport (2005) and Davenport and Iyer (2009).

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determinant of the worth of their companies. Companies with a high proportion of knowledge workers – let's call them knowledge-intensive – are the fastest-growing and most successful in the US and other leading economies, and have generated most of their growth in the past couple of decades. The market values of many knowledge-intensive companies – which include the market's perception of the value of knowledge and knowledge workers – dwarf their book values, which include only tangible assets (and the ratio of market to book value in US companies has doubled over the past 20 years, suggesting a great acceleration of knowledge asset value). Even in the so-called "industrial" companies, knowledge is increasingly used to differentiate physical goods and to diversify them into product-related services. As James Brian Quinn has pointed out, high proportions of workers in manufacturing firms (roughly 90% in semiconductors, for example) never touch the manufacturing process, but instead provide knowledge-based services such as marketing, distribution, or customer service (Quinn 1992).

It is already apparent that the firms with the highest degree and quality of knowledge work tend to be the fastest-growing and the most profitable ones. Leading IT firms, which are almost exclusively knowledge-based, are among the most profitable organizations in the history of the planet. Pharmaceutical firms not only save peoples' lives with their drug treatments but also tend to have high profit margins. "Growth industries" generally tend to be those with a high proportion of knowledge workers.

Within organizations, knowledge workers tend to be closely aligned with the organization's growth prospects. Knowledge workers in management roles come up with new strategies. Knowledge workers in R&D and engineering create new products. Knowledge workers in marketing package up products and services in ways that appeal to customers. Without knowledge workers, there would be no new products and services, and no growth.

Yet, despite the importance of knowledge workers to the economic success of countries, companies, and other groups, they have not received sufficient attention. We know little about how to improve knowledge workers' performances, which is very unfortunate, because no less an authority than Peter Drucker has said that improving knowledge worker performance is the most important economic issue of the age (Drucker 1968). In this chapter, I will describe how business process management – not in its traditional formulation, but using several modified variants of the idea – can contribute to better performance of knowledge work.

2 Improving Knowledge Work Through Process Management

A time-honored way of improving any form of work is to treat it as a process. To treat something as a process is to impose a formal structure on it – to identify its beginning, end, and intermediate steps, to clarify who the customer is for it, to measure it, to take stock of how well it is currently being performed, and ultimately to improve it. This process-based approach to improving performance is very

familiar (and is described in various forms in the rest of this Handbook) and is an obvious candidate for improving knowledge work activities.

But knowledge work and knowledge workers have not often been subject to this sort of analysis. In some cases, they have actively avoided it, and in others, it is just slid by them. Knowledge workers often have the power to resist being told what to do, and process analysis is usually a sophisticated approach to having someone else tell you how to do your job. It is not easy to view knowledge work in terms of processes, because much of it involves thinking, and it is often collaborative and iterative, which makes it difficult to structure.

When I had interviewed knowledge workers about their jobs, they had often said that they did not think that their workdays were consistent and repeatable enough to be viewed as processes. This does not mean, of course, that a process perspective could not be applied, or that there could not be more structure to knowledge work jobs – only that there has not been thus far.

Given the historical antipathy of knowledge workers to formalized processes, it is an obvious question to ask how a process orientation is in their interest. Many knowledge workers will view a formal process approach as a bureaucratic, procedural annoyance. A much more appealing possibility is that a process orientation is beneficial to knowledge workers – that they would benefit from the discipline and structure that a process brings, while remaining free to be creative and improvisational when necessary and desirable. In other words, a process can be viewed as art rather than science (Hall and Johnson 2009). Whether this is true, of course, varies by the process involved, by the way a process is implemented and managed, and by the particular individuals involved.

There is some case for optimism in this regard, however. Several researchers studied the issue of what happens to one type of knowledge workers – software developers – as a process orientation increases (Adler et al. 2003). In that particular process domain, there is a widely used measure of process orientation, the Software Engineering Institute's Capability Maturity Model (CMM), which allows analysis of different levels of process maturity. The researchers looked at two groups within a company that were at CMM Level 5, the highest level of process maturity, and two other groups in the same firm at Level 3.

They found that, for the most part, software developers experienced the increased process orientation as positive. He noted, for example, that

> "...the more routine tasks in software development were rendered more efficient by standardization and formalization, leaving the non-routine tasks relatively unstructured to allow more creativity in their performance."
>
> "...process maturity was experienced by many developers as enabling and empowering rather than coercive and alienating."
>
> "The key to ensuring a positive response to process discipline was extensive participation..." "People support what they help create."

This is good news for anyone interested in taking a process perspective on knowledge work. Of course, the findings do not necessarily generalize to all knowledge work, and much more research is needed. But it is a signal that a process

orientation can make knowledge work more productive as well as "enabling and empowering" if managed correctly, i.e., with extensive participation.

There will probably also be cases in which knowledge workers will actively resist or ignore a process orientation. In these cases, imposing it becomes a power struggle. The outcome of such struggles will vary across situations, but adopting more effective and productive processes in many industries may sometimes conflict with knowledge worker autonomy. As one expert in the health care industry, for example, puts it, "Less discretion for doctors would improve public safety." (Swidey 2004). Other industries are likely to face similar tradeoffs.

3 Processes and Knowledge Work Segments

Of course, all knowledge workers are not alike, and there are some key differences in process orientations among different types of knowledge work and workers. In the matrix shown in Fig. 1, there are four key types of knowledge work based on the degree of expertise and the level of coordination in the work. "Transaction" work is generally more easily structured in process terms than any other, because the work is normally repeatable, and because the people who do the work have less discretion to do it the way they like. At the opposite extreme are "Collaboration" workers, who present a challenge for process-oriented managers. These workers typically have a more iterative, collaborative approach to work for which patterns are more difficult to discern. They may deny that their work has any structure at all – "every day is different," they have often said to me. And if a process analyst should figure out a process to recommend to these workers, they have the power and the independence to be able to successfully resist it.

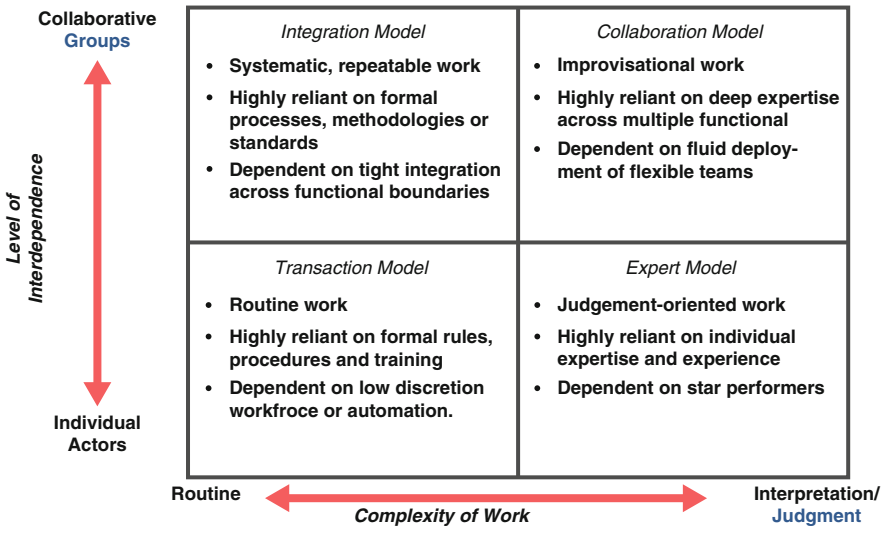

Fig. 1 Four approaches to knowledge work

"Integration" and "Expert" workers are somewhere in the middle in this process-orientation continuum. Integration work is often fairly structured, although higher levels of collaboration often lead to more process complexity. Integration-oriented workers are relatively likely to adopt process interventions. Expert work can be made more process-oriented, but experts themselves often resist an imposed process. Typically, one has to give them the ability to override or step out of the process, and they are often wary of "cookbook" approaches to their work.

Of course, it is not a binary question whether a process orientation is relevant to a particular type of knowledge work. For each of these types, there are rules of thumb about how best to move in a more process-oriented direction:

Transaction workers. These workers need to understand the flow of their work and the knowledge needed to perform it, but they rarely have time to consult external guidelines or knowledge sources. Fortunately, it is often relatively easy to embed a process flow into some form of computer-based application. These typically involve structured workflows or scripts. Such systems usually bring the work – and all information and knowledge required to perform it – to the worker, and they measure the process and worker productivity at the same time.

Integration workers. With this type of work, it is possible to articulate the process to be followed in documents, and workers typically have enough time and discretion to consult the documents. There is nothing new about describing a process, but the practice continues across many industries. Medical technicians, for example, often follow health care protocols in administering tests and treatments. Salespeople at the electronics retailer Best Buy follow a series of "standard operating procedures" for working with customers and making a sale. Even the US Army describes in detail its "doctrine" for how work is done – and with new technologies and war fighting methods, that work is increasingly knowledge-oriented.

Expert workers. These workers have high autonomy and discretion in their work, but there are some examples of organizations, such as several leading health care providers, which have applied technology to key aspects of the process (in their cases, ordering medications, tests, referrals, and other medical actions) (Davenport and Glaser 2002). But unless there is a way to embed a computer into the middle of the work process, experts will be a challenge from the standpoint of structuring work. Instead of specifying detailed aspects of the workflow, those who attempt to improve expert knowledge work should provide templates, sample outputs, and high-level guidelines. It is unlikely that expert workers will pay much attention to detailed process flows anyway.

Collaboration workers. As I have noted, this is the most difficult category to address in traditional process terms. The cautions above for experts also apply to collaborators – a gentle process touch is desirable. Rather than issuing process flow charts, specifying and measuring outputs, instilling a customer orientation, and fostering a sense of urgency are likely intervention approaches. If external knowledge and information are necessary to do the job, they must generally be made available through repositories and documents – it is very unusual for work in this category to be fully mediated and structured by a computer. Of course, this means that it is relatively less likely that the knowledge and information will be used.

4 Knowledge Creation, Distribution, and Application

But the four types of knowledge work I have discussed above are not the only way to segment it in terms of processes. Perhaps a more obvious segmentation approach is to think about processes in terms of the knowledge activity involved. That is, the process orientation differs by whether workers create knowledge, distribute it, or apply it.[2] This simple three-step model – a process in itself – is a useful way to think about how different knowledge activities require different process interventions.

4.1 Creation

The bugaboo of process management is knowledge *creation*. This is widely viewed as a creative, idiosyncratic, "black box" activity that is difficult to manage as a process but not impossible. Perhaps there are circumstances in which knowledge creation is totally unstructured, unmeasured, and unrepeatable – but in most situations, progress can still be made in this direction.

One common approach to knowledge creation processes is simply to decompose them into several pieces or stages. Many companies in the 1980s and 1990s, for example, divided their new product development processes into a series of stages or phases. The objective was to allow evaluation of the new knowledge created at the transition from one stage to another – stage gates. A new drug compound, a new car design, or a new toy model would move through a stage gate if it met the criteria for moving ahead – typically a combination of technical and market feasibility factors. If this approach is employed in a disciplined fashion, it has the virtue of freeing up resources from unproductive projects without imposing too heavy a process burden on new product developers. However, this approach does not really address the activities within the stages, or treat the new product development activity as an end-to-end process (Holmes and Campbell 2003).

Another challenge to the use of process thinking in new product development is that the early stages of the process are often called the "fuzzy front end." At this stage it is not clear what the customer requirements are, what the new product should do, or how it will work. There are things that can be done to make the fuzzy front end somewhat less fuzzy (Quality Function Deployment, for example, is a method for clearly articulating customer requirements; Conjoint Analysis is a statistical technique used to calculate the relative value of different product attributes to customers). However, no amount of technique or process management is going to make the fuzzy front end as clear and well-structured as the final stages of new product development, e.g., manufacturing or market testing. A process orientation may be less relevant to the beginning of the process than to the end based on the inherent degree of structure in each stage.

[2] I first employed this distinction in an article with Sirkka Jarvenpaa and Michael Beers, "Improving Knowledge Work Processes" (Davenport et al. 1996).

Other knowledge creation processes have been the subject of alternative approaches, but still with a relatively low degree of process orientation. Scientific research, for example, is the prototypical example of an unstructured knowledge creation process. While there are valid aspects of scientific research that are difficult to structure, there are plenty of approaches and tactics for bringing more process discipline to research. One is simply to measure outputs – number of patents or compounds or published papers per researcher per year, for example. Another is to assess quality – the number of citations a researcher receives per year, for example, is a widely used measure of scientific influence. A third approach is to involve customers of the research (either internal or external to the organization) in the creation process so that their influence is more directly felt. A number of corporate research laboratories – including IBM's Watson Labs and GE's Corporate Research organization – have adopted this approach over the past several years as they attempt to become more productive and profitable. If an organization is creative – and does not automatically resort to process flowcharts – there are a number of ways to make knowledge creation processes more effective and efficient.

Another knowledge creation process is oil exploration. Geologists and geological engineers create seismological knowledge of a targeted drilling area and try to progressively lower the risk of a dry hole with more knowledge over time. At Amerada Hess, a medium-sized oil firm with many exploration projects scattered around the globe, an attempt was made to document the process of oil exploration – the "Exploration Decision-Making Process." This was a cultural stretch for Hess, in that exploration had historically been a highly unstructured and iterative activity, and the people who did it enjoyed a free-thinking, "maverick" culture. Certainly, there were benefits from the exercise; depicting the Exploration Decision-Making Process in a visual format greatly enhanced the ability of participants to understand their roles, responsibilities, and interactions throughout the process. But the creation of a document was perhaps of greater value than the process map, which had strong support from some exploration managers and less from others. A "Prospect Evaluation Sheet" reviewed the story and history of how the lead progressed to its current prospect level. This documentation served to encourage open discussions among peers of alternative interpretations and enabled them to make sense of ambiguities. Even more important was the insistence that peer Reviews and peer Assists (carried out by peers within other parts of the Hess organization) take place prior to prospects qualifying to pass through decision gates. The Prospect Evaluation Sheet was just a way of recording how the prospect field was maturing through the process.

In general, it seems that workers engaged in knowledge creation should be given some structure, but not too much. IDEO, the highly successful new product design firm, for example, provides its employees with a structured brainstorming process, but few other processes have much if any structure or formality. Corning's R&D lab, like many scientific research organizations, employs a "stage gate" model of the innovation process, but there is substantial freedom within stages. Alessi, the Italian design studio, allows considerable creativity and intuition from designers in the early stages, and imposes more structure and evaluation on designs later in the

process. More structure than these organizations provide would begin to seem heavy-handed, and indeed some organizations have had difficulty in applying process-oriented disciplines such as Six Sigma to innovation (Hindo 2007; 'Conger 2010). Some observers feel that Six Sigma enforces too much structure and process-based discipline for traditionally creative activities such as innovation.

4.2 Distribution

As for knowledge *distribution* – sharing or transfer are other words for this activity – it is also difficult to structure. Some professions, such as customer service, journalism, and library workers, are only about distribution. For most knowledge workers, however, this is a part of the job, but not all of it. The lawyer or consultant is primarily responsible for generating solutions for clients, but also for sharing that solution with colleagues, and for searching out whether existing knowledge is already available that would help the client. This sharing is difficult to enforce, since we do not know what any person knows, or how diligently they have searched for available knowledge. Yet, there is a substantial body of research suggesting that knowledge worker groups that share knowledge perform better than those that do not.[3]

The most viable approach to managing knowledge distribution or sharing is not to manage the process itself, but rather the external circumstances in which knowledge distribution is undertaken. This typically involves changing where and with whom people work. Chrysler, for example, formed "platform teams" to improve the circulation of new car development knowledge across all the functions involved in building a car. Managers specified a process for the platform teams to follow, but they got much more knowledge sharing from the fact that platform teams were put together in the same sections of the Auburn Hills, MI Technical Center than from a process that instructed them to share at various points.

4.3 Application

Then there is the application of knowledge, which is filtered through the human brain and applied to job tasks. Examples of this type of work include sales, computer programming, accounting, medicine, engineering, and most professions. All of these jobs involve a degree of knowledge creation, but that is not the primary objective. In such cases, we generally want these knowledge workers not to invent new knowledge but to apply existing knowledge to familiar or unfamiliar situations. We do not want computer programmers to create new programming languages, but rather use existing ones to program applications. At best we want "small ideas" from these individuals – not reinvention of their jobs and companies.

[3]For an example of the relationship between knowledge sharing and performance, see Cummings (2004).

How do we make knowledge application better? In many cases, the goal is to reuse knowledge more effectively. We can greatly improve performance by having a lawyer reuse knowledge created in another case, or having a programmer employ a subroutine that someone else created.

Knowledge asset reuse is a frequently stated objective for organizations, but it is hard to achieve. Many organizational and professional cultures reward – sometimes unconsciously – knowledge creation over knowledge reuse. Furthermore, effective knowledge asset reuse requires investment in making knowledge reusable: documentation, libraries, catalogs, modular structures for knowledge objects. Many organizations and managers just do not take a sufficiently long view of reuse processes to make those investments.

When some colleagues and I researched knowledge asset reuse processes across several types of organizations (Davenport et al. 2003), there were several factors explaining whether organizations were successful with reuse. Leadership was one of the factors – having an executive in charge who understood the value of reuse and was willing to manage so as to make reuse a reality. Another factor was asset visibility, or the ability to easily find and employ the knowledge asset when there was a desire to do so. The third and final factor was asset control, or the activities designed to ensure that the quality of knowledge assets was maintained over time. Therefore, if you are interested in knowledge reuse as a means of improving knowledge use processes, you should try to put these three factors in place.

There are other factors that can be employed to improve use. Computers, of course, can oversee the process of reuse. At General Motors, for example, the Vehicle Engineering Centers want new car designers to reuse knowledge and engineering designs when possible, rather than create new ones. So they ensure that the desirable dimensions of new vehicles, and the parameters of existing component designs, are programmed into the computer-aided design systems that the engineers use, and it becomes difficult not to use them. One GM executive told me that you cannot force the engineers to reuse designs and components – you just have to make it much easier for them to do that than to create new ones.

Today, in most organizations, reuse is only addressed at the institutional level if at all. But it stands to reason that the most effective knowledge workers reuse their own knowledge all the time. A productive lawyer, for example, would index and rapidly find all the opinions and briefs he has ever written and reuse them all the time for new clients. But while we know this is true, organizations have yet to help knowledge workers do this sort of reuse. If they were smart, they would make it easier – and provide taxonomies, training, role models, and encouragement.

5 Process Versus Practice in Knowledge Work

In addition to taking a process perspective on knowledge work, it is important to remember that there is also a *practice* side to this type of work, which has to be balanced with the process perspective. This balance, first defined by Brown and

Duguid (1991), is an important consideration for anyone attempting to address knowledge work.[4]

Every effort to change how work is done needs a dose of both *process* – the design for how work is to be done – and *practice*, an understanding of how individual workers respond to the real world of work and accomplish their assigned tasks. Process work is a designing, modeling, and engineering activity, sometimes created by teams of analysts or consultants who do not actually do the work in question and often have only a dim understanding of how it is being done today. A process design is fundamentally an abstraction of how work should be done in the future. Process analysts may superficially address the "as is" process, but generally only as a quick preamble to the "to be" environment.

Practice analysis is a well-informed description of how work is done today by those who actually do it. Some analyses of work practice are done by anthropologists (ethnographers), who observe workers carefully over months, either through participant observation or through video. To really understand work practice, it requires detailed observation and a philosophical acceptance that there are usually good reasons for why work gets done by workers in a particular way. Just the acceptance of the practice idea suggests a respect for workers and their work, and an acknowledgement that they know what they are doing much of the time.

A pure focus on process in knowledge work means that a new design is unlikely to be implemented successfully; it probably would not be realistic. On the other hand, a pure focus on practice is not very helpful either – it leads to a detailed description of today's work activities, but it may not improve them much. Some anthropologists go just as far in the practice direction as some consultants go in the process direction. They argue that you have to observe work for a year or so in order to have any chance of understanding it at all, which is clearly unrealistic in a business context.

It is certainly true that some processes can be designed by others and implemented successfully – because they are relatively straightforward to begin with or because it is easy to use people or systems to structure and monitor their performance. Other jobs – particularly those involving knowledge and experts – are very difficult for outsiders to understand and design, and require a high proportion of practice orientation.

What does it mean to combine a process and practice orientation? Here are some obvious implications:

- Involve the knowledge workers in the design of the new process. Ask them what they would like to see changed and what is stopping them from being more effective and efficient.
- Watch them do their work (not for a year, but a few weeks is not unreasonable). Talk to them about why they do the things they do. Do not automatically assume that you know a better way.

[4]Brown and Duguid have elaborated on the process–practice distinction in their book "The Social Life of Information" (Brown and Duguid 2000, p. 91–116).

- Enlist analysts who have actually done the work in question before. If you are trying to improve health care processes, for example, use doctors and nurses to design the new process.
- Take your time. Devote as much attention to the "as is" as the "to be." Knowledge work is invisible, and it takes a while to understand the flow, rationale, and variations for the work process.
- Exercise some deference. Treat experienced workers as real experts (they probably are!). Get them on your side with credible assurances that your goal is to make their lives better.
- Use the Golden Rule of Process Management. Ask yourself, "Would I want to have my job analyzed and redesigned in the fashion that I'm doing it to others?"

6 Types of Process Interventions

There are many different types of process-oriented interventions that we can make with knowledge work. Some, such as process improvement, measurement, and outsourcing, have long been used with other types of business processes. Others, such as agile methods and positive deviance, are only present in particular knowledge work domains, but could be generalized.

6.1 Process Improvement Approaches for Knowledge Work

There are many ways to improve processes. Which work best with knowledge work? Process improvement can be radical or incremental, participative or top-down, one-time or continuous, focused on large, cross-functional processes or small ones at the work group level, and oriented to process flows or other attributes of processes. There is no single right answer to the question of which variant makes sense – it obviously depends on the organization's strategy, the degree of improvement necessary, and the type of work.

However, as I have noted, with knowledge work it is a good idea to make the improvement process as participative as possible. Knowledge workers are much more likely to agree with and adopt any process changes if they have been a party to designing them. This begins to restrict the change options some what. It is very difficult to have thousands of people participate in a highly participative change approach, so that largely dictates a focus on small processes. Participative change also typically yields more incremental change results, in that it is somewhat difficult for large numbers of people who are highly conversant with a process to develop a radical new approach to performing it. Participative, incremental change processes are often also continuous in their orientation, as opposed to one-time. It does not make sense to make one-time incremental changes if the organization is not going to follow them up with more improvements over time.

Based on this logic, the most desirable forms of process improvement for knowledge work are participative, incremental, and continuous. An example of this type of

approach would be Six Sigma, which has been adapted and adopted for knowledge work by a variety of firms (although, as I noted above, some firms have found it burdensome for innovation-oriented processes). General Electric, for example, has employed the approach extensively within its Global Research organization. It applies Six Sigma in research and design processes using its "Design for Six Sigma" (DFSS) methodology, which is about understanding the effects of variation on product performance before it is manufactured. Many of its researchers and engineers have Six Sigma green or black belts, and are experts in the application of statistical analysis to research and engineering processes. GE is perhaps the most advanced of all organizations in applying process management techniques to research. Even at GE, however, managers I have recently interviewed have suggested that the influence of Six Sigma over innovation-oriented processes is waning.[5]

The other key aspect of selecting a process-oriented intervention is the particular attribute of process management an organization addresses. As I have mentioned, it is all too common for organizations to interpret "process" as "flow diagram." It specifies "first you do this, and then you do this. . ." Such an engineering orientation to processes breaks down work into a series of sequential steps, and it is the aspect of process management that knowledge workers like least. Similar forms of this orientation are found when organizations attempt to create detailed methodologies for knowledge work, such as a system development methodology. It may be necessary in some cases to engineer the process flow, but it should not be the centerpiece of a knowledge work improvement initiative.

A simpler form of a highly detailed process flow is a straightforward checklist of what activities a knowledge worker needs to perform. This may seem obvious and simplistic, but there are some industries in which knowledge workers are benefitting from it. Medical workers such as doctors and nurses, for example, are increasingly using checklists to ensure that all major steps in a surgical operation are performed. One study found that a 19-item surgery checklist improved communication between surgical team members and reduced death rates by almost half (Haynes et al. 2009).

6.2 Agile Methods

Another alternative to highly engineered processes might be called "agile" methods. They are less focused on the specific steps to be followed in a process, and more oriented to the managerial and cultural context surrounding the process. Instead of detailed process flows, for example, agile methods might emphasize the size and composition of process teams, a highly iterative workflow, and a culture of urgency. This is the case, for example, in the agile method known as "extreme programming."

[5]For more on the relationship between Six Sigma and process management in general, see Conger (2010).

Martin Fowler, an expert on agile methods, describes the contrast between engineered methodologies and agile approaches in common-sense language on his web site:

- *Agile methods are adaptive rather than predictive*. Engineering methods tend to try to plan out a large part of the software process in great detail for a long span of time, this works well until things change. So their nature is to resist change. The agile methods, however, welcome change. They try to be processes that adapt and thrive on change, even to the point of changing themselves.
- *Agile methods are people-oriented rather than process-oriented*. The goal of engineering methods is to define a process that will work well whoever happens to be using it. Agile methods assert that no process will ever make up for the skill of the development team, so the role of a process is to support the development team in their work (Fowler 2005).[6]

As of now, agile methods are only established within software development, but over time they may migrate to other knowledge work processes.

It is not hard to imagine that before long we will see, for example, "extreme product development" or "extreme marketing."

6.3 Measurement

A key component of process management has always been to measure the performance of workers. In the industrial age, this was a relatively easy task; an individual worker's performance could be assessed through outputs – work actually produced – or visible inputs, including hours worked or apparent effort expended. Output measures over input measures, of course, are typically described as "productivity." The appeal of measuring productivity for knowledge workers is that it is a universal measure. Productivity-oriented approaches convert the value of outputs to currency. It is very appealing to look across an entire corporation or even a country and argue that we have increased productivity by an exact percentage – and economists often do so.

In the world of knowledge work, evaluating productivity and performance is much more difficult. How can a manager determine whether enough of a knowledge worker's brain cells are being devoted to a task? What is the formula for assessing the creativity and innovation of an idea? Given the difficulty of such evaluations, managers of knowledge workers have traditionally fallen back on measuring visible inputs, e.g., hours worked. Hence the long hours put in by attorneys, investment bankers, and consultants. However, the increasing movement of knowledge work out of the office and into homes, airplanes, and client sites makes it difficult to use hours worked as a measure, and that criterion never had much to do with the quality of knowledge produced.

[6]The use of Business Process Management approaches in collaborative work settings is explored in Kemsley (2010).

Quality is perhaps the greatest problem in measuring knowledge work. Why is one research paper, one advertising slogan, or one new chemical compound better than another? If you cannot easily measure the quality of knowledge work, it makes it difficult to determine who does it well, and to what degree interventions have improved it. Many organizations tend to fall back on measuring the volume of knowledge outputs produced – lines of programming code, for example – simply because it is possible to measure them. But without some measure of quality, the improvement of knowledge work is unlikely to succeed.

It is possible to measure the quality of knowledge work, albeit with a subjective method. It involves determining who is a relevant peer group for the particular work involved, and asking them what they think of it. This technique has often been used, for example, in evaluating professors for promotion and tenure. A jury of peers – usually from within and outside the professor's school – is consulted, and the quality of their published work assessed. Similarly, student evaluations are used to assess the quality of teaching. Any problems with lack of objectivity are remedied in the volume and diversity of responses. In the same fashion, a few organizations ask for multiple peer evaluations in annual performance reviews and promotion decisions. Some knowledge management applications ask each user of the system to rate the quality of the knowledge found. Thus, there are means of assessing quality, although the peer group and the assessment approach will vary by the context.

There does not seem to be, however, a universal measure for the quality or quantity of knowledge work outputs. What matters is high-quality outputs per unit of time and cost, and the specific outputs vary widely across knowledge worker types. A computer programmer produces lines of code; a physician produces well people; a scientist produces discoveries and research. The only way we can determine whether a particular intervention improves knowledge work performance is to assess the quantity and quality of the outputs produced by those workers. Universal measures are pretty much useless for this purpose.

Therefore, the appropriate output (and sometimes input) measures for knowledge work will vary by the industry, process, and job. In improving knowledge worker performance, it is important to determine what measures make sense for the particular type of work being addressed. Organizations need to begin to employ a broad array of inputs and outputs, some of which are internal to the knowledge worker's mind. One input might involve the information and knowledge that a knowledge worker consulted in making a decision or taking an action (a particularly important criterion for managers). ABB, the global electrical and engineering firm, uses this factor as one of many in assessing managerial performance. Another input could be the process that a knowledge worker follows in producing knowledge work. The self-reported allocation of the knowledge worker's time and attention is a third possible input.[7]

[7]For an example of how to assess self-reported attention allocation, see Davenport and Beck (2002).

Outputs could include the volume of knowledge produced, the quality of the decisions or actions taken on the basis of knowledge, and the impact of the knowledge produced (as judged by others). In the consulting industry, some consultants are already evaluated in part on the knowledge they bring to the firm and the impact it has on clients – in addition to the usual measures of chargeability and consulting projects sold.

Some knowledge work processes already employ well-defined measures. IT is certainly one of the more measured knowledge work domains. IT measurement is relatively advanced in both programming and in IT processes and capabilities. In programming, some organizations have measured for decades the production of either lines of code or function points, and various researchers have analyzed the considerable variance in productivity. These measures are not perfect, but they have allowed IT organizations to begin to understand differences across groups and individuals – something that lawyers, doctors, and managers cannot measure nearly as well.

The other primary domain of measurement is the assessment of IT processes, particularly software engineering (but also software acquisition, people management, and the development of software-intensive products). Thanks to the Software Engineering Institute and researcher Watts Humphrey, we have an international standard for the quality of software engineering: the Capability Maturity Models (Software Engineering Institute 1995). Thousands of organizations have been assessed along these five-level models. The Software Engineering Institute has developed a more general approach to assessing capability maturity (called CMMI – Capability Maturity Model Integration), but thus far it has largely been applied to software-related processes only (Crissis et al. 2003). Unfortunately, there is no similar global standard for other forms of knowledge work, other than perhaps the ISO 9000 family of standards for manufacturing quality.

6.4 Positive Deviance

Once measures have been developed for knowledge work, there are other approaches that can take advantage of them. One is called positive deviance, defined by Wikipedia as:

> Positive Deviance (PD) is an approach to personal, organizational and cultural change based on the idea that every community or group of people performing a similar function has certain individuals (the "Positive Deviants") whose special attitudes, practices/strategies/behaviors enable them to function more effectively than others with the exact same resources and conditions. Because Positive Deviants derive their extraordinary capabilities from the identical environmental conditions as those around them, but are not constrained by conventional wisdoms, Positive Deviants standards for attitudes, thinking and behavior are readily accepted as the foundation for profound organizational and cultural change (Wikipedia 2009).

Positive deviance-based approaches have been employed in health care (for example, to reduce infection from antibiotic-resistant bacteria) and international development. To use it for knowledge work improvement, different knowledge

workers within an organization would be measured on key metrics. Those individuals or groups that score relatively well are publicized, and their approaches investigated. They would become examples for less successful knowledge workers. Because humans are often competitive and want to improve, they often adopt the approaches used by their most successful peers.

6.5 Knowledge Management-Based Interventions

Since knowledge workers employ knowledge as a primary aspect of their jobs, it is natural that organizations would try to improve the work with knowledge management, or systematic attempts to improve the distribution and utilization of knowledge. However, most implementations of knowledge management within organizations do not employ a process-based approach. Instead, they typically involve adding knowledge management activities on top of existing work activity.

In a few cases, however, organizations have attempted to use knowledge management approaches to make knowledge available at the time of need in the context of the work process. This is similar to the idea of "performance support," which specified that learning would be delivered in real time as task performance required it (Gery 1991). One successful example of applying knowledge to the work process is at healthcare provider Partners HealthCare, where knowledge of appropriate therapies is made available to physicians as they input online orders for patients (Davenport and Glaser 2002). The system and the process have led to many benefits, including a 55% reduction in adverse drug events.

In such situations knowledge management can be a very effective way to improve knowledge work processes, but it is more difficult to implement than "traditional" knowledge management. It requires focusing on and supporting a particular work process, as opposed to an entire organization. It also may require considerable customization and integration of information technology tools. This is presumably the reason why more organizations do not implement knowledge management in a process context.

6.6 Outsourcing Knowledge Work

Outsourcing of business processes began for most organizations with structured, repetitive activities with high labor content, such as routine IT development, a call center, or an accounting back office. But today, many more intellectual and less structured activities are being outsourced. Back-office work is being supplanted by "knowledge process outsourcing" (KPO) of various types.

This transition began quietly more than a decade ago at GE's captive offshore center in India. GE Capital set up the center to do back-office work. But managers began to notice that they could get help with decision algorithms from their Indian employees. Soon the Indian operation was the primary provider of analytical tools

for credit and risk analysis. When GE spun out its captive offshore group in 2005, the resulting company, Genpact, began to take on KPO work for other clients in addition to GE. And GE eventually established a captive (offshore but not outsourced) R&D center in India that takes on the thorniest problems it encounters in its global operations.

Today, several offshore firms in addition to Genpact specialize in various forms of decision analysis. Organizations such as E-Valueserve, Mu Sigma, and MarketRX (now owned by Cognizant) are helping some of the largest US-based firms with their knowledge-based processes. They are helping a major retailer, for example, determine where to build their next stores. They are helping a major pharmaceutical firm decide which salespeople are most effective, and which drugs are passing their clinical trials. They are helping a major insurance company decide what price to charge different customers for automobile insurance. They are helping a major office products firm decide which promotions and products to offer to which customers. They are taking on a wide variety of product development activities for IT and other firms. Even larger offshore outsourcers that previously specialized in IT – such as Wipro, Infosys, and Satyam – have decided that KPO is a future growth area. With their scale and marketing budgets, as well as their orientation to process improvement, we will undoubtedly see substantial offshore KPO in the future.

Companies working with offshore decision outsourcers report great success in improving their decision processes and results, but they warn that the structure of the projects is critical. The result of a decision analysis is not useful unless it is implemented, and offshore analysts cannot easily influence executives to adopt the results. Therefore, the clients say, it is important to have at least one of their own employees on the analysis team. It is that person's job to ensure that the analysis is consistent with the decisions the organization wants to make, and to communicate the results to responsible executives. They also report that it is valuable to have at least one representative of the offshore firm working onshore at the client site. That person typically has responsibility for communicating and coordinating between the offshore team and the client.

With the shortage of knowledge workers in the US and Western Europe, and the ready supply of them in India, Eastern Europe, and China, it is perhaps not surprising that organizations are now outsourcing not only hands, but also brains. Outsourcing knowledge work can be just as effective an intervention as improving a process internally, for example.

7 Summary

This chapter has addressed process-oriented approaches to improving knowledge work. The different process techniques include:

- Segmentation of knowledge work into its more and less structured components;
- Differentiation by types of knowledge workers by level of integration and expertise, with different process-oriented interventions for each type;

- Different process interventions for knowledge creation, distribution, and application;
- Distinction between a process orientation and a practice orientation;
- The application of participative, incremental, and continuous process management approaches;
- The use of "agile" process methods;
- Process measurement as a tool for improvement;
- "Positive deviance" approaches to improvement;
- Knowledge management applied in a process context;
- Outsourcing of knowledge work processes.

The breadth of potential approaches to knowledge work improvement confirms that taking a traditional, engineering-oriented process approach is not the only or even the best way to improve a knowledge worker's performance. Any engineering perspective on processes has to be balanced against the day-to-day practice of knowledge workers, and the "softer" means of intervening into knowledge work.

In an ideal situation, knowledge work processes can create a climate in which innovation and discipline coexist. Knowledge workers are often passionate about their ideas, and would not abandon them easily. Yet, it is sometimes necessary to kill some knowledge work initiatives in order to free up resources for new ones. Managers in pharmaceutical firms, for example, have noted that a key aspect of a strong drug development program is the ability to cancel projects that do not meet success criteria. But cancellation should be the result of a process, not a matter of an individual's taste.

Kao Corporation, Japan's largest consumer products firm, is an example of an organization with both a strong orientation to knowledge and learning, and a sense of process-oriented discipline when necessary. Kao's CEO describes the company as an "educational institution," and it was one of the earliest adopters of knowledge management in Japan. Kao's researchers have a high degree of autonomy in the research they pursue, at least for Japanese firms. But Kao also has discipline. It has well-structured continuous process improvement programs, even in the R&D function. It also kills undesirable products and projects when necessary. The company had entered the floppy disk business and had become the world's second largest producer, but by the late 1990s it became clear that the business was fully commoditized. Most large Japanese firms are slow to restructure, but Kao first closed down half and then all of the business. 1998 was the first year in seventeen that Kao had not grown profits, but it was already back on the profit growth track by 1999 – and it is continued on that track since then.

Organizations like Kao take a process approach to knowledge work because it is one of the most successful and time-honored approaches to business improvement – dating back at least as far as Frederick Taylor at the dawn of the twentieth century. But a process orientation would not be successful without modifications and supplementary approaches that equip it for the unique attributes of knowledge work and workers.

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