Knowledge Work
and
Knowledge Workers

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Executive Summary

This working paper examines the nature of knowledge work the values and work styles of knowledge workers. The paper grew out of the February 2007 meeting of the Advisory Council for the WIRED West Michigan Knowledge Workers and Economic Development innovation project. The Council members were discussing the concept of remote work centers as a means of supporting the attraction and retention of knowledge workers in the West Michigan region when two deceptively simple questions were asked: "What is a knowledge worker? And how do we know that the work being done is, or could be, location-independent?

Like most "simple" questions, those two do not have simple answers. After some extended discussion at the Council meeting the two of us were charged with preparing this paper.

Our analysis suggests that indeed there is no simple or universal definition of knowledge work, and certainly no common understanding of who is, or is not, a knowledge worker. We've dug into the literature and cite perspectives from thought leaders like Peter Drucker and Tom Davenport, but we've also developed our own "typology" of knowledge work. And we suggest that there are at least two distinctive categories of knowledge workers – what we call "Knowledge Generators" and "Knowledge Executors." Simply put, the difference is between *creating* new knowledge and *applying* existing knowledge. The former kind of work is much more varied, unstructured, and unpredictable than the latter.

We then explore what factors – like degree of interactivity, urgency, and task complexity – make knowledge work activities more or less amenable to being carried out in a "location-neutral" way.

We do not come to any clear conclusions or suggest a specific diagnostic tool for determining whether a given knowledge-based task – or an individual knowledge worker – could be completed either wholly or in part in a "distributed" mode. It just isn't that simple. Rather, we call for managerial judgment to determine on a case-by-case basis whether a particular job or set of tasks could be handled in a remote or mobile work context. However, we do suggest a number of guidelines and frameworks for making those judgments – aids that we trust will provide adequate direction to decision-makers.

What is Knowledge Work?

Peter Drucker is generally credited with coining the term "knowledge worker" in 1959. In 1991 he wrote an article on knowledge worker productivity for the *Harvard Business Review*[1] in which he more or less put knowledge work (ill-defined at best) and service work in one large, rather amorphous, bucket. The closest he came to defining "knowledge and service" work in that article was this:

> *Knowledge and service workers range from research scientists and cardiac surgeons through draftswomen and store managers to 16-year olds who flip hamburgers in fast-food restaurants on Saturday afternoons. Their ranks also include people whose work makes them "machine operators": dishwashers, janitors, data-entry operators.*

At that time Drucker was not particularly concerned with where and when these knowledge workers accomplished their tasks; his focus was on improving their productivity, which he called the "single greatest challenge facing managers in the developed countries of the world."

However, in 2007, in a global economy that is enabled by powerful information technologies and driven by creativity and innovation, most knowledge workers are increasingly mobile, location-independent, and free to choose where, when, and for whom they will work.

As West Michigan considers whether to invest in new kinds of infrastructure and new work environments as part of its efforts to attract, retain, and leverage talent, we need to develop and agree on more precise definitions of who is a "knowledge worker," how many of them there are in the region, and what kinds of services and infrastructure they want and need to be successful (this last issue – their wants and needs – is treated more completely in a separate working paper.[2] It will be discussed here only briefly).

A Basic Definition

The broadest view of knowledge work is that it is an activity that either requires specialized knowledge or skills, or creates new knowledge. In contrast to physical labor, knowledge work focuses primarily on *creating* or *applying* information or knowledge to create value.

So what exactly *is* a knowledge worker, and how can the nature of his or her work be described? At the most generic level, the term "knowledge worker" refers to individuals who possess high levels of education and/or expertise in a particular area, and who use their cognitive skills to engage in complex problem solving.[3]

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[1] Drucker, Peter. The New Productivity Challenge. *Harvard Business Review*, Nov-Dec 1991, pp69-79.

[2] "What Attracts Knowledge Workers?" WIRED Working Paper prepared by Charlie Grantham and Jim Ware., February 2007. Available on request from the authors.

[3] Sulek, J. M., & Marucheck, A. S., A study of the impact of an integrated information technology on the time utilization of information workers. *Decision Sciences*, 23: 1174-1191 (1992).

Wikipedia defines a knowledge worker as someone "*who works primarily with information or one who develops and uses knowledge in the workplace*."[4]

Babson College Professor Thomas Davenport, who has probably studied knowledge work and knowledge workers more than almost any other active scholar today, has this to say about the concept:

> *I certainly think there's a lot of fuzziness, ambiguity, and imprecision about what a knowledge worker is, and it's not a term most managers use easily. They don't say, "Okay, these are my knowledge workers, these are my non-knowledge workers." So despite the fact that the term's been around for a long time, very few people have been comfortable using it as a managerial concept.*[5]

He then proceeds to define knowledge workers as "*people with high degrees of education or expertise whose primary job function involves some activity related to knowledge*."

These very broad definitions, however, encompass almost all forms of meaningful work. Even a barber, a hair stylist, a hamburger flipper, or an assembly line worker has some degree of specialized knowledge about what he or she must do to be successful, although there are certainly differing levels of productivity and effectiveness depending on an individual's knowledge and experience.

Thus, knowledge workers indisputably include individuals in the traditional professions, such as doctors, lawyers, scientists, educators, and engineers. Most of us would also include those who work in senior positions in marketing, advertising, consulting, finance, insurance, and strategy development, to name just a few functional specialties. And then there are also specialized knowledge-based jobs like airline pilots, musicians, senior business executives, and even government officials.

Because their work typically entails the interpretation and manipulation of information as well as the creation of new knowledge (as opposed to relatively routine data collection and processing), knowledge workers are usually considered a distinctly different "breed" than their less-skilled white-collar counterparts such as bank tellers, bookkeepers, call center specialists, or clerks who perform relatively routine work in highly structured and procedurally-constrained ways.

However, some would argue that those latter workers are increasingly taking on more "knowledge worker-like" qualities, due to the availability of computer-based technologies for conducting many of their routine activities; and today even factory-floor production management requires significant high-tech literacy and knowledge.

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[4] http://en.wikipedia.org/wiki/Knowledge_worker

[5] From an interview conducted by *Ubiquity Magazine*, available online at: http://www.acm.org/ubiquity/interviews/v6i34_davenport.html

As these examples of who "knowledge workers" are and what they do already indicate, knowledge work encompasses an enormously diverse set of tasks and jobs. Clearly, the nature of the work in these jobs varies all over the map.

Take for example the tasks of a software customer support technician versus those of a marketing strategist. A customer support technician often relies on a small number of routines to solve a particular customer problem, identifying the nature of the problem and then linking it to one or more pre-conceived solutions provided within a database of solutions.[6]

The job of a marketing strategist, on the other hand, is often much more imaginative and original. In this case, he or she may analyze marketing data and combine it with personal insight, intuition, etc. in order to design a new strategy (e.g., gaining market share). The process of converting a mass of raw information from many sources into something as abstract as a strategy is normally a much more complex and creative act than "merely" solving a customer's technical problem. In addition, this kind of knowledge worker frequently does not know for quite some time whether his or her activities solved a particular problem.

We believe that these apparent differences can be captured by two " ideal type" categories of knowledge workers: *Knowledge Executors* versus *Knowledge Generators*.[7] Knowledge Executors are those workers who apply existing knowledge by manipulating information through processes created or invented by others. Knowledge Generators, on the other hand, create new knowledge by manipulating information to develop new solutions to a given problem, or to create new concepts or products.

It must be stressed that we view Knowledge Executors and Knowledge Generators as "ideal types" and that we do not believe that any single type of knowledge worker can be placed neatly or exclusively in one category or the other. Rather, we propose that all knowledge work entails both kinds of activities but that each particular job can be placed along a continuum: some jobs entail more knowledge execution than knowledge generation, and visa versa.

Location-Independence as a Factor in Knowledge Work

Remember, however, that for our particular purposes in the Knowledge Workers and Economic Development innovation project, the dominant question is whether someone's work activities could be performed just as effectively from a remote location (or multiple locations over time). While most of the examples cited here are reasonably location-independent, there are often special circumstances that "bind" an individual to a specific workplace for at least some portion of his or her work time.

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[6] Pentland, B. T., & Rueter, H. H. Organizational Routines as Grammars of Action. Adm*inistrative Science Quarterly*, 39: 484-410 (1994)

[7] This distinction parallels the work of Richard Florida, who studied what he calls the "creative class" and identified a broad range of personal values, work styles, and motivations that are distinctive to that group of individuals. See *The Rise of the Creative Class*, Basic Books, 2002.

For example, an engineer working with specialized high-tech equipment would most likely not be able to afford multiple installations of that equipment at, say, several corporate locations and a home office. And some knowledge worker tasks do require physical proximity to other people. While there have been some advances in surgical robotics, we don't expect to see surgeons performing remote operations from their spare bedrooms in the very near future.

The difficulty with generalizations about knowledge workers is that knowledge work is inherently diverse and varied. Almost any definition of a knowledge-based job will include some tasks that are essentially location-independent, but only some jobs have become totally "post-geographic."

Our separate discussion of Remote Work Centers[8] included the concept of "task complexity" and suggested that if various jobs were arrayed on a spectrum from simple to complex, shared workplace facilities would be most appropriate for those jobs in the middle range – neither so simple that they could easily be done at home, or so complex that they would require specialized laboratory or test facilities. At both extremes the demand for a shared work center would be too small to justify accommodating the specialized needs of those workers.

A Typology of Knowledge Work

Thus, as helpful as the distinction between Knowledge Generators and Knowledge Executors may be, we believe the best way to achieve the level of specificity needed to determine whether a knowledge worker's activity can be moved into a remote or mobile work environment is to "decompose" his or her activity at an even finer level of detail.

Research conducted by the Work Design Collaborative over the past five years suggests that there are at least seven important dimensions of work activity that have an impact on where, when, and how that work can be accomplished:

Purpose – whether the task involves *applying* existing knowledge to a well-defined problem, or *generating* new knowledge.

Process Structure – the extent to which the knowledge required to complete the task is known and codified in advance or is being created as needed, drawing on the individual's experience, intuition and creativity.

Outcome Structure – the extent to which the outcome(s) of the work activity are known, predictable, and controllable. As will be described below, work tasks can be aligned along a spectrum from "production" work in which the work products are well-defined and highly uniform, to "research" and creative tasks in which the outcomes are unknown in advance.

Interactivity – the extent and type of interaction involved in the normal conduct of the work. Is it done primarily by an individual, or through interaction with

[8] "Market Segmentation and Development for Remote Work Centers" WIRED Working Paper prepared by Charlie Grantham and Jim Ware., January 2007. Available on request from the authors.

others (whether fellow employees or "outsiders" like customers, suppliers, government representatives, or other interested parties)

Place – whether the work is tied to a specific *place* like a laboratory, a geographic location, or a particular work facility, or can be carried out in many different places.

Proximity – must the work be *co-located* with other specific tasks (and the people doing them), or can it be carried out in a distributed environment?

Time – *when* the task is accomplished, or must be accomplished, and in particular how it relates to other tasks; must it be carried out simultaneously with other tasks, or can they be completed asynchronously?

In combination, these seven dimensions of work activity create a complex variety of differing task configurations. Together they affect information and communications support requirements, and they define the technologies, facilities, and skills that are needed for workers and teams to be effective and productive.

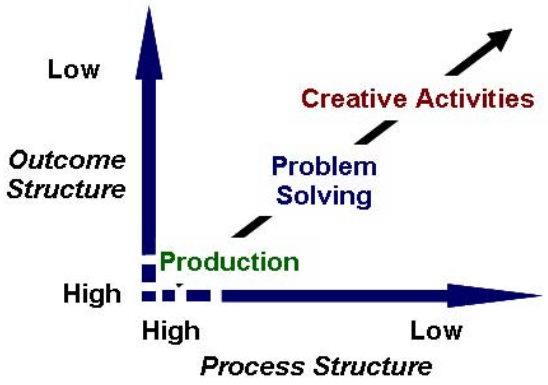
To simplify this admittedly complex analysis, we have found it helpful to distill these seven broad attributes of work into three primary categories of knowledge activity that affect whether and how that work could (or should) be distributed over time and space:

1. The degree of *structure* in the work and its outcomes
2. The *type* of knowledge produced, and the way it is *used*
3. The extent to which the work is *individual* or *collaborative*

Any complete analysis of a work environment will also take into account place, proximity, and time, but those factors (and their implications for distributed work) are much simpler to measure. Thus here we focus on structure, type of knowledge produced, its intended uses, and the degree of interactivity that is inherent in the tasks.

We find the following diagram (Figure One) a useful way to describe these dimensions of work.

Figure One: Three Kinds of Work



The questions are, first, how predictable, or structured, are the *outcomes* of the work activity; and, second, how structured, or well-defined are the *activities* or processes that produce those outcomes?

If both the processes and the results are highly structured, it's “production work.” There are certainly many organizational tasks that, even though they are very information-intensive, are essentially production work. For example, many call center jobs, accounting tasks, payment processing jobs, and even some technical support jobs are relatively routine activities that would actually decline in quality if the individuals doing them were to act creatively and deviate from prescribed procedures.

On the other hand, if both the task outcomes and the processes used to produce those outcomes are very loosely structured, it is creative work, or perhaps even research. And if the results are moderately structured, and generated by moderately structured processes, we call it "problem-solving." For example, a majority of technical support jobs involve a high degree of problem-solving. There is a reasonably well-defined outcome (though it will be different for each customer the tech support person responds to), and there are some known diagnostic questions or processes that guide the problem-solving, but each case is unique. The tech support person doesn’t know until he or she picks up the telephone what problem needs solving.

This typology is useful because it provides guidelines about how to manage differing kinds of work (and in particular to highlight how the management challenges increase when these activities are distributed). For example, all the work over the last decade or two about Quality Control and Six Sigma is all about removing variations, or unpredictability, from production work.

However, we have come to realize that there is actually more structure, or discipline, in a lot of creative work, than Figure One implies.[9] Some structure is necessary to guide and focus creative work, or you end up with chaos. But, that said, creative work is clearly a different beast than production work.

And that's a big reason why it can be so difficult to manage creative work and creative workers, especially when they are remote, mobile, or highly distributed. As we've said many times, you can't order up a "batch of creativity" to be delivered at precisely 10 AM on Wednesday morning the way you can produce well-defined widgets coming off an assembly line.

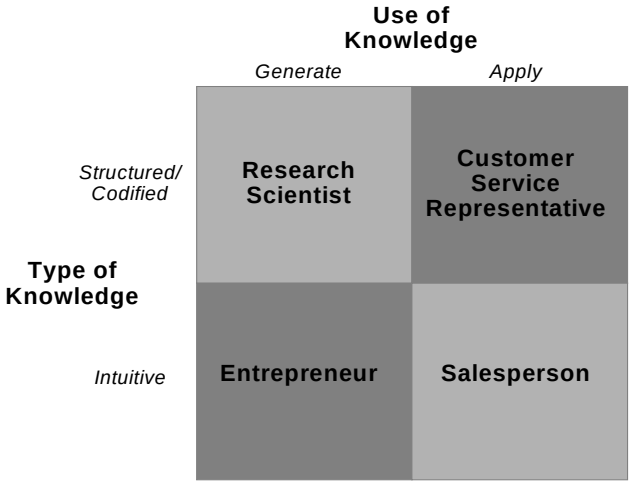
The Nature of the Work Being Done

We have identified two basic dimensions characterizing knowledge work (the degree of structure in the *process* and the certainty or uncertainty of the work's *outcomes*). But the *type* of work being performed also has a dramatic impact on distributed work environments.

For our purposes there are two additional important dimensions of knowledge work: the *type of knowledge* involved; and the *way it is used*. These factors have a major influence on how work activities must be conducted and managed in a distributed environment.

These two dimensions of knowledge combine to create four distinct types of knowledge work, as depicted in Figure Two.[10]

Figure Two: A Knowledge Work Typology (with Examples)



[9] See, for example, "The Three D's of Creativity," Nancy Napier's article in WDC's *Future of Work Agenda* newsletter in March, 2005

[10] This model is drawn from the work of Homa Bahrami of the Haas School of Business, University of California, Berkeley.

This diagram highlights (on the vertical axis) the differences between structured, fact-based work and intuitive, creatively-based work. Different kinds of interactions and interdependencies are needed to carry out differing work activities effectively. In addition, some tasks involve the *creation* of information or procedures while others involve the *application* of knowledge that has already been identified or created (the horizontal axis in Figure Two).

While a customer service representative faces some unexpected situations, he typically follows a well-defined set of procedures and has very little discretion on a daily basis. A customer service representative frequently works independently of his colleagues, interacting primarily with customers over the telephone or via the Internet. With the right technical support, this work can actually take place almost anywhere, as the example of Jet Blue's "virtual call center" in the Salt Lake City area demonstrates.

In contrast, a research chemist continually applies her skills to new situations in the quest to create new products, new processes, or new scientific understanding. While some aspects of a researcher's work may be relatively structured, the work is usually highly varied and it is difficult to evaluate the researcher's performance on a daily basis.

There is also third a characteristic of work that directly relates to operating in a distributed environment: some tasks are relatively individual, while others are highly interactive. Many activities, like copywriting, programming, graphic design, and legal research, are "heads down" individual tasks that require only periodic interaction with others. Other organizational roles typically require extensive interaction, sometimes with the same people (e.g., team members, supervisors, peers) and sometimes with an ever-changing mix of others (e.g., customers, suppliers, public officials, etc). Each of these activities has a different pattern of interaction and mobility, resulting in different needs for physical and IT support.[11]

Distributed knowledge workers whose jobs require interaction with others must rely on electronic media and postal and delivery services when they have to communicate, or on travel when it is necessary to meet face to face. In fact, many interactions are just as effective – and often actually more productive – when they take place electronically.

For many issues a telephone call can actually accomplish the required information exchange far more quickly than a face-to-face conversation. While informal social conversation is just as common in telephone calls as it is in face-to-face interaction, there is typically a good deal less of it – and of course it takes much less time to dial a phone number than it does to travel to another person's office or another city.

[11] See "Workforce Mobility Reexamined" in *The Corporate Toolkit for the Nineties: Organizations, The Work Force, and Technology,* Institute for the Future (Corporate Associates Program, vol. 4, number 2, 1993) for an extended discussion of the different types and ranges of mobility.

What Do Knowledge Workers Want?

In the end, what really matters, and the most important question for the WIRED project to address is, What do knowledge workers want? That is, what are they looking for in their work and their work environment? A community that seeks to attract and retain talented knowledge workers must pay close attention to their wants, needs, motivations, goals, and values.

We deal with this question in more detail in our companion working paper, "What Attracts Knowledge Workers?" Here we offer just a few broad perspectives.

We believe that the single most important desire of knowledge workers is *autonomy* – a sense of personal control over their lives and their work. Whether a knowledge worker is employed in a large (or small) organization or is a classic "free agent," he or she possesses an inherent sense of self-worth and professionalism: "I know best how to get this job done." Knowledge workers resent more than almost anything else being told how to do something, when to do it, or where.[12]

This core sense of confidence and need for self-control is exactly what makes managing knowledge workers such a challenge. And it has obvious implications for building a regional economy based on knowledge work, creativity, and innovation. Place becomes secondary to task. But ironically, that makes it even more important to provide the workforce with multiple choices about where to work, and ensuring that they have the resources they need and expect to work productively.

Concluding Thoughts

Dissecting knowledge work (and understanding knowledge workers) is clearly not a simple task. We can't produce a simple set of diagnostic questions that will reliably classify a given job as knowledge-based, or as amenable to being carried out remotely or in a mobile context. Judgment will always be required, as well as taking into account the individual motivations and values of the knowledge workers themselves.

This discussion has focused primarily on the *tasks* that knowledge workers carry out in their work. But we would be remiss if we didn't also acknowledge that one critical characteristic of knowledge work is that it is conducted by human beings – individuals who have distinctive work styles and preferences for where, when, and how they get their work done. Most knowledge-based work can follow many different paths to the

[12] We are fond of pointing out that anyone with a college degree has had a direct experience of being "in control" of their work and work schedule. We know of very few college professors who tell their students where or when to do their homework. The typical assignment is to "Turn in the paper by Noon on Friday" or "Read Chapter Three before the next class," with no direction at all about how to do the background research, whether to work in the library, the student union, the dorm, or the local Starbucks. Thus virtually all knowledge workers come into the workforce deeply experienced at being mobile, self-directed workers. The tragedy is how infrequently their managers recognize or act as if their workers are adults who are capable of responding on their own to objective of producing a "product" rather than being monitored every step along the way.

same end point. Thus human judgment, including that of the individuals who are doing the work, is an important and indispensable component of the work design process.

In addition, these characteristics of what "knowledge work" is don't dovetail very well with standard economic analysis variables such as those produced by the Bureau of Labor Statistics, the US Census, or other readily available demographic and economic data. It is therefore extremely difficult to produce hard, quantifiable statistics about the amount of work in a region that could be done in new, more flexible, location-independent ways.

Because of these complicating factors we often have to use "stand-in" indicators to size markets and predict staffing levels and other more traditional market variables. Levels of education, the distribution of types of industries, and income levels seem to be good proxies for some (but not all) of what we are looking for.

This situation, coupled with the fact that more and more knowledge workers are choosing to work independently of large organizations, compounds the difficulty of measuring and predicting the market viability of new approaches such as remote work centers. We are talking about social, economic, and technological change along so many simultaneous dimensions that any certainty about the future is virtually impossible.

Finally, it is not the job title, the occupation code, or the employment status that defines knowledge workers. It's what they do, how they choose to do it, and who they are.

About the Work Design Collaborative

The Work Design Collaborative, LLC (WDC) has grown out of a groundbreaking research and development project, "The Future of Work" that began in early 2002. Jim Ware and Charlie Grantham joined forces and recruited several corporate sponsors to address questions about how changing workforce demographics and values, new technologies, and new workplace designs were driving transformation in the very nature of work.

WDC now represents the combined interests, resources, and experiences of Jim and Charlie over the past 25 years. Our partnership has grown out of 10 years of collaborative research and consulting in information technology, human resources, and facilities management

Today the Work Design Collaborative, LLC, provides leadership and infrastructure services for the *Future of Work* community, a global network of resources – practitioners, thought leaders, researchers, and senior consultants – who are committed to building and implementing physical, social, and technology-based work environments that are cost-effective, socially and environmentally responsible, and personally satisfying.

WDC and *Future of Work* are focused on understanding and shaping the future of work and helping both organizations and individuals achieve new levels of workforce and workplace productivity. *Future of Work* produces and distributes management tools, surveys, benchmark databases, white papers and technical reports, conferences and workshops, newsletters, books and articles, and public presentations on the changing nature of work.

WIRED West Michigan has contracted with WDC to investigate the feasibility of establishing one or more remote work centers within the seven-county region of West Michigan. The goal of these remote work centers is to provide physical facilities and infrastructure support services to both organizational employees and independent entrepreneurs on a low-cost shared basis. It is our belief that these RWC's will support and enable the transition of the economic base by making it easier for the region to attract and retain talented knowledge workers, and by enabling and fostering growth in new small businesses.

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