When projects go badly, our reaction is often to work harder—by which we mean work longer hours. But it’s rarely that simple. Projects often go wrong at the very start, and their problems are generally symptoms of a deeply dysfunctional organization.

In a career spanning more than 60 years as a senior manager and researcher, Watts Humphrey has personally helped dozens of organizations go “from the brink of chaos to a sound, businesslike operation,” as he wrote in his 2002 book *Winning with Software*. That description applied to Watts’s experience with IBM, where he worked for 27 years, supervising 4,000 software professionals in 15 laboratories and 7 countries.

Later, as a senior fellow overseeing the process program at Carnegie Mellon University’s Software Engineering Institute (SEI), Watts made an “outrageous commitment”—his words—to transform the world of software. Beginning in 1986, he pioneered the Capability Maturity Model (CMM), the Personal Software Process (PSP), and the Team Software Process (TSP). Those methodologies have helped thousands more organizations and engineers establish and, most importantly, commit to following effective engineering and management practices for their software projects.

Watts did not stop at describing methods for improving software engineering processes. Rather, he made it his personal
responsibility to instruct “all software professionals and their managers to plan and track their work, use the best technical methods, and measure and manage the quality of this work.” In addition to teaching courses and presenting at conferences, Watts invoked the power of the pen, authoring 11 books and hundreds of technical reports, journal articles, and columns.

In 2005, at a White House ceremony, Watts was awarded the United States National Medal of Technology by the President of the United States “for his vision of a discipline for software engineering, for his work toward meeting that vision, and for the resultant impact on the U.S. government, industry, and academic communities.”

Much of Watts’s writing focuses on detailed descriptions of the tools of process management. But an equal amount is a remarkably clear presentation of his vision for properly planned and committed work. He writes in a straightforward and personal style. He draws on anecdotes from his years at IBM and the SEI but also from his earlier experience on the Auburn University wrestling team, for example, and from his service in the U.S. military. While he often describes success, he also recounts times when he felt that he failed and how he learned to approach a problem differently the next time.

This book, drawn from Watts’s books, articles, and columns, comprises a collection of advice, stories, and hard-earned wisdom, rather than specific instruction on how to implement the PSP or TSP (which are thoroughly covered in Watts’s books on those specific subjects). What emerges for the reader is an understanding that successful software project management is a journey with many obstacles. To succeed, engineers must manage more than their projects. They must use their own experience and that of their teams to first understand and then plan the project ahead. They must influence their teams’ attitudes
and methods for doing disciplined work. And they must persuade their bosses to set aside ill-informed notions of schedules and resource commitments and look instead at hard, historical data.

The essays in Part I provide insights on types of plans and the planning process. Part II covers team building and motivation. Part III describes how to work with your managers and persuade them to use best practices. And Part IV examines your personal responsibilities, commitments, and processes.

These essays shine a light on the challenges inherent in software development and can set engineers on the road to understanding how to succeed. And while Watts’s particular expertise is software, practitioners in every field of business will benefit from the wisdom and advice contained here.

—Bill Thomas
First and foremost, my thanks to Bill Thomas for all the work he did in putting this book together. He did a superb job of selecting topics and ordering the material so that it makes a cohesive whole. Even though I wrote all of the papers, reading them again brings back lots of memories of the wonderful experiences I have had in more than 60 years of professional work. In this time, I have been blessed with many opportunities and many wonderful associations. It has never ceased to amaze me how helpful people can be. Whether they are managers, peers, or subordinates, much of what I have learned has been due to the mentoring, advice, critiques, and even disagreements I have had over these years.

Second, I would like to comment briefly on where we are going. While what I have done has been exciting and rewarding, it is only a small step in the direction of the truly astounding changes coming in the not-too-distant future. Software has been hard to manage, because it is a new kind of work: large-scale knowledge work. Starting before the design of the ancient pyramids in Egypt, humans have been doing knowledge work, but on a small scale. While lots of people worked on these massive constructions, only a few of them were creative designers.

The first clues that large-scale creative work could be different were with the ancient cathedrals. While many people worked on
them, the overall architecture was designed by a very few people. However, there were hundreds of skilled artisans who also did creative work. They saw themselves as creating a cathedral for God, and they worked, not for some chief engineer or boss, but for the Almighty. These workers were volunteers, and they had an overall vision and motivation that was more than just doing a job. Of course they didn’t manage to tight schedules or control costs, but they did manage themselves.

What makes software more like building cathedrals than traditional work is that it is large-scale creative work. Never before have dozens, hundreds, and even thousands of people tried to work together to produce a single massive creation. Now, with the advances being made in team and multi-team management, we are learning how to do large-scale knowledge work.

Once these methods are widely practiced, we will see an enormous flowering of creative engineering. Large and complex systems will be produced on predictable schedules and for planned costs. As soon as we can do this, the possibilities of what we can design and build will be greatly expanded. We will be able to do many of the things we have thus far only dreamed about.

When we have truly mastered large-scale knowledge work, we will be ready for some unprecedented international crisis like deflecting a rogue meteoroid or reengineering the earth’s atmosphere. Assuming that we have the vision and technology, we will then have the management skills to actually bring off such a massive project and to do it on a predictable schedule. Hopefully, such international crises will not arise and, hopefully, there will be no need to escape to another world or to rebuild this one, but with these new knowledge-working methods, we should be able to do it.

Finally, I have dedicated this book to three marvelously skilled doctors. About a year ago I was told I had an inoperable cancer
of the liver and given three to six months to live. By a series of almost miraculous events, we found Dr. David Ryan at Mass General Hospital who introduced us to Dr. Theodore Hong, a radiologist who had invented a treatment specifically designed for my kind of cancer, and to Dr. David Forcioni, a gastroenterologist. Because of the care and skill of these three gentlemen, I completed the treatment and the latest reports show no sign of cancer. Dedicating this book to them is my way of saying thank you.

—Watts Humphrey

January 12, 2010
commitment next time. The estimates should be reviewed to see what was overlooked, and the contingencies should be revised to include the new experiences. By comparing actual performance with the estimates, engineers soon learn to make better estimates. This is why the people who will do the work should make their own plans: to learn how to consistently make commitments they can meet.

4.3 A GOAL IS SOMETHING YOU WANT TO ACHIEVE

The dictionary defines a goal as “the result or achievement toward which effort is directed.” Goals concern results and efforts, but most importantly they concern direction. Goals provide direction and focus for our efforts. They clearly define the end that we desire and establish a priority for the required work.

Goals also imply several other things. For example, you need to know whether you have achieved the desired result and where you are along the way. Are you winning or losing and are your efforts likely to be successful? All of these—the result, direction, measurement, and effort—are involved in setting and achieving goals.

Goals are useful for individuals. Few would argue that, without a goal, it is impossible to strive. Without some objective, all the effort seems pointless and a waste of time. After all, if the effort doesn’t get you anywhere, why bother? Thus, a goal concerns a destination, and this destination must be some place or some state that you really would like to achieve. This could be losing weight, getting a higher score, or delivering a product, but the goal provides a concrete objective toward which to strive.

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Another way to think about goals is in the negative. A key reason given when the presumed better competitor loses in boxing, track, or any other sports competition is that he or she did not want to win badly enough. Similarly, in building products, it is widely accepted that when people don’t strive to build quality products, they generally won’t. In fact, they really cannot. Challenging goals are not achieved by mistake. If you don’t consciously strive for them, you almost certainly will not achieve them.

So, goals are not just an invention of management, they actually satisfy a fundamental human need. The goal defines our purpose: why we are here, why we are working, or what we intend to achieve. Simply put, without a goal, you cannot succeed and, if you cannot succeed, why try? Goals are the motivators for human endeavor. They energize our lives and our work. They give us purpose. Achieving a goal provides a sense of achievement and satisfaction. Goals are important to people and they are even more important for teams.

Teams need goals for all of the same reasons that individuals do. In addition, goals provide a common working framework for the team. The goal is something that everyone agrees on and can cooperatively work to achieve. The goal helps to resolve issues. Does this activity move the team toward the goal or would something else be more effective? If some action does not help to achieve the goal, why bother doing it? After achieving a goal, the team members have something to celebrate. It was hard work, but they brought it off. It was a team achievement and everyone shares in the celebration and in the credit.

Without a common goal on which all members agree, you have a loose collection of individuals who share only a common trait or facility; you cannot have a team. It would be hard to imagine an athletic team where the members did not all share a common goal, agree on precisely what that goal was, and know exactly what the score was at every point in the play. In addition,
most needed. When time is short, engineers should take special care to avoid mistakes. Unfortunately, experience shows that this is the very circumstance when engineers and their managers are least likely to allow the time to do reviews, inspections, or thorough testing.

*Loss of trust.* If you frequently miss commitments, people will notice. They will learn that when you commit to something, you often don’t keep to your word. Such a reputation is hard to repair and will affect your grades, your job ratings, your pay, and even your job security.

*Loss of respect for your judgment.* When people do not trust what you say, they are unlikely to ask for your opinion and they are more likely to insist that you work to unreasonable schedules.

The most important single asset a software engineer can have is a reputation for meeting commitments. For people to trust your word, you need to say what you plan to do and then do what you say.

### 7.12 WHAT DO YOU WANT FROM LIFE?

What do you want from your life? This is a big question that many people have trouble answering. A few points are worth considering as you think about the answer.

One way to get satisfaction from a job is to have status or power. People can get this by being a boss or being put in charge of an important service. Power and status can also be indirect, like making a lot of money, working for an important company, or driving a fancy car. These are all parts of “being” someone.

While there is nothing wrong with status, it is temporary. You may hold an important job for a while but, sooner or later, your next step will be down. Losing status can be a crisis. Some people are devastated when they first lose an important job. It is easy to confuse the importance of a job with personal importance.
I have known managers who were crushed by a demotion. They had built an image of themselves as important people. As long as they held a big job, everybody treated them as important. The minute they lost that job, however, they were just like everyone else. Nobody cared what they said and they stopped getting special treatment. They had lost the corner office and no longer had a secretary. This can be such a severe shock that some people have nervous breakdowns, heart attacks, or family crises. Their reward was status and it is gone.

The need is to decide what it is that you want. Think ahead. When you ultimately retire, what would a satisfying life look like? I suggest that what you have done will be far more rewarding than what you have been. If, for example, you plan to do engineering work, you probably have the instincts of a builder. Maybe you will build systems or components. You could end up building methods or processes. Or you might have a scientific bent and build theories or do research to build fundamental knowledge.

Whatever you build, however, quality will be key. You will get little satisfaction from sloppy work. Somehow, even if no one else finds out, you will know you did a sloppy job. This will destroy your pride in the work and it will limit your satisfaction with life. You cannot honestly say to yourself that you really believe in quality, but you will just get by this one time. There are always lots of excuses. You might even satisfy others with an expedient answer, but you will never satisfy yourself.

When you do quality work, you will be proud. Even if no one else knows, you know you did a first-class job and you are satisfied that you did your best. The surprising thing is that quality work gets known. It may take a long time, but sooner or later quality work is recognized. Whether you know it, you will get credit for the quality of your work.

So ask yourself this question: “Do I want to feel proud of what I do?” Most people would answer yes. But if you really
mean it, you need to set personal standards and strive to meet them. When you meet these standards, raise them and strive again. Challenge yourself to do superior work and you will be surprised at what you can accomplish.

7.13 DEVOTE YOURSELF TO EXCELLENCE

As you look to the future, you will face many questions. How will your field evolve, and what can you do to meet the mounting challenges? While no one can know, your progress probably will be limited by your ability to build your personal skills. Make practice a part of every project and measure and observe your own work. You cannot stand still, so you should treat every project as a way to build talent rather than merely treating your talent as a way to build projects.

Deciding what you want from your chosen field is like asking what you want from life. Surprisingly often, people achieve their objectives, but in ways they did not expect. Life rarely turns out the way we plan. While our carefully developed strategies may go down in flames, a new and more rewarding opportunity shows up in the ashes. The key is to keep an open mind and to keep looking. In life, we all reach the same end, so we need to concentrate on the trip. Just as with a process, once you decide how you want to live, the rest will follow. Devote yourself to excellence, and you just might achieve it. That would be worth the trip.

SOURCES

7.1: From PSPSM: A Self-Improvement Process for Software Engineers, Chapter 1

7.2: From The Watts New Collection: Columns by the SEI’s Watts Humphrey, Number 8 2007, “Being Your Own Boss—Part IV: Being a Victim”

7.3: From Introduction to the Personal Software ProcessSM, Chapter 1
As a team leader, you will not generally face the problems of organization-wide change. However, it is important to consider the common symptoms of poor leadership and to ensure that your leadership style does not create similar problems. Poor leadership has many symptoms, but it generally stems from a failure to see what is needed and to set a direction that takes advantage of the available resources and opportunities.

It is often difficult to be objective and to establish goals for what to do and how to do it, but the key is to realize that you do not need to do it all by yourself. The modern world is simply too complex and no one person is smart enough or has enough knowledge to figure out everything without assistance. While you likely must make many leadership decisions yourself, you should take advantage of the intelligence, ideas, and creative suggestions of your team.

There is ample evidence that the combined intelligence of a group produces better results than even the most skilled and talented individual. So use your team. It needs leadership; it wants leadership; and it will gladly help you to provide that leadership.

8.4 LEADERSHIP MUST BE EARNED

Management uses resources to accomplish results; leadership motivates people to achieve objectives. Managing is impersonal and can be demeaning. It presumes that those being managed don’t have ideas and feelings and must be told what to do and how to do it. Management is appropriate for handling inanimate objects or routine jobs. However, people like to be motivated to accomplish more challenging tasks, and they do not like being herded and directed as if they were so many cattle.

Most of us enjoy technical work, and we sought development careers because we like to do creative and challenging things. We also like to see the results of our labors, particularly when our products work the way we intended. But when someone treats us as if we were stupid or unthinking, we lose our energy and creative spark. As team leader, you will probably have to manage at least some routine work, but development engineering calls for leadership and for energetic and motivated teams. That is the only way to consistently produce truly superior results.

One principal distinction between leaders and managers is that managers direct people to obey their orders while leaders lead them. This crucial distinction is best illustrated by an example. One software manager, Ben, told me how he learned what leadership was all about. He was a marine lieutenant in Vietnam and, for the first time, he was leading his platoon into combat. As they approached the front lines, the captain told him, “Take that hill.” “That hill” was where the enemy was dug in with a machine gun. There was no time for a discussion, so Ben told his troops, “Follow me,” and he started running up the hill. He told me that all he could think of as he ran was not whether he would get shot or what would happen if he got to the top. The question that kept running through his head was, “Are they following?” It turned out that they were and they took the hill, but Ben told me that he learned right then that the two key ingredients of leadership are getting out front and trusting your troops to follow.

So leadership is intensely personal. It is not something that you can order and it is not something that you can measure, evaluate, and test. It is a property like loyalty or trust. It cannot be bought or inherited. It must be earned, and earned through long and often painful experience. It can, however, be lost in an instant. All you need to do is to stop behaving like a leader. Then your followers will stop following. They may continue to
obey you, but you will soon sense that you no longer have their loyalty and trust. You can only tell if you are a leader by what happens: you are leading and they are following their leader.

What sets leaders apart from everyone else is that they have followers, and what attracts followers is a challenging and rewarding goal. It is impossible to be an effective leader without being committed to a cause that animates you and motivates your followers. Your energy and drive then come from your personal commitment to accomplish this objective.

This can’t be just any goal—it must be something that you feel strongly about and will strive to accomplish. You must be sufficiently committed to this goal so that you can exhort your troops to achieve it, in spite of all obstacles. While development projects can have this character, that is not always the case. But, as we shall see, it is usually possible to excite creative people about the challenges and rewards of producing something entirely new and original.

8.5 STRIVE TO BE A TRANSFORMATIONAL LEADER

How do you feel about the job you have to do? Are you excited about it and dying to be part of creating this marvelous new product? If you view the job as just another chore, you have little chance of building the team’s excitement to the feverish pitch required for great work. Excitement is contagious, but so are boredom and laziness. As a leader you not only set the team’s pace, but you also establish the attitude. If you want this team to win, they must act like winners. And for them to act like winners, you must act like a winner and also treat them as winners. It all starts with you.

Think about your job and what you can do to make it an exciting project where people will want to work. If you wake up in the middle of the night with ideas on how to attack a major
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