

# Knowledge Topics: A Vital Project Resource

BY DON COHEN

NASA projects require a variety of resources. Money, of course. Appropriate technical and management skills. Raw materials and (often) existing components, an infrastructure of equipment for building and testing hardware, a launch vehicle or aircraft for flight projects. Enough time to get the work done.





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There is another resource vital to successful projects that is unlikely to be mentioned in plans, budgets, or technical documents: social capital.

### What Is Social Capital?

To put it in the simplest terms, social capital is the value of the connections between people. An individual's social capital typically consists of an informal network of relationships—the people you can go to for advice, information, knowledge, and assistance. (And those same people will come to you for similar help.) In organizations, these personal-professional networks are essential to getting a lot of work done, but they are not recognized on org charts or other official documents.

People naturally seek out colleagues they have gotten to know over the course of their careers whose abilities they respect and—equally important—whom they trust to understand their requests and respond to them constructively. When faced with an especially tricky problem, established professionals are much more likely to go to these colleagues for help than they are to consult a database or other “knowledge repository.” Almost by definition, the tricky problem involves subtleties that cannot be explained in a written report or database entry, subtleties that can be teased out and understood in conversation between professionals. Discussing an issue with a colleague usually involves more than being handed an answer; it is an opportunity to collaborate on your problem, to think it through together.

That preference for going to a trusted person for help is doubly strong when the issue involves judgment and not just technical expertise. In fact, though the personal connections of social-capital networks are essential pathways for the transfer of technical knowledge, they are at least as important as sources of information and advice about “how things are really done around here”—the political realities, workarounds, unwritten rules and expectations, and influences that have such a powerful effect on project and personal success.

### How Is Social Capital Developed?

Probably the most important builders of these social-capital networks in organizations are the experiences people have

working together over time. In an organization like NASA, where most work is project work, being part of a series of project teams with overlapping but changing membership creates opportunities to form lasting relationships that are career-long sources of knowledge and assistance. Opportunities to spend time with people involved in similar work at conferences and workshops also help build these personal networks.

But there is nothing automatic or certain about that relationship building. It depends on and benefits from a set of conditions that may or may not exist in a given organization or part of an organization. Foremost among them is a culture of trust—a sense that good will, honesty, and cooperation (though not universal in any organization) are the norm rather than the exception.

Trust in organizations develops over time, built by interacting with leaders, managers, and colleagues who are trustworthy, by the experience of fairness in promotion and giving credit for accomplishments, and by people being trusted enough to be given some autonomy in deciding how best to get their work done. Many experienced project managers at NASA and elsewhere talk about telling their team members *what* needs to be done and *when* it needs to be finished, but leaving the *how* up to them. (The opposite of this kind of trusting behavior is micromanagement that overwhelms the micromanager with work even as it undermines the initiative, talent, and goodwill of the person being managed.)

For obvious reasons, having a shared meaningful goal enhances trust and cooperation. Knowing that both you and your colleagues are working toward an aim that you all value and that is larger than personal success or advancement is a solid foundation for a collaborative relationship. It can counterbalance some personal differences that might otherwise stand in the way of helping one another.

Long tenure is also a social-capital builder. The longer individuals are in an organization, the more people they meet, and the more chances they have to solidify relationships through repeated work together and opportunities to meet. And, in most cases, the more they know about the organization and how to do their work—that is, the more knowledge they have to share.



No organization is uniform. NASA, like every diverse and dispersed organization of any size, has many subcultures and different employee experiences good and bad. So it is not possible to generalize confidently about social capital at NASA. But there are features of the organization that strongly encourage these networks. I have already mentioned the extensive project work. As much as any organization in the world, NASA is characterized by important shared goals. The vast majority of civil servants and contractors are passionate believers in NASA's missions to advance science, technology, and exploration. Experienced project managers talk about how reminding teams of their shared mission has the power to counteract personal disagreements and potential discouragement over budget constraints or intractable technical problems. And people who work at NASA tend to stay many years, building up their networks over decades. Even many retirees stay involved, offering their "graybeard" expertise to younger colleagues both informally and through their involvement in review boards and advisory groups.

### Some NASA Examples

Probably every NASA project can offer multiple examples of social capital at work—instances where team members went to trusted mentors or former colleagues or other professional acquaintances for help solving a technical problem or an issue related to how their project is being carried out or how it is perceived or supported by others.

Here is one example of the power of social-capital connections to address a tricky technical issue.

#### "Give Me Two Pictures"

Rob Manning, chief engineer of the Mars Exploration program at the Jet Propulsion Laboratory, tells this story about a design breakthrough for entry, descent, and landing of the Spirit and Opportunity rovers:

We put these three rockets in the backshell and a little inertial sensor that allows us to figure out which way was up. The problem is, winds could be pushing along horizontally.

I'm thinking, I've got to get a horizontal velocity sensor. If there's a big steady wind pushing it along horizontally, right now the vehicle has no idea that's happening. If the spacecraft knew the velocity, it could use the small rockets to adjust for that. I told my friend Miguel San Martin, "I need to get Doppler radar on the vehicle to measure velocity." He puts two fingers up and says, "Give me two pictures." I said, "Oh, my God, what a brilliant idea. Who should I talk to?" He says, "Call Andrew Johnson. He does two-dimensional image-correlation algorithms." I knew this was not going to go over well with the project management. Emergency systems engineering, adding new subsystems at the last minute, is a sign of weakness. Luckily, it turns out we built rover electronics with ten camera ports but only nine were needed. We wanted to modify one of the existing science cameras and put it looking down and have it take pictures on the way down. It could compare two pictures. If they shifted by a certain amount and if you knew the time between them, you'd know how fast you were moving. We took three pictures—to double-check. Within six months it was in the design. Had we not used it, we would have ended up bouncing at 60 mph right toward the southern rim of Bonneville crater, where those sharp, wind-carved rocks called ventifacts lived.

Manning's story offers a vivid picture of social capital at work. A conversation with a friend quickly leads to an innovative technical solution to a problem that a much longer formal knowledge search of documents and databases would probably never have found. And the friend directs Manning to someone in *his* personal network who has the specialized expertise needed to make the idea work. Getting that new contact shows another aspect of the power of social networks: they frequently provide access to the acquaintances of one's acquaintances, vastly expanding the potential resources of knowledge and support.

#### The Orbital Boom Sensor System

After the *Columbia* accident, the shuttle fleet was grounded until the orbiters could check for thermal-protection system damage

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before returning to Earth. Kim Ess was project manager for the orbital boom sensor system, which gave them that capability. She notes:

We didn't have to convince anyone that the work mattered to the space program and to the safety of our astronauts. And the importance of returning to flight and preventing future catastrophes gave us a defining and unifying goal that inspired hard work and cooperation, although, as with any project, it was important to help team members keep the goal in view as they dealt with the details, complexities, and inevitable frustrations of their parts of the work.

An important shared goal—a “unifying aim”—fostered cooperation, building trust-based social capital. Ess also emphasizes the importance of personal contact. Teleconferences were important for sharing information, but, she says, “Travel, travel, travel was the most important part of our communication strategy.” It was the only way for people to develop real working relationships—robust social capital. She adds:

Over time, we established a we-have-a-problem attitude rather than a they-have-a-problem attitude. Having people travel from site to site contributed to this change. As people got to know and trust each other and recognize that we were all working toward the same goal, information about problems became just data for the team to work with, not indications of failure.

### Reviews and Social Capital

The reviews that are a standard part of NASA projects are an interesting example of a meeting place of formal process and informal social capital. Most NASA projects include milestone reviews (such as preliminary design review and critical design review) during which a board of experts from outside the project examines its progress and questions project team members to determine if the work is technically sound enough and adhering to schedules, budgets, and other managerial requirements well enough to proceed to the next stage of development. They often

pose tough questions that show the project team where serious work needs to be done.

Part of the process—the social-capital part—involves both the formation of the review panels and their questions and recommendations. Often, the project team leaders have some say in who will be on the boards and suggest members whose expertise and commitment they especially respect. So, although they are outside the project and likely to be tough critics, they are generally trusted colleagues, not strangers. Often, too, when they find a weakness or risk in the project that needs to be addressed, the review board members bring *their* social networks into the picture, saying, “You probably want to talk to X at Langley,” or, “Y at Goddard is an expert in this.” So the review process helps expand the network and the knowledge resources of the project team.

### Maintaining the Resource

Managers who recognize the importance of social capital as a project resource will take steps to protect and enhance it with the same kind of care they devote to other vital resources. Investing in social capital is not expensive and the dividends it pays are immense. These are, in summary, a few of the ways project leaders can help develop and maintain it:

- Trust team members to make decisions about how best to do their work.
- Give people time and space to talk to colleagues inside and outside the project. Recognize that informal conversations away from the computer or workbench (over coffee or a meal) often contribute to knowledge sharing and problem solving.
- Invest in travel for yourself and others on the team: face-to-face meeting matters.
- Help the team keep their shared goal in mind.
- Be open to good new ideas from any source.
- Give team members enthusiastic, public credit for the good work they do. ●