

## Lessons in Leadership: Robert Oppenheimer and the Los Alamos Laboratory

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The leadership of Robert Oppenheimer, Director of the Los Alamos Laboratory during WWII, serves as a vivid lesson in leadership. The recollections of those who worked with Oppenheimer at Los Alamos clearly attribute much of the success of the laboratory to Oppenheimer's leadership. Of specific interest are: Oppenheimer's efforts in recruiting, his ability to create a sense of meaning and purpose at the laboratory, his technical competence, and his ability to generate commitment and involvement among members of the laboratory.

**Key words:** Leadership, Robert Oppenheimer, Manhattan Project, Los Alamos Laboratory

In August, 1945, the Los Alamos Laboratory (known as Project Y) of the Manhattan Project completed its mission: develop a nuclear weapon that could be used in World War II. The achievement was extraordinary. The field was so new and the challenges were so incredibly complex that, at the founding of the laboratory in April 1943, the necessary equipment and experimental techniques simply did not exist (Lawren, 1988). Yet, under the leadership of its director, Robert Oppenheimer, the laboratory did achieve its mission in just over two years.

The recollections and records of those who worked with Oppenheimer are generally in agreement—Oppenheimer was an outstanding leader and much of the success of Los Alamos is attributable to his leadership. Since Oppenheimer was so successful in his leadership role, examining his leadership is not only interesting but also worthwhile. As Burns (2003) suggests, the best way to understand leadership is to study the “distinguishing characteristics” of leaders themselves. The study of historical leaders allows us to glean lessons that are applicable to leaders in contemporary organizations (Kets de Vries, 2003; Wilhelm, 1996).

Although Los Alamos was, in some ways, a unique organization, Oppenheimer's role as leader would have been fairly straightforward and similar to leaders in almost any organization: attract a competent workforce, align its activities to the organization's mission, and promote collaboration and cooperation across the organization (Collins, 2001; Kouzes & Posner, 2002). In addition, given the highly technical mission of the laboratory and that Oppenheimer held the title of “Scientific Director,” his own technical competence would have been vital (Kouzes & Posner, 1993).

These four aspects of leadership provide the framework for examining Oppenheimer's leadership. Approaching Oppenheimer's activities from these perspectives and employing related theoretical perspectives, this paper will attempt to address an important research question: Why

was Oppenheimer such a success in his leadership role at Los Alamos? The answer to that question also provides lessons that contemporary leaders can take from Oppenheimer's success.

A brief historical overview of Oppenheimer's leadership at Los Alamos is presented first. This overview includes a number of general observations about Oppenheimer's leadership from individuals who knew him well. This overview is followed by a review and analysis of key attributes of Oppenheimer's leadership in an attempt to answer the research question. In addressing this question, this paper will rely extensively on the recollections of those who worked closely with Oppenheimer at Los Alamos.

### **Historical Overview**

Oppenheimer was a surprising and controversial choice as director of the laboratory. General Leslie Groves (1962), who served as the Military Head of the Manhattan Project and who appointed Oppenheimer director of Los Alamos, later wrote that "Oppenheimer would [now] be considered a natural choice because he proved to be so successful . . . [but] no one with whom I talked showed any great enthusiasm about Oppenheimer as a possible director of the project" (p. 61). Groves (1962) would later conclude that that no one could have done better, or even as well, as Oppenheimer had as director of the laboratory.

I. I. Rabi (1969), a Noble Prize winner in physics who served as a consultant to the laboratory during the war, said, that based on experience and personality, it is difficult to imagine a less likely choice than Oppenheimer as the director of such a massive undertaking. Yet, Rabi was also later to state that it was "genius" to appoint Oppenheimer because he "did a fantastic job" (Lawren, 1988).

James Tuck, a British physicist who worked at Los Alamos, argues "By the grace of God the American government got the right man . . . A lesser man could not have done it" (Davis, 1968, p. 187).

Robert Bacher (1972), who as leader of the Experimental Physics Division at Los Alamos worked closely with Oppenheimer, states that the selection of Oppenheimer as director "was a brilliant choice." Eugene Wigner (1992), a physicist who was deeply involved in the Manhattan Project, believes that much of the credit for the success of Los Alamos is directly attributable to Oppenheimer.

At the time, Oppenheimer was well known within the physics community, but was relatively unknown to outsiders, especially to the government leaders who initiated the bomb project. He was also considered to have a number of weaknesses that would make running a laboratory difficult. According to General Groves (1962), Oppenheimer had two major weaknesses: the lack of a Nobel Prize in physics, and a lack of administrative experience. Groves (1962) considered, at the time, a Noble Prize to be critical—only a Noble Prize winner would have the sufficient "prestige among his fellow scientists" to lead the laboratory; Groves indicates that he was not alone in this belief.

Other than his experience in building the theoretical physics department at the University of California at Berkeley, Oppenheimer had no administrative experience; a weakness which became painfully obvious as Oppenheimer attempted to organize the laboratory (Bacher, 1972; Dudley, 1980; Seidel, 1995). Groves also was concerned that, as a theoretical physicist, Oppenheimer lacked the experimental background that was considered essential in the actual building of the bomb (Groves, 1962).

Oppenheimer also had interpersonal weaknesses that would make leading a laboratory extremely difficult. He was viewed as “arrogant” (Wigner, 1992), was often “nasty” to others (Rhodes, 1986) and could, and frequently would, make others feel foolish and inferior (Bethe, 1991; Davis, 1968; Hoddeson, Henriksen, Meade, & Westfall, 1995; Lawren, 1988; Rhodes, 1986).

Oppenheimer clearly struggled in the early months of his role as lab director, particularly in his approach to organizational issues. He is described as approaching the project with a “loose, almost poetic impracticality” (Goodchild, 1980). A number of those who worked with Oppenheimer have described the early difficulties in getting Oppenheimer to focus on such issues as the basic design of the organization (Goodchild, 1980; Manley, 1980). Hans Bethe argued that, without the help of I. I. Rabi, the laboratory

would have been a mess because Oppie did not want to have an organization. Rabi . . . came to Oppie and said, ‘You have to have an organization. The laboratory has to be organized in divisions and the divisions into groups. Otherwise, nothing will ever come of it.’ And, Oppie, well, that was all new to him. (Rigden, 1987, p. 149)

Despite these weaknesses and his early struggles, Oppenheimer succeeded and, by all accounts, succeeded brilliantly. Overcoming his weaknesses, he became, as Edward Teller believed “probably the best lab director I have ever seen” (Rhodes, 1986, p. 570).

In identifying those factors that most contributed to Oppenheimer’s success, the recollections and perspectives of those who worked with Oppenheimer at Los Alamos are highly consistent; that is, these accounts share very similar viewpoints regarding Oppenheimer’s leadership. These viewpoints and recollections, along with Oppenheimer’s own recollections and correspondence, provide insight into understanding why Oppenheimer was successful in his leadership role at Los Alamos.

From these accounts and perspectives, four key factors emerge as fundamental explanations for Oppenheimer’s success. To be sure, other factors are mentioned, but the following four factors are noted more frequently and with greater intensity than other aspects of Oppenheimer’s leadership.

First, Oppenheimer was committed, from the very beginning of his tenure as laboratory director, to recruiting the best scientists he could to join the project, including in senior leadership positions at Los Alamos.

Second, Oppenheimer worked to create a sense of purpose and meaning at Los Alamos. While the laboratory had a very clear wartime mission, Oppenheimer was able to create meaning and purpose beyond this official mission. While this sense of meaning had a direct impact on the environment that existed at Los Alamos, it also was linked to Oppenheimer's success in recruiting scientists to Los Alamos.

Third, Oppenheimer had outstanding technical and analytical skills. In fact, the impact and importance of Oppenheimer's technical and analytical skills are among the most common recollections of those who worked with him in those years.

Fourth, Oppenheimer was able to create an organization characterized by high participation and involvement. It is Oppenheimer's efforts in building high involvement that is most often mentioned by those who worked at Los Alamos.

Each of these four factors, along with Oppenheimer's activities and successes in each, are discussed below. This discussion will also incorporate relevant contemporary leadership approaches and perspectives in examining Oppenheimer's leadership. The paper will conclude with a discussion of the implications of Oppenheimer's leadership for current managers and leaders.

### **Oppenheimer's Recruiting Efforts**

Jim Collins' recent, and well-received, book *Good to Great* (2001), argues that leaders must first focus on who, rather than what. That is, the first step in effective leadership is to ensure that the organization is populated with talented and committed individuals, especially in executive/senior leadership positions. Collins refers to this as "getting the right people on the bus" (p. 41).

The accounts of Oppenheimer's leadership clearly suggest that Oppenheimer did exactly this—to the point of ruffling a few feathers in the process (Seidel, 1995). In fact, within days of his appointment as director by Groves (perhaps even before the appointment was official) Oppenheimer wrote to John Manely with the suggestion that they "start now on a policy of absolutely unscrupulous recruiting" (Smith & Weiner, 1980, p 231). Oppenheimer wanted the best staff he could get, even if it meant "stealing" them from other war-related projects. In a letter to James Conant in the fall of 1942 (Conant was director of the National Defense Research Committee, a federal organization responsible for mobilizing and organizing scientific resources in support of the war effort), Oppenheimer defends his raids on other laboratories with the justification that the raids are necessary and that the "dire predictions of disastrous disruptions" are unfounded (Smith & Weiner, 1980, p. 241).

The point is not that Oppenheimer angered others with his aggressive recruiting of scientists working at other facilities. The larger, far more important, point is Oppenheimer's determination to bring the best scientists to Los Alamos, and not settle for whoever might happen to be available. If that meant encouraging scientists to leave other laboratories and facilities, then so be it.

In anticipating resistance to his requests that key scientists be released from their current positions to join Los Alamos, Oppenheimer wrote in his letter to Conant, "I am inclined not to take too seriously the absolute no's with which we shall be greeted" (Smith & Weiner, 1980, p. 241). According to Oppenheimer, "The job we have to do will not be possible" without the proper staff (Smith & Weiner, 1980, p. 241).

A good example of Oppenheimer's commitment to acquiring the best scientists can be seen in his recruitment of two key scientists, Robert Bacher and Hans Bethe. Consistent with Collins' (2001) argument that leaders must first work to build a superior executive team, Oppenheimer desperately wanted both Bacher and Bethe to join Los Alamos in leadership positions.

In a February 1943, letter to I. I. Rabi, Oppenheimer asks for Rabi's help in convincing both Bacher and Bethe to join Los Alamos:

There are two men who I should be more than reluctant not to have on the project: Bethe and Bacher. I think that you know the reasons in each case, and agree with them. You have a great deal of influence with these two men, and they in turn on many others who are involved in the project. I am asking that you use that influence to persuade them to come rather than to stay away. (Smith & Weiner, 1980, p. 250)

In a later letter to Bacher, who was unsure whether he wanted to go to Los Alamos, Oppenheimer makes clear his desire to have Bacher join the laboratory:

You know that I have been extremely eager to have your help in this work. I think perhaps that you have not fully realized how much I appreciated your administrative experiences and obvious administrative wisdom, nor how aware I am of our need for just this in the present project. These . . . qualifications make you, in my opinion, very nearly unique, and that is why I have pursued you with such diligence for so many months. (Smith & Weiner, 1980, p. 254)

Both Bethe and Bacher did join Los Alamos. Bacher served as the director of the Experimental Physics Division, and Bethe as director of the Theoretical Physics Division. Both made significant contributions to the success of Los Alamos.

Oppenheimer's aggressive recruiting of Bethe and Bacher also illustrates an important element in his approach to attracting scientists to Los Alamos. Oppenheimer focused his initial attention on recruiting scientists who were well known and highly respected (e.g., Bethe and Bacher); attracting these scientists would bring a high level of credibility to the project (Goodchild, 1980). In a letter to Hans Bethe, Oppenheimer wrote, "one of the reasons I am so optimistic about our future is that if we really get the men promised us there will be many others who will want to come" (Smith & Weiner, 1980, p. 243).

Focusing his efforts on scientists who were highly regarded in the scientific community would bring credibility to the project itself and allow Oppenheimer to continue to recruit the most able and qualified staff he could.

A final element of Oppenheimer's views regarding his recruiting lies in his definition of what he considered to be the necessary qualifications of scientists. The scientific qualifications were essential, but Oppenheimer was also concerned about interpersonal relationships and the ability of the staff to work well together (Seidel, 1995; Smith & Weiner, 1980). As he argued to Conant, "in a tight isolated group such as we are now planning, some warmth and trust in personal relations is an indispensable prerequisite" (Smith & Weiner, 1980, p. 242).

For Oppenheimer, then, interpersonal abilities were key characteristics of the type of scientists he needed at Los Alamos.

Consistent with Collins' (2001) argument, Oppenheimer's recruiting was key to his success at Los Alamos. He was determined in his efforts to attract the absolute best scientists he could to the project (Smith & Weiner, 1980) and his success in this regard was, without a doubt, essential to the overall success of the project.

### **Oppenheimer and the Creation of Purpose and Meaning**

A number of contemporary approaches to leadership strongly suggest that an essential element of leadership involves the creation of meaning and purpose (Bass, 1990; Kouzes & Posner, 2002; Nanus, 1992). These, and other similar approaches, are elements of what Bryman (1999) refers to as the "New Leadership Approach." According to Bryman, this approach suggests that the key role of leaders is as "managers of meaning." It is in this role that leaders define reality for members of the organization, as well as the link between members of the organization and that reality (Bryman, 1999). This sense of meaning and purpose, which is generally an element of the vision and mission of the organization (Bryman, 1999), is linked to high levels of effort, enthusiasm, commitment, and performance on the part of members of the organization (Kouzes & Posner, 2002).

There is little doubt the war itself, particularly the threat of German development of an atomic weapon, was central to the sense of purpose that existed at Los Alamos. Joseph Hirschfelder (1980), a chemist who worked at Los Alamos, wrote:

At Los Alamos during World War II, there was no moral issue with respect to working on the atom bomb. Everyone was agreed on the necessity of stopping Hitler and the Japanese from destroying the free world. It was not an academic question—our friends and relatives were being killed and we, ourselves, were desperately afraid." (p. 68)

However, while the war did provide the essential mission for Los Alamos, it is clear that Oppenheimer imbued Los Alamos with a sense of meaning and purpose beyond the official war-time mission. The accounts of those who worked with Oppenheimer so often refer to

Oppenheimer's ability to create meaning and purpose, that this attribute of his leadership is difficult to ignore. In some real way, as Victor Weisskopf (1969) remembers, Oppenheimer created a "unique atmosphere of enthusiasm and challenge that pervaded the place throughout its time" (p. 25). Weisskopf and others recall how this environment of meaning and challenge created a "sense of participation" (Weisskopf, 1969), "a sense of urgency" (Davis, 1968), and an understanding that each person at Los Alamos was "personally responsible for its success" (Bethe & Christy, 2000).

How did Oppenheimer create this sense of meaning and purpose? What the record suggests is that he was able to communicate to others not just an explanation of what Los Alamos would do, but also a vivid image of the type of place that Los Alamos would be. That is, Oppenheimer created meaning by articulating an image of Los Alamos that went beyond the official wartime mission. This image became a "beckoning symbol of all that [was] possible for the organization" (Nanus, 1998, p. 321).

This "all that was possible" for Los Alamos went beyond the building of a nuclear bomb. Los Alamos, according to Oppenheimer, would not just build a bomb. Rather it would be a place that would create "applications of untold benefit to mankind" (Smith & Weiner, 1980, p. 239). For Oppenheimer, the bomb was only a part of Los Alamos—the science behind the bomb, the chance to solve an incredibly complex problem, an opportunity to take on a great scientific undertaking were all part of Oppenheimer's image of Los Alamos (Rhodes, 1986; Wyden, 1984). At Los Alamos, scientists would have an opportunity to "leap for the big breakthrough" and "create the hitherto impossible" (Wyden, 1984, p. 94). Most fundamentally, Los Alamos would be a place where history would be made (Conant, 2005; Rhodes, 1986).

It is this image of the laboratory—as a place where history would be made—that contributed the sense of meaning and purpose that existed at Los Alamos and, in some significant way, also contributed to the sense of enthusiasm and devotion (Davis, 1968; Weisskopf, 1969).

The ability to create this compelling image of Los Alamos was perhaps most important as Oppenheimer worked to recruit scientists. Indeed, Oppenheimer, who was, "a first class manipulator of the imagination and interpreter of it" (Smith & Weiner, 1980, p. 221) found that he had to use his significant powers of persuasion to entice scientists to come to Los Alamos (Conant, 2005). Oppenheimer had to entice scientists to come because, as he remembered, many scientists had misgivings about the project itself (Conant, 2005), as well as concerns about the location and conditions of the laboratory: "The notion of disappearing into the New Mexico desert for an interminable period and under quasi-military auspices disturbed a good many scientists" (Rhodes, 1986, p. 452).

In order to overcome these barriers, Oppenheimer would frequently meet personally with potential staff to encourage them to join Los Alamos. While Oppenheimer's "recruiting pitch" did emphasize the wartime mission, he also emphasized other elements of his image of Los Alamos, e.g., the great scientific undertaking and the chance to make history (Davis, 1968; Smith & Weiner, 1980). For example, Robert Wilson, who left Princeton to join Los Alamos, remembers

that Oppenheimer's description of the project "sounded romantic" (Wilson, 1975). Leo Lavatelli, who also left Princeton and likely heard the same description as Wilson, remembers that Oppenheimer described Los Alamos with "a mystical earnestness that captured our imagination" (Davis, 1968, p. 161).

Admittedly, it is difficult to measure to what extent Oppenheimer's image of Los Alamos made a difference above and beyond the clearly specified, and unambiguously attractive, wartime mission of finding a way to end the war. This, along with the intrinsically interesting nature of the work itself (could a bomb really be built?), certainly are key factors in explaining the high level of commitment and enthusiasm that was present at Los Alamos. However, it is also clear that Oppenheimer's leadership did create some additional degree of meaning and purpose among those who worked at the lab. The impact is best described by Robert Wilson (1975) who later recalled that Oppenheimer's "poetic vision of what we were doing, of life, of a relationship with people, inflamed me. In his presence, I became more intelligent, more vocal, more intense, more prescient, more poetic myself" (p. 45).

### **Oppenheimer's Technical Ability**

One of the most outstanding characteristics of Oppenheimer was his scientific and technical expertise. Hans Bethe states that Oppenheimer "knew and understood everything that went on in the laboratory, whether it was chemistry or theoretical physics or machine shop. . . . It was clear also at Los Alamos that he was intellectually superior to us" (Rhodes, 1986, p. 570).

Other scientists have made similar observations about Oppenheimer. Joseph Hirschfelder (1980) states that Oppenheimer was "absolutely brilliant" and had "a genius for finding other people's mistakes" (p. 79). Emilio Segrè (1970) remembers Oppenheimer's "iron memory" and that he was the "fastest thinker I have ever met" (p. 134). I. I. Rabi believed that Oppenheimer was "the best [American] physicist of his generation" (Davis, 1968). Norris Bradbury, who succeeded Oppenheimer as laboratory director, believed that "Oppenheimer could understand everything" (Davis, 1968). Edward Teller speaks of "the great mobility of [Oppenheimer's] mind" and "his successful effort to know about practically everything important invented in the laboratory" (Rhodes, 1986, p. 570).

Oppenheimer's scientific and technical abilities are examples of the importance of technical competence in leaders (Kouzes & Posner, 2002; Northouse, 2004). Kouzes and Posner (2002) argue that the importance of technical competence of leaders will vary depending on the position in the organization, as well as the nature of the industry; their general conclusion is that strong technical skills would be less important the more senior the leadership position. However, Kouzes and Posner (1993) also suggest that strong technical and intellectual skills may be quite important for senior leaders in highly technical organizations—Los Alamos was certainly such a place. The basic nature of Los Alamos and its mission (Hoddeson, et al., 1995) along with Oppenheimer's role as the scientific leader of the laboratory (Groves, 1962) would suggest that scientific and technical competencies would be essential to Oppenheimer's leadership (Kouzes & Posner, 1993; Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000). The historical record

strongly suggests that Oppenheimer's technical and scientific knowledge was a major factor in his success at Los Alamos.

As noted by Hans Bethe, Oppenheimer understood everything that went on at Los Alamos and had the ability to "keep it in his mind and coordinate it" (Rhodes, 1986). Oppenheimer, according to Bethe, "understood immediately when he heard anything, and fitted it into the general scheme of things and drew the right conclusions" (Rhodes, 1986, p. 570).

Robert Serber, a student of Oppenheimer's who joined him at Los Alamos, recalls how Oppenheimer could "show up at innumerable different meetings at Los Alamos, listen, and summarize in such a way as to make amazing sense (Davis, 1968, p. 184).

Other colleagues of Oppenheimer provide more specific descriptions of how Oppenheimer's abilities contributed to the resolution of difficult problems and to the ultimate success of the laboratory. George Kistiakowsky (1980) remembers Oppenheimer could organize the entire project in his mind and "make the right technical decisions." According to Robert Bacher (1972), Oppenheimer "had a tremendous ability to put his finger on critical issues and his clarity of summary after a complicated discussion often made the difference between moving forward and backward" (p. 282).

These were qualities, according to Bacher (1972), that Oppenheimer demonstrated over and over as director. Victor Weisskopf (1969) remembers that Oppenheimer

had an extraordinary talent for grasping the essential points of a problem, even in fields far removed from his special training. His ability to be ready with the answer before one had finished formulating the question helped him to be aware of everything interesting that happened on the hill [Los Alamos]. (p. 132)

What these accounts strongly suggest is that Oppenheimer's technical and scientific knowledge was a key factor in his leadership success at Los Alamos. In fact, as Bacher (1972) indicates, that knowledge was one of the key determinants of the success of the laboratory.

### **Oppenheimer and the Creation of Involvement**

Participative management styles have frequently been identified as contributing to organizational and leadership success (Yukl, 1998) and contemporary perspectives strongly argue that organizational success is enhanced as leaders build involvement and collaboration among organization members (Howard, 1997; Kouzes & Posner, 2002; Lawler, 1992). Perhaps the most fascinating characteristic of Oppenheimer during his time as director of the laboratory was his ability to create a sense of involvement and participation among those who worked there. It is also the characteristic most frequently mentioned by those who worked with Oppenheimer at Los Alamos.

Oppenheimer sent a clear message that the work of each member of the laboratory was important to the entire project (Rhodes, 1986). According to Joseph Hirschfelder (1980), Oppenheimer

believed that even the lowliest janitor could contribute significantly to the project. Raemer Schreiber, a physicist at Los Alamos, remembers that Oppenheimer “gave you a sense of urgency and made you feel that what you did was important” (Davis, 1968, p. 183).

Although the record is clear that Oppenheimer personally encouraged and advocated involvement and participation (Davis, 1968; Hirschelder, 1980), much of his success in building involvement at Los Alamos most likely results from his decisions related to the structure of the laboratory. Oppenheimer was determined to design an organization which encouraged the open sharing of information and, perhaps more importantly, facilitated participation and involvement at Los Alamos.

From the very beginning Oppenheimer believed and argued that every scientist working at Los Alamos should fully understand what was being developed in order to participate completely in the project. Initially, the project was characterized by “compartmentalization.” That is, scientists working on different facets of the project would be isolated physically and intellectually from each other in order to maintain security. Oppenheimer, over Groves’ initial opposition, refused to permit any compartmentalization at Los Alamos—he insisted that every scientist receive full information regarding the nature and status of the project and, perhaps more importantly, be able to discuss his work with his peers (Bethe, 1991; Manley, 1980). Oppenheimer, as Bethe remembered, “had to fight hard for free discussion,” but ultimately won Groves over (Bethe, 1991). Oppenheimer’s commitment to openness can be seen in one of Oppenheimer’s first decisions regarding the work of the laboratory.

In April of 1943, as the laboratory was preparing to begin its work, a series of introductory lectures was held. These lectures, which involved all the scientific staff who had come to Los Alamos, summed up the current theoretical and experimental progress and clearly outlined the program to build an atomic bomb. These lectures, however, were highly interactive and were, as John Manley (1980) recalled, “long discussions of all problems which could be foreseen.” These introductory discussions established a climate of “free flow of information and discussion” (Bethe, 1991) that characterized Los Alamos during the war. (Bethe, 1991; Bethe & Christy, 2000).

In addition to the introductory lectures, other elements of the structure of Los Alamos reflect Oppenheimer’s commitment to participation and involvement, and the open sharing of information. Three aspects of the structure of the laboratory illustrate this commitment.

First, Oppenheimer organized a governing board that consisted of the leaders of the various divisions (there were four divisions originally: Theoretical Physics, Experimental Physics, Chemistry and Metallurgy, and Ordnance), several administrative officers, and other individuals in important technical positions (Hawkins, 1983). The purpose of the board was to address general laboratory and administrative issues, as well as to coordinate and relate the work of the various divisions within Los Alamos, and to coordinate the work at Los Alamos with the other facets of the Manhattan Project (Bethe, 1991; Hawkins, 1983). This board met weekly.

Second, Oppenheimer organized a coordinating council which consisted of all members of the laboratory at the Group Leader level and above, about 50 people total (the divisions were organized into groups, each led by a group leader). The function of the coordinating council was primarily technical; it kept group leaders informed regarding important technical issues throughout the laboratory and served as a primary mechanism for the distribution of important technical and scientific information (Bethe, 1991; Hawkins, 1983). As with the governing board, the coordinating council met once a week.

Third, and perhaps most importantly, Oppenheimer insisted (again, over Groves' strong opposition) on a weekly colloquium at which progress on the project would be discussed openly (Manley, 1980; Seidel, 1995); all scientists involved in the project would be invited (approximately 300 scientists). The purpose of the colloquium was to provide a "generally complete and accurate picture of laboratory problems and progress" (Hawkins, 1983, p. 30). As previously discussed, this was a significant departure from the military policy of compartmentalization and, therefore, highly problematic (Hawkins 1983). It certainly explains Groves' opposition.

As suggested by current perspectives on participation and involvement (Kouzes & Posner, 2002), the refusal to compartmentalize and the weekly colloquium had an enormous impact on the morale and emotional commitment of scientists working at Los Alamos. (Alvarez, 1987; Rhodes, 1986; Wyden, 1984). David Hawkins (1983) argues that the colloquium, in particular, was "less a means of providing information than an institution that contributed to the viability of the laboratory and to maintaining the sense of common effort and responsibility" (p. 30).

Hans Bethe (1991) argues that because of the open sharing of information, especially the weekly colloquium, "everybody in the laboratory felt a part of the whole and felt that he should contribute to the success of the program" (p. 226.).

Recently, Hans Bethe and Robert Christy have responded to criticisms of Oppenheimer's leadership at Los Alamos by again emphasizing the impact that Oppenheimer's leadership had on the laboratory. Referring to the organization structure Oppenheimer created—the governing board, the coordinated council, and the colloquium—as well as Oppenheimer's leadership style, Bethe and Christy (2000) argue

The result of this openness was that we all felt that we were part of the lab and that each of us was personally responsible for its success. The ability to foster this esprit, to get the very best from every member, is what makes a great leader of a large project. (p. 15)

Bethe (1991) argues that the open sharing of information had an impact on morale and participation and, as a result, also improved the quality of the work."Very often a problem discussed in one of these meetings would intrigue a scientist in a completely different branch of the laboratory and he would come up with an unexpected solution" (p. 226).

In fact, Oppenheimer's efforts to build participation and open communication had an immediate impact on the mission of the laboratory.

At the April introductory lectures the basic design for the bomb was outlined. The “working” design was essentially a gun or cannon; one sub-critical piece of uranium (or plutonium) would be fixed in one end of the muzzle. A second sub-critical piece of uranium would be “fired” at the first, thus creating a critical mass and a nuclear explosion. During the lectures Robert Serber also mentioned other possible arrangements, including crushing a hollow sphere of material into a critical mass; this method was termed “implosion.” Implosion had not been analyzed because of the simplicity of the gun design and the assumed likelihood of its success (Seidel, 1995). Seth Neddermeyer, a physicist, immediately latched onto the concept of implosion as far superior to the gun method as a method of building a bomb, and immediately raised the issue. Although generally committed to the gun method for both uranium and plutonium, Oppenheimer listened to Neddermeyer and agreed that implosion must be looked into (Davis, 1968).

Later, as it became clear that the basic properties of plutonium made the gun design unworkable, implosion remained as the only feasible method of building a plutonium bomb (for a variety of political, scientific, and economic reasons, the development of a weapon using plutonium was viewed as absolutely essential). Without Oppenheimer’s commitment to open discussion, as well as the structure he created at Los Alamos, this solution may never have been identified. It would have been impossible for Neddermeyer to make the suggestion without the information that was shared during the lectures. It also would have been difficult to make the suggestion if the opportunity to be involved had not existed.

The openness of information and communication, through the introductory lectures and the weekly colloquium, along with a leadership style and organization structure that encouraged participation, contributed immensely to the commitment and morale that was present at Los Alamos—outcomes that are consistent with research on participative leadership styles (Kouzes & Posner, 2002; Yukl, 1998). Victor Weisskopf (1969) argues that Oppenheimer’s leadership style “produced a sense of direct participation in all of us. It created that unique atmosphere of enthusiasm and challenge that pervaded the place throughout its time” (p. 25).

Weisskopf (1969) remembers that “Everybody felt his encouragement, his readiness to help, and his interest in any personal achievement” (p. 133). Luis Alvarez (1987) asserts that the laboratory’s “fantastic morale” can be traced directly to Oppenheimer’s leadership style. Hans Bethe believes that Oppenheimer’s leadership style, his encouragement of participation, and his unwillingness to compartmentalize all contributed to a laboratory that became an “unforgettable experience” for those involved and created a “spirit of belonging together” during those years (Bethe, 1991). Most importantly, these factors greatly explain the technical success of Los Alamos (Bethe, 1991; Weisskopf, 1969).

## **Discussion and Applications**

There is little question that, despite his weaknesses and lack of experience, Oppenheimer was an outstanding leader. The records and recollections of those who worked with Oppenheimer are essentially unanimous in their views of Oppenheimer’s leadership. As Hans Bethe (1991) has

argued, Los Alamos might have succeeded without Oppenheimer as director but would only have done so “with much greater strain, less enthusiasm, and less speed” (p. 225).

More importantly, Oppenheimer may serve as an example of the necessary qualifications for successful leaders of contemporary organizations. First, Oppenheimer’s leadership demonstrates the value of rigorous and careful hiring, especially in leadership positions (Collins, 2001). Oppenheimer’s recruiting efforts were focused on getting the best scientists he could, including key scientists in important leadership positions. Importantly, Oppenheimer’s criteria including interpersonal, as well as technical and scientific, skills. This final point may be particularly critical given the importance of teamwork in many contemporary organizations.

Second, Oppenheimer is an example of the importance and value of meaning and purpose in an organization (Kouzes & Posner, 2002). Oppenheimer’s image of Los Alamos—as a wonderful place to work and a chance to make history (Conant, 2005; Wyden, 1984)—certainly appears to have been an essential element both in attracting scientists to the lab (Conant, 2005; Smith & Weiner, 1980) and enhancing the levels of enthusiasm and challenge among those who worked there (Kouzes & Posner, 2002; Weisskopf, 1969).

Third, Oppenheimer’s success illustrates the value and importance of technical ability in certain leadership situations. In highly technical organizations, the technical ability of leaders may be critical to their leadership success (Kouzes & Posner, 1993). Los Alamos would certainly be described as a highly technical organization and, as a result, Oppenheimer’s technical ability and scientific insight may have been key to his leadership success. Again, the historical record is quite clear; Oppenheimer consistently demonstrated significant technical ability, including the ability to solve—or help solve—the difficult and complex problems that Los Alamos faced. Oppenheimer had the ability to articulate the critical issues (Bacher, 1972; Weisskopf, 1969) and was almost always able to make the right technical decisions (Kistiakowsky, 1980). This technical and problem-solving ability frequently contributed to the progress of the project (Bacher, 1972).

Fourth, Oppenheimer’s leadership is an example of the value of creating an organization of participation and involvement (Kouzes & Posner, 2002). The recollections of those who worked with Oppenheimer are most clear on this point. The comments of Hans Bethe and Robert Christy reflect the general consensus regarding Oppenheimer’s leadership in this area. Referring to Oppenheimer’s efforts to build involvement and participation, Bethe and Christy (2000) argue that “we all felt that we were part of the lab and that each of us was personally responsible for its success” (p. 15).

Feeling a part of an organization, as well as having a personal investment in its success are outcomes that are not only desirable, but are associated with leadership that focuses on building involvement and participation (Howard, 1997; Kouzes & Posner, 2002).

An additional aspect of Oppenheimer’s leadership that merits discussion is related to the type of organization that Los Alamos was. Although the lessons from Oppenheimer’s success at Los

Alamos are applicable to managers and leaders in general, in many ways Oppenheimer's situation was not unlike the challenges that leaders face in the management of knowledge workers. There is little doubt that Los Alamos was a prototypical knowledge organization: the outcome of the project was almost entirely dependent on the knowledge and skills of the scientists who worked there (Drucker, 1999; 2003).

Oppenheimer's activities, therefore, may have particular application in the leadership of knowledge workers. Such workers may have stronger needs for meaning and purpose in their work (Drucker, 1999). They likely have higher needs for autonomy, involvement, and participation (Drucker 2003, Kanter, 2000). As noted above, knowledge workers may also have higher expectations of the technical ability of leaders (Kouzes & Posner, 1993), particularly in highly technical organizations and industries.

There are, of course, limitations in using Oppenheimer's experience at Los Alamos. While the lessons discussed in this paper—hiring carefully, creating meaning and purpose, possessing strong technical abilities, and building an environment of involvement—would appear to be applicable to most leadership situations, it is clear that Oppenheimer's situation at Los Alamos was unique.

First, it is not likely, for example, that many contemporary organizations have a mission that is as straightforward and as vital as that of Los Alamos. As noted earlier, it is somewhat problematic to determine the extent to which Oppenheimer's image of the laboratory made a difference above and beyond the official mission of Los Alamos.

Second, while Los Alamos is a good example of a knowledge organization, the very nature of Los Alamos was fundamentally different than a typical knowledge organization. Those who worked at Los Alamos were not simply knowledge workers, but many were among the preeminent scientists of the day. Many of them had won, or would go on to win, Nobel Prizes. While this may have made Oppenheimer's job more difficult in some ways (Wigner, 1992), it is clear that Los Alamos was a fundamentally different organization than almost any contemporary organization. As such, the lessons from Oppenheimer's leadership may be limited.

## **Conclusion**

There is little doubt that the success of Los Alamos was, to a great extent, due to Oppenheimer's effectiveness and brilliance as director (Davis, 1968; Kevles, 1978; Weisskopf, 1969; Wigner, 1992). The consensus of those who were with Oppenheimer at Los Alamos is quite clear on this point. Somehow, according to Eugene Wigner (1992), Oppenheimer was able to lead individuals who very much disliked being directed. Edward Teller concludes that the amazing success of Los Alamos grew out of the "brilliance, enthusiasm and charisma with which Oppenheimer led it" (Rhodes, 1986, p. 539). As Hans Bethe (1991) suggests, Los Alamos might have succeeded without Oppenheimer, but it would have been a far more difficult task.

The key lesson that can be drawn from Oppenheimer's tenure as Director of Los Alamos is that leadership matters. More specifically, it is those specific qualities that Oppenheimer displayed that made such a difference at Los Alamos—hiring carefully, creating meaning and purpose, having strong technical skills, and creating an environment of involvement and participation. These factors not only made a difference at Los Alamos, but they are likely to make a difference in many organizations.

### **Acknowledgements**

The author wishes to acknowledge the helpful and insightful comments of Dr. David Tranfield and the three anonymous reviewers.

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