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Exploring the role of national culture in the management of large-scale international science projects ☆

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Abstract

Collaborative projects extending across national boundaries introduce their own set of project management challenges. These challenges begin when individuals from different organizations, from different countries, and from different value systems must share authority, responsibility, and decision-making. But national culture and its influence on the project management process have received little emphasis in the literature. Using evidence from two case studies, this paper explores the role of national culture in the management of large-scale science projects. It raises questions about the relevance of this topic, proposes a method for studying the role of culture in the management process, and concludes with recommendations for those who manage these projects.

Keywords: Large-scale international projects; Project management; National culture; Global projects and global management; Partnerships management structure; Strategy

1. Introduction

The management of collaborative international projects is similar in many respects to the management of more conventional business projects [1]. Plans must be made, financing negotiated, resources organized, schedules created, and activities controlled. But these projects are more complex because they often require cooperation from organizations or groups whose managers come from countries where management processes and decision-making behavior are very different [1]. One underlying factor that helps to explain and understand these differences is the national culture in which these managers have been raised, educated, and trained. This paper explores the role of national culture in the management of large-scale science projects through two case studies. Large-scale science projects were chosen as the subject for this study because there has been a long history of these projects in Europe, Japan, Russia, and the United States, because these studies involve significant sums of money, because they address significant societal issues, and because they are public projects facilitating the collection of data and access to management staff [2–4]. Both projects, using Shenhar's [5] topology, can be classified as Super Tech Projects; key technologies do not exist when the project is initiated. The first project studied is the Joint European Torus, JET, and the second, the International Thermonuclear Experimental Reactor, ITER. Each project includes multiple national cultures and provides a rich environment for studying the role of culture in project management.

The paper begins by raising the relevance of this topic, proposes a method for studying the role of culture in the management process, explores culture's role in JET and ITER, and concludes with recommendations for those who manage international collaborative projects.

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2. Is culture relevant?

The topic of national culture has received considerable attention in the general management literature. In a landmark study, Hofstede [6,7] argued that managers are influenced not only by the job that needs to be done but also by the cultural values they bring to an organization. His work has been influential in many studies that range from marketing [8] to information systems design [9].

Driving the interest in national culture is the increase in strategic alliances across the globe. Businesses collaborate more closely with their global suppliers and governments collaborate more closely with other governments on such science projects as space stations, alternative energy sources, and particle accelerators. As these alliances increase, the significance of cultural differences also increases [10].

While there have been many studies that address culture's role in management, there is very little literature addressing culture's role in the project management process [1,11]. Yet people skills, of which national culture is one component, represent a significant concern to those who manage engineering projects [12]. Thamhain [13] contends that one of the roles taken by project managers is that of a 'social architect' who must understand the role that behavioral variables play in project success. When the role of national culture is mentioned in the project management literature, it is not explored in any depth. In a report to the United States Congress, International Partnerships in Large Science Projects [14] 'sociocultural' challenges are described as 'complicating' collaboration. In an OECD report, national culture is also suggested as a problem in collaborative projects [15]. Neither source, however, explores the cultural dimensions that might affect behavior.

This interest in national culture, but the apparent lack of research in this area, raises several questions.

- Is the study of culture relevant to the project management process?
- Which cultural dimensions are likely to affect the management process?
- Which management issues are linked to the influence of culture?
- Does culture affect project outcomes?
- How can knowledge of these issues be helpful to project managers?

These questions will be addressed here and summarized at the end of the paper.

Underscoring the importance of raising the issue of culture's role in project management is the increase in collaborative projects that cross national boundaries. In the private sector, strategic partnerships continue to expand from the globalization of manufacturing and marketing to the globalization of research and development [1]. In the public sector, the size of the collaborations from the International Space Station to the discovery of the SARS virus continues to expand. Consequently, what we can learn about the role of national culture in large-scale science project management may be very useful as businesses and governments engage in an increasing number of international projects.

3. Methodology

While no study has specifically identified and linked cultural dimensions with project management issues, there have been a few studies that have addressed the cultural issue. Kruglianskas and Thamhain [11] conducted a field study in which they compared the importance given to eight performance factors by project leaders in Brazil and the United States. They observed differences in behavior between these two groups, which they attributed to culture; more uniform agreement was observed among Brazilian managers and less uniform agreement among US managers.

Eriksson et al. [1] conducted a case study of a project in a globally dispersed organization. They addressed geographical, cultural, and organizational issues and concluded that culture affected management processes and outcomes. One cultural issue explored was authoritarian control. The avoidance of authoritarian control was credited as contributing to the success of the project. Each local facility maintained its own approach to project management, influenced by the working 'culture' of that organization. Cultural differences became most visible during joint meetings. The Swedish members of the team preferred to analyze a problem thoroughly while the US members preferred to quickly focus on a method that might work. The authors concluded that the Swedish approach led to delays and the American approach led to rework and additional costs.

The study presented in this paper attempts to go beyond the identification of those factors or issues treated differently among countries and attempts to explore why these differences occur. It is a study that can be classified as exploratory field research through semi-structured interviews [13]. In the first stage, the literature on culture and its affect on the management process was reviewed. This was followed, in the second stage, by the identification of those cultural variables that may help understand the link between culture, human behavior, and project decision-making. In the third stage, semi-structured interviews were conducted with managers from two large-scale collaborative projects. Those interviewed included managers from Culham, UK; managers and scientists at the European Union headquarters in Brussels, Belgium; officials at the Department of Energy in Washington, DC, USA; and research staff at the Organization for Economic Co-Operation and Development, OECD, in Paris, France. All interviews were

conducted on-site with the exception of the interviews in Culham, UK, which were conducted by telephone. The objective of these interviews was to identify management problems and to determine if a link between national culture and these problems could be identified. During the interviews the managers were asked to address their primary management concerns. They were then asked to elaborate these concerns and explore their source. Upon completion of the interviews, the problems were divided into categories and results organized around these categories. Finally, after the informal analysis was completed and the paper written, three high-level administrators with JET and ITER were asked to review the paper and either validate the conclusions reached from the initial interviews or recommend appropriate changes. The individuals used to validate the results were not among those originally interviewed.

4. Identifying the dimensions of national culture

Culture can be defined as the set of mental programs, established early in life and difficult to change, that control or influence an individual's responses in a given context [6]. To introduce this variable into a project management study is challenging [1]. It is challenging because culture is a construct and therefore not directly accessible through conversation. Further, it may only be observed indirectly through behavior. This translates into a practical problem when conducting interviews. Those interviewed cannot be expected to articulate the link between culture and management. Moreover, they are more likely to attribute management problems to concrete factors such as the unwillingness of some individuals to compromise or the inability of others to see problems another way [16]. Levitin [17] contends that culture is only inferable from verbal statements. Accordingly, the verbal statements expressed during the interviews were later related to an array of cultural dimensions taken from the literature.

Several models of national culture have been suggested [18–21]. One of the more influential was developed by Hofstede [6]. He studied the cultural beliefs of 116,000 employees from 40 nations working for the same multinational corporation. His work has had a significant influence on the management literature and has been widely referenced in research projects [9,22,23]. While his work has been influential, it has been criticized by those who contend that there is variation within cultures and that cultures change over time [23].

Hofstede suggested that national culture can be classified using four dimensions and that these dimensions shape organizations and social structures. They include power distance, uncertainty avoidance, individualism–collectivism, and masculinity–femininity. He later added future orientation as a fifth dimension [24]. The first four dimensions explain only 49% of the variance in his data, while 51%, he contends, remain specific to a country. Nonetheless these dimensions contribute to our understanding of differences, but they do not explain all the differences.

A more recent study, Project GLOBE, compared 18,000 middle managers from 62 countries [25]. Again, culture was linked to behavior in organizations. Nine critical cultural dimensions were identified: performance orientation, future orientation, assertiveness, uncertainty avoidance, power distance, collectivism, family collectivism, gender differentiation, and humane treatment. Five of these dimensions are similar to those uncovered in the Hofstede study. Both studies, criticism aside, suggest that there is some validity in attributing management differences to variation in national culture.

5. Relevant cultural variables

From these two studies (Hofstede and GLOBE), six dimensions were selected in this study to explore the influence of culture on the management of the JET and ITER projects.

- Power distance
- Uncertainty avoidance
- Individualism–collectivism
- Future orientation
- Performance orientation
- Humane treatment.

One Hofstede dimension, masculinity–femininity, and two GLOBE dimensions, gender differentiation and assertiveness, were omitted. They were not considered appropriate dimensions for this study, nor were their influences observed during the interviews. Two other GLOBE dimensions, collectivism and family collectivism, were considered to be covered by Hofstede's individualism–collectivism dimension.

These six dimensions can be defined in the following way:

- *Power distance* is the degree to which power is unequally shared among members of a society. Power is unequally shared in high power distance cultures and more equally shared in low power distance cultures.
- *Uncertainty avoidance* is the extent to which a society feels threatened by uncertain situations and prefers orderliness, structure, and laws.
- *Individualism–collectivism* suggests a loosely knit social fabric in which people take care of themselves (individualism) contrasted with a social fabric in which people are cared for by the group (collectivism).
- Future orientation is the extent to which a society encourages planning, investing in the future, and delaying gratification.

Table 1
Dimensions of culture

Country	Power distance	Uncertainty avoidance	Individualism	Long-term orientation	Humane treatment	Performance orientation
US	Low	Low	High	Low	Medium	High
France	High	High	High	Low	Low	N/A
Germany	Low	Medium	High	Medium	Low	N/A
Japan	Medium	High	Medium	High	N/A	Medium
Russia	High	High	Medium	Low	N/A	Low

Published data from Hofstede [23] appears in first four columns. Data from Project GLOBE [2001] appears in the last two columns.

- Performance orientation is the degree to which a society rewards performance and accomplishment.
- Humane treatment is the degree to which a society rewards behavior that is kind and considerate of others.

The scores from the Hofstede and GLOBE studies for selected countries involved in the JET and ITER projects are presented in Table 1. For example, of the countries studied by Hofstede, France ranks high in power distance, high in uncertainty avoidance, high in individualism, and low in long-term orientation. In the GLOBE study, France ranked low in humane treatment and, from the data that has been published, was not ranked in performance orientation.

6. Case studies

The first project studied was the Joint European Torus (JET). The concept for JET originated in the 1970s and the project's principle aim was to study the science of nuclear fusion [26]. Participants in the project included member states of the European Union. The site for the fusion reactor was Culham, UK. Fusion, the source of energy that drives the sun and other stars, is a technology that promises a source of limitless, clean, and relatively safe energy well into the 21st century. While the JET project ended in December 2002, it has been extended under a new EU agreement and continues to provide important scientific data.

The second project studied, ITER, started with a 1987 quadripartite agreement that included the European Union, Japan, Russian Federation, and the United States. In contrast to JET, ITER's goal is to establish the scientific and engineering feasibility for a much larger fusion reactor, one that will advance the pioneering work done by the JET project and pave the way for the eventual development of a commercially viable fusion power plant. It represents one of the world's largest joint international collaborations. In the first stage of the project, the focus was on the science of nuclear fusion. In the second phase, the emphasis shifted to engineering issues, and in the third phase, recently underway, the attention turned to site selection and the eventual construction of an experimental fusion reactor. Candidate sites have been narrowed to France and Japan.

7. Management issues and framework

Analyzing the semi-structured interviews and reviewing the limited literature on large-scale science projects, five management issues with potential linkages to the six dimensions of national culture emerged. These five issues are summarized in Table 2. Management structure and style shapes the administration of the project. It allocates power among participants and is an issue that directly reflects the balance that must be established between scientific, political, and social objectives. The geographic distribution of work allocates tasks to different groups and research centers throughout the world. Long-term budgetary commitment reflects the willingness of partners to continue their support of the project. Family and education issues relate to way in which project administrators care for participants when they are assigned to locations away from home. Pay equity addresses the difference in pay for individuals whose tasks are similar, but who are paid according to the pay scale standards of their home country.

7.1. Management structure

The design of the administrative structure has been identified as a critical success factor in project management [27]. When collaboration is international, the design of this structure must contend with cultural differences [28]. In large science projects, this design is further influenced by the political and social agendas expressed by the governments who support these pro-

Table 2
Classification of management issues

Issue
Management structure and style
Geographic work distribution
Long-term budgetary commitment
Family and education
Pay equity

jects [29,30]. The clearest example in this study of the cultural influence over management structure was observed in the ITER project.

During the Engineering Design Activities (EDA) phase of the ITER project, a hybrid structure emerged that was both centralized and decentralized. It included an ITER Council, a Management Advisory Committee, a Technical Advisory Committee, and a Joint Central Team divided among three separate offices located in Germany, Japan, and the United States. A primary function of the Joint Central Team office in San Diego, CA, was to centralize and integrate the administrative structure of the project. Home Teams in all four parties served to distribute administrative influence across participating partners. In addition, the distribution of research laboratories and research facilities, in government organizations and universities within a country and under the management influence of Home Teams, served to further decentralize management structure and management control.

Evidence from the interviews suggested different preferences for this structure. Research groups in Japan tended to favor a strong central team that would work closely with its Home Team. This was expressed as a strong need for interdependence. In contrast, research groups in the US expressed a preference to work more independently of the Joint Central Team. These groups did not feel the need to confer with the Joint Central Team on a routine basis. The French preferred to have top people involved. They expressed a preference for strong leadership that would place the home team in regular contact with the Joint Central Team. According to one manager, this placed the French in the middle between US and the Japanese.

National culture can be linked to these preferences. Both power distance and individualism–collectivism may explain why individuals from one country may prefer one management structure to another. Those from countries ranking low in power distance, for example, may be expected to prefer a structure that is more decentralized with greater autonomy for Joint Central Team offices, Home Teams, and cooperating institutions. This explains the comment that "the United States Home Team tends to work more independently of the Joint Central Team". Individuals from countries that rank high in power distance like France and those that rank medium such as Japan may prefer a more centralized, formal, and well-defined structure. This was corroborated during the interviews as evidence suggested that those from both of these countries preferred more central involvement. Power distance may also explain why research priorities in Japan are established at the highest government level and only after extensive interagency consultation has taken place. Individualism and collectivism may also affect structure. Individuals from countries that score high in individualism, such as the United States, may prefer a structure that is more decentralized. Individuals from countries higher in collectivism (lower in individualism), such as Japan, may be more comfortable with a strong centrally controlled and clearly defined structure.

Management structure, management style, and national culture were also linked in this study. One individual, involved with the JET project, suggested that cultural differences contributed to the pressure to replace European with British staff. It was also reported that in ITER, the French, high in power distance, often dominated the management process, especially when technical decisions had to be made. When choices or decisions were submitted, these choices were reviewed and often changed. Further there was no appeal in this process. This individual, a senior member of the staff, suggested that 'culture' is an 'extremely important' factor and that once the power struggle is over and an administrative hierarchy is established, the culturally dominant values expressed by the person at the top 'determines all the rules'.

7.2. Geographic work distribution

Geographic work distribution defines the way in which tasks are assigned to each work location. The challenge in large-scale international science projects is to organize work in such a way that it is appropriately allocated among research centers, coordinated between these centers, and at the same time decentralized to preserve some local autonomy. With too much central control, local initiative is stifled, but integration enhanced. With too little central control, integration is difficult or impossible, but local initiative preserved. In ITER, establishing an appropriate division of work was complicated for many reasons. Many participating parties had already earned a world-class reputation in specific research areas associated with the project, and in many areas no single country dominated. Geographic distribution was therefore an inherent challenge that came with the project. In addition, geographical distribution was complicated by the fact that within a single country, work was already distributed among many universities, industries, and government agencies. Finally, division of work and allocation of project tasks had political overtones.

Two approaches for assigning project tasks are possible. In the first, differences are negotiated before a geographically dispersed organization is established. As is true in any negotiation, all parties must be prepared to concede some of their interests. The downside here is that negotiations may take time and national interests may have to be compromised early in a relationship when they are most fragile.

The second approach is to utilize the current resources within each country without concern for overlap or duplication of efforts. This sidesteps early conflicts, but, when these paths ultimately converge, the problems imposed by lack of early coordination and integration can be too difficult to overcome. Concern over the second approach was emphasized during one interview. It was alleged that the failure of one very large international science project, not JET or ITER, occurred when the work done at separate sites and in separate countries was impossible to integrate.

Again, the preferences expressed during the interviews provided useful insight. Japan placed less emphasis on parallel structures and greater emphasis on centrally controlled and coordinated facilities. Examining the geographical distribution of their research facilities suggested their preference for linking facilities. Most were located in one region near Naka. This was in contrast to the United States, where facilities were distributed across the country from San Diego to Boston.

The difference between the preferences expressed for the geographic distribution of facilities in Japan and the United States can be explained, in part, by linking these preferences to national culture. Japan ranks higher in collectivism than the United States and individuals from that culture would be expected to prefer an environment where organizations work closely to coordinate their activities. Higher collectivism would also help to explain the concentration of facilities around Naka, Japan. Ranking medium in power distance, individuals from Japan would also be expected to prefer a somewhat stronger central control with a single chain of administrative control. In addition, individuals from Japan, scoring high in uncertainty avoidance, would also be more likely to prefer a single chain of command to minimize the uncertainties that might occur when several groups or institutions are working independently on the same problem.

7.3. Long-term budgetary commitment

The life-cycle of many international projects, especially ITER, is measured in decades not years. Maintaining budgetary commitment over this time period is a challenge of major importance. Projects undertaken during prosperous economic times, when funding is plentiful, may be subject to cuts, later, when an economy falters and project funding is difficult to sustain. Commitment may also be shaken when the business, social, or political climates change.

Funding uncertainty and long-term budgetary commitment plagued ITER from the early stages of the project when the United States, according to some, began dragging its feet [14]. Then in 1998, after supporting the project through two stages, the United States abruptly withdrew from the partnership. Three years later, the political climate changed. On January 3, 2003 a letter from the US Energy Secretary, Spencer Abraham, expressed an interest in rejoining ITER. In June 2003, the United States formally rejoined the project.

The withdrawal of the United States in 1998 and its subsequent commitment to rejoin the project underscores the precarious nature of political support in these large-scale international projects. But funding uncertainty is not limited to countries who may withdraw their support; it also extends to those who may join the project after it has begun. In January 2003, the Chinese Science Minister, Xu Gusnhua, sent a letter to the project's partners formally asking to join ITER. They offered to pay 10% of project costs. Subsequently, South Korea has joined the ITER project and India plans to participate with Great Britain as part of the European Union.

One very fundamental factor behind project commitment may be the preferences expressed through culture. Hofstede's dimension of long-term orientation and Project GLOBE's similar dimension of future orientation both address the extent to which societies encourage and reward future oriented behavior such as planning and investing. Countries like Japan, according to Hofstede's dimensions, score very high in long-term orientation, while the United States, France, and Russia score low. This may help explain why the United States, with its shorter time horizon, was less committed to the development of a technology unlikely to produce results for decades and why Japan stayed with the project.

While long-term orientation may help explain budgetary commitment, uncertainty avoidance may also play a role. As costs soar beyond budget estimates, and as outcome risks increases, commitment may suffer for countries high in uncertainty avoidance. The best example is expressed by looking at another large-scale project. The US, low in uncertainty avoidance, funded a $4 billion science project, the Super Conducting Super-Collider (SSC), on its own. As costs escalated past $18 billion, they were forced to seek international partners. But little interest was expressed by the international science community and in 1993 Congress voted to defund the project [31]. One explanation may be that among the usual participants in large-scale projects, the United States had the lowest Uncertainty Avoidance. When others where asked to join, the risks when compared to the payoffs were apparently too high.

7.4. Family and education

In the report to the United States Congress, cited earlier, it was suggested that sociocultural differences among participants are often neglected and that these differences can introduce obstacles to successful collaboration in large-scale science projects. During the interviews these differences became apparent. It was recommended that more needed to be done to assist

families and to accommodate their social needs, especially for those away from home for long periods of time. One OECD staff member, interviewed in Paris, expressed it this way, '' If you want to go to France for two years and have kids and your wife works, how do you go about it?'' The way to 'go about it', however, is not clear. Some participants expected help from management. Others were quite willing to solve their own problems without assistance.

Because many of the staff had school-age children, educational opportunities emerged as a particularly important sociocultural issue. Bringing a child to an unfamiliar country, with an unfamiliar language, and unfamiliar social norms, invariably created stress for the child, the family, and the project staff member. Could project administration help relieve some of this stress? Should project administration assume responsibility to provide direct assistance? These were the questions that were asked. No easy answers were volunteered.

School choice is often the focus of this concern. Many staff, for example, expressed reluctance to send their children to local public schools. They preferred a more familiar environment provided through private education.

In small projects, or early stages of large projects, educational issues may be less visible, but as projects grow in size these issues takes on greater significance. For example, as the ITER project enters the construction phase, with the need to maintain large communities of scientists and engineers on location for periods of five years or more, education will become an important issue that may have to be addressed in a formal way by project administration.

It is impossible to tie family and education issues directly to the achievement of project milestones or scientific objectives. That link is an ambiguous one. But, if management does little to address these needs, the report to the United States Congress does suggest that project milestones may be jeopardized; staff may cut their residence stays short or decline to move to common sites altogether, a concern confirmed by several of those interviewed.

Understanding national culture helps to understand the preferences that staff may express, the position taken by management, and the way in which these differences may be resolved. The interviews suggested that staff from cultures high in uncertainty avoidance, such as Japan and Russia tended to prefer help from project administration in finding an appropriate living situation. Those from cultures low in uncertainty avoidance such as the United States were more inclined to take the risk of finding their own housing and educational opportunities.

Individualism also played a role. Those from highly individualistic societies, such as the United States, were more comfortable when establishing their own family, social, and educational environment than those from societies lower in individualism, such as Japan and Russia, who expressed the need for a central authority to assume more of these responsibilities.

The dimension of humane treatment, from Project GLOBE, was also expected to play a role in expressing the need for help around these issues. Staff from cultures high in humane treatment might be expected to rely upon the involvement of project administration in solving social and educational problems. At the present time, however, Project GLOBE has not made public the humane treatment scores for Japan and Russia, so it was not possible to make this association for staff from these countries. Both France and Germany, however, scored low in humane treatment and evidence suggested that they were less concerned about help from project administrators.

7.5. Pay equity

When projects bring individuals together from different countries and when these individuals work together in the same room or building, the advantages that result from this synergistic collaboration do not come without problems. Perhaps the biggest problem expressed was that of pay inequity.

In JET, for example, within the same room, and among scientists with the same training and background, pay scales differed. This occurred because scientists from one country, where pay scales were high for scientific work, were working alongside scientists from countries where pay scales for the same work were lower.

This was a problem of significant concern to management. These differences often promoted jealousy, mistrust, and conflict among the scientists; while one scientist lived well, the other struggled. According to those interviewed, morale suffered. During an interview in Brussels it was expressed this way, ''pay equity is a major issue, it affects morale and we need to work this out in a better way.''

The reaction by staff and administrators can be partially explained by culture. Those from highly individualistic cultures, such as the manager interviewed in Brussels, who was from Italy, a country rated high in individualism by the Hofstede study, may be expected to express less concern over pay differentials than those from societies lower in individualism. In highly individualistic cultures, like the United States, for example, pay differences are accepted, especially as they relate to differences in individual performance. Power distance may also affect the way in which pay differentials are tolerated. Those from cultures high in power distance may be more willing to accept pay differentials that are administered from managers higher in the organizational structure than those from cultures low in power distance who are more likely to expect equity across ranks.

Performance orientation would also be expected to play a role in explaining the acceptance of pay

differentials. Those from cultures high in performance orientation, such as the United States, may accept these differentials provided there is some basis or evidence for the difference, while those from cultures low in performance orientation, such as Russia, may find it more difficult to accept these differences. This is indeed what was observed.

8. Management implications

At the beginning of the paper five questions were raised concerning the implications of national culture to the project management process. Observations from this study provide some tentative answers.

Is the study of culture relevant to the project management process? A review of the literature in management suggests that national culture plays an important role in how mangers think and how they make decisions. Evidence from interviews conducted at JET and ITER, two of the largest scientific projects in the world, suggest that managers from different countries did not always share the same preferences for management structure, geographic distribution of work, budgetary commitment, family and education, and pay equity issues. These preferences can be tied to national culture and suggest that culture may be an important factor in the project management process.

Which cultural dimensions are likely to affect the management process? While culture may be an important variable, the dimensions of culture that affect behavior are seldom identified. This study suggests that at least six dimensions may be involved. They include, power distance, uncertainty avoidance, individualism, future orientation, performance orientation, and humane treatment.

Which management issues are linked to the influence of culture? From the information obtained during the interviews, five management issues appear to be linked to culture. These include management structure and style, geographic work distribution, budgetary commitment, family and education, and pay. They are not intended to be exhaustive and only represent those issues expressed during the interview process. These issues and the cultural dimensions that may have affected them are summarized in Table 3.

Does culture affect project outcomes? The conflict over pay equity in the ITER project certainly drew management's attention and may have affected staff morale, but it is difficult to conclude from the evidence taken during the interviews whether this conflict, with its strong cultural overtones, had any impact on the achievement of project milestones.

Measuring the impact that culture may have on outcomes is difficult. One interviewee described a conflict that existed during the JET project in which managers from one country were having trouble with managers from another country. He suggested that these differences were attributable to the very different cultures in which these individuals had previously worked. It was a conflict that eventually led to management changes, but again this conflict is difficult to link directly to project delays.

Another interviewee emphasized the 'firm hand' exerted by a manager from one of the European Union member countries in the ITER project. It was a 'hand' that critically filtered suggestions coming from those in other cultures and a 'hand' that dominated decision-making. He attributed the 'firm hand' to culture, but how this affected outcomes is also difficult to determine.

The reason it is so difficult to link culture directly to project outcomes is because so many other factors are involved. What becomes apparent, however, is that culture does affect behavior but the extent to which it then influences outcomes is unclear.

It is expected that multinational collaborations affect projects in many positive ways. As individuals from different countries and different cultures work together, the argument is made that the different points-of-view brought to the project lead to more effective and creative solutions. What became apparent from these interviews, however, was that the benefits are not necessarily automatic. They must be managed. During one interview concern was expressed this way. In many respects ITER was not multinational. Yes, funding was multinational, but project management was not. The dominance of strong cultures, continued that individual, presented a challenge to others wishing to contribute.

How can knowledge of these issues be useful to project managers? If indeed, an understanding of culture is a useful tool in the management of international collaborative projects, how can it be used? The

Table 3
The issues affected by culture

	Power distance	Uncertainty avoidance	Individualism	Future orientation	Performance orientation	Humane treatment
Management structure	X		X			
Geographic work distribution	X	X	X			
Budgetary commitment		X		X		
Family and education		X	X			X
Pay equity			X		X	

framework developed in this paper should help. Becoming aware of power distance, uncertainty avoidance, individualism, long-term orientation and humane treatment provides managers with a vocabulary for creating another level of understanding when problems must be addressed. A very practical example is the challenges that can be expected since China becomes an ITER partner. With China scoring high in power distance, project participants would be expected to prefer a management structure with a clear chain of command, one that is more centralized than distributed. Scoring low in individualism, or high in collectivism, these participants would be expected to prefer human resource policies that accommodate their personal needs. Further, scoring high in future orientation, they would be expected to be committed to a project whose benefits are decades away. How does this information help? It is just one piece of the puzzle that helps managers understand the positions that the Chinese politicians and scientists are likely to bring to the project, and through this understanding more effective compromises can be reached.

9. Conclusions

Most managers engaged in international projects would agree that project management is influenced by culture. Exactly how culture affects management, however, is a question that most would find difficult to answer. The purpose of this paper was to conduct interviews with project managers to begin to explore this connection. The evidence suggests that power distance, uncertainty avoidance, individualism, humane treatment, and future orientation are dimensions of culture that are linked to project management and that these dimensions can be useful in explaining the preferences that guide management behavior and decision-making.

A very reasonable question to ask is, does this knowledge help project managers? The answer is that it may help because it provides them with a framework to explore the complexities of the management process, and by using this framework develop a more realistic way of understanding and managing the differences that are inevitable in international projects.

Care must be taken when generalizing the findings of this study to other projects. In this study, the expenditures were in the range of several billion US dollars, and the political influence of governments was substantial. Still, there may be basic human patterns, differentiated by culture, that may be applied to a wider range of projects, especially in this age when projects are becoming larger and international cooperation more common.

What would now be helpful is to conduct further studies that explore this issue in greater detail and to conduct studies in other project areas that might suggest a theory of culture in international project management.

References

[1] Eriksson M, Lillieskold J, Jonsson N, Novosel D. How to manage complex, multinational R&D projects successfully. Eng Manage J 2002;14(2):53–8.
[2] Laudel G. Collaboration, creativity and reward; why and how scientists collaborate. Int J Technol Manage 2001;22(7/8):762–81.
[3] Smith RK, Ahmed MU, Takanashi A. International collaboration for technological change in the 21st century. Int J Technol Manage 1999;18(3/4):285–91.
[4] Hicks D, Sylvan-Katz G. Science policy for a highly collaborative science system. Sci Public Policy 1996;23(1):39–44.
[5] Shenhar AJ. From theory to practice: toward a typology of project-management styles. IEEE Trans Eng Manage 1998;45(1):33–48.
[6] Hofstede G. Culture and organizations. Int Stud Manage Organ 1981;10(4):15–41.
[7] Hofstede G. Management scientists are human. Manage Sci 1994;40(1):4–13.
[8] Tse DK, Lee K, Vertinsky I, Wehrung DA. Does culture matter? A cross-cultural study of executives' choice, decisiveness, and risk adjustment in international marketing. J Market 1998;52:81–95.
[9] Shore B, Venkatachalam AR. The role of culture in systems analysis and design. J Global Inform Manage 1995;3(3):5–14.
[10] Bartlett CA, Ghoshal S. Managing across borders: the transnational solution. Boston, MA: Harvard Business School Press; 1989.
[11] Kruglianskas I, Thamhain HJ. Managing technology-based projects in multinational environments. IEEE Trans Eng Manage 2000;47(1):55–64.
[12] Kern DJ. Content and trends in engineering management literature. Eng Manage J 2002;14(1):43–8.
[13] Thamhain HJ. From the special issue guest editor. Eng Manage J 2002;14(2):2–3.
[14] Congress of the United States. International Partnerships in Large Science Projects. Washington; 1995.
[15] OECD. Report of the Study Group on Connections among Scientists, Agencies, and Governments in Decision Making for Regional and/or Global Megaprojects 1995. DSTI/STP/MS(95)5.
[16] Brislin RW, Pederson P. Cross-cultural orientation programs. New York: Gardner Press; 1976.
[17] Levitin T. Values. In: Robinson JP, Shaver PR, editors. Measures of social psychological attitudes. Ann Arbor, MI: Institute for Social Research, University of Michigan; 1973. p. 489–502.
[18] Parsons T, Shils EA. Toward a general theory of action. Cambridge, MA: Harvard University Press; 1951.
[19] Kluckhohn C, Strodtbeck F. Variations in value orientations. Westport, CT: Greenwood Press; 1961.
[20] McClelland DC. The achieving society. Princeton, NJ: Van Nostrand; 1961.
[21] Rokeach M. The nature of human values. New York: Free Press; 1973.
[22] Kedia BL, Bhagat RS. Cultural constraints on transfer of technology across nations: implications for research in international and comparative management. Acad Manage Rev 1988;13(4):559–71.
[23] Erez M, Earley PC. Culture, self-identity and work. New York: Oxford University Press; 1993.
[24] Hofstede G. Cultural constraints in management theories. Acad Manage Exec 1993;7(1):81–94.

[25] Javidan M, House RJ. Cultural acumen for the global manager: lessons from Project GLOBE. Organ Dyn 2001;299(4):289–305.
[26] Shaw EN. Europe's experiment in fusion: The JET joint undertaking. Amsterdam: North-Holland; 1990.
[27] Connell J, Edgar GC, Olex B, Scholl R, Shulman T, Tietjen R. Troubling successes and good failures: successful new product development requires five critical factors. Eng Manage J 2001;13(4):35–40.
[28] Ghoshal S, Nohria N. Horses for courses: organizational forms for multinational corporations. Sloan Manage Rev 1993;34(2):23–35.
[29] Nierenberg WA. NATO science programs; origins and influence. Technol Soc 2001;23(3):361–71.
[30] Carvalho-Rodrigues F. NATO's science programs; origins and influence. Technol Soc 2001;23(3):375–81.
[31] American Institute of Science Policy News. Number 93; June 17, 1998.