

# Hallowed Grounds: The Role of Cultural Values, Practices, and Institutions in TMS in an Offshored Complex Engineering Services Project

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**Abstract**—The globalization of complex engineering services has resulted in physically dispersed teams that can no longer rely on the traditional and familiar oral transmission of engineering expertise nor can they assume knowledge of their team members' culture. Yet, such teams need to be able coordinate effectively the dispersed knowledge of team members. We know little about how cultural differences among engineering team members impact the coordination of dispersed knowledge, so called transactive memory systems (TMSs)—or “who knows what” and “who knows who knows what.” In this paper, we present a longitudinal case study of a dispersed, cross-cultural team involving U.S. and Romanian engineers. The cultural differences in values, practices, and institutions had a major impact on TMS indicators of specialization, coordination, and credibility. The paper demonstrates how the cultural differences impeded TMS development. The results provide insight into TMS as an implicit coordination mechanism in a global team. We provide advice in terms of interventions that can promote the development of TMS in a culturally diverse team.

**Index Terms**—Culture, engineering services, longitudinal case study, offshoring, transactive memory systems (TMSs).

## I. INTRODUCTION

ENGINEERING companies offshore ever more complex work to low-cost locations [27]. Offshoring here refers to engaging another party outside the firm's home country to execute work that would otherwise be completed by the firm in the home country. Companies strive to improve coordination in offshored projects in order to reap better cost competitiveness.

The coordination needs are high with offshored projects. The design complexity, the portioning off of interrelated design segments, the different and often frequently revised and renegotiated client needs, local engineering codes, economic constraints on choices in design, productivity curves, and schedule control increase the need for coordination. The dispersed groups must learn, remember, and efficiently share dispersed specialized knowledge across geographies and cultures. In such an environment, knowledge of who knows what within a team, and

the use of that knowledge to decide who will do what, so called TMS [56], is of critical importance in ensuring effective division of labor.

TMS is a group information processing system, a network of interconnected individual memory systems and the transfer of knowledge among them, that promotes effective coordination of expertise in a team by locating knowledge with the right roles and responsibilities, assigning the most knowledgeable person to a role, and minimizing the amount of information that any one person has to store while providing access to a larger pool of information [36], [56]. TMS is considered well developed when team members have sufficient information of each other's knowledge, believe in the accuracy of others' knowledge, and establish an efficient division of cognitive labor that is clear to and shared by team members [37]. The TMS literature has established theoretically and empirically the link between well-developed TMS and effective teamwork in field settings [1], [4], [14], [36].

Teams can develop effective TMS in conditions that are far removed from the origins of TMS theory that dealt with the distribution of expertise in American intimate couples [56]. TMS can emerge even when team members are in dispersed settings [2], [46], have had no prior experience working together [28], and face a mixed motive situation [25], [40].

However, globalization of engineering services does not only mean lack of prior knowledge of team members, but also lack of prior experience with one another's culture [13], [18], [19]. Engineering skill sets, design practices, design preferences, experiences, tools, and routines are culturally embedded and vary across engineers residing in different country locations. These differences are hard to recognize and reconcile when the collaboration is primarily limited to virtual interactions [33]. Virtual interactions disrupt a familiar oral engineering culture and put greater reliance on more formal written means of recognizing, transmitting, and retrieving expertise.

In existing research literature on virtual teams, which are not unlike the team we are studying here in that they may never or rarely meet, culture has been identified to be significant in terms of behavior [13], [52]. Our knowledge about the role of culture in relation to TMS is very limited [48]. In fact, we know of no studies that have explicitly examined *the research question of how cultural differences impact TMS development in geographically dispersed teams*.

We conducted a longitudinal case study of a complex engineering services project that involved members of a U.S. engineering company and their offshore contractor in Romania.

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The project team faced challenges in coordinating expertise. The case study is significant as it contributes to the literature on offshoring by demonstrating how cultural differences influence cognitive structures that are critical for efficient work coordination to take place.

The paper is structured as follows. Section II gives a brief overview of TMS and culture. Section III presents our approach to data collection, as well as a description of the case context. Section IV provides analysis and results. Section V discusses the findings and implications in relation to our existing knowledge. Section VI discusses limitations and future research.

## II. CONCEPTUAL BACKGROUND

### A. TMS in Globally Distributed Teams

In teams where members rely on information inputs from geographically dispersed members, effective coordination is critical in order to produce high quality work outputs (e.g., [28] and [41]). Effective coordination allows the team to mitigate the distributed team challenges of high volatility and uncertainty of task goals (e.g., client needs), lack of shared context, and the inability to monitor others' behavior in a team [9], [10], [58]. Structured work processes such as goal setting, formal planning processes, and agreed upon work rules have been found to improve coordination in distributed teams (e.g., [43] and [53]).

Compared to structured work processes, few distributed team studies have examined emergent knowledge coordination including TMS (e.g., [2], [17], [25], and [28]). Although TMS was initially developed to explain shared awareness of who knows what in a dyad [56], it is now commonly used to explain the development and the impact of a collective memory system in work groups [39]. TMS consists of knowledge directories that map knowledge held by each individual to knowledge held by others in the system, as well as the communication processes in updating the knowledge directories, and accessing and retrieving knowledge from others [8]. When one person needs information in another's area of expertise, s/he can ask the expert instead of spending time and energy learning it on his/her own. Research has demonstrated that groups perform at high levels when a TMS has developed (e.g., [4], [36], [38], and [39]).

The initial TMS in a team may be derived from the team members' relative expertise, skills or experiences, formal assignment (by a manager or based on a job description), or negotiated agreements before the start of the project. However, the resulting TMS is likely to be erroneous and requires group interactions, discussions, and feedback to develop (e.g., [21], [39] and [57]). A TMS is well developed when it reflects three TMS indicators [36], [39]: the members in the team take responsibility for possessing and accumulating different but complementary knowledge, and sharing the knowledge of who is good at what (*specialization*); the team has a shared representation of the knowledge directories that minimizes any confusion of who knows what, who is to remember what, and who should be asked questions, and the team is able to integrate members' knowledge, synchronize its activities and anticipate each other's actions and reactions (*coordination*); and there is mutual reliance on the accuracy of each other's knowledge and convergence between expectations and actions of the other's participation in encoding

(learning), storage (memory), and retrieval (communicating) of specific information (*credibility*). A well-developed TMS means the team must have: 1) strong communication ties among its members that result from frequent, intense, reciprocal, and personal interactions among its members [62], and 2) perceptions of a high level of cognitive interdependence, or reliance on the knowledge of others that is tied to the reward system and/or the structure of the group task [8].

In distributed teams, TMS development takes longer [17]. TMS develops informally and implicitly through social interaction rather than by any formal design (e.g., [8] and [37]). The interaction happens at a much slower pace in distributed teams that rely on computer-mediated communication and it takes considerable time for members to learn each other's background, credentials, interests, and preferences [58]. Dispersion also limits observing other members' skills in action, in order to coordinate who does what, and to evaluate the willingness of team members to participate in TMS [9], [58]. Computer-based communication reduces spontaneity and informal feedback [11], [21]. Reduced interactions adversely impact the cognitive structures of the coordination system. Nevertheless, through interpersonal and computer-based mechanisms, TMS formation and maintenance can be achieved in a distributed team [2], [46]. The intensity of communication early on in the project compensates for the lack of shared work experience in building TMS [28]. Shared practices and rules increase TMS development by rendering predictability of not only what expertise others have but also what they are willing to share [25]. Hence, dispersion slows down but does not stop the development of a TMS.

However, what the literature has failed to consider is the role of culture in TMS development. Where culture has been mentioned, it is mainly in the context of how a group culture shapes knowledge and task representation [8], [62]. Jackson and Klobas [23] mentioned briefly how a certain national group is reluctant to contribute to the TMS directories because of the national culture of modesty. However, the literature contains no in-depth analysis of how cultural differences among members in a team, such as in offshored projects, play a role in TMS development. In the ever globalized world, this is a serious gap in our understanding.

### B. Culture

Culture here refers to the concept of learned and habituated patterns of behavior as well as the symbolic structures that give human behavior and activities significance and importance [12], [30], [50]. This includes shared attitudes, values, goals, and practices, as well as institutions and organizations. Cultural values are expressed through symbolic forms and practices, such as codes of behavior, dress, language use, expert/novice relations, religious systems, rituals, ideas about the individual, ideas about knowledge, aesthetics, etc. Institutions, values, and practices can be less stable over time than formerly realized or than people assume [15]. Cultural forms or "determinate orderings," which influence our everyday human interaction [59] are so habituated they often seem natural [7] and common to all, until they are unexpectedly challenged [16] such as in cross-cultural situations when our expectations are not met. Globalization

processes force us to see our local identities [44] within larger fields, for example, in the case of former Eastern Block countries such as Romania emerging into global capitalist markets.

Current theories of culture avoid an all-encompassing representation of a culture or a specific society in favor of focusing on context-specific and context-dependent practices or forms of participation [12]. Although the organizational literature differentiates between national, organizational, and professional culture, we do not follow this strategy as we find it fails to account for the interrelated nature of work environments and the cultures within which they emerge and are practiced. For purposes of this study, we follow several influential scholars of culture and society, and we focus on three key ways to understand culture: through practices [7], institutions [15], and values [6], [47].

People typically talk in vague terms about culture and its effects [31], or understand culture as something that resides in our minds, rather than in practices and institutions [32]. Cross-cultural differences are often bewildering or exoticized, and are even more difficult to negotiate and accommodate to when the basis of communication is computer-based [33]. In the remainder of the paper, we explore the research question of how cultural values, cultural practices, and cultural institutions impact TMS development.

### III. RESEARCH METHODOLOGY

The rationale of a single case study design was based on the “revelatory case” [61] as we were provided with unique, nearly unlimited access to both the U.S. engineering firm and their offshore Romanian partner. We were able to observe the U.S.-based engineers interacting with the Romanian engineers, and compare and contrast patterns of behavior when the same group of U.S.-based engineers interacted with other U.S.-based engineers and when the same group of Romanian-based engineers interacted with other Romanian engineers. The case study provided us a unique window into cross-cultural differences in engineering coordination.

#### A. Data Collection

We collected data from January to July 2008, both in the U.S. and in Romania as part of a broader research endeavor examining coordination in global engineering work. We made weekly visits to the U.S. site, and conducted a month long participant-observation at the Romanian site. Our data include interviews with over 40 engineers and staff (many of whom were interviewed 2 to 3 times over a 6-month period), of which over 30 worked in the U.S. and the other ten in Romania. Ten interviews were conducted in Romania during our month long participant-observation; the rest were conducted in the U.S. Our interviews spanned those in senior management, middle management, lower management, engineering team members, human resources, information technology, and industry experts.

We asked our interviewees in semistructured interviews to describe a typical day, work methods, experiences working with counterparts; we asked them to comment on communication, coordination, quality of work, level of effort, rework, credibility chains, conflicts, trust building, scheduling, culture, and

language issues; and to report on who their go-to person was for problems, typical problem resolution processes, and communication media used. We paid attention to narratives and life stories to understand cultural patterns and behaviors. Sample interview questions are in Appendix A. We also attended 23 weekly teleconferences and nine web conferences between U.S. and Romanian engineers. The meetings highlighted how communication and documents featured in coordinating efforts and in knowledge transfer.

We audiotaped and transcribed interviews and conference calls between the two sites. We also collected project documentation such as process flow diagrams, computer-aided design diagrams, organization charts, and email communication. We shared a summary of our findings with the U.S. and Romanian engineering sites.

#### B. Data Analysis

TMS was a concept that was identified a priori as potentially being of interest among others in terms of engineering expertise coordination. The construction engineering tasks involve high levels of specialization but also credibility and coordination so that the final design product is not only completed in a timely manner but meets the quality and performance targets. TMS emerged from the data as being culturally impacted. We based our conceptualization of TMS on Lewis [36] and Liang *et al.* [39]. To analyze how culture impacted specialization, credibility, and coordination, we used a discourse analysis approach (e.g., [54]) to examine our interview data, and a conversation analysis approach [3] to examine transcripts of meetings. We also looked at utterances and chains of utterances in relation to speech act theory [4]; specifically, how in speaking people take action, which they are accountable for, such as making requests, verifying, challenging, etc., all of which vary in their manner of appropriate articulation cross-culturally [29]. Our unit of analysis was not only the word and utterance level of speakers, but how actions and activities were discussed and accomplished across speakers and turns at talk. Many problems in understanding, unexplored conflicts in assumptions, and unstated preferences for particular modes of interaction do not surface in transcripts of turn-by-turn conversations, although interviews suggest they are noticed by participants and they can be discussed (see e.g., [60]). We, therefore, used both stretches of conversations in meetings and interview data in our analysis. Discourse analysis proceeds from the assumption that the ways that speakers develop topics show underlying assumptions and values, since through language speakers construct and contest particular ideas about the world and about others. Consequently, we looked at episodes, narratives and propositions about the world and the behavior of others (see, e.g., [26]) contained in the interviews, which we took as evidence of views of the speaker about the world or the task at hand, as well as shared meanings. Our goal was to understand phenomena through the meanings that our subjects assigned to them in order to produce an understanding of their encoding, storage, and retrieval. In other words we wanted to gain understanding from the point of view of the participants within a collaboration that operated within multiple social and institutional (cultural) contexts, the

type of understanding that is largely lost when textual data are quantified.

The first step of the analysis was to identify those segments in the transcribed data that pertained to engineering expertise coordination. We particularly looked for segments that related to problems in synchronizing members' activities such as elaborated clarification sequences, conflict episodes that suggested that TMS had not fully developed to enable smooth and efficient interactions. The second step was to code the identified segments into TMS indicators of specialization, coordination, and credibility. The transcribed data were further analyzed in terms of three culture elements: values, practices and institutions. Examples of coding are in Appendix B.

### C. Case Context

The project involved a detailed design of a major facility as a part of a new processing plant to be built in the U.S. The U.S. engineering firm, that had under 10 000 employees, had been involved with offshore vendor design firms previously in South America and in Eastern Europe. This was the third project where the U.S. firm worked with the Romanian design firm, a firm with less than 200 employees. The U.S. project engineer described this as a mid-sized engineering design project, under 200 000 man hours, scheduled to last 1.5 years. The Romanian portion was to last 9–10 months. The project involved multiple engineering disciplines including structural, instrumentation, piping, and electrical. Forty percent of the design work was to be completed in the U.S. and 60% in Romania. The U.S. engineering firm had 35 people formally part of the project although there were 10–12 core team members that were most integrated with their core Romanian counterparts. The reporting relationships of Romanian counterparts mimicked those of the U.S. The onshore part of the team was assigned a coordinator, an experienced engineer, who had worked in a similar role in prior offshore projects. The Romanian project manager served as the counterpart to the coordinator and had similarly held the same role in prior projects with the U.S. firm. Our observations focused on the U.S. and Romanian core members although our interviews reached to the broader project community. The U.S. firm's goal in offshoring was to gain cheaper man hours, while the Romanian group sought to increase work opportunities and expertise.

Initially, a subset of the core offshore group visited the U.S. to discuss the project scope, division of work, project schedules, and design standards. The core Romanian group returned to the U.S. a month later and a kickoff meeting was held in a face-to-face setting. The design phase involved three key milestones to monitor the progress of the project: 30% review, 60% review, and 90% review. The Romanian engineers worked at the U.S. site until the 30% review (3 weeks). After this point, the two groups of engineers worked geographically apart. The complex interdependencies required engineers in the two locations to be in frequent, often daily interaction with each other. After the 30% review, some members reported interacting via email or via phone five times a day with their offshore counterparts. The other tools in frequent use were a shared engineering design system and a shared, third party maintained database of drawings, a formal change order database, and weekly action lists. The

dispersed team held weekly conference calls and web conferences as needed. During the first six months of the project, the U.S. project manager, the U.S. coordinator, and one of the U.S. discipline leads (plus the project end client) visited the Romanian site. We had scheduled to complete our data collection at the end of six months at the 60% project review. It is important to note that our discussion and analysis in the rest of the paper is not about actual engineering skills or craft; rather, we only address issues of coordination of the complex knowledge and skills these engineers have.

## IV. ANALYSIS AND RESULTS

Both the U.S. and Romanian engineers were upbeat that sufficient knowledge had been exchanged about each other's roles, responsibilities, and expertise during the initial site visits, although both parties acknowledged that areas remained where learning had to continue as the two sides of the team worked apart. As soon as the onshore and offshore sides of the team separated, coordination problems surfaced. We listened to what the engineers themselves said about coordination problems, and we observed key coordination events including the weekly conference calls between the two sides of the team. Although certainly many other issues contributed to coordination failures, culture played a key role. Culture influenced retrieval processes in terms of who a person was willing to approach for the recall of knowledge and what kind of knowledge was being asked for, making the links between individual nodes of expertise unstable across cultures. Culture also impeded credibility, as actions such as clarifying and seeking confirmation were approached differently in each culture. An individual's withdrawal from certain behaviors was at times misrecognized as unwillingness to act on the expertise he/she had. Coordination failures continued during the 6 months we observed the team. The schedule was pushed back and the 60% review milestone had not yet been completed. To shed more light on the role of culture, we analyzed our data in terms of key TMS indicators of specialization, coordination, and credibility, and in terms of cultural values, practices, and institutions.

### A. Specialization

Specialization in TMS is based on team members' knowledge, expertise, skills or experiences, formal assignment, or negotiated agreements with members. Specialization was often only present at the company level. The U.S. project manager referred to the Romanian engineers, even when referring to individual engineers, as "Romania is performing this [task]." Engineers did not always know the domains of responsibility of the other engineers at the other site. We were told, "I do not know anyone in there [the U.S. company] above my discipline lead," or "I just go to my manager and he knows what to do." Cultural differences in engineering training and in approaches to the specialization of knowledge made it difficult for engineers on this project to fully develop the more implicit knowledge structures of TMS. Values impacted what was considered knowledge and what was encoded and mapped to directories.

1) *Value of Theoretical Versus Practical Knowledge:* Knowledge was specialized by engineering discipline, for

example, structural, piping, electrical, and instrumentation. However, there were differences in the boundaries of these specializations as in engineering training overall between the U.S. and Romania. Romanians, because they lacked facilities, had been trained less in the practical knowledge settings highly valued by U.S. engineers, and in a way that was highly theoretical. This contrast became a source of frustration on both sides. The Romanian project manager complained about the procedure of the U.S. members of the team to bypass theoretical data, and instead to rely on equipment manufacturers. Romanians believed that referencing theoretical knowledge contained on industry charts would avoid the delays of seeking knowledge from vendors. On the U.S. side, the theoretical knowledge was not found to be credible and the designs, while theoretically compliant with quality requirements, did not conform to expectations resulting in utterances such as, "It does not look right." Knowledge that was not valued was unlikely to be encoded in directories.

2) *Value of Individual Innovativeness*: The U.S. team members valued compliance with engineering codes and standards. However, at times, the standards and guidelines were also influenced by "the way it is usually done," as expressed by a certain engineering manager in the team. The U.S. engineers expected an engineer to have the ability to generate innovative solutions to problems in the field. The U.S. team members' acceptance and expectation of innovation and individual variation as a way of demonstrating level of expertise was, however, confusing to the Romanians who saw it as inconsistent, and therefore, incoherent, perhaps even at times associated with resistance to authority. Six months into the project, a Romanian engineer complained:

They say "Do it the [Company X] way," for example, with the piping, but the teams on each job are different and they observe differences in the way "Company X way" is implemented. Due to the different team and the leaders, they have another vision.

Differences in the value of innovativeness and the value of following established formal practices (e.g., U.S. standards) led to different knowledge being encoded in TMS.

3) *Value of Uncertainty*: The U.S. engineers saw the Romanian engineers as having a lower tolerance for uncertainty, based in part on differences in specialized knowledge, which resulted in what the U.S. team members saw as inappropriate or unnecessary demands for details up front. For example, a U.S. engineer discussed how the Romanians lacked the ability to "handle the end uncertainty." The characterization of U.S. engineers as having greater tolerance of "uncertainty" obscured the role of cultural knowledge (of appropriate or possible responses) in situations of uncertainty. In one example, an overt strategy to reduce uncertainty, which was proposed by the Romanian project manager, was rejected during a conference call as addressing issues that were too "minor." This denied the Romanian manager the opportunity to encode knowledge. A U.S. engineer later remarked how the U.S. engineers were "so busy that we do not explain everything in enough detail for them [the Romanians] to understand." Knowledge failed to be communicated and included in who knows what.

In addition to values, differences in cultural practices impeded the upgrading of mental maps of who knows what. In Romania,

a coordinator was seen as someone "who knew everything that we communicate in the project." In the U.S., a coordinator was a troubleshooter whose help was sought when problems or issues arose. Frustrations centered on unshared assumptions of whose job it was to do what, but also what was expected (either as a finished design product or a piece of information). The practice differences led to interactions where one party felt the other party deliberately misled them. When we brought up some of these cultural differences in interviews, the engineers at both sites expected them to be temporary and easily resolved or accommodated to. However, our observations suggested the opposite.

4) *Communication Practices*: U.S. engineers upgraded their specialized knowledge by innovating and asking questions when necessary. To the U.S. team members, the Romanians failed to ask questions and that limited their ability to have accurate assessments of who knew what. One engineer described communication differences as a "lost in translation type situation" that made him apprehensive, but he felt he could do nothing about it, because it was "invariably going to happen at some level just because of our lack of familiarity with their culture . . . probably the way we relate to our peers is not the same way they do."

In joint meetings with U.S. engineers, the Romanian engineers often passively observed the interactions among the U.S. engineers. They rarely offered to or were invited to demonstrate their own expertise or ask questions, both of which can be effective means to locate expertise. This occurred both in the face-to-face meeting while the Romanians were in the U.S. as well as when the two sides of the team were dispersed.

5) *Design Practices*: It was a Romanian practice to rely on specialized knowledge of construction field personnel, which meant to underspecify some of the design deliverables, at least from the U.S. perspective. The Romanians had certain expectations that expertise was located among the field personnel, whereas the U.S. engineers would not have located the expertise with the field personnel. Romanians criticized the U.S. engineers for a tendency to overbuild and overplan for mistakes and they assumed that the field personnel would have the expertise to correct them. Since Romania did not have a similar culture of litigation and fear of lawsuits, it did not make sense to them to continually consult and get written confirmation from wider networks of expertise and authorization. These different worldviews assumed a different level of specialization among the field personnel and impeded the emergence of shared TMS.

6) *Boundary Spanning Practices*: The interactive discussions, particularly early on in the project, that allowed members to understand each other's cultural preferences and practices were rarely seen to take place. The team members testified in the interviews that they believed it was enough to have a person assigned the role of coordinator to interpret or act as a single arbitrator or conduit of cultural information. A Romanian engineer who acted as a coordinator stated: "I will be coordinator in Romania, and if they have problems they will come to me and speak to me and I will explain in Romanian." The U.S. side also had a position of coordinator or boundary spanner. His position was characterized, not as a translator and specific culture specialist, but as someone who would mediate breakdowns by judging a correct path in the face of competing solutions

or arguments between the two sides. He was an experienced engineer who had served as a “cultural boundary” manager in the previous projects that the U.S. firm had offshored to Eastern Europe and Latin America. During the first six months of the project, he traveled twice to Romania and dealt with various administrative issues on the project.

The differences in communication, design, and boundary spanning practices impacted what knowledge engineers learned, remembered, and shared; however, these knowledge differences failed to be reflected in TMS because they were deeply embedded in routines and habitual practices and rarely made explicit in interactions. The same happened with knowledge embedded in cultural institutions that reinforced cultural values and cultural practices.

7) *Institution of Social Structure*: In Romania, the engineering disciplinary boundaries were superseded by hierarchy as a cultural institution. Differences in hierarchical structures between Romania and the U.S. made TMS updating and retrieval difficult. Even in initial joint meetings, it was the Romanian project manager who took the role of displaying the cued knowledge rather than the Romanian engineer who actually had the expertise and task responsibility, and in one of the early meetings when the Romanians were stationed in the U.S., the Romanian project manager was the only one sitting at the table with the U.S. engineers, whereas the rest of the Romanians were sitting away from the table. Still, the other engineers could gain valuable information as peripheral participants. However, when not face to face, the situation in joint teleconference calls, the consequences of the Romanian project manager being the spokesperson for the individual expertise on the Romanian side was more consequential. The U.S. side was often unable to differentiate who on the Romanian side was actually responsible for what.

In one representative case, when the two locations were trying to schedule a follow up conference call for the next day, the Romanian project manager declared it impossible because: “I will be out, and I am the main player here I think.” While knowledge of individual team members on the U.S. side was regularly encoded, updated, or retrieved, through their individual participation in the teleconference calls, the Romanian manager often failed to identify individual people on the Romanian side, for example, using the terms “my people” or “my person.” This means that the U.S. side had less information to update knowledge of specialization on the other side.

Variation in the relative importance of hierarchical relations affected TMS development. Managers who acted as gatekeepers for knowledge and information could reduce the number of possible interactions and knowledge sharing events that in turn reduced the opportunities to map knowledge to team members and their responsibilities. At the same time, the U.S. engineers at times invoked a rank hierarchy between themselves and the Romanians, a hierarchy that was contradicted in talk about equality, and which also reflected the lack of hierarchy in their own group. In one example, a U.S. engineer said to the Romanian project manager: “[if] anybody at any moment at any time gives you instructions, you have to do them.” To this the Romanian engineer replied: “Okay, we start to be crazy.” What seems crazy about this conversation from the point of view of the Roma-

nians is that no specialization nor work hierarchy is indicated, namely, anyone could give directives to a manager. Expertise and hierarchical authority structures were no longer the basis of coordination.

8) *Institution of Social Histories*: Cultural heritage or the collective histories and orderings of experiences also played a role. After the Second World War, survival strategies for dealing with chronic food shortages led to the development of shortage alleviating devices in Romania [55]. It was historically important to extend raw materials, such as steel, which were in short supply, as illustrated in the Romanian project manager’s caution to the U.S. side: “Gentlemen, in my opinion, we’ll follow your recommendation, but you’ll use more steel than included in our proposal,” whereas in the U.S. labor cost was an important consideration.

In summary, over the six months of our data collection, the cognitive maps of specialized knowledge and individuals’ relations to them remained incomplete and inaccurate.

## B. Coordination

Coordination difficulties occurred although the team used many human and IT-based coordination mechanisms to bridge temporal and geographical differences. Coordination mechanisms included communication technologies, group training, standards, change procedures, etc. However, regardless of the mechanism used, if the expertise was not recognized and found credible, it remained uncoordinated. In one conference call, there was a dialog about: “Who knows about it? And where we stand?” with the reply, “Good Question.” There was also a lack of knowledge about how the mechanisms worked on the other side, “Umm. I don’t know their procedure [for design changes]. I don’t know that the other site does it the same way.”

1) *Value of Design Aesthetics*: Coordination of existing knowledge specialization in building TMS was hindered by the differing design aesthetics of the two sides of the team. The weekly conference calls and the needs list, two coordinating mechanisms, rarely generated any dialog of differences in design strategies and problem solving approaches, which might have led to mutual adjustment. The needs list did not help uncover the superior design preferences and assumptions that the U.S. engineers were using and expected the Romanian engineers to follow. Rather these differences emerged after a design was completed by Romania and sent to the U.S. Surprises in the Romanian design in turn resulted in discussions of the merits of design, which the Romanians felt they rarely won. In one conference call, one of the U.S. engineers rejected a Romanian design proposal as weird: “This thing [the Romanian design] just look at it, it looks weird. . . It might be ok, but it looks weird.” After hedging his negative assessment somewhat by saying “okay, it’s just another configuration,” he described his way of doing the design, and said “and it will look right.” This conversation occurred six months into the project.

2) *Learning Practices*: Coordination of expertise was also affected by different practices about learning or how to gain expertise. The U.S. engineers were accustomed to a practice whereby acquisition of expertise was assumed unless a junior engineer contacted them and asked for help or directions on

how to proceed. The U.S. engineers, not accustomed to providing detailed information and not providing a workspace where information would be overheard via peripheral participation, waited to be consulted by the Romanians, and in the absence of requests for help assumed learning. Even when the U.S. engineers discovered that the Romanians did not show their state of understanding in the same way, it was difficult for the U.S. engineers to adjust to this difference, instead expressing incredulity, as revealed by the quote: “[they] never raised a question if they didn’t get any document, they should’ve raised a question like ‘hey we didn’t get [description], is it a problem?’” The U.S. role of assuming peer knowledge conflicted with the cultural expectations of the Romanian engineers who were habituated towards seniors who told them what to do and how to do it, “If I need something for my job, I send an email to [manager] because he is my boss.” This conflicted with the U.S. engineers’ expectations of what it meant to seek mentorship and how to be a mentee.

The learning opportunities also seemed to be limited to the Romanian engineers. When they were provided, the Romanian engineers did not always seem to use them, as one described “I think that meeting was for, was not for me or my [Romanian colleagues] especially. Because they talked about the budget and this is not my job.”

3) *Retrieval Practices*: Retrieval practices were different. These included knowing how long to wait for an answer, when to expect a response, when to use email versus phone, and to whom to address requests for information. These differences were addressed by the U.S. coordinating engineer after four months of working together, but they remained an ongoing issue.

4) *Institution of Office Layout*: While in the U.S., the Romanians worked in cubicles that were clustered together and not necessarily next to their U.S. counterpart. There were few opportunities for the U.S. engineers to observe Romanian work practices. In Romania, however, up to eight engineers shared a single room, each with an individual desk facing towards the others. A Romanian engineer while stationed in the U.S. remarked, “[In Romania] we have an open desk. We see each other, we talk to each other. . . . Here [in the U.S.] we’re not getting to know each other, getting friendship, relations, stuff like that. . . . [In Romania] you can hear everybody [talking] about the different projects, or different work.” The isolation in the U.S. hampered Romanian engineers’ coordination and the retrieval of information.

5) *Institution of U.S. Building Codes*: With the team members distantly located, the retrieval and updating of specialized information such as institutionalized U.S. building codes became a source of contention and confusion. This was complicated by the fact that the U.S. construction codes had just undergone revision. The Romanians were “piled with a ton of paper” and expected to learn the new codes as they progressed on the project. A U.S. engineer remarked on the difficult learning situation this presented to the Romanians, “I’m pretty sure their library is not even constantly being updated with the later versions of the codes.”

6) *Institutionalized External Memory Systems*: When mechanisms, which assist in retrieving and updating information have been institutionalized and formalized, their existence and the re-

trieval practices that surround them are assumed to be shared; thus some of the knowledge required to use them is considered so basic as to be part of any institutional framework and not considered necessary to explicitly state. Examples are formal change order documents that acted as mechanisms of sharing project information, and weekly updates to the cost document. However, the decontextualized documents left out important tacit information for the Romanians who were required to interpret and make sense of them, and it was often unclear how information was tied to an individual.

It became clear that the tacit knowledge on the U.S. side of what information each document should contain was not shared and hence updated in TMS directories. In one example, when a U.S. engineer suggested that the Romanians copy a template already in use, it became clear that the Romanians did not understand the document in the same way. After a clarification sequence, the U.S. engineer stated that “This is the format we have been using for reporting engineering progress.”

7) *Institution of Date Representation*: A simple but important way that coordination can fail is the difference between European and American time reporting conventions. After more than three months working together, in realizing a missed deadline, the U.S. project manager called for a means of encoding date representations: “let’s get rid of the numbers, let’s put in the actual month, and day. . . . [Name of Romanian Project Manager], can you pass that onto your team too? So instead of sayin’ 12–3 or 3–12, let’s say March 12th.”

In summary, exchanging task related information in conference calls and emails did not necessarily help in coordinating expertise because of differences in cultural knowledge systems.

### C. Credibility

Lack of explicit or agreed on reliability mechanisms, and failures of credibility were also related to cultural issues. The U.S. managers told their leads, “Don’t give them any more information, they will get confused. “A U.S. manager reflected, “We have to reevaluate how we feed them information and how we frame the expectation.” When we asked a Romanian engineer about coordinating with the U.S. lead, he replied, “he is very polite, but he doesn’t have understanding.” Credibility was also undermined as the engineers did not know how processes were handled at each site, “I don’t know their procedure.” Without knowing the procedure and the expertise of the U.S. engineers, it is questionable whether the Romanian engineers could rely on the information they received. At times, cultural differences completely suppressed credibility processes and adversely impacted TMS.

1) *Value of Stereotypes*: Stereotyping can preclude accurate credibility processes by providing an overly simplified way to authenticate a response or interpret expertise. In the absence of knowledge of the other person (of the type that is gained through face-to-face communication) and when expectations and actions did not converge, engineers tended to resort to cultural stereotypes. The stereotypes impeded the credibility of knowledge.

2) *Verbal Versus Written Credibility Practices*: The two sides of the team had different media preferences for information. The U.S. engineers preferred to rely on verbal information;

the Romanian side preferred written information. Romanians often asked for confirmation and “everything in writing.” At times the accuracy of information was questioned and sometimes pursued over several turns at talk. In one example, a U.S. engineer thought the Romanian engineer meant verbal confirmation, which he provided. This was followed by the Romanian engineer asking that written confirmation be sent. When the Romanian engineers repeatedly asked U.S. engineers to “put everything in writing,” they showed that they felt they could not rely on their acquired knowledge of location of expertise alone, but needed a credibility mechanism such as a time-stamp.

3) *Trust Building Practices:* Problems in building an accurate TMS were related to different views of what makes another engineer’s knowledge trustworthy. Whereas the U.S. engineers sought the knowledge of another engineer based on perceptions of ability and reliability, the Romanian engineers preferred to retrieve knowledge from an engineer they perceived as benevolent. This was shown when Romanians emailed or transmitted questions about knowledge or information itself to a person, not based on current institutional or team role, but on an already established and previously negotiated personal relationship. Western benevolence had a social history, as one Romanian engineer told us, “We waited 50 years for the Americans to save us.”

Trust in the Romanian engineers’ competence was undermined and integrity questioned in cases when requests were complied with in a manner that was perceived as unfaithful to the intent of the goals of the project. In one case of a transfer of documents, the number of documents returned was correct, but not the type of documents.

4) *Performance Feedback Practices:* Weekly conference calls, rather than enhancing credibility of TMS, promoted *ad hoc* problem solving with little evidence of increased accountability. Even when feedback was received, it created frustration. Feedback was sometimes just “thrown over the wall” with no dialog. Major delays in feedback were often due to information held by the equipment vendor or end client.

5) *Institution of the P.E. Stamp:* The U.S. verification mechanisms that were used in the project included the diagnostic checking of Romanian design documents by the U.S. engineers, specific design criteria of the project, U.S. building codes, and the lessons learned file. However, these mechanisms did little to help Romanian engineers to ensure that the U.S. engineers had taken action as expected. The Romanian engineers did not necessarily always have corresponding credibility mechanisms. Even when they did, the meaning of the mechanisms differed. In the U.S., a P.E. or Professional Engineer stamp certifies a document, specifying who is taking responsibility for its quality. Romania has a similar equivalent status (Inginer), but it did not play the same role and reflected differences in professional domains.

The data analysis also suggested that time emerged as important in the way we had not anticipated at the outset of our coding.

#### D. Time

Lapsed time on the project did not necessarily help develop improved memory systems about who was competent to do what and who was taking responsibility for what as suggested

in the TMS literature (e.g., [38]). In the middle of the project, a key person in Romania left and weeks went by before this was known at the U.S. site. Emails continued to be sent to this person, leading to more problems in timely delivery of information.

On both sides, TMS suffered as the project task kept changing even as the project neared the 60% review milestone. Shared task–expertise representation did not emerge to an effective level, a level where learning could be presumed, and where the cognitive map of specialized expertise and an individual’s relation to it was relatively stable over interactions and time. Some aspects of this were related to the fact that the client made unanticipated changes, which meant changing responsibilities at both sites. These changes were not always expeditiously communicated to the Romanian engineers. The Romanian engineers interpreted as intentional (rather than inefficient or locally contingent) the failure of the U.S. group to provide them with the technical knowledge and scheduling information they asked for. After months of working together, in one conference call, a Romanian engineer suggested to the U.S. side of the team, “I think you have some motivation for not sending [the information to] us.” This accusation exasperated the U.S. engineers, one U.S. engineer telling another not to respond but to “let it go.” Such incidents led to withdrawal behaviors and fewer demonstrations of other behaviors that could have been used to update TMS. Such incidents also seemed to erode TMS, at least temporarily, as team members began to question who is doing what.

In summary, unshared cultural values, practices, and institutions impeded the indicators of specialization, coordination, and credibility. The inability to meet face to face impacted accurate recognition of different social structures. Coordinating complex design expertise was hampered by technologies that made it difficult to coordinate voice, text, and drawings together in a way that is common in shared face-to-face office space. In one conference call, for example, the call was interrupted and everyone waited while one of the Romanian engineers drew a sketch of what was proposed and sent it by fax to the U.S. Differences in practices of asking questions and of learning limited the development of TMS. Documents based on U.S. reporting practices were not always well understood by the Romanian engineers, causing problems in the coordination of work. The problems lingered over time.

## V. DISCUSSION AND IMPLICATIONS

Our findings address an important gap in the literature. Although prior literature has examined TMS in offshoring contexts [46] and in distributed teams (e.g., [17]), it has failed to consider the impediments to TMS development in a culturally diverse team. This case study suggests that because of cultural differences, TMS indicators of specialization, coordination, and credibility were impacted in an engineering team composed of U.S. and Romanian engineers working in dispersed locations. Differences in cultural values, practices, and institutions impacted how the project task was viewed, what knowledge was valued, and the recognition of an individual’s contributions to the project. Who was assigned what expertise responsibilities was not necessarily explainable by task allocation and existing expertise alone. Culture affected who was privileged with

TABLE I  
CULTURAL DIFFERENCE FACTORS IMPACTING TMS PROCESSES

|                | Cultural Values  | Cultural Practices  | Cultural Institutions  |
|----------------|--|---|--|
| Specialization | Value of theoretical vs. practical knowledge<br><br>Value of individual innovativeness<br><br>Value of uncertainty | Communication practices<br><br>Design practices<br><br>Boundary spanning practices                            | Social structure<br><br>Social histories   |
| Coordination   | Design aesthetics  | Learning practices<br><br>Retrieval practices   | Office layout<br><br>U.S. building codes<br><br>External memory systems<br><br>Date representation |
| Credibility    | Stereotypes  | Verbal vs. written validation practices<br><br>Trust building practices<br><br>Performance feedback practices | P.E. Stamp   |

what information and who was viewed as a legitimate store of knowledge; in other words, who knows what and who knows who knows what is made less relevant by cultural conventions of who can display the knowledge. Culture influenced retrieval processes in terms of who a person was willing to approach for the recall of knowledge, making the links between individual nodes of expertise unstable across cultures. Culture also impeded reliance on other member's expertise, as actions such as clarifying and questioning were used differently or were thought inappropriate actions by some team members. Lapsed time on the project did not resolve these challenges and even exacerbated them.

The case data suggest a number of cultural difference factors that at least partly affected the development of TMS. We list these factors in Table I; however, the list is intended only to be illustrative of how culture impacts TMS. The case study results have several implications for literature on TMS, including the role of boundary spanners and culture. The results also have important practical implications for expertise coordination in culturally diverse teams, such as those involved in complex engineering services offshoring.

#### A. Implications for TMS Literature

The first implication is that cultural differences are more important than acknowledged in the TMS literature. Brandon and Hollingshead [8, p. 636] acknowledged that "Group culture may modify who is assigned to know what beyond what the task requires." Yuan *et al.* [62] underscored that normative and cultural pressures can impact expertise coordination. However, the TMS literature does not discuss how cultural differences impact organizing schemes of knowledge, and the transactive processes of learning, remembering, and sharing, and the resulting specialization, coordination, and credibility indicators of TMS. Our results suggest a need to revisit the TMS theory in a culturally diverse context. Incorrect conclusions may be reached when the influence of culture is not considered.

To elaborate, our study begins to explain how TMS indicators are impacted when value systems are differentiated among team members. Brandon and Hollingshead [8], p. 640] described an

incident where an accountant assigned to a decorating team does not plan to contribute any of the expertise the accountant has because senior management has made it clear that office redecoration is the lowest of priorities. The incident is used to illustrate how perceptions of status lead to a failure of credibility that occurs when "who should know what" does not correspond to "who actually does what." A broader sociocognitive view of TMS allows us to reexamine similar incidents in cross-cultural contexts as a failure to coordinate knowledge that is impacted by cultural values. What might be perceived as failures of credibility resulting from withdrawal or aggressive behavior might be less about credibility (or failure of it) than about culture, where cultural values have rendered certain behaviors as inappropriate or inconceivable but are not recognized as such by others in the team.

As demonstrated in this paper, culture affects the key indicators of TMS: specialization, coordination, and credibility. To account for culture, particularly the indicator of credibility needs to be rethought as to what it represents and what type of transactions are needed for its development. According to the prevailing TMS theory, when credibility is high, members are expected to trust that other members' knowledge is accurate and not question or criticize it [36]. Credibility is assumed to be symmetrical in the team and it is assumed that the team members are able to make themselves understandable to the others. These assumptions do not necessarily hold when team members do not understand how the others in the team see them. Engineers rarely correct each other for culturally inappropriate behavior, and they do not calibrate cultural practices in a way that would render them easily understandable. When cultural values and practices are discussed, it takes place as a third party commentary (talking to a non-Romanian about a Romanian) rather than as part of an interaction among people with unshared value systems. Hence, the implication is that members are not aware of low credibility until a conflict occurs. But then the incident is often rationalized for reasons unrelated to culture.

Another implication is that some of the prevailing assumptions of TMS development need to be questioned. The literature portrays TMS as developing gradually, even automatically without members consciously of being aware of it [8], [22]. In contrast, the current case findings suggest that TMS may not necessarily evolve, or may even manifest downward spirals, in the face of disconfirming information. This suggests that we need improved understanding of conditions when TMS may be eroding or unable to develop further. Both an unstable task and cultural differences appeared to contribute to the gaps in TMS development. The lack of a stable task structure meant that the team lacked a major organizing scheme to understand what needed to be done, what resources were needed, how to go about accomplishing the task, how to get resources, and who needed to accept responsibility for what. Although stable task structures do not mean that task representations do not change, a stable structure provides a more objective and collective reference system to which team members can incorporate new information, which also helps to ensure continuity over time. Stable task structures might also mute the impact of stereotypes and habitual routines.

The final TMS related implication addresses the use of managers as a locus of TMS directories. Jackson and Klobas [23] argued that collective directory updating can occur through intermediaries. They describe how managers acted as an entry node and facilitated maintenance of TMS directory structure. The current case reveals a rather different picture of intermediaries. Coordinators in the current case did not substitute for the direct interpersonal interactions needed to learn and update knowledge.

In offshoring, boundary spanners called “coordinators” often play a key role in expertise coordination [35]. Leonardi and Bailey [34] found that a boundary spanner could hamper the team’s activities if he or she did not possess the relevant knowledge. In the current case, we have no reason to suspect that the coordinators did not possess sufficient knowledge of the U.S. and Romanian cultural systems. Hence, one might expect the coordinators to be the location of specialized knowledge of cross cultural differences and be the source for others to seek and transfer that knowledge as needed. Yet, we rarely saw the coordinators exhibiting their specialized cross-cultural knowledge in the form of personal experience narratives (e.g., how an engineering acronym was created) and via modeling of dialog or in an interaction that tried to clarify cultural misunderstandings, or alternatively made space or built tolerance for different behaviors in a cross cultural team. Both narrated stories and modeling (performance role) are considered ways that facilitate the transfer of cultural knowledge as they help to accumulate generalized knowledge across different instances [45] and can mute the effect of cultural stereotypes. Why the coordinators did not demonstrate their cross-cultural knowledge is not entirely clear, but it is possible that the team did not consider cultural knowledge as knowledge relevant to the team’s activities. Hence, the coordinators are only as effective as cultural knowledge sources as the value placed on cultural knowledge in the team.

### B. Implications for Culture Literature

Implications of our results for research on culture include identifying which elements of cultural value systems, practices, and institutions might be most important to recognize as problematic in achieving efficient cross-cultural teamwork, and how these elements, which are expressed through highly habitual behaviors, might be made more recognizable and accessible to our analysis individually and collectively.

When the engineers talk in vague or broad terms about culture, such as “mind set” (with a connotation of fixity) and “philosophy” (an abstract notion, not practice-based), they obscure potential understanding of how cultural knowledge might be learned or where cultural knowledge might be found or accessed. A better understanding on the part of the engineers that culture is not something that resides in people’s heads, but instead is made up of routine practices and behavioral accounts that can be observed, discussed, adapted to, or adopted in varying degrees, would facilitate development of procedures for knowledge sharing and learning. Without such knowledge, when, for example, directness is expected, but indirectness is

encountered, an engineer may not grasp the significance. He may not realize that directness can be impractical to expect if it is culturally associated with negative moral character traits.

This research can also contribute to understanding culture change (acculturation), particularly how working together cross-culturally can affect the way events are interpreted, the way opinions are conveyed, and how each group imagines itself and each other.

### C. Implications for Practice

Practically, our study shows that offshoring companies need to be aware of how important it is to develop TMS. An emphasis solely on standards and on coordinating understandings of manuals can blind senior management to how critical to the success of the project the emergent knowledge sharing of an efficient TMS can be. Management must be made aware of how difficult it is to develop TMS in a dispersed, culturally diverse team. Yet, without TMS, project coordination will suffer, with a likely loss of efficiency, rework, and reduced profitability to business partners.

In terms of interventions, we suggest that engineers and other professionals could sharpen their skills in observing human behavior in order to recognize important details of embodied, habituated practices of members of another culture. We have discussed some ways these practices emerge in professional interactions. We also suggest that engineers share stories of personal experience with and elicit them from engineers with other cultural backgrounds, as these can be a fruitful way to communicate the values underlying practices. Stories can also reveal different cultural logics, since narratives build coherence and rationalize contradictions, and they display an array of local styles and aesthetic devices, whose evocative power can produce unforgettable learning. By exchanging personal narratives of, for example, learning to be an engineer or behavioral taboos, new perspectives can be gained and an understanding of values, institutions and practices built. To recognize and plan for the impact of institutional differences, engineers could learn something of the historical background of a society, in order to understand factors that influence communication, accountability, autonomy, and learning.

Finally, this paper complements offshoring literature that has focused on firms in emerging economies. Literature on economies transitioning from state controlled, protected markets to privatization and global capitalist markets suggests that attention to learning, particularly innovations in communication practices and information processes, as well as employee participation, is vital to success [24], and sociotechnical capability to manage increased complexity distinguishes leaders from the others in utilizing new investment efficiently [49]. Human resource costs emerge from difficulties related to knowledge, education, and attitudes [51], and from lack of government vision or planning in the diffusion of communication and technology skills [20]. The imposition of Western systems can negatively impact culturally valued ways of doing business, and a West-is-best assumption on the part of those in transition can lead to negative experiences [42].

VI. LIMITATIONS AND FUTURE RESEARCH

APPENDIX A

Our findings need to be considered in light of their limitations. First, our findings are based on a single project team within a specific U.S. engineering firm and their offshore contractor. We collected limited retrospective data on the U.S. engineering firm’s previous three offshore projects that were less complex (two with the same Romanian firm and one with a Venezuelan firm), and some of the same findings, although to a less extreme extent, persisted. The current approach limits the theoretical generalizability of the findings to other work settings but opens up new opportunities for future research.

In this paper, we primarily focused on how culture shaped cognitive structures of engineering knowledge expertise and transactive processes. Future research should examine whether culture has a different role when there is good versus bad fit between task representation and expertise distribution, and fit in the relevance of maintaining relationships of subordinate and superior persons. Future research should examine the type of interventions, implicit or explicit, that would help cross cultural groups’ members develop and participate in TMS. The Romanian engineers who had worked on the previous project with the U.S. engineering firm tended to rely on the TMS created on that project although the division of labor and the task were very different. Future research should examine unlearning in TMS and whether being distant and relying on mediating technologies makes such unlearning more difficult. Alternatively, the assumptions about the normativity of rapidly adapting to and adjusting the landscape of personal, team or work relationships in TMS can be reexamined to account for differences across cultures. Overall, we believe that had the team been face-to-face rather than distant, the cultural impact on the dynamics would have been lessened. For example, the Romanian engineers would have learned more cues to help get their differentiated knowledge accounted for by the U.S. engineers, and learned more skills in nuanced inferences used to direct or defer responsiveness or deflect responsibility. Future research should examine how cultural differences without geographic distance affect TMS. The role of external memory devices should also be studied.

VII. CONCLUSION

The goal of this paper was to extend the theory of TMS to incorporate cross cultural differences in the organization of cognitive structures and transactive processes. Improved understanding of TMS in situations of cultural difference is critical for the theory to be relevant for increasing global teamwork. The findings of the case study suggest that differences in cultures are not merely a matter of context and history but deeply impact the emergent knowledge integration dynamics of TMS indicators. The case findings suggest cultural differences triggered complications in building and updating new knowledge of relative individual expertise on particular issues and skills, retrieving and integrating the expertise, and rendering it in efficient actions. The implications include greater consideration of cultural differences in TMS development and greater investment in interventions that promote exchange of cultural knowledge.

1. How would you compare your work on an outsourced project to a project done in-house, and what are the major differences?
2. How do you work with a counterpart in offshoring and what are some of your experiences working with that counterpart?
3. Please comment on the following aspects of outsourcing complex engineering work: Communication, coordination, quality of work, man hours required for rework, conflicts, trust building, scheduling, and language issues.
4. What are some of the aspects of level of effort (LOE) that have affected you and how is LOE accounted for? What duplications of effort are necessary at this phase?
5. What types of meetings are regularly scheduled and how are documents handled between offices in terms of coordinating efforts?
6. What types of communication are used and how, e.g., email, telephone, web meetings, etc.? Who gets copied and included in these communications?
7. What is a typical day like?
8. What is the validation chain like?
9. Who is the “go-to” person for problems and why?
10. What signals do you look for to check understanding?
11. How did you prepare for this work?

APPENDIX B

CODING EXAMPLES

| Code/Description   | Example   |
|--|---|
| <b>Knowledge Specialization/</b><br>Effect of cultural institutions (social structure) | I think that meeting was...not for me or my colleagues...because they talked about the budget and this is not my job...If I need something for my job, I send an email or I talk to [Rom eng] because he is my boss, and I say "I need something" (Rom eng).<br>...maybe that's some cultural thing left behind, also Eastern European type mentality "This is the way I want it to be done, don't question." I don't know if that's true or not but seems like that's the idea (US eng).                       |
| Effect of cultural institutions: cross-cultural hierarchies                            | In my opinion, the documentation, the standards, are the best from here [US] and they are recognized around the world (Rom eng).  |
| Effect of cultural values (theoretical vs. practical knowledge)                        | [Co. X] always ask the manufacturer if the nozzles can do what they want, like with increased loads, and the manufacturer always says yes, however they keep to the old charts and this means time is wasted. Why don't they use new charts or data? The smart theorists at the university say you can use different data but [Co. X] has tunnel vision about this (Rom eng).   |
| Effect of cultural practices (different design practices)                              | Gentlemen, in my opinion, we'll follow your recommendation, but you'll use more steel than included in our proposal (Rom Proj Mgr)  |
| Effect of cultural practices (boundary spanners)                                       | [Rom eng] knows his mind, he knows the philosophy of the Romanian mind and he can translate the information better than [US eng] in some cases (Rom eng).   |
| Effect of cultural practices (communication)   | I have very strong words to say for the [Rom] team's commitment and work ethic but probably the way we relate to our peers is not the same way they do...[they] never raised a question (US eng).   |
| Effect of cultural institutions: differences in social histories                       | You cannot imagine...the Communist period. My brother, father, was put in the prison because he was a teacher. They take everything. In one night...To buy 1 liter of milk you shall stay at queue for 5 hours...wake up at 3 o'clock in the morning to put your bottle in the ...shopping area. This was unbelievable...the light the electricity was only on for 3 or 4 hours. The temperature in the building was very low...The crimes... (Rom eng).  |
| <b>Knowledge Coordination/</b><br>Effects of cultural values: different design         | We work for Russia...Thailand...here [US]. In some cases our Romanian standards were more or less accommodated to international standards than U.S....we have some problems because our standards are totally different than your standards...our people were obliged to study the standards, to understand...to accommodate these standards in a very short period...was misunderstandings, which was normal in my opinion. But with their help we correct, and I hope that in the future we reduce (Rom eng). |

|  |   |
|--|---|
| Effects of cultural practices: different learning practices                        | Lessons Learned file (US)<br>Learning is not written down formally (Romania)  |
| Effects of cultural institutions: differences in office layout                     | I feel very bad when I don't understand...I talk with [US eng] and I say "Excuse me, I don't quite understand, please repeat for me." ...it's easier to...show something so I said to him "Come with me I want to show you something in my own computer." (Rom eng)...[In Rom] we are 8 people in a room, and all the people talk about, talk with another (Rom eng).   |
| Effects of cultural institutions: reporting practices                              | ...get very guarded responses...if all you get is a sunshine report then you haven't learned anything...cultural reporting by exception is not necessarily in place, where you wouldn't bring out the problems and discuss them but shove them under the carpet (US eng).   |
| Effects of cultural institutions: building codes                                   | ...just as they are getting comfortable...then you throw a bunch of new civil codes at them...Well, hell, we're not used to dealing with them yet, much less anybody else (US eng).   |
| Knowledge Credibility/Effects of cultural practices, verbal vs. written validation | Rom Mgr: Dimension same as [prev. project]?<br>US Eng: We already said last week that it's the same.<br>Rom Mgr: I have the drawing but have no confirmation.<br>US Eng: ... will be the same as [prev. project]<br>Rom Mgr: Please send the confirmation.  |
| Effects of cultural practices: differences in trust building mechanisms            | Rom Mgr: This is my role to accommodate all these type of people to conclude it, to agree, to transfer the work in our office.<br>Author: And do they ever talk about this or was this something that was unspoken, that just takes place?<br>Rom Mgr: No this is my feeling and you should trust my feeling [laughter]   |
| Effects of cultural practices: performance feedback                                | In the conventional pipe stress world, you don't usually [describes Rom design]. Normally you put the horizontal beam just on the pipe [describes] ...that's just what's normally done industry wide...what we've got here is somewhat of an oddity, will it work? Sure, but [gives reasons] (US eng).  |
| Effects of cultural values: stereotyping   | When the Romanians first came...we were joking about the rules of the company...Rule #1: the boss is always right. Rule #2: if the boss is wrong see Rule #1. So, that's the kind of mindset over there...never question your boss, you never um go against the chain of command or authority. But I may be completely off base, but I'm just speculating on behalf of somebody that I have never met or had any interaction with to make a judgment on (US eng). |
| Effects of cultural institutions: PE stamp   | Different Romanian and U.S. engineering certifications  |

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