The Dissemination of Knowledge Management

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ABSTRACT
Our study on a community of knowledge management (KM) practitioners in the aerospace industry reveals challenges in the dissemination of KM concepts and tools. In this paper, we identify four reasons: (1) disparity of the community's stated purpose and the actual motives of its members; (2) multidisciplinary nature of KM; (3) unique characteristics of the aerospace industry and its engineering culture and (4) adoption of preferred or recommended solutions provided by chosen reference groups rather than a grounded approach. In particular, we address the issues in promoting recommended ideas and tools by chosen reference groups in work organizations without fully understanding work practices.

Categories and Subject Descriptors
K.4.3 [**Computers and Society**]: Organizational Impacts; K.7.2 [**The Computer Profession**]: Organizations

General Terms
Human Factors, Management

Keywords
Knowledge Management, Work Practice, Communities of Practice, Reference Groups, Diffusion, Aerospace Industry

1. INTRODUCTION
For the past three years, we have studied a community of knowledge management (KM) practitioners in the aerospace industry [33,37]. They physically meet at their quarterly forum, the KM Exchange, to discuss their KM practices with others in the field. Our ethnographic investigation reveals numerous challenges these practitioners encountered in their respective work organizations while promoting KM. The ultimate goal of the practitioner is to spread KM in their work organizations until it is embedded in the organization. One senior practitioner expressed his wish of what KM should become: *"My ultimate goal is … when you walk into our company, you cannot find the word KM because it's all embedded"* [33]. Moreover, we learned that practitioners genuinely believed KM was crucial for the success of their organizations. We pose the following question: why do practitioners face difficulties in disseminating KM despite their wishes and beliefs? Our aim in this paper is to expand on our past work and focus on the reasons for the practitioners' continuous hardships in ***disseminating*** KM.

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Our first study [33] on the KM practitioners' discourse revealed that despite the motivation to cultivate a community of practice for learning KM techniques, this forum instead became primarily a hub for legitimizing the KM discipline itself. Practitioners sought out a place for affirmation, validation and legitimization of their KM practices and for sharing their pain. For example, informants often noted that KM was relegated to a small team in a large company that had to face uphill battles against the prevailing aerospace engineering culture. One strategy they utilized was to promote their KM tools and practices as being "*progressive.*"

Thus, a community can be far different from Lave & Wenger's [16] communities of practice (CoP) model. The CoP model stresses that learning occurs among members through "legitimate peripheral participation." Moreover, our analysis [33] of the practitioners' discourse identifies three central and recurrent themes: (1) KM makes effective use of knowledge by capturing and reusing it (knowledge is objectified); (2) practitioners and their tools and practices are more progressive compared to other fields and (3) KM is misunderstood within their work organizations or people simply do not understand what KM is.

Alluding to the notion of social worlds explicated by Strauss [30], our second study [37] explored the power relationships among the KM Exchange members and, in particular, the role of the senior members. We argued that power relationships existing in one's respective workplaces can be *transferred* and *mirrored* in a new community and consequently impact the boundaries of the community, its knowledge sharing practices among the members and its institutionalized beliefs within the community. We surmise that this community, despite its stated purpose of equally sharing knowledge is in fact influenced by the activities of the members in their respective work organizations.

Building upon our previous studies, in this paper we examine the four reasons practitioners must deal with challenges in disseminating KM in the aerospace engineering settings (when we state "dissemination of KM," we imply dissemination of KM concepts, such as knowledge reuse and knowledge sharing, and KM tools). These reasons are (1) disparity of the community's stated purpose and the actual motives of the members for attending the community meetings; (2) multidisciplinary nature of KM; (3) unique characteristics of the aerospace industry and its engineering culture and (4) preferred or recommended solutions provided by chosen reference groups.

Our paper is structured as follows: in section two, we present the field sites and research methods; in sections three to six, we provide the background and analysis on our four reasons; in section seven, drawing on Orr's [24] ethnographic fieldwork of the community of copier technicians, we address the importance of understanding the work practice of users (i.e. aerospace engineers) rather than relying on solutions advocated by reference groups. Although we acknowledge that our ethnographic inquiry on the community of aerospace KM practitioners is somewhat limited in scope, we believe our study will have broader implications on the dissemination of concepts and tools in workplaces.

2. FIELD SITES AND METHODS

We have been participant observers at the KM Exchange quarterly meetings. The current membership consists of employees from six major aerospace organizations and people from three local universities. Alpha Corporation[1] is a research organization for the Department of Defense agency and Beta Institute is a government agency. The four other organizations are defense contractors. According to the membership list, there are about 85 members; however, the average attendance of the meetings ranges from 30 to 50 members. These organizations are dispersed in two counties of the region. The physical location of the meetings are rotated among these organizations; therefore, the members sometime need to drive more than 50 miles if the meeting is not held at their own site. Each quarterly meeting consists of networking, two presentations, lunch plus networking, and small break-out discussions. Each meeting usually lasts at least half a day.

The primary methods for data collection were observations of the KM Exchange meetings and semi-structured interviews. We attended ten quarterly meetings, two conferences organized by one senior member, one KM Exchange-sponsored conference which was open to other industries and one seminar presented by another senior member at the local university. We conducted 24 semi-structured face-to-face and telephone interviews ranging from 30 to 90 minutes and one follow up telephone conversation. We interviewed 23 members (one of them was interviewed twice) and, among them, 19 members were from the aerospace industry and four of them from academia. These interviews were audio recorded for accuracy. Additionally, we reviewed various KM websites and practical KM books to help us better understand the views of KM luminaries.

The field data is descriptive data on the nature of work and social life. To analyze the field data, we took a symbolic interactionism stance—"an inductive exploratory approach to studying the empirical world, wherein the researcher interprets the real world from the subjective perspective of the subjects under examination" [p.93, 8]. Taking the grounded theory approach [32], the field notes and interviews were transcribed, coded and analyzed on Atlas/ti (www.atlasti.com).

[1] All names in this paper are pseudonyms.

3. THE COMMUNITY – MISMATCHED EXPECTATIONS

The official website of the KM Exchange states that it is a place where "leaders in knowledge management in industry (with a focus on aerospace) and academia come together to share, collaborate, and discuss." Although this official statement implies that the purpose of the forum is for KM practitioners and academics to simply exchange knowledge on KM, our past studies revealed that this community contains a complex variety of motives among its members. For example, in our first study, we found that the community serves as a place for affirmation, validation and legitimization of their KM practices rather than only a place for learning KM techniques. Thus, new members' expectation of becoming KM experts in the aerospace company was not always fulfilled.

3.1 Shaped by the Core Members

In this section, we will briefly summarize our findings about this community from our previous studies [33,37]. The four founders (hereafter we will call them core members) molded this community from its initial formation and through its various stages of transformation. Via numerous small, temporary interactions, such as KM conferences and lunch gatherings, the core members formed their own tight-knit group which eventually expanded to the KM Exchange. These core members demonstrated the characteristics of leaders and trailblazers by initiating KM efforts in their work organizations. The core members recruited new members without any difficulty since the majority of their recruits were subordinates in their workplaces. Knowledge about KM was usually handed down from the core members and some senior members to newcomers. Moreover, the community developed institutionalized beliefs on KM that new members often accepted without question. Therefore, we surmised that the community was largely shaped by a handful of senior members.

Our field data revealed that newcomers and some old-timers had different expectations about what to gain from the KM Exchange. Unfulfilled expectations discouraged some newcomers from continuing their attendance at the meetings. This sense of *stagnation* in the community revealed a disparity between those whose desire to simply learn KM techniques and those whose desires are more nuanced—the core members and some senior members needed to legitimize KM in order to stay alive in their work organizations. They had to demonstrate KM's worthiness to gain a place in the organizational chart and consequently to secure funding to keep their KM efforts moving forward.

3.2 Shift from an Aerospace KM Community

Strauss [31] points out that a new social world often tries to set their boundaries to legitimize their existence. Boundary setting and boundary challenging are crucial processes for the transformations of the KM Exchange and the building of their identity. Strauss [30] also addresses the importance of keeping our attention on the history of the social world: "What are its origins, where is it now, what changes has it undergone, and where does it seem to be moving?" In this section, we build on our past two papers to address how the boundaries of the KM Exchange have evolved and what it means to the dissemination of KM.

Initially, the core members wanted a small and informal community due to the secretive nature of the aerospace industry; one senior member explained the motives of the core members: *"Their [core members'] intension was just having a comfort level of sharing that they could hint something that would help one another but not go so far into the detail that they would revealing trade secret. … by making the group [KM Exchange] larger, they worry they wouldn't have as frank conversation as they could, like among friends, you might have conversation."* Moreover, in its early stages, the membership boundaries of the KM Exchange were often discussed at the quarterly meeting. Some old-timers voiced their concerns about inviting non-aerospace people, especially non U.S. citizens, due to aerospace's security issues.

Despite the initial goal of the core members to have a small, informal forum to discuss and share aerospace specific KM issues, the boundaries and the identity of the KM Exchange have gradually changed over the years through interactions with other groups—academia and other industries. One core member explained to us why the inclusion of academia and other industries would help the KM Exchange: *"It was a way to supercharge the diversity of thoughts, opinions in the conversation, in any specific narrow industry, aerospace not very different from pharmaceutical or oil or gas or power generation or, or whatever that you can get very…you can get too detailed into this specific of your industry and sort of miss the things transcend the industry."*

Besides being leaders and trailblazers, the core members also conveyed characteristics of connectors and mavens [11], opinion leaders and early adapters [27] as well as spokespersons [15]. As several members noted about the core members, their strong ability to network brought in people outside of the aerospace industry and thus helped to expand this community.

From the early planning stages of the KM Exchange, the core members were in favor of including academics. One core member noted*: "I think 60:40 institutional to academic is pretty interesting, very unique balance for us. Any of the other local groups, regional groups that are transacting conversations around knowledge management would not have that very healthy ratio of academic participants."* All the core members and some senior members occasionally teach or present at universities. One core member helped establish the KM master's degree program at a member university and subsequently became a faculty member there. Two other core members became a lecturer at another member university for one quarter to teach KM. Nevertheless, in our interviews, other members could not clearly point out substantial benefits of having academia involved in this community. Our interpretation was that academia helped establish legitimization of the community [33]. At the very least, academic members gradually impacted the KM Exchange. For instance, one core member invited a professor from a local university whom he met at a conference. Because of this professor's enthusiastic and assertive nature, he quickly moved to the center of the KM Exchange. He hosted a quarterly meeting and a conference sponsored by the KM Exchange that featured presenters and participants from other industries (e.g., construction engineering and high-tech) at his university. Our own paper [37] even brought lively and reflective discussions among the core members.

The KM Exchange held a conference open to other industries in late 2007 and subsequently in the fall of 2008. One member commented on this expansion: *"They [members] want to grow the group. There are a couple pressures that make them want to grow the group… the general theme for growing the group is that they want knowledge management to be the idea to spread. And at least for the term to be recognized more [in their work organizations], what I would call legitimizing it*." In other words, expansion of the boundaries of KM Exchange allows this forum to become more reputable in the KM field and as a result legitimize KM in their own organizations [33]. Yet, one senior member questioned if the expansion would really help the KM Exchange: *"But, you know, it is interesting to think. Culture is heavily embedded with engineers and scientists. That culture, so unique … it will preclude benefiting from other industry, I don't know. "*

The majority of the KM Exchange members expressed a desire to grow—*but, in which way?* If the boundaries expanded to other industries, the members would gain knowledge of how KM is practiced in other mature industries and as a result the KM Exchange would be more established—senior members can better prove worthiness of the community to their upper management. On the other hand, they would need to compromise their identity as an aerospace KM community. Moreover, they will lose the informal nature of the community in which they felt comfortable enough to hint to each other how they practice KM in each other's companies. Consequently, how will the changes in boundaries and identity impact the goal of the KM Exchange members—disseminating KM at their aerospace work organizations? The KM Exchange is still struggling in maintaining its aerospace identity while trying to grow as a community.

4. THE MULTIDISCIPLINARY NATURE OF KM

As a discipline, KM has reached a state of maturity. Yet, its viability as a discipline is still contentious. KM as a discipline has never been well defined and its boundaries are not clearly delineated. These vague characteristics of KM have contributed to the challenges the practitioners in disseminating KM. Reflecting on the multidisciplinary nature of KM, the practitioners promoted a wide variety of tools and concepts in their work organizations.

First, we briefly present a recent history of KM. Drucker [6] first coined the term "knowledge worker" to delineate them from manual laborers. As we shifted from the Industrial Age to the Information Age, the ability to manage knowledge became more crucial in organizations. The concept of KM became popular in the corporate world in the late 1980s to the late 1990s. In its early days, the KM discipline was concerned with how to find and store individuals' knowledge. This IT-centered approach shifted to a people-centered approach as luminaries in the field realized that IT alone could not resolve KM issues. These concepts, such as CoP, became popular around this time [5, 10].

We now explain the current status of the KM discipline. KM draws upon diverse fields, such as organizational science, cognitive science, information technology, library science, communication and artificial intelligence. This multidisciplinary nature of KM makes it difficult to define what KM is. One researcher [5] found over 100 published definitions of "knowledge management" from business to information technology fields. Thus, KM suffers from the "Three Blind Men

and an Elephant" syndrome [5]. A practitioner or a luminary who is exposed to one aspect of KM may perceive KM differently from others who are exposed to other aspects. Some of the KM theorists and luminaries mentioned by the practitioners at the interviews are Drucker, Prusak, Davenport and St. Onge. The practitioners were not aware of KM studies in the CSCW field (e.g., Answer Garden 2 [1]). Supporters of KM argue that KM is crucial in today's corporate world because of the globalization of businesses, mobility of the workforce and huge technological advances [5]. In contrast, critiques argue that it is a utopian ideal propagated by some consultant companies [38].

In the corporate world, KM is either misunderstood or dismissed as a business fad of the past. As a result, practitioners often have to disguise the term "KM" when they promote KM at their workplaces. People belonging to other departments are also uncomfortable with some KM terms. For example, one practitioner from a construction engineering company told us at a conference that his company's legal department warned him that the term "lessons learned" might imply that the product or service had defects. Additionally, some terms are not clearly defined or are misused. For instance, people, including some practitioners, frequently do not distinguish "knowledge" from "data" or "information" and treat "knowledge" as a synonym of others. KM has sometimes misused or transformed the meaning of some terms (e.g., "tacit knowledge" [26], "communities of practice" [16]) originating from other disciplines,

Being a multidisciplinary field, a mixture of strategies, tools and techniques – both low tech and high tech - are used in the KM field [33]. The KM tools and practices promoted by the practitioners reflect the multidisciplinary nature or somewhat hodge-podge nature of KM. The practitioners deal with a wide variety of tools and practices. Document management systems (e.g. Livelink) and expert locator systems (e.g. AskMe) are typical KM tools. The practitioners showed strong interest in search engines since they are crucial for retrieving explicit knowledge stored in repositories. Quindi is a unique audio/video recording tool which some of the practitioners use to capture meetings and the tacit knowledge of retiring employees. To our surprise, the practitioners told us that communication tools, such as IM, WebEx and web portals were KM tools. The practitioners promoted low-tech practices, such as storytelling, mentoring, employee reward practice, and CoPs. As we will discuss later, the practitioners were also enthusiastic about Web 2.0.

The practitioners remarked that experimentation of these tools in actual work organizations is necessary because they could not predict which KM tools would be successfully adopted and diffused. One senior member lamented that she needed to *"plant thousand flowers and see which ones will bloom."* Another senior member commented: *"[We] come up with a strategy to promote anything that relates to knowledge management, including tool developments and deployments."* This approach—trying out anything even remotely related to KM and then finding out if they actually worked—has not produced the desired outcome they hoped for.

5. THE AEROSPACE INDUSTRY AND ENGINEERING CULTURE

In our first study [33], we identified the KM practitioners' struggles in promoting KM despite their inherent skills in understanding human/organizational behavior and in being a bridge for people in the organization. Their primary concerns were that a generation gap may cause significant knowledge loss and the nonexistence of a culture of sharing in the aerospace industry. Their main hurdle was to convince middle management of the merits of KM; unfortunately, middle management's concern was to produce immediate results whereas KM's ROI (return on investment) is for the long-term. In this section, we first recap the challenging aspects of the aerospace industry [33] and then introduce additional aerospace specific practices and its prevalent engineering culture. We will discuss aspects of the aerospace industry which make it challenging for the practitioners to disseminate KM—the workforce issues, the inherently secretive nature of this industry, the organizational structure and practice, and its engineering culture. We will further discuss engineering work practices and their knowledge seeking behaviors in Section 7. Additional data we collected since the first paper convinced us that this industry and its engineering culture and work practice are unique hurdles in the dissemination of KM.

Currently, the industry faces a workforce crisis—a widening generation gap and aging workforce [2]—due to massive layoffs in the 1990s and the inability to attract and retain young engineers. At one of the recent meetings, a senior member from a defense contractor commented that his company had difficulty in retaining both young and new employees and the retention ratio was one to eight (only one thousand out of eight thousand new hires stayed with the company). This generation gap causes technology adoption issues because the older generation sometime has difficulty in comprehending new tools which the younger generation is accustomed to using in their daily lives.

The culture of the aerospace industry is traditionally secretive since the industry is regulated by strict government laws and standards such as the International Traffic in Arms Regulations (ITAR) to ensure national security. Additionally, aerospace contractors need to gain a competitive advantage to win government contracts, some of which may last decades and award billions of dollars. Our field data revealed that aerospace employees frequently work in shielded work environments called "silos." In such environments, knowledge is rarely shared with other business units, even within the same company.

The organizational structure and practices of aerospace companies are other unique complex aspects which make the dissemination of KM challenging. Many aerospace companies are large in size and geographically dispersed. Aerospace companies are adhocracies in Mintzberg's [20] terms. They rely on a matrix structure and fuse experts drawn from different specialties into market based project units called "programs". Current projects are relatively short compared to earlier days [17]. As a result, engineers and project managers (middle managers) in programs spend less time on outside projects not directly related to their immediate work. Timekeeping is another concern. Employees are required to fill in timecards for their work, regardless of their profession and skill levels. A "charge number" is assigned to each task to fill in their time cards; however, it is not usually assigned

to an activity that is not directly associated to their work. Thus, employees have to use their own time to attend activities such as KM seminars and CoP meetings.

We will present two distinct characteristics of aerospace engineers that may hinder diffusion and adoption of KM. Overall, aerospace engineering is a bureaucratic profession. As engineering has became a professional occupation, it also became a bureaucratic occupation since large corporations have tried to treat engineers as technical rather than professional employees [14]. Vaughan's [34] description of NASA engineers does a good job of characterizing aerospace engineers. She notes that aerospace engineering is a very specialized profession that makes job alternatives relatively limited in the aerospace industry. Engineers generally accept working conditions created by upper management such as production pressure, cost cutting, limited resources and compromises as legitimate. Moreover, their creative work is controlled by the administrative decisions of the program they work for. In such a work environment, Vaughan says engineers associate their identity with their employers, rather than their profession, in contrast to other professionals. These characteristics make us question if aerospace engineers are well suited for building communities of practice for engineers.

Whalley and Barley's [36] description of engineers convince us that it is difficult to build explicit knowledge out of their tacit knowledge and make good use of their knowledge outside of their immediate work environment. Engineering still carries its manual legacy, the craftsmanship from earlier centuries. The engineering culture is one in which mental and manual skills coexist. Engineering work depends on trial and error and "local knowledge" embedded in an organizational context. Despite the public's (and some of the practitioners') perception that the production of engineering knowledge is precise and rationally based on numbers, it is full of ambiguity and deviation. While implementing and operating complex systems, engineers constantly produce new rules into an evolving knowledge base. Engineering knowledge is good on a specific system in the specific environment.

5.1 Inadequate Diffusion Methods

Many of the practitioners did not (due to insufficient funding) adopt systematic diffusion methods appropriate to disseminate KM in large organizations. A recent study [29] on dissemination of a community building tool in a large organization shows that the adoption of CSCW tools needs strong theoretical understanding of technology diffusion. Some members mentioned "The Tipping Point" as their reference book. Gladwell [11] describes the tipping point as the moment when "*ideas and products and messages and behaviors spread just like viruses do.*" Practitioners longed for their own tipping point when KM would spread wildly like an epidemic in their organization. Unfortunately, their diffusion methods only covered a small area of the enterprise.

After learning "*progressive*" tools and techniques from others at KM Exchange meetings and being reinforced into the idea of how KM could change the culture of the secretive nature of the aerospace industry, the practitioners were ready to spread the gospel of KM in their organizations. How would they disseminate KM in complex, geographically dispersed and hierarchically layered aerospace organizations? In order to ease diffusion and adoption, they wanted to gain recognition of their KM efforts by being announced at the most visible place in their organizations, such as "*the front page*" of the corporate website. Unfortunately, KM was not high on the agenda for the upper management to endorse it on the front page. Therefore, the practitioners promoted KM by convincing smaller groups one by one.

We introduced in our first study [33] that some practitioners cultivated disciples ("evangelists") who could help the practitioners spread the gospel of KM. Other traditional methods of spreading KM were presentations at staff meetings, executive briefings and simply by word of mouth. A junior KM practitioner noted how her wiki project got recognition: "*Usually, by word of mouth. Last March, I gave a presentation on wikis at [meeting], which is a corporate wide initiative that they have periodically … so I presented the wiki concept at that, and a few people who heard that presentation contacted me and asked me for more information about wikis, and then word spread from there...*" Another junior KM practitioner at the same company commented how she got a new assignment by briefing at an executive meeting: "*I had an opportunity to brief a [division] vice president and … as a result of that … people contacted me to help, 'Hey, you are doing this. I like you to do my program.'*"

A junior KM practitioner commented that she wanted to take a more people-centered approach: "*Well, one of the things I do, and I think that this is probably by far one of the most important job functions I have, is literally just wandering around, talking to people. Sometimes, I will just get up from my office, and I'll spend an hour or two just wandering around the site and popping into people's offices and talking with them.*"

One senior member stressed the importance of continuously promoting KM until his users saw its benefit: "*It's a lot of efforts convincing these folks to change their normal way of doing things to a new way. But, we constantly promote, and that's the only way. Just keep, keep put[ting]AskMe in front of their eyes, and eventually when they see a benefit, they will start using it.*"

5.2 Aerospace Specific Adoption Problems

For a variety of reasons, many technology diffusion and adoption studies have found that resistance to adoption of new technologies is common [12,18,19]. Similarly, our study also revealed that the practitioners encountered a variety of adoption problems while promoting KM. In this section, we will describe some of the major aerospace specific problems with diffusion and adoption.

Studies made on management mandate of tool adoption in large organizations have reported varied outcomes. Markus and Connolly [19] conclude that management mandate is necessary for tools to reach critical mass. Grudin and Palen [13] counter that management mandate was not needed for the adoption of a calendar system in two large organizations. An important factor for the successful dissemination of KM in a large complex aerospace organization is the support of upper management. All four core members expressed strong support from their upper management. At Alpha Corporation, a group of practitioners sought funding for Livelink since they thought a document management system was critical for maintaining knowledge in their organization. At first, it started as a grass root initiative. Yet, within a year, they realized they would need the top-down approach to overcome resistance from end users. Indeed, after two

years, they switched from the bottom-up approach to the top-down approach.

Upper management support and initiatives are the key ingredients for starting KM in a large organization. Nevertheless, the practitioners also need middle management support for KM to be successfully diffused and adopted within an organization. The practitioners struggled to convince middle management of the merits of KM for the success of the organization. In the aerospace organizations, middle managers are compelled to produce short-term results. Unfortunately, the effectiveness of KM can not be proven in such a short time. Moreover, ROI of KM is difficult to measure by statistics. Some KM practitioners suspect that middle management fear of certain KM practices such as communities of practice would take away their power and control. One senior member explained the conflict with middle management: *"Middle management, in some ways, they see it [KM] as unnecessary and some cases they might see it as destructing and maybe some levels they see it as removing their ability to control."*

The funding structure of the aerospace company is another obstacle. Aerospace employees are provided charge numbers to record their work hours. If a charge number is not provided for the activity, employees have to use their own free time. Since a charge number is not typically given to employees to attend KM seminars, participate in CoP meetings and in learning KM tools, it is difficult to draw employees into joining in on KM activities. One practitioner explained the challenge of not having charge numbers for KM efforts: *"Another significant challenge that we face is that … most of the people that we're focusing our KM efforts on are direct billing people… For a lot of people that we're targeting, it's just the charge—how do they—what do they charge to? We don't have anything for them to charge. They don't have anything for them to charge to. So it's almost like they have to volunteer free time to do any KM work."*

Some engineers are biased against professionals who are not engineers. One senior practitioner from Beta Institute described her experience while introducing KM to engineers: *"It's a little odd sometimes walking in [to the engineer's office] because people don't really know if you say you're a knowledge management person. 'Well, did you ever work on a flight project?' 'Yeah for fifteen years I worked on a flight projects.' 'Uh, so you're like a* ***real*** *[Beta Institute] person then?'"* One librarian explained engineering culture: *"I found that engineers didn't like to admit that they did not know something … I don't know what it is … ego thing or cultural thing <laugh>."* One member from academia described how engineers were against reinventing the wheel: *"And straight out of their mouths they say… 'It's fine that they [KM practitioners] are trying to capture this knowledge, but who uses it, because we're trained for the latest and greatest technology, because we're trained how to do things better than these people were trained.'"* Engineers are not always motivated to reuse other engineers' ideas. Like a case study [17] on NASA/JPL's KM practices illustrated, one senior manager noted: *"Advancing the creation of new knowledge is more important than capturing old knowledge"* and another manager warns: *"It's culturally challenging and against the grain of how we've done past missions. It's asking project managers to swallow a different kind of risk—to trust stuff that others have produced."*

It is perhaps surprising that engineers who can adeptly build extremely complex space systems in the lab have difficulty comprehending collaborative KM tools. The practitioners have commented that many older engineers had a problem in getting a grasp on KM tools. One librarian commented: *"A large percentage of our population is not particularly computer savvy as they're on the far end of the curve, like me they didn't grow up with computers. Um…the tool we selected while extremely capable was not the most intuitive thing in the world and most of these people refuse to go to training … It's funny, they can be dealing with the newest technology in the world in the lab, but trying to apply it to how they do their work it's like forget it."*

Some diffusion issues are rooted in the secretive nature of the industry. One practitioner explained how engineers felt apprehensive about the document management system: *"They [engineers] just also sense about security factor. The [document management] system is unclassified only. But, they need to have a comfort level that information is safe. In fact, any problems are human. System is… I have never seen a breach of the system."* Another practitioner from the same company noted: *"It [document management system] has a lot of granularities of how the permissions can be. And people had difficulty in coming to grasp with that, so a lot of them don't trust the system. They don't know who exactly can see the document they put online … they can't control, you know, who can see those [documents]. So, this is actually tended to lack of trust in the system because they don't understand permissions and group structure, so they are disinclined to put things in there."* Many aerospace engineers work in secluded labs and the network system in these labs are cut off from the other networks on which the KM tools reside; some engineers are entirely cut off from any Internet access. For instance, another practitioner explained that some users who worked in the "classified" environment could not easily access a particular KM system: *"A lot of our staff actually sit over there [secluded lab]. They may not have regular access to the system. They may be in some kind of classified vault where they have no computer that connects to the world. So, we've had a lot of issues with that and the implementation has been fairly slow and user acceptance has been even slower."*

6. PREFERRED SOLUTIONS BY REFERENCE GROUPS

Shibutani [p. 268, 28] defines a reference group as "the group whose perspective constitutes the frame of reference of the actor." An individual's behaviors, such as perception, judgments and self control, are strongly impacted by the frame of reference of the group in which he or she participates. Shibutani points out that the concept of reference groups is useful in understanding the individual's choice of reference groups among alternatives, especially when the choices seem to be contrary to the "best interests" of the individual. Frequently, individuals select groups to be their reference points in order to construct an ordered and meaningful view of their worlds. Other times, they are simply not aware that alternatives exist.

Due to the lack of other forums in the region for those in the aerospace industry who advocate KM, the KM Exchange has helped fill the void for KM practitioners to interact. Although some newcomers were critical of the repetitiveness of the meeting topics, for the majority of the members, the KM Exchange was

still their principal reference group. The members listed APQC (American Productivity & Quality Center), KM World Magazine, various KM websites, the KM master's degree program at the local university and practical (non-academic) KM books as their resources. To our surprise, they did not list any aerospace engineering groups as their reference groups. One exception was a core member from Beta Institute who was actively involved in the international aerospace KM groups.

The APQC is an example of a reference group primarily because the core members participated in APQC case studies and presented at APQC conferences; also, many non-core members also attend the annual APQC conferences. One core member commented that when he first became involved in KM in his organization, he sought KM resources in APQC. Some junior members told us that they were sent to an APQC conference for training when they joined the KM department. One organization's CoP manual was created due to a suggestion by a KM "luminary" who was involved in a number of APQC reports on CoPs. As a result, their CoP manual was strongly influenced by the APQC. To accomplish its mission of increasing productivity in organizations, APQC provides services, such as benchmarking, knowledge management and performance improvement, to its member organizations.

We identified numerous similarities between the views of these reference groups and the KM Exchange members. One striking similarity is that many reference groups and the practitioners consider KM as a medium for connecting people in the enterprise. Both showed intense enthusiasm toward social networking and the novelty of Web 2.0. In this section, we now focus on Web 2.0 to demonstrate how the KM Exchange and APQC shaped the perception of the KM Exchange's members on Web 2.0.

6.1 Enthusiasm toward Web 2.0

The enthusiasm of the members toward Web 2.0 indicates how Web 2.0 fits well into their perception of what an ideal KM tool is. Despite a lack of consensus as to what Web 2.0 means [22], experts of the KM field are attracted to the promise of collective intelligence arising through Web 2.0 technologies. The practitioners perceive their KM tools as "*progressive*" [33] and a medium for "*connecting people*"; therefore, it is no surprise to find that Web 2.0 is enthusiastically accepted.

The reference groups, such as APQC, showed similar views. Our brief review of their website (apqc.org) revealed their intense hype on Web 2.0. Numerous reports on Web 2.0 at their website focus on the collaborative and social networking aspects of Web 2.0. The rhetoric of these reports is that the purpose of Web 2.0 is to interconnect people. The APQC president [21] states that there is a growing focus on connecting people to people and a decreasing emphasis on centrally collecting and managing content.

Web 2.0 was often discussed at the KM Exchange quarterly meetings. Among the ten quarterly meetings we attended, three presentations were about wikis, one presentation was about social network analysis and one was about the evolution of Web 2.0. One core member introduced Second Life at the break-out discussion of the March 2006 meeting. Another time, the possible use of Second Life in the aerospace industry was presented at a conference hosted by another core member. At the September 2006 meeting, a *wiki evangelist* (who called herself the "*wiki lady*") presented her small wiki project launched at her workplace. At the following June 2007 meeting, another "*wiki lady,*" a college professor, presented her research on blogs and wikis. At the same meeting, a lecturer from another university presented material on social network analysis. During a break-out session at this meeting, some members came up with an idea to launch a wiki for the KM Exchange, saying, "*Why aren't we using technologies we think great for, why [isn't] the group itself using the technologies.*" Later, several members revisited this idea and the KM Exchange Wiki was implemented and deployed with university funding. Indeed, wikis were one of the most popular topics at the break-out discussions of the KM Exchange.

These Web 2.0 presentations at the KM Exchange sparked interest among the members. One senior member was ready to grab this novel technology: *"I believe wiki is real good technology we should employ and then employ some of the gaming technology into our work, yeah. And, I still don't know what gaming technology will do, but I think that's kind of far out concept, yeah."* A practitioner from another company was ready to use wikis after a quarterly meeting: *"I've decided that I wanted to set up a wiki for the engineering organization and I've got no experience with wikis, so, you know, there was information shared on that."*

Just as the practitioners experienced various aerospace specific technology adoption problems, they also faced obstacles in promoting Web 2.0 within their own community as well as their workplaces. In the following section, we will describe the problems they encountered.

6.2 Adoption of Web 2.0

Several months before the KM Exchange Wiki was launched, one senior member predicted that the majority of the members would not contribute to the wiki: "*But, <laugh> another vernacular way of saying is that stars did not line up. They are not going to do that [authoring]. That was pretty obvious that they are not going to author. These people are not going to author, including myself, even though their desires are there. And they were puzzled why we don't.*" As predicted, the KM Exchange Wiki has not yet been successfully adopted by its members; indeed, this follows Grudin's [12] point that users need to see or believe in some benefit from the groupware in order to contribute to the groupware. A few months after the launch, we learned the true extent of disinterest among the members—only three members had contributed to the KM Exchange Wiki.

At the March 2008 quarterly meeting, the members who were interested in the KM Exchange Wiki gathered and further discussed the problems. The members voiced a variety of opinions. Some even questioned if they would really need the KM Exchange Wiki. One interesting idea was setting the KM Exchange in Wikipedia instead of having their own wiki. The majority of the discussion centered about how they should use the KM Exchange Wiki—upcoming meeting topics, past meeting presentations, member lists and so on. Nevertheless, at its conclusion, no one could figure out why the members did not contribute to the KM Exchange Wiki. In many situations, the practitioners did not have a clear idea as to why some KM tools were not successfully adopted. This meeting demonstrated that

technology adoption and diffusion issues that are commonly discussed in the CSCW field are still new in other disciplines.

To certain users, Web 2.0 appeared to be harder to comprehend than other KM tools. Weakly-developed technological frames [23] of a new and different artifact can become a problem in technology adoption since the users view the new artifact based on their understanding of familiar artifacts. As a new communication and information sharing technology, Web 2.0 symbolizes the ideal KM tool the practitioners desire to promote. Nevertheless, Web 2.0 requires new mindsets to understand its usage. One senior practitioner commented: *"The wiki, I can edit yours, you can edit mine, that's a different mindset, a different mindset, a different generation and a group of people that are used to…"* The incongruence in technological frames on Web 2.0 revealed the generation gap between baby boomers and generations X and Y in the aerospace organizations. A senior member of Beta Institute explained that Web 2.0 may help attract and retain the younger workforce, yet she quickly learned about the difficulties in having older engineers comprehend the benefits of Web 2.0: *"We've got wikis and blogs and IM to try to be very simplistic ways of acknowledging and letting people share if that's the way that they're [young engineers] used to sharing. And then, you know, try to bring in the social networking capability, not the credit of MySpace before [Beta Institute]… all my sponsors from the 60's and 70's definitely…<laugh>"* A senior practitioner from another company also identified the generation gap: *"Blogs and wikis? … there's a generational thing too. Younger people, the young twenty-five group… the generation that always had instant messaging on the Internet, right? Blog and MySpace group. But you would have a hard time getting leadership, middle managers to see the value. So it would have to be applied very situationally. It [aerospace industry] is a very controlled industry."*

The aerospace engineering culture is another factor to be considered for Web 2.0 adoption. In order for Web 2.0 to be successfully adopted, some members suggested that a sharing and collaborating culture must pre-exist: *"A couple of our organizations use wikis for development. We have a hard time with culture because everything is personal: e-mail, phones, bulletin boards, People didn't want to use them [wikis]."* Another member observed that some professionals in the organization were more open to collaboration: *"You have to understand, those in the organization, proposal writing, software development, those are the ones who are more advanced in those types of collaboration."*

Sometimes, it is not evident if the adoption problem is a cultural, occupational, generational or merely personal preference. When Second Life was presented at the core member-hosted conference, some attendees were in the virtual open auditorium inside of Second Life whereas others were in the physical auditorium watching the virtual auditorium on the big screen. In the physical room, one attendee in military uniform commented that he was annoyed by the virtual attendees flying back and forth into the virtual auditorium and how they were dressed (e.g., as stuffed animal, in costume with black wings). Other times, members did not know why people did not want to use this new technology. A junior practitioner commented: *"We have a list of about thirty people that have been identified as part technology experts…so they were the very first people that were invited to participate in the wiki … there were a couple of people in that group that… one, flat out refused to even attend the class on wikis, didn't want to have anything to do with it. There were a couple of other people that attended the classes, and learned something about it that also point-blank refused to have anything to do with it after they learned about what it was, and I'm not really sure why."*

The field data indicates that preferred or recommended solutions by the chosen reference groups, such as Web 2.0 technologies, are not always openly accepted by people in their workplaces as the members hoped. Shared perspectives among the members shaped by the reference groups enable the members to see their world as "stable, orderly and predictable." These reference groups may help the members bolster their identity as KM practitioners. As a "support staff" [20] of the engineer-dominated aerospace organization, the members preach [33] KM, a discipline is still in dispute. Nevertheless, applying recommended solutions by the chosen reference groups may detract the members from tackling unique KM issues of the aerospace industry.

7. DISCUSSION

In the previous sections, we examined the reasons why the practitioners experienced difficulties in disseminating KM within the aerospace industry. The field data had us question how this community helped the members spread KM in their workplaces. It surprised us that, despite the majority of the members' beliefs that KM is crucial for their organizations, practical solutions to their KM problems were not frequently brought to the forefront at their meetings. This was even more puzzling as practitioners mentioned in our interviews that they were continuously challenged while promoting KM in their workplaces.

At the quarterly meetings, we observed that the members rarely provided practical solutions for these KM obstacles. Rather, the discussions at the meetings were sometimes reduced to simplistic analyses and solutions. The community developed prevailing uniform beliefs on KM which newcomers often accepted without questioning. Some of the beliefs institutionalized through senior members [37] included the potential knowledge drainage due to the large retiring workforce and the importance of a sharing culture to disseminate KM. Yet, some beliefs were built without sufficient supporting evidence. For instance, when the members discussed the retiring workforce issue, they did not usually distinguish any critical groups among retiring engineers. Apparently, certain groups of engineers have more established methods to codify their knowledge and, in certain engineering fields, the rate of technology advancement is greater; therefore, the loss of knowledge from retiring engineers is not considered so critical to the organization. Rather, their argument was that the workforce in the aerospace industry was aging; hence, the industry would face a serious knowledge drainage problem.

It appeared to us that some of the practitioners hastily grabbed preferred or recommended solutions chosen by the reference groups, such as the APQC, without fully understanding the complexities of the problems in the aerospace industry or the work practices of aerospace engineers. For instance, some practitioners were ready to promote cutting-edge tools that were recommended by their reference groups without thorough investigation of whether these tools would fit well in their work settings. It appeared they were sometimes caught up in the novel characteristics of the tools. For instance one practitioner told us

that his project for developing a "knowledge repository system" for specifications, manuals and briefings and lessons learned was scrapped when they realized during the midst of development that the size of his company is too large for such a system to handle.

In this paper, we noted these KM practitioners promote KM to aerospace engineers, scientists and other employees in the aerospace organization. Yet, work practices of aerospace engineers are not well known. Compared to the study of scientists and their communities, there have been few studies regarding engineers and their communities [14]. The views widely held by the public are that engineering is fundamentally the application of scientific principles [4]. Another prevailing public view on engineering is that technical knowledge is precise, objective and rule-following [34]. However, engineering work can not be simply characterized as *"solid"* or *"cold and unemotional"* as some practitioners remarked. Aerospace engineers work in unique work environments. As their job titles vary (e.g. real time software engineer, flight engineer, materials engineer), their work practices and knowledge seeking behaviors vary. It is crucial to recognize the difference among different types of engineers when we attempt to understand knowledge production, use and transfer behaviors [14]. The lack of attention to diversities in engineering types and activities has contributed to the lack of an effective aerospace knowledge diffusion system [14].

The knowledge *seeking* behaviors of aerospace engineers have not been well studied. The knowledge usage of engineers and scientists are significantly different. While scientists use knowledge to produce new knowledge, engineers use knowledge to help make decisions to solve a particular problem [14]. Engineers are "inward" people who work for their employers whereas scientists are "outward" people who are expected to share their knowledge among the members of an "invisible university." While aerospace engineers work in the bureaucratic work organizations, they also form informal engineering communities as they become involved in the design and development of particular aerospace products. These informal communities are crucial for knowledge creation and transfer [35].

There is a profusion of success stories that demonstrate time and money saved using KM in KM practitioner books. One such success story is Xerox's Eureka project. The Eureka database was designed based on the ethnographic fieldwork of a community of copier technicians [24]. "War stories" told by expert technicians at breakfast gatherings and next to troublesome copy machines were codified in the Eureka database so other copier technicians outside of the region might benefit. It is questionable whether the Eureka project was actually as successful as the KM literature raves about [3, 25]. Nevertheless, Orr's ethnographic study using a "thick description" of Xerox technicians'' work brought a valuable lesson. Work practice is different from work described by management. Also, a large body of CSCW work during the same period, drawing from ethnomethodology's [e.g., 7,9] study of the mundane, confirmed that in the daily work of various occupations, people work differently from what is expected.

As Orr [24] argues convincingly, we relate "work" to "being employed" rather than "work practice." Work practices are not generally well understood by people outside of the occupation and profession. While work practices have remained in the "black box," technology promoters in various fields often offer advice and encourage new concepts or tools to users whose work practice are unfamiliar to the promoters. They guard their tools and concepts with recommendations by their chosen reference groups. We argue that technology promoters need to better understand work practices of their users in order to disseminate tools and concepts.

8. CONCLUSION

We learned that a community can be considerably more complex than Lave and Wenger's ideal CoP model. First, a community can exist for purposes other than learning through participation. The KM Exchange partially existed for affirmation, validation and legitimization of KM in their respective work organizations [33]. The members learned not only KM techniques, but also how to legitimize KM at their workplaces. Second, a community is not a static entity, completely independent from others. It transforms through interactions with other groups [37], including their reference groups, and actions within the community itself.

We identified four factors that impacted the dissemination of KM at workplaces: (1) the disparity of the KM Exchange's stated purpose and the members' actual motives for attending meetings; (2) the multidisciplinary nature of KM; (3) the aerospace industry and its engineering culture and (4) the use of recommended solutions by chosen reference groups rather than a grounded approach.

Throughout our field study, we learned about the challenges the practitioners experienced while promoting KM at their work organizations in the aerospace industry. We argue that technology promoters need to understand the work practice of their users—namely, how they create, transfer and reuse knowledge. Ultimately, any technology promoter who attempts to disseminate their ideas and tools outside of their group into a large enterprise, such as aerospace organizations, may experience similar problems. We hope that our fieldwork on this community of KM practitioners in the aerospace industry will shed light on the role of a community, their reference groups and their impact on the dissemination of their tools and ideas in research and practice.

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10. REFERENCES

[1] Ackerman, M. and McDonald, D. 1996. Answer Garden 2: merging organizational memory with collaborative help. *Proc. ACM Conf. CSCW'96*, 97-105.

[2] AIAA. 2006. Statement by Mr. John W. Douglass President & CEO AIAA. Retrieved July 5, 2008 from www.aia-aerospace.org/aianews/speeches/2006/statement_douglass_061306.pdf

[3] Brown, J. and Duguid, P. 2000. *The Social Life of Information.* Boston: Harvard Business School Press.

[4] Bucciarelli, L. and Kuhn, S. 1997. Engineering Education and Engineering Practice: Improving the Fit. In S. Barley, &

J. Orr (Eds.). *Between Craft and Science: Technical Work in U.S. Settings* (pp.210-229). Ithaca, NY: Cornell University.

[5] Dalkir, K. 2005. Knowledge Management in Theory and Practice. Burlington, MA: Elsevir Butterworth-Heinemann.

[6] Drucker, P. 1957. Landmarks of Tomorrow: A Report on the New "Post-Modern" World. New York: Harper.

[7] Heath, C. and Luff, P. 1992. Collaboration and Control: Crisis Management and Multimedia Technology in London Underground Line Control Rooms. *Computer Supported Cooperative Work*, 1(1-2), 24-48.

[8] Herman, N. 1995. Interactionist Research Method. In N. Herman, & L. Reynolds (Eds.), *Symbolic Interaction: An Introduction to Social Psychology* (pp. 90-111). Dix Hills, NY: General Hall.

[9] Hughes, J., Randall, D., and Shapiro, D. 1993. From Ethnographic Record to System Design. *Computer Supported Cooperative Work*, 1(3), 123-142.

[10] Huysman, M. and Wulf, V. 2004. Social Capital and Information Technology: Current Debates and Research. In M. Huysman & V. Wulf (Eds.), *Social Capital and Information Technology* (pp.1-16). Cambridge, MA: MIT.

[11] Gladwell, M. 2002. The Tipping Point: How Little Things Can Make a Big Difference. New York: Little, Brown.

[12] Grudin, J. 1988. Why CSCW Applications Fail: Problems in the Design and Evaluation of Organizational Interfaces. *Proc. ACM Conf. CSCW' 88*, 85-93.

[13] Grudin, J. and Palen, 1995. Why Groupware Succeeds: Discretion or Mandate? *Proc. Conf. ECSCW'95*, 263-278.

[14] Kennedy, J., Pinelli, T. and Barclay, R. 1997. Distinguishing Engineers from Scientists – The Case for an Engineering Knowledge Community. In T. Pinelli, R. Barclay, J. Kennedy, & A. Bishop (Eds.), *Knowledge Diffusion in the U.S. Aerospace Industry* (pp.177-214). Greenwich, CT: Ablex.

[15] Latour, B. 2005. Reassembling the Social: An Introduction to Actor-Network Theory. New York: Oxford University.

[16] Lave, J. and Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation.* Cambridge, UK: Cambridge University Press.

[17] Leonard, D. and Kiron, D. 2002. Managing Knowledge and Learning at NASA and the Jet Propulsion Laboratory (JPL). *Harvard Business School Case Study 9-603-062.*

[18] Mark, G. and Poltrock, S. 2003. Shaping Technology across Social Worlds: Groupware Adoption in a Distributed Organization. *Proc. ACM Conf. GROUP'03*, 284 – 293.

[19] Markus, M. and Connolly, T. 1990. Why CSCW Application Fail: Problems in the Adoption of Interdependent Work Tools. *Proc. ACM Conf. CSCW'90*, 371-380.

[20] Mintzberg, H. 1980. Structure in 5's: A Synthesis of the Research on Organization Design. *Management S*cience, 26(3), 322-341.

[21] O'Dell, C. 2008. Web 2.0 and Knowledge Management. Retrieved July 5, 2008 from www.apqc.org.

[22] O'Reilly, T. 2005. What is Web 2.0. Retrieved July 5, 2008 from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html.

[23] Orlikowski, W. and Gash, D. 1994. Technological Frames: Making Sense of Information Technology in Organizations. *ACM Transactions on Information Systems*, 12(2), 174-207.

[24] Orr, J. 1996. Talking about Machines: An Ethnography of a Modern Job. Itacha, NY: Cornell University Press.

[25] Orr, J. 2006. Ten Years of Talking about Machines. Organization Studies, 27(12), 1805-1820.

[26] Polanyi, M. 1967. *The Tacit Dimension.* New York: Doubleday.

[27] Rogers, E. 2003. *Diffusion of Innovations* (5th ed.). New York: Free Press.

[28] Shibutani, T. 1995. Reference Groups as Perspectives. In N. Herman & L. Reynolds (Eds.), *Symbolic Interaction: An Introduction to Social Psychology* (pp. 267- 276). Dix Hills, NY: General Hall.

[29] Soroka, V. and Jacovi, M. 2004. The Diffusion of ReachOut: Analysis and Framework for the Successful Diffusion of Collaboration Technologies. *Proc. ACM Conf. CSCW'04*. 314-323.

[30] Strauss, A. 1978. A Social World Perspective. *Studies in Symbolic Interactions*, 1(1), 119-128.

[31] Strauss, A. 1982. Social Worlds and Legitimation Process. *Studies in Symbolic Interactions*, 4(1), 171- 190.

[32] Strauss, A. and Corbin, J. 1998. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Thousand Oaks, CA: Sage.

[33] Su, N., Wilensky, H., Redmiles, D., and Mark, G. 2007. The Gospel of Knowledge Management in and out of a Professional Community. *Proc. ACM Conf. GROUP'07,* 197-206.

[34] Vaughan, D. 1996. The Challenger Launch Decision: Risky technology, Culture, and Deviation at NASA. Chicago: University of Chicago Press.

[35] Vincenti, W.G. 1990. What Engineers Know and How They Know It: Analytical Studies From Aeronautical History. Baltimore, MD: Johns Hopkins University Press.

[36] Whalley, P. and Barley, S. 1997. Technical Work in the Division of Labor: Stalking the Wily Anomaly. In S. R. Barley, & J. E. Orr (Eds.). *Between Craft and Science: Technical Work in U.S. Settings* (pp. 23-52). Ithaca, NY: Cornell University Press.

[37] Wilensky, H., Su, N., Redmiles, D., and Mark, G. 2008. A Community of Knowledge Management Practitioners: Mirroring Power across Social Worlds. In M. Ackerman, R. Dieng-Kuntz, C. Simone, & V. Wulf (Eds.), *IFTP International Federation for Information Processing, 270, Knowledge Management in Action* (pp. 195-207). Boston: Springer.

[38] Wilson, T. D. 2002. The nonsense of 'knowledge management'. *Information Research*, 8(1).