MOTIVATORS AND CRITICAL FACTORS FOR WORKSHARING IN DESIGN AND ENGINEERING NETWORKS

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ABSTRACT

The globalization of infrastructure and building projects allows firms to operate subsidiary offices around the world. Furthermore, new technologies are rapidly changing work environments, thus enabling these companies to implement new work practices and processes to exploit new opportunities. The international design and engineering organizations, for example, now have the possibility to develop structures and processes that enable collaborative work by decomposing work tasks and distributing them across offices dispersed around the world. This exploratory research uses a series of qualitative case studies to investigate key characteristics of worksharing practices in project-based global design and engineering companies. Specifically, this paper identifies early results regarding the motivations, organizational strategies, success factors and barriers for worksharing within multinational design and engineering companies. This research aims to better understand the process of work distribution in international design and engineering companies and to extend existing knowledge with an empirical insight to this problem.

KEYWORDS: Worksharing, Global Projects, Engineering Organizations, Case Studies

MOTIVATING ENGINEERING AND BUSINESS PROBLEM

Globalization and rapid technological advancements influence work environments, allowing companies to distribute work tasks geographically. For example, new collaboration technologies allow the possibility of teeming project participants virtually to distribute work (Charoenngam et al. 2004). Architectural and engineering companies can benefit from these new technologies by distributing work to diverse locations for rapid and efficient execution. Nevertheless, many companies are still facing problems with the development of structures and processes to enable collaborative work across dispersed offices.

Using case studies, this research seeks to understand why and how architectural and engineering firms currently distribute work. Specifically, this research seeks to:

- Identify the reasons these firms distribute work
- Understand how an organization distributes design and engineering tasks (project phase, processes, etc.)
- Understand the challenges and risks from work distribution that lead to problems (schedule, design alignment, etc.)
- Explore the processes and strategies that participants indicate are effective to share tasks between offices to begin to identify best practices for distributing work.
This paper discusses theory that underpins the research before presenting our current research method. We then present preliminary findings of the motivators, organizational processes, barriers and success factors. Finally, we discuss the research limitations with our plans for additional data collection and analysis.

This paper uses the term worksharing to address the practice of geographic work distribution and integration within the organizational network. We focus primarily on the alignment of work within the spatial dimension of organizational structures (i.e. geographic dispersion).

POINTS OF DEPARTURE

In his famous book – The World is Flat, Thomas Friedman argues that during the last two decades, a specific series of events and forces caused the emergence of an entirely new global business environment. The new economy is characterized by the growing division between economic power and political power, hyper-competition, rapid technological changes, and shorter product life cycles (Friedman 2005). The new economy brings increasingly global businesses and leads to changes in work practices, including the distribution of work.

Cross-functional and geographically dispersed teams deliver an increasing number of projects in many industries and companies are faced with numerous and complex challenges this type of work assumes (Hinds and Kiesler 2002). Difficulties which many virtual teams encounter while operating can be related to the categories of conflict (Bishop 1999, Armstrong and Cole 2002), and trust (Zolin et al. 2004). Companies, therefore, need to address a series of issues to maintain control in their distributed projects.

Collaboration in a Fragmented Industry

Due to its traditional fragmentation, the architecture, engineering and construction industry suffers from difficulties in coordination and communication, which is an inherent barrier for the adoption of any collaboration intensive process, including the distribution of work. Higgin and Jessop (1966) emphasized that communication in such a fragmented industry comprises numerous issues including co-ordination of fragmented teams and discrete portions of work, and the alignment of multiple points of responsibilities within these complex organizational environments (Emmitt and Gorse 2003).

Due to these fragmentation and communication issues, the industry is struggling to adopt collaboration intensive approaches in its projects (Taylor and Levitt 2007). The adoption of such processes is driven by the need to “optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction” (AIA 2007). In this concept, companies need a large amount of IT driven processes, which, in turn, involve balancing between the technologies employed, people involved and the organizational strategies. Shelbourn et al. (2007) identified six critical aspects—vision, engagement, trust, communication, processes and technologies—of effective collaboration for each of those important three strategies. The same research concluded that the industry needs help to develop a decision making framework for effective collaboration on a project level.

Other research developed a prototype organizational breakdown structure for supporting distributed construction processes from a construction company’s point of reference. This research accented the need for centralized control and decentralized implementation of Distance Management processes within projects (Charoenngam et al. 2004). Chinowsky and Rojas (2003) also emphasize the need for a project-centric analysis of virtual teams in construction projects,
claiming that every task distribution strategy should be based primarily on successfully delivering projects.

At its most fundamental level, virtual work often leads to conflicts within teams and these conflicts have always had the same consequence—lack of trust—but for a different set of reasons: different disciplinary perspectives, different regional or national cultures, and the lack of face-to-face interaction (Zolin et al. 2004). However, other specific conclusions regarding distributed work can be reached by focusing on particular types of projects such as ones delivering design and engineering work.

**Distributed Projects**

Boh et al. (2007) conducted a study on how geographically dispersed organizations staff dispersed projects and this study argues that “dispersed projects garnered higher net earnings than local projects when there was a better match of scarce expertise to project requirements. However, a curvilinear relationship was observed, such that a very high percentage of dispersed experts on a project increased coordination costs and reduced net earnings”.

Similarly, construction design and engineering companies must be able to apply their knowledge effectively to local project conditions and vice versa – subsidiary offices must be able to engage in design and engineering activities at an equal level of competence. When these projects become global, they utilize collaboration technologies in diverse cultural settings to support their goals.

Other research publications on multinational firms in the Architecture-Engineering-Construction (AEC) sector found that, in addition to standard project knowledge, international projects require a complex set of additional institutional knowledge regarding the local project environment (Javernick-Will and Levitt 2009). Because distributed design and engineering work often crosses geographical borders, this local institutional knowledge is likely also important for worksharing. For example, if an international company shares engineering work for a project amongst offices in three different countries, the project team will be required to ensure that all of the offices working on the project are aware of the local laws, work practices and cultural requirements to create a locally accepted and sustainable design.

A fairly common strategy for work distribution is offshore outsourcing of engineering services, an increasingly popular topic comprising a number of complex issues (Messner 2008). Ongoing research on offshore outsourcing of complex engineering services from the perspectives of client and vendor identified eight key issues that are responsible for project success. These issues are: *cultural barriers, design practice norms, role redundancy, quality control, communication, schedule control, trust development, and knowledge sharing* (Nayak and Taylor 2008). Again, this research focuses on heterogeneous networks comprising multiple organizations, and not single company networks.

It is furthermore interesting to note that the practices of offshore outsourcing and inter-organizational work distribution are significantly different in their nature. While the former is focused on cross-organizational interoperability and financial savings (Messner 2008), this research will show that the latter is characterized by organizational issues arising from the need to match the organizational capacity with project demand to deliver complex projects.

The current literature review provides only limited answers to the set of motivating questions this research poses. To a certain extent, this research is trying to validate previously identified findings and, in addition, we complement prior research by addressing work distribution within design and engineering companies from a project perspective.
RESEARCH METHOD

Although a significant amount of academic and practical work related to distributed work already exists, the specific topic of distributed design and engineering of construction projects is still relatively unexplored. This research aims to expand the theoretical knowledge on distributed work from a perspective of a design and engineering firm.

Since the topic is fairly unexplored within this field, we have decided to use exploratory case studies for this research. Exploratory case studies will help us understand how and why architecture and engineering companies currently workshare, which will help us to build theory on processes grounded in practical engineering work. Furthermore, the case-based method is best suited to inform this exploratory research because the object under study is not readily distinguishable from its context—real projects (Eisenhardt 1989, Yin 2003).

We are collecting data primarily from semi-structured but open-ended ethnographic interviews with key informants—the practitioners engaged in worksharing practices within international projects. Currently, we have interviewed eight people from three major international design and engineering companies and two IT service provider companies who helped us understand the company requirements concerning technologies employed. All the informants have significant worksharing experience within their companies.

Following ethnographic interviewing techniques proposed by Spradley (1979), we ask open-ended questions across several categories in an attempt to uncover worksharing practices that were successful or encountered problems. Although many informants may not be able to communicate the motivations, success factors and barriers for worksharing directly; they often possess much of this knowledge. Asking open-ended questions regarding their experiences encourages them to tell stories from their specific projects and can unveil both expected and unexpected results regarding worksharing.

The interviews are being transcribed and compared across informants to reveal commonalities and differences within our four main areas of observation: motivations, organizational processes, success factors and barriers. Because the interview questions are open-ended, we allowed subcategories within each of the four areas to emerge naturally based upon participant responses. To enrich the interviews, we are asking informants to provide additional documents, such as organizational processes for worksharing or other project documents for how they engaged in worksharing. We are currently importing and coding the transcriptions into qualitative coding software, QSR NVivo, for further analysis and comparison. Additional subcategories may emerge in the following stages of data collection and analysis.

PRELIMINARY FINDINGS

We discuss the preliminary findings of the motivators, organizational processes for worksharing, success factors and barriers from our ongoing work below.

MOTIVATORS

We first wanted to understand the motivating factors that encourage international companies to workshare. To determine these motivating factors, the informants were asked to provide an answer to question: “Why does your company workshare?” or in other words “What specific project circumstances would motivate your company to engage in worksharing on a project?” The results indicate that companies workshare to meet project requirements for particular
expertise, or for organizational reasons such as balancing the workload between offices or cost savings.

**Achieving optimal match of expertise to project requirements**

When companies compete for projects, the organization's local office may not have the staff or expertise required to deliver the corresponding scope of work. For instance, large projects require tremendous amounts of manpower that necessitate distributing the work across offices. Other projects may require a specific expertise, such as tunneling ventilation, that is not available locally. Although the local office may not have the resources available to perform this work, the global organization often does. As a result, in order to win and execute projects, particularly large projects, they need to disperse portions of the work:

> In some of the major projects and the amount of work that we were doing, we had to pick up the engineering capacity wherever it might reside in the world.

In addition, they need to locate and match the skills required for the project:

> Well first of all, in order to get a project -[another office] can use our resumes and use our skill, to try to sell themselves and say that we could provide them that expertise if they workshare with us. That is definitely a motivator, we’re so much better as a group of people because we have so many diverse skills than each office operating in its own silo as we only can have so much skill within an office.

As one of our respondents indicated, every office cannot be staffed with the vast array of engineering specialties that exist:

> There are definitely so many different aspects of our business, that you can’t have expertise in every area in every office. If, for instance, this office is very, very strong in healthcare, but other offices might not have that skill; if they work on a hospital - they can use us.

Therefore, companies are motivated to share work amongst networks of their offices to better match resources—including manpower, skill, and expertise—to specific project requirements. This strategy also increases companies’ chances to win and deliver larger projects.

**Marketability to other global firms**

Another identified factor is being able to work with other global companies. Global companies often like working with other global firms that can provide design and engineering solutions at each of the locations they reside. They may be able to work under the same global contract with minor modifications for each project and do not have to go through detailed explanations of their company culture, etc. For example, a global auto company may want to hire one firm who can provide a standard design for each of its dealerships with options that can be adjusted slightly for each location. An executive of a major architectural design company argued this point:

> [Our company] has a lot of clients and they tend to be large companies. I think that if you are a large company, then it tends to get difficult dealing with small companies because they're just too small. So [this company] tries to say: We're a large company too and we can service you all over the world so that you can have one design firm no matter how many offices you have around the world.
Balancing workload between offices

Another motivator is being able to maintain employee head count and resisting the practice of having to hire and fire staff based on current project work and backlog. As one of our informants explained:

... but sometimes projects come in that are very large and that we can’t just man up and so, to take on those; and because some of those projects might go away and then we are left with this manpower excess - we do try to workshare. So if one office has excess power and one has a need, we always try to match those up.

Another executive commented:

It really comes down to balancing work against staff. Let’s say we have excess staff in location A and we have more work than we can handle in location B, so we try to workshare to balance those needs versus resources.

Financial savings

Some interviewees also indicated that financial savings was a motivating factor. In many cases, the cost of a manhour varies significantly between locations. As a result, the company can submit a lower cost for a project proposal or save money within the organization. One executive commented:

The original motivator was probably cost. To be able to compete on a global basis, initially we had to have a low cost labor component and that brought us to utilizing locations such as Manila or New Delhi. And another factor was the recognition of the cost involved in laying off employees in one location and hiring a similar group of employees in another location.

An executive from another company summarized his company’s motivations:

We would like to be able to use our low cost centers like other industries are doing... We have a fairly large presence in the Philippines, and the Philippines have very good professionals in computer drafting and other areas. And we try to use that, being interconnected electronically, and say: why don’t we take advantage of that low-cost center. There are benefits to us in terms of profitability, you know - if we’re under a lump-sum contract, if we execute the services more economically, than we are going to make more money on the contract. And also it allows us to operate 24/7 - we have people working around the clock depending on what time zone they’re in.

However, the motivation of financial savings for worksharing appears to be related to the company’s culture. An executive from yet another company commented:

We do not work in one location and deliver the project in another to save money. That is not a part of our business mentality.

Companies indicate that the benefits of worksharing become apparent during the bidding process when the ability to tap into the organization’s remote capacity significantly increases chances of winning and delivering projects. Other motivators include marketability and balancing company workload between offices. Although commonly perceived as one of the main motivators, the issue of financial savings appeared to be the least important of all the identified factors.
ORGANIZATIONAL STRATEGIES AND PROCESSES

To determine the key elements of successful work distribution within projects, informants of this research were asked an open-ended question of: “How does your company workshare?”. Asking this general question allowed us to uncover both expected and unexpected results. According to the responses, basic worksharing strategies for delivering international design and engineering projects roughly fall into three categories:

- Work distribution based upon “Vertical” Project Scope, i.e. physical scope of work delivered (Building 1 of 3)
- Work distribution based upon “Horizontal” Project Scope - i.e. the scope of work corresponding to a particular area of expertise (Plumbing throughout Buildings 1 through 3)
- Work distribution based upon Project Phase (Conceptual Design)

Although all three are mutually interconnected and interlocked, this section elaborates them separately.

**Vertical Project Scope Split**

Companies develop standardized business procedures for working across business lines and geographical organizational boundaries. One of the scope breakdown strategies which companies use for worksharing purposes is a “vertical split” where the physical scope of work is broken down into a number of smaller discrete units that are distributed amongst offices. One of the executives summarized the vertical split philosophy:

*So a vertical split might be that we ask another office to take on an entire unit of a facility...*

He continued:

*In cases where we didn’t do the front end design, then as we’re moving into detailed design, we might do more of a vertical split.*

In cases where projects are more complex, the distribution of work might even be taken outside the boundaries of a single organization. In such cases, the practice of executing outsourced parts of work is quite similar, as if it was being executed within the boundaries of a company, although it is more formalized. The following example of building a floating production storage and offloading facility demonstrates how a complex project was delivered through a vertical split strategy which involved worksharing with a different company.

*So when you do that, it’s clearly a vertical split, we had the top sides and the [other] firm had the haul and down that still requires a very high level of coordination. So we really worked hard at alignment processes, at interface management processes, and all the coordination of activities were just necessary to understand who’s got which piece of responsibility, when are they going to deliver on those elements of their responsibility, and what your expected inputs or outputs might be throughout the entire process.*

The vertical split strategy helps achieve the balancing of workload within a company network, but it doesn’t necessarily staff projects with the best available expertise.
Horizontal Split

Another formalized procedure, complementary to the one of vertical split, is a horizontal split where the scope breakdown strategy follows a particular area of expertise. In other words, smaller discrete units of project are formed according to company business line areas. An executive commented this.

A horizontal split might be that we ask another office to focus on piping design or pieces of piping design across the unit.

It is also interesting to note that in the horizontal split strategy, issues such as risk mitigation and the distribution of risk may arise more likely. One of our informants simplified it.

The horizontal split can certainly have a lot more of finger pointing.

The horizontal split strategy theoretically achieves better matching of design and engineering expertise to project requirements than the vertical split, but it is limited with the resource capacity of particular areas of expertise. Vertical and horizontal splits are complementary strategies that often happen simultaneously, not only during the execution phase of major projects, but also during the bidding phase. One informant described the complexities of a work breakdown strategy decision making process.

It is a standard way of doing work for all of our major projects and we would do horizontal and vertical splits of the work. And it depends both on the project type and it also depends on the project work that we pass... If the project is so large, a multibillion dollar project, we might actually be doing front end design in multiple locations and coordinating across the locations. And it’s not a single project decision either, we have to look at the entire mix of projects and the company and determine what projects, if awarded, where would they go. Because you can’t have 6 projects all, expecting that if we win them, that we’ll send pieces of the work to Manila, it would exceed their capacity to do the work. So there is also this coordination effort across projects in order to determine where the different project work would be executed if it is awarded. And all of that is working at the capacity within the offices as well as skill sets within the offices.

In addition to the scope of work and discipline requirements, another important consideration for any work distribution strategy is the project phase and timeline.

Project Phase Based Work distribution

From our data collection and analysis, project phase is one of the primary factors employed for distributed project execution. Companies must ensure that projects are defined in a sufficient level of detail before they are broken down and distributed for execution amongst offices as discrete units of work. One company described the importance of project phase, indicating that one office would execute conceptual design, and then, as it progressed, the work would be broken down further and distributed:

If we’re doing front end engineering, we might do that more in one office, and then when we move to detailed design, we’d push more of the detailed design to various offices

In addition, we noted that as the design progresses through the phases, international projects become more localized as they move away from the early stages of conceptual design and get closer to the procurement and building processes. Whereas conceptual design may be a
collaborative effort with the company’s best talent, wherever that talent resides; the project
design effort moves closer to the project location as the design progresses towards detailed
design. However, it is also important that they understand the local conditions by collaborating
with a few of the local designers during the early stages. One executive explained the basic flow
of a worksharing project:

Some of the basic rules are that if we win a project in the US with an American architect
on a project in Singapore, in the early schematic design phase, the effort will be
predominantly in the United States, and as we go further into detailed design, the effort
will translate to Singapore, because at the end of the detailed design phase they will be
procuring a contractor and the permits and finally the construction works will take place.
So in the initial phase, we would mostly resource projects from the US but we would wish
to have one or two people from the Singapore office to become intimately involved in the
design decisions, and to make sure that what they are going to receive is according to the
local expectations. As the project is transferred to the Singapore office, an interoffice
agreement would be made to define the responsibilities, and the project manager would
be where the original contract is hold. So we don’t transfer the responsibility over. And
the American office would monitor the subsequent work to make sure it aligns with the
expectations in the contract and the quality. We keep control where the original contract
is hold.

If the scope of workload is too large to be handled by employing the fore mentioned strategy, the
same company would, in a different situation, choose a remote, project phase based workload
distribution strategy which is illustrated in the following example.

So, for instance, we had a very huge project... We knew that this was going to take a
tremendous amount of manpower and effort to get this done and we had an opportunity
to take this on, but the only way we could say we could take it on, was we had a
commitment from Boston, Chicago and New York to support us and to provide
manpower. And they would do it, remotely, so we would package this thing out and then
we would get together periodically for meetings. And so we all went into it and agreed it.
That’s how we would take on this project. And it worked really well.

The described remote execution strategy also depends upon the project phase because the work
packages are much better defined in later stages of a project than in the beginning and therefore,
more convenient for seamless distribution. The same executive indicated:

I think in general, throughout all types of projects, when you get later in design and it’s
more detailed design, that’s probably easier to break out and send somewhere else.
Whereas the upfront, early engineering, where you’re doing a lot of conceptual design,
that’s a very dynamic process where you’re working with others that make this thing take
its shape and format, that’s hard to send somewhere else and package it up.

Costs associated with a particular office location sometimes motivate worksharing with low cost
centers in detailed design stages of a project. One informant supported this:

The idea is that, you know, in construction and later in detailed design, it’s more of a
commodity engineering, you already know what the design is, now you have to go and do
a bunch of calcs and it takes a lot more of manpower at that time to go through all that
but it’s more methodical as far as what you’re doing, so very often if we can, we will move that design to an office that can go through that for lesser costs.

In general, the geographic flow of project execution has a natural tendency to produce similar worksharing strategies – the ones where the early upfront design and engineering work is executed remotely, and as projects move forward, they are executed more locally in relation to the place where they will eventually be delivered.

SUCCESS FACTORS

We came across certain key factors which determine the success of worksharing within projects. In this category, we tried to identify some processes that the majority of informants consider important for distributing work successfully. These characteristics include the use of different organizational solutions in projects. To uncover these processes, informants are asked: “What processes and strategies have you found are critically important when engaging on a worksharing project?”

Organizational Structure and Strategic Priorities

Centralized Control

It is very important that the organizational strategy and policies support the practice of worksharing amongst offices. Sharing work amongst offices requires that the offices work with the similar tools and practices across the organization. In addition, the culture must support and encourage global collaboration. As one of the informants summarized it:

We have a culture within the company that’s being built for over 20 years of working across both geographic as well as business line boundaries. The need to drive to a level of consistency in order to successfully execute work, we utilize a lot of our knowledge management capabilities for that. We also, just from a pure tool perspective, we drive to a consistent set of tools that we use on projects so companywide, we have one material management system that we use across all business lines. One contract management system that we use across all business lines... we use one enterprise wide knowledge management solution.

Furthermore, it becomes obvious that for efficient work distribution, companies need to have very consistent internal standards and technologies, which implies that more centralized organizational control enables more seamless distributed work. The same executive explained:

A very important issue is to identify one location or office as the authority for the project. Otherwise you are going to have those subtle differences if you don’t set the specific way you are going to do to the work through some authority type structure. If you spread the work to three or four offices and let them all do their own thing, then you have an element of inconsistency that gets introduced into the process.

The same principle applies to the technologies employed on projects, also one of implicit worksharing success factors.

One thing that’s interesting is that the more you distribute project work the more—in my mind—the more it drives you to centralize your technology. I mean you could have a server in US and in Europe and in Asia... but when you are going to tap into experts anywhere in the world or ask people to participate from multiple locations, it’s much easier to have one place for them to go to access the project data, then it is to try to
distribute it around and have a different set of rules on every project. So it drives you to more centralization of your technology. It also means that anyone anywhere in the world needs to be able to get to with a level of performance that is acceptable which again drives the need toward that robust infrastructure.

Glocalization / Single Point of Contact with the Client
This issue relates again with centralized control and organizational structures, but from the perspective of a client. The client will be more motivated to hire a company that uses its global capacity and expertise, but interacts with the client in a personal manner. One executive from an architectural design service provider elaborated:

There’s a network within [the company] which connects all the teams together so that [the company] can provide consistent service and consistent design standards to a global organization. [The company] has this concept of global account managers so each of our global clients is assigned one person within [the company] who is obviously a very high level person, at least the principal or a managing director. So if anything happens on that account anywhere in the world, this person is responsible for it.

He continued:
[Our] global marketing is that a client has a single point of contact. So all the marketing material are going to be consistent across the whole firm, but they also try to make it that it’s kind of personal. So if you are a client, there’s a single person that you can call in the firm.

Upfront Planning and Collaborative Work
Respondents indicated that it was important to decide to workshare at the beginning of the project, when you can make decisions regarding collaboration, alignment and technologies. Planning the collaborations and requirements in advance helps to mitigate risks in the project execution phase.

Making a decision on worksharing is best done prior to even having the project awarded... So if you start to do a certain amount of project execution work and detailed design work and then decide to workshare, you may run into some significant technical barriers. And it’s not really different from constructability decisions or stick built versus modularization decisions, it’s that good upfront planning is necessary on any project and part of that upfront planning is the decision on what to workshare and how much to workshare.

BARRIERS
There are, however certain instances when worksharing will be difficult or even impossible. To uncover the barriers when distributing work, this research asked the informants the question: “What situations have you faced where a project experienced difficulties when worksharing?”.
The identified barriers include funding sources and requirements, the lack of trust and control amongst offices, financial constraints, and different technical and institutional requirements.

Funding Sources and Requirements
In some cases, the client significantly influences the worksharing strategy through sources of funding. Many infrastructure projects are funded publically through tax revenues or other
sources that impose expectations on where the project should be delivered. In these cases, considerable pressure exists to deliver the work locally. Both of the informants commenting on this issue are experienced in delivering large infrastructure projects for public agency clients and they both identified public sources of funding as a barrier to worksharing. The first one said:

...especially in the US because of that funding issue, there is a lot of pressure to have work performed locally. And there are political pressures in that regard as well because the local firms feel that they should be the ones that are involved in their home, so to speak.

The second executive gave a hint on how a company may choose to alleviate this barrier:

I think that certain clients might not be happy if they knew their work is being done somewhere else. They want the work done locally, we are working with the architect and the design team but they would get upset if they knew their work is being done in isolation. But that’s an internal thing and we don’t share that with them. But then there is other times when we sold ourselves as having a particular expertise that may be in another office, we might have advertised that and say: hey we have this global leader in sustainability and we are going to get him on this project.

Lack of Trust/Control

In some cases, office leaders and project managers are against worksharing because the project manager’s lose some control—both technically and financially—on their projects. The project manager must trust that the employees in the other offices have the skills and capability to perform the work. In addition, they must trust that their work is receiving priority for the employee versus other project work and that the person is billing their time to the right projects. As one person commented:

If that person is not sitting in your office, we feel like we don’t have control. You don’t know what that person is really doing, are they actually working on your job, are they working on something else...

Financial Issues

Another barrier relates to funding the actual worksharing effort. Certain costs are inevitable in worksharing, whether it requires lodging and transportation costs to transfer people, or the cost of the technologies required to distribute the work. The firm must determine how to distribute these costs appropriately across projects and offices, often causing problems based on the incentive structure for project managers. Aligning the interests of the project managers and offices with organizational interests and sources of funding often becomes problematic.

Another barrier would be, if you’re moving people around, there is a cost of getting those people, to pay for their travel, to pay for their accommodation here, and there is a barrier of who actually pays for that cost. Whether it is the project that pays for it, or it is the organization...

Different Technical and Legal Codes, Languages, and Cultural Issues

Working on international projects within a global organization creates additional challenges due to differences in regulations, norms and cultural beliefs (Mahalingam and Levitt 2007, Orr and Scott 2008, Javernick-Will and Scott 2009). These differences must be realized and explained in order to align team participants and execute the project effectively. Some of the informants
validated this finding within worksharing. In particular, they mentioned codes, industry practices and language as barriers:

So we’re seeing some of the international codes coming in and being applied which is good for us because then we have a standard code no matter where we are in the world. But in general, it is all pretty much driven by the codes that are applicable in the countries and even in the localities that we’re working in.

An executive from another firm commented:

Different places in the world have different interpretations of what should be done in terms of how you do it. There is certain industry practice that is kind of regional, the way we do things in California is not the same way that people do things in New York.

Later, he indicated that language can also be a barrier:

Language is another barrier, you bringing someone over from the Hong Kong office and we can’t really communicate with them as well as we would like or they are not able to communicate with our clients as well as we would like.

There are obviously many other barriers, but the ones identified in this section were the most important ones that emerged in this research. They also relate to the issues identified by previous research and partially validate them. However, issue of funding sources specifically relates to construction projects and, according to our literature review, has not been identified previously.

LIMITATIONS AND NEXT STEPS

This exploratory research is ongoing and the results presented are preliminary in nature. Thus far, only a limited number of cases have been analyzed. In addition, we focused on design and engineering firms within the construction industry, which can limit the generalizability of the results. We recognize that every project is unique and can contain a number of influencing factors that were not identified; therefore, we do not claim that these are the only motivating factors, organizational processes, success factors and barriers for worksharing. In addition, we acknowledge that project types, phases, owners and locations can all impact worksharing practices. For example, the architectural design phase of a privately funded building project executed and delivered within the same regulatory and cultural context is hardly comparable to worksharing during the detailed design and engineering phase for a public-funded infrastructure project delivered in a different regulatory, business and cultural setting.

In this stage of research, it is clear that there are different sets of rules governing different levels of the work distribution problem. This paper focuses on the organization level of a single company and takes into account the strategic decision making processes within a company and the alignment of project portfolios. There are clearly other perspectives related to this topic that should be researched in the future. For instance, a project-centered perspective can consider project tasks based on the context of a particular project. From a project perspective, for example, some tasks can be defined as non-location specific (such as general structural engineering) and others require local information and context (such as office layout). When putting it in a different context (such as a project portfolio), a task that might be normally recognized as specific to the local area may actually, in some cases, be executed from a remote location due to coordination reasons and organizational issues such as aligning the execution of projects portfolio within the network. The multi-level perspective requires further attention and should be the focus of future research efforts. Another extension of this study could analyze how
different companies handle different categories of workload with respect to work distribution strategy.

The next stage of this research will further validate the obtained results through the triangulation of existing data and collection of new data for theory building purposes. We are expanding the interviews to include additional companies and more formally addressing features of company organizational structures. For example, a purely architectural design service firm has a different set of priorities than an engineering design company with an architectural department.

**CONCLUSION**

This paper summarizes ongoing exploratory research aiming to uncover why and how international design and engineering companies within the AEC community distribute work. It uses interviews with executives to identify motivators, organizational strategies, challenges and success factors based on participants’ experiences and responses. We found that design and engineering firms choose to distribute projects geographically to *achieve optimal match of expertise to project requirements, encourage marketability within other global firms, enable balancing of workload between offices, and achieve financial savings*. We also identified three primary strategies for work breakdown within distributed design and engineering projects: *vertical splits, horizontal splits and project phase related work breakdown strategy*. Although each of those is theoretically a separate breakdown structure, the three strategies are mutually complementary and they often take place simultaneously within a large project. Moreover, we found that *organizational structure and strategic priorities* were the most important success factors for organizational worksharing. Some of those factors include centralized control and consistent up-front planning culture within an organization. Finally, this research identified worksharing barriers, including *funding sources and requirements, lack of trust and control, financial issues and differences in local institutions*. This set partially validates what was previously identified in theory and expands it to the realm of design and engineering.

Managers of companies and projects can benefit from the research by understanding the key risks and successful practices for distributing work across offices. In addition, this study extends existing theoretical knowledge on distributed work through an empirical study of the practice of worksharing within companies from a design and engineering firm’s point of perspective.

**REFERENCES**


