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Global dispersion of offshore service providers: an information processing perspective

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The diversity of knowledge management practices

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Abstract

Purpose – *This paper aims to propose a new theoretical perspective on the organizational design of offshoring service organizations by adopting an information processing perspective which incorporates the factors of collaborative information technologies, task commoditization and global customer service delivery that are characteristic of modern-day knowledge-intensive service (KIS) organizations.*

Design/methodology/approach – *The authors analyze data from a large multiyear survey of offshoring service providers conducted in 12 countries.*

Findings – *The authors show how use of collaborative technology is significantly and positively related to spatial and configurational dispersion, task commoditization is significantly and positively related to spatial and temporal dispersion and need for global customer presence is not related to spatial, temporal or configurational dispersion.*

Research limitations/implications – *The paper integrates concepts from management information system (MIS), operations management and international business to show how collaborative technology, task characteristics and customer service requirements affect the global dispersion of KISs.*

Practical implications – *The results show how use of collaborative technology, task characteristics and global customer service requirements need to be jointly considered in the global dispersion of activities by KIS providers.*

Originality/value – *The study sheds light on the effect of the key factors on different dimensions of global dispersion (i.e. spatial/temporal/configurational dispersion) in offshoring service provider organizations. Second, it shows how the traditional information processing perspective on organizations can be updated and applied to KIS organizations by incorporating the factors of global collaborative information technologies, task commoditization and global customer service.*

Keywords *Customer service, Information processing perspective, Knowledge-intensive services (KIS), Collaborative technology, Global dispersion, Offshoring service providers*

Paper type *Research paper*

Introduction

The increasing phenomenon of global knowledge sourcing in which organizations outsource certain knowledge-intensive activities to various locations around the world rather than carrying out all their activities internally has been extensively documented (Lewin *et al.*, 2006, 2009). This has led to the rapid growth of new specialist organizations providing offshored knowledge-intensive services (KISs) such as Infosys, WIPRO and Pangea3, as well as new markets for existing service organizations such as IBM, Accenture and Capgemini.

In such offshore service providers (OSPs), a key question is how best to disperse and coordinate the activities in the value chain to achieve an optimal level of performance

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"In determining the optimal global dispersion of work processes, KIS organizations face two major problems: distance and virtual organization."

(Contractor *et al.*, 2010). Most research on offshoring has focused on managing these issues in client firms, i.e. the firms that offshore their activities. However, much less research has examined the OSPs and the firms that supply the services. These are KIS firms in their own right, relying on skilled workers and technology to carry out their activities. Hence, they face the same problems as many other KIS organizations such as scarcity of skilled knowledge workers (Lewin *et al.*, 2009) and coordinating global, virtual teams (Gibson and Gibbs, 2006).

Although previous research has examined some of the success factors in offshoring of such global knowledge-intensive projects and teams, we know much less about the specific challenges it entails from an organizational perspective, such as how best to disperse the activities globally, and from a service provider perspective (Carmel *et al.*, 2010, Olson and Olson, 2000). However, such research is much needed, as KIS in many industries is now following such a pattern of globally dispersed activities and the KIS providers are themselves having to learn how to best manage such globally dispersed activities. In this paper, we contribute to filling in this lacuna in the literature by examining the factors that determine the global dispersion of activities in KIS OSPs. We extend the traditional information processing perspective by including internet-based collaborative technologies, customer requirements and task commoditization to examine the pattern of globally dispersed KIS activities. Although these factors have been examined in other studies of KIS, our study highlights the importance of considering their differing effects on various dimensions of global dispersion of activities (i.e. spatial, temporal and configurational dispersion). For example, the ability provided by internet-based collaborative technologies to work globally across different time zones highlights the need to consider temporal and spatial and configurational dispersion in organization design theories.

The rest of this paper is structured as follows. First, we briefly review previous research on offshoring and global dispersion of KIS. We argue that owing to the global nature of the industry and the reliance on information technology, a combination of information management and international business perspectives (Niederman, 2005) is required, as well as to propose the use of an information processing perspective (Daft and Lengel, 1986) which incorporates the effects of task characteristics, collaborative technology and customer needs for global delivery presence. Based on this perspective, we develop some hypotheses of their effects on different dimensions of global dispersion of knowledge-intensive activities. We then describe the empirical methods and analysis, which draws on a sample of data from the international Offshoring Research Network (ORN) database. The ORN has a comprehensive collection of data on offshoring by OSPs and clients in 12 countries worldwide. We present and discuss our findings and, finally, conclude with some discussion of the theoretical and practical implications of the results.

Literature review

There have been many definitions of offshoring. However, generally speaking, offshoring can be defined as the location of one or more activities in the firm's value chain in a foreign (offshore) location (Schmeisser, 2013). This includes both internal offshoring, where the offshored activity is carried out within the organization, sometimes referred to as "captive offshoring", and external offshoring, where the activity is carried out by an external organization, sometimes referred to as "offshore outsourcing". In this paper, we focus on the latter and specifically on the OSPs who carry out the outsourced services on behalf of clients.

To cut production and labour costs, beginning in the 1960s, firms from developed countries began to outsource low-value manufacturing activities to developing countries. This was followed later in the 1990s by offshore outsourcing of low KISs such as call centres, as improvements in information and communication technologies drastically reduced global communication costs, enabling firms to rapidly organize and relocate business activities and processes almost anywhere in the world. However, more recently, researchers have identified the increasing offshore outsourcing of KISs such as R&D, new product design and professional services (Lewin *et al.*, 2006).

Most research on offshore outsourcing has focused on managing these issues in client firms, i.e. the firms that offshore their activities. Offshore outsourcing of KISs provides a range of benefits for clients such as potential cost savings, access to knowledge and talent pool and improvement in flexibility and speed to market. Initially, offshoring was confined to low-value activities such as call centres and manufacturing assembly, but as they gain more experience, increasingly many organizations are outsourcing higher-value activities such as R&D, product design and professional services to service providers overseas. One of the key drivers of this shift has been a shortage of skilled talent in developed countries. Lewin *et al.* (2009, 2006) found that offshoring of innovation activities by US firms was largely driven by a growing shortage of technical and scientific personnel in the USA that limited their ability to staff innovation activities domestically.

On the other hand, Stringfellow *et al.* (2008) highlight the "invisible costs" to businesses of offshore outsourcing such as a reduced quality of customer service. First, compared to manufacturing, services often rely significantly on intangible knowledge, which is hard to articulate, making the specification of output difficult. Second, relying on foreign outsourcing providers carries a risk of reduced perceived service quality. For example, although service providers have put so much effort in recent years to overcome these problems, some customers still react negatively to foreign accents by call centre operators. Third, compared to manufacturing, service customers are much more involved in the service process and, in many cases, are vital "co-creators" of the output (Verma *et al.*, 2012).

Much less research has examined the OSPs, the firms that provide the offshore services to clients. These firms are KIS firms in their own right and face similar problems to other KIS businesses such as the need to provide a cost-effective but high level of customer service while competing in a global marketplace with global clients. How to meet these often competing requirements is a key organizational question for OSPs in determining how best to disperse their activities globally. This creates a greater need for global coordination and knowledge transfer mechanisms, as well as creating a number of new challenges such as coordinating an international network of activities and virtual teams across distant sites (Gibson and Gibbs, 2006). It is, therefore, necessary to examine in more detail what factors determine the global distribution of KIS activities in OSPs.

Traditional theoretical perspectives on offshoring

There is currently no single theoretical perspective on offshore outsourcing, but two traditional theoretical perspectives that have been often used by researchers of offshoring are the resource-based view (RBV) of the firm and the transaction cost economics (TCE) approach.

"Our study emphasizes the importance of considering all three dimensions of dispersion - spatial, temporal, and configurational - in location of offshored knowledge-intensive activities or global delivery units for such activities."

"This study also emphasizes the importance of considering the different effects of task commoditization, customer needs and use of collaborative technology in designing the most effective global dispersion of activities."

The RBV (Barney, 1991) examines the competitive advantages resulting from resources and capabilities in the firm, whereas TCE (Coase, 1937) focuses on the relative costs of carrying out transactions internally within the firm or externally through partner organizations. According to the RBV, the resources that firms can access offshore such as skilled personnel may enable firms to perform the existing activities more efficiently or else enable the organization to be more innovative, and a key driver of offshoring is the ability to access highly qualified personnel and resource capabilities at offshore locations. According to TCE, a key factor in the offshoring decision is the relative cost of carrying out activities in-house or outsourcing them, which depends on transaction costs. The transaction costs tend to be higher when the activities are performed at more geographically and organizationally distant locations from the home country (Contractor *et al.*, 2010; Ceci and Prencipe, 2013), so firms need to weigh these against any benefits of offshoring.

The RBV and TCE perspectives have proved very useful in many studies of offshoring at the strategic level in deciding when and where to offshore activities. However, to achieve benefits from offshoring, these decisions need to be implemented and executed (Kumar *et al.*, 2009). It is at this operational/task level that firms often fail, as they have not fully considered how best to allocate tasks globally using the available information technology infrastructure. A global survey of offshoring in public and private sector organizations by the ORN showed that the main problems for executives in offshoring lie in a lack of management expertise, appropriate operating procedures and management models needed to implement offshoring work distribution at an operational level (Lewin *et al.*, 2009). Here, both RBV and TCE provide little guidance.

Organizational perspectives on offshoring of work

Some guidance on offshoring work distribution is provided by theories on organizational structure in organization theory and design. A substantial body of work in organization theory, of which the best known is probably that of the "Aston group" (Hickson *et al.*, 1969; Child and Mansfield, 1972), has examined the relationships between various organizational characteristics such as technology, tasks and organization size, the organizational environment and organizational structure. The overall conclusion of this body of research is that the optimal organizational structure depends on the combination of organizational and environmental factors, including the nature of the tasks, technology and environmental contingencies.

However, traditional organizational theories of work organization (Stinchcombe, 1959; Thompson, 1967; Blau *et al.*, 1976) were developed in the 1950s-1970s primarily in the context of manufacturing or clerical processes and are of limited use in modern knowledge-intensive industries where often knowledge-based interactions and outcomes are not so easily observable (Kraut and Streeter, 1995) and tasks may be disaggregated into multiple subtasks, outsourced and globally distributed (Contractor *et al.*, 2010). This raises a number of issues in organizational design (Jensen *et al.*, 2013). In determining the optimal global dispersion of work processes, KIS organizations face two major problems: distance and virtual organization.

Distance. Geographic distance is a key factor which needs to be considered by KIS providers as distance creates problems for coordination and communication that inhibit interaction among individuals engaged in pursuing a joint activity. Based on field and laboratory studies on dispersed teamwork, O'Leary and Cummings (2007) identified and discussed three different dimensions of distance – spatial, temporal and configurational distance – and their impacts on different outcomes of geographically dispersed work. Spatial distance refers to the geographical distance of team members' locations and is argued to hinder communication, as it impedes direct observation by team members of each other. Temporal distance reflects the extent to which team members have overlapping working hours. Global time zone differences mean that team members at different sites may be working at different times, which can negatively impact global team working and real-time problem solving (Olson and Olson, 2000). On the other hand, time zone differences could be beneficial, as it enables an around-the-clock model, which increases speed to complete the task and offers better services to customers (Carmel *et al.*, 2010). Configurational distance is defined as:

- the number of sites where members are located;
- team members' isolation from each other; and
- the balance between subgroups of members across sites.

Configurational distance is argued to negatively affect team coordination and to lead to an increase in social conflicts.

Virtual organization. A second related problem faced by OSPs is that most are largely virtual organizations where much of the work involves processing of information done by knowledge workers distributed widely across the world on behalf of clients who may themselves be globally distributed and distant, and much of the communication is virtual, both internally within the organization and externally with clients. They, therefore, conform to what previous researchers have described as virtual organizations – organizations in which members are geographically dispersed, relying heavily on information technology to accomplish work with fluid membership (DeSanctis and Monge, 1999).

Geographic dispersion and electronic dependence can provide some advantages such as access to relevant expertise scattered around the globe. However, they also create a number of problems. Firstly, geographically separated team members may lack "mutual knowledge" of each other's situations, increasing coordination problems in acquiring knowledge and resources (Cramton, 2001). Secondly, reliance on computer-mediated communication reduces non-verbal communication cues and limits informal spontaneous interaction, hindering knowledge interpretation, and directly observing participants is often impossible (Carson *et al.*, 2003), so there is often less knowledge of results, making corrective behaviour more difficult. Electronic groups have also been found to have more difficulty in interpreting feedback in discussions (DeSanctis and Monge, 1999). Therefore, key to the success of OSPs is how well they can overcome these two problems of distance and virtuality in carrying out knowledge and information processing globally and virtually.

Knowledge and information processing perspective on offshoring

An alternative theoretical perspective to traditional theories of work organization that we suggest would be useful in examining the demands of distance and virtuality in modern knowledge-intensive organizations is the information processing perspective (Daft and Lengel, 1986). This perspective extends earlier work in organization theory which views organizations as systems of interdependent activities that must be coordinated to optimize organizational performance (Galbraith, 1974, Lawrence and Lorsch, 1967, Thompson, 1967) by adding the dimensions of organizational information requirements and media richness to structural design of organizations. The information processing perspective has been used with some success since its development in the 1980s when knowledge and information technology was more widely adopted in business organizations but interest waned as the research focus shifted to other theoretical perspectives such as RBV and TCE. Nevertheless, we believe that the underlying assumptions and theoretical arguments are still applicable and can be of value to current KIS organizations, particularly regarding the organization of global knowledge work.

The underlying assumption of the information processing perspective is that organizations process information to reduce uncertainty and equivocality (Daft and Lengel, 1986). Uncertainty is defined by Galbraith (1974) as "the difference between the amount of information required to perform the task and the amount of information already possessed by the organization", whereas equivocality is defined as the ambiguity of the task, caused by conflicting interpretations about a group situation or environment. More specifically, when equivocality is high, individuals do not know what questions to ask, and when uncertainty is high, the group knows the question but lacks the necessary information to reach an answer. As information increases, uncertainty and equivocality decrease. A second assumption is that effective managers make rational choices in designing organizations to match a particular communication medium to a specific task or objective and to the degree of richness required by that task.

The third assumption of this perspective is that certain communication media in organizations work better for certain tasks than others. Daft and Lengel (1986) classified media according to a hierarchy based on four criteria: feedback, multiple cues, language variety and personal focus. The richest communication medium is face-to-face meetings, followed by telephone, e-mail and memos and letters. A key difference in current KISs since Daft and Lengel's work in the 1980s is the development of the internet. At the time Daft and Lengel (1986) developed their classification, internet technology and social media technologies were not yet fully developed, but latest technologies such as Skype and videoconferencing, which incorporate video and audio, would be expected to lie close to face-to-face meetings. This not only increases the usefulness and reliance on computer-mediated communication technology but also creates two other issues that need to be considered:

1. the increasing importance of the customer; and
2. the increasing globalization of work processes.

Many researchers have highlighted the challenges of knowledge co-creation with clients (Larsen, 2001; Bettencourt *et al.*, 2002) and increasingly entwined information technology (IT) and production processes (Miozzo and Grimshaw, 2005) in knowledge-intensive services. We, therefore, propose adding the elements of collaborative technology and customer relationships to the information processing perspective, and we develop below some hypotheses which we tested in our study.

Hypotheses development

Task characteristics

The first factor which can either enable or constrain the global distribution of offshored activities is the nature of the tasks. Luo *et al.* (2012) found in a study of business processing outsourcing that the governance mode was determined by task features, such as knowledge specialization, information security and process codifiability and the required process integration. High-value-added tasks including knowledge-intensive activities by their nature are generally complex and interdependent (Kumar *et al.*, 2009). In this study, we propose that KIS providers' decisions about how to globally distribute their service delivery units are influenced by three major characteristics of knowledge-intensive activities: task complexity, required frequency of interaction and task commoditization.

Task complexity is driven mainly by the number of sub-tasks, level of interdependence among sub-tasks, degree of tacit knowledge required to complete the task and the existence of path-goal multiplicity. The literature suggests that the greater task complexity and interdependence, the greater communication and coordination effort required and the greater chance of loss of control (Cramton, 2001). Accordingly, we argue that the degree of task complexity leads to increasing difficulty in carrying out knowledge-intensive activities across globally dispersed teams and, hence, negatively influences the global dispersion of knowledge-intensive activities by offshoring service providers. Therefore, we hypothesized as follows:

H1. Degree of task complexity is negatively related to global dispersion of offshoring knowledge-intensive activities.

The second characteristic of offshored tasks that we consider is the required frequency of interaction. By definition, KIS involves high-value-creating activities, which require intangible knowledge. Hence, these activities require intensive communication, especially face-to-face communication, among different units and often rely on tacit knowledge held by individuals, all of which make them more difficult to be carried out by dispersed teams at a distance. Therefore, we hypothesized:

H2. Frequency of interaction required to complete the task is negatively related to global dispersion of offshoring knowledge-intensive activities.

Degree of task commoditization is another characteristic of offshored task that has been highlighted as a key driver of the growth of global sourcing and dispersion of activities (Manning, 2013). More specifically, task commoditization allows service providers to create scale and scope economies, as well as specialization advantages, which give clients more incentive to outsource the activities to reap these benefits. Task commoditization indicates the degree to which knowledge about how to perform an activity is widely available and diffused across service providers, and, hence, a large number of service providers can perform and complete the task. High task commoditization suggests that knowledge about how to perform a task can be easily transferred across organizations and locations. Previous research has also shown that the way tasks are partitioned within project teams can affect the communication among project team members and with outsiders and can affect the knowledge transfer process. For example, Chen (2005) showed how learning between team members in R&D teams is dependent on the degree of task partitioning in the production process. When tasks are partitioned, there is less need for close communication between different team members in the process, and team coordination should, therefore, be easier to conduct at a distance. Accordingly, we argue that a high degree of task commoditization facilitates OSPs' global dispersion of its knowledge-intensive activities and hypothesized that:

H3. Degree of task commoditization is positively related to global dispersion of offshoring knowledge-intensive activities.

Collaborative technology

In addition to the nature of the task offshored and need for global customer presence, the collaborative technology and communication medium used may also enhance or constrain the global distribution of tasks. Daft and Lengel (1986) argue that task performance will be improved when task information needs are matched to a medium's information richness as the manner in which individuals use media influences the development of shared understanding. Communication either face-to-face or through interactive collaborative technology is richer in information compared with media capable of sending fewer cues or providing slower feedback (e.g. written communication). Dennis *et al.* (2008) argue that processes that require convergent thinking benefit from the use of media that facilitate synchronicity, whereas processes that merely convey knowledge have a lesser need for synchronicity. Rich media should mitigate some of the communication problems associated with distance by allowing instantaneous or rapid feedback.

Therefore, we hypothesized:

H4. Use of collaborative technology is positively related to global dispersion of offshoring knowledge-intensive activities.

Customer requirement for global delivery

A factor which is missing from the traditional information processing perspective but which is critical in KISs is customer requirement for global delivery. As providing KISs often requires intimate customer knowledge, a key requirement in many KIS organizations is ensuring that the customer is part of the service process, which has variously been called customer engagement, customer contact, customer interaction, customer involvement, customer participation and customer influence in the services marketing (Verma *et al.*, 2012) and operations management literatures (Lewis and Brown, 2012). Because of this need for customer interaction, proximity to clients has been shown to be an important factor in perceived quality of professional business to business (B2B) services (La *et al.*, 2009). As KIS clients have globalised and increasingly demand 24/7 support, global delivery presence has also become increasingly important in global KISs. As highlighted by Carmel *et al.* (2010), a global delivery network enables service providers to utilize globally distributed teams to help deliver services around-the-clock. This also allows service providers to significantly reduce the time to complete a task by handing over tasks to colleagues in other locations when the work shift in one location finishes.

A globally distributed service delivery model may also reduce coordination costs as it facilitates customer access to strategic resources in different locations around the world (Manning *et al.*, 2015), such as experts who can deal with local customer queries, thus reducing the need for costly interventions by experts located at distant locations. As such, we argue that customer requirements for global service delivery, driven mainly by the importance of time to complete a task and cost savings, lead to an increased likelihood of KIS providers choosing to globally disperse their KIS delivery units. Therefore, we hypothesized:

H5. Customer requirement for global delivery is positively related to global dispersion of offshoring knowledge-intensive activities.

Methodology

Sample and data collection

We tested our hypotheses using data collected by the ORN. The ORN is a research network of scholars studying offshoring projects across countries from North America, Europe and Asia Pacific both from the perspective of client (i.e. offshoring) firms and service providers. In this study, we use the data from the ORN annual service provider survey (2007-2011). The ORN service provider database is unique as it contains detailed information both at service and firm levels from business service providers across the world. This information includes the services which the OSPs offer, the locations they provide services from, their client base, perceived client expectations, perceived risks and future plans. In this study, we limit the sample to service providers offering KISs, including product design, engineering services, finance and accounting, human resource, IT, knowledge services, legal services, marketing and sales, R&D and software development.

After removing responses with missing data, the usable sample contains 273 service providers, which offer at least one KIS. Among the providers in the sample, 14 per cent are major multinational service providers (e.g. Accenture, Tata Consulting, Infosys, Pangea3, Capgemini and PricewaterhouseCoopers), 27 per cent are medium-size (500-10,000 employees) service providers and 60 per cent are small service providers with less than 500 employees. These service providers are headquartered around the world in three main regions: USA (40 per cent), India (17 per cent) and Western Europe (16 per cent). Table I summarizes the characteristics of service providers included in the sample.

Apart from the ORN service provider database, we also include data from external databases to create our dependent variables. More specifically, we collect the geographical distance (in kilometres) data and time zone difference (in hours) between service providers' headquarters and each of their service delivery locations to generate our spatial and temporal dispersion variables. Using data from different data sources lessens

Table I Characteristics of service providers included in the sample

Characteristic	*Service providers (%)*
Service offered	
Product design	3
Engineering services	8
Finance and accounting	6
Human resource	9
IT	24
Knowledge services	5
Legal services	5
Marketing and sales	6
R&D	6
Software development	27
Headquarter region	
Asia	6
China	5
Eastern Europe	9
India	17
Latin	7
Other	1
US	40
Western Europe	16
Service provider size	
Large (>10,000 employees)	14
Midsize (500-10,000 employees)	27
Small (<500 employees)	59
Years of experience	
1	3
2	4
3	8
4	6
5	8
6	6
7	4
8	4
9	5
10+	51

concern over common method bias, which could pose a problematic challenge to survey-based studies using data from a single survey (Podsakoff *et al.*, 2003).

Variables

Dependent variable. Drawing on O'Leary and Cummings (2007), three dependent variables were used to represent the global dispersion of service providers' service delivery units for knowledge-intensive activities. First, spatial dispersion measures the geographical dispersion of service delivery units of a service provider. We constructed this variable based on secondary data on the geographical distance (in kilometres) between a service provider's headquarters and each of its service delivery locations. The service provider's geographical dispersion (SD) is measured by calculating Blau's (1977) index of diversity:

$$SD = 1 - \sum_{i=1}^{N} p_i^2$$

where p is the proportion of a firm's geographical distance (in kilometres) from headquarters to offshore location i to total distance to all offshore locations and N is the number of offshore locations of a firm. This measure has been used in several other studies of geographic dispersion in firms (Lahiri, 2010).

Second, temporal dispersion aims to capture the temporal distribution of service delivery units set up by a service provider. This variable is constructed based on publicly available data on the time zone positioning of a service provider's headquarters location and each of its service delivery locations. We then computed temporal dispersion by taking the difference between the closest and furthest time zones across delivery locations (Chudoba *et al.*, 2005). Third, configurational dispersion measures the number of service delivery locations where offshoring teams are located and is measured by the number of countries where a provider locates its service delivery units.

Task characteristics. To measure the effect of service characteristics on the global dispersion of service delivery units, we use four survey items to construct our independent variables. Degree of service commoditization is a composite measure derived from two survey items asking providers to indicate, for each KIS they provide, the extent of commoditization of a service currently and in the next 18-36 months. The responses are on a five-point Likert scale ranging from very low (1) to very high (5). We then calculated the average of these two survey items to construct the degree of service commoditization. We also capture the characteristics of services through the degree of service complexity, which is derived from the survey item asking providers to indicate, for each KIS, the degree to which they agree that the service involves highly complex tasks on five-point Likert scale. The aggregate measure is constructed by taking the average of task complexity across all KISs provided by a service provider. Frequency of interaction is another characteristic we capture in this study. We construct this measure based on the survey item asking providers to indicate, for each knowledge intensive service, the extent to which a task requires frequent interaction with a client on a five-point Likert scale. The average is then taken across all KISs a provider offers to create the aggregate measure.

Customer requirements. We measured customer requirements for global delivery through a combined three-item measure. Providers are asked to indicate, for each KIS, the perceived importance of global presence, of time to complete the task and of low cost delivery for clients to select them as a service provider (each on a five-point Likert scale). We then constructed customer requirement for global delivery based on the average score of these three survey items across all KIS functions. It should be noted that the measure is based on the perceptions of providers regarding the importance of customer requirements on global delivery model rather than the actual importance (i.e. objective measure), as we are interested in how the perceived customer requirements on global delivery model may affect a provider's decisions about global dispersion of service delivery units.

Role of technology. To measure the effect of collaborative technology on the global dispersion of service delivery locations, we use the survey item asking providers to indicate, for each KIS, the degree of Web-based collaborative technologies' use in each KIS on a five-point Likert scale. We then computed the average of these scores across KIS providers to construct the role of technology variable for our model.

Control variables. We used various control variables in our regressions. First, we account for the *size of service provider*, which could potentially influence global dispersion of delivery units. Service provider size was measured by the logarithm of the number of employees. We also included a *service experience* measure, measured by the number of years a provider has been offering offshoring services to control for any potential experience effect. Last, because service providers from different regions might pursue different approaches on how to locate their service deliver units, we controlled for regional idiosyncratic effects through the inclusion of a set of headquarters region fixed effects. Dummy variables are coded for providers with their headquarters from China, India, USA, Western Europe and other regions.

Table II summarizes the descriptive statistics and correlations among all variables included in our regressions. Correlations between core variables (excluding correlations between dependent variables) do not show any multicollinearity issues. The highest correlation between independent and dependent variables was between temporal dispersion and provider size (0.43), which, however, does not significantly affect the results of our hypothesis test.

Table II Descriptive statistics and correlations

No.	Variables	Mean	SD	Minimum	Maximum	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Configurational dispersion	5.744	13.32	0	192	1													
2	Spatial dispersion	0.409	0.378	0	0.975	*0.45*	1												
3	Time zone dispersion	4.398	5.066	0	17	*0.42*	*0.86*	1											
4	Degree of service commoditization	11.98	11.85	0	69.5	*0.18*	*0.3*	*0.32*	1										
5	Degree of service complexity	3.792	0.822	1	5	0.06	*0.17*	*0.14*	0.04	1									
6	Frequency of interaction	3.929	0.784	1	5	*0.11*	0.12	0.12	−0.07	*0.36*	1								
7	Customer requirement on global delivery model	1.818	1.594	0	5	−0.04	−0.12	−0.06	−0.01	−0.06	−0.09	1							
8	Use of collaborative technology	3.42	0.966	1	5	0.04	*0.2*	*0.2*	−0.01	*0.16*	*0.29*	−0.09	1						
9	Provider size (log of number of employees)	5.976	2.697	0.7	12.848	*0.19*	*0.47*	*0.43*	*0.29*	0.08	0.02	0	0	1					
10	Service experience	12	10.56	1	100	*0.31*	*0.35*	*0.33*	*0.19*	0.05	0.07	−0.06	0	*0.5*	1				
11	Provider HQ in China	0.051	0.221	0	1	−0.03	−0.11	−0.05	0.09	−0.07	−0.01	0.09	0.02	0.03	−0.09	1			
12	Provider HQ in India	0.168	0.375	0	1	0.02	0.11	0.03	−0.01	−0.09	−0.1	−0.05	−0.11	*0.25*	0	−0.1	1		
13	Provider HQ in US	0.396	0.49	0	1	−0.05	−0.09	0.04	0.03	0.06	0.11	−0.03	0.06	0.09	0.08	*−0.2*	*−0.4*	1	
14	Provider HQ in Western EU	0.158	0.365	0	1	*0.12*	0.02	−0.09	0.03	−0.05	−0.05	−0.02	−0.12	−0.13	0.01	−0.1	*−0.2*	*−0.4*	1

Note: Italic = significant at 5% confidence level

Statistical model

We tested our hypotheses using a hierarchical regression analysis with successive ordinary least squares (OLS) regression models, the gradual building of separate but related models with an increasing number of independent variables, until we reach the final model in which all independent variables are included. We performed the same set of regression models on each of the three dependent variables: spatial dispersion, temporal dispersion and configurational dispersion.

Results

The results from regression models on geographical dispersion are reported in Table III. Models 1-5 test the effects of task characteristics and customer requirements on global service delivery and the use of collaborative technology on spatial dispersion. Model 1 reports the effects of control variable only; Model 2 includes task characteristic measures and controls; Model 3 tests the effect of customer requirements on global service delivery and controls; Model 4 examines the effect of collaborative technology usage and controls; and Model 5 includes all explanatory and control variables.

Model 1 suggests that among all control variables, service provider size and headquarters location in China and the USA have a strong negative effect on a provider's geographical dispersion of global delivery locations. These effects are strong and significant throughout Models 1, 2, 3, 4 and the full model (Model 5). Model 2 indicates that the degree of task commoditization and the required frequency of interaction between a service provider and clients significantly increase the geographical dispersion of global delivery units (β = 0.007, $p < 0.001$; and β = 0.065, $p < 0.5$, respectively). Model 4 shows the significant positive effect of the use of collaborative technology on geographical dispersion of global delivery units (β = 0.075, $p < 0.001$). Model 5 is the full model of geographical dispersion and shows the significant positive effect of task commoditization (β = 0.007, $p < 0.001$) and the use of collaborative technology (β = 0.059, $p < 0.005$). This suggests that degree of task commoditization facilitates geographical dispersion of service delivery units, thus supporting *H3*. The use of collaborative technology also promotes geographical dispersion of KIS activities, supporting *H4*. However, degree of task complexity, frequency of

Table III Results of OLS models on spatial dispersion

	Spatial dispersion (KM)				
Variables	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Task characteristics					
Task commoditization		*0.007**** (0.002)			*0.007**** (0.002)
Task complexity		0.021 (0.032)			0.015 (0.032)
Required frequency of interaction		*0.065** (0.035)			0.046 (0.035)
Customer's requirements					
Customer pressure on global delivery model			−0.012 (0.016)		−0.006 (0.016)
Role of technology					
Use of collaborative technology				*0.075**** (0.025)	*0.059*** (0.026)
Controls					
Provider size	*0.060**** (0.012)	*0.047**** (0.012)	*0.060**** (0.012)	*0.057**** (0.011)	*0.046**** (0.012)
Service experience	0.004 (0.003)	0.004 (0.003)	0.004 (0.003)	0.005 (0.003)	0.004 (0.003)
Provider HQ in China	*−0.312*** (0.133)	*−0.380**** (0.133)	*−0.308*** (0.133)	*−0.308*** (0.130)	*−0.375**** (0.132)
Provider HQ in India	−0.081 (0.088)	−0.073 (0.086)	−0.086 (0.089)	−0.057 (0.087)	−0.060 (0.086)
Provider HQ in US	*−0.150*** (0.070)	*−0.184**** (0.069)	*−0.152*** (0.070)	*−0.142*** (0.068)	*−0.175*** (0.068)
Provider HQ in Western EU	−0.040 (0.084)	−0.060 (0.082)	−0.043 (0.084)	−0.019 (0.082)	−0.046 (0.081)
Constant	0.095 (0.077)	−0.230 (0.156)	0.117 (0.083)	−0.167 (0.114)	−0.331* (0.172)
Observations	186	186	186	186	186
R^2	0.245	0.309	0.247	0.282	0.332

Notes: Standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

interaction and customer requirement for global delivery do not show any significant effects in Model 5, indicating that *H1*, *H2* and *H5* cannot be supported.

Table IV shows the regression results of temporal dispersion. Models 6-10 examine the effects of task characteristics and customer requirement on global service delivery and the use of collaborative technology on temporal dispersion of service delivery units. Model 6 reports the effect of control variables only, which suggests that provider size and headquarters location in the USA significantly increase temporal dispersion of global delivery locations. Model 7 includes task characteristics and suggests the significant positive effect of both degree of commoditization ($\beta = 0.329$, $p < 0.001$) on temporal dispersion of global delivery locations, whereas task complexity does not show a significant effect. Model 8 examines the effect of customer requirement on global service delivery, which does not show any significant effect here. Model 9 tests the effect of collaborative technology and indicates that the use of collaborative technology has no significant effect on temporal dispersion of global delivery units. Model 10 is the full model of temporal dispersion, which includes the effects of task characteristics, customer requirement on global service delivery and the use of collaborative technology. The results are consistent with Models 7, 8 and 9, which reveal the strongly significant positive effect of the degree of task commoditization ($\beta = 0.058$, $p < 0.01$) on temporal dispersion of global delivery units, supporting *H3* and rejecting *H1*, *H2*, *H4* and *H5*. In addition, the results also suggest that among all control variables, provider size and headquarters in the USA positively affect temporal dispersion of global delivery units. Furthermore, the findings highlight the importance of the service experience on temporal dispersion.

Table V presents the results of regression model on configurational dispersion of global service delivery locations. Model 11 tests the effect of control variables and reveals the significant and positive effect of service provider size on configurational dispersion. Model 12 shows the effect of task characteristics. Among the three task characteristics, only the degree of task commoditization shows a significant and positive effect ($\beta = 0.109$, $p <$ 0.01) on configurational dispersion of global delivery units. Model 13 examines the role of customer requirement for global delivery, and the results suggest that customer requirement for global delivery does not have a significant effect here. Model 14 examines the use of collaborative technology and shows that use of collaborative technology has a

Table IV Results of OLS models on temporal dispersion

	Time zone dispersion (hours)				
Variables	*Model 6*	*Model 7*	*Model 8*	*Model 9*	*Model 10*
Task characteristics					
Task commoditization		*0.329**** (0.068)			*0.327**** (0.069)
Task complexity		0.639 (1.022)			0.589 (1.029)
Required frequency of interaction		1.392 (1.139)			1.242 (1.174)
Customer's requirements					
Customer Pressure on global delivery model			−0.236 (0.586)		−0.167 (0.567)
Role of technology					
Use of collaborative technology				0.899 (0.898)	0.474 (0.900)
Controls					
Provider size	*0.717** (0.388)	0.202 (0.388)	*0.713** (0.389)	*0.716** (0.388)	0.199 (0.390)
Service experience	*0.392**** (0.113)	*0.354**** (0.109)	*0.388**** (0.114)	*0.398**** (0.114)	*0.356**** (0.110)
Provider HQ in China	−2.421 (4.378)	−3.710 (4.244)	−2.259 (4.403)	−2.521 (4.379)	−3.648 (4.274)
Provider HQ in India	−2.275 (2.781)	−0.978 (2.689)	−2.304 (2.787)	−2.076 (2.788)	−0.915 (2.705)
Provider HQ in US	*−3.930** (2.109)	*−3.986** (2.040)	*−3.912** (2.112)	*−3.988** (2.109)	*−3.968** (2.047)
Provider HQ in Western EU	1.990 (2.712)	1.850 (2.607)	2.015 (2.717)	2.223 (2.722)	1.993 (2.626)
Constant	−0.693 (2.291)	−9.339* (5.269)	−0.269 (2.523)	−3.825 (3.880)	−9.927* (5.825)
Observations	273	273	273	273	273
R^2	0.114	0.192	0.115	0.117	0.193

Notes: Standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table V Results of OLS models on configurational dispersion

	Configurational dispersion				
Variables	*Model 11*	*Model 12*	*Model 13*	*Model 14*	*Model 15*
Task characteristics					
Task commoditization		*0.109**** (0.028)			*0.105**** (0.028)
Task complexity		0.265 (0.430)			0.214 (0.429)
Required frequency of interaction		0.630 (0.469)			0.414 (0.478)
Customer's requirements					
Customer pressure on global delivery model			−0.049 (0.224)		−0.008 (0.217)
Role of technology					
Use of collaborative technology				*0.867*** (0.342)	*0.701*** (0.347)
Controls					
Provider size	*0.715**** (0.157)	*0.529**** (0.158)	*0.716**** (0.158)	*0.684**** (0.155)	*0.515**** (0.157)
Service experience	0.022 (0.041)	0.015 (0.040)	0.021 (0.042)	0.031 (0.041)	0.022 (0.040)
Provider HQ in China	−2.171 (1.809)	−*3.272** (1.803)	−2.155 (1.815)	−2.126 (1.782)	−*3.220** (1.792)
Provider HQ in India	−1.347 (1.200)	−1.276 (1.169)	−1.368 (1.207)	−1.066 (1.187)	−1.092 (1.173)
Provider HQ in US	−0.704 (0.950)	−1.151 (0.931)	−0.713 (0.954)	−0.614 (0.937)	−1.020 (0.929)
Provider HQ in Western EU	−1.347 (1.137)	−1.673 (1.104)	−1.363 (1.143)	−1.114 (1.124)	−1.484 (1.106)
Constant	0.431 (1.045)	−2.942 (2.112)	0.526 (1.134)	−2.569 (1.568)	−4.337* (2.340)
Observations	186	186	186	186	186
R^2	0.168	0.246	0.168	0.197	0.263

Notes: Standard errors in parentheses; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

significant, positive effect ($\beta = 0.867$, $p < 0.05$). Model 15 shows the results of the full model including task characteristics, customer requirement for global service delivery and the use of collaborative technology. Among all independent variables, the degree of task commoditization ($\beta = 0.105$, $p < 0.01$) and use of collaborative technology ($\beta = 0.701$, $p < 0.05$) show significant and positive effects in this model, suggesting that *H3* and *H5* can be supported and *H1*, *H2* and *H4* cannot be supported for configurational dispersion. The findings also show the strongly significant positive effect of service provider size ($\beta = 0.515$, $p < 0.001$) and the negative effect of service provider in China ($\beta = -3.220$, $p < 0.1$), suggesting that Chinese service providers tend to have fewer global delivery units compared to providers from other regions. The results suggest slight differences in the effect of independent variables on configurational dispersion compared to geographical dispersion and temporal dispersion.

Discussion

The results confirm the importance of considering the effects of task characteristics and collaborative technology on the global dispersion of OSPs, consistent with previous organization theories on organization structure (Daft and Lengel, 1986). However, they further highlight the importance of also considering communication with the customer, as knowledge is often co-created with the customer in offshoring service relationships (Verma *et al.*, 2012). This adds an additional dimension that needs to be included in the organizational mix for OSPs.

All the models consistently show the importance of task commoditization on spatial, temporal and configurational dispersion of knowledge-intensive activities. This is consistent with other studies which have highlighted the importance of knowledge commoditization as one of the drivers of offshoring (Levy, 2005; Manning, 2013). However, contrary to our expectations and other studies which have suggested otherwise (Cramton, 2001; Kumar *et al.*, 2009), task complexity had no significant effect on geographic, temporal or configurational dispersion in any of the models. One possible reason for the difference is that unlike task commoditization, which is under managerial control, the task complexity cannot generally be changed. Complex tasks remain complex, although managers may be able to simplify some elements by commoditizing some sub-tasks.

Required frequency of interaction only had a significant effect on geographic dispersion in Model 2 but was not significant once use of collaborative technology and customer requirements for global delivery were included in the model, suggesting that use of collaborative technology and customer requirements for global delivery may offset the effects of required frequency of interaction.

Use of collaborative technology shows a highly significant positive relationship with spatial and temporal dispersion of knowledge-intensive delivery units, suggesting that the use of collaborative technology can significantly mitigate the negative effects of spatial and temporal dispersion in provision of offshored KISs. This is consistent with the extensive research studies and real-life examples which have highlighted the use of information technology to facilitate global team working across geographic locations and time zones (Carmel *et al.*, 2010). However, no significant effect of collaborative technology was observed with configurational dispersion, suggesting that although collaborative technology may enable an offshoring service provider to serve customers across a wider spread of geographic space and time, it does not necessarily enable them to set up operations in more locations, which may be driven by other factors such as availability of skilled resources in the location. Researchers have documented the emergence of certain "hotspots" in IT services offshoring, including well-established locations such as Bangalore, India, and newer locations such as Guadalajara, Mexico; Cordoba, Argentina; and Recife, Brazil (Manning *et al.*, 2010).

Surprisingly, customer requirements for global service delivery did not show up as significant in any of the models, suggesting either that customer requirement for global delivery has little effect on the location decisions of OSPs or that the spatial, temporal and configurational dispersion of OSPs in our sample are already sufficient to meet the customer requirements so that increasing customer requirements has little effect. This requires further investigation, which is, however, beyond the scope of the data we have in this study.

Conclusion

As highlighted in the literature review, there is scant research on offshoring service providers compared with offshoring clients, although offshoring services involve close interaction between both clients and service providers. Our study makes a number of contributions by highlighting the importance of collaborative technology and global customer service in the global dispersion of activities in OSPs and, more generally, other KIS organizations. We summarize below the theoretical and practical implications.

Theoretical implications

Our study shows how existing theories of organizational structure need to incorporate the key factors of internet-based collaborative technologies and global customer service requirements, in addition to task design, to explain the global dispersion of KIS organizations. Although these factors have been examined separately in previous studies of organizations, our study highlights the importance of considering their combined effects. Our findings suggest the importance of considering their differing effects on different dimensions of global dispersion of knowledge-intensive activities. This points out the need for future research to further unpack the global dispersion concept at a more fine-grained level. In particular, our results suggest the need to consider temporal, as well as spatial and configurational, dispersion in organization design theories of modern KIS organizations.

Although our study only examined OSPs, we believe that the findings may also have wider applicability for other KIS organizations. OSPs not only provide services to knowledge-intensive organizations but also are themselves examples of multinational KIS firms which operate internationally, so the factors which affect their global dispersion are also factors which would likely be important in the global dispersion of other global KIS firms which operate internationally, such as internet service providers, internet-based businesses or other businesses in which knowledge management and IT systems play a crucial role such as transportation services. However, the generalizability of our findings in other industries and other types of KIS organizations should be tested in future studies.

Practical implications

Our findings indicate a number of practical implications for managers and practitioners, especially in KIS organizations. Particularly, our study emphasizes the importance of considering all three dimensions of dispersion – spatial, temporal, and configurational – in location of offshored knowledge-intensive activities or global delivery units for such activities and the importance of considering the different effects of task commoditization, customer needs and use of collaborative technology in designing the most effective global dispersion of activities. Although KIS organizations may not be able to do much about task complexity, which is generally increasing, our study suggests that organizations still have considerable flexibility in the design of global distribution of work by selecting the most effective combination of task commoditization, customer needs and collaborative technology to match. Our findings regarding the effect of collaborative technology and customer interaction on different dimensions of global dispersion suggest that KIS organizations need to be strategic in designing and managing each dimension of their globally dispersed teams, as focusing on one specific dimension might jeopardize other dimensions.

Limitations and further research

As discussed above, OSPs are examples of KIS organizations so we believe that our findings of generalizable to other KIS organizations. However, our sample only included OSPs, so the generalizability to other global KIS needs to be tested. We should also note a number of other limitations in our study, which should be addressed in future studies. Firstly, our sample is biased towards OSPs located in the US IT and software service providers and small-size service providers. The relatively small sizes of the samples do not allow us to test differences between host countries, types of services and firm sizes, although the results in some models suggest significant effects of headquarters locations. This should be investigated in further research. Secondly, we are unable to match OSP providers with their clients, so we are unable to determine to what extent the distribution of providers' service locations mirrors the distribution of client locations, which has been found in some manufacturing companies. However, if such data were available, this would be worthwhile to explore in future studies. Finally, our data did not permit us to test the performance effects of different organizational designs, but once again, this would be worthwhile to explore in future studies if such data are available.

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